**Designation: B 701/B 701M – 9600**

# Standard Specification for Concentric-Lay-Stranded Self-Damping Aluminum Conductors, Steel Reinforced (ACSR/SD)[1]

This standard is issued under the fixed designation B 701/B 701M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification covers concentric-lay-stranded self-damping aluminum conductor, steel-reinforced (ACSR/SD) and its component wires for use as overhead electrical conductors (Explanatory Note 1 and Note 2).

1.2 The values stated in inch-pound or SI units are to be regarded separately as standard. Each system shall be used independently of the standard other. Combining values from the two systems may result in non-conformance with the spexcepification. Fofr conductor sizes designated by AWG or kcmpil, the requirements in SI units have been numerically converted from corresponding values stated or derived in inch-pound units. For conductor sizes designated by SI units only, the requirements are stated or derived in SI units.

1.2.1 For density, resistivity, and resistivity. The temperature, the values stated in SI equivalents of inch-pound units may are to be approximate. regarded as standard.

NOTE 1—ACSR/SD is designed to control aeolian vibration by integral damping. The conductors consist of a central core of a round steel wire or wires surrounded by two layers of trapezoidal aluminum 1350-H19 wires or two layers of trapezoidal aluminum 1350-H19 wires and one layer of round aluminum 1350-H19 wires (Fig. 1). The trapezoidal-wire layers are separated from each other and from the steel core by two small annular gaps that provide the conductors self-damping characteristics. The round aluminum wires are in tight layer contact between themselves and the underlying trapezoidal wire layer. Different strandings of the same size of conductor are identified by type, which is the approximate ratio of steel area to aluminum area, expressed in percent (Table 1 and Table 2).

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

NOTE 3—The 2—The aluminum and temper designations conform to ANSI Standard H 35.1. Aluminum 1350 corresponds to UNS A91350 in accordance with Practice E 527.

## 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:*

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

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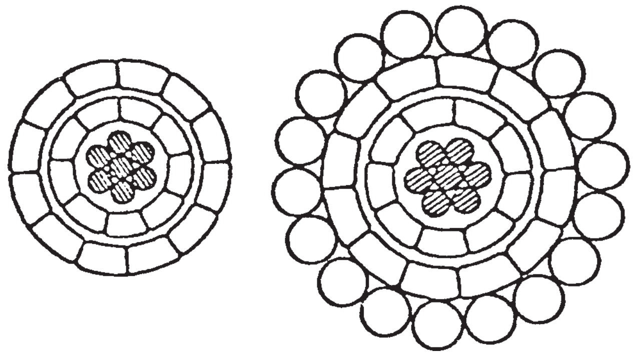

**FIG. 1 Illustrations of Typical ACSR/SD Strandings**

B 230/B 230M Specification for Aluminum 1350-H19 Wire for Electrical Purposes[2]
B 232/B 232M Specification for Concentric-Lay-Stranded Aluminum Conductors, Coated Steel-Reinforced (ACSR)[2]
B 263 Test Method for Determination of Cross-Sectional Area of Stranded Conductors[2]
B 341/B 341M Specification for Aluminum-Coated (Aluminized) Steel Core Wire for Aluminum Conductors, Steel Reinforced (ACSR/AZ)[2]
B 354 Terminology Relating to Uninsulated Metallic Electrical Conductors[2]
B 498/B 498M Specification for Zinc-Coated (Galvanized) Steel Core Wire for Aluminum Conductors, Steel Reinforced (ACSR)[2]
B 502 Specification for Aluminum-Clad Steel Core Wire for Aluminum Conductors, Aluminum-Clad Steel Reinforced[2]
B 549 Specification for Concentric-Lay-Stranded Aluminum Conductors, Aluminum-Clad Steel Reinforced (ACSR/AW)[2]
B 606 Specification for High-Strength Zinc-Coated (Galvanized) Steel Core Wire for Aluminum and Aluminum Alloy Conductors, Steel Reinforced[2]
B 802/B 802M Specification for Zinc-5 % Aluminum-Mischmetal Alloy-Coated Steel Core Wire for Aluminum Conductors, Steel Reinforced (ACSR)[2]
B 803 Specification for High-Strength Zinc-5 % Aluminum-Mischmetal Alloy-Coated Steel Core Wire for Aluminum and Aluminum-Alloy Conductors, Steel Reinforced[2]
E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications[3]
E 527 Practice for Numbering Metals and Alloys (UNS)[4]

2.3 *~~Other~~ANSI Documents:*
ANSI H35.1 American National Standard Alloy and Temper Designation Systems for Aluminum[5]

2.4 *NIST Documents:*
NBS Handbook 100 *—Copper Wire Tables of the National Bureau of Standards*[6]

2.5 *Aluminum Association Documents:*
Publication 50, Code Words for Overhead Aluminum Electrical Conductors[7]

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 ACSR/SD covered by this specification has five types of coated core wire and one type of aluminum-clad core wire which are designated by abbreviations as follows (Explanatory Note 2):

3.1.1.1 *ACSR/SD/AW*—ACSR/SD using aluminum-clad steel wire (Specification B 502).

3.1.1.2 *ACSR/SD/AZ*—ACSR/SD using aluminum-coated (aluminized) steel wire (Specification B 341/B 341M).

3.1.1.3 *ACSR/SD/GA*—ACSR/SD using Class A zinc-coated steel wire (Specification B 498/B 498M).

3.1.1.4 *ACSR/SD/GB*—ACSR/SD using Class B zinc-coated steel wire (Specification B 498/B 498M).

3.1.1.5 *ACSR/SD/GC*—ACSR/SD using Class C zinc-coated steel wire (Specification B 498/B 498M).

3.1.1.6 *ACSR/SD/HS*—ACSR/SD using extra highstrength steel wire (Specification B 606).

3.1.1.7 *ACSR/SD/MA*—ACSR/SD using Class A zinc-5 % aluminum-mischmetal alloy-coated steel core wire (Specification B 802/B 802M).

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[2] *Annual Book of ASTM Standards*, Vol 02.03.
[3] *Annual Book of ASTM Standards*, Vol 14.02.
[4] *Annual Book of ASTM Standards*, Vol 01.01.
[5] Available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.
[6] Available from National ~~Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.~~ Institute of Standards and Technology (NIST), Gaithersburg, MD 20899.
[7] Available from Aluminum Association Inc., 900 19th Street, NW, Suite 300, Washington, DC 20006.

3.1.1.8 *ACSR/SD/MB*—ACSR/SD using Class B zinc-5 % aluminum-mischmetal alloy-coated steel core wire (Specification B 802/B 802M).

3.1.1.9 *ACSR/SD/MC*—ACSR/SD using Class V zinc-5 % aluminum-mischmetal alloy-coated steel core wire (Specification B 802/B 802M).

3.1.1.10 *ACSR/SD/MS*—ACSR/SD using high-strength zinc-5 % Aluminum-mischmetal alloy-coated steel core wire (Specification B 803).

## 4. Ordering Information

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

4.1.1 Quantity of each size and type (Note 1),

4.1.2 Conductor size: kcmil area,

4.1.3 Conductor type and number of wires, aluminum and steel (Table 1),

4.1.4 Type of steel core wire and if zinc or Zn-5 % Al-MM alloy coated, area density (Classes A, B, and C) of coating (see 5.2),

4.1.5 Special tension test, if required (see 9.2),

4.1.6 Place of inspection (Section 15),

4.1.7 Package size (see 16.1),

4.1.8 Special package marking, if required (Section 17), and

4.1.9 Heavy wood lagging, if required (see 16.3).

## 5. Requirement For Wires

5.1 Before stranding, the round and trapezoidal aluminum wires shall conform to the requirements of Specification B 230 except for shape and diameter tolerance of the trapezoidal wires. The tensile strength and elongation requirements of trapezoidal wires shall be the same as for round wires of equal area. The area tolerances shall be such that the finished conductor conforms to Section 12.

5.2 Before stranding, the steel core wire shall meet the requirements of Specifications B 341/B 341M, B 498/B 498M, B 502, B 606, B 802/B 802M, or B 803, whichever is applicable.

## 6. Joints

6.1 Electric-butt welds, electric-butt, cold-upset welds, or cold-pressure welds may be made in the individual aluminum wires during the stranding process. No weld shall occur within 50 ft. (15 m) of any other weld in the completed conductor (Explanatory Note ~~3).~~ 2).

6.2 There shall be no joints made in the finished steel wires.

## 7. Lay

7.1 The nominal lay factors for the trapezoidal aluminum wires are shown in Table 1 (Explanatory Note 1).

7.2 The lay factor for the round aluminum wires shall be not less than 10 nor more than 13.

7.3 The lay factor for the 6-wire layer of 7 and 19-wire steel cores shall be not less than 18 nor more than 30.

7.4 The lay factor for the 12-wire layer of 19-wire steel cores shall be no less than 16 nor more than 24.

7.5 The direction of lay of the outside layer of aluminum wires shall be right-hand.

7.6 The direction of lay of the aluminum and steel wires shall be reversed in successive layers.

7.7 For the purpose of this specification the lay factor is the length of lay of a given layer divided by its outside diameter.

## 8. Construction

8.1 The nominal aluminum cross-sectional area, type, stranding, and equivalent wire diameters shall be as shown in Table 1 (Explanatory Note 1).

8.2 The smaller sizes of ACSR/SD consist of a steel core, an inner gap surrounded by a layer of trapezoidal aluminum wires (called the inner layer), and an outer gap surrounded by a second layer of trapezoidal aluminum wire (called the outer layer). The larger sizes of ACSR/SD consist of a steel core, an inner gap surrounded by a layer of trapezoidal aluminum wires (called the inner layer), an outer gap surrounded by a layer of trapezoidal aluminum wires (called the middle layer), and one of round aluminum wires (called the outer layer) fitting tightly over the middle layer. The diameter and number of steel core wires, the number and equivalent round wire diameters of the trapezoidal aluminum wires, and the number and diameter of the round aluminum wires shall be as shown in Table 1.

8.3 All conductor gaps shall be measured radially. The nominal thickness of the gap is 0.030 in. (0.75 mm). The tolerance of both the inner and outer gaps shall be plus 0.000 in. (0.00 mm) and minus 0.010 in. (0.25 mm).

**TABLE 1 Construction Requirements of Aluminum Conductors, Self Damping, Concentric-Lay-Stranded, Steel-Reinforced**

| Conductor Size | | | Stranding Number of Wires and Diameter, in.$^{A}$ | | | Nominal Aluminum Lay Factor | Mass per 1000 ft, lb | Rated Strength, kip$^{A,B}$ | Nominal Outside Diameter, in. |
|---|---|---|---|---|---|---|---|---|---|
| | | | Aluminum | | Steel$^{C}$ | | | | |
| kcmil | Type$^{D}$ | Code Word$^{E}$ | Round | Trapezoidal~~$^{E}$~~$^{F}$ | Round | | | | |
| 2156 | 8 | Bluebird | | 10 × 0.2179 | 19 × 0.0961 | 14.5 | 2504 | 60.7 | 1.716 |
| | | | | 15 × 0.2184 | | 12.1 | | | |
| | | | 21 × 0.2145 | | | 11.0 | | | |
| 1780 | 8 | Chukar | | 9 × 0.2041 | 19 × 0.0874 | 14.5 | 2068 | 51.1 | 1.565 |
| | | | | 13 × 0.2150 | | 12.0 | | | |
| | | | 21 × 0.1957 | | | 11.0 | | | |
| 1780 | 5 | Smew | | 8 × 0.2171 | 7 × 0.1144 | 16.0 | 1921 | 43.6 | 1.531 |
| | | | | 14 × 0.2128 | | 12.5 | | | |
| | | | 21 × 0.1914 | | | 11.5 | | | |
| 1590 | 13 | Falcon | | 10 × 0.1891 | 19 × 0.1030 | 13.5 | 2039 | 55.1 | 1.521 |
| | | | | 14 × 0.1977 | | 11.7 | | | |
| | | | 24 × 0.1690 | | | 11.5 | | | |
| 1590 | 7 | Lapwing | | 8 × 0.2059 | 7 × 0.1253 | 15.9 | 1791 | 42.6 | 1.468 |
| | | | | 12 × 0.2130 | | 12.8 | | | |
| | | | 21 × 0.1835 | | | 11.5 | | | |
| 1590 | 5 | Ratite | | 8 × 0.2095 | 7 × 0.1083 | 15.4 | 1715 | 39.1 | 1.447 |
| | | | | 13 × 0.2143 | | 12.5 | | | |
| | | | 23 × 0.1669 | | | 11.5 | | | |
| 1431 | 13 | Plover | | 10 × 0.1792 | 19 × 0.0977 | 13.5 | 1835 | 49.6 | 1.448 |
| | | | | 14 × 0.1868 | | 11.7 | | | |
| | | | 24 × 0.1609 | | | 11.5 | | | |
| 1431 | 7 | Bobolink | | 8 × 0.1946 | 7 × 0.1189 | 15.1 | 1612 | 38.9 | 1.398 |
| | | | | 12 × 0.2015 | | 12.2 | | | |
| | | | 21 × 0.1747 | | | 11.5 | | | |
| 1431 | 5 | Popinjay | | 8 × 0.1936 | 7 × 0.1025 | 16.0 | 1544 | 35.3 | 1.381 |
| | | | | 13 × 0.1972 | | 12.5 | | | |
| | | | 21 × 0.1726 | | | 11.5 | | | |
| ~~8 1351.5~~ | ~~13~~ | ~~Martin~~ | — | ~~11 × 0.1604~~ | ~~19 × 0.0949~~ | ~~14.7~~ | ~~1733~~ | ~~46.8~~ | ~~1.417~~ |
| | | | — | ~~15 × 0.1652~~ | | ~~12.8~~ | | | |
| | | | ~~21 × 0.1772~~ | | | ~~11.5~~ | | | |
| 1351.5 | 13 | Martin | | 11 × 0.1604 | 19 × 0.0949 | 14.7 | 1733 | 46.8 | 1.417 |
| | | | | 15 × 0.1652 | | 12.8 | | | |
| | | | 21 × 0.1772 | | | 11.5 | | | |
| ~~8 1351.5~~ | ~~10~~ | ~~Frigate~~ | — | ~~9 × 0.1786~~ | ~~7 × 0.1377~~ | ~~14.5~~ | ~~1629~~ | ~~41.7~~ | ~~1.389~~ |
| | | | — | ~~14 × 0.1757~~ | | ~~12.2~~ | | | |
| | | | ~~21 × 0.1735~~ | | | ~~11.0~~ | | | |
| 1351.5 | 10 | Frigate | | 9 × 0.1786 | 7 × 0.1377 | 14.5 | 1629 | 41.7 | 1.389 |
| | | | | 14 × 0.1757 | | 12.2 | | | |
| | | | 21 × 0.1735 | | | 11.0 | | | |
| ~~8 1351.5~~ | ~~7~~ | ~~Dipper~~ | — | ~~8 × 0.1890~~ | ~~7 × 0.1155~~ | ~~15.2~~ | ~~1522~~ | ~~36.7~~ | ~~1.361~~ |
| | | | — | ~~12 × 0.1954~~ | | ~~12.2~~ | | | |
| | | | ~~21 × 0.1701~~ | | | ~~11.0~~ | | | |
| 1351.5 | 7 | Dipper | | 8 × 0.1890 | 7 × 0.1155 | 15.2 | 1522 | 36.7 | 1.361 |
| | | | | 12 × 0.1954 | | 12.2 | | | |
| | | | 21 × 0.1701 | | | 11.0 | | | |
| ~~8 1351.5~~ | ~~5~~ | ~~Ringdove~~ | — | ~~8 × 0.1946~~ | ~~7 × 0.0997~~ | ~~16.0~~ | ~~1458~~ | ~~33.4~~ | ~~1.344~~ |
| | | | — | ~~12 × 0.1949~~ | | ~~12.8~~ | | | |
| | | | ~~21 × 0.1680~~ | | | ~~11.5~~ | | | |
| 1351.5 | 5 | Ringdove | | 8 × 0.1946 | 7 × 0.0997 | 16.0 | 1458 | 33.4 | 1.344 |
| | | | | 12 × 0.1949 | | 12.8 | | | |
| | | | 21 × 0.1680 | | | 11.5 | | | |
| 1272 | 13 | Pheasant | | 11 × 0.1552 | 19 × 0.0921 | 14.7 | 1631 | 44.1 | 1.378 |
| | | | | 15 × 0.1599 | | 12.8 | | | |
| | | | 21 × 0.1723 | | | 11.5 | | | |
| 1272 | 7 | Bittern | | 8 × 0.1829 | 7 × 0.1121 | 14.5 | 1433 | 34.6 | 1.323 |
| | | | | 12 × 0.1894 | | 12.3 | | | |
| | | | 21 × 0.1653 | | | 11.5 | | | |
| 1272 | 5 | Scissortail | | 7 × 0.1929 | 7 × 0.0967 | 15.7 | 1372 | 31.4 | 1.305 |
| | | | | 11 × 0.2029 | | 12.3 | | | |
| | | | 21 × 0.1631 | | | 11.5 | | | |
| ~~8 1192.5~~ | ~~13~~ | | | ~~10 × 0.2147~~ | ~~19 × 0.0892~~ | ~~14.2~~ | ~~1526~~ | ~~41.9~~ | ~~1.274~~ |
| 1192.5 | 13 | Grackle | | 10 × 0.2147 | 19 × 0.0892 | 14.2 | 1526 | 41.9 | 1.274 |
| | | | | 16 × 0.2138 | | 11.5 | | | |
| ~~8 1192.5~~ | ~~7~~ | | | ~~8 × 0.1768~~ | ~~7 × 0.1085~~ | ~~15.1~~ | ~~1343~~ | ~~32.4~~ | ~~1.284~~ |
| 1192.5 | 7 | Bunting | | 8 × 0.1768 | 7 × 0.1085 | 15.1 | 1343 | 32.4 | 1.284 |
| | | | | 12 × 0.1831 | | 12.2 | | | |
| | | | 21 × 0.1604 | | | 11.5 | | | |
| ~~8 1192.5~~ | ~~5~~ | ~~Oxbird~~ | — | ~~7 × 0.1868~~ | ~~7 × 0.0936~~ | ~~15.7~~ | ~~1286~~ | ~~29.5~~ | ~~1.266~~ |
| | | | — | ~~11 × 0.1960~~ | | ~~12.3~~ | | | |
| | | | ~~21 × 0.1582~~ | | | ~~11.5~~ | | | |

**TABLE 1** *Continued*

| Conductor Size | | Stranding Number of Wires and Diameter, in.[A] | | | | Nominal Aluminum Lay Factor | Mass per 1000 ft, lb | Rated Strength, kip[A,B] | Nominal Outside Diameter, in. |
|---|---|---|---|---|---|---|---|---|---|
| | | Aluminum | | | Steel[C] | | | | |
| kcmil | Type[D] | Code Word[E] | Round | Trapezoidal[~~E~~F] | Round | | | | |
| 1192.5 | 5 | Oxbird | | 7 × 0.1868 | 7 × 0.0936 | 15.7 | 1286 | 29.5 | 1.266 |
| | | | | 11 × 0.1960 | | 12.3 | | | |
| | | | 21 × 0.1582 | | | 11.5 | | | |
| ~~1113~~ | ~~13~~ | | | ~~9 × 0.2188~~ | ~~19 × 0.0862~~ | ~~14.2~~ | ~~1424~~ | ~~39.1~~ | ~~1.233~~ |
| 1113 | 13 | Finch | | 9 × 0.2188 | 19 × 0.0862 | 14.2 | 1424 | 39.1 | 1.233 |
| | | | | 15 × 0.2133 | | 11.5 | | | |
| ~~1113~~ | ~~7~~ | | | ~~8 × 0.1705~~ | ~~7 × 0.1049~~ | ~~15.9~~ | ~~1254~~ | ~~30.3~~ | ~~1.242~~ |
| 1113 | 7 | Bluejay | | 8 × 0.1705 | 7 × 0.1049 | 15.9 | 1254 | 30.3 | 1.242 |
| | | | | 12 × 0.1765 | | 12.8 | | | |
| | | | 21 × 0.1553 | | | 11.5 | | | |
| 1113 | 5 | Avocet | | 7 × 0.1818 | 7 × 0.0904 | 16.0 | 1200 | 27.5 | 1.226 |
| | | | | 12 × 0.1798 | | 12.4 | | | |
| | | | 21 × 0.1533 | | | 11.5 | | | |
| ~~1033.5~~ | ~~13~~ | | | ~~9 × 0.2106~~ | ~~7 × 0.1383~~ | ~~14.2~~ | ~~1329~~ | ~~36.3~~ | ~~1.191~~ |
| | | | | ~~14 × 0.2129~~ | | ~~11.5~~ | | | |
| 1033.5 | 13 | Curlew | | 9 × 0.2106 | 7 × 0.1383 | 14.2 | 1329 | 36.3 | 1.191 |
| | | | | 14 × 0.2129 | | 11.5 | | | |
| ~~1033.5~~ | ~~7~~ | | | ~~8 × 0.2168~~ | ~~7 × 0.1010~~ | ~~15.2~~ | ~~1161~~ | ~~28.1~~ | ~~1.145~~ |
| | | | | ~~14 × 0.2167~~ | | ~~11.5~~ | | | |
| 1033.5 | 7 | Ortolan | | 8 × 0.2168 | 7 × 0.1010 | 15.2 | 1161 | 28.1 | 1.145 |
| | | | | 14 × 0.2167 | | 11.5 | | | |
| 1033.5 | 5 | Snowbird | | 7 × 0.1746 | 7 × 0.871 | 16.0 | 1115 | 25.9 | 1.185 |
| | | | | 12 × 0.1731 | | 12.4 | | | |
| | | | 21 × 0.1481 | | | 11.5 | | | |
| ~~954~~ | ~~13~~ | | | ~~8 × 0.2147~~ | ~~7 × 0.1329~~ | ~~14.2~~ | ~~1227~~ | ~~33.5~~ | ~~1.147~~ |
| | | | | ~~13 × 0.2122~~ | | ~~11.5~~ | | | |
| 954 | 13 | Cardinal | | 8 × 0.2147 | 7 × 0.1329 | 14.2 | 1227 | 33.5 | 1.147 |
| | | | | 13 × 0.2122 | | 11.5 | | | |
| ~~954~~ | ~~7~~ | | | ~~8 × 0.2080~~ | ~~7 × 0.0971~~ | ~~15.2~~ | ~~1073~~ | ~~26.1~~ | ~~1.103~~ |
| | | | | ~~13 × 0.2163~~ | | ~~11.5~~ | | | |
| 954 | 7 | Rail | | 8 × 0.2080 | 7 × 0.0971 | 15.2 | 1073 | 26.1 | 1.103 |
| | | | | 13 × 0.2163 | | 11.5 | | | |
| ~~954~~ | ~~5~~ | | | ~~7 × 0.2196~~ | ~~7 × 0.0836~~ | ~~15.6~~ | ~~1027~~ | ~~23.7~~ | ~~1.088~~ |
| | | | | ~~13 × 0.2178~~ | | ~~11.5~~ | | | |
| 954 | 5 | Phoenix | | 7 × 0.2196 | 7 × 0.0836 | 15.6 | 1027 | 23.7 | 1.088 |
| | | | | 13 × 0.2178 | | 11.5 | | | |
| ~~795~~ | ~~16~~ | | | ~~9 × 0.1865~~ | ~~7 × 0.1360~~ | ~~13.9~~ | ~~1093~~ | ~~31.8~~ | ~~1.077~~ |
| | | | | ~~13 × 0.1926~~ | | ~~11.5~~ | | | |
| 795 | 16 | Drake | | 9 × 0.1865 | 7 × 0.1360 | 13.9 | 1093 | 31.8 | 1.077 |
| | | | | 13 × 0.1926 | | 11.5 | | | |
| ~~795~~ | ~~13~~ | | | ~~8 × 0.1957~~ | ~~7 × 0.1213~~ | ~~14.2~~ | ~~1023~~ | ~~28.2~~ | ~~1.055~~ |
| | | | | ~~12 × 0.2018~~ | | ~~11.5~~ | | | |
| 795 | 13 | Condor | | 8 × 0.1957 | 7 × 0.1213 | 14.2 | 1023 | 28.2 | 1.055 |
| | | | | 12 × 0.2018 | | 11.5 | | | |
| ~~795~~ | ~~10~~ | | | ~~7 × 0.2067~~ | ~~7 × 0.1056~~ | ~~14.7~~ | ~~956~~ | ~~25.1~~ | ~~1.034~~ |
| | | | | ~~12 × 0.2033~~ | | ~~11.5~~ | | | |
| 795 | 10 | Puffin | | 7 × 0.2067 | 7 × 0.1056 | 14.7 | 956 | 25.1 | 1.034 |
| | | | | 12 × 0.2033 | | 11.5 | | | |
| ~~795~~ | ~~7~~ | | | ~~7 × 0.2034~~ | ~~7 × 0.0886~~ | ~~15.2~~ | ~~893~~ | ~~21.9~~ | ~~1.013~~ |
| | | | | ~~11 × 0.2144~~ | | ~~11.5~~ | | | |
| 795 | 7 | Tern | | 7 × 0.2034 | 7 × 0.0886 | 15.2 | 893 | 21.9 | 1.013 |
| | | | | 11 × 0.2144 | | 11.5 | | | |
| ~~795~~ | ~~5~~ | | | ~~6 × 0.2167~~ | ~~7 × 0.0764~~ | ~~15.6~~ | ~~856~~ | ~~19.8~~ | ~~0.999~~ |
| | | | | ~~11 × 0.2160~~ | | ~~11.5~~ | | | |
| 795 | 5 | Macaw | | 6 × 0.2167 | 7 × 0.0764 | 15.6 | 856 | 19.8 | 0.999 |
| | | | | 11 × 0.2160 | | 11.5 | | | |
| ~~636~~ | ~~16~~ | | | ~~9 × 0.1666~~ | ~~7 × 0.1216~~ | ~~13.9~~ | ~~874~~ | ~~25.4~~ | ~~0.975~~ |
| | | | | ~~13 × 0.1723~~ | | ~~11.5~~ | | | |
| 636 | 16 | Grosbeak | | 9 × 0.1666 | 7 × 0.1216 | 13.9 | 874 | 25.4 | 0.975 |
| | | | | 13 × 0.1723 | | 11.5 | | | |
| ~~636~~ | ~~13~~ | | | ~~8 × 0.1749~~ | ~~7 × 0.1085~~ | ~~14.3~~ | ~~818~~ | ~~22.9~~ | ~~0.955~~ |
| | | | | ~~12 × 0.1806~~ | | ~~11.5~~ | | | |
| 636 | 13 | Rook | | 8 × 0.1749 | 7 × 0.1085 | 14.3 | 818 | 22.9 | 0.955 |
| | | | | 12 × 0.1806 | | 11.5 | | | |
| ~~636~~ | ~~10~~ | | | ~~7 × 0.1848~~ | ~~7 × 0.0945~~ | ~~14.7~~ | ~~765~~ | ~~20.1~~ | ~~0.935~~ |
| | | | | ~~12 × 0.1819~~ | | ~~11.5~~ | | | |
| 636 | 10 | Goldfinch | | 7 × 0.1848 | 7 × 0.0945 | 14.7 | 765 | 20.1 | 0.935 |
| | | | | 12 × 0.1819 | | 11.5 | | | |
| ~~636~~ | ~~7~~ | | | ~~7 × 0.1815~~ | ~~7 × 0.0793~~ | ~~15.2~~ | ~~715~~ | ~~17.7~~ | ~~0.917~~ |
| | | | | ~~12 × 0.1838~~ | | ~~11.5~~ | | | |

**TABLE 1** *Continued*

| Conductor Size | | Stranding Number of Wires and Diameter, in.[A] | | | | Nominal Aluminum Lay Factor | Mass per 1000 ft, lb | Rated Strength, kip[A,B] | Nominal Outside Diameter, in. |
|---|---|---|---|---|---|---|---|---|---|
| | | Aluminum | | | Steel[C] | | | | |
| kcmil | Type[D] | Code Word[E] | Round | Trapezoidal[~~E~~F] | Round | | | | |
| 636 | 7 | Killdeer | | 7 × 0.1815<br>12 × 0.1838 | 7 × 0.0793 | 15.2<br>11.5 | 715 | 17.7 | 0.917 |
| ~~636~~ | ~~5~~ | | | ~~6 × 0.1938~~<br>~~11 × 0.1932~~ | ~~7 × 0.0684~~ | ~~15.8~~<br>~~11.5~~ | ~~684~~ | ~~16.1~~ | ~~0.903~~ |
| 636 | 5 | Pipit | | 6 × 0.1938<br>11 × 0.1932 | 7 × 0.0684 | 15.8<br>11.5 | 684 | 16.1 | 0.903 |
| ~~556.5~~ | ~~16~~ | | | ~~9 × 0.1557~~<br>~~13 × 0.1613~~ | ~~7 × 0.1138~~ | ~~14.0~~<br>~~11.5~~ | ~~765~~ | ~~22.6~~ | ~~0.919~~ |
| 556.5 | 16 | Dove | | 9 × 0.1557<br>13 × 0.1613 | 7 × 0.1138 | 14.0<br>11.5 | 765 | 22.6 | 0.919 |
| ~~556.5~~ | ~~13~~ | | | ~~8 × 0.1637~~<br>~~13 × 0.1662~~ | ~~7 × 0.1015~~ | ~~14.3~~<br>~~11.5~~ | ~~716~~ | ~~20.0~~ | ~~0.901~~ |
| 556.5 | 13 | Parakeet | | 8 × 0.1637<br>13 × 0.1662 | 7 × 0.1015 | 14.3<br>11.5 | 716 | 20.0 | 0.901 |
| ~~556.5~~ | ~~10~~ | | | ~~7 × 0.1728~~<br>~~12 × 0.1702~~ | ~~7 × 0.0884~~ | ~~14.7~~<br>~~11.5~~ | ~~669~~ | ~~17.8~~ | ~~0.882~~ |
| 556.5 | 10 | Sapsucker | | 7 × 0.1728<br>12 × 0.1702 | 7 × 0.0884 | 14.7<br>11.5 | 669 | 17.8 | 0.882 |
| ~~556.5~~ | ~~7~~ | | | ~~7 × 0.1707~~<br>~~11 × 0.1790~~ | ~~7 × 0.0741~~ | ~~15.2~~<br>~~11.5~~ | ~~625~~ | ~~15.5~~ | ~~0.863~~ |
| 556.5 | 7 | Sunbird | | 7 × 0.1707<br>11 × 0.1790 | 7 × 0.0741 | 15.2<br>11.5 | 625 | 15.5 | 0.863 |
| ~~556.5~~ | ~~5~~ | | | ~~6 × 0.1820~~<br>~~10 × 0.1892~~ | ~~1 × 0.1692~~ | ~~15.8~~<br>~~11.5~~ | ~~599~~ | ~~13.6~~ | ~~0.843~~ |
| 556.5 | 5 | Blackbird | | 6 × 0.1820<br>10 × 0.1892 | 1 × 0.1692 | 15.8<br>11.5 | 599 | 13.6 | 0.843 |
| ~~477~~ | ~~16~~ | | | ~~9 × 0.1438~~<br>~~13 × 0.1496~~ | ~~7 × 0.1053~~ | ~~14.0~~<br>~~11.5~~ | ~~655.8~~ | ~~19.5~~ | ~~0.860~~ |
| 477 | 16 | Hawk | | 9 × 0.1438<br>13 × 0.1496 | 7 × 0.1053 | 14.0<br>11.5 | 655.8 | 19.5 | 0.860 |
| ~~477~~ | ~~13~~ | | | ~~8 × 0.1515~~<br>~~13 × 0.1502~~ | ~~7 × 0.0940~~ | ~~14.4~~<br>~~11.5~~ | ~~613.5~~ | ~~17.2~~ | ~~0.843~~ |
| 477 | 13 | Flicker | | 8 × 0.1515<br>13 × 0.1502 | 7 × 0.0940 | 14.4<br>11.5 | 613.5 | 17.2 | 0.843 |
| ~~477~~ | ~~10~~ | | | ~~7 × 0.1599~~<br>~~12 × 0.1576~~ | ~~7 × 0.0818~~ | ~~14.8~~<br>~~11.5~~ | ~~573.4~~ | ~~15.3~~ | ~~0.824~~ |
| 477 | 10 | Toucan | | 7 × 0.1599<br>12 × 0.1576 | 7 × 0.0818 | 14.8<br>11.5 | 573.4 | 15.3 | 0.824 |
| ~~477~~ | ~~7~~ | | | ~~7 × 0.1577~~<br>~~12 × 0.1589~~ | ~~7 × 0.0686~~ | ~~15.2~~<br>~~11.5~~ | ~~535.8~~ | ~~13.3~~ | ~~0.808~~ |
| 477 | 7 | Jackdaw | | 7 × 0.1577<br>12 × 0.1589 | 7 × 0.0686 | 15.2<br>11.5 | 535.8 | 13.3 | 0.808 |
| ~~477~~ | ~~5~~ | | | ~~6 × 0.1656~~<br>~~10 × 0.1768~~ | ~~1 × 0.1566~~ | ~~16.0~~<br>~~11.5~~ | ~~513.3~~ | ~~11.7~~ | ~~0.787~~ |
| 477 | 5 | Kestrel | | 6 × 0.1656<br>10 × 0.1768 | 1 × 0.1566 | 16.0<br>11.5 | 513.3 | 11.7 | 0.787 |
| ~~397.5~~ | ~~16~~ | | | ~~9 × 0.1278~~<br>~~14 × 0.1338~~ | ~~7 × 0.0961~~ | ~~14.2~~<br>~~11.5~~ | ~~546.5~~ | ~~16.4~~ | ~~0.771~~ |
| 397.5 | 16 | Ibis | | 9 × 0.1278<br>14 × 0.1338 | 7 × 0.0961 | 14.2<br>11.5 | 546.5 | 16.4 | 0.771 |
| ~~397.5~~ | ~~10~~ | | | ~~7 × 0.1424~~<br>~~12 × 0.1459~~ | ~~7 × 0.0747~~ | ~~15.0~~<br>~~11.5~~ | ~~477.9~~ | ~~12.9~~ | ~~0.750~~ |
| 397.5 | 10 | Stork | | 7 × 0.1424<br>12 × 0.1459 | 7 × 0.0747 | 15.0<br>11.5 | 477.9 | 12.9 | 0.750 |
| ~~397.5~~ | ~~7~~ | | | ~~6 × 0.1501~~<br>~~11 × 0.1544~~ | ~~1 × 0.1657~~ | ~~15.8~~<br>~~11.5~~ | ~~446.1~~ | ~~10.6~~ | ~~0.725~~ |
| 397.5 | 7 | Longspur | | 6 × 0.1501<br>11 × 0.1544 | 1 × 0.1657 | 15.8<br>11.5 | 446.1 | 10.6 | 0.725 |
| ~~397.5~~ | ~~5~~ | | | ~~6 × 0.1558~~ | ~~1 × 0.1430~~ | ~~15.6~~ | ~~427.7~~ | ~~9.74~~ | ~~0.717~~ |
| 397.5 | 5 | Erne | | 6 × 0.1558<br>10 × 0.1587 | 1 × 0.1430 | 15.6<br>11.5 | 427.7 | 9.74 | 0.717 |
| ~~336.4~~ | ~~16~~ | | | ~~10 × 0.1041~~ | ~~7 × 0.0884~~ | ~~14.7~~ | ~~462.4~~ | ~~14.3~~ | ~~0.716~~ |
| 336.4 | 16 | Linnet | | 10 × 0.1041<br>16 × 0.1194 | 7 × 0.0884 | 14.7<br>11.5 | 462.4 | 14.3 | 0.716 |
| ~~336.4~~ | ~~10~~ | | | ~~8 × 0.1215~~ | ~~7 × 0.0687~~ | ~~15.1~~ | ~~404.5~~ | ~~11.0~~ | ~~0.688~~ |
| 336.4 | 10 | Woodcock | | 8 × 0.1215<br>14 × 0.1249 | 7 × 0.0687 | 15.1<br>11.5 | 404.5 | 11.0 | 0.688 |
| ~~336.4~~ | ~~7~~ | | | ~~6 × 0.1406~~ | ~~1 × 0.1525~~ | ~~15.6~~ | ~~377.7~~ | ~~9.13~~ | ~~0.664~~ |
| 336.4 | 7 | Hummingbird | | 6 × 0.1406<br>11 × 0.1407 | 1 × 0.1525 | 15.6<br>11.5 | 377.7 | 9.13 | 0.664 |
| ~~336.4~~ | ~~5~~ | | | ~~6 × 0.1416~~ | ~~1 × 0.1315~~ | ~~15.9~~ | ~~361.9~~ | ~~8.5~~ | ~~0.667~~ |

TABLE 1 *Continued*

| Conductor Size | | Stranding Number of Wires and Diameter, in.$^{A}$ | | | | Nominal Aluminum Lay Factor | Mass per 1000 ft, lb | Rated Strength, kip$^{A,B}$ | Nominal Outside Diameter, in. |
|---|---|---|---|---|---|---|---|---|---|
| | | Aluminum | | | Steel$^{C}$ | | | | |
| kcmil | Type$^{D}$ | Code Word$^{E}$ | Round | Trapezoidal$^{E F}$ | Round | | | | |
| 336.4 | 5 | Cowbird | | 6 × 0.1416 | 1 × 0.1315 | 15.9 | 361.9 | 8.5 | 0.667 |
| | | | | 10 × 0.1470 | | 11.5 | | | |
| 266.8 | 16 | | | 10 × 0.0881 | 7 × 0.0788 | 15.0 | 367.0 | 11.35 | 0.645 |
| 266.8 | 16 | Partridge | | 10 × 0.0881 | 7 × 0.0788 | 15.0 | 367.0 | 11.35 | 0.645 |
| | | | | 12 × 0.1256 | | 11.5 | | | |
| 266.8 | 10 | | | 8 × 0.0978 | 1 × 0.1619 | 16.0 | 320.0 | 8.45 | 0.610 |
| 266.8 | 10 | Spoonbill | | 8 × 0.0978 | 1 × 0.1619 | 16.0 | 320.0 | 8.45 | 0.610 |
| | | | | 11 × 0.1315 | | 11.3 | | | |
| 266.8 | 7 | | | 7 × 0.1080 | 1 × 0.1358 | 16.0 | 299.4 | 7.61 | 0.601 |
| 266.8 | 7 | Eider | | 7 × 0.1080 | 1 × 0.1358 | 16.0 | 299.4 | 7.61 | 0.601 |
| | | | | 13 × 0.1193 | | 11.2 | | | |
| 266.8 | 5 | | | 6 × 0.1183 | 1 × 0.1171 | 16.0 | 286.9 | 6.92 | 0.593 |
| 266.8 | 5 | Titmouse | | 6 × 0.1183 | 1 × 0.1171 | 16.0 | 286.9 | 6.92 | 0.593 |
| | | | | 12 × 0.1234 | | 11.1 | | | |

$^{A}$ *Conversion Factors:*
1 kcmil = 0.5067 mm$^{2}$1 in. = 25.4 mm1 kip = 1000 lbf = 4.448 kN.
$^{B}$ Rated strengths of complete conductors are calculated in accordance with 9.1 and with Class A zinc-coated steel core wire in accordance with Specification B 498/B 498M.
$^{C}$ Lay factors for steel core are the same as for equivalent stranding of conventional ACSR.
$^{D}$ The type number is the approximate ratio of the steel to aluminum area in percent.
$^{E}$ Code words shown in this column are obtained from, “Publication 50, Code Words for Overhead Aluminum Electrical Conductors”, by the Aluminum Association. They are provided here for information only.
$^{F}$ Wire size indicates equal area round wire diameter.

8.4 Tests to determine the actual diameter of the conductor are not required by this specification but shall be made if agreed upon between the manufacturer and purchaser at the time of placing the order. When measurements of the diameter are made, these shall be made in the manufacturer’s premises during fabrication and at the central point between the final closing die of the strander and the capstan when the conductor is under tension. When so measured the maximum difference in mean diameter from the nominal diameter shall be 1 % (measured in the transverse plane), and the maximum difference in diameter at any transverse section shall be not greater than 3 %.

TABLE 2 Comparison of ACSR/SD with Equivalent Stranding of ACSR$^{A}$

| ACSR/SD Type Number$^{B}$ | Conventional ACSR Stranding$^{C}$ |
|---|---|
| 5 | 42/7 |
| 7 | 45/7 |
| 8 | 84/19 |
| 10 | 22/7 |
| 13 | 54/7 |
| 13 | 54/19 |
| 13 | 24/7 |
| 16 | 26/7 |

$^{A}$ The equivalent stranding is that stranding of conventional ACSR that has the same area of aluminum and steel as a given ACSR/SD type.
$^{B}$ACSR/SD type number is the approximate ratio of the steel area to the aluminum area in %.
$^{C}$ See Specifications B 232/B 232M and B 549.

## 9. Strength of Conductor

9.1 The rated strength of a complete conductor, as shown in Table 1, shall be taken as the aggregate strength of the aluminum and steel components calculated as follows. The strength contribution of the aluminum 1350-H19 wires shall be taken as the percentage indicated in Table 3, in accordance with the number of aluminum layers, of the sum of the wire strengths calculated from the specified diameter of the round wires and from the diameters of round wires having the same area as the trapezoidal wires shown in Table 1, and the appropriate minimum average tensile strength given in Specification B 230/B 230M. The strength contribution of the steel core wires shall be taken as the percentage, indicated in Table 3, of the sum of the strengths of the steel wires calculated from their specified nominal wire diameter and the appropriate specified minimum stress at 1 % extension given in Specifications B 341/B 341M, B 498/B 498M, B 502, B 606, B 802/B 802M, or B 803, whichever is applicable (Explanatory Note 2).

9.1.1 The rated strengths of conductors calculated in accordance with 9.1 and 9.3, using Class A zinc-coated steel wires in accordance with Specification B 498/B 498M, are listed in Table 1.

9.2 Routine production testing after stranding is not required. However, when such tests are requested by the purchaser and agreed to by the manufacturer at the time of ordering (or made for other reasons) aluminum wires removed from the completed conductor shall have tensile strengths of not less than 95 % of the minimum tensile strength specified for the wire before stranding. The electrical resistivity shall meet the minimum resistivity specified for wire before stranding. Elongation tests may be made for

**TABLE 3 Rating Factors**

| Number of Layers | | | No. of Steel Wires | Rating Factor, % | |
|---|---|---|---|---|---|
| Aluminum | | Steel | | | |
| Round | Trape-zoidal | Round | | Alumi-num | Steel |
| ... | 2 | A | 1 | 95 | 96 |
| ... | 2 | 1 | 7 | 95 | 96 |
| ... | 2 | 2 | 19 | 95 | 93 |
| 1 | 2 | 1 | 7 | 93 | 96 |
| 1 | 2 | 2 | 19 | 93 | 93 |

A Central steel wire only; the 96 % rating factor is applied to the single steel wire core as a factor of safety in the event the steel wire contains a weld (made prior to drawing).

information purposes only and no minimum values are assigned (Explanatory Note 3). The frequency of these tests shall be decided upon between the purchaser and the manufacturer.

9.3 Rated strength and breaking strength values shall be rounded to three significant figures in the final value only, in accordance with Practice E 29.

## 10. Density

10.1 For the purpose of calculating mass per unit length, cross-sections, etc., the density of aluminum shall be taken as 2705 kg/m $^3$ (0.0975 lb/in.$^3$) at 20°C (Explanatory Note 4).

10.2 For the purpose of calculating mass per unit length, cross-sections, etc., the density of galvanized or aluminized steel wire shall be taken as 7780 kg/m$^3$ (0.2810 lb/in.$^3$) at 20°C.

10.3 For the purpose of calculating mass per unit length, cross-sections, etc., the density of aluminum-clad steel wire shall be taken as 6590 kg/m$^3$ (0.2381 lb/in.$^3$) at 20°C.

## 11. Mass per Unit Length and Electrical Resistance

11.1 The mass per unit length and electrical resistance of a unit length of stranded conductor are a function of the length of lay. The approximate mass per unit length and electrical resistance of a stranded conductor may be determined using the standard increments shown in Table 4. When greater accuracy is desired, the increment based on the actual lay of the conductor may be calculated (Explanatory Note 5).

11.2 In the calculation of the electrical resistance of a completed conductor, the resistivity of zinc-coated or aluminum-coated steel core wires shall be taken as 0.19157 Ω- mm$^2$/m at 20°C (68°F) and the resistivity of aluminum-clad steel core wires shall be taken as 0.0848 Ω- mm$^2$/m at 20°C. These are typical values and are not guaranteed.

## 12. Variations in Area

12.1 The area of cross-section of the aluminum wires of the conductor shall be not less than 98 % of the area specified. The area of each wire shall be determined by Test Method B 263. In applying this method, the increment in area density resulting from

**TABLE 4 Standard Increments Due to Stranding**

| Stranding of ACSR/SD | | Increment (Increase),% Mass per Unit Length and Electrical Resistance | |
|---|---|---|---|
| Type No. | Steel | Aluminum | Steel |
| Two layer designs | | | |
| 5 | 1 | 2.1 | 0 |
| 5 | 7 | 2.1 | 0.4 |
| 7 | 1 | 2.1 | 0 |
| 7 | 7 | 2.1 | 0.4 |
| 10 | 1 | 2.0 | 0 |
| 10 | 7 | 2.25 | 0.4 |
| 13 | 7 | 2.3 | 0.4 |
| 13 | 19 | 2.3 | 0.6 |
| 16 | 7 | 2.35 | 0.4 |
| Three layer designs | | | |
| 5 | 7 | 2.35 | 0.4 |
| 7 | 7 | 2.4 | 0.4 |
| 8 | 19 | 2.6 | 0.6 |
| 13 | 19 | 2.65 | 0.6 |

stranding may be the applicable value specified in Table 4, or it may be calculated from the measured dimensions of the sample under test. In case of questions regarding area compliance, the actual area density increment due to stranding shall be calculated.

## 13. Workmanship, Finish, and Appearance

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

## 14. Mechanical and Electrical Tests

14.1 Tests for mechanical and electrical properties of aluminum wires shall be made before stranding (Explanatory Note 5).

14.2 Tests for the properties of the steel core wires shall be made before stranding (Explanatory Note 6).

14.3 Measurement of gap dimensions specified in 8.3 shall be made during fabrication of the conductor. These measurements, as a minimum, shall be made after each new production setup and at least once for each 500 000 ft (150 000 m) of production unless otherwise agreed upon between the manufacturer and the purchaser at the time of placing the order (Explanatory Note 7).

## 15. Inspection

15.1 Unless otherwise specified in the contact or purchase order, the manufacturer shall be responsible for the performance of all inspection and test requirements specified.

15.2 All inspections and tests shall be made at the place of manufacture unless otherwise especially agreed upon between the manufacturer and the purchaser at the time of the purchase.

15.3 The manufacturer shall afford the inspector representing the purchaser all reasonable manufacturer's facilities to satisfy him that the material is being furnished in accordance with this specification.

## 16. Packaging and Package Marking

16.1 Package sizes and kind of package, reels, etc. shall be agreed upon between the manufacturer and the purchaser.

16.2 There shall be only one length of conductor on a reel.

16.3 The conductors shall be protected against damage in ordinary handling and shipping. If heavy wood lagging is required, it shall be specified by the purchaser at the time of placing the order.

16.4 The net linear density, length, size, kind of conductor, conductor type, stranding, type of steel coating or cladding, class of zinc or Zn-5 % Al-MM alloy coating (if used) and any other necessary identification shall be marked on a tag attached to the conductor inside the package. This same information, together with the purchase order number, the manufacturer's serial number (if any), and all shipping marks and other information required by the purchaser shall appear on the outside of the package.

## 17. Keywords

17.1 aluminum electrical conductors; concentric-lay stranded aluminum conductors; concentric-lay stranded aluminum conductors, steel-reinforced; concentric-lay stranded self-damping aluminum conductors, steel reinforced; electrical conductors; electrical conductors—aluminum; self-damping conductors; steel reinforced stranded aluminum conductors; stranded aluminum conductors

## EXPLANATORY NOTES

NOTE 1—In this specification only concentric-lay-stranded self-damping aluminum conductors, steel-reinforced, are specifically designated. Conductor constructions not included in this specification should be agreed upon between the manufacturer and the purchaser when placing the order.

NOTE 2—For definitions of terms relating to conductors, refer to Terminology B 354.

NOTE 3—The behavior of properly spaced joints in aluminum wires in stranded conductors is related to both their tensile strength and elongation. Because of its higher elongation properties, the lower-strength electric-butt weld gives equivalent overall performance to that of a cold-pressure weld or an electric-butt, cold-upset weld in stranded conductors.

NOTE 4—The lay factor with respect to the outside diameter of a layer of wires varies for different layers and for different diameters of conductor, being larger for the inside layers than for the outside layer.

NOTE 5—To obtain the actual breaking strength of ACSR/SD tested as a unit requires special devices for gripping the ends of the aluminum and steel wires without causing damage thereto and resultant failure below the actual strength of the conductor. Various special dead-end devices are available for this purpose, such as compression sleeves. Ordinary grips or clamping devices are usually not suitable.

NOTE 6—Wire unlaid from conductors may have different physical properties from those of the wire prior to stranding because of the deformation brought about by stranding and straightening for test.

NOTE 7—This density is based upon 1350 aluminum.

NOTE 8—This increment of mass per unit length or electrical resistance of a complete concentric-lay-stranded conductor ($k$) in percent is:

$$k = 100(m - 1)$$

where $m$ is the stranding factor, and is also the ratio of the mass per unit length or electrical resistance of a unit length of stranded conductor to that of a solid conductor of the same cross-sectional area or of a stranded conductor with infinite length of lay, that is, all wires parallel to the conductor axis. The stranding factor for the completed stranded conductors is the *numerical average* of the stranding factors for each of the individual wires in the conductor, including the straight core wire, if any (for which the stranding factor is unity). The stranding factor ($m_{ind}$) for any given wire in a concentric-lay-stranded conductor is:

$$m_{ind} = \sqrt{1 + (9.8696/n^2)}$$

where:

$n$ = $\frac{\text{length of lay}}{\text{diameter of helical path of wire}}$

The derivation of the above is given in NBS Handbook 100.[6]

The factors $k$ and $m$ are to be determined separately for the steel core (Section 7).

NOTE 9—Wires unlaid from conductors may have different physical properties from those of the wire before stranding because of the deformation brought about by laying and again straightening for test.

NOTE 10—Tests for measuring the size of the gaps can be carried out by either of the following methods: Note 7(*a*)—Method A consists of drilling, radially, two small holes approximately 8 in. (200 mm) apart through the aluminum layers to the outside of the steel core while the conductor is under tension in the strander. The gaps in the conductor, including voids, are then filled through these holes with a permanent quick-setting compound. After the compound has set, the sample is removed from the conductor. From this sample a short section is further encapsulated; one cross-section of which is polished. Gap measurements are then taken (with a microscope of known magnification) to determine the average gap dimension. The average gap is the arithmetic mean of the individual gap measurements taken between the inner layer of trapezoidal aluminum wires and the nearest point on the outer aluminum trapezoidal layer or the steel core as the case may be, allowing for any misalignment that may exist in the individual trapezoidal wires.

NOTE 11—Method B consists of encapsulating a short section of each trapezoidal wire layer of the conductor as it is fabricated in the strander in a quick-setting soft compound. This encapsulation is cut and removed in one piece from the trapezoidal wire layer under test. Measurements are then made of this encapsulation (with a comparator of known magnification) to determine the maximum amount of misalignment of the wires in each trapezoidal wire layer. The amount of this misalignment is then subtracted from the average gap which has been calculated from measurements taken of the core wire size, layer diameters, and trapezoidal wire thickness in order to determine the net gap of the sample.