



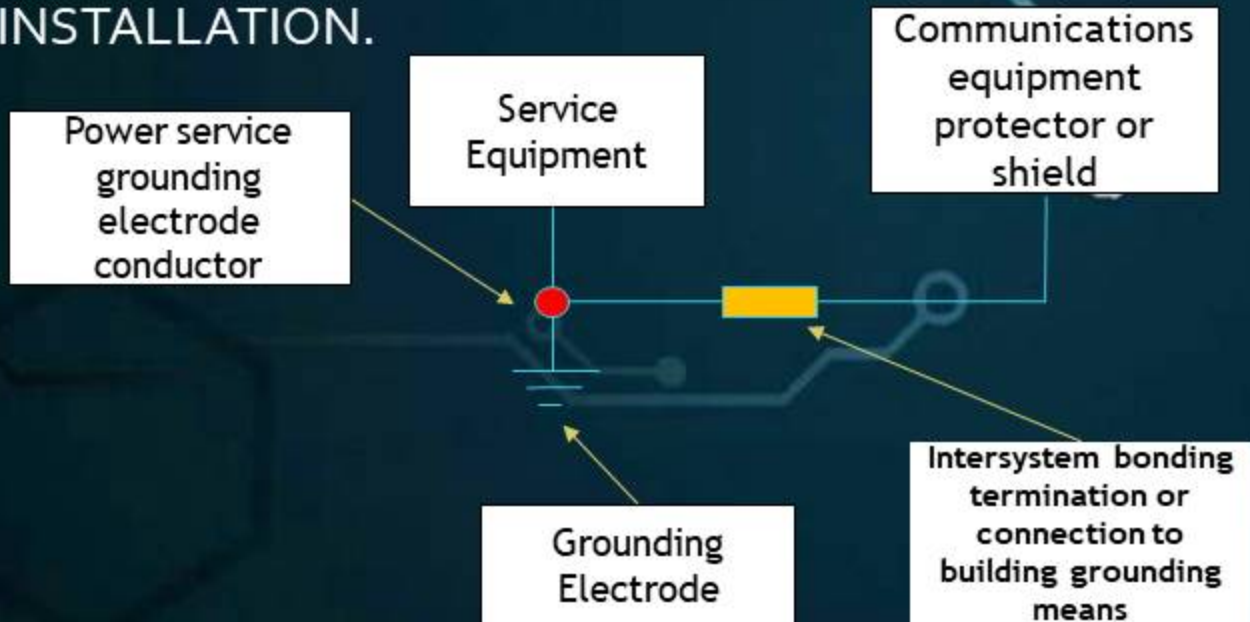
**CHAPTER - 10**

**COMMUNICATION  
SYSTEMS**

# 8.0 COMMUNICATIONS CIRCUITS

2

ILLUSTRATION OF A BONDING CONDUCTOR IN A COMMUNICATIONS INSTALLATION.



This figure illustrates the bonding and grounding electrode conductors in communication installations.

# 8.0 COMMUNICATIONS CIRCUITS

3

ILLUSTRATION OF GROUNDING ELECTRODE CONDUCTOR IN A COMMUNICATIONS INSTALLATION.

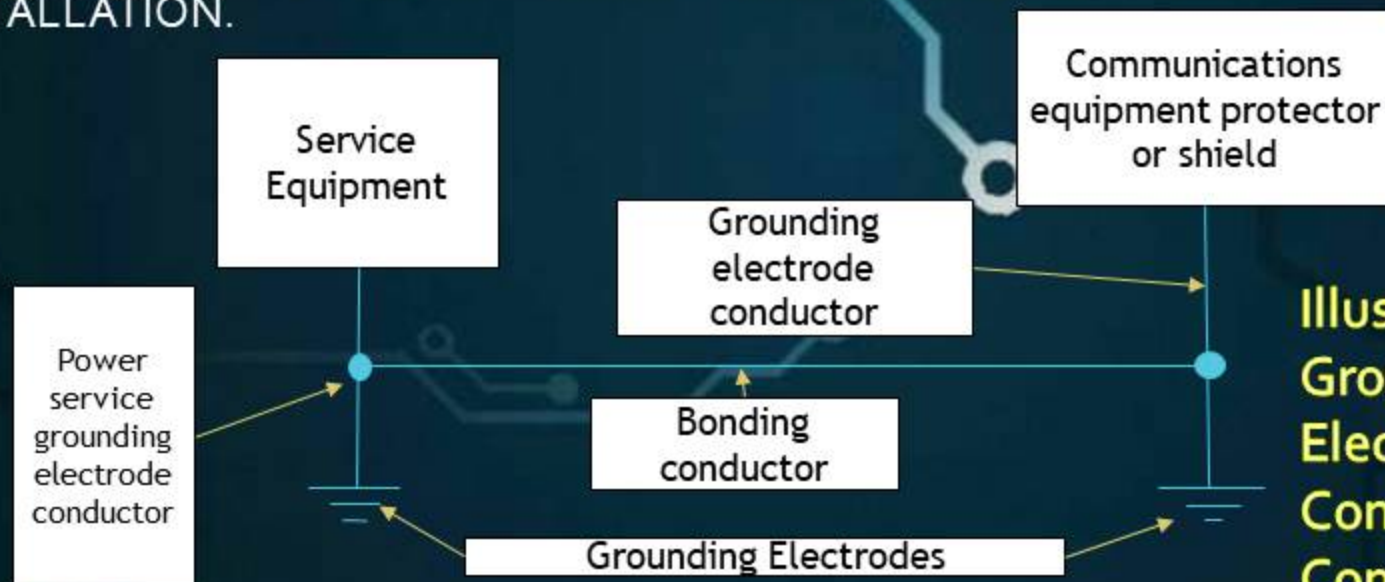


Illustration of a  
Grounding  
Electrode  
Conductor in a  
Communications  
Installation



## 8.0.1.1 Scope: Communication Circuits and Equipment

4

- **FPN NO.1**-For installations of communication circuits and equipment that are not covered.
- **FPN NO.2**-For further information for remote-control, signaling, and power-limited circuits.
- **FPN NO.3**-For further information for fire alarm systems.



## 8.0.1.2 DEFINITIONS: FOR THE PURPOSE OF PROVIDING INFORMATION

5

- **ABANDONED COMMUNICATIONS CABLE:** Installed communications cable that is not terminated at both ends at a connector or other equipment and not identified for future use with a tag.
- **BLOCK:** A square or portion of a city, town, or village enclosed by streets and including the alleys so enclosed, but not any street.
- **CABLE:** A factory assembly of two or more conductors having an overall covering.

## 8.0.1.2 DEFINITIONS: FOR THE PURPOSE OF PROVIDING INFORMATION

- **CABLE SHEATH:** A covering over the conductor assembly that may include one or more metallic members, strength members, or jackets.
- **COMMUNICATIONS CIRCUIT:** The circuit that extends voice, audio, data, interactive services, telegraph(except radio), outside wiring for fire alarm and burglar alarm from the communications utility to the costumer's communication equipment up to and including terminal equipment such as telephone, fax machine, or answering machine.



## 8.0.1.2 DEFINITIONS: FOR THE PURPOSE OF PROVIDING INFORMATION

- **COMMUNICATIONS CIRCUIT INTEGRITY (CI) CABLE:** Used in communications systems to ensure continued operation of critical circuits during a specified time under fire conditions.
- **EXPOSED (TO ACCIDENTAL CONTACT):** A circuit that is in such a position that, in case of failure of supports or insulation, contact with another circuit may result.
- **POINT OF ENTRANCE:** The point within a building at which the communication wire or cable emerges from an external wall, from a concrete floor slab.



## 8.0.1.2 DEFINITIONS: FOR THE PURPOSE OF PROVIDING INFORMATION

8

- **PREMISES:** The land and buildings of a user located on the user side of the utility-user network point demarcation.
- **WIRE:** A factory assembly of one or more insulated conductors without an overall covering.

8.o.1.18 INSTALLATION OF EQUIPMENT: Electrically connected equipment on a communication network shall be listed in accordance with 8.o.6.1

9

**EXCEPTION:** *This listing requirement shall not apply to test equipment that is intended for temporary connection to a telecommunications network by qualified persons during the course of installation, maintenance, or repair of telecommunication equipment or systems.*

## 8.0.1.21 ACCESS TO ELECTRICAL EQUIPMENT BEHIND PANELS DESIGNED TO ALLOW ACCESS.

10

- Access to electrical equipment shall not be denied by an accumulation of communication wire and cables that prevents removal of panels, end covers and the likes, etc. including suspended ceiling panels.



## 8.0.1.24 MECHANICAL EXECUTION OF WORK

11

- Communication circuits and equipment shall be installed in a neat and workmanlike manner.
- Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use.
- Such 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.

## 8.0.1.25 ABANDONED CABLES

12

- The accessible portion of abandoned communication cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

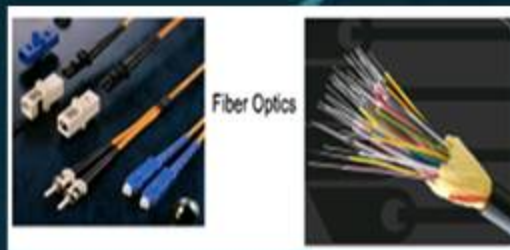


## 8.0.1.26 SPREAD OF FIRE OR PRODUCTS OF COMBUSTION

13

- Installations of communication cables, communication raceways, cable routing assemblies in hollow spaces, vertical shafts, and ventilation or air-handling ducts shall be made so that the possible spread of fire or products of combustion will not be substantially increased. Openings around penetrations of communication cables, communication raceways, and cable routing assemblies through fire-resistant-rated walls, partitions, floors, or ceilings shall be fire stopped using approved methods to maintain the fire resistance rating.





## 8.0.2 WIRES AND CABLES OUTSIDE AND ENTERING BUILDINGS

## 8.0.2.1 OVERHEAD (AERIAL) COMMUNICATION WIRES AND CABLES

15

- Overhead (aerial) communication wires and cables entering the buildings shall comply with 8.0.2.1 A and B.

## (A) ON POLES AND IN-SPAN

16

- Where communication wires and cables shall be located below the electric light or power conductors are supported by the same pole or are run in parallel to each other in-span.



## (1) RELATIVE LOCATION

17

- Where practicable, the communication wires and cables shall be located below the electric light or power conductors.

## (2) ATTACHMENT TO CROSS-ARMS

18

- Communication wires and cables shall not be attached to a cross-arm that carries electric light or power conductors.

### (3) CLIMBING SPACE

19

- The climbing space through communication wires and cables shall comply with the requirements of 2.25.1.14 (D).



## (4) CLEARANCE

20

- Supply service drops and sets of overhead service conductors of 0 to 750 volts running above and parallel to communication service drops shall have a minimum separation of 300 mm at any point in the span, including the point of and at their attachment to the building, provided that the ungrounded conductors are insulated and that a clearance of not less than 1000 mm is maintained between the two services at the pole.

## (B) ABOVE ROOFS

21

- Communication wires and cables shall have a vertical clearance of not less than 2500 mm from all points of roofs above which they pass.

## Exception no. 1

22

Communication wires and cables shall not be required to have a vertical clearance of not less than 2500 mm above auxiliary buildings, such as garages and the like.



## Exception no. 2

23

A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm shall be permitted if (A) not more than 200 mm of communication service-drop conductors pass above the roof overhang and (B) they are terminated at a through- or above-the-roof raceway or approved support.

## Exception no. 3

24

Where the roof has a slope of not less than 100 mm in 300 mm, a reduction in clearance to not less than 900 mm shall be permitted.

## 8.0.2.4 Underground Communications Wires and Cables Entering Buildings

25

Underground communication wires and cables entering the buildings shall comply with 8.0.2.4(A) and (B). The requirements of 3.10.2.1(C) shall not apply to communications wires and cables



## (a) Underground Systems with Electric light, Power, Class 1, or Non-power-limited Fire Alarm Circuit Conductors

26

Underground communications wires and cables in a raceway, handhole enclosure, or manhole containing electric light, power, Class 1, or non-power-limited fire alarm circuit conductors shall be in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

## (b) Underground Block Distribution

27

Where the entire street circuit is run underground and the circuit within the block is placed so as to be free from the likelihood of accidental contact with electric light or power circuits of over 300 volts to ground, the insulation requirements of 8.0.2.7(A) and (C) shall not apply, insulating supports shall not be required for the conductors, and bushings shall not be required where the conductors enter the building.



## 8.0.2.5 Unlisted Cables Entering Buildings.

28

Unlisted outside plant communications cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m and the cable enters the building from the outside and is terminated in a enclosure or on a listed primary protector.



- 1.) Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating telephone cables.
- 2.) This section limits the length of unlisted outside plant cable to 15m, while 8.0.3.1(B) requires that the primary protector be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, the outside plant cable may not be permitted to extend 15m into the building if it is practicable to place the primary protector closer than 15m to the point of entrance.

## 8.0.2.6 Metallic Entrance Conduit Grounding

30

Metallic conduit containing communications entrance wire or cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode in accordance with 8.0.4.1(B).

## 8.0.2.7 Circuits Requiring Primary Protectors

31

Circuits that require primary protectors as provided in 8.0.3.1 shall comply with 8.0.2.7(A), (B), and (C).



## (A) Insulation, Wires, and Cables

32

- Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed in accordance with 8.0.6.4.

## (B) On Buildings

- Communications wires and cables in accordance with 8.0.2.7(A) shall be separated at least 100mm from electric light or power conductors not in a raceway or cable or be permanently separated from conductors of the other systems by a continuous and firmly fixed nonconductor in addition to the insulation on the wires such as porcelain tubes or flexible tubing.

## exception

34

- Separation from woodwork shall not be required where fuses are omitted as provided for in 8.0.3.1(A)(1), or where conductors are used to extend circuits to a building from a cable having a grounded metal sheath.



## (C) Entering Buildings

35

- A primary protector is installed inside the building, the communications wires and cables shall enter the building either through a noncombustible, nonabsorbent insulating bushing or through a metal raceway.

## Non-Requirement of Insulating Bushing

36

- Metal-sheathed cable
- Pass through masonry
- Meet the requirements of 8.0.2.7(A) and fuses are omitted as provided in 8.0.3.1(A)(1),
- Meet the requirements of 8.0.2.7(A) and are used to extend circuits to a building from a cable having a grounded metallic sheath.

## 8.0.2.10 Lightning Conductors

37

- A separation of at least 1800mm shall be maintained between communication wires and cables on buildings and lightning conductors.
- **FPN**-specific separation distances may be calculated from the side flash equation in NFPA 780-2014, Standard for the Installation of Lightning Protection Systems, 4.16.2.



A man with short blonde hair is looking down at a server rack. The rack is filled with numerous orange cables, some of which are bundled together with white labels. The background is dark, and the lighting is focused on the man and the cables.

## 8.0.3 PROTECTION

38

### 8.0.3.1 Protective Devices

## (a) Application

39

- A listed primary protector shall be provided on each circuit run partly or entirely in aerial wire or aerial cable not confined within a block. Also, a listed primary protector shall be provided on each circuit aerial or underground, located within the block containing the building served so as to be exposed to accidental contact with electric light or power conductors operating at over 300 volts to ground.



- **No. 1** - On a circuit not exposed to accidental contact with power conductors, providing a listed primary protector in accordance with this article helps protect against other hazards, such as lightning and above-normal voltages induced by fault currents on power circuits in proximity to the communication circuit.
- **No. 2** - Interbuilding circuits are considered to have lightning exposure unless one or more of the following conditions exist.



## Conditions

41

- (1) circuits in large metropolitan areas where buildings are close together and sufficiently high to interrupt lightning.
- (2) interbuilding cable runs of 42m or less, directly buried or in underground conduit , where a continuous metallic conduit containing the cable is connected to each building grounding electrode system.
- (3) areas having an average of five or fewer thunderstorm days per year and earth resistivity of less than 100 ohmmeters. Such areas are found along the pacific coast.

## (1) Fuseless Primary Protectors

42

- Fuseless-type primary protectors shall be permitted under any of conditions given in (A)(1)(a) through (A)(1)(e).

## (A)(1)

- **A.** conductors entering a building through a cable with grounded metallic sheath member(s) and where the conductors in the cable safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor.
- **B.** insulated conductors in accordance with 8.0.2.7(A) are used to extend circuits to a building from a cable with an effectively grounded metallic sheath member(s) and where the conductors in the cable or cable stub, or the connections between the insulated conductors and the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground.



## (A)(1)

- C. insulated conductors in accordance with 8.0.2.7(A) or (B) are used to extend circuits to a building from other than a cable with metallic sheath member(s), where;
  1. The primary protector is listed as being suitable for this purpose for application with circuits extending from other than a cable with metallic sheath members.
  2. The connections of the insulated conductors to the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground or the conductors of the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground safely fuse on all current greater than the current-carrying capacity of the primary protector.

**(A)(1)**

- **D.** insulated conductors in accordance with 8.0.2.7(A) are used to extend circuits aerially to a building from a buried or underground circuit that is unexposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground.



## (A)(1)

46

- E. insulated conductors in accordance with 8.0.2.7(A) are used to extend circuits aerially to a building from cable with an effectively grounded metallic sheath member(s) where;
  1. The combination of the primary protector and insulated conductors is listed as being suitable for this purpose for application with circuits extending from a cable with an effectively grounded metallic sheath member(s).
  2. The insulated conductors safely fuse on all currents greater than the current capacity of the primary protector and the primary protector bonding conductor or grounding electrode conductor.



## (2) Fused Primary Protectors

47

- If requirements are not met, these type of protector shall be used. Fused-type primary protectors shall consist of an arrester of an arrester connected between each line conductor, and an appropriate mounting arrangement. Protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

## (B) Location

- Primary protector shall be located in, on, or immediately adjacent to the structure or building served and as close as practicable to the point of entrance.
- Primary protectors located at mobile home service equipment within 9000 mm of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor and located within 9000 mm of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

## (C) Hazardous (classified) Locations

- Primary protector shall not be located in any hazardous (classified) locations, as defined in 5.0.1.5 and 5.5.1.5 or in the vicinity of easily ignitable material.
- **EXCEPTION:** as permitted in 5.1.3.51, 5.2.3.51, and 5.3.3.51.



## (D) Secondary Protectors

- A secondary protector is installed in series with the indoor communications wire and cable between the primary protector and the equipment, it shall be listed for the purpose in accordance with 8.0.6.1(B).
- FPN. Secondary protectors on circuits exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground are not intended for use without primary protectors.

## 8.0.3.4 Grounding or Interruption of Metallic Sheath Members of Communications Cables

51

- Communication cables entering the building or terminating on the outside of the building shall comply with 8.0.3.4(A) or(B).

## (A) Entering Buildings

- In installations where the communications cable enters a building, the metallic sheath members of the cable shall be either grounded as specified in 8.0.4.1 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of entrance.



## (B) Terminating on the Outside of the Building

53

- In installations where the communications cable is terminated on the outside of the building, the metallic sheath members of the cable shall be either grounded as specified in 8.0.4.1 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of termination of the cable.



## 8.0.4 Grounding Methods

54

## 8.0.4.1 Cable and Primary Protector Bonding and Grounding

55

- The primary protector and the metallic sheath member(s) of the cable sheath shall be bonded or grounded as specified in 8.0.4.1(A) through (D).





**(A) Bonding Conductor or  
Grounding Electrode  
Conductor**

56

## (1) Insulation

57

- The bonding conductor or grounding electrode conductor shall be listed and shall be permitted to be insulated, covered or bare.

## (2) Material

58

- The bonding conductor or grounding electrode conductor shall be copper or other corrosion-resistant conductive material, stranded or solid.



### (3) Size

- The bonding conductor or grounding electrode conductor shall not be smaller than  $2.0 \text{ mm}^2$ . It shall have a current-carrying capacity not less than the grounded metallic sheath member(s) and protected conductor(s) of the communication cable. The bonding conductor or grounding electrode conductor shall not be required to exceed  $14 \text{ mm}^2$ .

## (4) Length

60

- The primary protector grounding electrode conductor shall be as short as practicable. In one- and two-family dwellings, The primary protector or grounding electrode conductor shall be as short as practicable, not to exceed 6000 mm in length.

## (5) Run in Straight Line

61

- The bonding conductor or grounding electrode conductor shall be run in as straight a line as practicable.



## (6) Physical Protection

62

- Bonding conductors and grounding electrode conductor shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of a raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

## (B) Electrode

63

- The bonding conductor or grounding electrode conductor shall be connected in accordance with 8.0.4.1(B), (B)(2), or (B)(3).

## (1) In buildings or structures with an intersystem bonding termination

64

- If the building or structure served has an intersystem bonding termination as required by 2.50.5.5, the bonding conductor shall be connected to the intersystem bonding termination.



## (2) In buildings or structures with grounding means

65

- If the building structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

- a. The building or structure grounding electrode system as covered in 2.50.3.2
- b. The grounded interior metal water piping system, <sup>66</sup> within 1500 mm from its point of entrance to the building, as covered in 2.50.3.2
- c. The power service accessible means external to enclosures using the options identified in 2.50.5.5(A), Exception
- d. The nonflexible metallic service raceway
- e. The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service.
- f. The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is grounding to an electrode as covered in 2.50.2.13



(3) In buildings or structures without an intersystem bonding termination or grounding means

- If the building or structure served has no intersystem bonding termination or grounding means, as described in 8.0.4.1(B)(2), the grounding electrode conductor shall be connected to either of the following:



- a) To any one of the individual grounding electrodes described in 2.50.3.3(A)(1), (A)(2), (A)(3), or (A)(4).
- b) If the building or structure served has no intersystem bonding termination or grounding means to any one of the grounding electrodes or to a ground rod or pipe not less than 1500 mm in length and 12.7 mm in diameter, driven, where practicable, into permanently damp earth and separated from lightning protection system conductor shall not be employed as electrodes for protectors and grounded metallic members.

- Connections to grounding electrodes shall comply with 2.50.3.21.


## (D) Bonding of Electrodes

70

- A bonding jumper not smaller than 14 mm<sup>2</sup> copper or equivalent shall be connected between the communications grounding electrode and power grounding electrode system at the building or structure served where separate electrodes are used.

**EXCEPTION:** At mobile homes as covered in 8.0.4.7.



A person wearing a red jacket is shown in profile, looking down at a handheld electronic device with a screen and a long antenna. The device is mounted on a black carrying case. In the background, there are green trees and a tall, lattice-structured radio tower against a clear sky. The image is split horizontally by a dark grey bar containing text.

## 8.0.5.1 Raceways and Cable Routing Assemblies for Communications Wires and Cables

71

## (a) Types of Raceways

- (1) Raceways recognized in Chapter 3: Communications wires and cables shall be permitted to be installed in any raceway included in chapter 3.
- (2) Communications Raceways: Communications wires and cables shall be permitted to be installed in listed plenum, riser, and general purpose communications raceways.
- (3) Interduct for Communications wires and cables: Listed plenum, riser, and general purpose communication raceway shall be permitted to be installed as innerduct in any type of listed raceway.

## (B) Raceway Fill for Communication Wires and Cables

73

- The raceway fill requirement of chapters 3 and 9 shall not apply to communications wires and cables.



## (C) Cable Routing Assemblies

74

- Communications wires and cables shall be permitted in plenum, riser, and general-purpose cable routing assemblies selected in accordance w/ table 8.0.5.45(c), listed in accordance with 8.06.13, and installed in accordance with 8.0.5.1(c)(1) and (2) and 8.0.5.4

## (1) Horizontal Support

- Cable routing assemblies shall be supported where run horizontally at intervals not to exceed 900 mm, and at each end or joint, unless listed for other support intervals. In no case shall the distance between supports exceed 3000 mm.

## (2) Vertical Support

76

- Vertical runs of cable routing assemblies shall be supported at intervals not exceeding 1200 mm, unless listed for other support intervals, and shall not have more than one joint between supports.



#### 8.0.5.4 Installation of Communication Wires, Cables and Raceways, and Cable Routing Assemblies

77

- Installation of communication wires, cables and raceways, and cable routing assemblies shall comply with 8.0.5.4(a) through (l).
- Installation of cable routing assemblies shall also comply with 8.0.5.1.

## (A) Listing

- Communication wires, cables, raceways, and cable routing assemblies installed in the buildings shall be listed.
- **EXCEPTION:** communications cables that are installed in compliance with 8.0.2.5 shall not be required to be listed.

## (B) Ducts Specially Fabricated for Environmental Air

79

- (1) up to 1200 mm of type CMP Cable.
- (2) types CMP, CMR, CMG, CM, and CMX cables and communications wires installed in raceways that are installed in compliance with 3.0.1.22(B)



## (C) Other Spaces Used for Environmental Air (Plenums)

80

- The following wires, cables, and raceways shall be permitted in other spaces used for environmental air as described in 3.0.1.22(C).

1. Type CMP cables
2. Plenum communications raceways
3. Plenum cable routing assemblies
4. Type CMP cables installed in plenum communications raceways.
5. Type CMP cables installed in plenum cable routing assemblies.
6. Type CMP cables and plenum communications raceways supported by open metallic cable trays or cable tray systems.

1. Types CMP, CMR, CMG, CM, and CMX cables and communications wires installed in raceways that are installed in compliance with 3.0.1.22(C)
2. Type CMP, CMR, CMG, CM, and CMX cables plenum, risers, and general-purpose communications raceways supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums)
3. Type CMP, CMR, CMG, CM, and CMX cables installed in plenum, riser, and general-purpose communication raceways supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums)



## (D) Risers-Cables, Raceways, and Cable Routing Assemblies in Vertical Runs.

83

- The following cables, raceways, and cable routing assemblies shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:
  - (1) types CMP and CMR cables
  - (2) plenum and riser communication raceways
  - (3) plenum and riser cable routing assemblies

(4) Types CMP and CMR cables installed in:

- a) Plenum communications raceways
- b) Riser communication raceways
- c) Plenum cable routing assemblies
- d) Riser cable routing assemblies

## (E) Risers-Cables and Innerducts in Metal Raceways

85

- (1) types CMP, CMR, CMG, CM, and CMX cables (innerduct)
- (2) plenum, riser, and general-purpose communications raceways (innerduct)
- (3) types CMP, CMR, CMG, CM, and CMX cables installed in:  
a) Plenum communications raceways  
b) Riser communication raceways  
c) General-purpose communication raceways



## (F) Risers-Cables, Raceways, and Cable Routing Assemblies in Fireproof shafts

86

- The following cables, raceways, and cable routing assemblies shall be permitted to be installed in fireproof riser shafts having firestops at each floor:
  - (1) Types CMP, CMR, CMG, and CMX cables
  - (2) Plenum, riser and general-purpose communication raceways
  - (3) Plenum, riser and general-purpose cable routing assemblies

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

87

- a) Plenum communication raceways
- b) Riser communications raceways
- c) General-purpose communications raceways
- d) General-purpose cable routing assemblies
- e) Plenum cable routing assemblies
- f) Riser cable routing assemblies

## (G) Risers-One and Two-Family Dwellings

88

- (1) types CMP, CMR,CMG, and CM cables
- (2) type CMX cables less than 6 mm in diameter
- (3) plenum, riser, and general-purpose communications raceways
- (4) plenum, riser and general-purpose cable routing assemblies
- (5) types CMP, CMR,CMG, and CM cables installed in:
  - a) Plenum communication raceways
  - b) Riser communications raceways
  - c) General-purpose communications raceways
  - d) Plenum cable routing assemblies
  - e) Riser cable routing assemblies
  - f) General-purpose cable routing assemblies



## (H) Cable Trays

- (1) types CMP, CMR, CMG, and CM cables
- (2) plenum, riser, and general-purpose communication raceways
- (3) communications wires and types CMP, CMR, CMG, and CM cables installed in:
  - a) Plenum communications raceways
  - b) Riser communication raceways
  - c) General-purpose communication raceways

## (I) Distributing Frames and Cross-Connect Arrays

90

- The following wires, cables, raceways, and cable routing assemblies shall be permitted to be installed in distributing frames and cross-connect arrays:

- (1) types CMP, CMR, CMG, and CM cables and communication wires
- (2) plenum, riser, and general-purpose communication raceways
- (3) plenum, riser and general-purpose cable routing assemblies
- (4) communications wires and types CMP, CMR, CMG, and CM cables installed in:
  - a) Plenum communications raceways
  - b) Riser communication raceways
  - c) General-purpose communication raceways
  - d) General-purpose cable routing assemblies
  - e) Plenum cable routing assemblies
  - f) Riser cable routing assemblies



## (J) Other Building Locations

- (1) types CMP, CMR, CMG, and CM cables
- (2) a maximum of 3000 mm of exposed type CMX in nonconcealed spaces
- (3) plenum, riser, and general-purpose communications raceways
- (4) plenum, riser, and general-purpose cable routing assemblies

(5) Communications wires and types CMP, CMR, CMG, and CM cables installed in:

93

- a) Plenum communications raceways
- b) Riser communication raceways
- c) General-purpose communication raceways

(6) Types CMP, CMR, CMG, and CM cables installed in:

94

a) Plenum communications raceways

b) Riser communication raceways

c) General-purpose communication raceways

(7) Communications wires and Types CMP, CMR, CMG, and CM cables installed in raceways recognized in chapter 3

(8) Type CMUC under-carpet communications wires and cables under carpet, modular tiles, and planks.



## (K) Multifamily Dwellings

- (1) types CMP, CMR, CMG, and CM cables
- (2) type CMX cables less than 6 mm (in diameter in nonconcealed spaces
- (3) plenum, riser, and general-purpose communications raceways
- (4) plenum, riser, and general-purpose cable routing assemblies
- (5) Types CMP, CMR, CMG, and CM cables installed in:
  - a) Plenum cable routing assemblies
  - b) Riser cable routing assemblies
  - c) General-purpose cable routing assemblies

## (L)One- and Two- Family Dwellings

96

- Cables, raceways, and cable routing assemblies shall be permitted to be installed in one and two family dwellings in locations other than the locations covered in 8.0.5.4(B) through (F).

A photograph of a worker in a blue shirt and yellow hard hat on a metal tower structure. The tower is covered in a dense network of red and white communication wires. The background is a clear blue sky. The text '8.0.5.24 Installation of Communication Wires, Cables, and Equipment' is overlaid on a dark grey rectangular background on the left side of the image.

## 8.0.5.24 Installation of Communication Wires, Cables, and Equipment

97



## (A) Separation from Other Conductors

- (1) In Raceways, Cable Trays, Boxes, Cables, Enclosures, and Cable Routing Assemblies
  - a) Other Circuits. Communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with cables of any of the following:

## (a) Other Circuits.

- (1) class 2 and class 3 remote-control signaling, and power-limited circuits.
- (2) Power-limited fire alarm systems
- (3) nonconductive and conductive optical cable fibers
- (4) community antenna television and radio distribution systems
- (5) low-power network-powered broadband communications circuits

## (b) Class 2 and Class 3 Circuits

100

- Shall be permitted in the same cable with communication circuits, in which case the class 2 and 3 circuits shall be classified as communications circuits and shall meet the requirements of the article.



## (2) Other Applications

- Communications wires and cables shall be separated at least 50 mm from the conductors of any electric light, power, class 1, non-power-limited fire alarm, or medium-power network-powered broadband communications circuits.

## (B) Support of Communication Wires and Cables

102

- Raceways shall be used for their intended purpose.
- Communication wires and cables shall not be strapped, taped, or attached by any means to the exterior of any raceway as a means of support.
- **EXCEPTION:** overhead (aerial) spans of communications wires and cables shall be permitted to be attached to the exterior of a raceway-type mast intended for the attachment and support of such wires and cables.



8.0.5.45 Applications of  
Listed Communications  
Wires, Cables and Raceways,  
and Listed Cable Routing  
Assemblies

103



Permitted and Non-permitted applications of listed communication wires, cables, and raceways, and listed cable-routing assemblies:

- (1) Listed communications wires and cables as indicated in Table 8.0.5.45(A)
- (2) Listed communication raceways as indicated in Table 8.0.5.45(B)
- (3) Listed cable routing assemblies as indicated in Table 8.0.5.45(C)

•

## 8.0.5.47 Dwelling unit Communication Outlet

105

- For new construction, a minimum of one communications outlet shall be installed within the dwelling in a readily accessible area and cabled to the service provider demarcation point.

Cable Type	Permitted Substitutions
CMR	CMP
CMG,CM	CMP,CMR
CMX	CMP,CMR, CMG,CM

Table 8.0.5.45(d) Cable Substitutions

A photograph of a satellite ground station featuring several large white parabolic dish antennas mounted on metal structures. In the background, there are orange and black buildings and a range of mountains under a clear blue sky. A black horizontal bar is overlaid across the middle of the image, containing the section title. A cyan rectangular box is positioned on the right side of the image, containing the page number.

## 8.0.6 Listing Requirements

106



## 8.0.5.1 Equipment

107

- Communications equipment shall be listed as being suitable for electrical connection to a communications network

# Figure 8.0.5.45 Cable Substitution Hierarchy

108

Plenum

Riser

General purpose

Dwellings

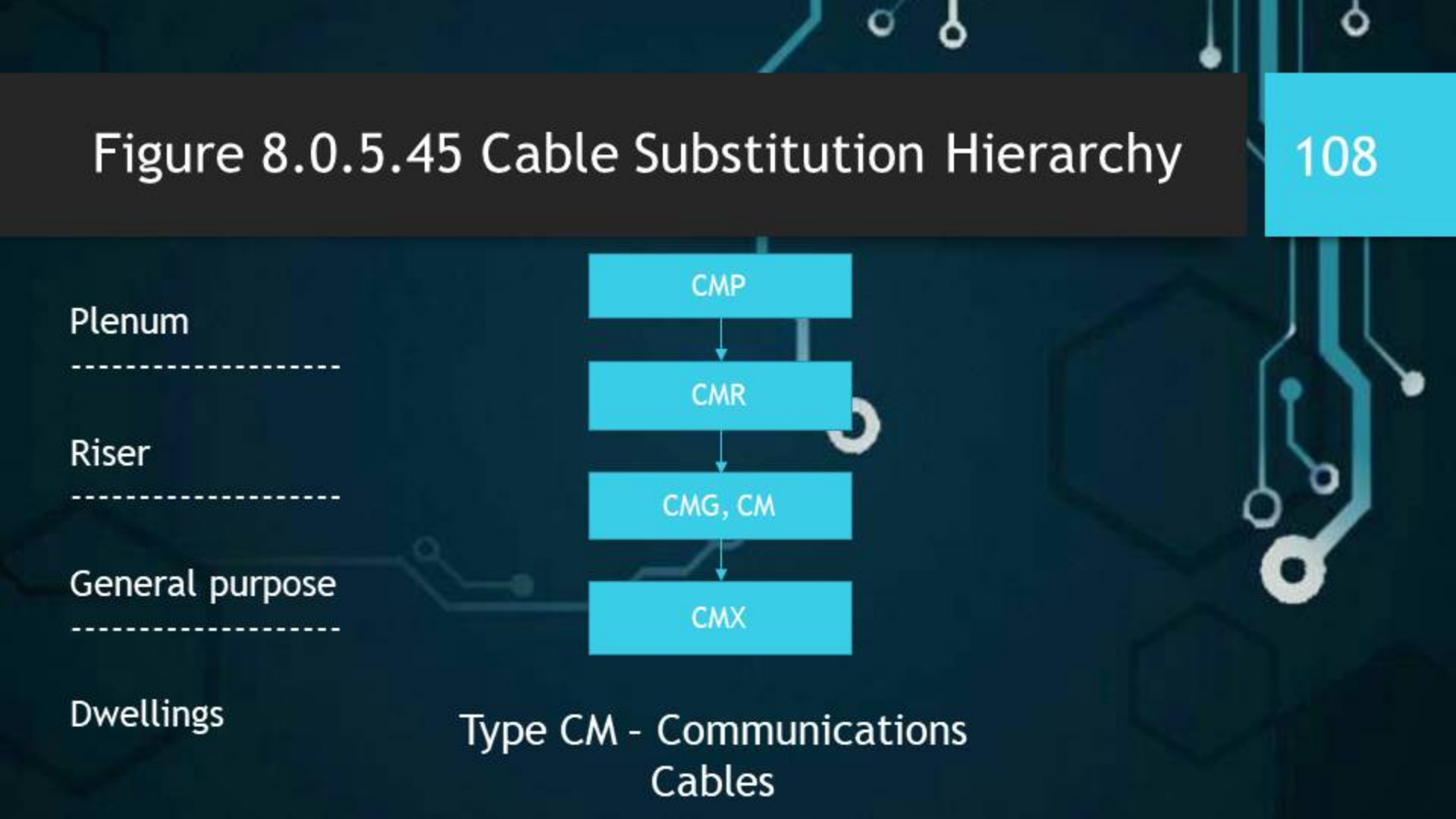
CMP

↓  
CMR

↓  
CMG, CM

↓  
CMX

Type CM - Communications  
Cables



## (A) Primary Protector

109

- Shall consist of an arrester connected between each line conductor and ground in an appropriate marked to indicate line and ground as applicable.



## (B) Secondary Protectors

- Shall be listed as suitable to provide means to safely limit currents to less than the current-carrying capacity of listed indoor communications wire and cable, listed telephone set line cords, and listed communications circuits. Any overvoltage protection, arrester, or grounding connection shall be connected on the equipment terminals side of the secondary protector current-limiting means.

## (c) Plenum Grade Cable Ties

111

- Cable ties intended for use in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties.

## 8.0.6.4 Drop Wire and Cable

112

- Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed as being suitable for the purpose and shall have a current-carrying capacity as specified in 8.0.3.1(A)(1)(b) or (A)(1)(c).



## 8.0.6.10 Communications Wires and Cables

113

- Shall have a voltage rating of not less than 300 volts. The insulation for the individual conductors, other than the outer conductor of a coaxial cable, shall be rated for 300 volts minimum.

## (A) Type CMP

114

- Communications plenum cables shall be listed as being suitable for use in ducts, plenums, and other spaces used for environmental air and shall also be listed as having adequate fire-resistant and low smoke-producing characteristics.

## (B) Type CMR

115

- Communications riser 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 fire from floor to floor.



## (C) Type CMG

116

- General-purpose communications cables shall be listed as being suitable for general-purpose communications use, with the exception of risers and plenums.

## (D)Type CM

117

- communications cables shall be listed as being suitable for general-purpose communications use, with the exception of risers and plenums, and shall also be listed as being resistant to the spread of fire.

## (E) Type CMX

118

- Limited-use communications cables shall be listed as being suitable for use in dwellings and for use in raceway and shall be listed as being resistant to flame spread.



## (F) Type CMUC Undercarpet Wires and Cables

119

- Undercarpet communications wires and cables shall be listed as being suitable for undercarpet use and shall also be listed as being resistant to flame spread.

## (G) Circuit Integrity (CI) Cable or Electrical Circuit Protective System

120

- FPN: The listing organization provides information for circuit integrity (CI) cable and electrical circuit protective systems, including installation requirements required to maintain the fire rating.

## (H) Communications Wires

121

- Communication wires, such as distributing frame wire and jumper wire, shall be listed as being resistant to the spread of fire.



## (I) Hybrid Power and Communications Cables

122

- Listed hybrid power and communications cables shall be permitted where the power cable is listed as Type NM or NM-B, and the communications cable is a listed Type CM, the jackets on the listed NM or NM-B, and listed CM cables are rated for 600 volts minimum, and the hybrid cable is listed as being resistant to the spread of fire.

## Table 8.0.6.10 Cable Markings

123

Cable Marking	Type
CMP	Communications plenum cable
CMR	Communications riser cable
CMG	Communications general-purpose cable
CM	Communications general-purpose cable
CMX	Communications cable, limited use
CMUC	Under-carpet communications wire and cable



# 8.10 RADIO AND TELEVISION EQUIPMENT

124



## 8.10.1.1 SCOPE:

125

- covers antenna systems for radio and television receiving equipment, amateur and citizen band radio transmitting and receiving equipment, and certain features of transmitter safety

#### 8.10.1.4 Community Television Antenna

126

- The antenna shall comply with this article.
- The distribution system shall comply with article 8.20

## 8.10.1.5 Radio Noise Suppressors

127

- Radio interference eliminators, interference capacitors or noise suppressors connected to power-supply leads shall be of a listed type. They shall not be exposed to physical damage.



## 8.10.1.6 Antenna Lead-In Protectors

128

- Where an antenna lead-in surge protector is installed, it shall be listed as being suitable for limiting surges on the cable that connects the antenna to the receiver/transmitter electronics and shall be connected between the conductors and the grounded shield or other ground connection.



## 8.10.2 Receiving Equipment-Antenna Systems

129

- Antennas and lead-in conductors shall be of hard-drawn copper, bronze, aluminum alloy, copper-clad steel, or other high-strength, corrosion-resistant material.



## 8.10.2.2 Supports

131

- Outdoor antennas and lead-in conductors shall be securely supported.
- The antennas or lead-in conductors shall not be attached to the electric service mast.
- They shall not be attached to poles or similar structures carrying open electric light or power wires of over 250 volts between conductors.
- Insulators supporting the antenna conductors shall have sufficient mechanical strength to safely support the conductors.
- Lead-in conductors shall be securely attached to the antennas.

### 8.10.2.3 Avoidance of Contacts with Conductors of Other Systems

132

- Outdoor antennas and lead-in conductors from an antenna to a building shall not cross over open conductors of electric light or power circuits and shall be kept well away from all such circuits so as to avoid the possibility of accidental contact.


## 8.10.2.4 Splices

133

- Splices and joints in antenna spans shall be made secure with approved splicing devices or by such other means as will not appreciably weaken the conductors.



- Masts and metal structures supporting means shall be grounded in accordance with 8.10.2.11, unless the antenna and its related supporting mast or structure are within a zone of protection defined by a 46 m radius rolling sphere.



## 8.10.2.6 Size of Wire-Strung Antenna - Station

135

## (A) Size of Antenna Conductors

136

- Outdoor antenna conductors for receiving stations shall be of a size not less than given in Table 8.10.2.6(A).

Table 8.10.2.6(A). Size of Receiving Station Outdoor Antenna Conductors	Minimum size of Conductors (mm <sup>2</sup> (mm dia)) Where Maximum Open Span Length is		
Material	Less than 11 m	11m to 45 m	Over 45 m
Aluminum alloy, hard-drawn copper	0.65(0.9)	2.0(1.6)	3.5(2.0)
Cooper-clad steel, bronze, or other high-strength material	0.50(0.8)	0.90(1.11)	2.0(1.6)



## (B) Self-Supporting Antennas

- Outdoor antennas, such as vertical rods and flat, parabolic or dipole structures, shall be of corrosion-resistant materials and of strength suitable to withstand rain and wind loading conditions and shall be located well away from overhead conductors of electric lights and power circuits of over 150 volts to ground.

- For various maximum open span lengths, shall be of such size as to have a tensile strength of at least as great as that of the conductors for antennas as specified in 8.10.2.6.

## 8.10.2.8 Clearances - Receiving Stations

139



## (A) Outside of Buildings

- Lead-in conductors attached to buildings shall be installed so that they cannot swing closer than 600 mm to the conductors of circuits of 250 volts or less between conductors, or 3000 mm to the conductors of circuits of over 250 volts between conductors, except in the case of circuits not over 150 volts between conductors.

## (B) Antennas and Lead-ins - Indoors

141

- Shall not be run nearer than 50 mm to conductors of other wiring systems in the premises.

## (C) In Boxes or Other Enclosures

142

- Indoor antennas/lead-ins shall be permitted to occupy the same box enclosure with conductors of other wiring systems where separated from such other conductors of other wiring systems where separated from such other conductors by an effective permanently installed barrier.



## 8.10.2.9 Electrical Supply Circuits used in Lieu of Antenna - Receiving Stations

143

- Electrical supply circuits is used I lieu of an antenna, the device by which the radio receiving set is connected to the supply circuit shall be listed.

## 8.10.2.10 Antenna Discharge Units - Receiving Stations

144

## (A) Where Required


145

- Each conductor of a lead-in from an outdoor antenna shall be provided with a listed antenna discharge unit.



## (B) Location

- Antenna discharge units shall be located outside the building or inside the building between the point of entrance of the lead-in and the radio set or transformers and as near as practicable to the entrance of the conductors of the building.
- Antenna discharge unit shall not be located near combustible material or in hazardous (classified) location.



8.10.2.11 Bonding  
Conductors and  
Grounding Electrode  
Conductors - Receiving  
Stations

147

## (A) Material

148

- The bonding or grounding electrode conductor shall be made of copper, aluminum, aluminum alloy, copper-clad steel, bronze, or similar corrosion-resistant material.



## (B) Insulation

149

- Insulation on bonding conductors or grounding electrode conductors shall not be required.

## (C) Supports

150

- The bonding/grounding electrode conductor shall be securely fastened in place and shall be permitted to be directly attached to the surface wired over without the use of insulating supports.

## (D) Physical Protection

- Bonding conductors shall be protected where exposed to physical damage.
- The bonding or grounding electrode conductor installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding or grounding electrode conductor is connected.



## (E) Run in Straight Line

152

- The bonding or grounding electrode conductor for an antenna mast or antenna discharge unit shall be run in as straight a line as practicable.

## (F) Electrode

153

- The bonding or grounding electrode conductor shall be connected as required in 8.10.2.11(F)(1) through (F)(3).

## (F)(1) In Buildings or Structures with an Intersystem Bonding Termination

154

- If the building or structure served has an intersystem bonding termination as required by 2.50.5.5, the bonding conductor shall be connected to the intersystem bonding termination.



## (F)(2) In Buildings or Structures with Grounding Means

155

- If the building or structure served has no intersystem bonding termination, the bonding or grounding electrode conductor shall be connected to the nearest accessible location on the following:

## Nearest Accessible Location

156

- a) The building or structure grounding electrode system as covered in 2.50.3.1
- b) The grounded interior metal water piping systems, within 1500 mm from its point of entrance to the building, as covered in 2.50.3.3
- c) The power service accessible means external to the building, as covered in 2.50.5.5
- d) The nonflexible metallic power service railway.
- e) The service equipment enclosure, or
- f) The grounding electrode conductor or the grounding electrode conductor metal enclosures of the power service

(F)(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means

157

- If the building or structure served has no intersystem bonding termination or grounding means, the grounding electrode conductor shall be connected to a grounding electrode as described in 2.50.3.3



## (G) Inside or Outside Building

158

- The bonding or grounding electrode conductor shall be permitted to be run either inside or outside the building.

## (H) Size

159

- The grounding conductor shall not be smaller than 5.5 mm<sup>2</sup> (2.6 mm dia.) copper, 8.0 mm<sup>2</sup> (3.2 mm dia.) aluminum, or 0.90 mm<sup>2</sup> (1.1 mm dia.) copper-clad steel or bronze.

## (I) Common Ground

160

- A single bonding or grounding electrode conductor shall be permitted for both protective and operating purposes.



## (J) Bonding of Electrodes

- A bonding jumper not smaller than 14 mm<sup>2</sup> copper or equivalent shall be connected between the radio and television equipment grounding electrode and the power grounding electrode system at the building or structure served where separate electrodes are used.

## (K) Electrode Connection

162

- Connections to grounding electrode shall comply with 2.50.3.21.

# 8.10.3 Amateur and Citizen Band Transmitting and Receiving Stations Antenna Systems

163



## 8.10.3.1 Other Sections

164

- In addition to complying with Part 8.10.3, antenna systems for amateur and citizen band transmitting and receiving stations shall also comply with 8.10.2.1 through 8.10.2.5

## 8.10.3.2 Size of Antenna

165

- Antenna conductors for transmitting and receiving stations shall be of a size not less than given in table 8.10.3.2

**Table 8.10.3.2 Size of Outdoor Antenna Conductor**

Material	Minimum Size of Conductors [mm <sup>2</sup> (mm dia.)] Where Maximum Open span length is	
	11 m to 45 m	Over 45 m
Aluminum alloy, hard-drawn copper	2.0 (1.6)	5.5 (2.6)
Copper-clad steel, bronze or other high-strength material	2.0 (1.6)	3.5 (2.0)

## 8.10.3.3 Size of Lead-in Conductors

166

- Lead-in conductors for transmitting stations shall, for various maximum span lengths, be of a size at least as great as that of conductors for antennas specified in 8.10.3.2

**Table 8.10.3.2 Size of Outdoor Antenna Conductor**

Material	Minimum Size of Conductors [mm <sup>2</sup> (mm dia.)] Where Maximum Open span length is	
	11 m to 45 m	Over 45 m
Aluminum alloy, hard-drawn copper	2.0 (1.6)	5.5 (2.6)
Copper-clad steel, bronze or other high-strength material	2.0 (1.6)	3.5 (2.0)



## 8.10.3.4 Clearance on Building

167

- Antenna conductors for transmitting stations, attached to buildings, shall be firmly mounted at least 75 mm clear of the surface of the building on nonabsorbent insulating supports, such as treated pins or brackets equipped with insulators having not less than 75-mm creep age and air gap distances.
- Lead-in conductors attached to buildings shall comply with these requirements.

## 8.10.3.5 Entrance to Building

168

- Except where protected with a continuous metallic shield that is grounded with a conductors, lead-in conductors for transmitting stations shall enter buildings by one of the following methods:
  - (1) Through a rigid, noncombustible, nonabsorbent insulating tube or bushing
  - (2) Through an opening provided for the purpose in which the entrance conductors are firmly secured so as to provide a clearance of at least 50mm
  - (3) Through a drilled window pane

### 8.10.3.6 Protection Against Accidental Contact.

169

- Lead-in conductors to radio transmitters shall be located or installed so as to make accidental contact with them difficult.



### 8.10.3.7 Antenna Discharge Units - Transmitting Stations

170

- Each conductor of lead-in for outdoor antennas shall be provided with an antenna discharge unit or other suitable means that drain static charges from the antenna system.

# 8.10.3.8 Bonding Conductors and Grounding Electrode Conductors

Amateur and Citizen Band  
Transmitting and Receiving  
Stations

171

## (A) Other Sections

172

- All bonding and grounding electrode conductor for amateur and citizen band transmitting and receiving stations shall comply with 8.10.2.11(A) through (K)



## (B) Size of Protective Bonding Conductor or Grounding Electrode Conductor

173

- The protective bonding or grounding electrode conductor for transmitting stations shall be as large as the lead-in but not smaller than 5.5. mm<sup>2</sup> (2.6 mm dia.) copper, bronze, or copper-clad steel.

## (C) Size of Operating Bonding Conductor or Grounding Electrode Conductor

174

- The operating bonding or grounding electrode conductor for transmitting stations shall not be less than 2.0 mm<sup>2</sup> copper or its equivalent.



## 8.10.4 Interior Installation - Transmitting Stations

175



#### 8.10.4.1 Clearance from Other Conductors

176

- All conductors inside the building shall be separated at least 100 mm from the conductors of any electric light, power, or signaling circuit.

## 8.10.4.2 General

177

Compliance of Transmitters

## (A) Enclosing

- The transmitter shall be enclosed in a metal frame or grille or separated from the operating space by a barrier or other equivalent means, all metallic parts of which are effectively connected to a bonding or grounding electrode conductor.



## (B) Grounding of Controls

179

- All external metal handles and controls accessible to the operating personnel shall be effectively connected to an equipment grounding conductor if the transmitter is powered by the premises wiring system or grounded with a conductor.

## (C) Interlocks on Doors

180

- All access doors shall be provided with interlocks that disconnect all voltages of over 30 volts between conductors when any access door is opened.



## 8.3 COMMUNITY ANTENNA TELEVISION AND RADIO DISTRIBUTION SYSTEMS

181



## 8.20.1 General

182

- The article covers coaxial cable distribution of radio frequency signals typically employed in community antenna television (CATV) systems

## 8.20.1.2 Definitions

184



## 8.20.1.2 Definitions

185

- **Abandoned Coaxial Cable** - Installed coaxial cable that is not terminated at equipment other than a coaxial connector and not identified for future use with tag.
- **Exposed (to Accidental Contact)** - A circuit in such a position that, in case of failure of supports and or insulation, contact with another circuit may result.
- **Point of Entrance** - The point within a building at which the coaxial cable emerges from an external wall, from a concrete floor slab.
- **Premises** - The land and buildings of a user located on the user side of utility-user network point of demarcation.

## 8.20.1.3 Other Articles

186

Circuits and Equipment shall comply with  
8.20.1.3(A) through (J)

## (A) Hazardous (Classified) Locations

187

- CATV equipment installed in a location that is classified in accordance with 5.0.1.5 and 5.5.1.5 shall comply with the applicable requirements of Chapter 5.



## 8.20.1.3 Other Articles

188

(B) Wiring in Ducts for Dust, Loose Stock, or Vapor Removal

The requirements of 3.0.1.22(A) shall apply.

(C) Equipment in Other Space Used for Environmental

Air

The requirements of 3.0.1.22(C)(3) shall apply.

(D) Installation and Use

The requirements of 1.10.1.3(B) shall apply

## 8.20.1.3 Other Articles

189

(E) Installations of Conductive and Nonconductive Optical Fiber Cables

The requirements of Article 7.70 shall apply.

(F) Communications Circuits

The requirements of Article 8.0 shall apply.

(G) Network-Powered Broadband Communications

The requirements of Article 8.30 shall apply.

## 8.20.1.3 Other Articles

190

### (H) Premises-Powered Broadband Communications

- The requirements of Article 8.40 shall apply.

### (I) Alternate Wiring Methods

- The wiring methods of Article 8.30 shall be permitted to substitute for the wiring methods of Article 8.20



## 8.20.1.15 Power Limitations

191

- Coaxial cable shall be permitted to deliver power to equipment that is directly associated with the radio frequency distribution system if the voltage is not over 60 volts and if the current is supplied by a transformer or other device that has power-limiting characteristics.

## 8.10.1.21 Access to Electrical Equipment Behind Panels Designed to Allow Access

192

- Access to electrical equipment shall not be denied by an accumulation of coaxial cables that prevents removal of panels, end covers and the likes, etc., including suspended ceiling panels

## 8.20.1.24 Mechanical Execution of Work

- Community television and radio distribution systems shall be installed in a neat and workmanlike manner.
- Coaxial cables installed exposed on the surface of ceiling and sidewalls shall be supported by building structures in such manner that the cables will not be damaged by normal building use.
- Such 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.



## 8.20.1.25 Abandoned Cables


194

- The accessible portion of abandoned coaxial cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

## 8.20.1.26 Spread of Fire or Products of Combustion

195

- Installations of coaxial cables and communications raceways in hollow spaces, vertical shafts, and ventilation or air-handling ducts shall be made so that the possible spread of fire or products of combustion will not be substantially increased.



## 8.20.2.1 Coaxial Cables Outside and Entering Buildings

196



## 8.20.2.1 Overhead (Aerial) Coaxial Cables

197

- Overhead (aerial) coaxial cables, prior to the point of grounding, as specified in 8.20.3.1, shall comply with 8.20.2.1(A) through 8.20.2.1(E).

## (A) On Poles and In-Span

- (1) **Relative Location** - Where practicable, the coaxial cables shall be located below the electric light or power conductors.
- (2) **Attachment to Cross-Arms** - Coaxial cables shall not be attached to cross-arm that carries electric light or power conductors
- (3) **Climbing Space** - Climbing space through coaxial cables shall comply with the requirements of 2.25.1.14(D).
- (4) **Clearance** - Lead-in or overhead (aerial) - drop coaxial cables from a pole or other support, including the point of initial attachment to a building or structure, shall be kept away from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors so as to avoid the possibility of accidental contact.

## (B) Above Roofs

199

- Coaxial cables shall have a vertical clearance of not less than 2500 mm from all points of roofs above which they pass.



## (C) On Masts

200

- Overhead (aerial) coaxial cables shall be permitted to be attached to an above-the-roof raceway mast that does not enclose or support conductors of electric light or power circuits.

## (D) Between Buildings

- Coaxial cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified and shall have sufficient strength to withstand the loads to which they might be subjected.

## (E) On Buildings

202

- Where attached to buildings, coaxial cables shall be securely fastened in such a manner that they will be separated from other conductors in accordance to the following:



### (1) Electric Light or Power

The coaxial cable shall have a separation of at least 100 mm from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or shall be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

### (2) Other Communication System

Coaxial cable shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cable, messenger strand, or equipment of any other system

### (3) Lighting Conductors

Where practicable, a separation of at least 1800 mm shall be maintained between any coaxial cable and lightning conductors.



8.20.2.4 Underground  
Coaxial Cables Entering  
Buildings

204

## (A) Underground Systems with Electric Light, Power, Class 1, or Non-Power-Limited Fire Alarm Circuit Conductors

205

- Underground coaxial cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power, or Class 1 or non-power-limited fire alarm circuit conductors shall be in a section permanently separated from such conductors by means of a suitable barrier.



## (B) Direct-Buried Cables and Raceways

206

- Direct-buried cables and raceways shall be separated at least 300 mm from conductors of any light or power, non-power-limited fire alarm circuit conductors, or Class 1 circuit.

## 8.20.2.5 Unlisted Cables Entering Buildings

207

- Unlisted outside plant coaxial cables shall be permitted to be installed in building spaces other than risers, ducts and other spaces used for environmental air , where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m and the cable enters the building from the outside and is terminated at a grounding block.

## 8.20.2.6 Metallic Entrance Conduit Grounding

208

- Metallic conduit containing entrance coaxial cable shall be connected by a bonding conductor to a grounding electrode in accordance with 8.20.4.1(B).





## 8.20.3 Protection

209



## 8.20.3.1 Grounding of the Outer Conductive Shield of Coaxial Cables

210

- Coaxial cables entering buildings or attached to buildings shall comply with 8.20.3.1(A) or (B).

## 8.20.3.1 Grounding of the Outer Conductive Shield of Coaxial Cables

211

- (A) Entering Buildings - In installations where the coaxial cable enters the building, the outer conductive shield shall be grounded. The grounding shall be as close as practicable to the point of entrance.
- (B) Terminating Outside of the Building - In installations where the coaxial cable is terminated outside the building, the outer conductive shield shall be grounded. The grounding shall be as close as practicable to the point of attachment or termination.





## 8.20.4 Grounding Methods

212



## 8.20.4.1 Cable Bonding and Grounding - Exception

213

- *For communication systems using coaxial cable completely contained within the building or the exterior zone of protection defined by a 46 m radius rolling sphere and isolated from outside cable plant, the shield shall be permitted to be grounded by a connection to an equipment grounding conductor.*

## (A) Bonding or Grounding Electrode Conductor

214

- (1) Insulation - The grounding or bonding electrode conductor shall be listed and shall be permitted to be insulated, covered, or bare.
- (2) Material - The bonding or grounding electrode conductor shall be copper or other corrosion-resistant conductive material, stranded or solid.



## (A) Bonding or Grounding Electrode Conductor

215

- (3) Size - The bonding or grounding electrode conductor shall not be smaller than 2.0 mm<sup>2</sup>. It shall have a current-carrying capacity not less than the outer sheath of the coaxial cable and shall not be required to exceed 14 mm<sup>2</sup>.
- (4) Length - The bonding or grounding electrode conductor shall be as short as practicable. In one- and two-family dwellings, it shall be as short as practicable, not to exceed 6000 mm in length.

## (A) Bonding or Grounding Electrode Conductor

216

- (5) Run in Straight Line - The bonding or grounding electrode conductor shall be run in as straight a line as practicable.
- (6) Physical Protection - Bonding and grounding electrode conductors shall be protected where exposed to physical damage.

## (B) Electrode

(1) In Buildings or Structures with an Intersystem Bonding Termination - If the building or structure served has an intersystem bonding termination, the bonding conductor shall be connected to the intersystem bonding termination.

(2) In Buildings or Structures with grounding Means - If the building or structure served has an established intersystem bonding termination, 2.50.5.5(A) shall apply.

(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means - The electrode shall be connected to individual grounding electrodes described in 2.50.3.3(A)(1), (A)(2), (A)(3), or (A)(4).



## (C) Electrode Connection

218

Connections to grounding electrodes shall comply with 2.50.3.21.

## (D) Bonding of Electrodes

- A bonding jumper not less than 14 mm<sup>2</sup> copper or equivalent shall be connected between the community antenna television system's grounding electrode and power grounding electrode system at the building or structure served where separate electrodes are used.

## (E) Shield Protection Devices

220


- Grounding of a coaxial drop cable shield by means of a protective device that does not interrupt the grounding system within the premises shall be permitted.



## 8.20.4.4 Equipment Grounding

221

- Unpowered equipment and enclosures or equipment powered by the coaxial cable shall be considered grounded where connected to the metallic cable shield.



## 8.20.6 Listing Requirements

222

## 8.20.6.1 Coaxial Cables

223

- Cables shall be listed in accordance with 8.20.6.1(A) through (D) and marked in accordance with Table 8.20.6.1.
- The cable voltage rating shall not be marked on the cable.
- Coaxial cables shall have a temperature rating of not less than 60°C.
- The temperature rating shall be marked on the jacket of coaxial cables that have a temperature rating exceeding 60°C.



## 8.20.6.1(A) Type CATVP

224

- Community antenna television plenum coaxial cables shall be listed as being suitable for use in ducts, plenums, and other spaces used for environmental air and shall also be listed as having adequate fire-resistant and low-smoke-producing characteristics.

## 8.20.6.1(B) Type CATVR

225

- Community antenna television riser coaxial 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.

## 8.20.6.1(C) Type CATV

226

- Community antenna television coaxial cables shall be listed as being suitable for general-purpose CATV use, with the exception of risers and plenums, and shall also be listed as being resistant to the spread of fire.



## 8.20.6.1(D) Type CATVX

227

- Limited-use community antenna television coaxial cables shall be listed as being suitable for use in dwellings and for use in raceway and shall also be listed as being resistant to flame spread.

Table 8.20.6.1 Coaxial Cable Markings

Cable Marking	Type
CATVP	CATV plenum cable
CATVR	CATV riser cable
CATV	CATV cable
CATVX	CATV cable, limited use


FPN: Cable types are listed in descending order of fire resistance rating

## 8.20.6.2 Grounding Devices

229

- Where bonding or grounding is required, devices used to connect a shield, a sheath, or non-current-carrying metallic members of a cable to a bonding conductor, or grounding electrode conductor, shall be listed or be part of listed equipment.





## 8.3 NETWORK-POWERED BROADBAND COMMUNICATION SYSTEMS

230

## 8.30.1 General

231

## 8.30.1.1 Scope

232

- This article covers network-powered broadband communications systems that provide any combination of voice, audio, video, data and interactive services through a network interface unit.



## 8.30.1.2 Definitions

233

## Abandoned Network-Powered Broadband Communications Cable

234

- Installed network-powered communications cable that is not terminated at equipment other than a connector and not identified for future use with a tag.

- A square or portion of a city, town, or village enclosed by streets, including alleys so enclosed but not any street.



## Exposed (to Accidental Contact)

236

- A circuit in such a position that, in case of failure of supports or insulation, contact with another circuit may result.

## Fault Protection Device

237

- An electronic device that is intended for the protection of personnel and functions under fault conditions, such as network-powered broadband communications cable short or open circuit, to limit the current or voltage, or both to provide acceptable protection for electric shock.

## Network Interface Unit (NIU)

238

- A device that converts a broadband signal into component voice, audio, video, data, and interactive services signals and provides isolation between the network power and the premises signal circuits.



- The point within a building at which the network-powered broadband communications cable emerges from an external wall, from a concrete floor slab, from rigid metal conduit (RMC), or from intermediate metal conduit (IMC).

## 8.30.1.15 Power Limitations

240

Network-powered broadband communications systems shall be classified as having low- or medium-power sources

241

- (1) Sources shall be classified as defined in Table 8.30.1.15.
- (2) Direct-current power sources exceeding 150 volts to ground, but no more than 200 volts to ground, with the current to ground limited to 10 mA dc.



# Table 8.30.1.15 Limitations for Network-Powered Broadband Communications Systems

Network Power Source	Low	Medium
Circuit voltage, $V_{max}$ (volts) <sup>1</sup>	0-100	0-150
Power Limitation, $VA_{max}$ (volt-amperes) <sup>1</sup>	250	250
Current Limitations, $I_{max}$ (amperes) <sup>1</sup>	$1000/V_{max}$	$1000/V_{max}$
Maximum power rating (volt-amperes)	100	100
Maximum voltage rating (volts)	100	150
Maximum overcurrent protection (amperes) <sup>2</sup>	$1000/V_{max}$	NA



8.30.6.1 Network-Powered Broadband Communications Equipment and Cables-Listing Requirements

243

## (A) Network-Powered Broadband Communications Medium-Power Cables

244

- Network-powered broadband communications medium-power cables shall be factory-assembled consisting of a jacketed coaxial cable.
- The insulation for the individual conductors shall be rated for 300 volts minimum.



## (A) Network-Powered Broadband Communications Medium-Power Cables

245

(1) **Type BMR** - 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.

(2) **Type BM** - shall be listed as being suitable for general-purpose use, with the exception of risers and plenums, and shall also be listed as being resistant to the spread of fire.

(3) **Type BMU** - shall be jacketed and listed as being suitable for outdoor underground use.

## (A) Network-Powered Broadband Communications Medium-Power Cables

246

- **BMU** - network-powered broadband communications medium power underground cable
- **BM** - network-powered broadband communications medium power cable
- **BMR** - network-powered broadband communications medium power riser cable

## (B) Network-Powered Broadband Communications Low-Power Cables

247

- Network-powered broadband communications low-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors.



## (1) Type BLP

- **BLP** - network-powered broadband communications low-power plenum cable
- Shall be listed as being suitable for use in ducts, plenums, and other spaces used for environmental air and shall also be listed as having adequate fire-resistant and low-smoke producing characteristics.

## (2) Type BLR

- **BLR** - network-powered broadband communications low-power riser cable
- 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.

### (3) Type BL

- **BL** - network-powered broadband communications low-power cable
- Shall be listed as being suitable for general-purpose use, with the exception of risers and plenums, and shall also be listed as being resistant to the spread of fire.



## (4) Type BLX

- **BLX** - limited use network-powered broadband communications low power cable
- Limited-use cables shall be listed as being suitable for use outside, for use in dwellings, and for use in raceways and shall also be listed as being resistant to flame spread.

## (5) Type BLU

252

- **BLU** - network-powered broadband low power underground cable
- Shall be jacketed and listed as being suitable for outdoor underground use.



Article 8.40-PREMISES-  
POWERED BROADBAND  
COMMUNICATIONS  
SYSTEMS

253



## 8.40.1.1 Scope.

This article covers premises-powered broadband communications systems.

FPN No. 1: A typical basic system configuration consists of an optical fiber, twisted pair, or coaxial cable to the premises supplying a broadband signal to a network terminal that converts a broadband signal into component electrical signals , such as traditional telephone, video, high-speed internet, and interactive services.

## 8.40.1.2. Definitions.

**Network Terminal.** A device that converts network-provided signals( optical, electrical, or wireless) into components signal, including voice, audio, video, data, wireless, optical, and interactive services, and consider a network device on the premises that is connected to a communications service provided and is powered at the premises.

**Premises Communications Circuit.** The circuit that extends voice, audio, video, data, interactive services, telegraph ( except radio), and outside wiring for fire.

## 8.40.1.2. Definitions.

256

- **Premises Community Antenna Television (CATV) Circuit.** The circuit that extends community antenna television (CATV) systems for audio, video, data, and interactive services from the service provider's ONT to appropriate customer equipment.



## 8.40.1.3 Other Articles

257

**(A) Hazardous (Classified) Locations.** Premises-powered broadband communications circuits and equipment installed in a location that is classified in accordance with 5.0.1.5 and 5.5.1.5 shall comply with the applicable requirements of Chapter 5.

**(B) Cables in Ducts for Dust, Loose Stock, or Vapor Removal.** The requirements of 3.0.1.22(A), 7.70.1.3(B), 8.0.1.3(B), and 8.20..1.3(B) shall apply

## 8.40.1.3 Other Articles

258

- (A) **Hazardous (Classified) Locations.** Premises-powered broadband communications circuits and equipment installed in a location that is classified in accordance with 5.0.1.5 and 5.5.1.5 shall comply with the applicable requirements of Chapter 5.
- (B) **Cables in Ducts for Dust, Loose Stock, or Vapor Removal.** The requirements of 3.0.1.22(A), 7.70.1.3(B), 8.0.1.3(B), and 8.20.1.3(B) shall apply

## 8.40.1.3 Other Articles

259

**(C) Equipment in Other Space Used for Environmental Air.** The requirements of 3.0.1.22(C) (3) shall apply.

**(D) Installation and Use.** The requirements of 1.10.1.3(B) shall apply.

**(E) Output Circuits.** As appropriate for the services provided, the output circuits derived from the network terminal shall comply with the requirements of the following:

- (1) Installations of communications- Part 8.0.5



## (E) Output Circuits.

(2) Installations of premises (within buildings) community antenna television and radio distribution circuits.- Part 8.20.5

(3) Installations of optical fiber cables- Part 7.70.5

(4) Installations of Class 2 and Class 3 circuits- Part 7.25.3

FPN: See 7.25.3.1 for information on the classification of information technology equipment circuits.

(5) Installations of power-limited fire alarm circuits- Part 7.60.3

## (F) Communications System.

261

As appropriate for the system involved , traditional communications systems shall comply with the requirements of the following:

- (1) Communications Circuits - Article 8.0
- (2) Radio and Television Equipment - Article 8.10
- (3) Community Antenna Television and Radio Distribution Systems- Article 8.20
- (4) Network-Powered Broadband Communications Systems- Article 8.30

## (G) Electrical Classifications of Data Circuits and Cables.

262

- Sections 7.25.3.19(D)(1) and 8.0.5.24(A)(1)(c) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same cable with communications circuits.
- **8.40.1.21 Access to Electrical Equipment Behind Panels Design to Allow Access.** Access to electrical equipment shall not be denied by an accumulation of premises-powered broadband cables that prevents removal of panels, end covers and the likes, etc..., included suspended ceiling panels



## **(G) Electrical Classifications of Data Circuits and Cables.**

263

**8.40.1.24 Mechanical Execution of Work.** The requirements of 7.70.1.24, 8.0.1.24, and 8.20.1.24 shall apply.

**8.40.1.25 Abandoned Cables.** The requirements of 7.70.1.25, 8.0.1.25, and 8.20.1.25 shall apply

**8.40.1.26 Spread of Fire or Products of Combustion.** The requirements of 7.70.1.26, 8.0.1.26, and 8.20.1.26 shall apply.

## 8.40.2 Cables outside and Entering the Building

264

**8.40.2.1 Overhead (Aerial) Optical Fiber Cables.** Overhead (aerial) optical fiber cables containing a non-current-carrying metallic member entering buildings shall comply with 8.40.2.1(A) and (B).

**(A) On Poles and In-Span.** Where outside plant optical fiber cables and electric light or power conductors are supported by the same pole or are run parallel to each other in-span, the conditions described in 8.40.2.1(A) (1) - (A)(40) shall be met.

## (A) On Poles and In-Span.

- (1) **Relative Location.** Where practicable, the outside plant optical fiber cables shall be located below the electric light or power conductors.
- (2) **Attachment to Cross-Arms.** Attachment of outside plant optical fiber cables to a cross-arm that carries electric light or power conductors shall not be permitted.
- (3) **Climbing Space.** The climbing space through outside plant optical fiber cables shall comply with the requirements of 2.25.1.14(D)



## (A) On Poles and In-Span.

- **(4) Clearance.** Supply service drops and sets of overhead service conductors of 0 to 750 volts running above and parallel to broadband communications service shall have a minimum separation of 300 mm at any point in the span, including the point of and at their attachment to the building. Clearance of not less than 1000 mm shall be maintained between the two services at the pole.

## (B) Above Roofs.

Outside plant optical fiber cables shall have a vertical clearance of not less than 2500 mm from all points of roofs above which they pass.

Exception No. 1: Vertical clearance requirement shall not apply to auxiliary buildings, such as garages and the like.

Exception No. 2: A reduction in clearance above only the overhanging portion of the roof, to not less than 450 mm, shall be permitted if (A) not more than 1200 mm of premises-powered broadband communications service-drop

## (B) Above Roofs.

Cable passes above the roof overhang, and (B) the cable is terminated at a through- or above- the- roof raceway or approved support.

Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm, a reduction in clearance to not less than 900 mm shall be permitted.

FPN: For the additional information regarding overhead wires and cables, see ANSI/IEEE C2-2012, National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines.



## (1) Optical Fiber Cables.

- **(1) Class 1 or Non-Power-Limited Fire Alarm Circuits.** Underground conductive optical fiber cables entering buildings with electric light, power, Class 1, or non-power-limited fire alarm circuit conductors in a raceway, handhole enclosure, or manhole shall be located in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

## (2) Direct-Buried Cables.

Direct buried conductive optical fiber cable shall be separated by at least 300 mm from conductors of any electric light, power, or non-power limited fire alarm circuit conductors or Class 1 circuit.

Exception No. 1: Separation shall not be required where the electric service conductors are installed in raceways or have metal cable armor.

Exception No. 2: Separation shall not be required where the electric light or power branch-circuit or feeder conductors, non-power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal clad, or Type UF or Type USE cables.



## 8.40.2.5 Unlisted Wires and Cables Entering Buildings.

271

Installations of unlisted cables entering buildings shall comply with 8.40.2.5(A),(B), or (C) as applicable.

**(A) Optical Fiber Cables.** Installation of unlisted optical fiber cables entering buildings shall comply with 7..70.2.5.

**(B) Communication Wires and Cables.** Installation of unlisted communication wires and unlisted multipair communications cables entering buildings shall comply with 8.0.2.5.

**(C) Coaxial Cables.** Installations of unlisted coaxial cables entering buildings shall comply with 8.20.2.5.



## 8.40.4 Grounding Methods

**8.40.4.1 Network Terminal and Cable Grounding.** Grounding required for protection of the network terminal, conductive optical fiber cables, multi pair communications cables, antenna lead-in conductors, and coaxial cables shall comply with 7.70.4.1, 8.0.4.1, 8.10.2.11, or 8.20.4.1, as applicable.

**8.40.4.2 Premises Circuits Not Leaving The Building.** Where the network terminal is served by a nonconductive optical fiber cable, or where any non-current-carrying metallic member of a conductive optical fiber cable is interrupted by an insulating joint or equivalent device, and circuits that terminate at the network terminal and are completely contained within the building(i.e., they do not exit the building), 8.40.4.2(A), (B), or (C) shall apply , as applicable.

## (A) Coaxial Cable Shield Grounding.

The shield of coaxial cable shall be grounded by one of the following:

- (1) Any of the methods described in 8.20.4.1 or 8.20.4.7
- (2) A fixed connection to an equipment grounding conductor as described in 2.50.6.9
- (3) Connection to the network terminal grounding terminal provided that the terminal is connected to ground by one of the methods described in 8.20.4.1 or 8.20.4.7, or to an equipment grounding conductor through a listed grounding device that will retain the ground connection if the network terminal is unplugged.



**(B) Communication Circuit Grounding.** Communication circuit shall not be required to be grounded.

**(C) Network Terminal Grounding.** The network terminal shall not be required to be grounded unless required by its listing. If the coaxial cable shield is separately grounded as described in 8.40.4.2(A)(1) or 8.40.4.2(A)(2), the use of cord and plug for the connection to the network terminal grounding connection shall be permitted.



## 8.40.5 Installations Methods Within Buildings

275

**8.40.5.1 Raceway and Cable Routing Assemblies.** Installations of raceway and cable routing assemblies for premises-powered broadband communications cables shall comply with 8.40.5.1((A), (B), or (C) as applicable.

**(A) Optical Fiber Cables.** The requirements of 7.70.5.1 shall apply.

**(B) Multipair Communications Cable.** The requirements of 8.0.5.1 shall apply.

**(C) Coaxial Cables.** The requirements of 8.20.5.1 shall apply.

## 8.40.6 Premises Powering of Communications Equipment over Communication Cables

276

- **8.40.6.1 Powering Circuits.** Communications cables, in addition to carrying the communication circuit, shall also be permitted to carry circuits for powering communications equipment. Where the power supplied over a communications cable to communications equipment is greater than 60 watts, communications cables and power shall comply with 7.25.3.24 where communications cables are used in place of Class 2 and Class 3 cables.



**THANK YOU!**

277