



UL 96A

STANDARD FOR SAFETY

Installation Requirements for Lightning Protection Systems

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UL Standard for Safety for Installation Requirements for Lightning Protection Systems, UL 96A

Thirteenth Edition, Dated March 18, 2016

Summary of Topics

The Thirteenth Edition of the Standard for Installation Requirements for Lightning Protection Systems, UL 96A, has been issued to incorporate the proposal dated October 2, 2015. This proposal includes the following:

- ***Deletion of paragraph 9.2.3 and addition of exception to paragraph 9.1.3.***

The revised requirements are substantially in accordance with Proposal(s) on this subject dated October 2, 2015.

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MARCH 18, 2016

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UL 96A

Standard for Installation Requirements for Lightning Protection Systems

Prior to the sixth edition, previous numbered and unnumbered editions covering Installation Requirements for Lightning Protection Systems have been published since 1916. The sixth edition was titled Installation Requirements for Master Labeled Lightning Protection Systems.

Sixth Edition – March, 1958
Seventh Edition – April, 1960
Eighth Edition – June, 1963
Ninth Edition – April, 1982
Tenth Edition – May, 1994
Eleventh Edition – July, 2001
Twelfth Edition – May, 2007

Thirteenth Edition

March 18, 2016

This UL Standard for Safety consists of the Thirteenth Edition.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <http://csds.ul.com>.

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INTRODUCTION

1 Scope

1.1 These requirements cover the installation of lightning protection systems on all types of structures other than structures used for the production, handling, or storage of ammunition, explosives, flammable liquids or gases, and other explosive ingredients including dust.

1.2 These requirements apply to lightning protection systems that are complete and cover all parts of a structure. Partial systems are not covered by this standard.

1.3 These requirements shall not apply to adjacent structures.

1.4 Adjacent structures shall be considered separate structures.

1.5 Adjacent structures with lightning protection shall be considered part of the structure if the adjacent structure's lightning protection system complies with this standard and is connected to the lightning protection system of the structure in accordance with Section 10.4.

1.6 Walkways that are attached to a structure shall be considered part of that structure.

1.7 Free standing Walkways shall be considered an adjacent structure under the following conditions:

a) It is separated by a fire wall and conductive media that is shared by both facilities has an SPD in accordance with Section 13.

b) It is isolated by a distance of not less than six feet and conductive media that is shared by both facilities has an SPD in accordance with Section 13.

1.8 This standard does not cover lightning protection for:

a) Electric transmission lines or open air distribution racks,

b) Outdoor substations or switch yards, and

c) Electric generators unenclosed by a building other enclosed structure.

1.9 Enclosed generators and conventional building structures at or associated with generators or power plants, etc. are covered.

1.10 These requirements do not cover lightning protection components, which are covered by the Standard for Lightning Protection Components, UL 96.

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2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this standard shall comply with the requirements for that component.

2.2 A component is not required to comply with a specific requirement that:

- a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or
- b) Is superseded by a requirement in this standard.

2.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

2.5 Components utilized in the installation of a lightning protection system covered by this standard shall comply with the Standard for Lightning Protection Components, UL 96 or other applicable UL Standards.

Exception: Screws, bolts, nuts, washers and nails.

3 Units of Measurement

3.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

4 Undated References

4.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

5 Glossary

5.1 For the purpose of this standard, the following definitions apply.

5.2 ADJACENT STRUCTURE – A structure that is physically separated by a fire wall or greater than six feet of distance separating it from a structure with lightning protection.

5.3 AIR TERMINAL – A type of strike termination device intentionally installed for the purpose of intercepting lightning flashes. These items are sometimes referred to as lightning rods.

5.4 BONDING (POTENTIAL EQUALIZATION) – An electrical connection between an electrically conductive object and a component of a lightning protection system with a secondary or main-size conductor intended to significantly reduce potential differences created by lightning currents in the main lightning conductors and other grounded metal objects.

5.5 BUILDINGS:

- a) Ordinary Building – A building of common or conventional construction used for ordinary purposes, whether commercial, farm, industrial, institutional, or residential.
- b) Class I Ordinary Building – A building that is not more than 75 feet (22.9 m) high.
- c) Class II Ordinary Building – A building that is more than 75 feet (22.9 m) high or greater.
- d) Metal-Clad Building – A building with either sides or roof made of or covered with sheet metal.
- e) Metal-Framed Building – A building with electrically continuous framing of sufficient size and conductivity to be used as part of the lightning protection system.

5.6 CHIMNEY – A smoke or vent stack not meeting the requirements of a heavy-duty stack.

5.7 CONDUCTOR – The portion of a lightning protection system intended to transfer lightning discharge currents between strike termination devices and ground or to provide potential equalization between conductive bodies in/on the structure.

- a) Main Conductor – A conductor intended to conduct primary lightning currents that interconnects strike termination devices with grounding electrodes.
- b) Secondary Conductor – A conductor that connects metal bodies within the zone of protection to the lightning protection system to eliminate electrical potential that may create arcing.

5.8 EARTH – Finished grade level around a structure.

5.9 ELECTRICALLY CONTINUOUS – An uninterrupted electrically conductive path or one made electrically continuous by being bonded together by welding, brazing, compression fitting or suitable bonding plate.

5.10 FASTENER – An attachment to secure a conductor to a structure.

5.11 GALVALUME – An aluminum coated sheet steel product. It is comprised of 55% aluminum, 1.6% silicon and 43.4% zinc. The coating is applied to the base metal in a continuous hot dip method. The product is described in ASTM-792, coating classes of AZ 50, AZ 55 and AZ 60. These classes equate to an average minimum coating thickness of .50, .55 and .60 ounces per square foot.

5.12 GROUND GRID – A system of grounding electrodes consisting of interconnected bare cables buried in the earth to provide a common ground.

5.13 GROUNDING ELECTRODE – That portion of a lightning protection system extending into the earth, such as a ground rod, ground plate, or conductor, serving to bring the lightning protection system into electrical contact with the earth.

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5.14 GROUNDED – Connected to earth, or to a conductive material that is connected to earth, so that electric charges are distributed freely to the earth.

5.15 LIGHTNING PROTECTION SYSTEM – A complete system of strike termination devices, conductors, grounding electrodes, interconnecting conductors, surge protective devices, connectors or fittings.

5.16 LOOP CONDUCTOR – A conductor:

- a) That encircles a structure; and
- b) That is used to interconnect grounding electrodes, main conductors, or other grounded bodies.

5.17 METAL BODY:

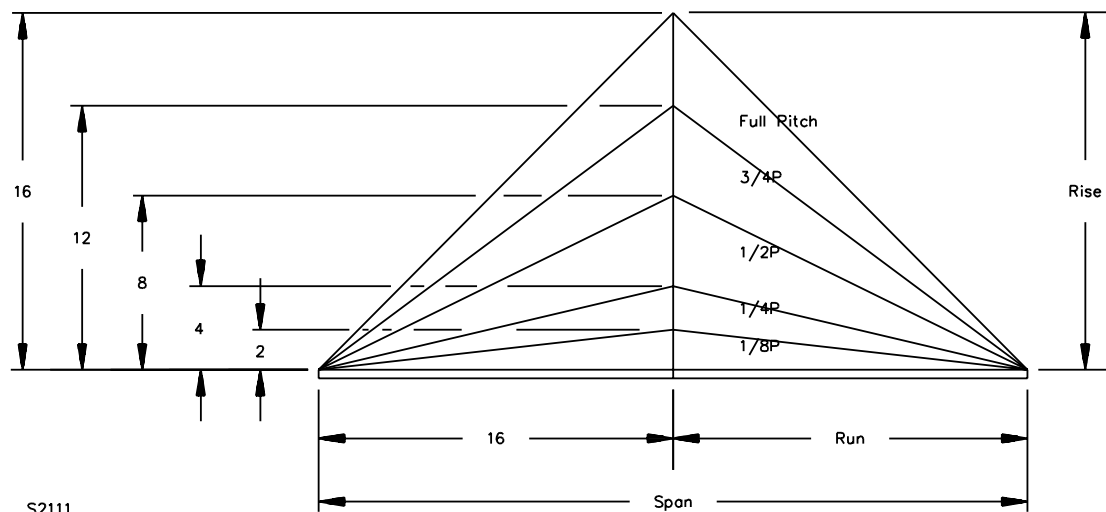
- a) Grounded (Non-Isolated) Metal Body – A metal body having a ground path independent of the lightning protection system.
- b) Isolated (Ungrounded) Metal Body – A metal body having no ground path.

5.18 ROOF, FLAT OR GENTLY SLOPING – A roof having a span of 40 feet (12.2 m) or less and a pitch of less than 1/8, or a roof having a span exceeding 40 feet (12.2 m) and a pitch less than 1/4. Roof pitch is determined by the method illustrated in Figure 5.1.

5.19 ROOF, TYPES – Typical roof types are shown in Figure 5.2.

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Figure 5.1
Determination of roof pitch



$$\text{Pitch (P)} = \frac{\text{Rise}}{\text{Run}}$$

Example: If Rise = 3 units, and Run = 12 units, Pitch = $3/12 = 1/4$

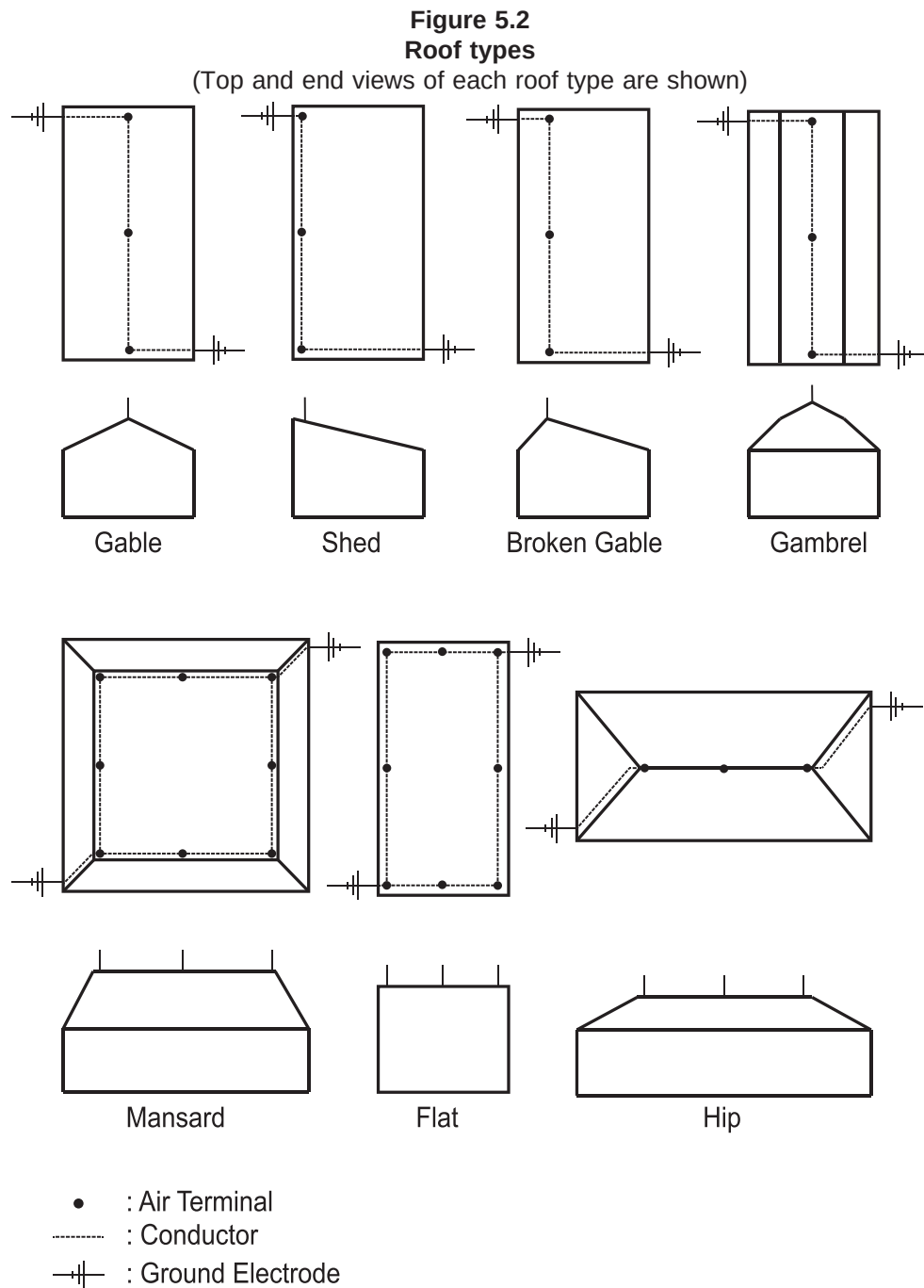
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5.20 SECONDARY ROOF AREA – A secondary roof is less than 10 percent of the total roof area of the protected building and lower than adjacent roofs.

5.21 STACK, HEAVY-DUTY – A smoke or vent stack more than 75 feet (22.9 m) high, and in which the cross-sectional area of the flue is more than 500 square inches (0.3 m²).

5.22 STRIKE TERMINATION DEVICE – A metallic component of a lightning protection system that intercepts lightning flashes and connects them to a path to ground.

5.23 STRIKING DISTANCE – The distance over which final breakdown of the initial strike to ground or to a grounded object occurs.

5.24 STRUCTURE – That which is built or constructed.

5.25 SURGE PROTECTIVE DEVICE (SPD) – A device composed of at least one non-linear component and intended for limiting surge voltages on equipment by diverting or limiting surge current and is capable of repeating these functions as specified.

5.26 ZONE OF PROTECTION – The space adjacent to a grounded air terminal or mast or overhead ground wire that is substantially immune to direct strokes of lightning.

PROTECTION FOR ORDINARY BUILDINGS

6 General

6.1 A system on a Class II building shall be installed in accordance with the requirements for a Class I building and with the following requirements.

a) Air terminals and conductors shall be Class II.

b) Splices and cable connectors shall be metal and shall be secured with bolts or welds that are rated for use on Class II structures.

c) When part of a structure is over 75 feet (22.9 m) high (such as a steeple), and the main portion is less than 75 feet (22.9 m) high, the requirements for Class II components shall apply only to that portion over 75 feet (22.9 m) high. Class II conductors from the higher portion shall be continuous to ground and shall be interconnected with the balance of the system.

6.2 Lightning protection systems shall be installed in a neat, professional manner.

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7 Materials

7.1 A lightning protection system shall be made of materials that are resistant to corrosion or shall be acceptably protected against corrosion as specified in the Standard for Lightning Protection Components, UL 96.

7.2 Metals shall not be used in combinations that form electrolytic corrosion (metals that are not galvanically compatible) that accelerates their degradation (corrosion or oxidation) in the presence of moisture. This requirement is applicable to lightning protection system components as well as the surface material on which they are mounted. For example, a combination of copper and aluminum shall not be used. See 7.4 – 7.7. Some examples of metals acceptable for use with copper and aluminum are as follows:

a) Metals acceptable for use with copper:

Nickel

Brass

Tin

Lead

Stainless Steel

Monel

b) Metals acceptable for use with aluminum:

Magnesium

Zinc

Galvanized Steel

Stainless Steel

Lead

Wrought Iron

Galvalume

7.3 A conductor that runs through metal pipe or tubing shall be galvanically compatible as specified in 7.2.

7.4 A copper lightning protection component shall not be installed directly on aluminum surfaces or external galvanized steel surfaces. See 7.2.

Exception: Copper conductor shall be allowed to be run in galvanized conduit when the conductor is bonded to the conduit at the top and bottom and is sealed at the top with a through roof assembly listed for the purposes.

7.5 An aluminum lightning protection component shall not be installed directly on copper roofing material or other copper surface or below the run off from a copper surface. See 7.2.

7.6 Aluminum components shall not be used where they come into direct contact with earth. Bimetallic fittings shall be used for the connection of aluminum down conductors to copper or copper-clad conductors. Where so used, bimetallic fittings shall not be installed less than 18 inches (460 mm) above earth level. See 7.2.

7.7 Bimetallic fittings shall be used when joining metals that are not galvanically compatible. See 7.2.

7.8 Aluminum conductors and components shall not be:

- a) Embedded in concrete or masonry;
- b) In direct contact with a surface coated with an alkaline base paint; or
- c) Installed in wet locations, for example inside eave troughs or downspouts.

8 Strike Termination Devices

8.1 General

8.1.1 A metal body that is 3/16 inch (4.8 mm) thick or greater that is subject to a direct lightning strike may serve as a strike termination device and shall be connected to the lightning protection system. The connections shall be main-size and provide a two-way path to ground as is required for air terminals.

8.1.2 Strike termination devices shall be installed to provide a zone of protection in accordance with Section 8.2 for each part of a structure that is exposed to direct lightning strikes.

8.1.3 Air terminals are not required for parts of a structure located within a zone of protection.

8.1.4 Strike termination devices that are a permanent part of the structure and that are 3/16 inch (4.8 mm) thick or more shall be connected to the lightning protection system using main-size conductors and a main size bonding plate/connector as described 12.10 and shall have a two-way path to ground as is required for air terminals.

8.1.5 An air terminal shall be placed not more than 2 feet (610 mm) from the ends of each ridge, edge, or outside corner of roofs. See Figure 8.2.

8.1.6 Where air terminals are used, they shall be secured against overturning either by attachment to the object to be protected or by means of braces that are permanently and rigidly attached to the building. See Figure 8.3. Each terminal that is more than 24 inches (610 mm) in length shall be supported either:

- a) Utilizing a brace that is at a point no less than one-half the height of the air terminal, or
- b) Secured to the object or structure at a minimum of two locations, separated by a minimum distance between the securement points of 18 inches (457.2 mm) and a maximum distance from the highest securement point and the tip of the air terminal not exceeding 60 inches (1524 mm). The attachment of the air terminal to the base is not considered one of the two bracing locations.

8.1.7 The wind-resistance area of an ornament or decoration on a freestanding, un-braced air terminal shall not exceed 20 square inches (130 cm²) in any plane. A ball, 5 inches (127 mm) or less in diameter, complies with this requirement.

8.2 Zone of protection

8.2.1 General

8.2.1.1 The zone of protection shall be determined by one or more of the methods described in the following: 8.2.2, 8.2.3, or 8.2.4.

8.2.2 Air terminal placement

8.2.2.1 When establishing a perimeter zone of protection, the tip of an air terminal shall be at least 10 inches (254 mm) above the object to be protected if the interval between air terminals is not more than 20 feet (6.1 m) and at least 24 inches (610 mm) above the object to be protected, or if the interval between air terminals is more than 20 feet (6.1 m) but not more than 25 feet (7.6 m). See Figure 8.3.

8.2.2.2 When establishing a zone of protection for flat or gently sloping roofs exceeding 50 feet (15.2 m) in width or length, air terminals shall be located at intervals not exceeding 50 feet (15.2 m) on the flat or gently sloping areas. See Figure 8.1. Also see 9.2.2.

8.2.2.3 Air terminals shall be placed as described in 8.1.5 on ridges of ridged roofs, or around the perimeter of a flat or gently sloping roof.

8.2.2.4 A pitched roof with eaves height of 50 ft (15.2 m) or less above grade with no projections shall require protection for the ridge only, where there is no horizontal portion of the building that extends beyond the eaves, other than a gutter. Pitched roofs with eaves height over 50 ft (15.2 m) shall have air terminals located in accordance with 8.1.5 and 8.2.2.

8.2.3 Rolling sphere

8.2.3.1 A zone of protection for a structure may be represented by the area under an imaginary rolling sphere having a radius of 150 feet (45.7 m), under all of the following conditions:

- a) The sphere never touches the building directly;
- b) The sphere is tangent to earth and in contact with properly spaced perimeter air terminals;
- c) The sphere rests on three or more air terminals properly spaced as determined by using the rolling sphere concept so that the sphere never touches the structure; and
- d) All possible placements (meaning three-dimensional) of the sphere shall be considered when determining the zone of protection using the rolling sphere model.

See Figures 8.4, 8.5, 8.6, and 8.7 for a graph and illustrations showing zones of protection and applicable computations determined by using the rolling sphere concept of 8.2.3.

8.2.3.2 A protected building protects lower building sections that lie within its zone of protection described in 8.2.3. An example is shown in Figure 8.7 where two higher protected sections of the building protect a lower section.

8.2.3.3 A protected building that is more than 150 feet (45.7 m) high provides protection for lower roof areas starting at 150 feet (45.7 m) and below when the lower area is located under an arc that has a 150 foot (45.7 m) radius and that is tangent to the side of the protected building and to the earth. See Figure 8.4.

8.2.4 Protective angle

8.2.4.1 A strike termination device that is not more than 25 feet (7.6 m) above earth protects lower areas in a one-to-two zone of protection.

8.2.4.2 A strike termination device that is more than 25 feet (7.6 m) but not more than 50 feet (15.2 m) above earth protects lower areas in a one-to-one zone of protection.

8.3 Dormers

8.3.1 Dormers that are as high or higher than the main roof shall be protected with air terminals, cable, down conductors, and grounds as normally specified in 8.2. Dormers and projections below the main ridge shall have air terminals on all areas extending outside a zone of protection as defined in 8.2. See Figure 9.2.

8.4 Intermediate ridges

8.4.1 A roof with a series of parallel ridges shall have air terminals along the end ridges at intervals not exceeding 20 feet (6 m) for air terminals 10 inches (254 mm) in height; or at intervals not exceeding 25 feet (7.6 m) for air terminals 24 inches (610 mm) in height. See 8.2.2.1. The intermediate area between ridges shall be protected according to the requirements for flat roofs in 8.2.2.2. Any intermediate ridge higher than an end ridge shall be protected in a manner similar to the end ridges. See Figure 8.8.

8.4.2 An air terminal shall be placed within 2 feet (610 mm) of the end of each intermediate ridge. See Figure 8.8.