



Designation: B231/B231M – 23

# Standard Specification for Concentric-Lay-Stranded Aluminum 1350 Conductors<sup>1</sup>

This standard is issued under the fixed designation B231/B231M; the number immediately following the designation indicates the year of original adoption or, in the case of last 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.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## 1. Scope

1.1 This specification covers aluminum 1350-H19 (extra hard), 1350-H16 or -H26 ( $\frac{3}{4}$  hard), 1350-H14 or -H24 ( $\frac{1}{2}$  hard), and 1350-H142 or -H242 ( $\frac{1}{2}$  hard), bare concentric-lay-stranded conductors constructed with a straight round central wire surrounded by one or more layers of helically layed wires. The conductors are for general use for electrical purposes (Explanatory [Note 1](#) and [Note 2](#)).

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.2.1 For density, resistivity and temperature, the values stated in SI units are to be regarded as standard.

NOTE 1—Prior to 1975, aluminum 1350 was designated as EC aluminum.

NOTE 2—The aluminum and temper designations conform to ANSI Standard H35.1/H35.1M. Aluminum 1350 corresponds to Unified Numbering System A91350 in accordance with Practice [E527](#).

NOTE 3—Sealed conductors that are intended to prevent longitudinal water propagation and are further covered/insulated are also permitted within the guidelines of this specification.

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:

<sup>1</sup> 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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## 2.2 ASTM Standards:<sup>2</sup>

[B193](#) Test Method for Resistivity of Electrical Conductor Materials

[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

[B609/B609M](#) Specification for Aluminum 1350 Round Wire, Annealed and Intermediate Tempers, for Electrical Purposes

[B682](#) Specification for Standard Metric Sizes of Electrical Conductors

[E29](#) Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

[E527](#) Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

## 2.3 ANSI Documents:<sup>3</sup>

[ANSI H35.1](#) American National Standard Alloy and Temper Designation System for Aluminum

[ANSI H35.1M](#) American National Standard Alloy and Temper Designation Systems for Aluminum [Metric]

## 2.4 NIST Document:<sup>4</sup>

[NBS Handbook 100—Copper Wire Tables](#)

## 2.5 Aluminum Association Document:<sup>5</sup>

[Publication 50](#) Code Words for Overhead Aluminum Electrical Conductors

## 3. Classification

3.1 For the purpose of this specification, conductors are classified as follows (Explanatory [Note 1](#) and [Note 2](#)):

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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

<sup>4</sup> Available from National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 1070, Gaithersburg, MD 20899-1070, <http://www.nist.gov>.

<sup>5</sup> Available from Aluminum Association, 1400 Crystal Dr., Suite 430, Arlington, VA 22202, <http://www.aluminum.org>.



3.1.1 *Class AA*—For bare conductors usually used in overhead lines.

3.1.2 *Class A*—For conductors to be covered with weather-resistant materials, and for bare conductors where greater flexibility than is afforded by Class AA is required. Conductors intended for further fabrication into tree wire or to be insulated and laid helically with or around aluminum or ACSR messengers, shall be regarded as Class A conductors with respect to direction of lay only (see 7.5).

3.1.3 *Class B*—For conductors to be insulated with various materials such as rubber, paper, varnished cloth, and so forth, and for the conductors indicated under Class A where greater flexibility is required.

3.1.4 *Classes C and D*—For conductors where greater flexibility is required than is provided by Class B conductors.

#### 4. Ordering Information

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

4.1.1 Quantity,

4.1.2 Conductor size: square millimetres, if cross-sectional area is specified as a requirement (Section 8 and Tables 1-4),

4.1.2.1 Conductor size, number, and diameter of wires for Class B, C, or D conductors, if cross-sectional area is not specified as a requirement (see 8.2),

4.1.3 Class (see 3.1),

4.1.4 Temper (see 5.1),

4.1.5 Details of special-purpose lays, when required (see 7.2 through 7.6),

4.1.6 Special tension tests if required (see 14.1 and 15.1),

4.1.7 Package size and type (see 17.1 and Table 1 or Table 2),

4.1.8 Special package marking, if required (Section 19),

4.1.9 Heavy wood lagging, if required (see 18.2),

4.1.10 Place of inspection (Section 17), and

4.1.11 Method of cross-sectional area determination if not optional (see 12.1).

#### 5. Requirements for Wires

5.1 Aluminum wire employed in Classes AA and A conductors shall be 1350-H19, unless otherwise specified. The purchaser shall designate the temper of conductors of Classes B, C, and D.

5.1.1 For conductor tempers other than 1350-H19, when temper designations are not more specific in the inquiry and purchase order, the manufacturer shall have the following options on manufacturing method:

5.1.1.1 Strand the conductor from wires drawn to final temper;

5.1.1.2 Strand the conductor from wires drawn to H19 temper and annealed to final temper prior to stranding;

5.1.1.3 Strand the conductor from 1350-H19 wires and anneal the stranded conductor to final temper.

5.2 Before stranding, the aluminum wire used shall meet the requirements of Specifications B230/B230M or B609/B609M, whichever is applicable.

5.3 All wires in the conductor shall be of the same temper.

#### 6. Joints

6.1 Only cold-pressure joints or electric-butt, cold-upset joints may be made in the six outer finished wires of (1) Class AA conductors composed of seven wires or (2) Class A conductors composed of seven wires used in overhead lines. In other conductors, electric-butt welds, cold-pressure welds, or electric-butt, cold-upset welds may be made in the finished wires composing conductors, but such welds shall not be closer than prescribed in Table 5 (Explanatory Note 3).

#### 7. Lay

7.1 For Class AA conductors composed of seven wires or more, the length of lay of a layer of wires shall not be less than 10 nor more than 16 times the outside diameter of that layer.

7.2 For all other classes the lay of a layer of wires shall be not less than 8 nor more than 16 times the outside diameter of that layer, except that for conductors composed of 37 wires or more, this requirement shall apply only to the two outer layers. The lay of the layers other than the two outer layers shall be at the option of the manufacturer, unless otherwise agreed upon.

7.2.1 For conductors to be used in covered or insulated wires or cables, the lay length of the wires shall not be less than 8 nor more than 16 times the outer diameter of the finished conductor. For conductors of 37 wires or more, this requirement shall apply to the wires in the outer two layers. The lay of the layers other than the outer two layers shall be at the option of the manufacturer, unless otherwise agreed upon.

7.3 For Class AA and A bare conductors 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.

7.4 Other lays for special purposes shall be furnished by special agreement between the manufacturer and the purchaser (Explanatory Note 4).

7.5 The direction of lay of the outer layer shall be right-hand for Classes AA and A and left-hand for other classes, unless the direction of lay is specified otherwise by the purchaser.

7.6 The direction of lay for conductors having a nominal cross-sectional area larger than No. 8 AWG (8 mm<sup>2</sup>) shall be reversed in successive layers, unless otherwise specified by the purchaser.

7.6.1 For conductors to be used in covered or insulated wires or cables, the direction of lay of the outer layer shall be left hand and may be reversed or unidirectional/unilay in successive layers, unless otherwise agreed upon with the purchaser.

#### 8. Construction

8.1 The areas of cross section, numbers, and diameters of wires in the various classes of concentric-lay-stranded conductors shall conform to the requirements prescribed in Tables 1-4. Sizes 1100 kcmil, 1200 kcmil, and 1250 kcmil, Class B concentric-lay-stranded conductors may have 61 wires subject to mutual agreement between the manufacturer and customer.

8.2 The diameters of the wires listed in Tables 3 and 4 are nominal. Where “combination strand” is required in order to