



Designation: B549 – 22

Standard Specification for Concentric-Lay-Stranded Aluminum Conductors, Aluminum-Clad Steel Reinforced for Use in Overhead Electrical Conductors¹

This standard is issued under the fixed designation B549; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers concentric-lay-stranded conductors made from round aluminum 1350-H19 (extra hard) aluminum wires and round aluminum-clad steel core wires for use as overhead electrical conductors (Explanatory **Note 1** and **Note 2**).

1.2 The SI values of density and resistivity are to be regarded as standard. For all other properties the inch-pound units are regarded as standard and the SI units may be approximate.

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 The following documents of the issue in effect on date of material purchase form a part of this specification to the extent referenced herein.

2.2 *ASTM Standards:*²

B230/B230M Specification for Aluminum 1350-H19 Wire for Electrical Purposes

B263 Test Method for Determination of Cross-Sectional Area of Stranded Conductors

B354 Terminology Relating to Uninsulated Metallic Electrical Conductors

B500/B500M Specification for Metallic Coated or Aluminum Clad Stranded Steel Core for Use in Overhead

Electrical Conductors

B502/B502M Specification for Aluminum-Clad Steel Core Wire for Use in Overhead Electrical Aluminum Conductors

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.3 *ANSI Standards:*³

ANSI C 42.100 Dictionary of Electrical and Electronics Terms

ANSI H 35.1 American National Standard Alloy and Temper Designation Systems for Aluminum

2.4 *Other Standard:*

NBS Handbook 100—Copper Wire Tables of the National Bureau of Standards⁴

3. Terminology

3.1 *Description of Terms Specific to This Standard*

3.1.1 ACSR covered by this specification has one type of steel core wire which is designated by the following abbreviation (Explanatory **Note 2**):

3.1.1.1 ACSR/AW—ACSR using aluminum-clad steel wire (Explanatory **Note 2**).

4. Classification

4.1 For the purpose of this specification, conductors are classified as follows (Explanatory **Note 1** and **Note 2**):

4.1.1 *Class AA*—For bare conductors usually used in overhead lines. These conductors are used as follows:

4.1.1.1 Conductors used for regular overhead line construction and

4.1.1.2 Conductors having a high ratio of mechanical strength to current-carrying capacity used for overhead ground wires and for extra-long span construction.

4.1.2 *Class A*—For conductors to be covered with weather-resistant (weatherproof) materials.

¹ This specification is under the jurisdiction of ASTM Committee B01 on Electrical Conductors and is the direct responsibility of Subcommittee B01.07 on Conductors of Light Metals.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from National Technical Information Service (NTIS), 5301 Shawnee Rd., Alexandria, VA 22312, <http://www.ntis.gov>.

5. Ordering Information

5.1 Orders for material under this specification shall include the following information:

- 5.1.1 Quantity of each size, stranding, and class,
- 5.1.2 Conductor size: circular mil area or AWG of aluminum wires (Section 9 and Table 1),
- 5.1.3 Number of wires, aluminum, and aluminum-clad steel (Table 1),
- 5.1.4 Direction of lay of outer layer of aluminum wires if other than right-hand (see 8.3),
- 5.1.5 Special tests, if required (see 15.3 and 15.5),
- 5.1.6 Package size (see 17.1 and Explanatory Note 5),
- 5.1.7 Special package marking, if required (Section 17),
- 5.1.8 Lagging, if required (see 17.3), and
- 5.1.9 Place of inspection (Section 16).

6. Requirement for Wires

6.1 Before stranding, the aluminum wires used shall meet all the requirements of Specification B230/B230M.

6.2 Before stranding, the aluminum-clad steel core wires used shall meet all the requirements of Specification B502/B502M.

7. Joints

7.1 Electric-butt welds, cold-pressure welds, or electric-butt, cold-upset welds in the finished individual aluminum wires composing the conductor may be made during the stranding process. No weld shall occur within 50 ft (15 m) of a weld in the same wire or in any other wire of the completed conductor (Explanatory Note 4).

7.2 There shall be no joints of any kind made in the finished aluminum-clad steel wires.

8. Lay

8.1 The length of lay of the various layers of aluminum wires in a conductor shall conform to Table 2 (Explanatory Note 5). The length of lay of the various layers of aluminum-clad steel wires shall conform to the requirements of Specification B500/B500M. The length of lay of the various layers of mixed aluminum and aluminum-clad steel wires (AWAC) shall conform to Table 2.

8.2 In a conductor having multiple layers of aluminum wires, the length of lay of any aluminum layer shall not be less than the length of lay of the aluminum layer immediately beneath it.

8.3 The direction of lay of the outside layer of wires shall be right hand unless otherwise specified in the purchase order. The direction of lay of the aluminum and aluminum-clad steel wires shall be reversed in successive layers.

9. Construction

9.1 The number and diameter of aluminum and steel wires and the areas of cross section of aluminum wires shall conform to the requirements prescribed in Table 1 and Fig. 1.

9.2 Where compressed stranding is required in order to insulate the conductor properly, one or more aluminum layers

of any stranded conductor consisting of 7 wires or more may be slightly compressed. The nominal diameter of the compressed conductor is 3 % below the nominal diameter of non-compressed conductor and the area of cross section after compressing is in accordance with Section 13.

9.3 The diameter of the finished conductor shall not be less than 99 % nor more than 101 % of that shown in Table 1 when measured with a diameter tape between the closing die(s) and the capstan of the strander.

10. Rated Strength of Conductor

10.1 The rated strength of a completed conductor shall be taken as the aggregate strength of the aluminum and aluminum-clad steel components, calculated as follows. The strength contribution of the aluminum wires shall be taken as the percentage, according to the number of layers of aluminum wires, indicated in Table 3, of the sum of the strengths of the 1350-H19 wires, calculated from their specified nominal wire diameter and the appropriate specified minimum average tensile strength given in Specification B230/B230M. The strength contribution of the aluminum-clad steel core wires shall be taken as the percentage according to the number of layers of aluminum-clad steel wires, indicated in Table 3, of the sum of the strengths of the aluminum-clad steel wires, calculated from their specified nominal wire diameter and the appropriate specified minimum stress at 1 % extension given in Specification B502/B502M.

10.2 Rated strength and breaking strength values shall be rounded to three significant figures, in the final value only, in accordance with the rounding method of Practice E29.

11. Density

11.1 For the purpose of calculating mass, cross sections, etc., the density of aluminum 1350 shall be taken from Specification B230/B230M.

11.2 For the purpose of calculating mass, cross sections, etc., the density of aluminum-clad steel wire shall be taken from Specification B502/B502M.

12. Mass and Electrical Resistance

12.1 The mass and electrical resistance of a unit length of stranded conductor are a function of the length of lay. The approximate mass and electrical resistance may be determined using the standard increments shown in Table 4. When greater accuracy is desired, the increment based on the specific lay of the conductor may be calculated (Explanatory Note 6).

12.2 In the calculation of the electrical resistance of a completed conductor, the resistivity of the aluminum-clad steel core wire shall be taken as $0.08480 \Omega \cdot \text{mm}^2/\text{m}$ ($51.01 \Omega \cdot \text{cmil}/\text{ft}$) at 20°C (68°F).

13. Variation in Area

13.1 The area of cross section of the aluminum wires of a conductor shall be not less than 98 % of the area specified. Unless otherwise specified by the purchaser, the manufacturer may have the option of determining the cross-sectional area by