

Common Bonding of Grounded Systems

ULPA/LPI Annual Conference
2013

N F P A 7 0 ®



2011



National Electrical Code®
International Electrical Code® Series

NEC - 250.52 Grounding Electrodes.

(A) Electrodes Permitted for Grounding.

- 1. Metal Underground Water Pipe.** A metal underground water pipe in direct contact with the earth for 3.0 m (10 ft.) or more
- 2. Metal Frame of the Building or Structure.** The metal frame of the building or structure that is connected to the earth
- 3. Concrete-Encased Electrode.** A concrete-encased electrode shall consist of at least 6.0 m (20 ft.) of either....
- 4. Ground Ring.** A ground ring encircling the building or structure, in direct contact with the earth, consisting of
- 5. Rod and Pipe Electrodes.** Rod and pipe electrodes shall not be less than 2.44 m (8 ft.) in length and shall consist of the following materials....
- 6. Other Listed Electrodes.**
- 7. Plate Electrodes.** Each plate electrode shall expose not less than 0.186 m² (2 ft²) of surface to exterior soil.
- 8. Other Local Metal Underground Systems or Structures.**

NEC - 250.52 Grounding Electrodes – (contd.)

(B) Not Permitted for Use as Grounding Electrodes. The following systems and materials shall not be used as grounding electrodes:

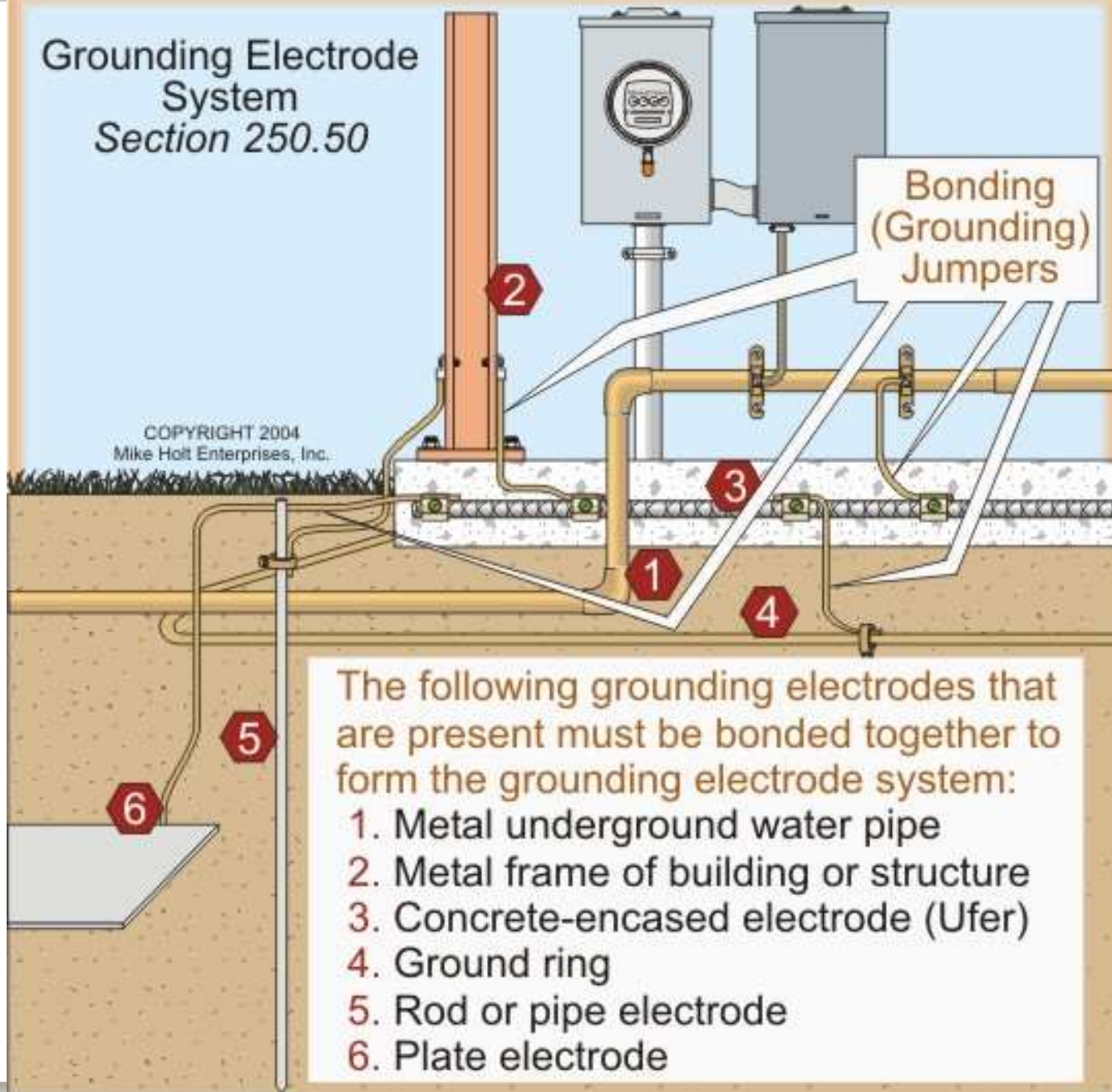
- (1) Metal underground gas piping systems
- (2) Aluminum

NEC - 250.50 Grounding Electrode System.

All grounding electrodes as described in 250.52(A)(1) through (A)(7) that are present at each building or structure served shall be bonded together to form the grounding electrode system. Where none of these grounding electrodes exist, one or more of the grounding electrodes specified in 250.52(A)(4) through (A)(8) shall be installed and used.

Grounding Electrode System Section 250.50

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The following grounding electrodes that are present must be bonded together to form the grounding electrode system:

1. Metal underground water pipe
2. Metal frame of building or structure
3. Concrete-encased electrode (Ufer)
4. Ground ring
5. Rod or pipe electrode
6. Plate electrode

250.68 Grounding Electrode Conductor and Bonding Jumper Connection to Grounding Electrodes.

The connection of a grounding electrode conductor at the service, at each building or structure where supplied by a feeder(s) or branch circuit(s), or at a separately derived system and associated bonding jumper(s) shall be made

(A) Accessibility. All mechanical elements used to terminate a grounding electrode conductor or bonding jumper to a grounding electrode shall be accessible.

(B) Effective Grounding Path. The connection of a grounding electrode conductor or bonding jumper to a grounding electrode shall be made in a manner that will ensure an effective grounding path.

(C) Metallic Water Pipe and Structural Metal. Grounding electrode conductors and bonding jumpers shall be permitted to be connected at the following locations and used to extend the connection to an electrode(s):

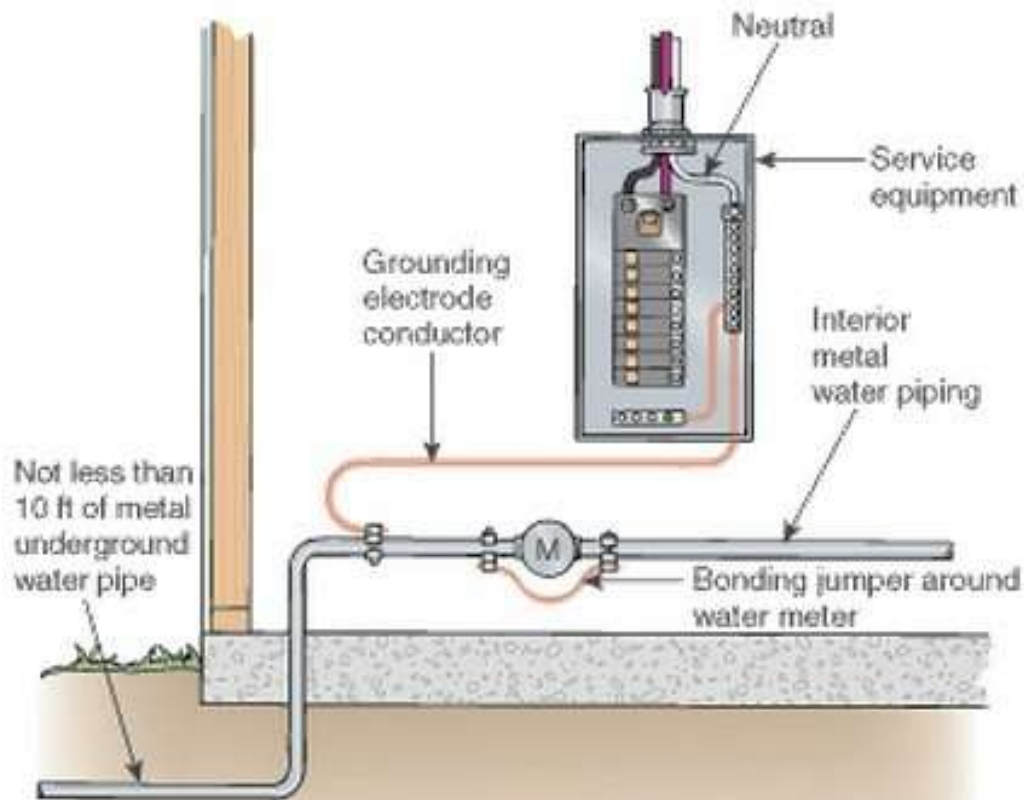
(1) Interior metal water piping located not more than 1.52 m (5 ft.) from the point of entrance to the building shall be permitted to be used as a conductor to interconnect electrodes that are part of the grounding electrode system.

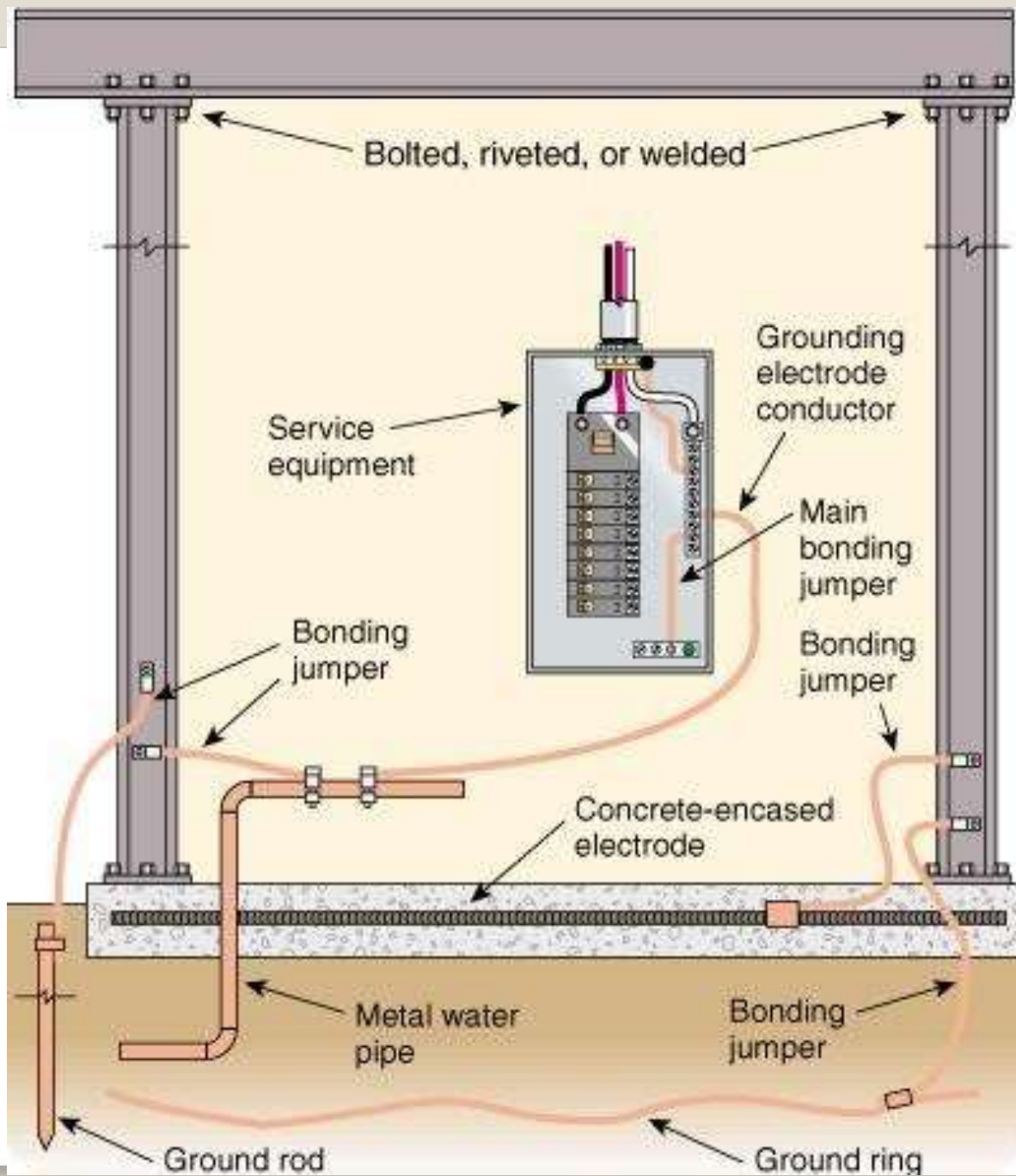
(2) The structural frame of a building that is directly connected to a grounding electrode



Illustration for 250.52(A)(1)

This grounding electrode conductor is connected to interior water piping not more than 5 ft from the point where it enters the building, as required by **250.52(A)(1)**.





NEC - 250.104 **Bonding** of Piping Systems and Exposed Structural Steel.

- **(A) Metal Water Piping...** Metal water piping system(s) installed in or attached to a building or structure shall be bonded to the service equipment enclosure, the grounded conductor at the service, the grounding electrode conductor where of sufficient size, or to the one or more grounding electrodes used.
- **(B) Other Metal Piping.** If installed in, or attached to, a building or structure, a metal piping system(s), including gas piping, that is likely to become energized shall be bonded ...
- **(C) Structural Metal.** Exposed structural metal that is interconnected to form a metal building frame and is not intentionally grounded or bonded and is likely to become energized shall be bonded ...
- **(D) Separately Derived Systems.** Metal water piping systems and structural metal that is interconnected to form a building frame shall be bonded to separately derived systems ...

ANSI/TIA-607-B Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises



This Standard provides basic principles, components, and design of telecommunications bonding and grounding that shall be followed to ensure that the telecommunication bonding and grounding systems within a building will have one electrical potential.

For a designer of telecommunications bonding and grounding systems, the ANSI/TIA-607-B standard is the most encompassing standard to follow for premises buildings.

For electrical contractors subcontracting out the telecommunications work, the demarcation point for work between electrical and telecommunications contractors should be carefully coordinated. A recommended practice is for the electrical contractor to provide the grounding conductor and connection from the main electrical ground to the TMGB, as well as from an electrical panel in a telecommunications room to the grounding busbar in that room. The telecommunications contractor would then provide all of the grounding busbars and bonding conductors within and between the telecommunications rooms, as well as make all final connections to the TMGB, TGBs, and telecommunications infrastructure / equipment.

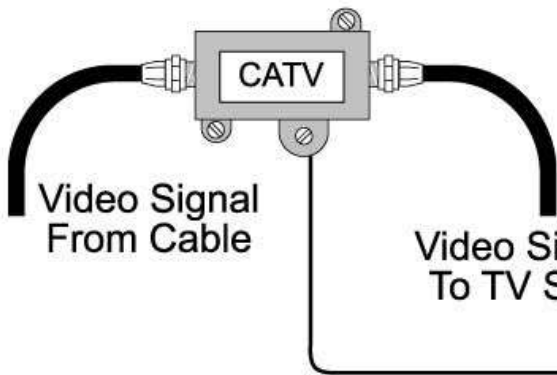
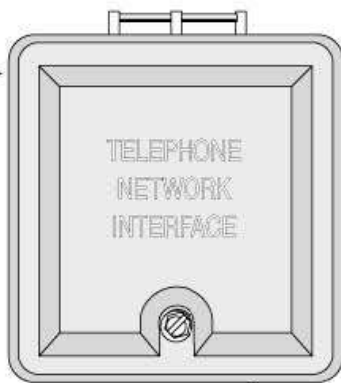
(TMGB = Telecommunication Main Ground Bar)

Ground to Service
Panel

Revenue Meter

INTERSYSTEM BONDING POINT

Telephone Network
Interface Device

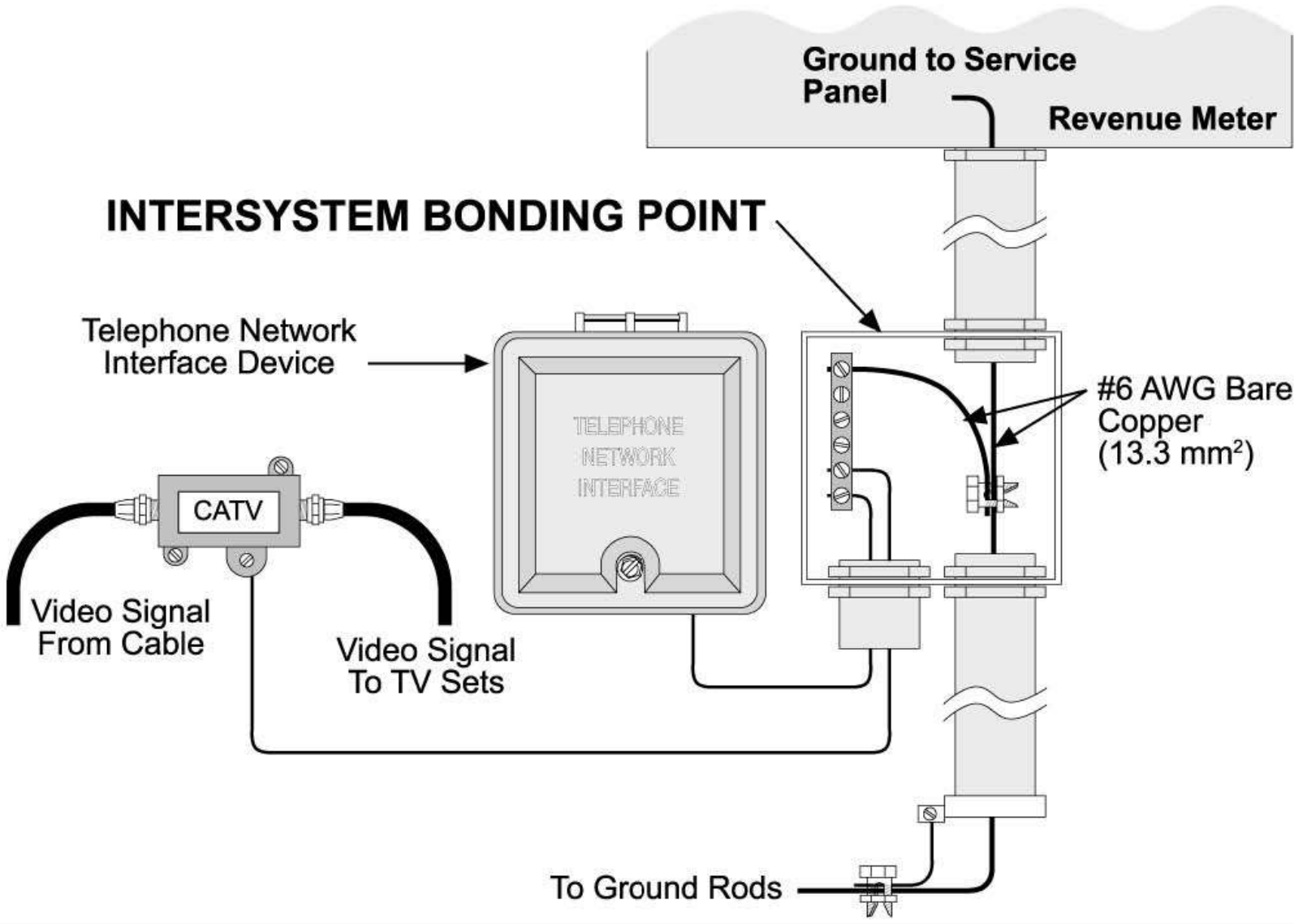


Video Signal
From Cable

Video Signal
To TV Sets

#6 AWG Bare
Copper
(13.3 mm²)

To Ground Rods



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NFPA® 780
Standard for the
Installation of Lightning
Protection Systems
2011 Edition

2014
Edition



NFPA 780 - 2014

4.14 Common Bonding of Grounded Systems.

4.14.1 General. All grounded media and buried metallic conductors that can assist in providing a path for lightning currents in or on a structure shall be interconnected to the lightning protection system within 3.6 vertical meters (12 vertical feet) of the base of the structure to provide a common ground potential.

4.14.2 For structures exceeding 18 m (60 ft.) in height, the interconnection of the lightning protection system grounding electrodes and other grounded media shall be in the form of a ground loop conductor.

4.14.3 This interconnection shall include all building grounding electrode systems including lightning protection, electric service, communication, and antenna system grounding electrodes.

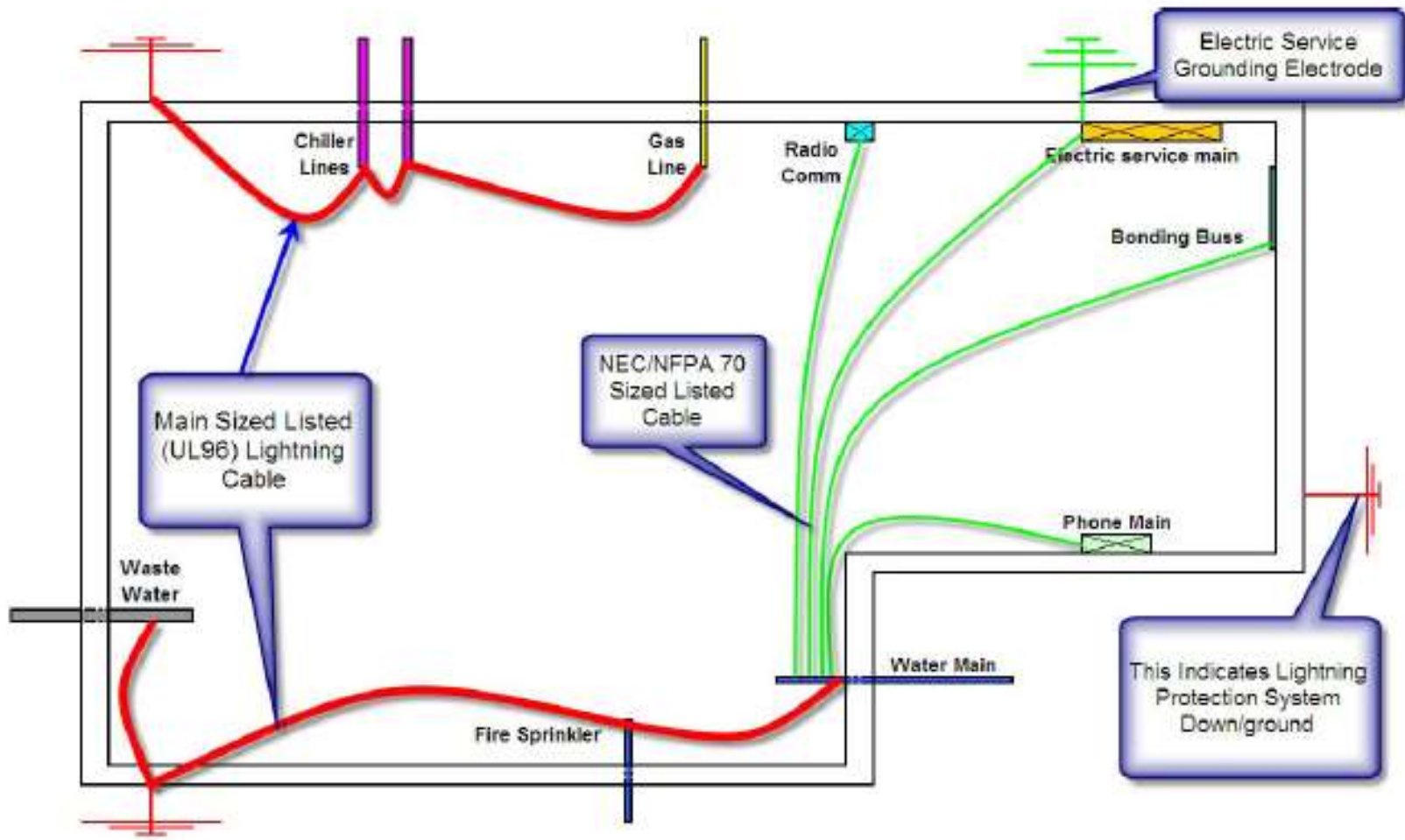
4.14.4 Interconnection of underground metallic piping systems shall include water service, well casings located within 7.6 m (25 ft.) of the structure, gas piping, underground conduits, underground liquefied petroleum gas piping systems, and so on. If the water pipe is not electrically continuous due to the use of plastic pipe sections or other reasons, the nonconductive sections shall be bridged with main size conductors, or the connection shall be made at a point where electrical continuity is ensured.

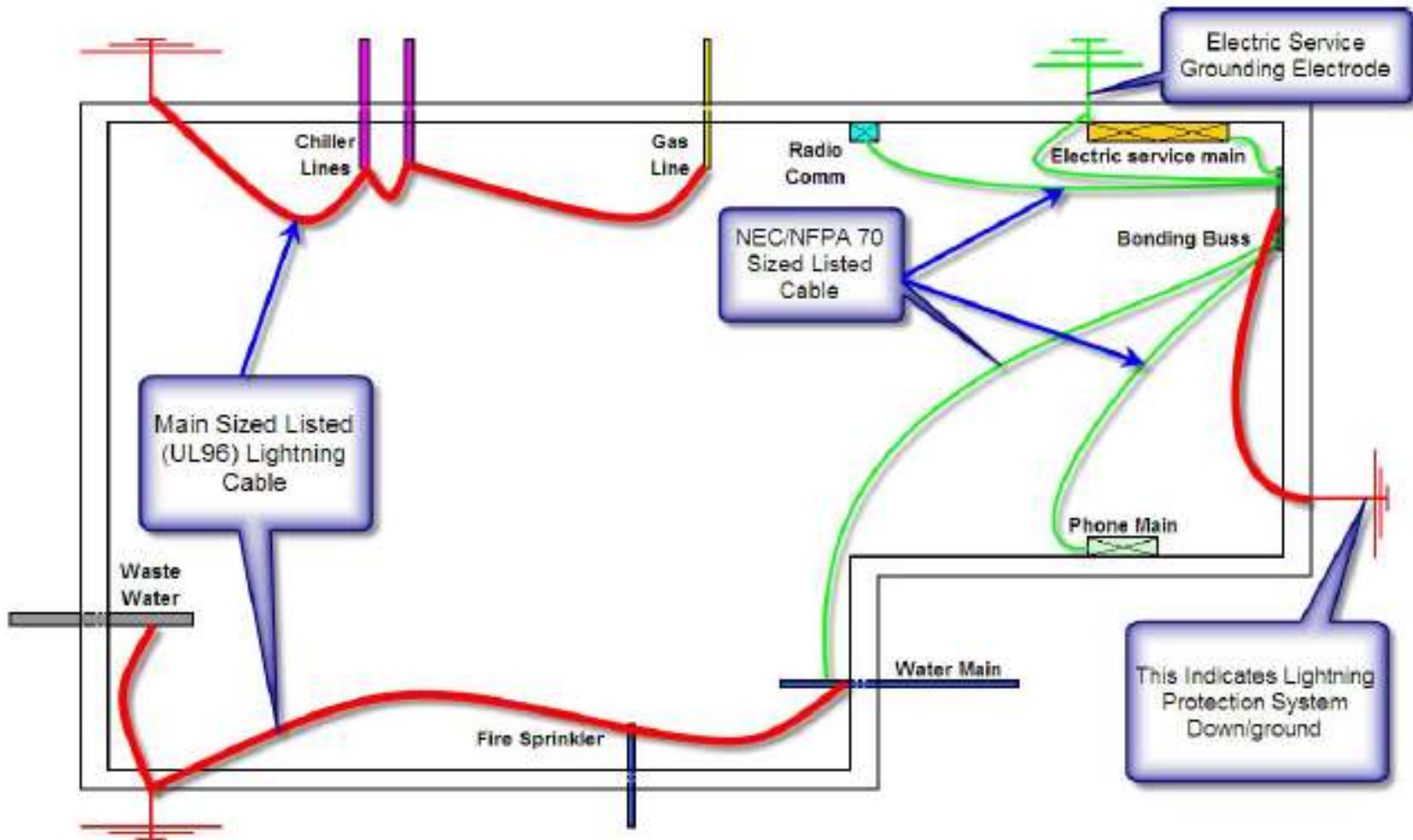
4.14.5 When the building grounded systems noted above are interconnected at a common accessible point in or on the structure, the lightning protection system shall have only one main size conductor connected to the common bonding point. This common bonding point shall include a ground bar, a section of water pipe, or the metallic structural frame per NFPA 70.

4.14.6 Where bonding of the lightning protection grounding system, grounded media, and buried metallic conductors has not been accomplished at a common point, interconnection shall be provided according to the following:

- A. Grounded media and buried metallic conductors shall be bonded to the lightning protection grounding system below a height 12 ft. (3.6 m) vertically above the base of the structure.
- B. Grounded media and buried metallic conductors inherently bonded through construction to the lightning protection grounding system shall not require further bonding.
- C. The continuous metal framework of a structure shall be connected to the lightning protection system (See 4.9.13 and 4.16).
- D. Main size lightning conductors shall be used for direct connection of grounded media and buried metallic conductors to the lightning protection system.
- E. A ground bar designed for interconnection of building grounded systems shall have one connection to the lightning protection system.
- F. A continuous metal water pipe system designed for interconnection of building grounded systems shall be connected to the lightning protection system.
- G. Interconnection to a gas line shall be made on the customer's side of the meter.
- H. Where galvanic corrosion is a concern or where a direct bond is prohibited by local code, an isolating spark gap shall be permitted.







w here:	d = horizontal distance from l.p. system component to grounded body in question
	h = vertical height betw een bond under consideration and actual bond to the l.p. system
	value related to dow n conductors 25 ft. (7.6 m) apart w ithin 100 ft. (30 m) zone of bond
	n = under consideration
	n = 1 w here only 1 dow nconductor in the zone
	n = 1.5 w here only 2 dow nconductors in the zone
	n = 2.25 w here 3 or more dow nconductors in the zone
	n = total number of system dow nleads below 60 ft. (18 m) from top ground loop (roof circuit)
	Km = medium betw een l.p. system and grounded body in question
	Km = 1 if flashover w ill occur through air
	Km = 0.50 if flashover w ill occur through non-metallic building materials

Variable Value

h =	60	(insert height to nearest bond w ith l.p. system)
n =	1.5	(insert value for n from above - 1, 1.5, 2.25, or total of dow nleads)
Km =	1	(insert value for Km from above - 1 or 0.50)
d =	6.7	(calculated distance w ithin w hich a bond betw een systems is required or potential sideflash distance)

UL STP Proposals

10. New UL 96A Proposal - Addition of Paragraph 10.4.4

RATIONALE

Paragraph 10.4.4 proposed to be added to accommodate compliance to changes in NFPA 70

PROPOSAL

10.4.4 If utility services are grounded to a common bus bar, then common (equipotential) bonding shall be accomplished by attaching a main size conductor to that bus bar with an appropriately sized bonding fitting.

14. New UL 96A Proposal - Revisions to Section 11

RATIONALE

These proposed revisions provide a simple and easily inspectable rule to install to that closely approximates the bonding distances required by the formula currently in this standard and NFPA 780.

PROPOSAL

11.4 Grounded metal bodies that are on a roof that is 60 feet or less above grade shall be bonded to main conductor if they are within six feet or less to that conductor. ~~within 6 feet (1.8 m) of the main conductor shall be bonded to the system.~~

11.5 The bonding distance for grounded metal bodies on a roof over 60 feet shall be one foot for every ten feet of elevation above grade or portion there, of up to a maximum distance of twenty feet. ~~Grounded metal bodies that are more than 6 feet (1.8 m) from the main conductor where an isolated metal body will influence the distance shall comply with 11.6.~~

~~11.6 Where the sum of the distances between an isolated metal body and a grounded metal body and the distance between this isolated metal body and the main conductor is less than 6 feet (1.8 m) as illustrated in Figure 11.4, bonding from the grounded metal body to the main conductor is required.~~

~~11.7 Isolated metal bodies that show no conductance to ground shall not require bonding.~~

~~Exception: For down conductors, only grounded metal bodies that are within the first 6 feet (1.8 m) of the main conductor shall be bonded to the system. Isolated metal bodies that comply with 11.7 need no further bonding.~~

~~11.8 A grounded metal body shall be bonded at the closest point to the system using bonding conductors and fittings. See 9.4.2 and Table SA1.2 for secondary conductors. See 12.11.~~

UL STP Proposals

15. New UL 96A Proposal - Grounded Metal Bodies

RATIONALE

The intent of the proposal is to include requirements that specify when to bond multiple roof top grounded metal bodies and avoid daisy chaining.

PROPOSAL

11.4 Grounded metal bodies that are within 6 feet (1.8 m) of the main conductor shall be bonded to the system.

11.4.1 Where the sum of the distances between a main conductor and a bonded (grounded) metal body and the distance from the bonded (grounded) metal body to other grounded metal bodies is 6 feet (1.8m) or more, no additional bonding of the grounded metal bodies is needed.

NFPA 70®

National Electrical Code
2011 Edition

250.106 Lightning Protection Systems. The lightning protection system ground terminals shall be bonded to the building or structure grounding electrode system.
Informational Note No. 1: See 250.60 for use of strike termination devices. For further information, see NFPA 780-2011, *Standard for the Installation of Lightning Protection Systems, which contains detailed information on* grounding, bonding, and sideflash distance from lightning protection systems.
Informational Note No. 2: Metal raceways, enclosures, frames, and other non-current-carrying metal parts of electrical equipment installed on a building equipped with a lightning protection system may require bonding or spacing from the lightning protection conductors in accordance with NFPA 780-2011, *Standard for the Installation of Lightning Protection Systems.*

NFPA® 13

Standard for the Installation of
Sprinkler Systems
2010 Edition

10.6.8* In no case shall the underground piping be used as a grounding electrode for electrical systems.
10.6.8.1* The requirement of 10.6.8 shall not preclude the bonding of the underground piping to the lightning protection grounding system as required by NFPA 780 in those cases where lightning protection is provided for the structure.

NFPA® 54

ANSI Z223.1
National Fuel Gas Code
2012 Edition

7.13.3* Prohibited Use. Gas piping shall not be used as a grounding conductor or electrode.
7.13.4* Lightning Protection Systems. Where a lightning protection system is installed, the bonding of the gas piping shall be in accordance with NFPA 780, *Standard for the Installation of* Lightning Protection Systems.

NFPA® 24

Standard for the Installation of Private
Fire Service Mains and Their

10.6.8* In no case shall the underground piping be used as a grounding electrode for electrical systems.
10.6.8.1* The requirement of 10.6.8 shall not preclude the