



UL 83B

STANDARD FOR SAFETY

Switchboard and Switchgear Wires and Cables

UL Standard for Safety for Switchboard and Switchgear Wires and Cables, UL 83B

First Edition, Dated October 15, 2020

Summary of Topics

This First Edition of ANSI/UL 83B covers requirements for 14 – 4/0 AWG sizes of 600-V, single-conductor, switchboard and switchgear wires and cables, Type TBS, for use in accordance with the National Electrical Code.

The new requirements are substantially in accordance with Proposal(s) on this subject dated July 17, 2020.

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OCTOBER 15, 2020



ANSI/UL 83B-2020

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UL 83B

Standard for Switchboard and Switchgear Wires and Cables

First Edition

October 15, 2020

This ANSI/UL Standard for Safety consists of the First Edition.

The most recent designation of ANSI/UL 83B as an American National Standard (ANSI) occurred on October 15, 2020. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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 <https://csds.ul.com>.

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1 Scope

1.1 These requirements cover 14 – 4/0 AWG sizes of 600-V, single-conductor, switchboard and switchgear wires and cables for use in accordance with the National Electrical Code.

2 General

2.1 Units of measure

Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information. This applies to all values with the exception of conductor size.

2.2 Reference publications

Where reference is made to any Standards, such reference shall be considered to refer to the latest editions and revisions thereto available at the time of printing, unless otherwise specified.

NFPA (National Fire Protection Association) Publication

NFPA 70-2014, *National Electrical Code*

3 Definitions

3.1 The following definitions apply in this Standard:

PVC – a thermoplastic compound whose characteristic constituent is polyvinyl chloride or a copolymer of vinyl chloride and vinyl acetate.

Thermoplastic – a polymeric material that can repeatedly be softened by heating and hardened by cooling and that in the softened state can be shaped through the application of force.

4 Construction

4.1 Conductors

4.1.1 General

Circuit and equipment-grounding conductors shall be of either copper, copper-clad aluminum, or aluminum.

4.1.2 Aluminum conductors

4.1.2.1 Aluminum conductors shall be of aluminum conductor material (ACM), AA 8000 series alloy.

4.1.2.2 Annex [A](#) provides the chemical composition of recognized aluminum alloy conductor materials.

4.1.2.3 Solid aluminum conductors in size 12 – 8 AWG shall comply with the requirements for aluminum-wire stock (aluminum-alloy conductor material). All other aluminum conductors shall comply with the requirements for semi-annealed 8000 series aluminum conductors in Requirements for Aluminum Conductors of an 8000 Series Alloy, Section 10 of UL 1581.

4.1.3 Copper-clad aluminum conductors

4.1.3.1 The requirements of Annex [B](#) shall apply to solid conductors or the individual wires of stranded conductors prior to stranding.

4.1.3.2 Copper-clad aluminum conductors shall comply with the requirements in Requirements for Copper-Clad Aluminum Conductors, Section 11 of UL 1581.

4.1.4 Copper conductors

4.1.4.1 General

The requirements of Clauses [4.1.4.2](#) or [4.1.4.3](#) shall apply to solid conductors or the individual wires of stranded conductors prior to stranding.

4.1.4.2 Bare copper conductors

Each wire in a bare copper conductor shall comply with the requirements of ASTM B3.

4.1.4.3 Tin-coated copper conductors

Each wire in a tin-coated conductor shall comply with the requirements of ASTM B33.

4.1.5 Sizes and stranding

4.1.5.1 Sizes

Conductor sizes and stranding shall be as shown in [Table 1](#).

4.1.5.2 Stranding

4.1.5.2.1 General

4.1.5.2.1.1 The minimum number of wires (strands) in a conductor shall be in accordance with [Table 2](#).

4.1.5.2.1.2 Copper strands smaller than 0.0127 mm^2 (36 AWG) and aluminum strands smaller than 0.324 mm^2 (22 AWG) shall not be used. A compact-stranded conductor shall not be segmented.

4.1.5.2.2 Concentric

A concentric conductor shall be a round conductor consisting of a round central core surrounded by one or more layers of helically laid round wires all having the same diameter.

4.1.5.2.3 Compact

A compact-stranded conductor shall be a round conductor consisting of a central core surrounded by one or more layers of helically laid wires, and formed into a smooth outermost layer by rolling, drawing, or other means. The lay length of every layer shall be not less than 8 times nor more than 16 times the outside diameter of the completed conductor, except that for sizes 33.6 mm^2 (2 AWG) and smaller, the maximum lay length shall be 17.5 times the outside diameter. The direction of lay of the outermost layer shall be left-hand, and it shall be reversed or unidirectional/unilay in successive layers.

4.1.5.2.4 Compressed

A compressed-stranded conductor shall be a round conductor consisting of a central core surrounded by one or more layers of helically laid wires with either the direction of lay reversed in successive layers or unilay or unidirectional lay. The direction of lay of the outer layer shall be left-hand in all cases. The strands of one or more layers shall be slightly compressed by rolling, drawing, or other means to change the originally round strands to various shapes that achieve filling of some of the spaces originally present between the strands.

4.1.5.2.5 Assembly of strands

A 19-wire combination round-wire unilay stranded conductor shall be round and shall consist of a straight central wire, an inner layer of six wires of the same diameter as the central wire, and an outer layer consisting of six wires with the same diameter as the central wire alternated with six wires with a diameter of 0.732 times the diameter of the central wire. No particular assembly of the individual wires of any other stranded conductor shall be required. However, simple bunching (untwisted strands) shall not be used. The length of lay of the strands in a bunch-stranded conductor twisted as a single bunch shall not be greater than as indicated in [Table 3](#). The direction of lay of the strands in a bunch-stranded conductor shall be left-hand.

4.1.5.2.6 Length and direction of lay

Every stranded conductor other than a compact-stranded conductor or a bunch-stranded conductor twisted as a single bunch shall comply with the following:

- a) The direction of lay of the strands, members, or ropes in a $13.3 - 107 \text{ mm}^2$ (6 AWG – 4/0) conductor, other than a compressed unilay single input wire, combination unilay or a compressed unilay or compressed unidirectional lay conductor, shall be reversed in successive layers. Rope-lay conductors with bunch-stranded or concentric-stranded members shall be either unidirectional or reversed. All unidirectional lays and the outer layer of reversed lays shall be in the left-hand direction.
- b) For a bunch-stranded member of a rope-lay-stranded conductor in which the members are formed into rope-stranded components that are then cabled into the final conductor, the length of lay of the individual members within each component shall not be more than 30 times the outside diameter of one of those members.
- c) For a concentric-stranded member of a rope-lay-stranded conductor, the length of lay of the individual strands in a member shall be 8 – 16 times the outside diameter of the member. The direction of lay of the strands in each member shall be reversed in successive layers of the member.
- d) The length of lay of the strands in both layers of a 19-wire combination round-wire unilay-stranded copper or aluminum conductor shall be 8 – 16 times the outside diameter of the completed conductor. Otherwise, the length of lay of the strands in every layer of a concentric-lay-stranded conductor consisting of fewer than 37 strands shall be 8 – 16 times the outside diameter of the conductor.
- e) The length of lay of the strands in the outer two layers of a concentric-lay-stranded conductor consisting of 37 or more strands shall be 8 – 16 times the outside diameter of the conductor.
- f) The length of lay of the members or ropes in the outer layer of a rope-lay-stranded conductor shall be 8 – 16 times the outside diameter of that layer.

The length of lay shall be determined in accordance with the test, Length of lay, in UL 2556.