First Revision No. 103-NFPA 780-2020 [Global Input]

Add text to existing annex from 4.13.6.1 from current A.4.13.2.

A.4.13.6.1 should finish by reading:

Consideration of the corrosive environment is necessary in the selection of an appropriate stainless-steel alloy as a material for the grounding electrode. Research has been presented that warns that stainless steel is very susceptible to corrosion in many soil conditions. Extreme caution should be used with proper soil analysis where this type of rod is used.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 13:18:37 EST 2020

Committee Statement

Committee Statement: The last sentence of existing A.4.13.2 is deleted because the requirement discussed is specific to lightning protection, not to grounding of electrical systems. The remaining text in A.4.13.2 is applicable specifically to 4.13.1.6 so it is moved into A.4.13.1.6.

Response Message: FR-103-NFPA 780-2020

First Revision No. 16-NFPA 780-2020 [Global Input]

Section 4.20.2 through 4.20.9 have been revised and reorganized. This results in a multi-section 4.20.2. See attached file.

Supplemental Information

File Name	Description	Approved
FR16_4.20.2_rework.docx	FR 16 reorganized 4.20.2. For staff use	
780_Global_FR-16_4.20.2_rework_for_ballot.pdf	For ballot	

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Thu Nov 12 15:31:28 EST 2020

Committee Statement

Committee Statement: This first revision reformats, enhances, and clarifies the rules and requirements for surge-protective devices (SPDs) under one section of Section 4.20. Technical terminology, spelling, and abbreviation revisions have been made to correlate the NFPA 780 with the NEC (NFPA 70), primarily Part II. of Article 242 in the 2020 NEC.

New 4.20.2.10 corresponds directly with Section 242.22 of the 2020 NEC.

New 4.20.2.11 corresponds directly with Sections 242.20 and 242.30 of the 2020 NEC and replaces the language being deleted in 4.20.5.4.

4.20.2.13.2 (former 4.20.9.2) has been revised for clarity and new annex material has been added to provide the reader guidance from NEMA and the NEC regarding enclosure environmental ratings.

Response Message: FR-16-NFPA 780-2020

Public Input No. 65-NFPA 780-2020 [Sections 4.20.3.1.1, 4.20.3.1.2]
Public Input No. 69-NFPA 780-2020 [Section No. A.4.20.2.4]
Public Input No. 142-NFPA 780-2020 [Section No. A.4.20.5]
Public Input No. 68-NFPA 780-2020 [Sections 4.20.8, 4.20.9]
Public Input No. 76-NFPA 780-2020 [Section No. A.4.20.3.1]
Public Input No. 73-NFPA 780-2020 [Section No. A.4.20.5]
Public Input No. 71-NFPA 780-2020 [Section No. A.4.20.8]
Public Input No. 70-NFPA 780-2020 [Section No. A.4.20.4]
Public Input No. 11-NFPA 780-2020 [Section No. 4.20.2.3]
Public Input No. 169-NFPA 780-2020 [Section No. 4.20.5.3]
Public Input No. 141-NFPA 780-2020 [Section No. 4.20.2.5]
Public Input No. 67-NFPA 780-2020 [Section No. 4.20.4]
Public Input No. 75-NFPA 780-2020 [New Section after A.4.20.2.5]
Public Input No. 63-NFPA 780-2020 [Section No. 4.20.2]
Public Input No. 72-NFPA 780-2020 [Section No. A.4.20.7.4]
Public Input No. 66-NFPA 780-2020 [Section No. 4.20.5]

Note: 4.20 was renumbered to 4.19 due to other changes in Chapter 4.

4.20.2* Surge-Protective Device (SPD) ~~Protection~~ Requirements.

A.4.20.2

An SPD responds to surges by lowering its internal impedance so as to divert a surge current to limit the voltage to its protective level — the measured limiting voltage. After the occurrence of surges, the SPD recovers to a high-impedance-state line-to-ground and extinguishes the current-to-ground through the device when the line voltage returns to normal. The SPD performs~~achieves~~ these functions under normal service conditions, which are ~~specified by~~specific to the frequency of the system, voltage, load current, altitude (i.e., air pressure), humidity, and ambient air temperature.

4.20.2.1

SPDs shall be installed at all power ~~service entrances *(see 4.20.3.1, 4.20.4, and 4.20.5 for selection criteria)*~~services supplying a building, structure, or equipment.

4.20.2.1.1

SPDs shall be an integral part of the service equipment or located immediately adjacent thereto.

~~4.20.2.2*~~

~~SPDs shall be installed at entrances of conductive communications systems (including, but not limited to, CATV, alarm, and data) and antenna systems.~~

~~A.4.20.2.2~~

~~Antennas are considered a part of conductive signal, data, and communication services.~~

4.20.2.~~3~~ 2

SPDs shall be installed at all points of supply where ~~an electrical or electronic system~~a service, feeder, or branch circuit conductor or cable ~~leaves~~ enters or exits a building or structure to supply another building or structure ~~if~~ and where the conductors or cables are run over 100 ft (30 m).

4.20.2.~~4~~3*

~~Surge protection~~SPDs shall be permitted ~~for installation at subpanels or branch panels and~~to be installed anywhere on the load side of a service disconnect overcurrent device or at the point of utilization ~~(outlet or signal termination; also termed *supplementary protection*)~~on the load side of a branch circuit overcurrent protection device up to the equipment served; this protection is in addition to that required by 4.20.2.1 and 4.20.2.2.

A.4.20.2.~~4~~3

Permanent failure of electrical and electronic systems can result from conducted and induced surges transmitted to an apparatus via connecting wiring, as well as from the effects of radiated electromagnetic fields impinging directly onto the apparatus itself. Protection ~~at~~ of ~~primary panels and subpanels~~the service equipment and downstream equipment (~~coordinated~~ cascading SPD system) is recommended to reduce such effects.

To reduce the probability of failure of mission-critical equipment or equipment that is critical to life safety, surge protection should also be considered ~~on~~ for the branch distribution ~~panels~~ equipment powering the~~is~~ equipment. IEC 62305-4, *Protection Against Lightning — Part 4: Electrical and Electronic Systems Within Structures*, recommends that the length of system wiring between the point at which the SPD is installed and ~~that of~~ the equipment being protected be no greater than 30 ft (10 m). Induced voltages can be reintroduced onto long lengths of system wiring, which can ~~will~~ add to the protection level (U_p) of the SPD. If ~~this~~ the protection level exceeds the withstand voltage level (U_w) of the equipment being protected, the protection afforded by the SPD might not be adequate. In such a case, the installer should locate an SPD closer to the point of utilization of the equipment. This ~~same~~ philosophy extends to the protection of service ~~panels~~equipment.

Depending on the presence of other protective measures (e.g., shielding), SPDs should be considered ~~on~~ for branch distribution ~~panels~~ equipment as close as 30 ft (10 m) or more from the ~~primary~~ service ~~entrance panel~~ equipment where the electrical equipment fed by the panel equipment is susceptible to overvoltage~~s~~. Inductive coupling of electrical and magnetic fields can result in surges ~~sufficient to~~that can cause damage to susceptible electrical equipment.

4.20.2.~~5~~4*

SPDs shall not be required where, under engineering supervision, it is determined that the surge threat is negligible, ~~or~~ the lines are equivalently protected, or ~~where~~ installation would compromise~~s~~ safety.

A.4.20.2.~~5~~4

Most services to facilities ~~will~~ require discrete surge suppression devices ~~installed~~ to protect against damaging surges. Occasionally, services ~~will~~ might be located in an area or ~~a~~ manner ~~where~~ for which the threat from lightning-induced surges and overvoltage transients ~~might~~ is~~be~~ negligible. For example, the requirement~~s~~ in 4.20.2.3 *(~~also~~ see also A.4.20.6.1)* exempts services less than 100 ft (30 m) in length that are run in grounded metal conduit between buildings requiring surge protection. Other examples where SPDs might not be required ~~to be installed~~ at each service entrance are those applications ~~where~~ for which fiber optic transmission lines (with no conducting members) are used. The standard recognizes that there ~~can~~ might be ~~acceptable~~ some exceptions. ~~and c~~Consequently, the standard allows for such exceptions to the requirements for surge suppression on electrical utility, data, and other signal lines~~,~~ provided a competent engineering authority ~~has~~ determines~~ed~~ that the threat is negligible or that the system is protected in a manner equivalent to surge suppression protection.

The ~~A~~allowance in this standard for the exemption of surge suppression protection at specific locations is not intended ~~as a means~~ to provide a broad exemption simply because surge suppression equipment might be ~~considered~~ inconvenient to install. Rather, this allowance recognizes that all possible circumstances and configurations, particularly those in specialized industries, cannot be covered by this standard.

Determinations made by an engineering authority for exempting the installation of SPDs should focus on the likelihood of lightning activity in ~~the~~ a region, the level of damage that might be incurred, and the potential loss of human life or essential services due to inadequate overvoltage protection.

The following ~~F~~four methods of analysis are commonly used for this determination, although other equivalent analysis can be used~~. The four methods are the following~~:

(1) A *risk assessment* ~~could~~ can be performed in accordance with IEC 62305-2, *Protection Against Lightning — Part 2: Risk Management*, and surge protection requirements ~~could~~ can be waived if justified by the assessment.

(2) ~~The~~ A *lightning flash density/risk analysis* ~~is an analysis to~~can be performed to determine the frequency of lightning activity in the geographic area of ~~the~~ a facility. As a rule of thumb, if the flash density exceeds one flash per square kilometer per year, surge suppression or other physical protection should be considered. Lightning energy can indirectly couple to services at ranges greater than 0.6 mi (1 km) to create potentially damaging overvoltage~~s~~.

(3) *Plant/facility statistical or maintenance records* ~~can also be used for risk analysis. If these records~~ can be used for risk analysis, if they demonstrate the lack of damage on a service ~~due~~ caused by~~to~~ surges, as well as ~~they can be used~~ to justify low risk of surge damage ~~to~~ in ~~a~~ particular systems or facilities~~y~~.

(4) ~~The~~ A *lightning electromagnetic environment analysis* ~~starts with a~~can take the threat of an electromagnetic field from a nearby lightning strike and compute~~s~~ the magnitude and rise-time characteristics of transients coupled into services feeding a structure or facility. Based

on the computed threat, SPDs can be sized appropriately or omitted, as warranted. This analysis is typically performed ~~for~~ in critical communications facilities and ~~in~~ for military applications. Electromagnetic environments for such an analysis can be found in MIL-STD-464C, *Interface Standard Electromagnetic Environmental Effects Requirements for Systems*, and IEC 62305-4, *Protection Against Lightning — Part 4: Electrical and Electronic Systems Within Structures*.

In all cases, the criticality of continued operation, potential ~~life~~ hazard to persons and essential services, and ~~the~~ consequences of facility damage or shutdown should be considered~~factors in the analysis~~. If a hazardous condition results from a surge causing temporary shutdown without permanent damage (e.g., ~~through~~ due to the disabling of a computer or communication system), then the requirements for surge suppression as articulated by Section 4.20 should not be exempted.

4.20.3.1.1 [Move to 4.20.2.5]

The SPD shall protect against surges produced by a 1.2/50-~~-~~µs and 8/20-~~-~~µs combination waveform generator.

4.20.3.1.2* [Move to 4.20.2.6]

SPDs at the service entrance shall have a nominal discharge current (I_n) rating of at least 20 kA 8/20 µs per phase.

A.4.20.3.1 [Reassociate to 4.20.2.6]

SPDs are typically sized significantly larger than the expected ~~challenge~~ surge level. ~~At~~ With service ~~entries~~equipment, it is generally agreed that a nominal discharge current (I_n) of 20 kA will provide adequate protection. However, ~~larger~~ higher ratings that protect against less probable but more powerful lightning events ~~will~~ usually provide a better capability to handle multiple strikes and have ~~will usually provide~~ a longer service life.

Rating the SPD's I_n higher than the minimums in this document is recommended in areas with frequent lightning.

Where installed, SPDs ~~at~~ on ~~branch panels or subpanels~~downstream equipment should have an I_n rating of 10 kA 8/20 µs or greater per ~~phase~~mode.

Where installed, supplementary protection (also called *point of utilization protection*) SPDs should have an I_n rating of 5 kA 8/20 µs or greater per ~~phase~~mode.

4.20.4* ~~**Measured Limiting Voltage of an SPD.**~~ **[Move to 4.20.2.7]**

The published voltage protection rating (VPR) of the SPD for each mode of protection shall be ~~selected to be~~ no greater than ~~those~~ that given in Table 4.20.4 for the different power distribution systems to which they can be connected.

Table 4.20.4 Maximum Allowed Voltage Protection Rating per Mode of Protection Provided for Different Power Distribution Systems to Which the SPD Can Be Connected

Power Distribution System	Line-to-Neutral	Line-to-Ground	Neutral-to-Ground	Line-to-Line
120 2W + ground	700	700	700	—
240 2W + ground	1000	1000	1000	—
120/240 3W + ground	700	700	700	1200
120/208 WYE 4W + ground	700	700	700	1200
277/480 WYE 4W + ground	1200	1200	1200	1800
277/480 WYE 4W + HRG (high-resistance ground)	1200	1800	1200	1800
347/600 WYE 4W + ground	1800	1800	1800	4000
240 DELTA 3W + ground (corner grounded)	—	1000	—	1000
240 DELTA 3W (ungrounded)	—	1000	—	1000
480 DELTA 3W + ground (corner grounded)	—	1800	—	1800
480 DELTA 3W (ungrounded)	—	1800	—	1800

A.4.20.4 [A.4.20.2.7]

The measured limiting voltages of the SPD should be selected to limit damage to the service or equipment protected.

Devices rated in accordance with ~~ANSI/~~UL 1449, ~~*Standard for* ~~*Safety for Surge Protective Devices*, reflect that the voltage rating test in this edition utilizes a 3 kA peak current~~ instead of the 500 A current level previously used in the SVR test of the 2nd edition of ANSI/UL 1449, *Standard for Safety for Transient Voltage Surge Suppressors*~~.

4.20.5.1 [Move to 4.20.2.8]

The ~~short-circuit current rating of the ~~SPD shall be ~~coordinated ~~marked with ~~the available fault~~a short-circuit current rating~~ of the supply (panel) to which it is connected, in accordance with *NFPA 70*~~.

4.20.2.8.1

The requirement for a short-circuit current rating marking shall not apply to receptacles.

4.20.2.8.2

SPDs shall not be installed at a point on the system where the available fault current is in excess of the SPD rating.

4.20.5.2 [Move to 4.20.2.9]

The maximum continuous operating voltage (MCOV) of the SPD shall be selected to ensure that it is greater than the upper tolerance of the utility power system to which it is connected.

4.20.2.10

SPDs shall be permitted to be located indoors or outdoors.

4.20.2.11

SPDs shall be made inaccessible to unqualified persons unless the SPDs are listed for installation in accessible locations.

4.20.2.12*

Where used at a point on a circuit, an SPD shall be connected to each ungrounded conductor.

A.4.20.5 [Reassociate to 4.20.2.12]

Surges can be induced upon any line entering a structure.

Where installed, ~~branch panels~~downstream equipment over 100 ft (30 m) from the service ~~entrance~~ equipment should have L–G or L–N and N–G modes of protection. Additionally, L–L protection is ~~also~~ permitted — although this is usually achieved ~~by~~ with the L–N modes across two phases.

The following modes of protection ~~are possible~~can be used to minimize the voltage differences between the individual conductors:

(1) Line-to-line (L–L) protection places the SPD between the current-carrying conductors in a power system.

(2) Line-to-neutral (L–N) protection places the SPD between the current-carrying conductors and the grounded conductor (neutral) in a power system.

(3) Line-to-ground (L–G) protection places the SPD between the current-carrying conductors and the grounding conductor (ground) in a power system.

(4) Neutral-to-ground (N–G) protection places ~~an~~ the SPD between the grounded conductor (neutral) and the grounding conductor (ground) in a power system. This mode of protection is not required at the service ~~entrance (primary service panel board)~~equipment if the neutral-to-ground bond is implemented at this location or within proximity of ~~this~~ the point of installation. Thus, in general, an SPD with only L–L and L–N modes of protection might be required at the service ~~entrance~~equipment.

~~(5) *Common mode* is a term used for a mode of protecting telecommunications, data lines, and so forth. This mode places the SPD between the signal conductor and ground. It is analogous to L–G mode in power systems.~~

~~(6) *Differential mode* is a term used for a mode of protecting telecommunications, data lines, and so forth. In this mode, an SPD is placed between the individual signal lines, analogous to the L–L mode of protection in power systems.~~

4.20.2.12.1

A surge-protective device shall be permitted to be connected between any two conductors — ungrounded conductors, grounded conductors, equipment grounded conductors, or grounding electrode conductors.

4.20.2.12.2

The conductors used to connect the SPD to the line or bus and to ground shall not be any longer than necessary and shall have no unnecessary bends.

4.20.8* Earth Grounding Electrode. [Move to 4.20.2.13]

The ~~R~~resistance of the earth electrode system used in the grounding of SPDs shall comply with *NFPA 70*.

A.4.20.8 [A.4.20.2.13]

The effectiveness of ~~the~~ an SPD is based on the impedance of the path to ground. A lower impedance minimizes the voltage differences of conductors attached to SPDs near the service entrance and reduces the chance of arcing or insulation breach. Consequently, it is essential to minimize impedance in this circuit.

4.20.9 Physical Characteristics. [Move to 4.20.2.14]

4.20.9.1 [4.20.2.14.1]

~~The~~ SPDs shall be protected with consideration for the operational environment conditions and according to the manufacturer's installation instructions.

4.20.9.2* [4.20.2.14.2]

Enclosures ~~and other ancillary equipment~~ shall be ~~listed for the purpose~~marked with environmental rating(s) by type.

A.4.20.2.14.2

For information on enclosure environmental ratings, see NEMA 250, *Enclosures for Electrical Equipment (1,000 Volts Maximum)*, and Section 110.28 of *NFPA 70 (NEC)*.

~~**4.20.3 Surge Protective Device Ratings.**~~

~~**4.20.3.1* Electrical Power Circuits.**~~

~~**4.20.3.2 Signal, Data, and Communication Protection.**~~

~~**4.20.3.2.1**~~

~~SPDs shall be listed for the protection of signal, data, and communications systems.~~

First Revision No. 17-NFPA 780-2020 [Global Input]

Section 4.20.2 through 4.20.9 have been revised and reorganized. This results in a multi-section 4.20.4. See attached file.

Supplemental Information

File Name	Description	Approved
FR17_4.20.4_rework.docx	FR17 4.20.4 reorganization	
780_Global_FR-17_4.20.4_rework_for_ballot.pdf	For ballot	

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Thu Nov 12 16:26:00 EST 2020

Committee Statement

Committee Statement: This first revision reformats, enhances, and clarifies the rules and requirements for surge protectors under one section of Section 4.20. Technical terminology, spelling, and abbreviation revisions have been made to correlate the NFPA 780 with the NEC (NFPA 70), primarily Article 800 in the 2020 NEC and with the applicable product certification standard (UL 497 series).

4.20.4.1 combines the requirements found in the current 4.20.6 and 4.20.6.5 into one section for clarity and conciseness.

4.20.4.2 provides location details that are currently found in 4.20.2.2. and 4.20.2.3.

Annex material has been added to 4.20.4.5 to point the reader to the applicable IEEE C62 Standards related to isolation transformer surge protection.

Response Message: FR-17-NFPA 780-2020

Public Input No. 86-NFPA 780-2020 [New Section after 4.20.3.2.2]

Public Input No. 219-NFPA 780-2020 [Section No. 4.20.6.4.1]

Public Input No. 21-NFPA 780-2020 [Section No. 4.20.6.4.2]

Public Input No. 168-NFPA 780-2020 [Section No. 4.20.3.2.1]

Public Input No. 92-NFPA 780-2020 [Section No. A.4.20.7.2]

Public Input No. 88-NFPA 780-2020 [Section No. 4.20.3.2]

Public Input No. 91-NFPA 780-2020 [Section No. 4.20.7]

Public Input No. 90-NFPA 780-2020 [Section No. 4.20.6]

Public Input No. 89-NFPA 780-2020 [New Section after 4.20.4]

Note: 4.20 was renumbered to 4.19 due to other changes in Chapter 4.

4.20.4 Surge Protector Requirements.

4.20.4.1*
Surge protectors shall be installed on all signal, data, and communications systems that enter or exit a building or structure or supply equipment, including proprietary equipment from communication utility providers or tenant communication utilities.

A.4.20.4.1
Antennas are considered part of conductive signal, data, and communication services.

4.20.6.5.2 [Move to 4.20.4.1.1]
~~SPDs~~ Surge protectors shall not be required if ~~the~~ a service provider has made other provisions for lightning surge threats.

4.20.4.2*
Surge protectors shall be installed where signal, data, or communications system conductors or cables enter or exit a building or structure to supply another building or structure and where the conductors or cables are run over 100 ft (30 m).

A.4.20.6.1 [Reassociate to new 4.20.4.2]
~~SPDs~~ Surge protectors should be placed on both ends of external signal, data, and communication lines longer than 100 ft (30 m) that connect pieces of equipment or facilities~~,~~ to protect against surges coupled into the wiring or caused by ground potential differences.

4.20.3.2.2* [Move to 4.20.4.3]
~~Signal, data, and communications SPDs~~Surge protectors shall have a maximum discharge current (I_{max}) rating of at least 10 kA 8/20 µs when installed at the entrance.

A.4.20.4.3
Where surge protectors having a rating of 10 kA 8/20 µs do not exist, devices complying with the requirements of Section 1.3 should be installed.

4.20.6.2 [Move to 4.20.4.4]
The selection of ~~SPDs~~ surge protectors shall take into consideration aspects such as ~~the~~ frequency, bandwidth, and voltage.

4.20.6.3 [Move to 4.20.4.4.1]
Losses (such as returns loss, insertion loss, impedance mismatch, or other attenuation) introduced by the ~~SPD(s)~~surge protector shall be within acceptable operational limits.

4.20.4.5*
Surge protectors shall be grounded.

A.4.20.4.5

Additional information on the surge parameters of isolating transformers can be found in IEEE C62.69-2016, *Standard for the Surge Parameters of Isolating Transformers Used in Networking Devices and Equipment*; IEEE C62.36-2016, *Standard Test Methods for Surge Protectors and Protective Circuits Used in Information and Communications Technology (ICT) Circuits, and Smart Grid Data Circuits*; and IEEE C62.43-2005, *Guide for the Application of Surge Protectors Used in Low-Voltage (Equal to or Less than 1000 Vrms or 1200 Vdc) Data, Communications, and Signaling Circuits*.

4.20.4.5.1

Surge protectors that perform their protection function through isolation shall not be required to be grounded.

4.20.6.4.1* **[Move to 4.20.4.5.2]**

Surge protectors that do not perform their surge protection function through isolation~~SPDs protecting communications systems~~ shall be grounded in accordance with Chapter 8 of *NFPA 70*~~, with the exception of devices that perform their surge protection function through isolation~~.

A.4.20.6.4.1 **[A.4.20.4.5.2]**

The purpose of ~~the~~ a ~~SPD~~ surge protector is to equalize ~~L–L, L–N, L–G, and N–G~~conductor-to-conductor and conductor-to-ground potential~~s~~. While a good ground is important, a good bond is imperative to minimize the damage ~~due~~ caused by~~to~~ lightning and power contact or induction. Common mode is a mode of protecting telecommunications lines, data lines, and so forth. This mode places the protector between the signal conductor and the ground. It is analogous to L–G mode in power systems. Differential mode is a mode of protecting telecommunications lines, data lines, and so forth. In this mode, a protector is placed between the individual signal lines, analogous to the L–L mode of protection in power systems.

4.20.6.4.2 **[Move to 4.20.4.6]**

~~If~~ Where the point of grounding ~~in~~ referenced in ~~4.20.6.4.1~~4.20.4.5 is more than 20 ft (6 m) away, a ~~x~~supplementary ground reference point shall be installed at the ~~SPD~~ surge protector location. ~~Acceptable supplementary ground reference points shall be permitted as follows:~~

~~(1) Equipotential ground bus bar~~

~~(2) Structural metal framework in accordance with 4.19.1~~

~~(3) Ground reference at a secondary power distribution panel~~

4.20.4.6.1

~~Acceptable supplementary~~Supplementary ground reference points shall be permitted as follows:

(1) Equipotential ground bus bar

(2) Structural metal framework in accordance with 4.19.1

(3) Ground reference at a secondary power distribution panel

4.20.6.4.3 **[Move to 4.20.4.7]**

~~SPDs~~ Surge protectors shall not be grounded through a down conductor of the lightning protection system.

4.20.7.2* **[Move to 4.20.4.8]**
~~SPDs~~ Surge protectors shall be located and installed so as to minimize lead length, and interconnecting leads shall be routed so as to avoid sharp bends, coils, or kinks.

A.4.20.7.2 **[A.4.20.4.8]**
Longer~~,~~ or looped~~, SPD line and ground~~surge protector conductors increase the impedance of the ~~SPD ground~~protector circuit. Increasing the lead length serves to increase the pass-through voltage at the point where the ~~SPD~~ protector is wired into ~~service~~ signal, data, or communications equipment~~ or a branch panelboard~~. Consequently, it is essential to minimize lead length impedance in this circuit.

4.20.7.3 **[Move to 4.20.4.9]**
The ~~SPD~~ surge protector grounding conductor, if provided, shall be installed in accordance with the manufacturer's installation instructions.

4.20.7.4* **[Move to 4.20.4.10]**
~~All SPD components~~Surge protectors shall be accessible for inspection and maintenance.

A.4.20.7.4 **[A.4.20.4.10]**
Some SPD units are provided with a failure indicator. This feature is recommended because it facilitates maintenance or test procedures. Where used, this indicator should be visible. ~~Building maintenance should consider p~~Periodic inspection or testing of SPDs should be considered as part of building maintenance. *(See NFPA 70B.)*

~~**4.20.5* Facility ac Surge Protection.**~~

~~**4.20.5.3**~~
~~The protection of service entrances shall use Type 1 or Type 2 SPDs, in compliance with applicable standards such as ANSI/UL 1449, *Standard for Safety for Surge Protective Devices*.~~
~~**4.20.5.4**~~
~~SPDs at grounded service entrances shall be wired in a line-to-ground (L–G) or line-to-neutral (L–N) configuration.~~
~~**4.20.5.4.1**~~
~~Additional modes, line-to-line (L–L), or neutral-to-ground (N–G) shall be permitted at the service entrance.~~
~~**4.20.5.4.2**~~
~~For services without a neutral, SPD elements shall be connected line-to-ground (L–G). Additional line-to-line (L–L) connections shall also be permitted.~~

4.20.~~6~~ 5 Communications Surge Protection.

4.20.~~6~~5.1*
SPDs shall be provided for all communications systems (including, but not limited to, CATV, alarm, and data systems) and antenna systems at facility entrances.

4.20.~~6.4~~5.2
SPDs protecting communications systems shall be grounded, with the exception of devices that perform their surge protection function through isolation.

4.20.~~6.4.4~~5.2.1*
SPDs for data and signal line protection shall provide common mode protection, with the exception of devices that perform their surge protection function through isolation.

A.4.20.~~6.4.4~~5.2.1
Differential mode protection should also be provided where practicable.

4.20.~~6.5~~5.3 Utility-Owned Communication Equipment.

4.20.~~6.5~~5.3.1
SPDs shall be provided on all proprietary equipment by ~~the~~ communication utility providers or ~~the~~ tenant communication utilit~~y~~ies.

4.20.~~7~~ 6 Installation.

4.20.~~7~~6.1
Installation of surge suppression hardware shall conform to the requirements of *NFPA 70*.

First Revision No. 67-NFPA 780-2020 [Global Input]

reorganization of Chapter 7

Subsections under headings will go with this renumbering.

Supplemental Information

File Name	Description	Approved
FR-67_restructure_of_Chapter_7.docx	FR-67 Restructure of Chapter 7. For staff use	
FR-67A_restructure_of_Chapter_7_for_ballot.docx	For ballot	

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 10:06:08 EST 2020

Committee Statement

Committee Statement: The existing layout of Chapter 7 condenses all protection requirements for specific classes of structures into a single Section 7.4. This revision revises the layout of the chapter to separate each protection application into its own section to make the chapter easier to use and eliminates 6 digit paragraph numbers.

The Committee Input also reduces the size of some clause headings for consistency.

Response Message: FR-67-NFPA 780-2020

Chapter 7 Protection for Structures Containing Flammable Vapors, Flammable Gases, or Liquids That Can Give Off Flammable Vapors

7.1* Applicability.

7.2 Principles of Protection.

7.3 Protective Measures.

7.4 ~~Protection of Specific Classes of Structures~~ ~~7.4.1~~ Operating Facilities (Non-storage Applications).

7.~~4.2~~5 Storage Tanks Under Pressure.

7.~~4.3~~6 Aboveground Tanks at Atmospheric Pressure ~~Containing Flammable Vapors or Liquids That Give Off Flammable Vapors~~.

7.~~4.3~~6.1* Fixed Roof Tanks (Metallic) and Tanks with Internal Floating Roofs.

7.~~4.3~~6.2 External Floating Roof Tanks.

7.~~4.3~~6.2.1* Sliding Contacts.

7.~~4.3~~6.2.2* Fixed Contacts.

7.~~4.3~~6.2.3 Parallel Conducting Paths (Seal Assembly from the Floating Roof Tank).

7.~~4.3~~6.2.4 Insulation of Gauge or Guide Poles.

7.~~4.3~~6.3 Metallic Tanks with Nonmetallic Roofs.

7.~~4.4~~7 Earthen Containers at Atmospheric Pressure Containing Flammable Vapors or Liquids That Give Off Flammable Vapors.

First Revision No. 137-NFPA 780-2021 [Detail]

Add annex to **4.8.13** Down Conductors and Structural Columns.

A.4.8.13

When it is necessary to install down conductors on or within the required bonding distance of steel-reinforced concrete columns in an existing structure, engineering consultation should be sought before piercing the column to access the rebar. Disturbing the concrete could impact the structural integrity of the steel-reinforced concrete column. If the engineer denies the alteration of the concrete column, coursing the down conductor on the column can be used as a means of last resort at the direction of the AHJ.

It is highly recommended that no attempt be made to bond steel-reinforcing cables in post-tensioned concrete.

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Tue Feb 02 12:52:04 EST 2021

Committee Statement

Committee Statement: Annex material provides guidance when working on existing structures with steel reinforced concrete columns to consult a competent engineering authority prior to making any effort to access rebar encased in concrete.

It also warns against disturbing the concrete on any post tension member.

Response Message: FR-137-NFPA 780-2021

First Revision No. 138-NFPA 780-2021 [Detail]

Add annex to **4.12.3** Concrete-Encased Electrodes.

A.4.12.3

Concrete-encased electrodes used in the grounding of lightning protection systems should be limited to those specifically designed for that purpose. The AHJ or its designated representative should confirm and document that the concrete-encased electrode meets the requirements of 4.12.3.

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Tue Feb 02 13:00:36 EST 2021

Committee Statement

Committee Statement: The addition of the annex material addresses the concern that new construction does not guarantee the concrete-encased electrode will meet the criteria of 4.13.3 unless it is designed specifically for that purpose.
Response Message: FR-138-NFPA 780-2021

First Revision No. 139-NFPA 780-2021 [Detail]

Delete current 8.1.3 along with any associated annex and move all text as new annex item for current 8.1 Application.

A.8.1

~~Where~~An AHJ might elect to omit the installation of a lightning protection system when all of the following conditions are met~~,~~: ~~lightning protection systems shall be permitted to be omitted:~~

(1) The facility is served by an approved local lightning warning system as determined by the AHJ, and the lightning warning system permits explosives operations to be terminated before an approaching thunderstorm is within 10 mi (16 km) of the installation. Data by López and Holle, "Lightning Casualties and Damages in the United States from 1959 to 1994," suggests that a minimum warning distance of at least6 mi to 8 mi (9.6 km to 12.8 km) is required to ensure that there is no significant damage from a lightning strike.

(2) All personnel are evacuated to a shelter providing adequate protection.

(3) The resulting damage and loss from a lightning strike are acceptable to the AHJ. Annex L provides guidance for performing a facility risk assessment.

(4) The facility contains only explosive materials that cannot be initiated by lightning~~,~~and ~~where~~ no fire hazard exists, as determined by documented tests and analyses and approved by the AHJ.

(5) ~~Personnel are~~Injury to personnel is not expected;~~to sustain injury;~~there ~~will be a~~is minimal risk of economic loss in relation to the structure, its contents, or the surrounding facilities; and the potential resulting damage and loss from a lightning strike ~~are~~is acceptable to the AHJ.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Wed Feb 03 11:00:34 EST 2021

Committee Statement

Committee Statement: The information in previous 8.1.3. was related to the decision on when to install lightning protection systems. Section 8.1.3 is relocated to the annex because the information was not related to the installation of a system.

Response Message: FR-139-NFPA 780-2021

Public Input No. 191-NFPA 780-2020 [Section No. 8.1.3]

First Revision No. 98-NFPA 780-2020 [Section No. 2.2]

2.2 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 61, *Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities,* ~~2017~~ 2020 edition.

NFPA 70®, National Electrical Code®, ~~2020~~ 2023 edition.

NFPA 122, *Standard for Fire Prevention and Control in Metal/Nonmetal Mining and Metal Mineral Processing Facilities,* ~~2015~~ 2020 edition.

NFPA 664, *Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities,* ~~2017~~ 2020 edition.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 12:41:04 EST 2020

Committee Statement

Committee Statement: This first revision updates several NFPA referenced standards to the most current edition at time of the First Draft Meeting.

Response Message: FR-98-NFPA 780-2020

First Revision No. 81-NFPA 780-2020 [Section No. 2.3.3]

~~**2.3.3** UL Publications.~~

~~Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.~~

~~ANSI/UL 1449, *Standard for Safety for Surge Protective Devices* , 2014, revised 2016.~~

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 14:47:27 EST 2020

Committee Statement

Committee Statement: UL 1449 is no longer referenced in this document.

Response Message: FR-81-NFPA 780-2020 UL 96 and 497 are not referenced in the body of the standard.

Public Input No. 167-NFPA 780-2020 [Section No. 2.3.3]

First Revision No. 99-NFPA 780-2020 [Section No. 2.4]

2.4 References for Extracts in Mandatory Sections.

NFPA 70®, *National Electrical Code®*, ~~2017~~ 2023 edition.

NFPA 115, *Standard for Laser Fire Protection,* ~~2016~~ 2020 edition.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 12:41:52 EST 2020

Committee Statement

Committee Statement: This first revision updates several NFPA referenced standards to the most current edition at time of the First Draft Meeting.

Response Message: FR-99-NFPA 780-2020

First Revision No. 126-NFPA 780-2020 [Section No. 3.3.1]

3.3.1* Air Terminal.

A strike termination device that is a receptor for the attachment of flashes to the lightning protection system. ~~and is listed for the purpose.~~

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Tue Dec 01 13:41:25 EST 2020

Committee Statement

Committee Statement: Revision removes requirement for listing from the definition.
Response Message: FR-126-NFPA 780-2020

First Revision No. 84-NFPA 780-2020 [Section No. 3.3.8.5]

3.3.8.5 Loop Conductor.

A main-sized conductor encircling a structure that is used to interconnect grounding electrodes, main conductors, or other electrically conductive bodies.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 15:34:28 EST 2020

Committee Statement

Committee Statement: The definition of down conductor, roof conductor, and ground loop conductor all specify it is a main-sized conductor.

Response Message: FR-84-NFPA 780-2020

Public Input No. 138-NFPA 780-2020 [Section No. 3.3.8.5]

First Revision No. 85-NFPA 780-2020 [Section No. 3.3.10.1]

3.3.10.1 Maximum Discharge Current (I_{max}).

The maximum instantaneous value of ~~the~~ a current through ~~the~~ a surge- protective device (SPD) having an 8/20 μs waveform.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 15:39:02 EST 2020

Committee Statement

Committee Statement: This first revision adds a hyphen between “surge” and “protective” to correct the spelling and to correlate the use of the term “surge-protective device (SPD)” in the NEC (NFPA 70) with the NFPA 780.

Response Message: FR-85-NFPA 780-2020

Public Input No. 49-NFPA 780-2020 [Section No. 3.3.10.1]

First Revision No. 86-NFPA 780-2020 [Section No. 3.3.10.2]

3.3.10.2 Nominal Discharge Current (I_n).

Peak value of 8/20 µs current waveform selected by the manufacturer for which ~~an SPD~~ a surge-protective device (SPD) remains functional after 15 surges.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 15:40:34 EST 2020

Committee Statement

Committee Statement: This first revision spells out “surge-protective device (SPD) in its entirety to match the defined term in the standard and to correlate the use of this term in the NEC (NFPA 70) with the NFPA 780.

Response Message: FR-86-NFPA 780-2020

Public Input No. 50-NFPA 780-2020 [Section No. 3.3.10.2]

First Revision No. 127-NFPA 780-2020 [Section No. 3.3.16]

~~**3.3.16** Gastight.~~

~~Describes a structure so constructed that gas or air cannot enter or leave the structure except through vents or piping provided for the purpose.~~

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Tue Dec 01 14:05:11 EST 2020

Committee Statement

Committee Statement: Revision deletes unnecessary definition.The intent of term is clear where it is used in the standard.
Response Message: FR-127-NFPA 780-2020

First Revision No. 87-NFPA 780-2020 [Section No. 3.3.18]

3.3.18 Grounding Electrode.

~~The portion~~ A component of a lightning protection system~~, such as a ground rod, ground plate electrode, or ground conductor, that is~~ installed for the purpose of ~~allowing~~ transferring lightning current flow into the earth.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 15:42:14 EST 2020

Committee Statement

Committee Statement: What is permitted to be used as an electrode is in the normative text. This is a revised definition of a grounding electrode.

Response Message: FR-87-NFPA 780-2020

Public Input No. 2-NFPA 780-2020 [Section No. 3.3.18]

First Revision No. 129-NFPA 780-2020 [Section No. 3.3.23]

~~**3.3.23** ISO Container.~~

~~Intermodal container designed to transport freight by ship, truck, or rail built in accordance with ISO 1496, *Series 1 freight containers — Specification and testing — Part 1: General cargo containers for general purposes* .~~

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Tue Dec 01 14:21:28 EST 2020

Committee Statement

Committee Statement: Revision deletes unnecessary definition.
Response Message: FR-129-NFPA 780-2020

First Revision No. 88-NFPA 780-2020 [Section No. 3.3.26]

3.3.25* Lightning Protection System.

A complete system of strike termination devices, conductors (which could include conductive structural members), grounding electrodes, interconnecting conductors, surge ~~protective devices~~ protection , and other connectors and fittings required to complete the system.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 15:54:20 EST 2020

Committee Statement

Committee Statement: Changing surge protective devices to surge protection to refer to all surge protection methodologies that could be employed as part of a lightning protection system.

Response Message: FR-88-NFPA 780-2020

Public Input No. 51-NFPA 780-2020 [Section No. 3.3.26]

First Revision No. 89-NFPA 780-2020 [Section No. 3.3.30]

3.3.29 Mast-Type Lightning Protection System.

A lightning protection system using one or more masts that are remote from the structure to provide the primary attachment point for a lightning discharge and that provides a zone of protection as described in this standard .

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 15:55:41 EST 2020

Committee Statement

Committee Statement: Added text clarifies that the mast-type lightning protection system provides a zone of protection, as described in Chapter 4.

Response Message: FR-89-NFPA 780-2020

Public Input No. 192-NFPA 780-2020 [Section No. 3.3.30]

First Revision No. 90-NFPA 780-2020 [Section No. 3.3.31.3]

3.3.11 ~~Explosive~~ Explosives Materials.

Materials, including explosives, blasting agents, and detonators, that are authorized for transportation by the Department of Transportation or the Department of Defense as explosive materials.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 15:59:44 EST 2020

Committee Statement

Committee Statement: The definition of explosives materials is separated from materials used for lightning protection components. Explosives materials are not used for lightning protection.

Response Message: FR-90-NFPA 780-2020

Public Input No. 3-NFPA 780-2020 [New Section after 3.3.31.3]

Public Input No. 4-NFPA 780-2020 [Section No. 3.3.31.3]

First Revision No. 91-NFPA 780-2020 [Section No. 3.3.37]

3.3.36 Solar Array.

A group of ~~solar~~ photovoltaic (PV) modules or solar thermal collectors wired or connected together in a string or larger collection system.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 12:04:41 EST 2020

Committee Statement

Committee Statement: Revised text makes the definition consistent with normative text.

Response Message: FR-91-NFPA 780-2020

Public Input No. 44-NFPA 780-2020 [Section No. 3.3.37]

First Revision No. 136-NFPA 780-2021 [Section No. 3.3.42]

~~**3.3.42** Structure.~~

~~**3.3.42.1** Metal-Clad Structure.~~

~~A structure with sides or roof, or both, covered with metal.~~

~~**3.3.42.2** Metal-Framed Structure.~~

~~A structure with electrically continuous structural members of sufficient size to provide an electrical path equivalent to that of lightning conductors.~~

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Tue Feb 02 12:46:23 EST 2021

Committee Statement

Committee Statement: Revision removes definitions of terms not used in standard.
Response Message: FR-136-NFPA 780-2021

First Revision No. 82-NFPA 780-2020 [New Section after 3.3.43]

3.3.42* Surge Arrester.

A protective device for limiting surge voltages by discharging or bypassing the surge current.

A.3.3.42 Surge Arrester.

A surge arrester also prevents continued flow of follow current while remaining capable of repeating these functions.

Requirements for surge arresters are outlined in Part III of Article 242 of *NFPA 70* and Section 19 of ANSI C2, *National Electrical Safety Code (NESC)* . For further information on surge arresters, see IEEE C62.11-2012, *Standard for Metal-Oxide Surge Arresters for AC Power Circuits (>1 kV)* , and IEEE C62.22-2009, *Guide for the Application of Metal-Oxide Surge Arresters for Alternating-Current Systems* .

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 15:27:57 EST 2020

Committee Statement

Committee Statement: This first revision adds a definition to cover a method of surge protection of premises wiring systems and equipment over 1,000 volts using the same definition used in the NEC (NFPA 70). Annex material is also being added to provide guidance on surge arrester installation requirements and applicable product certification standards.

Response Message: FR-82-NFPA 780-2020

Public Input No. 52-NFPA 780-2020 [New Section after 3.3.43]

First Revision No. 134-NFPA 780-2020 [Section No. 3.3.43]

3.3.41* Surge.

A transient wave of current, potential, or power in an electric circuit. ~~Surges do not include longer duration temporary overvoltages (TOV) consisting of an increase in the power frequency voltage for several cycles.~~

A.3.3.41 Surge.

Surges do not include longer duration temporary overvoltages (TOV) ~~consisting~~ , which consist of an increase in the power frequency voltage for several cycles.

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Tue Dec 01 14:43:54 EST 2020

Committee Statement

Committee Statement: Revision moves narrative text to annex.
Response Message: FR-134-NFPA 780-2020

First Revision No. 22-NFPA 780-2020 [New Section after 3.3.44]

3.3.45* Tank Battery.

A group of tanks and the associated process equipment for crude oil production or saltwater disposal.

A.3.3.45 Tank Battery.

Examples of items that might be included in a tank battery are connected piping, walkways, electrical systems, and data/communication systems.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 12:39:05 EST 2020

Committee Statement

Committee Statement: A new definition is added to define the term used in the new Section 7.5 covering tank batteries.

Response Message: FR-22-NFPA 780-2020

Public Input No. 131-NFPA 780-2020 [New Section after 3.3]

First Revision No. 83-NFPA 780-2020 [New Section after 3.3.44]

3.3.43* Surge Protector.

A protective device for limiting excessive potential and current on signal, data, and communication circuits caused by lightning, contact with power conductors, power induction, and rises in ground potential, while also preventing the continued flow of the follow current while remaining capable of repeating these functions.

A.3.3.43 Surge Protector.

A surge protector consists of single- and multiple-pair air gap arresters, gas tube arresters, or solid-state arresters, with or without fuses or other voltage-limiting devices. Additional information on surge protectors can be found in UL 497, *Standard for Protectors for Paired-Conductor Communications Circuits* ; UL 497A, *Standard for Secondary Protectors for Communications Circuits* ; UL 497B, *Standard for Protectors for Data Communications and Fire-Alarm Circuits* ; UL 497C, *Standard for Protectors for Coaxial Communications Circuits* ; UL 497D, *Outline of Investigation for Component Secondary Protectors for Communications Circuits Used with Specified Voltage Suppression* ; and UL 497E, *Outline of Investigation for Protectors for Antenna Lead-In Conductors.*

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Mon Nov 23 15:29:57 EST 2020

Committee Statement

Committee Statement: This first revision adds a definition to cover a method of surge protection of signal, data, and communication systems and equipment along with annex material to provide guidance on applicable product certification standards.

Response Message: FR-83-NFPA 780-2020

Public Input No. 53-NFPA 780-2020 [New Section after 3.3.44]

First Revision No. 92-NFPA 780-2020 [Section No. 3.3.44]

3.3.44* Surge-Protective Device (SPD).

A protective device ~~intended~~ for limiting the ~~surge~~ transient voltages ~~on equipment~~ by diverting or limiting the surge current ~~that comprises at least one nonlinear component~~ and preventing the continued flow of the follow current while remaining capable of repeating these functions.

A.3.3.44 Surge-Protective Device (SPD).

Requirements for SPDs are outlined in Part II of Article 242 in *NFPA 70* . Additional information on Type 1, Type 2, and Type 3 SPDs can be found in UL 1449, *Surge Protective Devices* . SPDs are designated as follows:

Type 1: Permanently connected SPDs intended for installation between the secondary side of the service transformer and the line side of the service disconnect overcurrent device.

Type 2: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.

Type 3: Point of utilization SPDs.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 12:07:53 EST 2020

Committee Statement

Committee Statement: This first revision correlates the definition of "surge-protective device (SPD)" in NFPA 780 with the NEC (NFPA 70). Annex material is added to provide guidance on where to find requirements for SPDs in the NEC along with a reference to the applicable product certification standard.

Response Message: FR-92-NFPA 780-2020

Public Input No. 54-NFPA 780-2020 [Section No. 3.3.44]

First Revision No. 135-NFPA 780-2020 [Section No. 3.3.45]

3.3.46 Transient.

A subcycle disturbance in the ac waveform that is evidenced by a sharp, brief discontinuity of the waveform. ~~It can be of either polarity and can be additive to, or subtractive from, the nominal waveform.~~

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Dec 01 14:45:09 EST 2020

Committee Statement

Committee Statement: Narrative text is removed from definition.

Response Message: FR-135-NFPA 780-2020

First Revision No. 132-NFPA 780-2020 [Section No. 3.3.47]

~~**3.3.48** Vapor Opening.~~

~~An opening through a tank shell or roof that is above the surface of the stored liquid and that is provided for tank breathing, tank gauging, fire fighting, or other operating purposes.~~

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Dec 01 14:39:37 EST 2020

Committee Statement

Committee Statement: Revision removes definition of term not used in standard.

Response Message: FR-132-NFPA 780-2020

First Revision No. 93-NFPA 780-2020 [Section No. 3.3.48.1]

3.3.48.1 Maximum Continuous Operating Voltage (MCOV).

The maximum designated ~~rms~~ root mean square (rms) value of the power frequency voltage that can be continuously applied to the mode of protection of a surge protective- device (SPD).

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 12:30:39 EST 2020

Committee Statement

Committee Statement: This first revision spells out “root mean squared” and places “rms” in parenthesis to comply with the NFPA Style Manual. A hyphen is added between “surge” and “protective” to correct the spelling and to correlate the use of the term “surge-protective device (SPD)” in the NEC (NFPA 70) with the NFPA 780.

Response Message: FR-93-NFPA 780-2020

Public Input No. 55-NFPA 780-2020 [Section No. 3.3.48.1]

Public Input No. 197-NFPA 780-2020 [Section No. 3.3.48.1]

First Revision No. 94-NFPA 780-2020 [Section No. 3.3.48.2]

3.3.48.2 Maximum Permitted DC Voltage (Vpvdc).

The maximum permitted dc voltage rating across a photovoltaic surge-protective ~~protection~~ device (PV SPD).

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 12:32:39 EST 2020

Committee Statement

Committee Statement: This first revision corrects the name and spelling of "PV SPD" by changing the term "protection" to "protective" and by adding a hyphen after "surge".

Response Message: FR-94-NFPA 780-2020

Public Input No. 56-NFPA 780-2020 [Section No. 3.3.48.2]

First Revision No. 95-NFPA 780-2020 [Section No. 3.3.48.3]

3.3.48.3 Measured Limiting Voltage (MLV).

Maximum magnitude of voltage that is measured across the terminals of the surge- protective device (SPD) during the application of impulses of specified waveshape and amplitude.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 12:33:50 EST 2020

Committee Statement

Committee Statement: This first revision adds a hyphen between “surge” and “protective” to correct the spelling and to correlate the use of the term “surge-protective device (SPD)” in the NEC (NFPA 70) with NFPA 780.

Response Message: FR-95-NFPA 780-2020

Public Input No. 57-NFPA 780-2020 [Section No. 3.3.48.3]

First Revision No. 133-NFPA 780-2020 [Section No. 3.3.48.4]

~~**3.3.49.4** Nominal System Voltage.~~

~~The nominal voltage (rms) of the power frequency supply.~~

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Tue Dec 01 14:42:21 EST 2020

Committee Statement

Committee Statement: Revision removes definition of term not used in standard.
Response Message: FR-133-NFPA 780-2020

First Revision No. 97-NFPA 780-2020 [Section No. 3.3.48.5]

~~**3.3.49.5** Normal Operating Voltage.~~

~~The normal ac power frequency voltage rating, as specified by the manufacturer, to which the SPD can be connected.~~

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Tue Nov 24 12:36:42 EST 2020

Committee Statement

Committee Statement: Revision removes definition of term not used in standard.
Response Message: FR-97-NFPA 780-2020

Public Input No. 58-NFPA 780-2020 [Section No. 3.3.48.5]

First Revision No. 96-NFPA 780-2020 [Section No. 3.3.49]

3.3.49* Voltage Protection Rating (VPR).

A rating (or ratings) selected by the manufacturer based on the measured limiting voltage determined when the ~~SPD~~ surge-protective device (SPD) is subjected to a combination waveform with an open circuit voltage of 6 kV and a short-circuit current of 3 kA.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 12:34:43 EST 2020

Committee Statement

Committee Statement: This first revision adds "surge-protective device" before "(SPD)" to correlate the use of terms in all of the "voltage" definitions of the standard and as used in the NEC (NFPA 70).

Response Message: FR-96-NFPA 780-2020

Public Input No. 59-NFPA 780-2020 [Section No. 3.3.49]

First Revision No. 112-NFPA 780-2020 [New Section after 4.1.1.3]

4.1.1.4 Additions to Structures.

4.1.1.4.1

An existing structure requiring Class I materials on which a new addition requires Class II materials shall be permitted to use the existing ground ring conductor installed and determined to be suitable for continued service.

4.1.1.4.2

Class II air terminals and roof/down conductors shall apply only to that portion of the structure exceeding 75 ft (23 m) in height.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 14:11:41 EST 2020

Committee Statement

Committee Statement: The new section addresses the cases where an addition that would meet the criteria for a Class II structure is added to an existing Class I structure with a lightning protection system meeting the requirements for a Class I structure.

Response Message: FR-112-NFPA 780-2020

Public Input No. 77-NFPA 780-2020 [Section No. A.4.14.2]

First Revision No. 51-NFPA 780-2020 [Sections 4.2, 4.3, 4.4, 4.5]

4.2 Materials.

Protection systems shall be made up of materials that are resistant to or protected against corrosion. ~~or protected against corrosion.~~

4.2.1

Combinations of materials that form electrolytic couples ~~of such a nature~~ that, in the presence of moisture, accelerate corrosion ~~is accelerated~~ shall not be used *(see also Section 4.3)* .

4.2.2

One or more of the materials in 4.2.2.1 through 4.2.2.3 shall be used.

4.2.2.1 Copper.

Copper shall be of the grade required for commercial electrical work and shall be of 95 percent conductivity when annealed.

4.2.2.2 Copper Alloys.

Copper ~~alloys~~ alloy shall be as resistant to corrosion as ~~is~~ copper is .

4.2.2.3 Aluminum.

4.2.2.3.1*

Aluminum shall not be used within 18 in. (450 mm) of the point where the lightning protection system comes into contact with the earth ~~is possible~~ or where rapid deterioration is possible.

A.4.2.2.3.1

The greater the separation of metals in the galvanic series, the greater the propensity for corrosion. Galvanic corrosion between aluminum and steel is generally not a problem unless they are in an environment rich in chlorides.

Hernández, et al. (2011) reported that the size of pitting in aluminum is greatly influenced by the concentration of pollutants in and the wetness of atmospheres. There was a linear relationship between pitting parameters and the chloride content in an environment, with a lesser effect from sulfur ions. The addition of sulphate ions to chloride-containing solutions increased the probability of larger pits.

The corrosion rate of aluminum increases with increasing relative humidity and temperature. Bengtsson, et al. (2001) reported that a humid salt spray environment increased the corrosion of aluminum by a factor of 10 to 20. It was suggested that the rapid corrosion of aluminum coated with salt in humidity-free air is connected to high-pH areas that develop in the electrolyte surface due to the cathodic reduction of oxygen.

4.2.2.3.2

Conductors shall be of electrical-grade aluminum with a minimum chemical composition of 99 percent aluminum.

4.2.3

Copper lightning protection materials shall not be installed on or in contact with aluminum roofing, aluminum siding, or other aluminum surfaces.

4.2.4*

Aluminum lightning protection materials shall not be installed on or in contact with copper roofing materials or other copper surfaces, or where exposed to runoff from copper surfaces .

A.4.2.4

Runoff from copper surfaces and components is particularly detrimental to aluminum and aluminum-based coatings. The intent of this requirement is to ensure that lightning protection systems are not installed such that they can be compromised by incompatible runoff. The AHJ or building owner is responsible for understanding runoff issues, as well as issues with the interaction of lightning protection components with other elements of the structure.

4.2.5*

Lightning protection systems shall be designed to minimize the effects caused by runoff from both copper and aluminum lightning protection materials to prevent the deterioration of incompatible materials and minimize the degradation of building aesthetics caused by staining.

A.4.2.5

Aluminum and copper on any structure must be designed and installed to ensure compatibility such that the expected lifecycle for any given component can be realized. The AHJ or building owner must have a thorough understanding of these compatibility issues.

4.3 Corrosion Protection.

4.3.1

Protection shall be provided against the deterioration of lightning protection components ~~due to~~ caused by local atmospheric conditions.

4.3.2

Copper components installed within 24 in. (600 mm) of the top of a chimney or vent emitting corrosive gases shall be protected by a hot-dipped lead or tin coating.

4.3.3

An aluminum conductor shall not be attached to a surface coated with alkaline-~~base~~ based paint, embedded in concrete or masonry, or installed in a location subject to excessive moisture.

4.3.4 Connectors and Fittings.

4.3.4.1

Connectors and fittings shall be compatible for use with the conductor and ~~the~~ surfaces on which they are installed.

4.3.4.2

Bimetallic connectors and fittings shall be used for splicing or bonding dissimilar metals.

4.3.4.3

Fittings used for the connection of aluminum down conductors to copper or copper-clad grounding equipment shall be of the bimetallic type.

4.4 Mechanical Damage or Displacement.

4.4.1*

Any part of a lightning protection system that is subject to mechanical damage or displacement shall be protected with a protective molding or covering.

4.4.2

Where metal pipe or tubing is used around ~~the~~ a conductor, the conductor shall be bonded to the pipe or tubing at both ends.

~~**4.5** Use of Aluminum.~~

~~Aluminum systems shall be installed in accordance with other applicable sections and 4.5.1 through 4.5.3 .~~

~~**4.5.1**~~

~~Aluminum lightning protection equipment shall not be installed on or in direct contact with copper roofing materials or other copper surfaces, or where exposed to runoff from copper surfaces.~~

~~**4.5.2**~~

~~Aluminum materials shall not be used within 18 in. (450 mm) of the point where the lightning protection system conductor comes into contact with the earth.~~

~~**4.5.2.2**~~

~~Bimetallic connectors shall be installed not less than 18 in. (450 mm) above earth level.~~

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 17 12:56:26 EST 2020

Committee Statement

Committee Statement: This First Revision reorganizes Sections 4.2 through 4.5 for clarity and to eliminate redundant text. The revision adds a reference to where the user can find guidance and specific requirements related to corrosion protection. It incorporates 4.5.2 into 4.2.2.3.1 to consolidate restrictions on the use of aluminum, with annex text to identify factors that can lead to rapid deterioration of aluminum. It merges the text in 4.5.1 into an existing 4.2.4 to recognize the probability of corrosion of aluminum from copper runoff. The revision relocates text from Section 4.5 that belongs in 4.3.3 and deletes the redundant text that is now incorporated into the relevant sections of 4.2 and 4.3.

The text related to copper runoff was clarified by adding annex material for.4.2.4. Additional material was added to create 4.2.5 to emphasize the problems created by copper runoff.

Response Message: FR-51-NFPA 780-2020

Public Input No. 182-NFPA 780-2020 [Section No. 4.2.4]

Public Input No. 199-NFPA 780-2020 [Section No. 4.5.1]

Public Input No. 184-NFPA 780-2020 [New Section after 4.3.3.2]

Public Input No. 179-NFPA 780-2020 [Section No. 4.2.1]

Public Input No. 180-NFPA 780-2020 [Section No. 4.5]

Public Input No. 181-NFPA 780-2020 [Section No. 4.2.2.3.1]

Public Input No. 213-NFPA 780-2020 [New Section after A.4.4.1]

Public Input No. 186-NFPA 780-2020 [New Section after 4.3.2]

First Revision No. 4-NFPA 780-2020 [Sections 4.6.4.4, 4.6.4.5]

4.5.4.4

~~The overhead~~ Overhead ground wires shall be ~~a minimum diameter of ½ in. (13 mm) and shall be~~ self-supporting with minimum sag under all conditions.

4.5.4.5 Overhead Ground Wire Conductor Size.

4.5.4.5.1

Overhead ground wires shall have a minimum cross-sectional area equal to that of a main conductor.

4.5.4.5.2

When steel or stainless-steel cable is used for the overhead ground wire, it shall have a minimum diameter of ½ in. (12.7 mm).

4.5.4.6

Connections between galvanized steel overhead ground wires and copper conductors shall be made through a suitable component that does not permit direct contact between the two materials.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 10 06:07:21 EST 2020

Committee Statement

Committee Statement: It is recognized that the size of main conductors, with aluminum and copper as permitted materials, have sufficient cross-section to safely conduct lightning currents. Steel cable applied to overhead ground wires, as a lightning conductor, is a special case permitted only in this application to address concerns of mechanical strength. It was never the intent that 1/2 inch diameter was necessary for ALL overhead ground wires, including copper and aluminum. A 1/2 inch diameter corresponds to over 4/0 AWG, which greatly exceeds the diameter of Class II copper main size conductors. The 1/2 inch diameter for steel overhead ground wires was implemented between the 2014 and 2017 editions and was selected to account for the increased resistivity of the steel material compared to copper or aluminum. (Overall path resistance of the conductor decreases as cross-sectional area increases.) This revision, enacted after the 2014 cycle, was not intended to account for the resistivity of the aluminum and copper main size conductor that have electrical properties sufficient for lightning current, requiring no increase to their cross-section to apply to overhead ground wires.

Response Message: FR-4-NFPA 780-2020

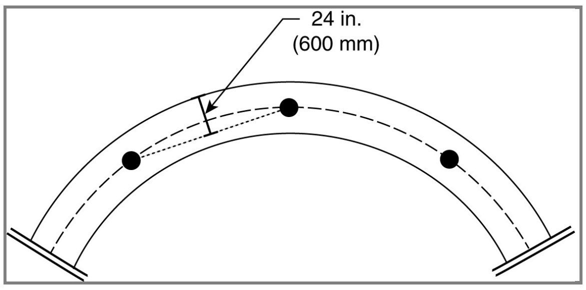
Public Input No. 163-NFPA 780-2020 [Section No. 4.6.4.4]

First Revision No. 2-NFPA 780-2020 [New Section after 4.7.6.2]

4.8.6.3

A curved perimeter of a structure shall be protected so that the outer edge of the structure is less than 24 in. (600 mm) from a straight line or chord between two adjacent air terminals, as shown in Figure 4.8.6.3 , unless it is in a zone of protection in accordance with Section 4.8 .

Figure 4.8.6.3 Flat or Gently Sloping Roof with a Curved Perimeter.



Supplemental Information

File Name	Description	Approved
FR-2_figure_4.7.6.3.pdf	FR-2 new figure 4.7.6.3 - for staff use	

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 09 15:28:48 EST 2020

Committee Statement

Committee Statement: The figure adds clarity to the existing requirement.

Response Message: FR-2-NFPA 780-2020

Public Input No. 205-NFPA 780-2020 [New Section after 4.7.6]

First Revision No. 3-NFPA 780-2020 [Section No. 4.8.2.4]

4.7.2.4*

Structures that do not exceed 50 ft (15 m) above the earth shall be considered to protect lower portions of a structure located within a one-to-one zone of protection, as shown in Figure 4.7.2.4(a) and Figure 4.7.2.4(b).

Figure 4.7.2.4(a) Lower Roof Protection for Buildings 50 ft (15 m) or Less in Height.

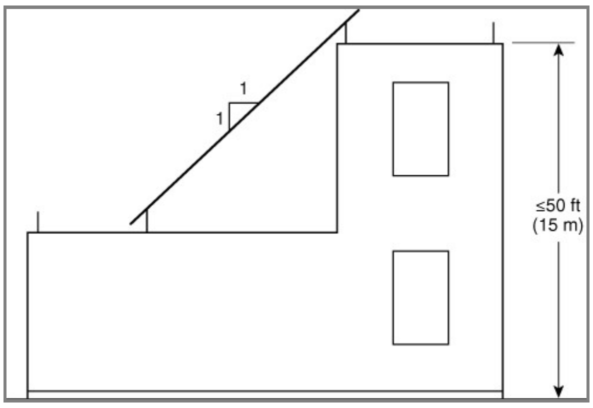
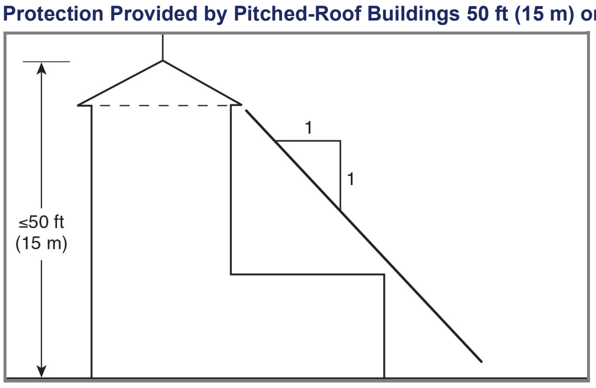


Figure 4.7.2.4(b) Lower Roof Protection Provided by Pitched-Roof Buildings 50 ft (15 m) or Less in Height.



A.4.7.2.4

The purpose of Figure 4.7.2.4(b) is to provide a graphical representation of the area protected by the upper roof. The reference point is the eave because the criteria in 4.7.3 have been met and, thus, air terminals are not required on the ridge. It has been determined that this area is not susceptible to a direct strike.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 09 15:45:44 EST 2020

Committee Statement

Committee Statement: A greater explanation is necessary to understand that the protective angle is provided by the eave of the upper roof. A task group has been formed to clarify the protection of multilevel roofs. The text in 4.7.3 that indicates air terminals are not necessary on the eave of pitched roofs meeting the criteria of 4.7.3. The direct tie in 4.8.2.4 between the protective angle and multiple level roofs could be seen to exclude the applicability of the requirements of 4.7.3 when dealing with pitched roofs on the upper level of a multiple roof structure. Restructuring of Section 4.8 may be necessary to address the applicability of more than one of the methods identified in 4.8.1 used to determine the zone of protection for a structure.

Response Message: FR-3-NFPA 780-2020

Public Input No. 217-NFPA 780-2020 [New Section after A.4.8.3.1]

First Revision No. 5-NFPA 780-2020 [Section No. 4.9 [Excluding any Sub-Sections]]

Main conductors shall: ~~do the following:~~

(1) Interconnect all strike termination devices

(2) Form two or more paths from each strike termination device downward, horizontally, or rising at no more than ¼ slope to connections with grounding electrodes, except as permitted by 4.8.1 and 4.8.2

(3) Permit one rising path on pitched roofs not to exceed 50 ft (15 m) in length

(4) Permit one rising path not exceeding ¼ slope on flat or gently sloping roofs

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 10 12:13:59 EST 2020

Committee Statement

Committee Statement: The phrase “do the following” was deleted as it is not necessary. A limit to the length of the rising path was added to be consistent with other sections of the standard.

Response Message: FR-5-NFPA 780-2020

Public Input No. 140-NFPA 780-2020 [Section No. 4.9 [Excluding any Sub-Sections]]

Public Input No. 207-NFPA 780-2020 [Section No. 4.9 [Excluding any Sub-Sections]]

Public Input No. 209-NFPA 780-2020 [Section No. 4.9 [Excluding any Sub-Sections]]

First Revision No. 6-NFPA 780-2020 [Section No. 4.9.11 [Excluding any Sub-Sections]]

Down conductors located ~~in runways, driveways, school playgrounds, cattle yards, public walks, or other locations~~ where subject to physical damage or displacement shall be guarded.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 10 12:29:44 EST 2020

Committee Statement

Committee Statement: This revision removes an incomplete list of locations and reinforces that down conductors are to be guarded any where they are subject to physical damage.

Response Message: FR-6-NFPA 780-2020

Public Input No. 7-NFPA 780-2020 [Section No. 4.9.11 [Excluding any Sub-Sections]]

First Revision No. 7-NFPA 780-2020 [Section No. 4.9.13 [Excluding any Sub-Sections]]

Down conductors coursed ~~on or in~~ in reinforced concrete columns or coursed on or within the calculated bonding distance of reinforced concrete columns or structural steel columns in accordance with 4.15.2.5 or 4.15.2.6 ~~reinforced concrete columns or on structural steel columns~~ shall be ~~connected~~ bonded to the reinforcing steel or the structural steel member at ~~their~~ its upper and lower extremities.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 10 13:05:03 EST 2020

Committee Statement

Committee Statement: The electromagnetic coupling between the down conductor and the reinforcing steel or structural steel in a long parallel path is addressed for conductors coursed on, in or near structural columns. It also allows calculation of the bonding distance to be used to locate conductors outside areas subject to electromagnetic coupling.

Response Message: FR-7-NFPA 780-2020

Public Input No. 85-NFPA 780-2020 [New Section after A.4.9.8.1]

Public Input No. 84-NFPA 780-2020 [Section No. 4.9.13 [Excluding any Sub-Sections]]

First Revision No. 100-NFPA 780-2020 [Section No. 4.13.1.1]

4.12.1.1*

Each down conductor shall terminate to one of the following:

(1) A grounding electrode dedicated to the lightning protection system

(2)* A grounding electrode system of a building, structure, or facility that has multiple grounding electrodes bonded together with a ground ring electrode meeting the requirements of 4.12.4

A.4.12.1.1(2)

For lightning protection, a single integrated (interconnected) grounding system including lightning protection, power systems, communications systems, and other grounded systems is preferable.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 12:44:27 EST 2020

Committee Statement

Committee Statement: Annex is added to A.4.13.1.1(2) to clarify that a single integrated grounding system is preferable for the grounding of the LPS, power, communications, or other grounding systems in the structure.

Response Message: FR-100-NFPA 780-2020

Public Input No. 218-NFPA 780-2020 [New Section after A.4.13.1.1]

First Revision No. 104-NFPA 780-2020 [Section No. 4.13.1.6]

4.12.1.6*

In corrosive environments, the use of stainless-steel alloy grounding electrodes shall be permitted.

A.4.12.1.6

Consideration of the corrosive environment is necessary ~~in~~ for the selection of ~~an~~ the appropriate stainless-steel alloy ~~as a~~ material for the grounding electrode . Research has been presented that warns that stainless steel is very susceptible to corrosion in many soil conditions. Extreme caution should be used ~~with~~ and proper soil analysis should be performed where this type of rod is used. which contains detailed information on the grounding of electrical systems.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 13:23:53 EST 2020

Committee Statement

Committee Statement: Existing A.4.13.1.6 was modified to clarify stainless steel is the material for the grounding electrode. The text in A.4.13.2 is applicable specifically to 4.13.1.6 regarding installations in soils that could be corrosive to stainless steel so it is moved into A.4.13.1.6.

Response Message: FR-104-NFPA 780-2020

Public Input No. 188-NFPA 780-2020 [Section No. A.4.13.1.6]

Public Input No. 220-NFPA 780-2020 [Section No. A.4.13.1.6]

Public Input No. 221-NFPA 780-2020 [Section No. A.4.13.1.6]

First Revision No. 102-NFPA 780-2020 [Section No. 4.13.2.1]

4.12.2.1*

Ground rods shall be not less than ½ in. (12.7 mm) in diameter and 8 ft (2.4 m) long.

A.4.12.2.1

IEEE 142, *Recommended Practice for Grounding of Industrial and Commercial Power Systems* , states that the effect of the ground rod diameter on the resistance of the connection to earth is small and that ground rod diameter is more a function of mechanical strength and rigidity. Driving a ½ in. (12.7 mm) diameter 8 ft (2.4 m) ground rod into sandy soil is easily accomplished. However, driving the same 8 ft (2.4 m) ground rod into rocky soil or 80 ft (24 m) ground rod into sandy soil could require the mechanical strength of a ¾ in. (19 mm) diameter ground rod. The designer should select a ground rod diameter based on sound engineering practices and the success of the selected diameter in previous installations.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 13:08:54 EST 2020

Committee Statement

Committee Statement: The annex material provides guidance on ground rod diameter sizes with respect to soil types.

Response Message: FR-102-NFPA 780-2020 The PI's proposed solution as written addressed an issue in only one soil type and added unnecessary expense to some projects. Creating annex material that addressed the submitters concerns was a better solution and also addressed various soil types.

Public Input No. 16-NFPA 780-2020 [Section No. 4.13.2.1]

First Revision No. 106-NFPA 780-2020 [Section No. 4.13.2.5]

4.12.2.2

Ground rods shall be copper-clad steel, solid copper, or stainless steel.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 13:34:21 EST 2020

Committee Statement

Committee Statement: Existing 4.13.2.5 is relocated to 4.13.2.2 as it provides material requirements of ground rods and belongs in 4.13.2.

Response Message: FR-106-NFPA 780-2020

Public Input No. 8-NFPA 780-2020 [Section No. 4.13.2.5]

First Revision No. 108-NFPA 780-2020 [Section No. 4.13.3.2]

4.12.3.2*

The concrete- encased electrode shall consist of one of the following:

(1) Not less than 20 ft (6 m) of bare copper main-size conductor

(2) At least 20 ft (6 m) of one or more bare or electrically conductive coated steel reinforcing bars or rods not less than ½ in. (12.7 mm) in diameter that have been effectively bonded together by welding, structural mechanical coupling, or overlapping 20 diameters and wire tying

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 13:39:34 EST 2020

Committee Statement

Committee Statement: Additional text is provided to be consistent in terminology and clarify that plastic coated, fiberglass, or other non-conductive reinforcing bars may not be used in concrete-encased electrodes.

Response Message: FR-108-NFPA 780-2020

Public Input No. 9-NFPA 780-2020 [Section No. 4.13.3.2]

First Revision No. 109-NFPA 780-2020 [Section No. 4.13.4.1]

4.12.4.1*

The ground ring electrode shall be in direct contact with earth at a depth of not less than 18 in. (450 mm) or encased in a concrete footing in accordance with 4.12.3.

A.4.12.4.1

Soil and climate conditions could, due to a lack of moisture or reduction of surface area contact, create high resistance between the local earth and grounding electrode(s), as well as the associated conductor(s). Where such conditions exist, additional measures should be considered to reduce the resistance of the lightning protection system to remote earth. Some examples are using ground enhancing materials or, where practicable, embedding the ground ring and grounding electrodes below the permanent moisture level of earth at the site.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 13:54:51 EST 2020

Committee Statement

Committee Statement: Annex material is added to offer guidance on additional measures that should be considered to reduce the resistance of the lightning protection system in environments where soil moisture levels are likely to drop well below the 18 inch minimum burial depth during drought conditions.

Response Message: FR-109-NFPA 780-2020

Public Input No. 17-NFPA 780-2020 [Section No. 4.13.4.1]

First Revision No. 110-NFPA 780-2020 [Section No. 4.13.5.3]

4.12.5.3*

The radial electrode shall be buried not less than 18 in. (450 mm) below grade.

A.4.12.5.3

Soil and climate conditions could, due to a lack of moisture or reduction of surface area contact, create high resistance between the local earth and radial electrode(s), as well as the associated conductor(s). Where such conditions exist, additional measures should be considered to reduce the resistance of the lightning protection system to remote earth. Some examples are using ground enhancing materials or, where practicable, embedding the radial electrode(s) below the permanent moisture level of earth at the site.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 13:57:15 EST 2020

Committee Statement

Committee Statement: Annex material is added to offer guidance on additional measures that should be considered to reduce the resistance of the lightning protection system in environments where soil moisture levels are likely to drop well below the 18 inch minimum burial depth during drought conditions.

Response Message: FR-110-NFPA 780-2020

Public Input No. 18-NFPA 780-2020 [Section No. 4.13.5.3]

First Revision No. 122-NFPA 780-2020 [Section No. 4.13.6]

4.12.6 Plate Electrode or Ground Plate Electrode.

4.12.6.1*

A ground plate or plate electrode shall have a minimum thickness of 0.032 in. (0.8 mm) and a minimum surface area of 2 ft^2 (0.18 m^2).

A.4.12.6.1

The 2 ft^2 (0.18 m^2) surface area requirement can be ~~accomplished by~~ met using a 1 ft^2 (0.09 m^2) plate with both sides in contact with the earth.

4.12.6.2*

The ground plate electrode shall be buried not less than 18 in. (450 mm) below grade.

A.4.12.6.2

Soil and climate conditions could, due to a lack of moisture or reduction of surface area contact, create high resistance between the local earth and ground plate electrode(s), as well as the associated conductor(s). Where such conditions exist, additional measures should be considered to reduce the resistance of the lightning protection system to remote earth. Some examples are using ground enhancing materials or, where practicable, embedding the ground plate electrode(s) below the permanent moisture level of earth at the site.

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Wed Nov 25 11:51:58 EST 2020

Committee Statement

Committee Statement: The annex material currently linked to 4.13.6 is specifically linked to 4.13.6.1, not the entire 4.13.6. The asterisk is moved from 4.13.6 to 4.13.6.1 and the annex text moved from A.4.13.6 and added as new A.4.13.6.1.

Annex material is added to 4.13.6.2 to offer guidance on additional measures that should be considered to reduce the resistance of the lightning protection system in environments where soil moisture levels are likely to drop well below the 18 inch minimum burial depth during drought conditions.

Response Message: FR-122-NFPA 780-2020

Public Input No. 30-NFPA 780-2020 [Section No. 4.13.6]

Public Input No. 19-NFPA 780-2020 [Section No. 4.13.6.2]

Public Input No. 31-NFPA 780-2020 [Section No. A.4.13.6]

First Revision No. 119-NFPA 780-2020 [Sections 4.13.8.1.3, 4.13.8.1.4]

4.12.8.1.3 Bedrock.

~~Where a method of 4.12.8.1.2 is impossible, radial(s) shall be permitted to be laid directly on bedrock a minimum distance of 12 ft (3.6 m) from the foundation or exterior footing. A ground ring electrode encircling the structure shall be permitted to be laid directly on bedrock a minimum distance of 24 in. (600 mm) from the foundation or exterior footing.~~

4.12.8.1.3.1

Where ~~a~~ use of the method ~~of~~ s in 4.12.8.1.2 is ~~impossible~~ not possible , radial(s) shall be permitted to be laid directly on bedrock a minimum distance of 12 ft (3.6 m) from the foundation or exterior footing.

4.12.8.1.3.2

A ground ring electrode encircling the structure shall be permitted to be laid directly on bedrock a minimum distance of 24 in. (600 mm) from the foundation or exterior footing.

4.12.8.1.3.3

In those cases where the grounding conductor is laid directly on bedrock, the conductor shall be secured to the bedrock every 3 ft (1 m) ~~by nailing~~ with nails , conductive cement, or a conductive adhesive to ensure electrical contact and protect against movement.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 15:54:54 EST 2020

Committee Statement

Committee Statement:	The revision eliminates the 2 requirements in same section and clarifies the grounding conductor in 4.13.8.1.3.3 is that conductor used as the radial or ground ring electrode.
Response Message:	FR-119-NFPA 780-2020

First Revision No. 120-NFPA 780-2020 [Section No. 4.13.8.2]

4.12.8.2 Sandy Soil Conditions.

~~Because sandy or gravelly soil conditions are characterized by high soil resistivity, multiple~~ Multiple grounding electrodes shall be used to augment the lightning grounding electrode system in installations characterized by high soil resistivity, such as in sandy or gravelly soil conditions .

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Tue Nov 24 15:56:35 EST 2020

Committee Statement

Committee Statement: The requirement is reworded to eliminate the narrative and clarify that more than one electrode is required.
Response Message: FR-120-NFPA 780-2020

First Revision No. 121-NFPA 780-2020 [Section No. 4.14.4]

4.13.4 Underground Metallic Piping Systems.

~~Interconnection of underground metallic piping systems shall include, but not be limited to, water service, well casings located within 25 ft (7.6 m) of the structure, gas piping, underground conduits, and underground liquefied petroleum gas piping systems. 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 the required electrical continuity is ensured.~~

4.13.4.1

~~Interconnection of underground~~ Underground metallic piping systems requiring interconnection to the lightning protection system shall include, but not be limited to, the following: ~~water service, well casings located within 25 ft (7.6 m) of the structure, gas piping, underground conduits, and underground liquefied petroleum gas piping systems.~~

(1) ~~water~~ Water service

(2) ~~well~~ Well casings located within 25 ft (7.6 m) of the ~~structure~~ lightning protection grounding system

(3) ~~gas~~ Gas piping

(4) ~~underground~~ Underground conduits

(5) ~~underground~~ Underground liquefied petroleum gas piping systems

4.13.4.2

If ~~the~~ a water pipe is not electrically continuous due to the use of ~~plastic~~ nonconductive pipe sections or for any other reason~~s~~ , the nonconductive sections shall be bridged with main-size conductors or the connection shall be made at a point where the required electrical continuity ~~is~~ can be ensured.

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Tue Nov 24 16:06:23 EST 2020

Committee Statement

Committee Statement: The revision eliminates the multiple requirements in 4.14.4. Item (2) was revised to indicate that the spacing is to the lightning protection system.

Response Message: FR-121-NFPA 780-2020

First Revision No. 116-NFPA 780-2020 [Section No. 4.16.3.2]

4.15.3.2

Horizontal grounded metal bodies that are parallel to a main lightning conductor and ~~that are~~ within the bonding distance calculated in ~~4.15.2.4~~ 4.15.2.5 or ~~4.15.2.5~~ 4.15.2.6 shall be bonded to the main conductor at intervals averaging not more than 100 ft (30 m) along the main conductor unless inherently bonded through construction at those locations.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 15:30:24 EST 2020

Committee Statement

Committee Statement: The existing text is revised for editorially.

Response Message: FR-116-NFPA 780-2020

Public Input No. 10-NFPA 780-2020 [Section No. 4.16.3.2]

First Revision No. 117-NFPA 780-2020 [Section No. 4.16.5]

4.15.5 Materials.

~~Conductors used for the bonding of grounded or ungrounded metal bodies requiring connection to the lightning protection system shall be sized in accordance with bonding conductor requirements in Table 4.1.1.1.1 and Table 4.1.1.1.2 .~~

4.15.5.1

Conductors used for the bonding of grounded or ungrounded metal bodies requiring connection to the lightning protection system shall be sized in accordance with the bonding conductor requirements in Table 4.1.1.1.1 and Table 4.1.1.1.2.

4.15.5.2

Connectors for equipotential bonding shall have a minimum surface contact area of 0.021 in^2 (0.133 cm^2) for copper and 0.032 in^2 (0.208 cm^2) for aluminum.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 15:35:52 EST 2020

Committee Statement

Committee Statement: A new section includes dimensions for bonding connections. The dimensions mirror those in UL 96, Lightning Protection Components.

Response Message: FR-117-NFPA 780-2020

Public Input No. 206-NFPA 780-2020 [Section No. 4.16.5]

First Revision No. 8-NFPA 780-2020 [Section No. 4.20.1]

4.19.1* General.

~~The requirements for surge protection systems installed for the electrical, communications (including, but not limited to, CATV, alarm, and data), or antenna systems or for other electrical system hardware shall apply only to permanently installed surge protection devices (SPDs).~~ Surge protection shall comply with the following:

(1) Type 1 or Type 2 listed surge-protective devices (SPDs) permanently installed on premises wiring systems operating at 1,000 volts or less in accordance with 4.19.2

(2) Surge arresters permanently installed on circuits, equipment, or systems operating over 1,000 V in accordance with 4.19.3

(3) Listed surge protectors permanently installed for signal, data, and communication systems in accordance with 4.19.4

A.4.19.1

Surge protection alone is not intended to prevent or limit physical damage ~~from~~ caused by a direct lightning strike to a facility or structure. Rather, it is intended to defend against the indirect lightning effects imposed upon the electrical services ~~to~~ of a structure as part of a coordinated lightning protection system installed in accordance with the requirements of this standard.

Surge currents and their corresponding overvoltage transients can be coupled onto electrical utility feeders in a number of ways. These mechanisms include the magnetic or capacitive coupling of a nearby strike or the more dramatic, but much less ~~frequent~~ frequently used, conductive coupling of a direct cloud-to-ground discharge. These overvoltage transients pose a significant threat to modern electrical and electronic equipment.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 10 13:31:21 EST 2020

Committee Statement

Committee Statement: This first revision re-formats 4.20.1 into three parts to address surge-protective devices, surge arresters, and surge protectors. This new formatting and the additional criteria for surge-protective devices, surge arresters, and surge protectors enhances the rules for surge protection and more closely aligns the NFPA 780 with the NEC (NFPA 70), IEEE C62 Standards, and applicable UL product certification standards.

Response Message: FR-8-NFPA 780-2020

Public Input No. 61-NFPA 780-2020 [Section No. 4.20.1]

Public Input No. 20-NFPA 780-2020 [Section No. 4.20.1]

First Revision No. 10-NFPA 780-2020 [New Section after 4.20.2]

4.19.3* Surge Arrester Requirements.

A.4.19.3

For further information on surge arresters, see IEEE C62.11-2012, *Standard for Metal-Oxide Surge Arresters for Alternating-Current Power Circuits (>1 kV)* , and IEEE C62.22-2009, *Guide for the Application of Metal-Oxide Surge Arresters for Alternating-Current Systems* .

4.19.3.1

Surge arresters shall be installed in accordance with 4.19.2.1 and 4.19.2.2 when a building, structure, or equipment operates over 1,000 V.

4.19.3.2*

The duty cycle rating of a surge arrester shall be not less than 125 percent of the maximum system voltage available at the point of application.

A.4.19.3.2

The selection of a properly rated metal arrester should be based on the maximum continuous operating voltage and the magnitude and duration of overvoltage at the arrester location as affected by phase-to-ground faults, system grounding techniques, switching surges, and other causes. A surge arrester should never be installed where the rating of the surge arrester is equal to or less than the maximum continuous phase-to-ground voltage at the power frequency available at the point of application. See the manufacturer's application rules to select the specific arrester for a particular location.

4.19.3.3

Surge arresters shall be permitted to be located indoors or outdoors.

4.19.3.4

Surge arresters shall be made inaccessible to unqualified persons unless the surge arresters are listed for installation in accessible locations.

4.19.3.5

Where used at a point on a circuit, a surge arrester shall be connected to each ungrounded conductor.

4.19.3.5.1

A single installation of surge arresters shall be permitted to protect a number of interconnected circuits if no circuit is exposed to surges while disconnected from the surge arresters.

4.19.3.6

The conductor used to connect a surge arrester to a line, bus, or equipment and to an equipment grounding conductor or grounding electrode connection point shall not be any longer than necessary and shall have no unnecessary bends.

4.19.3.7

The conductor between the surge arrester and the line and the surge arrester and the grounding connection shall be not smaller than 6 AWG copper or aluminum, or it shall utilize a conductive material that has a capacity and withstand rating equivalent to at least a 6 AWG conductor.

4.19.3.8

A surge arrester protecting a transformer that supplies a secondary distribution system shall be interconnected in accordance with Part III of Article 242 of *NFPA 70* *(NEC)* .

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 10 13:58:24 EST 2020

Committee Statement

Committee Statement: This first revision provides the prescriptive and performance criteria for the installation of surge arresters for circuits, equipment, or systems operating over 1,000 volts.

Annex material is provided for Section 4.20.3 to refer the reader to the applicable IEEE Standards related to surge arresters.

4.20.3.1 points the reader back to 4.20.2.1. and 4.20.2.2 to identify the locations where surge arresters must be installed so that it doesn't have to be repeated in 4.20.3.

4.20.3.2 provides criteria for MCOV ratings and is derived from Part III. of Article 242 in the 2020 NEC. Annex material is provided with this rule to provide additional guidance.

4.20.3.3 and 4.20.3.4 provide additional location requirements and is aligned with 242.46 of the 2020 NEC.

4.20.3.5 provides details on the number of surge arresters required and is aligned with 242.44 of the 2020 NEC.

4.20.3.6 provides details for the routing of conductors and is aligned with 242.48 of the 2020 NEC.

4.20.3.7 provides additional details on surge arrester conductors and is aligned with 242.52 of the 2020 NEC.

4.20.3.8 provides details for surge arrester interconnection

Response Message: FR-10-NFPA 780-2020

Public Input No. 87-NFPA 780-2020 [New Section after 4.20.3]

First Revision No. 29-NFPA 780-2020 [Section No. 6.3.3.1]

6.3.3.1

~~They~~ Strike termination devices shall be at least ⅝ in. (15 mm) in diameter, exclusive of the corrosion protection.

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Mon Nov 16 14:04:25 EST 2020

Committee Statement

Committee Statement: The pronoun was changed to noun for clarity.
Response Message: FR-29-NFPA 780-2020

First Revision No. 30-NFPA 780-2020 [Section No. 6.3.5.2]

6.3.5.2

The hood ~~serves~~ shall be permitted to serve as a top loop conductor ~~and shall be~~ when connected to each down conductor using a connection plate with an area of not less than 8 in.^{2} (5200 mm^2) bolted or welded to the hood.

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Mon Nov 16 14:22:17 EST 2020

Committee Statement

Committee Statement: The revision confirms that the hood is permitted to serve as a top loop conductor.
Response Message: FR-30-NFPA 780-2020

First Revision No. 12-NFPA 780-2020 [Section No. 7.1.1]

7.1.1*

This chapter shall apply to the protection of structures containing flammable vapors, flammable gases, or liquids that give off flammable vapors.

A.7.1.1

This chapter applies to structures that might contain a hazardous (classified) location.

Sections 7.1 and 7.2 provide administrative information and a discussion on the general principles of the protection of structures containing flammable vapors, flammable gases, or liquids that give off flammable vapors. These are only general principles. Specific requirements for specific applications can be found in the sections that follow.

Section 7.3 provides general protective measures and baseline requirements. These requirements apply to all structures except where specified otherwise for specific structures. It covers all the aspects of protection, but all the requirements might not apply to every structure.

Section 7.4 contains requirements for specific classes of structures. Subsection 7.4.1 provides the requirements for operating facilities and other non-storage applications.

Section 7.5 applies to storage tanks under pressure and Section 7.6 addresses aboveground tanks at atmospheric pressure. Section 7.7 addresses earthen containers at atmospheric pressure.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 10 15:07:53 EST 2020

Committee Statement

Committee Statement: The purpose of the annex text is to explain the layout of the requirements in the chapter and reduce confusion as to the applicability of the various sections in the chapter.

Response Message: FR-12-NFPA 780-2020

Public Input No. 216-NFPA 780-2020 [New Section after A.7.1]

Public Input No. 78-NFPA 780-2020 [New Section after A.7.1]

First Revision No. 13-NFPA 780-2020 [Section No. 7.2.1.1]

7.2.1.1

A primary means to reduce the ignition of flammable vapors shall be to minimize the presence of those vapors in locations that are vulnerable to a source of ignition, such as heating, arcing, or corona discharge caused by one or more of the following:

(1) ~~A direct~~ Direct strike

(2) Upward streamer

(3) Lightning electromagnetic pulse (LEMP)

(4) Secondary arcing

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 10 15:15:15 EST 2020

Committee Statement

Committee Statement: Energy in unsuccessful upward streamers should be considered as a potential ignition source.

Response Message: FR-13-NFPA 780-2020

Public Input No. 202-NFPA 780-2020 [Section No. 7.2.1.1]

First Revision No. 14-NFPA 780-2020 [Section No. 7.2.1.2]

7.2.1.2*

Flammable air-vapor mixtures shall be prevented, to the greatest extent possible, from accumulating in areas where a source of ignition is likely to be present.

A.7.2.1.2

Systems should be designed to control the air-to-vapor ratio and maintain that ratio at a level that is not flammable to mitigate ignition.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 10 15:18:27 EST 2020

Committee Statement

Committee Statement: The new text encourages the alternate approaches to prevented damage to structures containing flammable vapors by maintain those vapors outside of the flammable range.

Response Message: FR-14-NFPA 780-2020

Public Input No. 211-NFPA 780-2020 [Section No. 7.2.1.1]

Public Input No. 212-NFPA 780-2020 [New Section after A.7.2.1]

First Revision No. 20-NFPA 780-2020 [Section No. 7.2.2]

7.2.2* Inherent Protection.

Metallic structures that are electrically continuous; tightly sealed to prevent the escape of liquids, vapors, or gases; and of 3⁄16 in. (4.8 mm) thickness or greater to withstand direct strikes shall be considered ~~to be~~ inherently ~~self-protecting~~ self-protected .

A.7.2.2

A structure is considered inherently self-protected from the effects of lightning if, by construction and perhaps intended design, components of the installation are sufficient to protect against direct strikes, strikes near a structure, strikes to an incoming line, and strikes near an incoming line. In such cases, additional lightning protection is not required.

In practice, such structures are uncommon due to the presence of structural vulnerabilities that undermine the inherent self-protection. These structural vulnerabilities include, but are not limited to, the following:

(1) Vents that compromise the seal

(2) Valves or other appurtenances that provide a location for secondary arcing *(see 7.5.2)*

(3) A floating roof that is not sufficiently bonded to the tank shell

(4) Primary and secondary seals that do not completely prevent the escape of flammable vapors

(5) Any electronic equipment that requires SPDs

(6) Any structure that permits the accumulation of flammable vapors

For structures containing flammable gases or vapors, protection should also include procedures to prevent the accumulation of gases or vapors that would require classification of the location where direct strikes or arcing is likely to occur.

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Mon Nov 16 12:17:43 EST 2020

Committee Statement

Committee Statement: Annex material is included to clarify the intent of 7.2.2.
Response Message: FR-20-NFPA 780-2020

Public Input No. 160-NFPA 780-2020 [Section No. 7.2.2]

First Revision No. 19-NFPA 780-2020 [Section No. 7.3.6]

7.3.6 Surge Protection.

7.3.6.1

Surge protection shall be provided for equipment and services in accordance with the requirements of Section 4.19 and *NFPA 70*.

7.3.6.2

Surge protective devices shall be ~~positioned~~ installed outside ~~a~~ hazardous ~~area~~ (classified) locations where practicable.

7.3.6.3*

Surge ~~protective devices positioned~~ protection installed inside a hazardous ~~area~~ (classified) location shall be ~~approved for the hazardous area in which they are installed~~ within enclosures identified for the Class and Division of the specific location .

A.7.3.6.3

Additional guidance on the installation of surge protection in hazardous (classified) locations can be found in Sections 501.35 and 502.35 of *NFPA 70* *(NEC)* .

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Thu Nov 12 16:38:37 EST 2020

Committee Statement

Committee Statement: This first revision makes editorial changes to clarify the rules for surge protection installations in hazardous (classified) locations. New annex material gives the reader a pointer to the applicable sections of the NFPA 70 related to surge protection in hazardous (classified) areas.

Response Message: FR-19-NFPA 780-2020 The term surge protection adequately describes the protection covered in Section 4.20. The term “overvoltage” does not adequately address the risk exposure presented to a premises wiring system from lightning.

Public Input No. 95-NFPA 780-2020 [Section No. 7.3.6]

First Revision No. 31-NFPA 780-2020 [Section No. 7.3.7.1]

7.3.7.1

Except as specified in 7.3.7.2 and 7.3.7.3, a ground ring electrode or ground loop conductor supplemented by one or more grounding electrodes, as identified in 4.12.2 through 4.12.7, shall be provided for structures containing flammable vapors, flammable gases, or liquids that can give off flammable vapors.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 14:28:54 EST 2020

Committee Statement

Committee Statement: The revision clarifies the number of electrodes to qualify as supplemental.

Response Message: FR-31-NFPA 780-2020

First Revision No. 21-NFPA 780-2020 [New Section after 7.4]

7.8* Tank Batteries.

A.7.8

The requirements of this section are not applicable to nonmetallic tanks. Considerations for nonmetallic tanks are discussed in Annex N and are not within the scope of Chapter 7 .

7.8.1

Protection of tank batteries shall include the protection of associated equipment.

7.8.2

Strike termination methods shall be provided in accordance with 7.3.3 and 7.6.3.2 .

7.8.3*

Site appurtenances — such as flare stacks, separators, and heater treaters — outside of a zone of protection shall be protected.

A.7.8.3

Consideration should be given to interconnecting the grounding electrode for the site appurtenance discussed in 7.8.3 to the battery grounding system, depending on proximity.

7.8.4

A grounding system interconnecting all the components and ground within the tank battery shall be provided for ground-level potential equalization of all the grounding systems and underground piping within the battery.

7.8.5*

In locations where direct strikes or arcing is likely to occur, engineering methods shall be used to minimize the accumulation of flammable vapors in areas where a source of ignition is likely to be present.

A.7.8.5

A method of venting in locations where arcing is likely to occur is to install a vapor recovery system or, at a minimum, a horizontal vent line that terminates at least 50 ft (15.2 m) from the tank battery.

All vents, flame arrestors, and thief hatches should be maintained in operating condition. All thief hatches should be closed during normal tank operations.

7.8.6

Surge protection shall comply with 7.3.6 .

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 12:36:02 EST 2020

Committee Statement

Committee Statement: The new section and annex material address the additional application addressing the interconnection of systems into a complete integrated lightning protection system for a tank battery.

Response Message: FR-21-NFPA 780-2020

Public Input No. 130-NFPA 780-2020 [New Section after 7.2.1]

First Revision No. 15-NFPA 780-2020 [Sections 7.4.1.1, 7.4.1.2]

7.4.1*

Structures containing hazardous (classified) locations used ~~in~~ for non-storage applications shall comply with the requirements of Section 7.3 unless justified by a lightning risk assessment.

A.7.4.1

For structures in which ~~the~~ a hazardous (classified) location exists in only one part of the structure, ~~it shall be permitted for~~ a risk assessment might ~~to~~ utilize the lightning protection zone (LPZ) concept in accordance with IEC 62305-2, *Protection Against Lightning — Part 2: Risk Management*.

The lightning risk assessment provided in Annex L does not currently incorporate the concept of defining multiple ~~lightning protection zones (LPZs)~~ LPZs in a structure, but the methodology for the assessment is given below .

An LPZ is characterized by a common set of lightning risk components and not necessarily by walls or other physical barriers. LPZs are generally used to address risks related to a specific area(s) in or around a structure. They are associated with specific characteristics of susceptibility to lightning-related threats. A structure might be characterized as a single zone or it could be divided into multiple risk zones, where each risk zone is defined by a common set of relevant risk components.

The advantage of using the LPZ concept can be seen where only a portion of a larger structure needs to meet the requirements of Chapter 7 and the cost of protecting the structure as a single zone would be greater than mitigating the risk in that zone. Dividing the structure into lightning protection zones enables each zone to be assessed individually to determine whether measures could be taken within that zone to reduce risk to a tolerable level and not require the measures to be implemented throughout the structure.

In such cases, the characteristics of each zone in the structure must be evaluated, taking into account each risk component relevant to that zone. This enables the most suitable protection measures to be applied to each risk zone, tailoring the protection against lightning for specific applications.

~~**7.4.2** Operating Facilities (Nonstorage Applications).~~

~~**7.4.2.1**~~

~~For structures in which the hazardous (classified) location exists in only one part of the structure, it shall be permitted for a risk assessment to utilize the lightning protection zone (LPZ) concept in accordance with IEC 62305-2, *Protection Against Lightning — Part 2: Risk Management* .~~

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 10 15:41:31 EST 2020

Committee Statement

Committee Statement: New A.7.4.1 incorporates previous 7.4.1.2 and A.7.4.1.2 with explanatory text developed by the committee to provide guidance on the use of lightning protection zones in assessing structures where a hazardous (classified) location exists in only a part of a structure..

Response Message: FR-15-NFPA 780-2020

Public Input No. 161-NFPA 780-2020 [Sections 7.4.1.1, 7.4.1.2]

First Revision No. 24-NFPA 780-2020 [New Section after 8.1.4]

8.1.4

Lightning protection shall be installed as specified in Chapter 4 , except as modified by this chapter.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 13:15:23 EST 2020

Committee Statement

Committee Statement:	Adding 8.1.5 clarifies that lightning protection requirements from Chapter 4 are applicable to all ordnance buildings not just earth covered magazine.
Response Message:	FR-24-NFPA 780-2020

Public Input No. 81-NFPA 780-2020 [New Section after 8.1.4]

First Revision No. 32-NFPA 780-2020 [Section No. 8.3.3.5]

8.3.3.5* Grounding of Masts.

A.8.3.3.5

A significant difference in the resistance to earth of grounding systems can result in a significant difference in current division from an attachment point on the lightning protection system. For lightning protection systems using mast or catenary systems consisting of three or more masts, the use of a ground ring electrode should be considered. The use of a buried grounding conductor interconnecting systems using two masts should also be considered if there is a significant difference between the value of resistance to earth for the two masts.

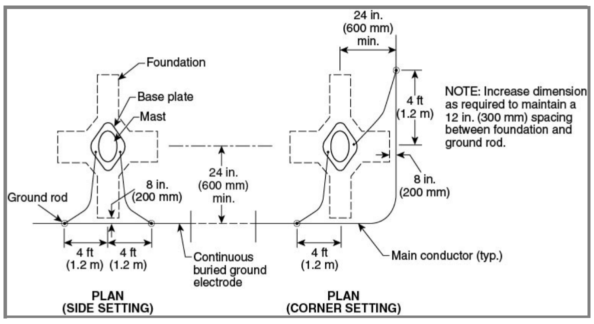
8.3.3.5.1

Grounding of masts shall comply with the requirements of Section 4.12.

8.3.3.5.2

Metallic masts shall be grounded as shown in Figure 8.3.3.5.2.

Figure 8.3.3.5.2 Connection of Metallic Masts to Ground Ring Electrode.



Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 14:31:46 EST 2020

Committee Statement

Committee Statement: Annex material added to increase the explanation of ground ring conductors and the improvements they make to the overall LPS,

Response Message: FR-32-NFPA 780-2020

Public Input No. 194-NFPA 780-2020 [Section No. 8.3.3.5]

Public Input No. 193-NFPA 780-2020 [New Section after A.8.3.5]

First Revision No. 33-NFPA 780-2020 [Section No. 8.3.5]

8.3.5* Integral Lightning Protection Systems.

Strike termination devices directly attached to the structure shall be installed as specified in Chapter 4, except as modified to meet the zone of protection requirements ~~for a~~ using a striking distance of 100 ft (30 m) ~~striking distance~~ as specified in 8.2.1 .

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 14:34:41 EST 2020

Committee Statement

Committee Statement: Editorial change to clarify the intent of using the correct striking distance.

Response Message: FR-33-NFPA 780-2020

Public Input No. 195-NFPA 780-2020 [Section No. 8.3.5]

First Revision No. 25-NFPA 780-2020 [Sections 8.4.2, 8.4.3, 8.4.4, 8.4.5]

8.4.2* ~~Concrete-Encased~~ Grounding Electrodes.

~~Concrete-encased electrodes shall comply with 4.13.3 .~~

A.8.4.2

Section 4.12.2.5 allows for the use of copper-clad steel and stainless-steel ground rods; however, AHJs should understand that installation of these rods in some conditions and locations can greatly affect their serviceability over the expected lifecycle of the lightning protection system. Soil conditions with rocky or larger gravel concentrations can abrade copper cladding, exposing the steel core to corrosive elements that can greatly diminish the performance and effectiveness of the electrode over time. Acidic and corrosive soil conditions can adversely affect the lifespan of stainless-steel grounding electrodes.

8.4.2.1

Grounding electrodes, as defined in Section 4.12 , that are used in lightning protection systems in explosives facilities shall be selected from the following:

(1) Ground ring electrodes

(2) Ground rods

(3) Radials

(4) Ground plate electrodes

(5) Concrete-encased electrodes

8.4.2.2

Ground ring electrodes shall be augmented with a minimum of two ground rods. ~~meeting the requirements of 4.13.2.4 .~~

8.4.2.3

~~The ground~~ Ground ring electrodes shall be installed no less than 3 ft (1 m) from the structure foundation or footing.

8.4.2.4*

Ground ring electrodes shall be bare copper conductors meeting or exceeding 105,000 circular mils.

A.8.4.2.4

A conductor with a cross-sectional area of 105,000 circular mils ensures that cables can remain serviceable over the lifecycle of the system.

8.4.2.5*

Concrete-encased electrodes shall be designed, installed, and verified as specified in 4.12.3 prior to being placed into service.

A.8.4.2.5

The effectiveness of concrete-encased electrodes can be drastically influenced by their design and implementation. It is recommended that AHJs fully understand the design characteristics that influence the effectiveness of concrete-encased electrodes as they pertain to their applicability in conducting lightning energies into the earth. The design requirements of 4.12.3.1 and 4.12.3.2(1) and 4.12.3.2(2) are particularly influential in the effectiveness of the concrete-encased electrode's ability to perform and function and to transfer lightning energies into the earth and should be confirmed.

~~**8.4.3** Ground Ring Electrodes.~~

~~Ground ring electrodes shall be bare conductors meeting or exceeding the requirements for Class II conductors.~~

~~**8.4.4** Radials.~~

~~Radials shall comply with the requirements of 4.13.5 .~~

~~**8.4.5** Ground Plate Electrodes.~~

~~Ground plate electrodes shall comply with 4.13.6 .~~

Supplemental Information

File Name	Description	Approved
FR_25_Attachement_for_8.4.2.docx	attachment for FR 25 Section 8.4.2 - for staff use	

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 13:26:37 EST 2020

Committee Statement

Committee Statement: Revision clarifies the requirements for grounding electrodes and supplements the grounding requirements in Section 4.13 specifically for an ordnance facility. A conductor with a cross sectional area of 105,000 cir mils ensures that the cable can remain serviceable over the lifecycle of the system's install.

Response Message: FR-25-NFPA 780-2020

Public Input No. 196-NFPA 780-2020 [Sections 8.4.2, 8.4.3, 8.4.4, 8.4.5]

First Revision No. 26-NFPA 780-2020 [Section No. 8.6 [Excluding any Sub-Sections]]

Surge protection as described in Section 4.19 shall be required for all power, ~~communications~~ signal, data , and ~~data~~ communications conductors and cables entering or exiting a structure housing explosives.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 13:39:02 EST 2020

Committee Statement

Committee Statement: This First Revision aligns the terms used in Section 8.6 with Section 4.20 and adds cables in addition to conductors to be inclusive of all wiring methods utilized for signal, data, and communication circuits.

Response Message: FR-26-NFPA 780-2020

Public Input No. 96-NFPA 780-2020 [Section No. 8.6]

First Revision No. 27-NFPA 780-2020 [Section No. 8.7.1.1]

8.7.1.1*

Strike termination devices shall be placed to ~~cover~~ protect the headwall, any ventilator, or other metal bodies as required ~~to provide protection~~ in ~~accordance with~~ Sections 8.2 and 8.3.

A.8.7.1.1

The AHJ should determine the necessity of the placement of strike termination devices other than headwalls, ventilators, or other metal bodies. When an earth-covered magazine can provide metallic (Faraday-Like) cage protection, as defined in 8.3.2 , non-metal bodies that do not penetrate the structure can be omitted from consideration for strike termination protection.

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Mon Nov 16 13:41:15 EST 2020

Committee Statement

Committee Statement: This revision clarifies whether strike termination devices are required to be placed on headwalls, ventilators, or other metal bodies.

Annex material was added for clarification of required strike termination protection.

Response Message: FR-27-NFPA 780-2020

Public Input No. 198-NFPA 780-2020 [Section No. 8.7.1.1]

First Revision No. 28-NFPA 780-2020 [Section No. 8.10.6.3]

8.10.6.3*

~~SPDs~~ Surge protection installed in accordance with Section 4.19 shall be inspected ~~in accordance with the manufacturer's instructions~~ at intervals not exceeding 7 months, ~~or~~ when visual inspection is performed, and after any suspected lightning strike.

A.8.10.6.3

The manufacturer's installation instructions or product markings might provide additional criteria or guidance on how and when to inspect, test, and maintain equipment providing surge protection.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 14:00:28 EST 2020

Committee Statement

Committee Statement: This First Revision clarifies that all methods of surge protection will need to be inspected, tested, and maintained at the intervals defined in the section. Information related to the manufacturer's installation instructions or product markings has been moved to annex material from the main rule to remove a potential loophole in the requirement where inspection details are not provided by the manufacturer.

Response Message: FR-28-NFPA 780-2020

Public Input No. 97-NFPA 780-2020 [Section No. 8.10.6.3]

First Revision No. 48-NFPA 780-2020 [Section No. 9.2.5]

9.2.5*

The cover for the hub~~, referred to as the spinner,~~ shall be protected with a strike termination device as required ~~in~~ by Section 4.5.

A.9.2.5

A hub is also referred to as a spinner.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 17 12:23:36 EST 2020

Committee Statement

Committee Statement: The information is beneficial and relocated to the narrative portion of the annex.

Response Message: FR-48-NFPA 780-2020

First Revision No. 34-NFPA 780-2020 [Section No. 9.3.1]

9.3.1

Because the nacelle, hub, tower, and base structure sections of the wind turbine typically house electrical and mechanical control systems, consideration shall be given to the protection of these systems with bonding, shielding, and surge protection in accordance with the following:

(1) Separation distance and bonding techniques maintained in accordance with Sections 4.14 and 4.15

(2) Maximized distance between lightning conductors and electrical system components and electrical system cabling located on or near a ground plane

(3) Electrical system cabling magnetically shielded by either braided wire sheath or wire mesh screen or bonding of metallic conduit, cable trays, or raceways

(4) Electrical equipment that is exposed to lightning electromagnetic impulse (LEMP) located within metal enclosures

(5) Large loop areas within electrical cabling avoided

(6) ~~SPDs~~ Surge protection installed as close as practicable to the equipment to be protected

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 14:51:03 EST 2020

Committee Statement

Committee Statement: This First Revision changes “SPDs” to “surge protection” to be inclusive of all surge protection types recognized in Section 4.20.

Response Message: FR-34-NFPA 780-2020

Public Input No. 98-NFPA 780-2020 [Section No. 9.3.1]

First Revision No. 35-NFPA 780-2020 [Section No. 9.3.2]

9.3.2

~~SPDs~~ Surge protection shall be in accordance with Section 4.19.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 14:52:20 EST 2020

Committee Statement

Committee Statement: This First Revision changes “SPDs” to “surge protection” to be inclusive of all surge protection types recognized in Section 4.20.

Response Message: FR-35-NFPA 780-2020

Public Input No. 99-NFPA 780-2020 [Section No. 9.3.2]

First Revision No. 49-NFPA 780-2020 [Section No. 10.3.2.2]

10.3.2.2

The strike termination devices shall be mechanically strong to withstand the roll and pitching action of the hull, as well as heavy weather.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 17 12:27:44 EST 2020

Committee Statement

Committee Statement: The additional text is necessary to properly describe the “devices” referenced in 10.3.2.2.

Response Message: FR-49-NFPA 780-2020

First Revision No. 50-NFPA 780-2020 [Section No. 10.4.5.2.1]

10.4.5.2.1

~~Depending on the material, the contact minimum~~ The minimum contact area for a connection in a main conductor shall be given by 10.4.1.1 (for copper), 10.4.1.2 (for aluminum), or 10.4.1.3 (for other metals).

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 17 12:29:01 EST 2020

Committee Statement

Committee Statement: The wording was unnecessary and did not contribute to the intent of the section.

Response Message: FR-50-NFPA 780-2020

First Revision No. 37-NFPA 780-2020 [Section No. 10.5.5]

10.5.5* Galvanic Corrosion Protection.

A.10.5.5

~~An air~~ A spark gap or ~~SPD (such as a~~ gas discharge tube (GDT) might be desirable to reduce corrosion in the presence of leakage currents in the water and could reduce galvanic corrosion. However, using ~~an air~~ a spark gap to isolate an immersed conductor from the water can increase the risk of a ground fault current bypassing any ground fault protection device. Hence, a hazardous current can be inadvertently introduced into the water. For this reason, measures should be taken to ensure that loose electrical connections cannot contact any part of the isolated grounding electrode. A spark gap should not be used where there is the possibility of ignitible vapors or personal hazards.

10.5.5.1

~~An air~~ A spark gap or ~~SPD (such as a gas discharge tube~~ (GDT) shall be permitted to break the path of a main conductor within 8 in. (200 mm) of a grounding electrode.

10.5.5.2

The breakdown voltage of ~~an air~~ a spark gap or ~~SPD (such as a gas discharge tube~~ (GDT) shall be not less than 600 V and not greater than 15 kV.

10.5.5.3

With the exception of the gap itself, all components in and connections to ~~an air~~ a spark gap device shall have a cross-sectional area meeting the requirements for a main conductor.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 15:03:11 EST 2020

Committee Statement

Committee Statement: This first revision changes “air gap” to “spark gap” to more precisely describe the corrosion protection method as defined in 3.3.39 and to change “SPD” to “gas discharge tube (GDT)” to correctly identify the other protective method permitted in 10.5.5.

Response Message: FR-37-NFPA 780-2020

Public Input No. 100-NFPA 780-2020 [Section No. 10.5.5]

Public Input No. 108-NFPA 780-2020 [Section No. A.10.5.5]

First Revision No. 38-NFPA 780-2020 [Section No. 11.2.4]

11.2.4*

An airfield lighting lightning protection system shall be permitted to be omitted by the AHJ when the average lightning flash density is ~~two or fewer flashes~~ less than or equal to one flash per square kilometer per year.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 15:09:24 EST 2020

Committee Statement

Committee Statement: This change makes flash density requirements in 11.2.4 consistent with flash density in A.4.20.2.5(2).

Response Message: FR-38-NFPA 780-2020

Public Input No. 25-NFPA 780-2020 [Section No. 11.2.4]

First Revision No. 40-NFPA 780-2020 [Section No. 11.4.2.5]

11.4.2.5

Reinforcing steel, where used as part of the light base installation, shall be bonded to the metallic light base using a minimum 6 AWG bare solid copper conductor.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 15:17:57 EST 2020

Committee Statement

Committee Statement: 6 AWG bare solid copper conductor is the minimum size permitted. A.11.4.1.1 states the counterpoise size should be determined by the engineer of record (EOR) using sound engineering practices and recommends a 2 AWG conductor. Adding the word “minimum” permits the EOR to size the conductor in accordance with sound engineering practices.

Response Message: FR-40-NFPA 780-2020

Public Input No. 27-NFPA 780-2020 [Section No. 11.4.2.5]

First Revision No. 41-NFPA 780-2020 [Section No. 11.4.2.6.2.2]

11.4.2.6.2.2*

Each light base or mounting stake shall be provided with a grounding electrode in accordance with one of the following methods:

(1) Where a metallic light base is used, the grounding electrode shall be bonded to the metallic light base or mounting stake with a minimum 6 AWG bare, annealed, or soft drawn, solid copper conductor.

(2) Where a nonmetallic light base is used, the grounding electrode shall be bonded to the metallic light fixture or metallic base plate with a minimum 6 AWG bare, annealed, or soft drawn, solid copper conductor.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 15:20:07 EST 2020

Committee Statement

Committee Statement: 6 AWG bare solid copper conductor is the minimum size permitted. A.11.4.1.1 states the counterpoise size should be determined by the engineer of record (EOR) using sound engineering practices and recommends a 2 AWG conductor. Adding the word “minimum” permits the EOR to size the conductor in accordance with sound engineering practices.

Response Message: FR-41-NFPA 780-2020

Public Input No. 28-NFPA 780-2020 [Section No. 11.4.2.6.2.2]

First Revision No. 42-NFPA 780-2020 [Section No. 11.4.6]

11.4.6 Bonding Jumpers.

A minimum 6 AWG stranded copper green insulated bonding jumper shall be installed between the following items:

(1) In-pavement airfield lighting fixture and the metallic light base

(2) Elevated fixture base plate and metallic light base

(3) Surge arresters and metallic light base

11.4.6.1

A bonding jumper shall be installed between the metallic frame of the airfield lighting sign(s) or other system components not listed in 11.4.6 and its respective metallic light base.

11.4.6.2

Bonding jumper length shall permit direct removal and maintenance of the airfield lighting component without damage to or disconnection of the bonding jumper and not interfere with the intended operation of a frangible coupling.

11.4.6.3

Copper conductors and copper braids of equal current-carrying capacity shall be permitted as an alternative to the minimum 6 AWG bonding jumper as permitted by the AHJ.

11.4.6.4

Frangible couplings shall be conductive.

11.4.6.5*

All non-current-carrying electrically conductive materials having the potential to become energized by a lightning-induced surge shall be bonded together and bonded to the airfield lighting counterpoise system.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 15:26:20 EST 2020

Committee Statement

Committee Statement: 6 AWG bare solid copper conductor is the minimum size permitted. A.11.4.1.1 states the counterpoise size should be determined by the engineer of record (EOR) using sound engineering practices and recommends a 2 AWG conductor. Adding the word “minimum” permits the EOR to size the conductor in accordance with sound engineering practices.

Response Message: FR-42-NFPA 780-2020

First Revision No. 45-NFPA 780-2020 [Section No. 12.4]

12.4 Protection of Electrical and Mechanical Systems.

12.4.1

Where practicable, ~~the~~ electrical and/or electromechanical control systems shall be protected with bonding, shielding, increased separation distance, and surge protection in accordance with the following:

(1) Separation distance and bonding techniques maintained in accordance with Sections 4.14 and 4.15

(2) Maximized distance between lightning air terminals and conductors and the solar array, electrical control systems, and cabling

(3) ~~SPDs~~ Surge protective devices (SPDs) installed as close as practicable to the solar array and electrical systems (inverters) and to the solar tracking control systems

(4) The photovoltaic (PV) output circuit cabling electromagnetically shielded by either braided wire sheath or wire mesh screen or installed within electrically bonded metallic conduit, cable trays , or raceways

(5) Lightning conductors run separately and outside of the cable path of the PV output circuit

12.4.2 PV ~~Output Circuit~~ Surge Protection.

12.4.2.1

Surge protection shall be ~~provided on~~ installed for the ~~PV output circuit of the solar module from positive to ground and negative to ground, and at the combiner and recombiner box for multiple solar modules~~ protection of PV systems and PV system dc circuits .

12.4.2.1.1

PV ~~surge protective devices~~ SPDs shall have a nominal discharge current rating (I_n) of 20 kA 8/20 μs per mode.

12.4.2.1.2

PV ~~surge protective devices~~ SPDs shall be listed for use on PV systems and marked "DC", "DC PV," or "PV SPD."

12.4.2.1.3

If the system inverter is more than 100 ft (30 m) from the closest combiner or recombiner box, additional PV SPDs shall be required at the PV output circuit adjacent to the inverter.

12.4.2.1.4

PV SPDs provided on the PV output circuit shall have a nominal dc operating voltage or V_{pvdc} rating equal to or greater than the maximum photovoltaic system voltage of the circuit(s) as specified in Article 690 of *NFPA 70*.

12.4.2.1.5

The short-circuit current rating of the PV SPD shall be not ~~be coordinated with~~ less than the prospective fault ~~of~~ current of the PV output circuit(s).

12.4.2.1.6

The ~~VPR~~ voltage protection rating of each mode of the PV SPD shall be no greater than three times the circuit's maximum PV system voltage to which that mode is connected.

12.4.2.1.7

For two-port PV SPDs, the load current rating of the SPD shall be equal to~~,~~ or greater than~~,~~ that of the system's load current to the inverter.

12.4.2.1.8

The maximum rated ambient temperature of the PV SPD shall not be exceeded.

12.4.2.2 AC PV Protection.

12.4.2.2.1

SPDs shall be installed for the protection of electric power production and distribution network circuits and equipment supplied by an ac module system.

12.4.2.2.2

SPDs shall be listed and comply with Section 4.19 and Part II of Article 242 of *NFPA 70* .

12.4.2.2.3

The SPD shall be located at the PV system disconnect as specified in Article 690 of *NFPA 70* .

12.4.3 Inverter Output Surge Protection.

12.4.3.1

Surge protection in accordance with Section 4.19 shall be provided at the ac output of the inverter.

12.4.3.2

~~Surge protective devices~~ SPDs shall have a nominal discharge current rating (I_n) of 20 kA 8/20 μs per mode.

12.4.3.3

The short-circuit current rating of the SPD shall be not ~~be coordinated with~~ less than the prospective fault current of the inverter.

12.4.3.4

The ~~VPR~~ voltage protection rating of the SPD shall be no greater than those ~~given~~ in Table 4.19.2.7.

12.4.3.5

For distribution system voltages exceeding the values in Table 4.19.2.7, the ~~VPR~~ voltage protection rating shall be permitted to be three times the ac output voltage of the inverter.

12.4.3.6

The maximum rated ambient temperature of the SPD shall not be exceeded.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 15:36:27 EST 2020

Committee Statement

Committee This first revision reorganizes the surge protection requirements for solar PV systems to align with the terminology used

Statement:	in the NEC (NFPA 70) and to provide prescriptive and performance criteria for both DC and AC module systems.
Response Message:	FR-45-NFPA 780-2020

Public Input No. 83-NFPA 780-2020 [Section No. 12.4.2]

Public Input No. 170-NFPA 780-2020 [Section No. 12.4.2.3]

Public Input No. 104-NFPA 780-2020 [Section No. 12.4]

First Revision No. 1-NFPA 780-2020 [Section No. A.4.4.1]

A.4.4.1

The requirement to protect conductors from mechanical damage does not preclude the running of exposed wiring at roofing perimeters, on roof surfaces, or in other similar locations where incidental foot traffic or manual disturbance of the conductor is possible. This paragraph is not intended to require the concealment of all exposed lightning protection components in conduit or ~~similar~~ another type of physical protection .

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 09 13:37:49 EST 2020

Committee Statement

Committee Statement: This eliminates the vague word "similar".

Response Message: FR-1-NFPA 780-2020

Public Input No. 29-NFPA 780-2020 [Section No. A.4.4.1]

First Revision No. 105-NFPA 780-2020 [Section No. A.4.13.2]

~~**A.4.13.2**~~

~~Research has been presented that warns that stainless steel is very susceptible to corrosion in many soil conditions. Extreme caution should be used with proper soil analysis where this type of rod is used. For further information, see *NFPA 70* which contains detailed information on the grounding of electrical systems.~~

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 13:27:06 EST 2020

Committee Statement

Committee Statement: The last sentence of existing A.4.13.2 is deleted because the requirement discussed is specific to lightning protection, not to grounding of electrical systems. The remaining text in A.4.13.2 is applicable specifically to 4.13.1.6 so it is moved into A.4.13.1.6.

Response Message: FR-105-NFPA 780-2020

Public Input No. 187-NFPA 780-2020 [Section No. A.4.13.2]

First Revision No. 111-NFPA 780-2020 [Section No. A.4.14.1]

A.4.13.1

The interconnection of incoming services to the lightning protection system should be performed as near the service entry as reasonable and ~~not meander greatly~~ as direct as practicable through the structure before its interconnection. For larger structures with services entering the structure at different locations, multiple equipotential ground bus bars (EGB) should be considered. In these cases, the interconnection of the multiple EGBs is best accomplished through interconnection with a ground ring electrode.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 14:04:42 EST 2020

Committee Statement

Committee Statement: An editorial change to replace “not meander greatly” with “as direct as practicable” for clarity of intent.

Response Message: FR-111-NFPA 780-2020

Public Input No. 22-NFPA 780-2020 [Section No. A.4.14.1]

First Revision No. 113-NFPA 780-2020 [Section No. A.4.14.3]

A.4.13.3

~~Definitions~~ The definitions in *NFPA 70 (NEC)* and in this standard for *bonded (bonding)*, *grounded*, *grounding*, and *grounding electrode* are similar. The actual sections in the *NEC* and in this standard that define what constitutes these various items point to differences in application, equipment, and requirements.

Section 250.50 of the *NEC* requires that all electrodes present at each building or structure be bonded together to form the grounding electrode system, which coordinates with the requirements of Section 4.13 of this standard . The differences occur in 250.52 of the *NEC*, which describes grounding electrode devices not shown in Section 4.12. Grounding electrode devices described in 250.52 of the *NEC* but not referenced in this document include the following:

(1) 250.52(A)(1): 10 ft (3 m) of metallic underground water pipe ~~extending~~ that extends from the structure in contact with earth.

(2) 250.52(A)(2): The metal ~~frame of the~~ in-ground support structure that is in contact with earth.

(3) 250.52(A)(3)(2): The concrete-encased electrode described as #4 AWG, which would need to be a main-size conductor per 4.12.3.2.

(4) 250.52(A)(4): The ground ring electrode not smaller than 2 AWG that is acceptable for Class I but would not be acceptable for Class II *(see Table 4.1.1.1.2)*.

(5) 250.52(A)(5): Pipe electrodes described in item (a), which are not included~~. Rod~~ , and rod electrodes described in item (b) as zinc-coated steel, which are not covered *(see 4.12.2.2)*.

(6) 250.52(A)(6): Other listed electrodes, which would need to comply with the various paragraphs of Section 4.12.

(7) 250.52(A)(7): Plate electrodes, which would need to comply with 4.12.6.

(8) 250.52(A)(8): “Other local metal underground systems or structures, ” which are not referenced as grounding electrodes in this standard.

The lightning protection system designer must be familiar with these differences to ~~be able to~~ coordinate interconnection with other building grounding electrodes or the structural grounding electrode system as required by 4.13.3.

Where separate but adjacent buildings or facilities are interconnected directly (not through a utility) by electric, CATV, CCTV, data, or communications wiring, the grounding systems of those buildings should be directly interconnected ~~to each other~~ with a main-size conductor. The need for this interconnection can be eliminated ~~by~~ with the use of fiber-optic cable, shielded wire, wire run in grounded metallic conduit, or ~~redundant~~ cascading surge protection ~~[SPDs~~ [surge arresters, surge protective devices (SPDs), or surge protectors installed at the entrance(s) and exit(s) of ~~both~~ buildings or facilities].

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 14:57:14 EST 2020

Committee Statement

Committee Statement: This first revision adds the three types of surge protection recognized in Section 4.20 in addition to SPDs alone. Surge protection is coordinated with cascading protection which is not redundant. List Item 2 has been revised to coordinate with the NEC.

Response Message: FR-113-NFPA 780-2020

Public Input No. 105-NFPA 780-2020 [Section No. A.4.14.3]

First Revision No. 114-NFPA 780-2020 [Section No. A.4.16]

A.4.15

See Annex C for a technical discussion of lightning protection potential-equalization bonding and isolation.

In addition to the bonding of metal bodies, surge ~~suppression~~ protection should be provided to protect power, communication, signal, and data lines from dangerous overvoltages and sparks caused by lightning strikes.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 15:05:53 EST 2020

Committee Statement

Committee Statement: This first revision replaces “suppression” with “protection” and inserts the term “signal” to correlate this annex material with Section 4.20.

Response Message: FR-114-NFPA 780-2020

Public Input No. 106-NFPA 780-2020 [Section No. A.4.16]

First Revision No. 118-NFPA 780-2020 [Section No. A.4.17]

A.4.16

Metallic antenna masts or supports should not be used as strike termination devices. Thin metallic supports could be damaged and damage to the antenna lead-in conductors will most likely occur. Antenna should be placed in a zone of protection and isolated from the lightning protection system. Communications conductors should not be located near lightning conductors. *(See Section ~~4.19.6~~ 4.19 for ~~communications~~ surge protection requirements.)*

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 24 15:42:04 EST 2020

Committee Statement

Committee Statement: The text is revised to coordinate with changes made in Section 4.20.

Response Message: FR-118-NFPA 780-2020

Public Input No. 107-NFPA 780-2020 [Section No. A.4.17]

First Revision No. 18-NFPA 780-2020 [Section No. A.7.1.2]

~~**A.7.1.2**~~

~~This chapter shall not apply to the protection of nonmetallic tanks containing flammable vapors, flammable gases, or liquids that give off flammable vapors. *(See Annex N .)*~~

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Thu Nov 12 16:34:54 EST 2020

Committee Statement

Committee Statement: Delete the annex material which duplicated the requirement.

Response Message: FR-18-NFPA 780-2020

Public Input No. 201-NFPA 780-2020 [Section No. A.7.1.2]

First Revision No. 128-NFPA 780-2020 [Section No. A.8.7.4]

A.8.7.4

ISO containers meeting the requirements of ISO 1496, *Series 1 freight containers — Specification and testing — Part 1: General cargo containers for general purposes* , are sometimes used for temporary storage of various explosives materials, such as small arms in ammo boxes, various weapons system configurations in shipping containers, commercial explosives, fireworks, and so forth. Because the metal frame of a properly maintained ISO container does not meet the metal thickness requirement for strike termination devices, there could be burn-through ~~for~~ caused by some strikes. The metal frame will provide some ~~shielding~~ protection from lightning electromagnetic effects~~,~~ and the surface area contact of the superstructure on the local earth will provide some impedance to earth. These provide protection against the effects of lightning for some configurations and sensitivity of contents, but not all. In some cases, it might be necessary to provide strike termination devices, additional bonding, and grounding of the ISO container. Whether the ISO container is to be supplemented by lightning protection is a decision for the AHJ to make~~,~~ based on a risk assessment of the sensitivity of the container's contents.

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Tue Dec 01 14:19:09 EST 2020

Committee Statement

Committee Statement: Reference to the appropriate ISO standard is moved into annex.
Response Message: FR-128-NFPA 780-2020

First Revision No. 36-NFPA 780-2020 [Section No. A.10.4.3.1]

A.10.4.3.1

The function of ~~the~~ a loop conductor is to conduct ~~the~~ lightning current around the outside of ~~the~~ a watercraft while minimizing the risk of a sideflash to the water~~,~~ or to the metallic structures and personnel in the vessel. In the absence of conducting fittings or occupied areas, it is preferable to place the loop conductor as high as possible above the waterline to minimize the risk of a sideflash between the loop conductor and the water. ~~However, this risk is less for a horizontal conductor than for a conductor, such as a chain plate, that is more vertically oriented.~~ If conducting fittings or crewed areas exist near the loop conductor, it is preferable to place the loop conductor between the vulnerable ~~location~~ area and the water.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 14:54:41 EST 2020

Committee Statement

Committee Statement: The normative text requires a main-size loop conductor routed horizontally around the watercraft, the reference to a chain plate does not add clarity or function to the annex text, and is covered by the last sentence if it is below the loop conductor.

Response Message: FR-36-NFPA 780-2020

Public Input No. 139-NFPA 780-2020 [Section No. A.10.4.3.1]

First Revision No. 46-NFPA 780-2020 [Section No. A.11.1.1]

A.11.1.1

Chapter 11 pertains to lightning protection of airfield lighting systems. These systems are installed underground in both paved (~~i.e.,~~ e.g., full-strength pavement and shoulder pavement) and unpaved areas. The protected components include in-pavement fixtures, elevated fixtures, airfield signs, underground power systems , communications systems, control and signal circuits, and components of runway, taxiway, and apron lighting systems. These systems are installed ~~on~~ in the portions of an airport that encompass the approach, departure, landing, takeoff, taxiing, and parking areas for aircraft ~~and~~ . These areas include runways, taxiways, and other parts of an airport used for taxiing, takeoff, and landing of aircraft; loading ramps; and parking areas exclusive of building-mounted helipads, approach light structures, and antennas. This chapter could also apply to other areas with airfield lighting systems.

There are two generally accepted methods for providing lightning protection for airfield lighting circuits: equipotential and isolation. The equipotential method, which is described in 11.4.2.6.1, is shown in Figure A.11.1.1(a). The isolation method, which is described in 11.4.2.6.2, is shown in Figure A.11.1.1(b). The two methods should not be employed on a single circuit. The designer should select the installation method based ~~upon~~ on sound engineering practices and the success of the selected method in previous installations.

Figure A.11.1.1(a) Equipotential Method.

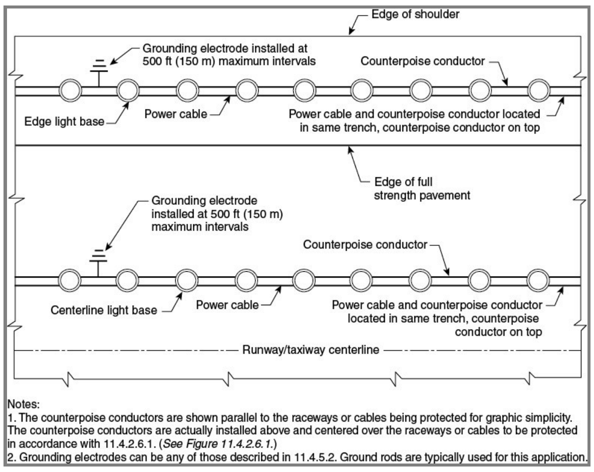
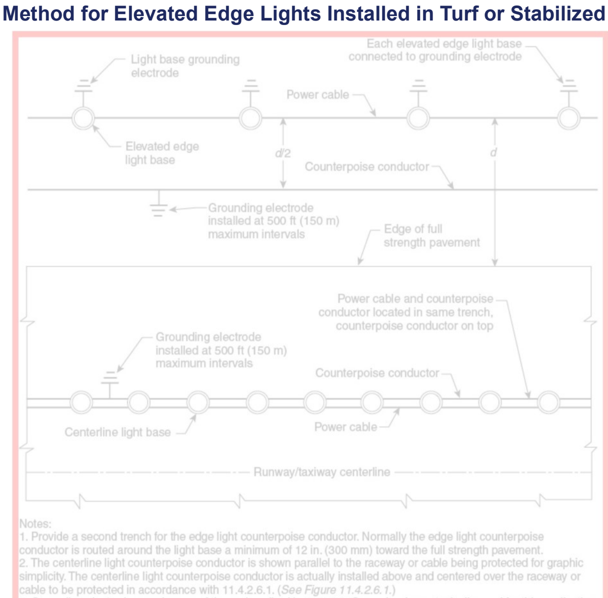
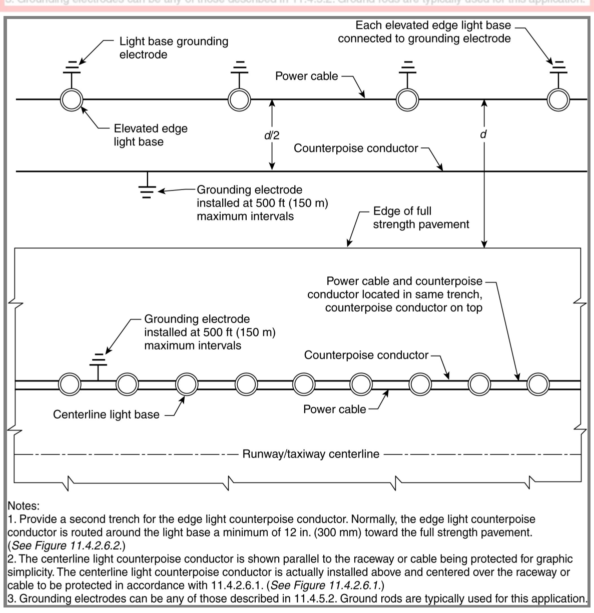


Figure A.11.1.1(b) Isolation Method for Elevated Edge Lights Installed in Turf or Stabilized Soil.





Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 17 10:56:59 EST 2020

Committee Statement

Committee Statement:	Adding the reference to Figure 11.4.2.6.2 at the end of Note 1 in Figure A.11.1.1(b) corresponds with a similar reference in Figure A.11.1.1(a). Figure 11.4.2.6.2 provides an elevation view of the concept shown in the Figure A.11.1.1(b) plan view.
Response Message:	FR-46-NFPA 780-2020

Public Input No. 32-NFPA 780-2020 [Section No. A.11.1.1]

First Revision No. 39-NFPA 780-2020 [Section No. A.11.4.2.4]

A.11.4.2.4

A Chapter 4-compliant lightning protection system and SPDs ~~could~~ can be installed at the airfield lighting vault or ~~other~~ another airfield lighting circuit power source.

The need for an airfield lighting vault building lightning protection system, SPDs, or surge arresters should be determined by the ~~Engineer of Record,~~ engineer of record based on sound engineering practices. Lightning protection systems, SPDs, and surge arresters are recommended for high-priority airfield lighting systems and airfield lighting systems installed in areas with a lightning flash density greater than ~~two flashes~~ one flash per square kilometer per year.

The criteria in A.11.4.1.1 can be used to determine if ~~the~~ airfield lighting field circuits should be provided with surge arresters.

A lightning risk assessment performed in accordance with Annex L can be used to determine if the airfield lighting vault building or equivalent electrical equipment protective structure should be provided with a lightning protection system and SPDs in accordance with Chapter 4.

The AHJ can determine and approve the need for the airfield lighting vault building or equivalent electrical equipment protective structure lightning protection system, SPDs, and airfield lighting circuit surge arresters.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 15:16:51 EST 2020

Committee Statement

Committee Statement: This change makes flash density requirements in 11.2.4 consistent with flash density in A.4.20.2.5(2).

Response Message: FR-39-NFPA 780-2020

Public Input No. 26-NFPA 780-2020 [Section No. A.11.4.2.4]

First Revision No. 43-NFPA 780-2020 [Section No. A.11.4.2.6.1.2]

A.11.4.2.6.1.2

Airfield pavement systems design is an intricate engineering solution involving a large number of complex variables. Operating aircraft and pavement systems interact with each other. This interaction must be addressed by the pavement design process. Structural designs of airfield pavement systems include the determination of the overall pavement system thickness to achieve the final design objectives. Airfield pavement systems are normally constructed in courses or layers.

Many factors influence the pavement system layer thicknesses required to provide satisfactory pavement system design. Two key components that affect the structural design of the pavement system are the type of pavement and the load-bearing capacity of the supporting materials.

A typical pavement system design might consist of the following layers:

(1) Conditioned and compacted earth fill and subgrade below the pavement system (typically 100 percent compaction required)

(2) Enhanced sub-base course material, including additional layering, or enhanced existing subgrade

(3) Pavement base course (flexible or semi-rigid materials to support the pavement surface materials)

(4) Final pavement surface, either hot mix asphalt (HMA), a flexible pavement typically installed in multiple layers, or Portland cement concrete (PCC), a rigid pavement typically installed in one layer

The thickness of each of the overall pavement layers is determined ~~by~~ based on the structural requirements of the pavement system based on existing conditions, aircraft sizes and weights, number of ~~repetitions~~ aircraft operations , environmental factors, and other features.

The airfield lighting system is incorporated into the airfield pavement system. The design of the depth and ~~the~~ height of the various airfield lighting system components, including light bases, light base accessories, conduits, and counterpoise conductors, must be adjusted to integrate the components into the varying pavement system layer thicknesses. Although reasonable effort should be made to comply with the 8 in. (200 mm) requirement contained in 11.4.2.6.1.1, it is for these reasons that the variation described in 11.4.2.6.1.2 is necessary.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 15:27:46 EST 2020

Committee Statement

Committee Statement: The word change provides a more accurate description. The term "aircraft operations" would be more easily understood in the aviation community than the word "repetitions".

Response Message: FR-43-NFPA 780-2020

Public Input No. 33-NFPA 780-2020 [Section No. A.11.4.2.6.1.2]

First Revision No. 44-NFPA 780-2020 [Section No. A.11.4.8.5]

A.11.4.8.5

Exothermic welding is not the recommended method of connecting the counterpoise conductor to a galvanized steel light base. Refer to Part 12.5 of FAA Advisory Circular 150/5340-~~30F~~ 30J , *Design and Installation Details for Airport Visual Aids*.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 16 15:29:47 EST 2020

Committee Statement

Committee Statement: Updated edition number of FAA Advisory Circular to reflect current version.

Response Message: FR-44-NFPA 780-2020

Public Input No. 34-NFPA 780-2020 [Section No. A.11.4.8.5]

First Revision No. 52-NFPA 780-2020 [Section No. B.2.2]

B.2.2

While intercepting, conducting, and dissipating the main discharge, the three basic protection system components do not ensure safety from possible secondary effects of a lightning strike. Therefore, secondary conductors are provided to interconnect metal bodies to ensure that such metal bodies are maintained at the same electrical potential so as to prevent sideflashes or sparkover. Surge ~~suppression devices are~~ protection is also provided to protect power lines and associated equipment from both direct discharges and induced currents.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 17 14:38:48 EST 2020

Committee Statement

Committee Statement: This revision corrects the terminology used to align B.2.2 with Section 4.20.

Response Message: FR-52-NFPA 780-2020

Public Input No. 23-NFPA 780-2020 [Section No. B.2.2]

Public Input No. 110-NFPA 780-2020 [Section No. B.2.2]

First Revision No. 53-NFPA 780-2020 [Section No. B.4.8]

B.4.8

Lightning currents entering protected buildings on overhead or underground power lines, telephone conductors, or television or radio antennas are not necessarily restricted to associated wiring systems and appliances. Therefore, such systems should be equipped with appropriate ~~protective devices~~ surge protection and bonded to ensure a common potential.

Submitter Information Verification

Committee: LIG-AAA

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Committee Statement

Committee Statement: This revision corrects the terminology used to align B.4.8 with Section 4.20.

Response Message: FR-53-NFPA 780-2020

Public Input No. 111-NFPA 780-2020 [Section No. B.4.8]

First Revision No. 54-NFPA 780-2020 [Section No. C.2.2]

C.2.2 Inductive Effect.

When a large current passes down the lightning conductor *ABC*, a magnetic field is generated in circular motion around the conductor as shown in Figure C.2. The higher the lightning current, the higher the magnetic field. These magnetic field lines can be referred to as *magnetic flux*.

The loop *BCDEF* is intercepted by these lines of magnetic flux. The rate of change of the flux passing through this loop induces a voltage in the loop, creating a potential difference between *B* and *F*. This potential difference can be in the order of a few million volts, again causing a sideflash.

The bonding techniques described in this standard call for bonding the gaps over which high potentials exist, such as *BF*, in order to remove the spark and provide a safe path to ground for the current. The bonding-distance formulas are ~~calculated~~ derived from the laws of physics, making assumptions on the relevant lightning characteristics that influence the induced voltage. The assumptions for this standard are based on an extremely severe lightning current, thereby providing a bonding distance that is almost totally protective.

The voltage across the gap *BF* is related to the size of the loop *BCDEF* but dominantly to the height *BC* rather than the horizontal measure *CD*; hence the height *h* term is used in the formulas of 4.15.2. Equalizing the potentials at frequent heights in accordance with Section 4.14 also reduces the size of the loop *BCDEF*, thereby keeping the gap voltage to a controllable value that can be removed by simple bonding.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 17 14:48:20 EST 2020

Committee Statement

Committee Statement: The term ‘derived’ is more accurate in context.

Response Message: FR-54-NFPA 780-2020

Public Input No. 35-NFPA 780-2020 [Section No. C.2.2]

First Revision No. 55-NFPA 780-2020 [Section No. C.2.3]

C.2.3 Power and Communications Services.

One factor that is difficult to control is ~~the problem~~ related to power and communication lines entering the building. For all intents, such lines are at ground potential relative to the extremely high induced voltages. If the line *DEF* were such an electrical, telephone, power, or data line not bonded at ground, the voltage across the loop would be enhanced by the resistive effect described by Ohm's ~~law~~ Law, as well as by the inductive effect. Hence, *BF* could soon approach breakdown, which could ~~would~~ lead to sparks causing fire, as well as the obvious electrical, electronic, and human life ~~problems~~ dangers . All such lines entering the building should have electrical bonding through surge protection as specified in Section 4.19, thereby reducing the resistive component and controlling dangerous sparking and damage. If ~~just~~ one wire~~, however,~~ does not have such ~~suppression devices~~ surge protection , the dangers described still exist ~~to~~ for the protected building and the electrical equipment. Table C.2.3 shows sample calculations.

Table C.2.3 Sample Calculations of Bonding Distances

h			*D*					
			n = 1.0		*n* = 1.5		*n* = 2.25	
ft	m	K_m	ft	m	ft	m	ft	m
10	3.05	1	1 ft 8 in.	0.50	1 ft 1⅜ in.	0.33	9 in.	0.22
		0.5	10 in.	0.25	6¾ in.	0.17	4½ in.	0.11
20	6.10	1	3 ft 4 in.	1.01	2 ft 2¾ in.	0.67	1 ft 6 in.	0.45
		0.5	1 ft 8 in.	0.50	1 ft 1⅜ in.	0.33	9 in.	0.22
30	9.15	1	5 ft 0 in.	1.52	3 ft 4 in.	1.01	2 ft 2¾ in.	0.67
		0.5	2 ft 6 in.	0.76	1 ft 8 in.	0.50	1 ft 1⅜ in.	0.33
40	12.2	1	6 ft 8 in.	2.03	4 ft 6 in.	1.37	3 ft	0.91
		0.5	3 ft 4 in.	1.01	2 ft 3 in.	0.68	1 ft 6 in.	0.45

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Tue Nov 17 14:50:56 EST 2020

Committee Statement

Committee Statement: This revision corrects the terminology used to align C.2.3 with Section 4.20.
Response Message: FR-55-NFPA 780-2020

Public Input No. 112-NFPA 780-2020 [Section No. C.2.3]

First Revision No. 56-NFPA 780-2020 [Section No. D.1.2]

D.1.2 Visual Inspection.

Visual inspections are made to ascertain the following:

(1) The system is in good repair.

(2) There are no loose connections that might result in high-resistance joints.

(3) No part of the system has been weakened by corrosion or vibration.

(4) All down conductors and grounding electrodes are intact (nonsevered).

(5) All conductors and system components are fastened securely to their mounting surfaces and are protected against accidental mechanical displacement as required.

(6) There have not been additions or alterations to the protected structure that would require additional protection.

(7) There is no visual indication of damage to ~~surge suppression (overvoltage) devices~~ equipment providing surge protection .

(8) The system complies in all respects with the current edition of this standard.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 17 14:54:51 EST 2020

Committee Statement

Committee Statement: This revision corrects the terminology used to align D.1.2 with Section 4.20.

Response Message: FR-56-NFPA 780-2020

Public Input No. 113-NFPA 780-2020 [Section No. D.1.2]

First Revision No. 57-NFPA 780-2020 [Section No. D.2.2.2]

D.2.2.2

Lightning protection system maintenance procedures should be established for each system and should become a part of the overall maintenance program for the structure ~~that~~ it protects.

A maintenance program should contain a list of more or less routine items that can serve as a checklist and ~~can~~ establish a definite maintenance procedure that can be followed regularly. It is the repeatability of the procedures that enhances the effectiveness of a good maintenance program.

A good maintenance program should contain provisions for the following:

(1) Inspection of all conductors and system components

(2) Tightening of all clamps and splicers

(3) Measurement of lightning protection system resistance

(4) Measurement of resistance of grounding electrodes

(a) Inspection, testing, or both of equipment providing surge ~~suppression devices~~ protection to determine ~~their~~ its effectiveness compared ~~with~~ to similar new devices

~~Inspection, testing, or both of surge suppression devices to determine their effectiveness compared with similar new devices~~

(5) Refastening and tightening of components and conductors as required

(6) Inspection and testing as required to determine if the effectiveness of the lightning protection system has been altered by additions to or changes in the structure

Submitter Information Verification

Committee: LIG-AAA

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Committee Statement

Committee Statement: This revision corrects the terminology used to align D.2.2.2 with Section 4.20.

Response Message: FR-57-NFPA 780-2020

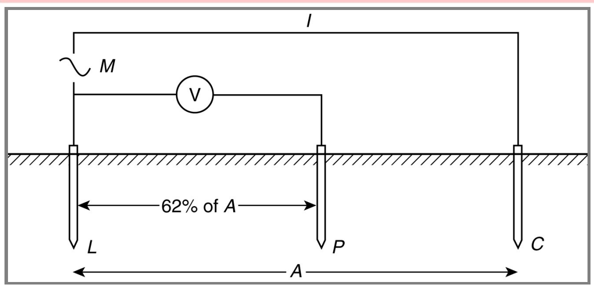
Public Input No. 114-NFPA 780-2020 [Section No. D.2.2.2]

First Revision No. 63-NFPA 780-2020 [Section No. E.1.3]

E.1.3

The principle of ground resistance measurement is shown in Figure E.1.3. *L* is the lightning ~~ground rod or ground rod~~ grounding electrode or grounding electrode system, *P* is ~~a~~ the potential (voltage) test probe, and ~~*A*~~ *C* is ~~an auxiliary~~ the remote current probe. *M* is the standard ~~ac~~ earth resistivity measuring equipment for three-point technique ground resistance measurements. Convenient distances for *LP* and ~~*LA*~~ *LC* are 75 ft (23 m) and 120 ft (36 m), respectively. In general, *P* should be ~~at~~ 62 percent of the ~~distance from~~ *L* to ~~*A*~~ *C* . If a distance of 120 ft (36 m) is not convenient, it ~~could~~ can be increased significantly [or reduced to no less than 50 ft (15 m)], provided *LP* is increased/decreased proportionately.

Figure E.1.3 Measurement of Ground Resistance.



The P and C probes should be placed at an angle of 90 degrees to minimize mutual coupling between the P and C probes. A current, *I*, is passed through the electrode or electrodes to be tested, *L*, and through ~~an auxiliary~~ the C probe, *A*. ~~The distance, *LA* , is long compared to the electrode length.~~ The voltage, *V*, between *L* and *P* is measured by the test equipment, which ~~also monitors~~ ~~*I*~~ injects a known current, *I* , and calculates the ground resistance, *R*, as *V*/*I*. Alternating current, generally greater than 60 Hz, is used to avoid errors ~~due to~~ caused by electrolytic factors in the soil and to remove effects ~~due to~~ caused by stray currents.

Three-point ground resistance-measuring equipment using these principles is relatively inexpensive and allows for direct reading of *R*.

NOTE: The individual equipment manufacturer's recommended operational procedures should be used.

Supplemental Information

File Name	Description	Approved
FR-63_New_firgure_E.1.3.jpg	New figure E.1.3 for FR 63 - for staff use	

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 17 15:38:39 EST 2020

Committee Statement

Committee Statement: The revised text clarifies the ground resistance test and coordinates test methodology with other standards, notably IEEE 81 (IEEE Guide for Measuring Earth Resistivity, Ground Impedance) and Earth Surface Potentials of a Grounding System.

Response Message: FR-63-NFPA 780-2020

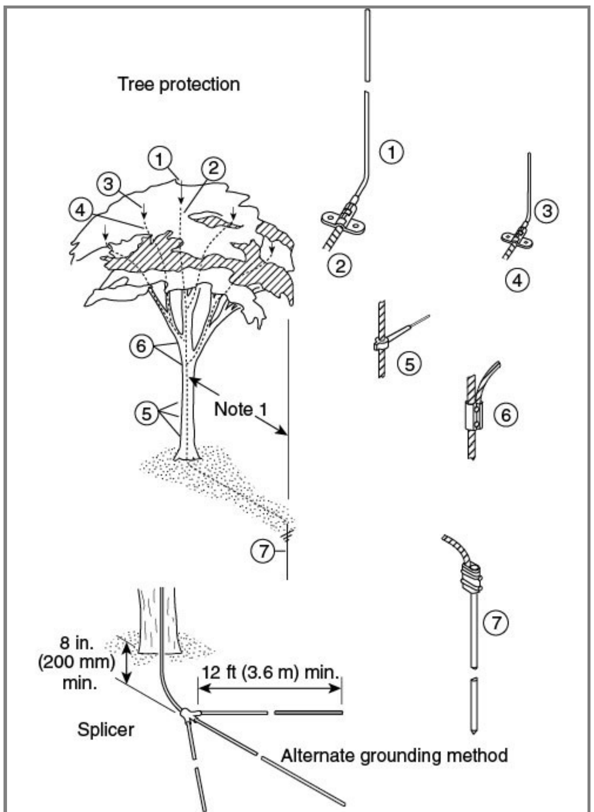
Public Input No. 24-NFPA 780-2020 [Section No. E.1.3]

First Revision No. 58-NFPA 780-2020 [Section No. F.1]

F.1 General.

Trees with trunks within 10 ft (3 m) of a structure or with branches that extend to a height above the structure should be equipped with ~~a~~ lightning protection ~~system because of~~ systems due to the danger of sideflash, fire, or superheating of the moisture in the tree, which could result in ~~the~~ splintering of the tree. It might be desirable to equip other trees with a lightning protection system because of a particular tree's value to the owner. Figure F.1 illustrates such protection.

Figure F.1 Protection for Trees.



1. Main trunk air terminal
2. Class I or Class II main size conductor
3. Branch air terminal
4. Branch conductor (bonding size conductor, minimum)
5. Drive-type cable clip no more than 6 ft (2 m) O/C
6. Splicer
7. Ground rod and clamp

Notes:
1. Locate grounding electrode at least 12 ft (3.6 m) from the trunk to avoid root damage.
2. Air terminal tip configurations can be sharp or blunt.

Note that ~~it should not be inferred that~~ adding protection to a tree will not ensure the safety of people seeking shelter under the tree during a thunderstorm. Possible sideflashes, step potential, and touch potentials could threaten the safety of people ~~seeking shelter~~ under trees. ~~even if the trees are protected.~~

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 17 15:03:08 EST 2020

Committee Statement

Committee Statement: The revision clarifies that protection of a tree will not ensure the safety of people seeking shelter under the tree during a thunderstorm. The purpose of the lightning protection systems is only to protect the tree from damage.

Response Message: FR-58-NFPA 780-2020

Public Input No. 204-NFPA 780-2020 [Section No. F.1]

First Revision No. 59-NFPA 780-2020 [Section No. I.1.3]

I.1.3

The effects of lightning strikes to metal and composite aircraft are a matter of continuous study. The use of surge ~~suppression circuitry~~ protection on critical navigational, radio-communication, and radar equipment can help to minimize these effects. Suitable equipment and electrical wiring layout can also aid in reducing lightning-induced problems.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 17 15:14:17 EST 2020

Committee Statement

Committee Statement: This revision corrects the terminology used to align I.1.3 with Section 4.20.

Response Message: FR-59-NFPA 780-2020

Public Input No. 115-NFPA 780-2020 [Section No. I.1.3]

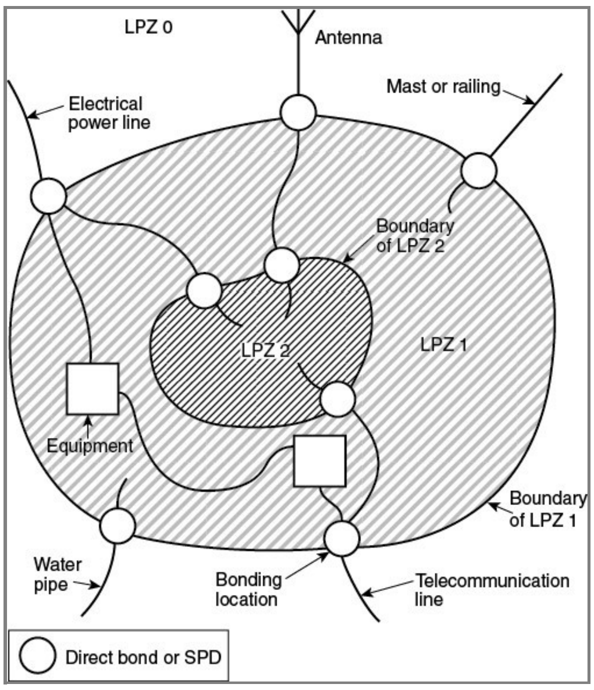
First Revision No. 60-NFPA 780-2020 [Section No. J.5]

J.5 Lightning Protection Zones.

A lightning protection zone (LPZ) is an area or zone with a defined electromagnetic environment. For example, LPZ 0 represents the external lightning threat environment. It is subdivided into LPZ 0_A, which is the electromagnetic environment defined by the threat of a direct lightning strike (full or partial lightning surge current) and a nonattenuated lightning electromagnetic field (LEMP), and LPZ 0_B, which is ~~subjected~~ subject to the same electromagnetic environment but not subject to direct strikes. Equipment located in an LPZ 0_B environment could be ~~subjected~~ subject to partial lightning surge currents.

Direct bond or ~~SPD~~ surge protection zones interior to the structure are characterized by exposure to surge current levels limited by current sharing, isolating interfaces, and/or ~~by SPDs~~ surge protection at the boundary of the zone. The walls of the structure will likely attenuate the lightning electromagnetic field~~;~~ , the amount of which will be dependent on the actual construction techniques. The initial lightning protection zone in a structure is indicated as LPZ 1 and the specific environment required for the zone is dictated by the characteristics of the internal electrical equipment (where the LEMP severity is compatible with the withstand level of the internal systems enclosed). Where there is electrical equipment with greater sensitivity to the LEMP environment defined for LPZ 1, successive zones should be established. The boundary of an LPZ is defined by the protection measures employed. Figure J.5 provides the general application of the zone concept and identifies an application with two internal zones. Subsequent zones reflect the need for greater limitations of surge current, which can be implemented through additional current sharing, isolating interfaces, and/or ~~and by~~ additional ~~SPDs~~ surge protection at the boundary. Additional spatial shielding should be used to further attenuate the lightning electromagnetic field.

Figure J.5 Concept of Lightning Protection Zones. (Based on IEC 62305-4, *Protection Against Lightning — Part 4: Electrical and Electronic Systems within Structures*, Edition 2.)



Submitter Information Verification

Committee: LIG-AAA

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Committee Statement

Committee Statement: This revision corrects the terminology used to align J.5 with Section 4.20.

Response Message: FR-60-NFPA 780-2020

Public Input No. 117-NFPA 780-2020 [Section No. J.5]

First Revision No. 66-NFPA 780-2020 [Section No. J.6.2]

J.6.2 Distributed Equipment.

Distributed equipment places heavy reliance on surge protection ~~devices (SPDs)~~ . Section 4.19 describes ~~SPD~~ surge protection arrangements for lightning protection with additional emphasis on supplementary ~~SPDs~~ surge protection, in addition to entry/exit ~~SPDs~~ surge protection on smart structures. For example, ~~SPDs~~ surge protection ~~are~~ is needed on conductors penetrating an equipotential LPZ. However, once a conductor leaves the equipotential LPZ and/or a structure, additional surge protection is needed, especially for sensitive equipment that is placed at a considerable distance from an equipotential LPZ. Distributed equipment should be installed in an equipotential LPZ rated higher than LPZ 0. A separate LPZ should be established for remotely installed equipment.

J.6.2.1 Surge Propagation.

Surges, or transients, induced in the conductors of a service (power or signal) are bidirectional, meaning they propagate both back to the origination of the service and to the location of the distributed equipment. A common error is to provide ~~SPDs~~ surge protection only at the origin of the service but not at the distributed equipment. The most common types of distributed equipment affected are cameras, gate motors, and pumps. These installations, which are typically ~~installed~~ at locations remote to a structure, have both power and signal services. It is necessary to provide common (equipotential) ground at or close to the point of utilization, which essentially establishes an LPZ for the utilization point. Both power and signal services need appropriately rated ~~SPDs~~ surge protection at the point of utilization.

J.6.2.2 ~~SPDs~~ Surge Protection on Distributed Equipment Within Structures.

Often, distributed equipment within a structure but outside of an LPZ needs ~~SPDs~~ surge protection . For example, a structure could have an LPZ established for a computer server room ~~(~~ [which has entry ~~SPDs)~~ surge-protective devices (SPDs)] but not for the equipment connected through telecommunications cabling to that room. More often, a structure will have entry SPDs and equipotential grounding, establishing an LPZ (LPZ 1). However, primary~~,~~ or entry SPDs are often not rated to intercept ~~the~~ lower level transients and surges that can damage very sensitive equipment. ~~So the~~ The primary or entry SPD sometimes cannot be relied upon for complete protection due to the sensitivity of some equipment. Typically, this equipment includes control interfaces (touchpads), motor controllers, and cameras. Because this equipment is often sensitive to voltages lower than the voltage protection rating (VPR) of the primary SPD, and possibly that of a supplementary SPD at a service subpanel, additional SPDs should be considered at the point-of-use to protect sensitive equipment. However, where applied in multiple layers like this, coordination of the SPDs ~~needs consideration~~ should be considered .

Submitter Information Verification

Committee: LIG-AAA

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Committee Statement

Committee Statement: This first revision corrects the terminology used in J.6.2 to align with Section 4.20 for all surge protection types recognized by the standard.

Response Message: FR-66-NFPA 780-2020

Public Input No. 118-NFPA 780-2020 [Section No. J.6.2]

First Revision No. 61-NFPA 780-2020 [Section No. J.6.3]

J.6.3 ~~SPD~~ Surge Protection Coordination.

Where ~~sequential SPDs are~~ cascaded surge protection is applied to circuits, coordination of the ~~SPDs~~ surge protection is necessary. Often, supplementary ~~SPDs~~ surge protection will function at a lower voltage than ~~a~~ primary ~~SPD~~ surge protection . Because the secondary ~~SPD~~ surge protection ~~will operate~~ operates first upon exposure to a lower voltage, it must contain some ~~method~~ way to limit the amount of current flowing on the internal building cable conductors within the structure~~,~~ between the primary ~~SPD~~ surge protection and the equipment.

The objective of the secondary ~~protector~~ protection should be to transition the surge — whether it is ~~a~~ caused by lightning or a power surge event — from the secondary to the primary ~~SPD~~ surge protection , which is much more robust than the secondary ~~protector~~ protection . Equipment that has been designed to ~~“withstand” the over-voltage~~ withstand the overvoltage end-of-life characteristics of ~~a~~ primary ~~SPD~~ surge protection will provide more reliable service overall.

For example, the telephone company employs a primary ~~SPD~~ surge protector on signal conductors, which ~~is~~ are generally placed at or near the entrance of the structure served. A primary ~~SPD~~ surge protector , usually meeting ~~UL 497 requirements,~~ the requirements of UL 497, *Safety Protectors for Paired-Conductor Communications Circuits* , is used if the telephone facility (cable) is exposed to possible contact with 300 ~~volts~~ V or greater. The nominal ~~“~~ operating voltage~~”~~ (the voltage ~~when~~ at which the ~~SPD~~ surge protector activates) is from 265 to 350 ~~volts~~ V rms for a ~~100 volt/second~~ 100 V/sec rise time for a gas discharge tube (GDT). Impulse response (nearby induced lightning) ranges from 500 to 700 ~~volts~~ V for a ~~100 volt/microsecond~~ 100 V/μs rise time surge. Solid-state devices (typically thyristors) have essentially the same operating response voltage for both fast and slow waveforms. However, GDTs are generally used at customer locations due to their substantially better reliability versus ~~the~~ solid-state protectors in lightning-prone areas, such as the southeastern United States.

The secondary ~~SPD~~ surge protector is generally an integral component of the customer’s equipment (telephone set, PBX and data equipment, etc.) and is designed to operate at a substantially lower voltage than the primary ~~SPD~~ surge protector . Because the secondary ~~SPD will operate~~ surge protector operates first, it must contain some method to limit the amount of current flowing on the internal building cable conductors within the structure~~,~~ between the primary ~~SPD~~ surge protector and the equipment. Limiting the current will minimize the possibility of ~~fire due to~~ fusing of the internal cable conductors and/or uncontrolled component failure ~~resulting~~ , which can result in a fire within ~~the~~ customer equipment when the secondary protector operates — especially ~~with~~ after contact with power lines (power cross).

The components used to help make the transition from the secondary to the primary surge protector can also introduce transmission impairments on the telecom circuit. Series resistance effectively lengthens the cable facility; lumped inductances can induce increased roll-off at ~~the~~ higher frequencies, reducing bandwidth; and lumped capacitance to ground results in high-frequency roll-off. Each of these issues can significantly affect insertion loss, return loss, and balance (common mode). As required in Section 4.19, ~~the SPDs~~ surge protectors must meet the characteristics of ~~the~~ a protected line, particularly for signal conductors.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 17 15:29:37 EST 2020

Committee Statement

Committee Statement: This first revision corrects the terminology used in J.6.3 to align with Section 4.20 for all surge protection types recognized by the standard.

Response Message: FR-61-NFPA 780-2020

Public Input No. 119-NFPA 780-2020 [Section No. J.6.3]

First Revision No. 62-NFPA 780-2020 [Section No. J.8]

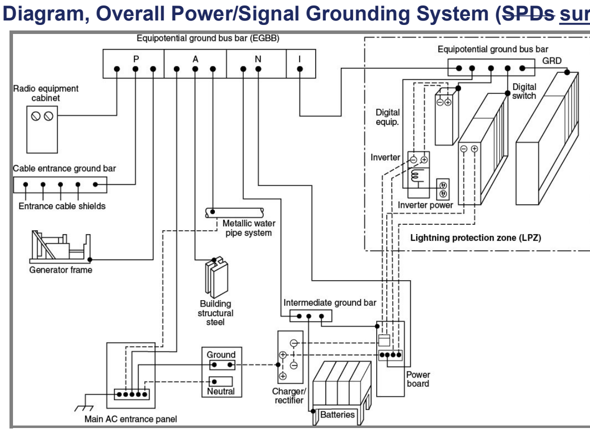
J.8 Overall Smart Structure System.

The overall concept of protection for a smart structure is essentially a concentric protection concept illustrated by the successive LPZ in Figure J.5. It includes equipotential bonding at a single point for structures, the EGBB. Equipotential bonding requirements should also be coordinated with the requirements of Sections 4.13–4.15. The EGBB constitutes the ground transition for the structure to external services.

Similarly, one or more equipotential LPZs can exist within the structure, each with a single-point grounding bar and ground transition to the rest of the structure, implemented at the EGBB. Through this ground transition, the EGBB is connected to a robust earth electrode system. Equipotential LPZs should be used for equipment rooms housing sensitive equipment. Coordinated ~~SPDs~~ surge protection will protect all boundaries of the LPZs, the structure, and the distributed equipment. Distributed equipment also must have common equipotential grounding in close proximity~~,~~ to limit induced voltage differences that could cause damage. A representative system is illustrated in Figure J.8.

The best way to protect ~~the~~ smart structure equipment is to consider protection in the design and to have an overall plan and specification for the installation based on the recommendations of this annex and the other requirements of NFPA 780. Close coordination of the various trades is needed to ~~ensure meeting~~ meet these requirements.

Figure J.8 Representational Diagram, Overall Power/Signal Grounding System (~~SPDs~~ surge protection omitted).



Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 17 15:30:11 EST 2020

Committee Statement

Committee Statement: This first revision corrects the terminology used in J.8 to align with Section 4.20 for all surge protection types recognized by the standard and affirms the acronym EGBB for equipotential ground bus bar...

Response Message: FR-62-NFPA 780-2020

Public Input No. 121-NFPA 780-2020 [Section No. J.8]

First Revision No. 64-NFPA 780-2020 [Section No. J.9.1.2.1]

J.9.1.2.1 Surge Protection.

Appropriately rated ~~SPDs~~ surge protectors need ~~installation~~ to be installed on all inputs to the electrical enclosure. *(See Section 4.19.)* Another method to reduce surges is ~~use of~~ using fiber optics wherever practicable. ~~SPDs~~ Surge protectors should be installed on the building end of the wiring to avoid surges backfeeding into the structure and the rest of the video and control system.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 17 15:51:12 EST 2020

Committee Statement

Committee Statement: This first revision corrects the terminology used in J.9.1.2.1 to align with Section 4.20 for all surge protection types recognized by the standard.

Response Message: FR-64-NFPA 780-2020

Public Input No. 122-NFPA 780-2020 [Section No. J.9.1.2.1]

First Revision No. 65-NFPA 780-2020 [Section No. J.9.3.2.3]

J.9.3.2.3 Surge Protection.

Install ~~SPDs~~ surge protection as near as possible to the device at the gate in accordance with Section 4.19. The ~~SPD~~ surge protection selected should be appropriate for the equipment and should protect both power and phone/control conductors. Because electrical transients are bidirectional, ~~SPDs~~ surge protection should be installed at the gate and at the structure providing the service to the gate. Shielded data, signal, and coaxial cable will minimize damage from induced currents caused by electromagnetic coupling, but will not stop the direct injection of lightning current. Fiber optic cable is immune, however, and is a good alternative.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Nov 17 15:56:38 EST 2020

Committee Statement

Committee Statement: This first revision corrects the terminology used in J.9.3.2.3 to align with Section 4.20 for all surge protection types recognized by the standard.

Response Message: FR-65-NFPA 780-2020

Public Input No. 126-NFPA 780-2020 [Section No. J.9.3.2.3]

First Revision No. 124-NFPA 780-2020 [Section No. K.3]

K.3 Current Sharing Considerations.

Annex G of IEC 62305-4, *Protection Against Lightning — Part 4: Electrical and Electronic Systems Within Structures*, provides information concerning the current sharing that is likely to occur between the lightning protection conductors and the PV output circuit cabling during a lightning event. For this analysis, it considers the following two cases:

(1) Where the separation distance(s) cannot be maintained between the lightning protection system and the photovoltaic modules~~,~~ and, thus, equipotential bonding must be applied

(2) Where the separation distance(s) can be maintained and no bonding between the lightning protection system and the photovoltaic system is required

Depending on each case, the current sharing of the lightning current to ground is divided between the lightning protection system and the PV output circuit cabling. This, in turn, affects the selection (class and ratings) of the SPDs that will be installed on the photovoltaic system. For example, if the separation distance between the strike termination devices and the photovoltaic modules cannot be maintained for the calculated bonding distance ~~being designed to~~ , then the strike termination devices must be bonded to the photovoltaic module supporting rack. This then implies that the PV output circuit will also ~~act to~~ carry a portion of the lightning current to ground. In its simplest form, the current sharing can be considered as:

$$I = I_{pk} / n \qquad \textbf{[K.3]}$$

where:

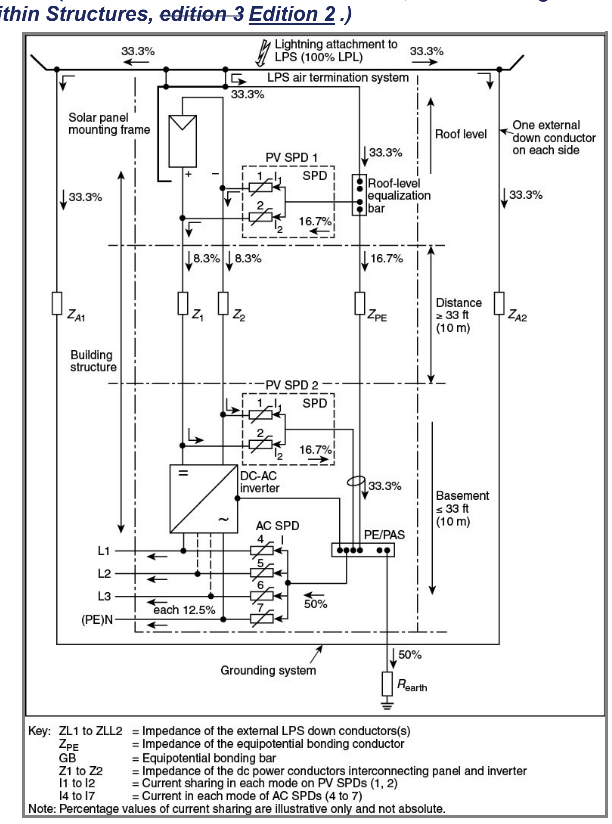
I_{pk} = is the peak lightning discharge current

n = is the number of parallel paths to ground

In this example, where bonding is required, n is taken to be equal to the number of down conductors (1)~~,~~ because the PV output circuit is also considered a path to ground. This is a simplistic model but does serve to illustrate that the photovoltaic system can become involved in the conveyance of lightning current to ground. This implication ~~then~~ also follows through to the selection of the surge protective devices (SPDs) that will be installed on the PV output circuit. In the preceding example, where the strike termination devices are bonded to the module racks, the PV output circuit will also convey a portion of the lightning current to ground.

Figure K.3 depicts a current sharing concept between the lightning protection and photovoltaic systems and how this impacts ~~on~~ the various SPDs installed.

Figure K.3 Depiction of a Roof Level PV Installation Showing Typical Lightning Current Distribution Among Current Carrying Conductors and SPDs. ***(Source: modified from IEC 62305-4, Protection Against Lightning — Part 4: Electrical and Electronic Systems Within Structures, ~~edition 3~~ Edition 2 .)***



Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Dec 01 12:23:48 EST 2020

Committee Statement

Committee Statement: The edition citation was corrected to reflect that Edition 3 has not yet been published.

Response Message: FR-124-NFPA 780-2020

First Revision No. 123-NFPA 780-2020 [Section No. K.5]

~~**K.5** Isolated Lightning Protection Components.~~

~~IEC/TS 62561-8, *Lightning Protection System Components (LPSC) — Part 8: Requirements for Components for Isolated LPS* , provides information on the means of reducing the separation distance through the use of isolated lightning protection components on PV installations.~~

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Dec 01 12:16:05 EST 2020

Committee Statement

Committee Statement: This component is currently covered by an IEC Technical Specification in transition which is under consideration by IEC TC 81 for approval as an International Standard. The Committee will monitor the work of IEC TC 81 and revisit the subject at a later date. Given this action, it would be inconsistent to cite the use of the component in this application. The removal of the clause does not preclude the use of the component by a relevant AHJ.

Response Message: FR-123-NFPA 780-2020

First Revision No. 72-NFPA 780-2020 [Section No. L.4.1.1]

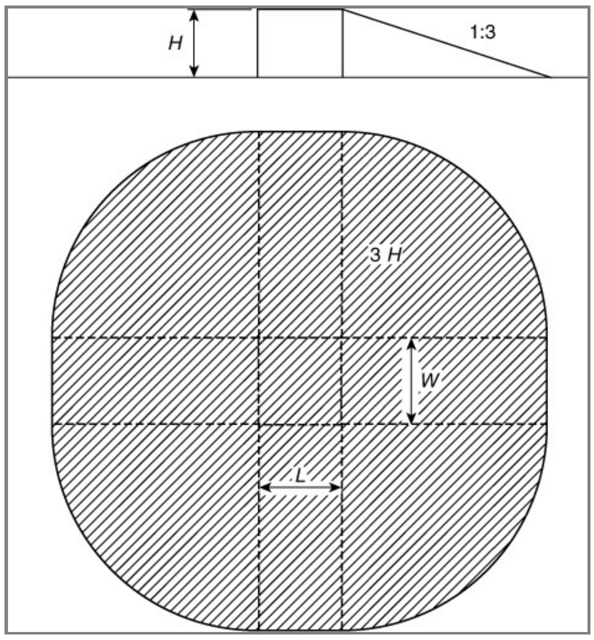
L.4.1.1

The equivalent collection area of a rectangular structure with length *L*, width *W*, and height *H (see Figure L.4.1.1)* is as follows:

$$A_D = LW + 6H(L+W) + \pi 9H^2$$

$$A_D = LW + 6H(L+W) + 9\pi H^2 \quad \text{[L.4.1.1]}$$

Figure L.4.1.1 Calculation of the Equivalent Ground Collection Area for a Rectangular Structure.



Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 12:36:01 EST 2020

Committee Statement

Committee Statement: This corrects the position to standard nomenclature and is consistent with the text in the annex.

Response Message: FR-72-NFPA 780-2020

First Revision No. 68-NFPA 780-2020 [Section No. L.5.2.2]

L.5.2.2

Table L.5.2.2 provides a simple method of calculating and using the assessment methods described in Section L.5.

Table L.5.2.2 Simplified Risk Calculation

Data Input Equations	Computation	Result
Equivalent collection area: $A_D = LW + 6H(L + W) + \pi 9H^2$*	L = W = H = H^2 =	A_D =
Expected annual threat occurrence: $N_{\cancel{D}}$ <u>G</u> = $(N_G)(A_D)(C_D)(10^{-6})$	$N_{\cancel{D}}$ <u>G</u> = A_D = C_D =	N_D =
Tolerable lightning frequency to the structure: $N_C = (1.5 \times 10^{-3})/C$, where $C = (C_2)(C_3)(C_4)(C_5)$ If $N_D \leq N_C$, an LPS ~~could be~~ <u>is</u> optional. If $N_D > N_C$, an LPS is recommended.	C_2 = C_3 = C_4 = C_5 = C =	N_C =

*Use the appropriate collection area calculation as defined in L.4.1.1.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 12:06:54 EST 2020

Committee Statement

Committee Statement: Table L5.2.2 result variable for Expected annual threat occurrence is identified as ND however this is the result variable. In the computation column of Table L.5.2.2, ND is changed to NG.

Response Message: FR-68-NFPA 780-2020

Public Input No. 12-NFPA 780-2020 [Section No. L.5.2.2]

First Revision No. 69-NFPA 780-2020 [Section No. L.6.6.1.2]

L.6.6.1.2

The annual threat of occurrence due to strikes near a structure (N_M) is given by the following equation *(see Figure L.6.6.1.2)*:

$$N_M = N_G(A_M - A_D)(C_D)10^{-6} \text{events/year} \quad \textbf{[L.6.6.1.2]}$$

where:

N_G = lightning ground flash density in flashes/km^2/year *(see Section L.2)*

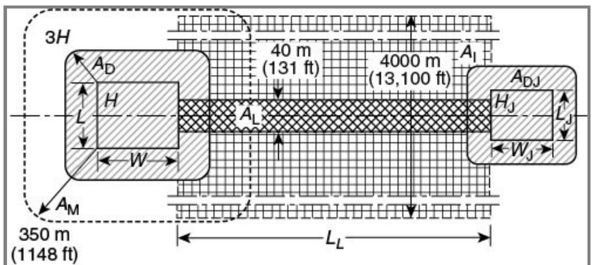
A_M = collection area of flashes near the structure (m^2) *(see Figure L.6.6.1.2)*

A_D = equivalent collection area of the structure (m^2) *(see Figure L.6.6.1.2)*

C_D = environmental coefficient *(see Table L.4.2)*

The collection area for flashes near the structure (A_M) includes the area extending a distance of ~~500 m (1640 ft)~~ 350 m (1148 ft) around the perimeter of the structure. For cases where N_M is negative, a value of 0 is assigned to N_M.

Figure L.6.6.1.2 Collection Areas (A_D, A_M, A_L, A_{DJ}, A_I). *(Source: IEC.)*



Notes:
1. Area A_D is the area subject to direct strikes to the facility *(see L.6.6.1.1)*.
2. Area A_M is the area subject to strikes near the structure *(see L.6.6.1.2)*.
3. Area A_L is the area subject to direct strikes to the incoming service *(see L.6.6.1.3)*.
4. Area A_{DJ} is the area subject to strikes to the adjacent structure *(see L.6.6.1.4)*.
5. Area A_I is the area subject to strikes near the incoming service *(see L.6.6.1.5)*.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 12:13:22 EST 2020

Committee Statement

Committee Statement: This revision is made to correlate with IEC 62305-2.

Response Message: FR-69-NFPA 780-2020 See also FR-70

Public Input No. 162-NFPA 780-2020 [Sections L.6.6.1.2, L.6.6.1.3]

First Revision No. 70-NFPA 780-2020 [Section No. L.6.6.1.3]

L.6.6.1.3

The annual threat of occurrence due to a strike to an incoming service (N_L) is characterized by the following formula:

$$N_L = N_G A_L C_E C_T 10^{-6} \text{ events/year} \quad \textbf{[L.6.6.1.3]}$$

where:

N_G = lightning ground flash density in flashes/km^2/year *(see Section L.2)*

A_L = collection area of flashes striking the service (m^2) *(see Figure L.6.6.1.2)*

C_E = environmental coefficient of the incoming service *(see Table L.6.7.1)*

C_T = correction factor for the presence of an HV/LV transformer located between the point of strike and the structure

~~A_L = 40 × L_L~~

~~L_L = the length of the incoming service *(see Figure L.6.6.1.2)*~~

where:

A_L = 40 × L_L

L_L = the length of the incoming service *(see Figure L.6.6.1.2)*

Where the value of L_L ~~(used in the determination of A_L)~~ is not known, a value of 1 km ~~is~~ should be assumed for the assessment. ~~A default value of 500 Ωm can be used for soil resistivity (ρ) where this value cannot be determined.~~

If the installation incorporates underground cables run underneath a ground mesh, A_l could be assumed to be 0 for that cable set (N_L = 0).

C_T applies to line sections between the transformer and the structure. A value of 0.2 is applicable for installations having a transformer located between the strike and the structure. Otherwise, a value of 1 is assigned to this variable.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 12:16:19 EST 2020

Committee Statement

Committee Statement: The section layout is modified to increase clarity of the calculation and eliminate any confusion as to whether the collection area of flashes striking the service is related to the HV/LV transformer. The soil resistivity factor is removed since it is no longer used in this section.

Response Message: FR-70-NFPA 780-2020

First Revision No. 71-NFPA 780-2020 [Section No. L.6.6.1.4]

L.6.6.1.4

The annual threat of occurrence due to flashes to an adjacent structure (N_{DJ}) at the end of an incoming service can be estimated ~~by~~ using the following equation:

$$\cancel{N_{DJ} = N_G A_{DJ} C_D C_T 10^{-6} \text{ events/year}} \quad A_{DJ} = LW + 6H(L+W) + 9\pi H^2 \qquad \text{[L.6.6.1.4]}$$

~~where:~~

~~N_G = lightning ground flash density in flashes/km^2/year *(see Section L.2)*~~

~~A_{DJ} = equivalent collection area of the adjacent structure *(see Figure L.6.6.1.2, where A_{DJ} = 40 × L_L and L_L = the length of the incoming service)*~~

~~C_D = environmental coefficient *(see Table L.4.2)*~~

~~C_T = correction factor for the presence of an HV/LV transformer located between the point of strike and the structure~~

~~C_T applies to line sections between the transformer and the structure. A value of 0.2 is applicable for installations having a transformer located between the strike and the structure. Otherwise, a value of 1 is assigned to this variable.~~

For additional details, see also L.4.1.1 .

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 12:29:37 EST 2020

Committee Statement

Committee Statement: ADJ deals with strikes to an adjacent structure but the equation in L.6.6.1.4 is for strikes to a line. The equation in L.6.6.1.4 should be equivalent to ADJ.

Response Message: FR-71-NFPA 780-2020

First Revision No. 73-NFPA 780-2020 [Section No. L.6.6.1.5]

L.6.6.1.5

The annual threat of occurrence due to flashes near a service (N_I) can be estimated ~~by~~ using the following equation:

$$N_I = N_G A_I C_E C_T 10^{-6} \text{events/year} \quad \textbf{[L.6.6.1.5]}$$

where:

N_G = lightning ground flash density in flashes/km^2/year *(see Section L.2)*

A_I = equivalent collection area of flashes to ground near the service (m^2) *(see Figure L.6.6.1.2)*

C_E = service environmental coefficient *(see Table L.6.7.1 where A_I= 4000 × L_L and L_L= the length of the incoming service)*

C_T = correction factor for the presence of an HV/LV transformer located between the point of strike and the structure

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 12:39:58 EST 2020

Committee Statement

Committee Statement: The word “by” was removed to grammatically correct sentence.

Response Message: FR-73-NFPA 780-2020

First Revision No. 74-NFPA 780-2020 [Section No. L.6.6.3 [Excluding any Sub-Sections]]

The ~~value of L_T, L_F, and L_O can be determined in terms of the relative~~ probability of losses related to the injury of personnel is relative to the number of victims ~~from the following approximate relationship~~ , which can be found with the following equation :

$$\cancel{L_A = (n_Z / n_T) \times (t_Z / 8760)} \quad P_P = (n_Z / n_T) \times (t_Z / 8760) \qquad \textbf{[L.6.6.3]}$$

where:

~~L_A~~ P_P = ~~value for loss of human life~~ probability that a person will be in a dangerous place

n_Z = number of possible endangered persons (victims)

n_T = expected total number of persons (in the structure)

t_Z = time in hours per year ~~for~~ during which the persons are present in a dangerous place, either outside ~~of~~ the structure (L_T only) or inside the structure (L_T, L_F, and L_O)

Typical mean values of L_T, L_F, and L_O, for use when the determination of n_Z, n_T, and t_Z is uncertain or difficult, are ~~given~~ provided in Table L.6.7.9.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 13:01:08 EST 2020

Committee Statement

Committee Statement: The sentence is modified to reflect the equation. LA in the equation is changed to PP and the associated identifier below the equation is modified accordingly.

Response Message: FR-74-NFPA 780-2020

First Revision No. 75-NFPA 780-2020 [Section No. L.6.6.3.3]

L.6.6.3.3 Failure of Internal Systems.

The following equation calculates the value of loss due to failure of internal systems:

$$L_C = L_M = L_W = L_Z = L_O \quad \textbf{[L.6.6.3.3]}$$

where:

L_C = value of loss due to direct strike to the structure

L_M = value of loss due to a strike near the structure

L_W = value of loss due to a strike to a service connected to the structure

L_Z = value of loss due to a strike near a service connected to the structure

L_O = mean value of loss of internal system *(see ~~Table L.6.7.8~~ Table L.6.7.9)*

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 13:08:18 EST 2020

Committee Statement

Committee Statement: Reference to table for Lo is incorrect. Table L.6.7.9 is correct reference.

Response Message: FR-75-NFPA 780-2020

First Revision No. 125-NFPA 780-2020 [Section No. N.4]

N.4 ~~Charge~~ Potential Equalization.

~~Charge~~ Potential equalization of the contained product to grounded metal tank components should be considered~~. If not equalized, the charge on the product could arc to another mass at a different potential during a direct or nearby lightning strike. One technique is~~ to reduce the probability of arcing. One technique to equalize the potential of the product to that of the metal bodies is to install a low-impedance conductive appliance ~~with low electrical resistance~~ inside the tank that is suspended from and ~~electrically~~ bonded to the thief ~~hatch~~ collar ~~and extending~~ , extends to the bottom of the tank, ~~penetrating~~ and penetrates the surface of the product at all fill levels. This will not equalize ~~charge~~ the potential in all areas of the product~~,~~ but can serve to equalize ~~charge~~ potential local to the appliance.

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Tue Dec 01 12:45:26 EST 2020

Committee Statement

Committee Statement: The term charge equalization is not appropriate for bonding and the term potential equalization is more appropriate. The section is revised to clarify the example provided regarding potential equalization.

Response Message: FR-125-NFPA 780-2020

Public Input No. 15-NFPA 780-2020 [Section No. N.4]

First Revision No. 77-NFPA 780-2020 [Section No. O.1.1]

O.1.1 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 70®, *National Electrical Code®*, ~~2020~~ 2023 edition.

NFPA 70B, *Recommended Practice for Electrical Equipment Maintenance*, ~~2019~~ 2022 edition.

NFPA 70E®, *Standard for Electrical Safety in the Workplace®*, ~~2018~~ 2021 edition.

NFPA 302, *Fire Protection Standard for Pleasure and Commercial Motor Craft*, 2020 edition.

NFPA 407, *Standard for Aircraft Fuel Servicing*, ~~2017~~ 2022 edition.

NFPA 410, *Standard on Aircraft Maintenance*, ~~2015~~ 2020 edition.

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Mon Nov 23 13:38:24 EST 2020

Committee Statement

Committee Statement: Updates applicable referenced standards to current version in effect at time of publication.
Response Message: FR-77-NFPA 780-2020

Public Input No. 37-NFPA 780-2020 [Section No. O.1.1]

First Revision No. 78-NFPA 780-2020 [Section No. O.1.2.2]

O.1.2.2 Federal Aviation Administration (FAA) Publications.

US Department of Transportation, ~~Subsequent Business Office, Annmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785~~ 1200 New Jersey Ave SE, Washington, DC 20590 . FAA Advisory Circulars are also available at http://www.faa.gov/airports/resources/advisory_circulars/.

FAA Advisory Circular 150/5340-~~30F~~ 30J , *Design and Installation Details for Airport Visual Aids*, ~~September 29, 2011~~ February 2018 .

FAA Advisory Circular 150/5345-~~42F~~ 42J , *Specification for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories*, ~~October 17, 2006~~ September 2019 .

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 13:46:46 EST 2020

Committee Statement

Committee Statement: Updates applicable referenced standards to current version in effect at time of publication.

Response Message: FR-78-NFPA 780-2020

Public Input No. 36-NFPA 780-2020 [Section No. O.1.2.2]

First Revision No. 79-NFPA 780-2020 [Section No. O.1.2.6]

O.1.2.6 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

~~ANSI/~~ UL 497, ~~*Standard for*~~ *Safety Protectors for Paired-Conductor Communications Circuits*, ~~2009, revised~~ 2013.

UL 497A, *Standard for Secondary Protectors for Communications Circuits* , 2019.

UL 497B, *Standard for Protectors for Data Communications and Fire-Alarm Circuits* , 2004.

UL 497C, *Standard for Protectors for Coaxial Communications Circuits* , 2001.

UL 497D, *Outline of Investigation for Component Secondary Protectors for Communications Circuits Used with Specified Voltage Suppression* , 2007.

UL 497E, *Outline of Investigation for Protectors for Antenna Lead-In Conductors* , 2007.

~~ANSI/UL 1449, *Standard for Safety for Transit Voltage Surge Suppressors* , 2nd edition, 1996.~~

~~ANSI/~~ UL 1449, ~~*Standard for*~~ *Safety for Surge Protective Devices*, ~~2016~~ 2018 .

Submitter Information Verification

Committee: LIG-AAA

Submittal Date: Mon Nov 23 13:47:28 EST 2020

Committee Statement

Committee Statement: Updates applicable referenced standards to current version in effect at time of publication. UL 1449 2nd edition was removed because it is no longer referenced or applicable, as TVSS devices are superseded.

Response Message: FR-79-NFPA 780-2020

Public Input No. 165-NFPA 780-2020 [Section No. O.1.2.6]

First Revision No. 80-NFPA 780-2020 [Section No. O.2.4]

O.2.4 UL Publications.

~~UL LLC~~ Underwriters Laboratories Inc. , 333 Pfingsten Road, Northbrook, IL 60062-2096.

~~ANSI/~~ UL 497, ~~*Standard for*~~ *Protectors for Paired Conductor Communications Circuits*, ~~7th Edition, 2001~~ revision 2017 .

~~ANSI/~~ UL 497A, ~~*Standard for*~~ *Secondary Protectors for Communications Circuits*, ~~3rd Edition, 2001~~ revision 2019 .

~~ANSI/~~ UL 497B, ~~*Standard for*~~ *Protectors for Data Communications and Fire Alarm Circuits*, ~~4th Edition, 2004~~ revision 2017 .

~~ANSI/~~ UL 497C, ~~*Standard for*~~ *Protectors for Coaxial Communications Circuits*, ~~2nd Edition, 2001~~ revision 2017 .

UL 497E, *Outline of Investigation for Protectors for Antenna Lead-In Conductors*, revision 2011.

Submitter Information Verification

Committee: LIG-AAA
Submittal Date: Mon Nov 23 13:48:44 EST 2020

Committee Statement

Committee Statement: Updates applicable referenced standards to current version in effect at time of publication.
Response Message: FR-80-NFPA 780-2020

Public Input No. 166-NFPA 780-2020 [Section No. O.2.4]