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Mike Holt's Illustrated Guide to

# **ARTICLE 810**

## **RADIO AND TELEVISION SATELLITE EQUIPMENT**

Extracted from Mike Holt's Understanding the National Electrical Code® - Volume 2

April 28, 2018

**Based on the 2017 NEC®**

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## ABOUT THE AUTHOR

**Mike Holt** worked his way up through the electrical trade. He began as an apprentice electrician and became one of the most recognized experts in the world as it relates to electrical power installations. He's worked as a journeyman electrician, master electrician, and electrical contractor. Mike's experience in the real world gives him a unique understanding of how the *NEC* relates to electrical installations from a practical standpoint.

You'll find his writing style to be direct, nontechnical, and powerful.

Did you know Mike didn't finish high school? So if you struggled in high school or didn't finish at all, don't let it get you down. However, realizing that success depends on one's continuing pursuit of education, Mike immediately attained his GED, and ultimately attended the University of Miami's Graduate School for a Master's degree in Business Administration.

Mike resides in Central Florida, is the father of seven children, has five grandchildren, and enjoys many outside interests and activities. He's a nine-time National Barefoot Water-Ski Champion (1988, 1999, 2005–2009, 2012–2013). He's set many national records and continues to train year-round at a World competition level ([www.barefootwaterskier.com](http://www.barefootwaterskier.com)).

What sets him apart from some is his commitment to living a balanced lifestyle; placing God first, family, career, then self.



*I dedicate this book to the  
**Lord Jesus Christ,**  
my mentor and teacher.  
Proverbs 16:3*



# ARTICLE 810

## RADIO AND TELEVISION SATELLITE EQUIPMENT

### Introduction to Article 810—Radio and Television Satellite Equipment

This article covers transmitter and receiver (antenna) equipment—and the wiring and cabling associated with that equipment. Here are a few key points to remember about Article 810:

- Avoid contact with conductors of other systems.
- Don't attach antennas or other equipment to the service-entrance power mast.
- Keep the bonding conductor or grounding electrode conductor as straight as practicable, and protect it from physical damage.
- If the mast isn't bonded properly, you risk flashovers and possible electrocution.
- Keep in mind that the purpose of bonding is to prevent a difference of voltage between metallic objects and other conductive items, such as swimming pools.
- Clearances are critical, and Article 810 contains detailed clearance requirements. For example, it provides separate clearance requirements for indoor and outdoor locations.

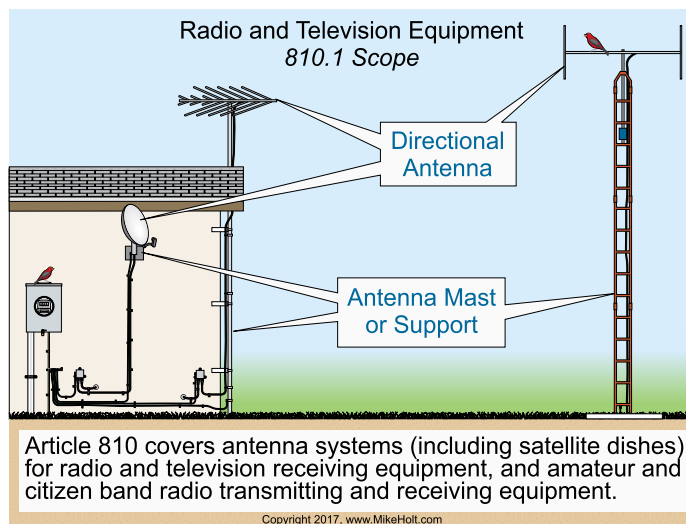
### Part I. General

#### 810.1 Scope

Article 810 contains the installation requirements for the wiring of television and radio receiving equipment, such as digital satellite receiving equipment for television signals and amateur/citizen band radio equipment antennas. ▶[Figure 810–1](#)

#### Author's Comment:

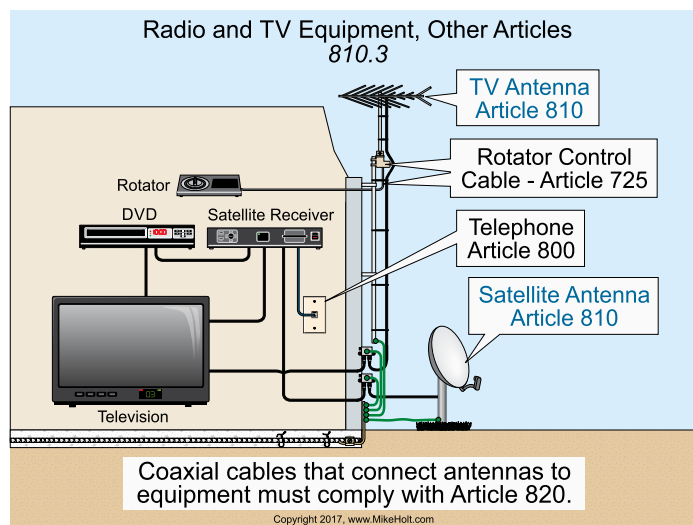
- Article 810 covers:
  - ◆ Antennas that receive local television signals.
  - ◆ Satellite antennas, which are often referred to as satellite dishes.
  - ◆ Roof-mounted antennas for AM/FM/XM radio reception.
  - ◆ Amateur radio transmitting and receiving equipment, including HAM radio equipment (a noncommercial [amateur] communications system).



▶[Figure 810–1](#)

### 810.3 Other Articles

Wiring from the power supply to Article 810 equipment must be installed in accordance with Chapters 1 through 4 except as modified by parts I and II of Article 640. Wiring for audio equipment must comply with Article 640, and coaxial cables that connect antennas to equipment must be installed in accordance with Article 820. ▶Figure 810-2



▶Figure 810-2

#### Author's Comment:

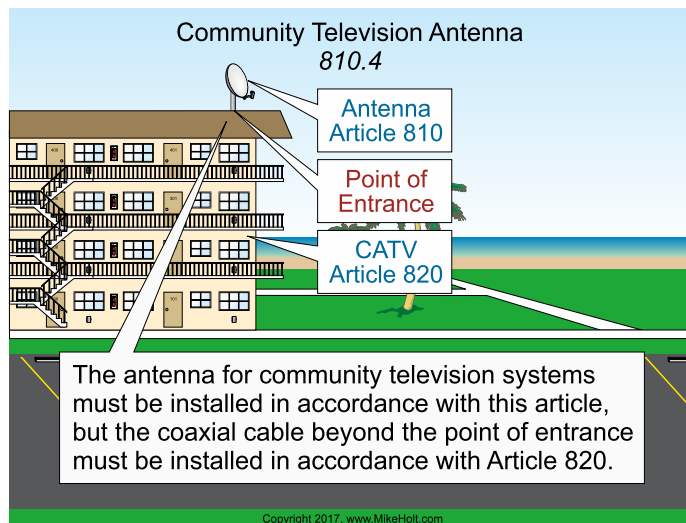
- The grounding requirements for antenna cables are contained in 810.20(C) and 810.21, not Article 820.

### 810.4 Community Television Antenna

The antenna for community television systems must be installed in accordance with this article, but the coaxial cable beyond the point of entrance must be installed in accordance with Article 820. ▶Figure 810-3

#### Author's Comment:

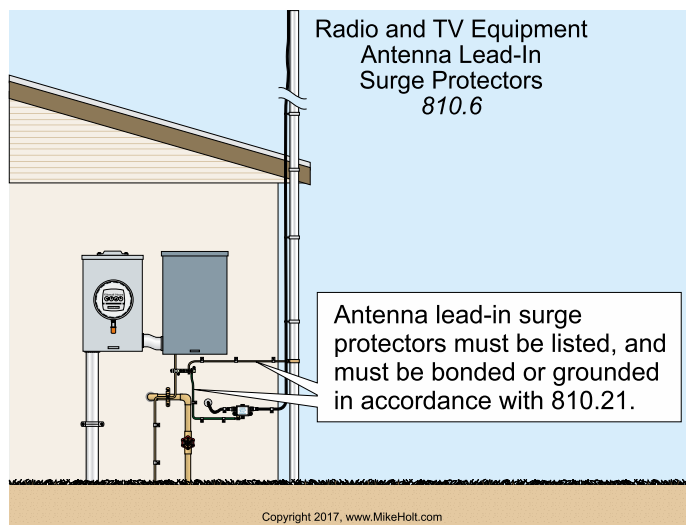
- A community TV antenna is used for multiple-occupancy facilities, such as apartments, condominiums, motels, and hotels.



▶Figure 810-3

### 810.6 Antenna Lead-In Protectors

Antenna lead-in surge protectors must be listed, and must be bonded or grounded in accordance with 810.21. ▶Figure 810-4



▶Figure 810-4

### 810.7 Grounding Devices

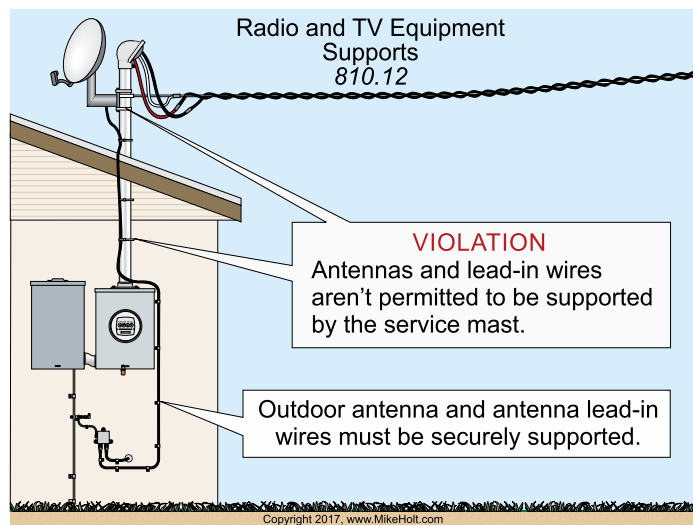
Fittings used to connect bonding jumpers or grounding electrode conductors to equipment must be listed.



## Part II. Receiving Equipment—Antenna Systems

### 810.12 Supports

Outdoor antennas and lead-in conductors must be securely supported, and the lead-in conductors must be securely attached to the antenna. The antennas or lead-in conductors aren't permitted to be attached to the electric service mast. ▶Figure 810-5



▶Figure 810-5

### 810.13 Avoid Contact with Conductors of Other Systems

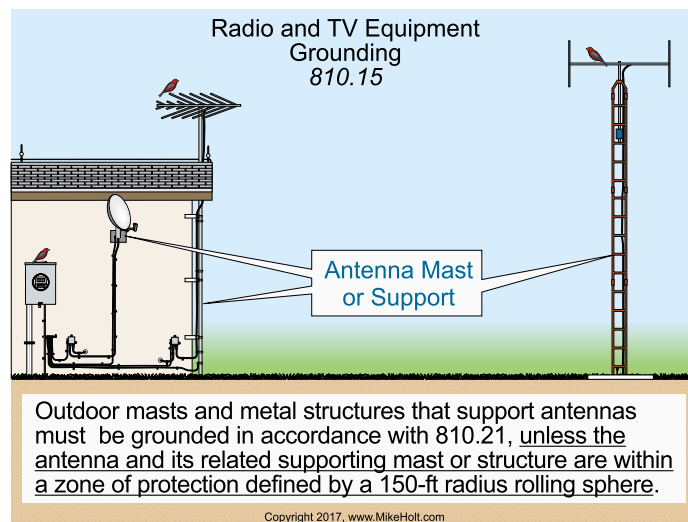
Outdoor antennas and lead-in conductors must be kept at least 2 ft from exposed electric power conductors to avoid the possibility of accidental contact.

#### Author's Comment:

- According to the *National Electrical Code Handbook*, "One of the leading causes of electrical shock and electrocution is the accidental contact of radio, television, and amateur radio transmitting and receiving antennas, and equipment with light or power conductors. Extreme caution should therefore be exercised during this type of installation, and periodic visual inspections should be conducted thereafter."

### 810.15 Metal Antenna Supports—Grounding

Outdoor masts and metal structures that support antennas must be grounded in accordance with 810.21 unless the antenna and its related supporting mast or structure are within a zone of protection defined by a 150-ft radius rolling sphere. ▶Figure 810-6



▶Figure 810-6

**Note:** See NFPA 780, *Standard for the Installation of Lightning Protection Systems*, 4.8.3.1 for the application of the term "rolling sphere."

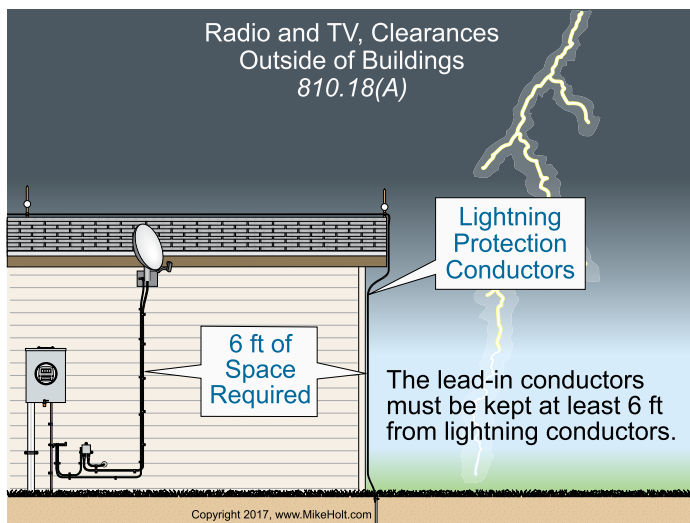
### 810.18 Clearances

**(A) Outside of Buildings.** Lead-in conductors attached to buildings must be installed so they can't swing closer than 2 ft to the conductors of circuits of 250V or less, or closer than 10 ft to the conductors of circuits of over 250V.

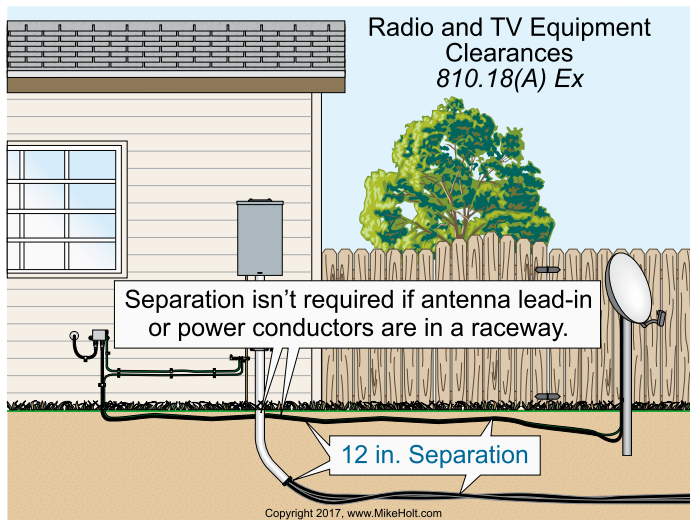
Lead-in conductors must be kept at least 6 ft from the lightning protection system and underground antenna lead-in conductors must maintain a separation not less than 12 in. from electric power conductors. ▶Figure 810-7

*Ex: Separation isn't required where the underground antenna lead-in conductors or the electric power conductors are installed in raceways or cable armor.* ▶Figure 810-8

**(B) Indoors.** Indoor antenna and lead-in conductors aren't permitted to be less than 2 in. from electrical power conductors.



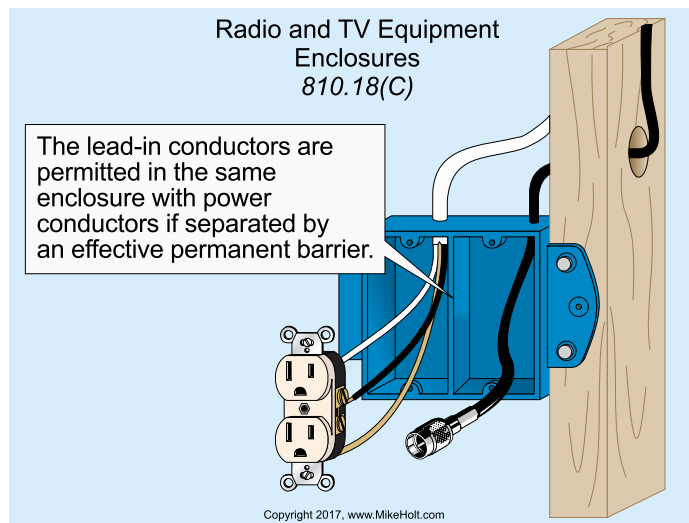
►Figure 810-7



►Figure 810-8

*Ex 1: Separation isn't required if the antenna lead-in conductors or the electrical power conductors are installed within a raceway or cable armor.*

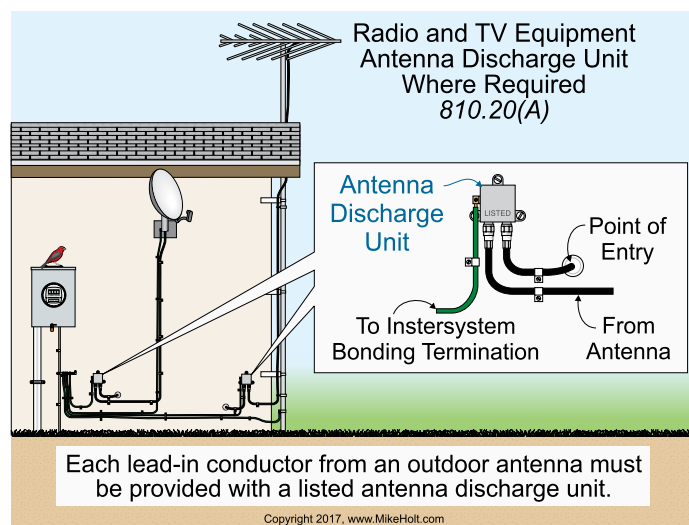
**(C) Enclosures.** Indoor antenna lead-in conductors can be in the same enclosure with electric power conductors where separated by an effective, permanently installed barrier. ►Figure 810-9



►Figure 810-9

## 810.20 Antenna Discharge Unit

**(A) Where Required.** Each lead-in conductor from an outdoor antenna must be provided with a listed antenna discharge unit. ►Figure 810-10



►Figure 810-10

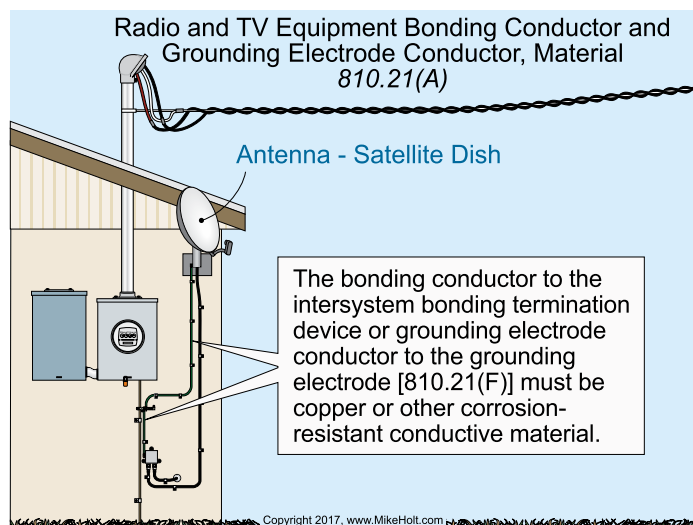
**(B) Location.** The antenna discharge unit must be located outside or inside the building, nearest the point of entrance, but not near combustible material or in a hazardous (classified) location as defined in Article 500.

**(C) Grounding.** The antenna discharge unit must be bonded or grounded in accordance with 810.21.

## 810.21 Bonding Conductor and Grounding Electrode Conductors

Bonding conductors and grounding electrode conductors must meet the requirements of 810.21(A) through 810.21(K).

**(A) Material.** The bonding conductor to the intersystem bonding termination or grounding electrode conductor to the grounding electrode [810.21(F)] must be copper or other corrosion-resistant conductive material. ▶Figure 810-11



▶Figure 810-11

**(B) Insulation.** Insulation on bonding conductors or grounding electrode conductors isn't required.

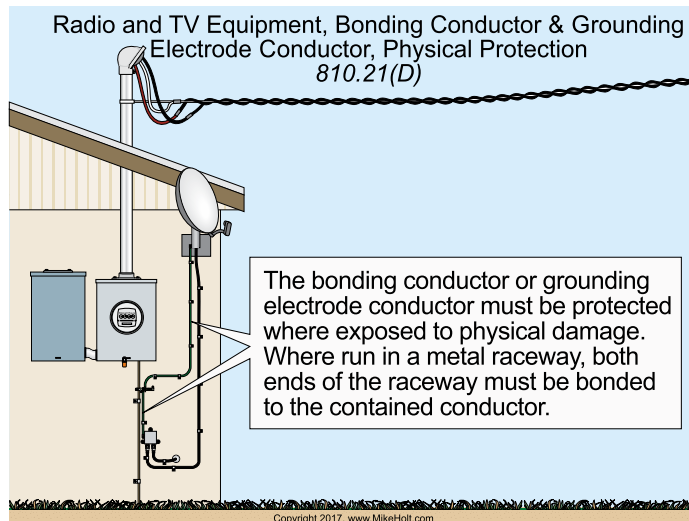
**(C) Supports.** The bonding conductor or grounding electrode conductor must be securely fastened in place.

**(D) Physical Protection.** Bonding conductors or grounding electrode conductors must be mechanically protected where subject to physical damage; and where installed in a metal raceway, both ends of the raceway must be bonded to the bonding conductor or grounding electrode conductor. ▶Figure 810-12

### Author's Comment:

- Installing the bonding conductor or grounding electrode conductor in PVC conduit is a better practice.

**(E) Run in Straight Line.** The bonding conductor or grounding electrode conductor must be run in as straight a line as practicable.



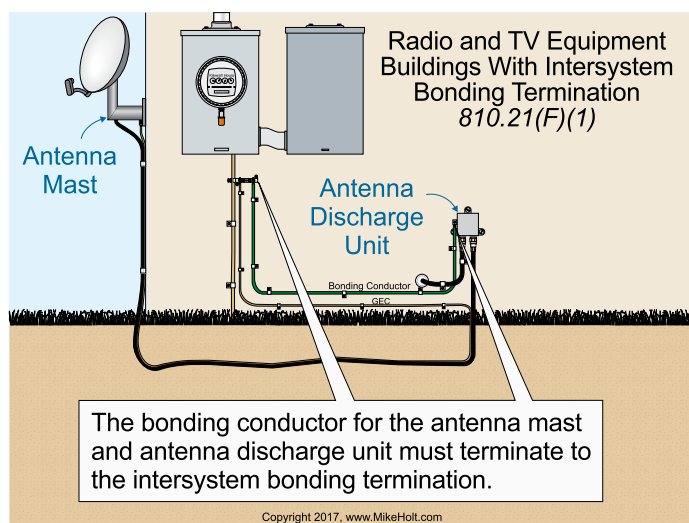
▶Figure 810-12

### Author's Comment:

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

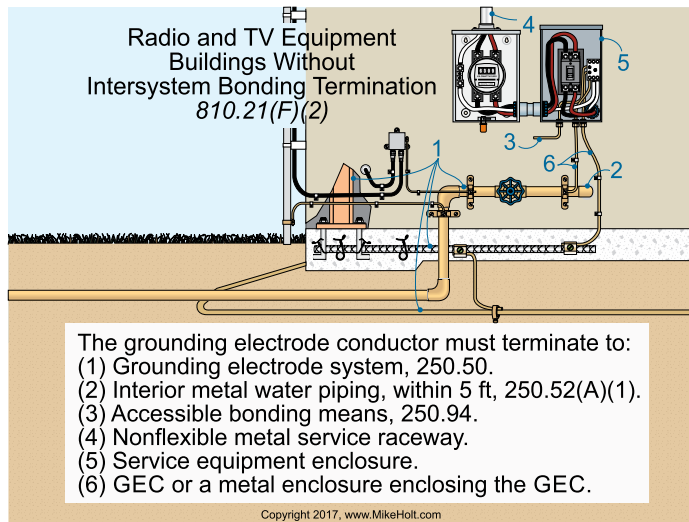
**(F) Electrode.** The bonding conductor or grounding electrode conductor must terminate in accordance with (1), (2), or (3).

**(1) Buildings with an Intersystem Bonding Termination.** The bonding conductor for the antenna mast and antenna discharge unit must terminate to the intersystem bonding termination as required by 250.94 [Article 100 and 250.94]. ▶Figure 810-13



▶Figure 810-13

**(2) In Buildings Without Intersystem Bonding Termination.** The bonding conductor or grounding electrode conductor for the antenna mast and antenna discharge unit must terminate to the nearest accessible location on the following: ▶ **Figure 810–14**



▶ **Figure 810–14**

- (1) The building grounding electrode system [250.50].
- (2) The interior metal water piping system, within 5 ft from its point of entrance [250.52(A)(1)].
- (3) The power service accessible means external to the building, as covered in 250.94, including the exception.
- (4) The nonflexible metallic service raceway.
- (5) The service equipment enclosure.
- (6) The grounding electrode conductor or the grounding electrode conductor metal enclosure.

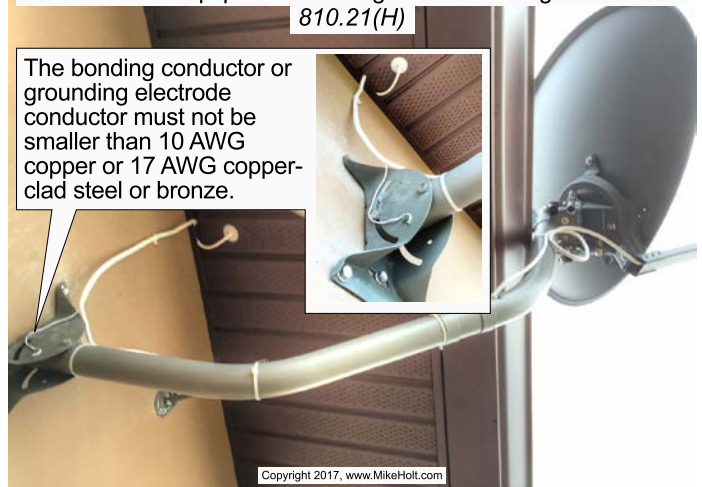
**(3) In Buildings Without a Grounding Means.** The grounding electrode conductor for the antenna mast and antenna discharge unit must be connected to a grounding electrode as described in 250.52.

**(G) Inside or Outside Building.** The bonding conductor or grounding electrode conductor can be installed either inside or outside the building.

**(H) Size.** The bonding conductor or grounding electrode conductor isn't permitted to be smaller than 10 AWG copper or 17 AWG copper-clad steel or bronze. ▶ **Figure 810–15**

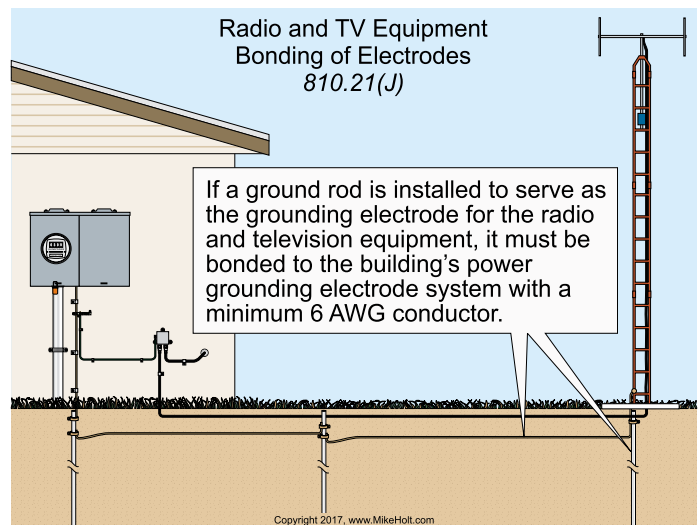
#### Radio and TV Equipment Bonding and Grounding Conductors 810.21(H)

The bonding conductor or grounding electrode conductor must not be smaller than 10 AWG copper or 17 AWG copper-clad steel or bronze.



▶ **Figure 810–15**

**(J) Bonding of Electrodes.** If a ground rod is installed to serve as the grounding electrode for the radio and television equipment, it must be bonded to the building's power grounding electrode system with a minimum 6 AWG conductor. ▶ **Figure 810–16**

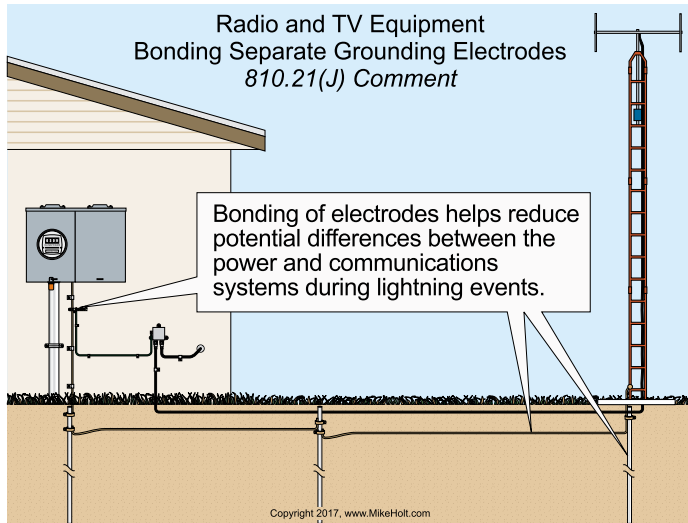


▶ **Figure 810–16**

#### Author's Comment:

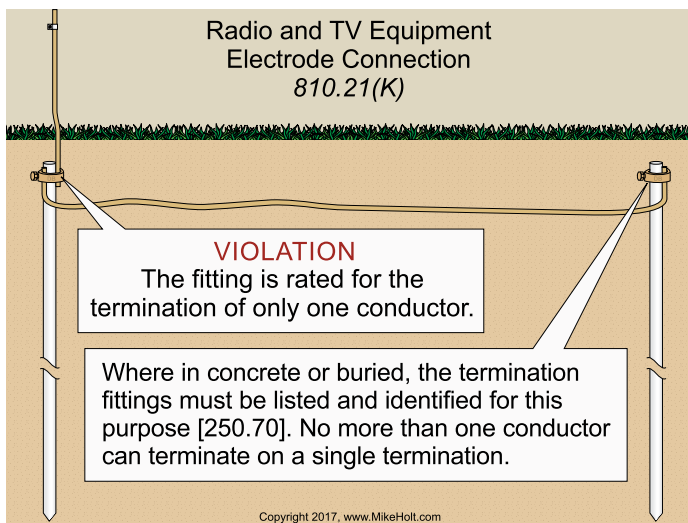
- Bonding of electrodes helps reduce induced voltage differences between the power and communications systems during lightning events. ▶ **Figure 810–17**





►Figure 810-17

**(K) Electrode Connection.** Termination of the bonding conductor or grounding electrode conductor 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 in accordance with 250.70. ►Figure 810-18



►Figure 810-18

#### Author's Comment:

- Grounding the lead-in antenna cables and the mast helps prevent voltage surges caused by static discharge or nearby lightning strikes from reaching the center conductor of the lead-in coaxial cable. Because the satellite dish sits outdoors, wind creates a static charge on the antenna as well as on the cable to which it's attached. This charge can build up on both the antenna and the cable until it jumps across an air space, often passing through the electronics inside the low noise block down converter feedhorn (LNBF) or receiver. Connecting the coaxial cable and dish to the building's grounding electrode system (grounding) helps dissipate this static charge.
- Nothing can prevent damage from a direct lightning strike, but grounding with proper surge protection can help reduce damage to the satellite dish and other equipment from nearby lightning strikes.

### Part III. Amateur and Citizen Band Transmitting and Receiving—Antenna Systems

#### 810.51 Other Sections

Antenna systems for amateur and citizen band transmitting and receiving stations must also comply with the following requirements:

**Support of Lead-In Cables.** Antennas and lead-in conductors must be securely supported, and the lead-in conductors must be securely attached to the antenna [810.12].

**Avoid Contact with Conductors of Other Systems.** Outdoor antennas and lead-in conductors must be kept at least 2 ft from exposed electric power conductors to avoid the possibility of accidental contact [810.13].

**Metal Antenna Supports—Grounding.** Outdoor masts and metal structures that support antennas must be grounded in accordance with 810.21 [810.15].

#### 810.54 Clearance on Building

Antenna lead-in conductors must be firmly mounted at least 3 in. away from the surface of the building.

### 810.57 Antenna Discharge Units

Each lead-in conductor from an outdoor antenna must be provided with a listed antenna discharge unit or other suitable means that drains static charges from the antenna system.

*Ex 1: If the lead-in is protected by a continuous metallic shield that's grounded in accordance with 810.58 an antenna discharge unit or other suitable means isn't required.*

*Ex 2: If the antenna is grounded in accordance with 810.58 an antenna discharge unit or other suitable means isn't required.*

### 810.58 Bonding Conductor or Grounding Electrode Conductors

**(A) Other Sections.** The antenna mast [810.15] and antenna discharge unit [810.57] must be grounded as specified in 810.21.

**(B) Size of Protective Bonding Conductor or Grounding Electrode Conductor.** The bonding conductor or grounding electrode conductor must be the same size as the lead-in conductors, but not smaller than 10 AWG copper, bronze, or copper-clad steel.

**(C) Size of Operating Bonding Conductor or Grounding Electrode Conductor.** The operating bonding conductor or grounding electrode conductor for transmitting stations aren't permitted to be smaller than 14 AWG copper or its equivalent.

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