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NATIONAL STANDARD

# ANSI/CAN/UL 96:2020

## STANDARD FOR SAFETY

### Lightning Protection Components

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UL Standard for Safety for Lightning Protection Components, ANSI/CAN/UL 96

Sixth Edition, Dated June 30, 2016

### **Summary of Topics**

***This revision of ANSI/CAN/UL 96, has been issued to reflect the latest ANSI and SCC approval dates, and to incorporate the proposal dated October 18, 2019.***

#### **• Additional Stainless Steel Hardware; [6.1](#)**

The revised requirements are substantially in accordance with Proposal(s) on this subject dated October 18, 2019.

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ANSI/UL 96-2020

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**ANSI/CAN/UL 96:2020**

### **Standard for Lightning Protection Components**

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#### **Sixth Edition**

**June 30, 2016**

This ANSI/UL Standard for Safety consists of the Sixth Edition including revisions through March 27, 2020.

The most recent designation of ANSI/UL 96 as an American National Standard (ANSI) occurred on March 27, 2020. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, Preface or SCC Foreword.

This standard has been designated as a National Standard of Canada (NSC) on March 27, 2020.

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## Preface (UL)

This is the Sixth Edition of the ANSI/CAN/UL 96, Standard for Safety for Lightning Protection Components.

UL is accredited by the American National Standards Institute (ANSI) and the Standards Council of Canada (SCC) as a Standards Development Organization (SDO).

This Standard has been developed in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization.

This ANSI/CAN/UL 96 Standard is under continuous maintenance, whereby each revision is approved in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization. In the event that no revisions are issued for a period of four years from the date of publication, action to revise, reaffirm, or withdraw the standard shall be initiated.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

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This Edition of the Standard has been formally approved by the UL Standards Technical Panel (STP) on Lightning Protection Components, STP 96.

This list represents the STP 96 membership when the final text in this standard was balloted. Since that time, changes in the membership may have occurred.

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This Standard is intended to be used for conformity assessment.

The intended primary application of this standard is stated in its scope. It is important to note that it remains the responsibility of the user of the standard to judge its suitability for this particular application.

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## INTRODUCTION

### 1 Scope

1.1 These requirements cover lightning protection components for use in the installation of complete systems of lightning protection on buildings and structures.

1.2 These requirements do not cover the installation of lightning protection components. Products of this type are covered by the Standard for Installation Requirements for Lightning Protection Systems, UL 96A, and the Installation Code for Lightning Protection Systems, CAN/CSA-B72-M87.

1.3 Lightning protection components are divided into three classes, according to their intended application as defined in [5.3](#) – [5.5](#).

### 2 Units of Measurement

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

### 3 Undated References

3.1 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.

### 4 Normative References

4.1 Products covered by this standard shall comply with the reference installation codes and standards noted in this section as appropriate for the country where the product is to be used. When the product is intended for use in more than one country, the product shall comply with the installation codes and standards for all countries where it is intended to be used.

4.2 The following standards are referenced in this standard, and portions of these referenced standards and codes identified in this standard may be essential for compliance.

#### UL Standards

UL 96A  
*Installation Requirements for Lightning Protection Systems*

UL 467  
*Grounding and Bonding Equipment*

UL 651  
*Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings*

#### American Society for Testing and Materials (ASTM) Standards

ASTM A 313/A 313-95a  
*Standard Specification for Stainless Steel Spring Wire*

## CSA Group Standards

CAN/CSA B72-M87

*Installation Code for Lightning Protection Systems*

## Institute of Electrical and Electronics Engineers (IEEE) Standards

IEEE 837

*Standard for Qualifying Permanent Connections Used in Substation Grounding*

## 5 Glossary

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

5.2 AIR TERMINAL – A component of a lightning protection system that is intended to intercept lightning flashes.

5.3 CLASS I COMPONENTS – All conductors, fittings, and fixtures necessary to protect ordinary buildings and structures not more than 23 m (75 ft) high.

5.4 CLASS II COMPONENTS – All conductors, fittings, and fixtures necessary to protect ordinary buildings and structures more than 23 m (75 ft) high.

5.5 CLASS III COMPONENTS – Components constructed for use in a system to protect a heavy duty stack.

5.6 CONDUCTOR – The portion of a lightning protection system intended to carry the lightning discharge between air terminals and ground.

a) Main Conductor – A conductor that interconnects air terminals and serves as a down lead to ground.

b) Secondary Conductor – A conductor that connects metal bodies to the lightning protection system to eliminate the buildup of an electrical potential between them during a lightning strike.

5.7 HEAVY-DUTY STACK – A smoke or vent stack that is more than 23 m (75 ft) high and has a flue with a cross sectional area greater than 0.3 m<sup>2</sup> (500 in<sup>2</sup>).

## CONSTRUCTION

### CLASS I COMPONENTS

## 6 General

6.1 Class I components shall be made of copper, copper alloy, aluminum or aluminum alloy with hardware made from stainless steel, unless otherwise required in this Standard, as outlined below:

a) Copper conductors and air terminals shall be made from electrical grade copper, C11000, generally designated as being 95% conductivity when annealed.

b) Aluminum conductors shall be made of electrical grade aluminum, with a minimum chemical composition of 99% aluminum.

c) Aluminum air terminals, stampings and couplings, shall be made with an alloy having a minimum chemical composition of 90% aluminum.

d) Stainless Steel hardware, such as nuts, bolts, washers, screws, threaded rods, and fasteners shall be of minimum 18-8 grade (Chromium & Nickel content) with acceptable alloys being 302, 303, 304, and 316.

e) All copper alloys other than brass shall have a minimum copper content of 80%.

f) Aluminum alloys suitable for use in castings shall have a minimum aluminum content of 85%.

g) Brass alloys suitable for use in couplings, connectors, bases and fittings shall have a minimum copper content of 60%.

## 7 Air Terminals

7.1 An air terminal may be of one piece construction or may have several separate parts including: point (tip portion), elevation conductor, and base support.

7.2 An air terminal shall not be less than 254 mm (10 in) long and shall comply with the requirements in [Table 7.1](#).

**Table 7.1**  
**Minimum air terminal dimensions**

Material	Construction	Diameter <sup>a</sup>		Base end thread diameter		Wall thickness		Cross-Sectional area <sup>a</sup>	
		mm	(in)	mm	(in)	mm	(in)	mm <sup>2</sup>	(in <sup>2</sup> )
Copper and copper alloy	Solid	9.5	(3/8)	9.5	(3/8)	—	—	71	(0.110)
	Tubular	15.9	(5/8)	12.7	(1/2)	0.81	(0.032)	—	—
Aluminum	Solid	12.7	(1/2)	12.7	(1/2)	—	—	126	(0.196)
	Tubular	15.9	(5/8)	12.7	(1/2)	1.63	(0.064)	—	—

<sup>a</sup> The minimum diameter and minimum cross-sectional area are to be determined by measurements taken at various points along the axis of the air terminal for a distance not to exceed 50 percent of the total length of the air terminal measured from the threaded or base end and exclusive of the threaded portion or adapter of a tubular air terminal.

7.3 Each air terminal shall be provided with an integral base support or with not less than five full threads for attachment to the base support.

7.4 The threaded portion of an internally threaded air terminal shall have a minimum wall thickness of 1.6 mm (1/16 in), measured at the base of the threads.

7.5 A tubular air terminal shall be provided with a threaded adapter for attachment to the base support. The threaded adapter shall comply with the requirements in [7.3](#) and [Table 7.1](#) with respect to minimum thread size, and shall be securely attached to the air terminal.

7.6 The wind-resistance area of an ornament or decoration on a freestanding, un-braced air terminal shall not exceed 130 cm<sup>2</sup> (20 in<sup>2</sup>) in any plane. For example: A ball 127 mm (5 in) or less in diameter complies with this requirement.

7.7 Any decoration, ornament or accessory added to the top section of an air terminal, shall be a minimum of 4.8 mm (3/16 in) thick and comply with [7.6](#) for wind resistance.

7.8 A spring loaded air terminal adapter shall meet the following criteria:

- a) The materials used shall be stainless steel and comply with the Standard Specification for Stainless Steel Spring Wire ASTM A 313/A 313-95a.
- b) The spring shall be a closed spring with a minimum wire OD of 3.048 mm (0.120 in).
- c) The materials used for the adapter sections of the component shall meet the criteria in Section 6.
- d) The design of the adapter sections of the component that attach to the air terminal and base shall comply with 7.3 and 7.4.
- e) The adapter section of the component shall have a minimum length of 38.1 mm (1-1/2 in).
- f) The adapter section of the component shall have a minimum diameter of 7.94 mm (5/16 in) and a minimum surface contact with the interior or exterior of the spring, along the axis of the spring, for 12.7 mm (1/2 in) for each end of the adapter.
- g) Each spring loaded air terminal component shall have a breakaway wire securely attached to it.

## 8 Air Terminal Base Supports

8.1 The thickness of an air terminal base support shall not be less than the applicable value specified in Table 8.1.

**Table 8.1**  
**Thickness of air terminal base supports**

Material	Construction	Minimum thickness	
		mm	(in)
Copper or copper alloy	Cast	2.4	(3/32)
	Stamped	1.55	(0.061)
Aluminum	Cast	2.4	(3/32)
	Stamped	2.46	(0.097)

8.2 A threaded hub provided for the attachment of the air terminal shall have at least five full threads and, if internally threaded, shall have a wall thickness of not less than 1.6 mm (1/16 in) measured at the base of the threads.

8.3 A threaded hub is not required on a base support for a construction in which the air terminal is secured by a locknut on each side of the base support.

8.4 Each base support shall incorporate a connector fitting for connection to the lightning conductor. The conducting cross-sectional area of the base support, between the connector and the base of the air terminal, shall be equal to or greater than that of the conductor. The conductor shall contact the base for not less than 38 mm (1-1/2 in) on all sides of the cable.

*Exception: This requirement does not apply to a base support that complies with the Standard for Qualifying Permanent Connections Used in Substation Grounding, IEEE Std. 837. The applicable tests of IEEE Std. 837 shall be conducted with commercially available lightning protection conductors.*

8.5 At least two mounting holes that will accept a M5 x .8 (No. 10 – 24) or larger bolt or screw shall be provided in the support so that it can be permanently and rigidly fastened.



8.6 An adhesive base shall be constructed with a minimum footprint of 45.1612 cm<sup>2</sup> (7 in<sup>2</sup>) overall. These bases shall have a minimum of six openings of 6.35 mm (1/4 in) or greater and a minimum width of 50.8 mm (2 in).

8.7 An air terminals swivel coupling shall meet the following criteria:

- a) The materials used shall comply with [6.1](#) and constructed so as to comply with [7.3](#) and [7.4](#).
- b) Shall have a minimum length of 38.1 mm (1-1/2 in) per section or segment.
- c) Shall have a minimum surface contact area of 9.525 mm (3/8 in).
- d) Shall have a minimum bolt thread size of M6 x 1 (1/4-20) that is made of stainless steel.

8.8 An air terminal coupling shall meet the following criteria:

- a) The material used shall comply with [6.1](#) and constructed in compliance with [8.2](#).
- b) It shall have a minimum length of 31.5 mm (1-1/4 in).

## 9 Braces

9.1 An air-terminal brace shall be provided with two, three, or four legs and with one or two air-terminal guides.

9.2 A brace shall be made of 6.4-mm (1/4-in) minimum diameter rod of aluminum, copper/copper alloy, stainless steel or hot-dipped galvanized steel.

9.3 Each mounting foot shall be flattened and shall have at least two mounting holes that accepts a M5 x .8 (No. 10 – 24) or larger bolt or screw.

9.4 A brace that is made of steel shall be protected from corrosion by hot dipped galvanized coating.

## 10 Conductors

10.1 Among the various types of lightning conductors are as follows: rope lay, smooth twist, and loose-weave cable; flexible and solid-strip conductors; tubular; and round, rectangular, square, or star-shaped rod.

10.2 The twist or lay of wires in a cable is not specified but the cable shall be stranded tightly enough to form a symmetrical cable and to remain in a fixed position when installed.

10.3 The size and weight of Class I conductors shall be as specified in [Table 10.1](#) and [Table 10.2](#).

**Table 10.1**  
**Minimum dimensions of Class I main conductors**

Type of conductor	Material	
	Copper	Aluminum
Cable		
Strand Diameter	1.14 mm (0.045 in)	1.63 mm (0.064 in)
Weight	278 g/m (0.187 lb/ft)	141 g/m (0.095 lb/ft)
Area	29 mm <sup>2</sup> (57,400 circular mills)	50 mm <sup>2</sup> (98,600 circular mills)
Solid Strip		
Thickness	1.30 mm (0.051 in)	1.63 mm (0.064 in)
Width <sup>a</sup>	25.4 mm (1 in)	25.4 mm (1.21 in)
Solid Rod		
Weight	278 g/m (0.187 lb/ft)	141 g/m (0.095 lb/ft)
<sup>a</sup> This is the minimum width for a strip without perforations. If perforated, the minimum intended width is to be increased by the diameter of the perforations.		

**Table 10.2**  
**Minimum dimensions of secondary conductors**

Type of conductor	Material	
	Copper	Aluminum
Cable		
Strand diameter	1.15 mm (0.045 in)	1.63 mm (0.064 in)
Number of strands	14	10
Solid Strip		
Thickness	1.30 mm (0.051 in)	1.63 mm (0.064 in)
Width <sup>a</sup>	12.7 mm (1/2 in)	12.7 mm (1/2 in)
Solid Rod		
Diameter	4.11 mm (0.162 in)	5.18 mm (0.204 in)
<sup>a</sup> This is the minimum width for a strip without perforations. If perforated, the minimum intended width is to be increased by the diameter of the perforations.		

## 11 Connector Fittings

11.1 Connector fittings as specified in Sections [12](#) – [15](#) shall comply with the requirements in this Section.

11.2 A connector fitting shall be a casting or shall be stamped from sheet stock, and shall comply with the requirements in [Table 11.1](#).

*Exception: A connector fitting that complies with the Standard for Qualifying Permanent Connections Used in Substation Grounding, IEEE Std. 837, is not required to comply with these requirements. The applicable tests of IEEE Std. 837 shall be conducted with commercially available lightning protection conductors.*

**Table 11.1**  
**Minimum dimensions of connector fittings**

Material	Construction	Thickness		Number of full threads	Bolt size
		mm	(in)		
Copper or copper alloy	Cast	2.4	(3/32)	4	1/4 in-20
	Stamped	1.55	(0.061)	—	
Aluminum	Cast	2.4	(3/32)	4	1/4 in-20
	Stamped	2.46	(0.097)	—	

11.3 A connector fitting shall be constructed so that a minimum of 38 mm (1-1/2 in) of each conductor can be secured within the connector.

*Exception: This requirement does not apply to connector fitting that complies with the Standard for Qualifying Permanent Connections Used in Substation Grounding, IEEE Std. 837. The applicable tests of IEEE Std. 837 shall be conducted with commercially available lightning protection conductors.*

11.4 The fitting shall be provided with at least two 3.2 mm (1/8 in) high projections on an interior surface that embed in the conductor when the connector is compressed around the conductor.

*Exception: This requirement does not apply to connector fitting that complies with the Standard for Qualifying Permanent Connections Used in Substation Grounding, IEEE Std. 837. The applicable tests of IEEE Std. 837 shall be conducted with commercially available lightning protection conductors.*

## **12 Bimetallic Connectors**

12.1 A bimetallic connector shall be made of copper and aluminum or a copper alloy and aluminum or stainless steel. The joint between the metals shall be constructed to exclude moisture.

12.2 A barrier shall be provided within each connector to separate the two conductors. When a conductive barrier is used, the material shall have electrochemical potentials below the 0.6 V level as indicated on [Table 12.1](#).

*Exception: The use of stainless steel hardware as outlined in [6.1](#) is permissible for use in contact with aluminum components and conductors.*

**Table 12.1**  
**Electrochemical potentials (V)**

Magnesium, magnesium alloys	Zinc, zinc alloys	80 tin/20 Zn on steel, Zn on iron or steel	Aluminium	Cd on steel	Al/Mg alloy	Mild steel	Duralumin	Lead	Cr on steel, soft solder	Cr on Ni on steel, tin on steel, 12% Cr stainless steel	High Cr stainless steel	Copper, copper alloys	Silver solder, austenitic stainless steel	Ni on steel	Silver	Rh on Ag on Cu, silver/gold alloy	Carbon	Gold, platinum	
0	0.5	0.55	0.7	0.8	0.85	0.9	1.0	1.05	1.1	1.15	1.25	1.35	1.4	1.45	1.6	1.65	1.7	1.75	Magnesium, magnesium alloys
	0	0.05	0.2	0.3	0.35	0.4	0.5	0.55	0.6	0.65	0.75	0.85	0.9	0.95	1.1	1.15	1.2	1.25	Zinc, zinc alloys
		0	0.15	0.25	0.3	0.35	0.45	0.5	0.55	0.6	0.7	0.8	0.85	0.9	1.05	1.1	1.15	1.2	80 tin/20 Zn on steel, Zn on iron or steel
			0	0.1	0.15	0.2	0.3	0.35	0.4	0.45	0.55	0.65	0.7	0.75	0.9	0.95	1.0	1.05	Aluminium
				0	0.05	0.1	0.2	0.25	0.3	0.35	0.45	0.55	0.6	0.65	0.8	0.85	0.9	0.95	Cd on steel
					0	0.05	0.15	0.2	0.25	0.3	0.4	0.5	0.55	0.6	0.75	0.8	0.85	0.9	Al/Mg alloy
						0	0.1	0.15	0.2	0.25	0.35	0.45	0.5	0.55	0.7	0.75	0.8	0.85	Mild steel
							0	0.05	0.1	0.15	0.25	0.35	0.4	0.45	0.6	0.65	0.7	0.75	Duralumin
								0	0.05	0.1	0.2	0.3	0.35	0.4	0.55	0.6	0.66	0.7	Lead
									0	0.05	0.15	0.25	0.3	0.35	0.5	0.55	0.6	0.65	Cr on steel, soft solder
										0	0.1	0.2	0.25	0.3	0.45	0.5	0.55	0.6	Cr on Ni on steel, tin on steel, 12% Cr stainless steel
											0	0.1	0.15	0.2	0.35	0.4	0.45	0.5	High Cr stainless steel
												0	0.05	0.1	0.25	0.3	0.35	0.4	Copper, copper alloys
													0	0.05	0.2	0.25	0.3	0.35	Silver solder, austenitic stainless steel
														0	0.15	0.2	0.25	0.3	Ni on steel
															0	0.05	0.1	0.15	Silver
																0	0.05	0.1	Rh on Ag on Cu, silver/gold alloy
																	0	0.05	Carbon
																		0	Gold, platinum

su0803c

Ag = Silver

Al = Aluminium

Cr = Chromium

Cd = Cadmium

Cu = Copper

Mg = Magnesium

Ni = Nickel

Rh = Rhodium

Zn = Zinc

Note – Corrosion due to electrochemical action between dissimilar metals which are in contact is minimized if the combined electrochemical potential is below about 0.6V. In the above table the combined electrochemical potentials are listed for a number of pairs of metals in common use; combinations above the dividing line should be avoided.