



Designation: B901 – 04(Reapproved 2011)

# Standard Specification for Compressed Round Stranded Aluminum Conductors Using Single Input Wire Construction<sup>1</sup>

This standard is issued under the fixed designation B901; 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.

## 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), 1350-H142 or -H242 ( $\frac{1}{2}$  hard), and aluminum alloy 8XXX series as listed in Specification B800 for tempers “O” and H1X or H2X, bare stranded conductors composed of one or more roller shaped or die compressed layers of helically layed wires. The conductors are for general use for electrical purposes (Explanatory Notes 1 and 2).

NOTE 1—For the purposes of this specification, single input wire (SIW) construction is defined as follows: a stranded conductor design methodology that varies the number of wires within a range of conductor sizes in order to permit that range of conductor sizes to be constructed from a single wire size.

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

NOTE 2—Prior to 1975, aluminum 1350 was designated as EC aluminum.

NOTE 3—The aluminum and temper designations conform to ANSI H35.1. Aluminum 1350 corresponds to Unified Numbering System A91350 in accordance with Practice E527. Aluminum alloys in the 8000 series correspond to Unified Numbering System A98XXX in accordance with Practice E527.

NOTE 4—This specification also permits conductors for use as covered or insulated electrical conductors.

NOTE 5—Sealed conductors, which 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 the 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 of 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

B800 Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes—Annealed and Intermediate Tempers

B801 Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation

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 Other Standards:

ANSI H35.1 American National Standard Alloy and Temper Designation System for Aluminum<sup>3</sup>

NBS Handbook 100—Copper Wire Tables<sup>4</sup>

## 3. Classification

3.1 The conductors described in this specification are intended for subsequent insulation or covering. The classification of these conductors is SIW compressed.

## 4. Ordering Information

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

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



- 4.1.1 Quantity,  
 4.1.2 Conductor size: circular-mil area of AWG (see Section 8 and Table 1),  
 4.1.3 Alloy designation,  
 4.1.4 Class (see 3.1),  
 4.1.5 Temper (see 5.1 and 5.3),  
 4.1.6 Details of special-purpose lays, when required (see 7.2 and 7.3),  
 4.1.7 When tension tests are required on the completed conductor (see Section 15),  
 4.1.8 Package size (see 19.1),  
 4.1.9 Special package marking, if required (see Section 20),

TABLE 1 Construction Requirements of Compressed Round SIW Stranded

## Aluminum Conductors

| Conductor Size |      |        | Hard Drawn Copper Equivalent |      |        | Minimum Number of Wires | Nominal Diameter of SIW Compressed Conductor in. | Nominal Diameter of SIW Compressed Conductor mm | Mass            |          | DC Resistance at 20°C |        |
|----------------|------|--------|------------------------------|------|--------|-------------------------|--------------------------------------------------|-------------------------------------------------|-----------------|----------|-----------------------|--------|
| cmils          | AWG  | mm²    | cmils                        | AWG  | mm²    |                         |                                                  |                                                 | lb/1000ft/kg/km | Ω/1000ft | Ω/km                  |        |
| 4 000 000      |      | 2027   | 2 520 000                    |      | 1277   | 217                     | 2.168                                            | 55.07                                           | 3823            | 5688     | 0.00442               | 0.0145 |
| 3 500 000      |      | 1773   | 2 200 000                    |      | 1115   | 169                     | 2.028                                            | 51.51                                           | 3345            | 4977     | 0.00505               | 0.0166 |
| 3 000 000      |      | 1520   | 1 890 000                    |      | 957.7  | 169                     | 1.878                                            | 47.69                                           | 2839            | 4225     | 0.00584               | 0.0192 |
| 2 500 000      |      | 1267   | 1 570 000                    |      | 795.5  | 127                     | 1.714                                            | 43.54                                           | 2366            | 3521     | 0.00701               | 0.0230 |
| 2 000 000      |      | 1013   | 1 260 000                    |      | 638.5  | 127                     | 1.533                                            | 38.94                                           | 1875            | 2789     | 0.00867               | 0.0284 |
| 1 900 000      |      | 962.7  | 1 195 000                    |      | 605.5  | 127                     | 1.494                                            | 37.95                                           | 1781            | 2650     | 0.00913               | 0.0300 |
| 1 800 000      |      | 912.1  | 1 132 000                    |      | 573.6  | 127                     | 1.454                                            | 36.93                                           | 1687            | 2510     | 0.00963               | 0.0316 |
| 1 750 000      |      | 886.7  | 1 101 000                    |      | 557.9  | 127                     | 1.434                                            | 36.42                                           | 1640            | 2441     | 0.0099                | 0.0325 |
| 1 700 000      |      | 861.4  | 1 069 000                    |      | 541.7  | 127                     | 1.413                                            | 35.89                                           | 1593            | 2371     | 0.0102                | 0.0335 |
| 1 600 000      |      | 810.7  | 1 006 000                    |      | 509.7  | 127                     | 1.371                                            | 34.82                                           | 1500            | 2232     | 0.0109                | 0.0358 |
| 1 500 000      |      | 760.1  | 943 000                      |      | 477.8  | 90                      | 1.327                                            | 33.71                                           | 1406            | 2092     | 0.0116                | 0.0381 |
| 1 400 000      |      | 709.4  | 880 000                      |      | 445.9  | 90                      | 1.282                                            | 32.56                                           | 1312            | 1953     | 0.0124                | 0.0407 |
| 1 300 000      |      | 658.7  | 818 000                      |      | 414.5  | 90                      | 1.236                                            | 31.39                                           | 1218            | 1813     | 0.0133                | 0.0436 |
| 1 250 000      |      | 633.4  | 786 000                      |      | 398.3  | 90                      | 1.212                                            | 30.78                                           | 1172            | 1743     | 0.0138                | 0.0453 |
| 1 200 000      |      | 608.0  | 755 000                      |      | 382.6  | 90                      | 1.187                                            | 30.15                                           | 1125            | 1674     | 0.0144                | 0.0472 |
| 1 100 000      |      | 557.4  | 692 000                      |      | 350.6  | 90                      | 1.137                                            | 28.88                                           | 1030            | 1533     | 0.0158                | 0.0518 |
| 1 000 000      |      | 506.7  | 629 000                      |      | 318.7  | 53                      | 1.084                                            | 27.53                                           | 937             | 1395     | 0.0173                | 0.0568 |
| 900 000        |      | 456.0  | 566 000                      |      | 286.8  | 53                      | 1.028                                            | 26.11                                           | 844             | 1255     | 0.0193                | 0.0633 |
| 800 000        |      | 405.4  | 503 000                      |      | 254.9  | 53                      | 0.969                                            | 24.61                                           | 750             | 1116     | 0.0217                | 0.0712 |
| 750 000        |      | 380.0  | 472 000                      |      | 239.2  | 53                      | 0.939                                            | 23.85                                           | 703             | 1046     | 0.0231                | 0.0758 |
| 700 000        |      | 354.7  | 440 000                      |      | 223.0  | 34                      | 0.907                                            | 23.04                                           | 656             | 976      | 0.0248                | 0.0814 |
| 650 000        |      | 329.4  | 409 000                      |      | 207.2  | 34                      | 0.874                                            | 22.20                                           | 609             | 907      | 0.0267                | 0.0876 |
| 636 000        |      | 322.3  | 400 000                      |      | 202.7  | 34                      | 0.865                                            | 21.96                                           | 596             | 887      | 0.0273                | 0.0896 |
| 600 000        |      | 304.0  | 377 000                      |      | 191.0  | 34                      | 0.840                                            | 21.34                                           | 562             | 837      | 0.0289                | 0.0948 |
| 550 000        |      | 278.7  | 346 000                      |      | 175.3  | 34                      | 0.804                                            | 20.42                                           | 516             | 767      | 0.0315                | 0.103  |
| 500 000        |      | 253.4  | 314 000                      |      | 159.1  | 30                      | 0.766                                            | 19.46                                           | 469             | 697      | 0.0347                | 0.114  |
| 477 000        |      | 241.7  | 300 000                      |      | 152.0  | 30                      | 0.747                                            | 18.96                                           | 447             | 665      | 0.0364                | 0.119  |
| 450 000        |      | 228.0  | 283 000                      |      | 143.4  | 30                      | 0.727                                            | 18.47                                           | 422             | 628      | 0.0385                | 0.126  |
| 400 000        |      | 202.7  | 252 000                      |      | 127.7  | 24                      | 0.685                                            | 17.40                                           | 375             | 558      | 0.0434                | 0.142  |
| 350 000        |      | 177.3  | 220 000                      |      | 111.5  | 24                      | 0.641                                            | 16.28                                           | 328             | 488      | 0.0495                | 0.162  |
| 336 400        |      | 170.5  | 211 600                      | 0000 | 107.2  | 18                      | 0.629                                            | 15.96                                           | 315             | 469      | 0.0516                | 0.169  |
| 300 000        |      | 152.0  | 188 700                      |      | 95.62  | 18                      | 0.594                                            | 15.09                                           | 281             | 418      | 0.0578                | 0.190  |
| 266 800        |      | 135.2  | 167 800                      | 000  | 85.03  | 18                      | 0.560                                            | 14.22                                           | 250             | 372      | 0.0650                | 0.213  |
| 250 000        |      | 126.7  | 157 200                      |      | 79.65  | 18                      | 0.542                                            | 13.77                                           | 234             | 349      | 0.0694                | 0.228  |
| 211 600        | 0000 | 107.2  | 133 100                      | 00   | 67.44  | 17                      | 0.498                                            | 12.65                                           | 198             | 295      | 0.082                 | 0.269  |
| 167 800        | 000  | 85.03  | 105 600                      | 0    | 53.51  | 15                      | 0.443                                            | 11.25                                           | 157             | 234      | 0.103                 | 0.338  |
| 133 100        | 00   | 67.44  | 83 690                       | 1    | 42.41  | 11                      | 0.395                                            | 10.03                                           | 125             | 186      | 0.130                 | 0.426  |
| 105 600        | 0    | 53.51  | 66 360                       | 2    | 33.63  | 7                       | 0.352                                            | 8.94                                            | 99.0            | 147      | 0.164                 | 0.538  |
| 83 690         | 1    | 42.41  | 52 620                       | 3    | 26.66  | 7                       | 0.313                                            | 7.95                                            | 78.4            | 117      | 0.207                 | 0.679  |
| 66 360         | 2    | 33.63  | 41 740                       | 4    | 21.15  | 6                       | 0.283                                            | 7.19                                            | 62.2            | 92.6     | 0.261                 | 0.856  |
| 52 620         | 3    | 26.66  | 33 090                       | 5    | 16.77  | 6                       | 0.252                                            | 6.40                                            | 49.3            | 73.4     | 0.330                 | 1.08   |
| 41 740         | 4    | 21.15  | 26 240                       | 6    | 13.30  | 6                       | 0.225                                            | 5.72                                            | 39.1            | 58.2     | 0.416                 | 1.36   |
| 33 090         | 5    | 16.77  | 20 820                       | 7    | 10.55  | 6                       | 0.200                                            | 5.08                                            | 31.0            | 46.2     | 0.523                 | 1.72   |
| 26 240         | 6    | 13.30  | 16 510                       | 8    | 8.366  | 6                       | 0.178                                            | 4.52                                            | 24.6            | 36.6     | 0.661                 | 2.17   |
| 20 820         | 7    | 10.55  | 13 090                       | 9    | 6.633  | 6                       | 0.159                                            | 4.04                                            | 19.5            | 29.0     | 0.834                 | 2.74   |
| 16 510         | 8    | 8.366  | 10 380                       | 10   | 5.260  | 6                       | 0.142                                            | 3.61                                            | 15.5            | 23.0     | 1.05                  | 3.44   |
| 13 090         | 9    | 6.633  | 8 234                        | 11   | 4.172  | 6                       | 0.126                                            | 3.20                                            | 12.3            | 18.3     | 1.32                  | 4.33   |
| 10 380         | 10   | 5.260  | 6 530                        | 12   | 3.309  | 6                       | 0.113                                            | 2.87                                            | 9.73            | 14.5     | 1.67                  | 5.48   |
| 6 530          | 12   | 3.309  | 4 110                        | 14   | 2.083  | 6                       | 0.089                                            | 2.26                                            | 6.12            | 9.11     | 2.67                  | 8.76   |
| 4 110          | 14   | 2.083  | 2 580                        | 16   | 1.307  | 6                       | 0.071                                            | 1.80                                            | 3.85            | 5.73     | 4.22                  | 13.8   |
| 2 580          | 16   | 1.307  | 1620                         | 18   | 0.8209 | 6                       | 0.054                                            | 1.37                                            | 2.42            | 3.60     | 6.71                  | 22.0   |
| 1 620          | 18   | 0.8209 | 1020                         | 20   | 0.5168 | 6                       | 0.043                                            | 1.09                                            | 1.52            | 2.26     | 10.7                  | 35.1   |
| 1 020          | 20   | 0.5168 | 642                          | 22   | 0.3253 | 6                       | 0.034                                            | 0.86                                            | 0.96            | 1.42     | 16.9                  | 55.4   |



4.1.10 Heavy wood lagging, if required (see 19.2), and

4.1.11 Place of inspection (see Section 18).

## 5. Requirements for Wires

5.1 The purchaser shall designate the temper of conductors of SIW compressed or SIW conductor.

5.1.1 For conductor tempers other than H19, 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; or

5.1.1.3 Strand the conductor from 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, B609/B609M, or B800, 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 wires of SIW compressed or SIW conductor.

6.2 The minimum distance between joints in the wires of the completed conductor shall be no less than 1 ft (0.3 m).

## 7. Lay

7.1 For SIW compressed stranded conductors manufactured for subsequent covering or insulating, the average lay length of the wires shall be not 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 only, unless otherwise agreed upon.

7.2 Other lays for special purposes shall be furnished by special agreement between the manufacturer and the purchaser (Explanatory Note 3).

7.3 For conductors manufactured for subsequent covering or insulating, the direction of lay of the outer layer shall be left hand and may be reversed or unidirectional/unilay in successive layers, unless otherwise specified by the purchaser.

## 8. Construction

8.1 The areas of cross section, the minimum number of wires, and diameters of the finished strand shall conform to the requirements prescribed in Table 1.

## 9. Rated Strength of Conductor

9.1 The rated strength of 1350-H19 conductors shall be taken as the percent, indicated in Table 2, 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.

9.2 The rated strengths of 8000 series conductors shall be taken as the percent, indicated in Specification B801, of the

TABLE 2 Rating Factors<sup>A</sup>

| Number of Layers | Rating Factor, % |
|------------------|------------------|
| 1                | 96               |
| 2                | 93               |
| 3                | 91               |
| 4                | 90               |
| 5 and above      | 89               |

<sup>A</sup> This relates to 1350 alloy only. Refer to the Rating Factors Table in Specification B801 for values for 8000 series alloys.

sum of strengths of the component wires, calculated using the nominal wire diameters and the specified minimum average tensile strength given in Specification B800 for 8000 series wire.

9.3 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 2. The maximum rated strength of the conductors shall be taken as the sum of the calculated maximum strength of the component wires multiplied by the rating factors given in Table 2.

9.4 Calculations for rated strengths of 8000 series “O” temper H1X and H2X conductors shall be made on the basis of the strengths of the component wires, using the nominal wire diameter for the noncompacted construction and the specified maximum and minimum tensile strengths of the appropriate temper of the respective component wires given in Specification B800. 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 Specification B801. The maximum rated strength of the conductors shall be taken as the sum of the calculated maximum strengths of the component wires.

9.5 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.

## 10. Density

10.1 For the purpose of calculating mass, cross sections, and so forth, the density of aluminum 1350 shall be taken as 0.0975 lb/in.<sup>3</sup> (2705 kg/m<sup>3</sup>) at 20°C. The density of 8000 series aluminum alloys shall be taken as 0.098 lb/in.<sup>3</sup> (2.710 g/cm<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 3. When greater accuracy is desired, the increment based on the specific lay of the conductor may be calculated (Explanatory Note 6).