



Designation: B231/B231M – 11

# 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 revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the 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.

## 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*:<sup>2</sup>

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

[B230/B230M Specification for Aluminum 1350–H19 Wire](#)

<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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<sup>2</sup> 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.

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 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](#)):

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 [7.4](#)).

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

<sup>4</sup> Available from National Technical Information Service (NTIS), U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161.

<sup>5</sup> Available from the Aluminum Association, Inc., 900 19th Street, NW, Suite 300, Washington, DC 20006.

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 7.5),
- 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 preferred lay of a layer of wires is 13.5 times the outside diameter of that layer, but the lay shall be not less than 10 nor more than 16 times this diameter.

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

7.4 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.

7.5 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.

7.5.1 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 1050, 1200, 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 insulate the conductor properly, wires of different diameters may be used provided that the area of cross section after stranding is in accordance with Section 12.

8.3 Where compressed stranding is required in order to insulate the conductor properly, one or more layers of any stranded conductor consisting of 7 wires or more may be slightly compressed, thereby reducing the outside diameter of the conductor to the nominal values shown in Table 3 or Table 4, provided that the area of cross section after compressing is in accordance with Section 12.

8.3.1 The average diameter of the conductor in 8.3 shall vary by not more than +1 or –2 % from the diameter specified in Table 3 or Table 4.

**TABLE 1 Construction Requirements and Recommended Reel Sizes and Shipping Lengths of Aluminum Conductors, Concentric-Lay-Stranded, Class AA, and Class A**

NOTE 1—Metric values listed represent a soft conversion and as such they may not be the same as those masses which are calculated from the basic metric density.

| Conductor Size                  |                 | Required Construction      |       |                       |                  | Mass |                       | Rated Strength |      | Recommended Package Sizes <sup>A</sup> |                                  |   |  |
|---------------------------------|-----------------|----------------------------|-------|-----------------------|------------------|------|-----------------------|----------------|------|--|----------------------------------|---|--|
| cmils <sup>B</sup><br>or<br>AWG | mm <sup>2</sup> | Code<br>Words <sup>C</sup> | Class | Number<br>of<br>Wires | Diameter of Wire |      | Per<br>1000 ft,<br>lb | Per km,<br>kg  | kips | kN                                     | Reel<br>Designation <sup>D</sup> | Nominal<br>Length<br>of Each<br>Piece,<br>ft <sup>B</sup> | Nominal<br>Mass<br>of Each<br>Length,<br>lb <sup>B</sup> |
|                                 |                 |                            |       |                       | in.              | mm   |                       |                |      |  |                                  |   |  |
| 3 500 000                       | 1773            | Bluebonnet                 | A     | 127                   | 0.1660           | 4.22 | 3345                  | 4977           | 58.7 | 261                                    | RMT 90.45                        | 2840  | 9530   |
| 3 000 000                       | 1520            | Trillium                   | A     | 127                   | 0.1537           | 3.90 | 2840                  | 4226           | 50.3 | 223                                    | RMT 90.45                        | 3350  | 9530   |
| 2 750 000                       | 1393            | Bitterroot                 | A     | 91                    | 0.1738           | 4.42 | 2602                  | 3872           | 46.1 | 205                                    | RMT 90.45                        | 3490  | 9100   |
| 2 500 000                       | 1267            | Lupine                     | A     | 91                    | 0.1657           | 4.21 | 2365                  | 3519           | 41.9 | 186                                    | RMT 90.45                        | 3840  | 9100   |
| 2 250 000                       | 1140            | Sagebrush                  | A     | 91                    | 0.1572           | 3.99 | 2128                  | 3166           | 37.7 | 167                                    | RMT 90.45                        | 4270  | 9100   |
| 2 000 000                       | 1013            | Cowslip                    | A     | 91                    | 0.1482           | 3.77 | 1873                  | 2787           | 34.2 | 153                                    | RMT 90.45                        | 4850  | 9100   |
| 1 750 000                       | 886.7           | Jessamine                  | AA    | 61                    | 0.1694           | 4.30 | 1641                  | 2442           | 29.7 | 132                                    | RMT 90.45                        | 5940  | 9760   |
| 1 590 000                       | 805.7           | Coreopsis                  | AA    | 61                    | 0.1614           | 4.10 | 1489                  | 2216           | 27.0 | 120                                    | RMT 90.45                        | 6540  | 9760   |
| 1 510 500                       | 765.4           | Gladiolus                  | AA, A | 61                    | 0.1574           | 4.00 | 1417                  | 2108           | 25.6 | 114                                    | RM 68.38                         | 3270  | 4880   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RMT 90.45                        | 6880  | 9760   |
| 1 431 000                       | 725.1           | Carnation                  | AA, A | 61                    | 0.1532           | 3.89 | 1342                  | 1997           | 24.3 | 108                                    | RM 68.38                         | 3440  | 4880   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RMT 90.45                        | 7270  | 9760   |
| 1 351 000                       | 694.8           | Columbine                  | AA, A | 61                    | 0.1488           | 3.78 | 1266                  | 1884           | 23.4 | 104                                    | RM 68.38                         | 3635  | 4880   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RMT 90.45                        | 7690  | 9760   |
| 1 272 000                       | 644.5           | Narcissus                  | AA, A | 61                    | 0.1444           | 3.67 | 1192                  | 1774           | 22.0 | 98.1                                   | RM 68.38                         | 3845  | 4880   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RMT 90.45                        | 8170  | 9760   |
| 1 192 500                       | 604.2           | Hawthorn                   | AA, A | 61                    | 0.1398           | 3.55 | 1117                  | 1662           | 21.1 | 93.5                                   | RM 68.38                         | 4085  | 4880   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RMT 90.45                        | 9340  | 9760   |
| 1 113 000                       | 564.0           | Marigold                   | AA, A | 61                    | 0.1351           | 3.43 | 1044                  | 1553           | 19.7 | 87.3                                   | RM 68.38                         | 4360  | 4880   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RMT 90.45                        | 9340  | 9760   |
| 1 033 500                       | 523.7           | Bluebell                   | AA    | 37                    | 0.1671           | 4.25 | 968.4                 | 1441           | 17.7 | 78.8                                   | RMT 84.45                        | 4670  | 4880   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RM 66.32                         | 7630  | 7400   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | NR 48.28                         | 3815  | 3700   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | NR 48.28                         | 1910  | 1850   |
| 1 033 500                       | 523.7           | Larkspur                   | A     | 61                    | 0.1302           | 3.31 | 969.2                 | 1442           | 18.3 | 81.3                                   | RMT 90.45                        | 10 060  | 9760   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RM 68.38                         | 5030  | 4880   |
| 1 000 000                       | 506.7           | Hawkweed                   | AA    | 37                    | 0.1644           | 4.18 | 937.3                 | 1395           | 17.2 | 76.2                                   | RMT 84.45                        | 7880  | 7400   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RM 66.32                         | 3940  | 3700   |
| 1 000 000                       | 506.7           | Camellia                   | A     | 61                    | 0.1280           | 3.25 | 936.8                 | 1394           | 17.7 | 78.3                                   | NR 48.28                         | 1970  | 1850   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RMT 90.45                        | 10 400  | 9760   |
| 954 000                         | 483.4           | Magnolia                   | AA    | 37                    | 0.1606           | 4.08 | 894.5                 | 1331           | 16.4 | 72.6                                   | RM 68.38                         | 5200  | 4880   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RMT 84.45                        | 8260  | 7400   |
| 954 000                         | 483.4           | Goldenrod                  | A     | 61                    | 0.1251           | 3.18 | 894.8                 | 1331           | 16.9 | 75.0                                   | RM 66.32                         | 4130  | 3700   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | NR 48.28                         | 2065  | 1850   |
| 900 000                         | 456.0           | Cockscomb                  | AA    | 37                    | 0.1560           | 3.96 | 844.0                 | 1256           | 16.4 | 68.4                                   | RMT 90.45                        | 10 900  | 9760   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RM 68.38                         | 5450  | 4880   |
| 900 000                         | 456.0           | Snapdragon                 | A     | 61                    | 0.1215           | 3.09 | 844.0                 | 1256           | 15.9 | 70.8                                   | RMT 84.45                        | 8760  | 7400   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RM 66.32                         | 4390  | 3700   |
| 795 00                          | 402.8           | Arbutus                    | AA    | 37                    | 0.1466           | 3.72 | 745.3                 | 1109           | 13.9 | 61.8                                   | NR 48.28                         | 2190  | 1850   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RMT 90.45                        | 11 550  | 9760   |
| 795 000                         | 402.8           | Lilac                      | A     | 61                    | 0.1142           | 2.90 | 745.7                 | 1110           | 14.3 | 63.8                                   | RM 68.38                         | 5775  | 4880   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RMT 84.45                        | 9920  | 7400   |
| 750 000                         | 380.0           | Petunia                    | AA    | 37                    | 0.1424           | 3.62 | 703.2                 | 1046           | 13.1 | 58.6                                   | RM 66.32                         | 4960  | 3700   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | NR 48.28                         | 2480  | 1850   |
| 750 000                         | 380.0           | Cattail                    | A     | 61                    | 0.1109           | 2.82 | 703.2                 | 1046           | 13.5 | 60.3                                   | RMT 90.45                        | 13 080  | 9760   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RM 68.38                         | 6540  | 4880   |
| 715 500                         | 362.6           | Violet                     | AA    | 37                    | 0.1391           | 3.53 | 671                   | 998.5          | 12.8 | 56.7                                   | RMT 84.45                        | 10 510  | 7400   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RM 66.32                         | 5255  | 3700   |
| 715 500                         | 362.6           | Nasturtium                 | A     | 61                    | 0.1083           | 2.75 | 671                   | 998.5          | 13.1 | 58.4                                   | NR 48.28                         | 2630  | 1850   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RMT 90.45                        | 14 530  | 9760   |
| 700 000                         | 354.7           | Verbena                    | AA    | 37                    | 0.1375           | 3.49 | 655.7                 | 975.7          | 12.5 | 55.4                                   | RM 68.38                         | 7265  | 4880   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RMT 84.45                        | 11 260  | 7400   |
| 700 000                         | 354.7           | Flag                       | A     | 61                    | 0.1071           | 2.72 | 655.8                 | 975.8          | 12.9 | 57.1                                   | RM 66.32                         | 5630  | 3700   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | NR 48.28                         | 2815  | 1850   |
| 650 000                         | 329.4           | Heuchera                   | AA    | 37                    | 0.1326           | 3.37 | 609.8                 | 907.4          | 11.6 | 51.7                                   | RMT 90.45                        | 14 850  | 9760   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RM 68.38                         | 7425  | 4880   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RMT 84.45                        | 12 130  | 7400   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | RM 66.32                         | 6065  | 3700   |
|                                 |                 |                            |       |                       |                  |      |                       |                |      |  | NR 48.28                         | 3035  | 1850   |

**TABLE 1** *Continued*

| Conductor Size                  |                 | Required Construction      |       |                       | Mass             |      | Rated Strength        |               | Recommended Package Sizes <sup>A</sup> |      |                                  |   |  |
|---------------------------------|-----------------|----------------------------|-------|-----------------------|------------------|------|-----------------------|---------------|--|------|----------------------------------|---|--|
| cmils <sup>B</sup><br>or<br>AWG | mm <sup>2</sup> | Code<br>Words <sup>C</sup> | Class | Number<br>of<br>Wires | Diameter of Wire |      | Per<br>1000 ft,<br>lb | Per km,<br>kg | kips                                   | kN   | Reel<br>Designation <sup>D</sup> | Nominal<br>Length<br>of Each<br>Piece,<br>ft <sup>E</sup> | Nominal<br>Mass<br>of Each<br>Length,<br>lb <sup>F</sup> |
|                                 |                 |                            |       |                       | in.              | mm   |                       |               |  |      |                                  |   |  |
| 636 000                         | 322.3           | Orchid                     | AA, A | 37                    | 0.1311           | 3.33 | 596.0                 | 886.9         | 11.4                                   | 50.4 | RMT 84.45                        | 12 400  | 7400   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | RM 66.32                         | 6200  | 3700   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 48.28                         | 3100  | 1850   |
| 600 000                         | 304.0           | Meadowsweet                | AA, A | 37                    | 0.1273           | 3.23 | 562.0                 | 836.3         | 10.7                                   | 47.5 | RMT 84.45                        | 13 140  | 7400   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | RM 66.32                         | 6570  | 3700   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 48.28                         | 3285  | 1850   |
| 556 500                         | 282.0           | Dahlia                     | AA    | 19                    | 0.1711           | 4.35 | 521.4                 | 775.8         | 9.75                                   | 43.3 | RM 66.32                         | 7270  | 3800   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 48.28                         | 3635  | 1900   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 2425  | 1265   |
| 556 500                         | 282.0           | Mistletoe                  | A     | 37                    | 0.1226           | 3.12 | 521.3                 | 775.7         | 9.94                                   | 44.3 | RMT 84.45                        | 14 170  | 7400   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | RM 66.32                         | 7085  | 3700   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 48.28                         | 3545  | 1850   |
| 500 000                         | 253.3           | Zinnia                     | AA    | 19                    | 0.1622           | 4.12 | 468.5                 | 697.1         | 8.76                                   | 38.9 | RM 66.32                         | 8100  | 3800   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 48.28                         | 4050  | 1900   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 2700  | 1265   |
| 500 000                         | 253.3           | Hyacinth                   | A     | 37                    | 0.1162           | 2.95 | 468.3                 | 696.8         | 9.11                                   | 40.5 | RMT 84.45                        | 15 760  | 7400   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | RM 66.32                         | 7880  | 3700   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 48.28                         | 3940  | 1850   |
| 477 000                         | 241.7           | Cosmos                     | AA    | 19                    | 0.1584           | 4.02 | 446.8                 | 664.8         | 8.36                                   | 37.0 | RM 66.32                         | 8490  | 3800   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 48.28                         | 4245  | 1900   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 2830  | 1265   |
| 477 000                         | 241.7           | Syringa                    | A     | 37                    | 0.1135           | 2.88 | 446.8                 | 664.8         | 8.69                                   | 38.6 | RMT 84.45                        | 16 530  | 7400   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | RM 66.32                         | 8265  | 3700   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 48.28                         | 4135  | 1850   |
| 450 000                         | 228.0           | Goldentuft                 | AA    | 19                    | 0.1539           | 3.91 | 421.8                 | 627.6         | 7.89                                   | 35.0 | RM 66.32                         | 9000  | 3800   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 48.28                         | 4500  | 1900   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 3000  | 1265   |
| 397 500                         | 201.4           | Canna                      | AA, A | 19                    | 0.1447           | 3.67 | 372.9                 | 554.9         | 7.11                                   | 31.6 | RM 66.32                         | 10 180  | 3800   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 48.28                         | 5090  | 1900   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 3395  | 1265   |
| 350 000                         | 177.3           | Daffodil                   | A     | 19                    | 0.1357           | 3.45 | 327.9                 | 487.9         | 6.39                                   | 28.4 | RM 66.32                         | 11 560  | 3800   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 48.28                         | 5780  | 1900   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 3855  | 1265   |
| 336 400                         | 170.5           | Tulip                      | A     | 19                    | 0.1331           | 3.38 | 315.5                 | 469.5         | 6.15                                   | 27.3 | RM 66.32                         | 12 030  | 3800   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 48.28                         | 6015  | 1900   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 4010  | 1265   |
| 300 000                         | 152.0           | Peony                      | A     | 19                    | 0.1257           | 3.19 | 281.4                 | 418.3         | 5.48                                   | 24.3 | RM 66.32                         | 13 490  | 3800   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 48.28                         | 6745  | 1900   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 4495  | 1265   |
| 266 800                         | 135.2           | Daisy                      | AA    | 7                     | 0.1953           | 4.96 | 250.2                 | 372.3         | 4.83                                   | 21.4 | NR 42.28                         | 5590  | 1400   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 36.22                         | 2795  | 700  |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | RM 66.32                         | 15 170  | 3800   |
| 266 800                         | 135.2           | Laurel                     | A     | 19                    | 0.1185           | 3.01 | 250.1                 | 372.2         | 4.97                                   | 22.1 | NR 48.28                         | 7585  | 1900   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 5055  | 1265   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 5970  | 1400   |
| 250 000                         | 126.7           | Sneezewort                 | AA    | 7                     | 0.1890           | 4.80 | 234.4                 | 348.8         | 4.52                                   | 20.1 | NR 36.22                         | 2985  | 700  |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | RM 66.32                         | 16 190  | 3800   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 48.28                         | 8095  | 1900   |
| 250 000                         | 126.7           | Valerian                   | A     | 19                    | 0.1147           | 2.91 | 234.3                 | 348.6         | 4.66                                   | 20.7 | NR 42.28                         | 5395  | 1265   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 7050  | 1400   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 36.22                         | 3525  | 700  |
| 4/0                             | 107.2           | Oxlip                      | AA, A | 7                     | 0.1739           | 4.42 | 198.4                 | 295.2         | 3.83                                   | 17.0 | NR 42.28                         | 7050  | 1400   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 36.22                         | 4445  | 700  |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 8890  | 1400   |
| 3/0                             | 85.0            | Phlox                      | AA, A | 7                     | 0.1548           | 3.93 | 157.2                 | 233.9         | 3.04                                   | 13.5 | NR 36.22                         | 4445  | 700  |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 11 210  | 1400   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 36.22                         | 5605  | 700  |
| 2/0                             | 67.4            | Aster                      | AA, A | 7                     | 0.1379           | 3.50 | 124.8                 | 185.7         | 2.51                                   | 11.1 | NR 42.28                         | 11 210  | 1400   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 36.22                         | 7065  | 700  |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 14 130  | 1400   |
| 1/0                             | 53.5            | Poppy                      | AA, A | 7                     | 0.1228           | 3.12 | 98.9                  | 147.2         | 1.99                                   | 8.84 | NR 36.22                         | 7065  | 700  |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 17 830  | 1400   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 36.22                         | 8915  | 700  |
| 1                               | 42.4            | Pansy                      | AA, A | 7                     | 0.1093           | 2.78 | 78.4                  | 116.6         | 1.64                                   | 7.30 | NR 42.28                         | 22 470  | 1400   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 36.22                         | 11 235  | 700  |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 35 710  | 1400   |
| 2                               | 33.6            | Iris                       | AA, A | 7                     | 0.0974           | 2.47 | 62.2                  | 92.6          | 1.35                                   | 5.99 | NR 36.22                         | 17 855  | 700  |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 56 910  | 1400   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 36.22                         | 28 455  | 700  |
| 4                               | 21.1            | Rose                       | A     | 7                     | 0.0772           | 1.96 | 39.1                  | 58.2          | 0.881                                  | 3.91 | NR 42.28                         | 56 910  | 1400   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 36.22                         | 17 855  | 700  |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 56 910  | 1400   |
| 6                               | 13.3            | Peachbell                  | A     | 7                     | 0.0612           | 1.56 | 24.6                  | 36.6          | 0.563                                  | 2.53 | NR 42.28                         | 56 910  | 1400   |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 36.22                         | 28 455  | 700  |
|                                 |                 |                            |       |                       |                  |      |                       |               |  |      | NR 42.28                         | 56 910  | 1400   |

<sup>A</sup> For information only.

<sup>B</sup> Conversion factors: 1 cmil = 5.067 E-04 mm<sup>2</sup>, 1 mil + 2.54 E-02 mm, 1 lb/1000 ft = 1.488 E+00 kg/km, 1 ft = 3.048 E-01 m, 1 lb = 4.536 E-01 kg, 1 lbf = 4.448 E-03 kN.

<sup>C</sup> Code words shown in this column are from, "Publication 50, Code Words for Overhead Aluminum Electrical Conductors," by the Aluminum Association. They are provided here for information only.

<sup>D</sup> See Table 9 for dimensions of standard reels.

8.4 The nominal overall diameter of a Class A and AA stranded conductor shall be calculated based on the numerical sum of the diameter thickness of the individual strand wire component in the conductor. The diameter of the individual strand wire component shall be as specified in **Table 1** and **Table 2** and this diameter shall be referred to as the “mean diameter” value. The minimum and maximum overall diameter of a Class A and AA stranded conductor shall be based on calculations made using the mean diameter tolerances as specified by Specification **B230/B230M** for the corresponding strand wire size.

## 9. Rated Strength of Conductor

9.1 The rated strength of 1350-H19 conductors shall be taken as the percent, indicated in **Table 6**, of the sum of the strengths of the component wires, calculated using the nominal wire diameters and the specified minimum average tensile strength given in Specification **B230/B230M** for 1350-H19 wire. In the case of compressed conductors, the nominal wire diameter should be that of the corresponding non-compressed construction as listed in **Tables 1-4**.

9.2 Calculations for rated strengths of 1350-H16, -H26, -H14, -H24, -H142, and -H242 conductors shall be made on the basis of the strengths of the component wires using the nominal wire diameters and the specified maximum and minimum tensile strengths for the appropriate temper of the respective component wires given in Specification **B609/B609M**. The minimum rated strengths of the conductors shall be taken as the sum of the calculated minimum strengths of the component wires multiplied by the rating factor given in **Table 6**. The maximum rated strength of the conductors shall be taken as the sum of the calculated maximum strengths of the component wires.

9.3 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**.

9.4 Rated strengths of conductors are given in **Table 1** or **Table 2**.

## 10. Density

10.1 For the purpose of calculating mass, cross sections, and so forth, the density of aluminum 1350 shall be taken as 2705 kg/m<sup>3</sup> [0.0975 lb/in.<sup>3</sup>] at 20°C.

## 11. Mass and Electrical Resistance

11.1 The mass and electrical resistance of a unit length of a 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 7**. When greater accuracy is desired, the increment based on the specific lay of the conductor may be calculated (Explanatory **Note 5**).

11.2 The maximum electrical resistance of a unit length of stranded conductor shall not exceed 2 % over the nominal dc resistance shown in **Tables 3 and 4** (Explanatory **Note 8**). When

the dc resistance is measured at other than 20°C, it is to be corrected by using the multiplying factor given in **Table 8**.

11.3 For conductors to be used in covered or insulated wires or cables dc resistance measurement may be used in lieu of the method outlined in Section **12**, to determine compliance with this specification.

## 12. Variation in Area

12.1 The area of cross section of the completed conductor shall not be less than 98 % of the area of cross section of the conductor size listed in Column 1 of **Tables 1-4**. The manufacturer may have the option of determining the cross-sectional area by either of the following methods, except that in case of question regarding area compliance, the method of **12.1.2** shall be used.

12.1.1 The area of cross section of a conductor may be determined by calculations from diameter measurements, expressed to four decimal places, of its component wires at any point when measured perpendicularly to their axes.

12.1.2 The area of cross section of a conductor may be determined by Test Method **B263**. In applying that test method, the increment in mass resulting from stranding may be the applicable value specified in **11.1** or may be calculated from the measured component dimensions of the sample under test. In case of question regarding area compliance, the actual mass increment due to stranding shall be calculated.

## 13. Finish

13.1 The conductor shall be free of all imperfections not consistent with good commercial practice.

## 14. Mechanical and Electrical Tests of Conductors NOT Annealed After Stranding

14.1 Wires composing the conductors shall be tested prior to stranding in accordance with the applicable specification (see **5.2**), and tests on the completed conductor are not required. However, when requested by the purchaser and agreed to by the manufacturer at time of ordering, the tension tests of wires before stranding may be waived and the completed conductor tested in accordance with **14.2**, or wires removed from the completed conductor tested in accordance with **14.3**.

14.2 When the completed conductor is tested as a unit, the breaking strength shall be not less than the rated strength of 1350-H19 conductors or the minimum rated strength of 1350-H16, -H26, -H14, -H24, -H142, and -H242 conductors if failure occurs in the free length at least 1 in. [25 mm] beyond the end of either gripping device, or shall be not less than 95 % of the rated or minimum rated strength if failure occurs inside, or within 1 in. [25 mm] of the end of either gripping device. The breaking strength of 1350-H16, -H26, -H14, -H24, -H142, and -H242 conductors shall be not greater than their maximum rated strengths. The free length between grips of the test specimen shall be not less than 24 in. [600 mm] and care shall be taken to ensure that the wires in the conductor are evenly gripped during the test (Explanatory **Note 6**).

**TABLE 2 Construction Requirements and Recommended Reel Sizes and Shipping Lengths of Aluminum Conductors, Concentric Lay-Stranded, Classes AA and A**

NOTE 1—Sizes selected from Specification B682.

| Conductor Size, mm <sup>2</sup> | Class | Stranding       |              | Mass, kg/km | Rated Strength 1350-H19, kN | Recommended Package Sizes <sup>A</sup> |                                 |                                 |
|---------------------------------|-------|-----------------|--------------|-------------|-----------------------------|--|---------------------------------|---------------------------------|
|                                 |       | Number of Wires | Diameter, mm |             |                             | Reel Designation <sup>B</sup>          | Nominal Length of Each Piece, m | Nominal Mass of Each Length, kg |
| 2000                            | A     | 127             | 4.48         | 5632        | 294                         | RMT 90.45                              | 770                             | 4325                            |
| 1600                            | A     | 127             | 4.01         | 4512        | 236                         | RMT 90.45                              | 960                             | 4325                            |
| 1250                            | A     | 91              | 4.18         | 3479        | 183                         | RMT 90.45                              | 1185                            | 4130                            |
| 1120                            | A     | 91              | 3.96         | 3123        | 165                         | RMT 90.45                              | 1320                            | 4130                            |
| 1000                            | A     | 91              | 3.74         | 2785        | 151                         | RMT 90.45                              | 1495                            | 4130                            |
| 900                             | AA    | 61              | 4.33         | 2478        | 133                         | RMT 90.45                              | 1785                            | 4425                            |
| 800                             | AA, A | 61              | 4.09         | 2211        | 119                         | RMT 90.45                              | 2000                            | 4425                            |
|                                 |       |                 |              |             |                             | RM 68.38                               | 1000                            | 2215                            |
| 710                             | AA, A | 61              | 3.85         | 1959        | 105                         | RMT 90.45                              | 2260                            | 4425                            |
|                                 |       |                 |              |             |                             | RM 68.38                               | 1130                            | 2215                            |
| 630                             | AA, A | 61              | 3.63         | 1742        | 96.6                        | RMT 90.45                              | 2540                            | 4425                            |
|                                 |       |                 |              |             |                             | RM 68.38                               | 1270                            | 2215                            |
| 560                             | AA, A | 61              | 3.42         | 1546        | 85.7                        | RMT 90.45                              | 2860                            | 4425                            |
|                                 |       |                 |              |             |                             | RM 68.38                               | 1430                            | 2215                            |
| 500                             | AA    | 37              | 4.15         | 1381        | 75.1                        | RMT 84.45                              | 2430                            | 3355                            |
|                                 |       |                 |              |             |                             | RM 66.32                               | 1215                            | 1680                            |
|                                 |       |                 |              |             |                             | NR 48.28                               | 610                             | 840                             |
| 500                             | A     | 61              | 3.23         | 1379        | 76.5                        | RMT 90.45                              | 3210                            | 4425                            |
|                                 |       |                 |              |             |                             | RM 68.38                               | 1605                            | 2215                            |
| 450                             | AA    | 37              | 3.94         | 1245        | 67.7                        | RMT 84.45                              | 2695                            | 3355                            |
|                                 |       |                 |              |             |                             | RM 66.32                               | 1350                            | 1680                            |
|                                 |       |                 |              |             |                             | NR 48.28                               | 675                             | 840                             |
| 450                             | A     | 61              | 3.06         | 1238        | 68.6                        | RMT 90.45                              | 3575                            | 4425                            |
|                                 |       |                 |              |             |                             | RM 68.38                               | 1790                            | 2215                            |
| 400                             | AA    | 37              | 3.71         | 1104        | 61.9                        | RMT 84.45                              | 3040                            | 3355                            |
|                                 |       |                 |              |             |                             | RM 66.32                               | 1520                            | 1680                            |
|                                 |       |                 |              |             |                             | NR 48.28                               | 760                             | 840                             |
| 400                             | A     | 61              | 2.89         | 1104        | 63.0                        | RMT 90.45                              | 4010                            | 4425                            |
|                                 |       |                 |              |             |                             | RM 68.38                               | 2005                            | 2215                            |
| 355                             | AA    | 37              | 3.50         | 982         | 55.1                        | RMT 84.45                              | 3415                            | 3355                            |
|                                 |       |                 |              |             |                             | RM 66.32                               | 1710                            | 1680                            |
|                                 |       |                 |              |             |                             | NR 48.28                               | 855                             | 840                             |
| 355                             | A     | 61              | 2.72         | 978         | 57.4                        | RMT 90.45                              | 4525                            | 4425                            |
|                                 |       |                 |              |             |                             | RM 68.38                               | 2265                            | 2215                            |
| 315                             | AA, A | 37              | 3.29         | 868         | 48.7                        | RMT 84.45                              | 3865                            | 3355                            |
|                                 |       |                 |              |             |                             | RM 66.32                               | 1935                            | 1680                            |
|                                 |       |                 |              |             |                             | NR 48.28                               | 970                             | 840                             |
| 280                             | AA    | 19              | 4.33         | 772         | 42.9                        | RM 66.32                               | 2235                            | 1725                            |
|                                 |       |                 |              |             |                             | NR 48.28                               | 1115                            | 860                             |
|                                 |       |                 |              |             |                             | NR 42.28                               | 745                             | 575                             |
| 280                             | A     | 37              | 3.10         | 771         | 43.2                        | RMT 84.45                              | 4350                            | 3355                            |
|                                 |       |                 |              |             |                             | RM 66.32                               | 2180                            | 1680                            |
|                                 |       |                 |              |             |                             | NR 48.28                               | 1090                            | 840                             |
| 250                             | AA    | 19              | 4.09         | 689         | 38.3                        | RM 66.32                               | 2505                            | 1725                            |
|                                 |       |                 |              |             |                             | NR 48.28                               | 1250                            | 860                             |
|                                 |       |                 |              |             |                             | NR 42.28                               | 835                             | 575                             |
| 250                             | A     | 37              | 2.93         | 688         | 39.7                        | RMT 84.45                              | 875                             | 3355                            |
|                                 |       |                 |              |             |                             | RM 66.32                               | 2440                            | 1680                            |
|                                 |       |                 |              |             |                             | NR 48.28                               | 1220                            | 840                             |
| 224                             | AA    | 19              | 3.87         | 617         | 34.3                        | RM 66.32                               | 2795                            | 1725                            |
|                                 |       |                 |              |             |                             | NR 48.28                               | 1395                            | 860                             |
|                                 |       |                 |              |             |                             | NR 42.28                               | 930                             | 575                             |
| 200                             | AA, A | 19              | 3.66         | 552         | 31.6                        | RM 66.32                               | 3125                            | 1725                            |
|                                 |       |                 |              |             |                             | NR 48.28                               | 1560                            | 860                             |
|                                 |       |                 |              |             |                             | NR 42.28                               | 1040                            | 575                             |
| 180                             | A     | 19              | 3.47         | 496         | 28.4                        | RM 66.32                               | 3480                            | 1725                            |
|                                 |       |                 |              |             |                             | NR 48.28                               | 1730                            | 860                             |
|                                 |       |                 |              |             |                             | NR 42.28                               | 1160                            | 575                             |
| 160                             | A     | 19              | 3.27         | 440         | 25.2                        | RM 66.32                               | 3920                            | 1725                            |
|                                 |       |                 |              |             |                             | NR 48.28                               | 1955                            | 860                             |
|                                 |       |                 |              |             |                             | NR 42.28                               | 1305                            | 575                             |
| 140                             | AA    | 7               | 5.05         | 387.0       | 22.2                        | NR 42.28                               | 1640                            | 635                             |
|                                 |       |                 |              |             |                             | NR 36.22                               | 830                             | 320                             |
| 140                             | A     | 19              | 3.06         | 386         | 22.1                        | RM 66.32                               | 4470                            | 1725                            |
|                                 |       |                 |              |             |                             | NR 48.28                               | 2230                            | 860                             |
|                                 |       |                 |              |             |                             | NR 42.28                               | 1490                            | 575                             |
| 125                             | AA    | 7               | 4.77         | 345         | 19.8                        | NR 42.28                               | 1840                            | 635                             |
|                                 |       |                 |              |             |                             | NR 36.22                               | 930                             | 320                             |