Designation: B231/B231M – 12

Standard Specification for Concentric-Lay-Stranded Aluminum 1350 Conductors[1]

1. Scope

1.1 This specification covers aluminum 1350-H19 (extra hard), 1350-H16 or -H26 (¾ hard), 1350-H14 or -H24 (½ hard), and 1350-H142 or -H242 (½ 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:*[2]

B193 Test Method for Resistivity of Electrical Conductor Materials

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

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

B354 Terminology Relating to Uninsulated Metallic Electrical Conductors

B609/B609M Specification for Aluminum 1350 Round Wire, Annealed and Intermediate Tempers, for Electrical Purposes

B682 Specification for 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:*[3]

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:*[4]

NBS Handbook 100—Copper Wire Tables

2.5 *Aluminum Association Document:*[5]

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).

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

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

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

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

[5] 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^2) 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 1100, 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[A]		
cmils[B] or AWG	mm²	Code Words[C]	Class	Number of Wires	Diameter of Wire, in.	Diameter of Wire, mm	Per 1000 ft, lb	Per km, kg	kips	kN	Reel Designation[D]	Nominal Length of Each Piece, ft[B]	Nominal Mass of Each Length, lb[B]
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
											RM 68.38	3270	4880
1 510 500	765.4	Gladiolus	AA, A	61	0.1574	4.00	1417	2108	25.6	114	RMT 90.45	6880	9760
											RM 68.38	3440	4880
1 431 000	725.1	Carnation	AA, A	61	0.1532	3.89	1342	1997	24.3	108	RMT 90.45	7270	9760
											RM 68.38	3635	4880
1 351 000	684.6	Columbine	AA, A	61	0.1488	3.78	1266	1884	23.4	104	RMT 90.45	7690	9760
											RM 68.38	3845	4880
1 272 000	644.5	Narcissus	AA, A	61	0.1444	3.67	1192	1774	22.0	98.1	RMT 90.45	8170	9760
											RM 68.38	4085	4880
1 192 500	604.2	Hawthorn	AA, A	61	0.1398	3.55	1117	1662	21.1	93.5	RMT 90.45	9340	9760
											RM 68.38	4360	4880
1 113 000	564.0	Marigold	AA, A	61	0.1351	3.43	1044	1553	19.7	87.3	RMT 90.45	9340	9760
											RM 68.38	4670	4880
1 033 500	523.7	Bluebell	AA	37	0.1671	4.25	968.4	1441	17.7	78.8	RMT 84.45	7630	7400
											RM 66.32	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
											NR 48.28	1970	1850
1 000 000	506.7	Camellia	A	61	0.1280	3.25	936.8	1394	17.7	78.3	RMT 90.45	10 400	9760
											RM 68.38	5200	4880
954 000	483.4	Magnolia	AA	37	0.1606	4.08	894.5	1331	16.4	72.6	RMT 84.45	8260	7400
											RM 66.32	4130	3700
											NR 48.28	2065	1850
954 000	483.4	Goldenrod	A	61	0.1251	3.18	894.8	1331	16.9	75.0	RMT 90.45	10 900	9760
											RM 68.38	5450	4880
900 000	456.0	Cockscomb	AA	37	0.1560	3.96	844.0	1256	16.4	68.4	RMT 84.45	8760	7400
											RM 66.32	4390	3700
											NR 48.28	2190	1850
900 000	456.0	Snapdragon	A	61	0.1215	3.09	844.0	1256	15.9	70.8	RMT 90.45	11 550	9760
											RM 68.38	5775	4880
795 00	402.8	Arbutus	AA	37	0.1466	3.72	745.3	1109	13.9	61.8	RMT 84.45	9920	7400
											RM 66.32	4960	3700
											NR 48.28	2480	1850
795 000	402.8	Lilac	A	61	0.1142	2.90	745.7	1110	14.3	63.8	RMT 90.45	13 080	9760
											RM 68.38	6540	4880
750 000	380.0	Petunia	AA	37	0.1424	3.62	703.2	1046	13.1	58.6	RMT 84.45	10 510	7400
											RM 66.32	5255	3700
											NR 48.28	2630	1850
750 000	380.0	Cattail	A	61	0.1109	2.82	703.2	1046	13.5	60.3	RMT 90.45	13 860	9760
											RM 68.38	6930	4880
715 500	362.6	Violet	AA	37	0.1391	3.53	671	998.5	12.8	56.7	RTM 84.45	11 020	7400
											RM 66.32	5510	3700
											NR 48.28	2755	1850
715 500	362.6	Nasturtium	A	61	0.1083	2.75	671	998.5	13.1	58.4	RMT 90.45	14 530	9760
											RM 68.38	7265	4880
700 000	354.7	Verbena	AA	37	0.1375	3.49	655.7	975.7	12.5	55.4	RMT 84.45	11 260	7400
											RM 66.32	5630	3700
											NR 48.28	2815	1850
700 000	354.7	Flag	A	61	0.1071	2.72	655.8	975.8	12.9	57.1	RMT 90.45	14 850	9760
											RM 68.38	7425	4880

TABLE 1 *Continued*

Conductor Size				Required Construction			Mass		Rated Strength		Recommended Package Sizes[A]		
cmils[B] or AWG	mm²	Code Words[C]	Class	Number of Wires	Diameter of Wire in.	Diameter of Wire mm	Per 1000 ft, lb	Per km, kg	kips	kN	Reel Designation[D]	Nominal Length of Each Piece, ft[B]	Nominal Mass of Each Length, lb[B]
650 000	329.4	Heuchera	AA	37	0.1326	3.37	609.8	907.4	11.6	51.7	RMT 84.45	12 130	7400
											RM 66.32	6065	3700
											NR 48.28	3035	1850
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
266 800	135.2	Laurel	A	19	0.1185	3.01	250.1	372.2	4.97	22.1	RM 66.32	15 170	3800
											NR 48.28	7585	1900
											NR 42.28	5055	1265
250 000	126.7	Sneezewort	AA	7	0.1890	4.80	234.4	348.8	4.52	20.1	NR 42.28	5970	1400
											NR 36.22	2985	700
250 000	126.7	Valerian	A	19	0.1147	2.91	234.3	348.6	4.66	20.7	RM 66.32	16 190	3800
											NR 48.28	8095	1900
											NR 42.28	5395	1265
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	3525	700
3/0	85.0	Phlox	AA, A	7	0.1548	3.93	157.2	233.9	3.04	13.5	NR 42.28	8890	1400
											NR 36.22	4445	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	5605	700
1/0	53.5	Poppy	AA, A	7	0.1228	3.12	98.9	147.2	1.99	8.84	NR 42.28	14 130	1400
											NR 36.22	7065	700
1	42.4	Pansy	AA, A	7	0.1093	2.78	78.4	116.6	1.64	7.30	NR 42.28	17 830	1400
											NR 36.22	8915	700
2	33.6	Iris	AA, A	7	0.0974	2.47	62.2	92.6	1.35	5.99	NR 42.28	22 470	1400
											NR 36.22	11 235	700
4	21.1	Rose	A	7	0.0772	1.96	39.1	58.2	0.881	3.91	NR 42.28	35 710	1400
											NR 36.22	17 855	700

TABLE 1 *Continued*

Conductor Size				Required Construction			Mass		Rated Strength		Recommended Package Sizes[A]		
cmils[B] or AWG	mm^2	Code Words[C]	Class	Number of Wires	Diameter of Wire in.	Diameter of Wire mm	Per 1000 ft, lb	Per km, kg	kips	kN	Reel Designation[D]	Nominal Length of Each Piece, ft[B]	Nominal Mass of Each Length, lb[B]
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

[A] For information only.
[B] Conversion factors: 1 cmil = 5.067 E-04 mm^2, 1 mil + 2.54 E-02 mm, 1 lb/1000 ft = 1.488 E+00 kg/km, 1 ft = 3.048 E-01 m, l lb = 4.536 E-01 kg, 1 lbf = 4.448 E-03 kN.
[C] 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.
[D] 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^3 [0.0975 $lb/in.^3$] 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.

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, mm²	Class	Stranding		Mass, kg/km	Rated Strength 1350-H19, kN	Recommended Package Sizes[A]		
		Number of Wires	Diameter, mm			Reel Designation[B]	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

TABLE 3 Construction Requirements of Aluminum Conductors, Concentric-Lay-Stranded, Class B, C, and D

Conductor Size		Hard-Drawn Copper Equivalent		Stranding									
				Class B		Class C		Class D					
cmils[A]	AWG	cmils[A]	AWG	Number of Wires	Diameter of Wire, mils[B]	Number of Wires	Diameter of Wire, mils[A]	Number of Wires	Diameter of Wire, mils[A]	Reverse Concentric Compressed Class B Diameter, in.	Unilay Com-pressed Class B Diameter, in.	Direct Current Resistance at 20°C	
												Ω/1000 ft	Ω/km
4 000 000	. . .	2 520 000	. . .	217	135.8	271	121.5	271	121.5	. . .	. . .	0.00442	0.0145
3 500 000	. . .	2 200 000	. . .	169	143.9	217	127.0	271	113.6	. . .	. . .	0.00505	0.0166
3 000 000	. . .	1 890 000	. . .	169	133.2	217	117.6	271	105.2	. . .	. . .	0.00584	0.0192
2 500 000	. . .	1 570 000	. . .	127	140.3	169	121.6	217	107.3	. . .	. . .	0.00701	0.0229
2 000 000	. . .	1 260 000	. . .	127	125.5	169	108.8	217	96.0	1.583	1.533	0.00867	0.0284
1 900 000	. . .	1 195 000	. . .	127	122.3	169	106.0	217	93.6	1.542	1.494	0.00913	0.0299
1 800 000	. . .	1 132 000	. . .	127	119.1	169	103.2	217	91.1	1.502	1.454	0.00963	0.0316
1 750 000	. . .	1 101 000	. . .	127	117.4	169	101.8	217	89.8	1.480	1.434	0.0099	0.0325
1 700 000	. . .	1 069 000	. . .	127	115.7	169	100.3	217	88.5	1.459	1.413	0.0102	0.0335
1 600 000[C]	. . .	1 006 000	. . .	127	112.2	169	97.3	217	85.9	1.415	1.371	0.0109	0.0357
1 500 000	. . .	943 000	. . .	91	128.4	127	108.7	169	94.2	1.370	1.327	0.0116	0.0380
1 400 000	. . .	880 000	. . .	91	124.0	127	105.0	169	91.0	1.323	1.282	0.0124	0.0407
1 300 000	. . .	818 000	. . .	91	119.5	127	101.2	169	87.7	1.275	1.236	0.0133	0.0436
1 250 000[C]	. . .	786 000	. . .	91[D]	117.2	127	99.2	169	86.0	1.250	1.212	0.0138	0.0453
1 200 000	. . .	755 000	. . .	91[D]	114.8	127	97.2	169	84.3	1.225	1.187	0.0144	0.0472
1 100 000	. . .	692 000	. . .	91[D]	109.9	127	93.1	169	80.7	1.173	1.137	0.0158	0.0518
1 000 000[B]	. . .	629 000	. . .	61	128.0	91	104.8	127	88.7	1.117	1.084	0.0173	0.0568
900 000	. . .	566 000	. . .	61	121.5	91	99.4	127	84.2	1.060	1.028	0.0193	0.0633
800 000[C]	. . .	503 000	. . .	61	114.5	91	93.8	127	79.4	1.000	0.969	0.0217	0.0712
750 000	. . .	472 000	. . .	61	110.9	91	90.8	127	76.8	0.968	0.939	0.0231	0.0758
700 000	. . .	440 000	. . .	61	107.1	91	87.7	127	74.2	0.935	0.907	0.0248	0.0814
650 000	. . .	409 000	. . .	61	103.2	91	84.5	127	71.5	0.901	0.874	0.0267	0.0876
636 000	. . .	400 000	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
600 000	. . .	377 000	. . .	61	99.2	91	81.2	127	68.7	0.866	0.840	0.0289	0.0948
550 000	. . .	346 000	. . .	61	95.0	91	77.7	127	65.8	0.829	0.804	0.0315	0.103
500 000	. . .	314 000	. . .	37	116.2	61	90.5	91	74.1	0.789	0.766	0.0347	0.114
477 000	. . .	300 000	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
450 000	. . .	283 000	. . .	37	110.3	61	85.9	91	70.3	0.749	0.727	0.0385	0.126
400 000[C]	. . .	252 000	. . .	37	104.0	61	81.0	91	66.3	0.706	0.685	0.0434	0.142
350 000	. . .	220 000	. . .	37	97.3	61	75.7	91	62.0	0.661	0.641	0.0495	0.162
336 400	. . .	. . .	0000	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
300 000	. . .	188 700	. . .	37	90.0	61	70.1	91	57.4	0.611	0.594	0.0578	0.187
266 800	. . .	. . .	000	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
250 000	. . .	157 200	. . .	37	82.2	61	64.0	91	52.4	0.558	0.542	0.0694	0.228
211 600	0000	. . .	00	19	105.5	37	75.6	61	58.9	0.512	0.498	0.0820	0.269
167 800	000	. . .	0	19	94.0	37	67.3	61	52.4	0.456	0.443	0.103	0.338
133 100	00	. . .	1	19	83.7	37	60.0	61	46.7	0.405	0.395	0.130	0.427
105 600	0	. . .	2	19	74.5	37	53.4	61	41.6	0.362	0.352	0.164	0.538
83 690	1	. . .	3	19	66.4	37	47.6	61	37.0	0.322	0.313	0.207	0.679
66 360	2	. . .	4	7	97.4	19	59.1	37	42.4	0.283	. . .	0.261	0.856
52 620	3	. . .	5	7	86.7	19	52.6	37	37.7	0.252	. . .	0.330	1.08
41 740	4	. . .	6	7	77.2	19	46.9	37	33.6	0.225	. . .	0.416	1.36
33 090	5	. . .	7	7	68.8	19	41.7	37	29.9	0.200	. . .	0.523	1.72
26 240	6	. . .	8	7	61.2	19	37.2	37	26.6	0.178	. . .	0.661	2.17
20 820	7	. . .	9	7	54.5	19	33.1	37	23.7	0.159	. . .	0.834	2.74
16 510	8	. . .	10	7	48.6	19	29.5	37	21.1	0.142	. . .	1.05	3.44
13 090	9	. . .	11	7	43.2	19	26.2	37	18.8	0.126	. . .	1.32	4.33
10 380	10	. . .	12	7	38.5	19	23.4	37	16.7	0.113	. . .	1.67	5.48
	11	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	0.100	. . .	2.11	6.92
6530	12	. . .	14	7	30.5	19	18.5	37	13.3	0.089	. . .	2.67	8.76
	13	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	0.080	. . .	3.34	10.96
4110	14	. . .	16	7	24.2	19	14.7	37	10.5	0.071	. . .	4.22	13.8
2580	16	. . .	18	7	19.2	19	11.7	. . .	. . .	. . .	. . .	6.71	22.0
1620	18	. . .	20	7	15.2	. . .	. . .	. . .	. . .	. . .	. . .	10.7	35.1
1020	20	. . .	22	7	12.1	. . .	. . .	. . .	. . .	. . .	. . .	16.9	55.4

[A] See Footnote B of Table 1.
[B] This size is sensibly equivalent to size 1 033 500 cmils within a difference of 3.24 %.
[C] These sizes are sensibly equivalent to sizes 1 590 000; 1 272 000; 795 000; and 397 500 cmil respectively within the cross-sectional area tolerances stipulated by this specification and associated Specifications B230/B230M and B609/B609M.
[D] 61 As agreed upon between the manufacturer and the customer, these sizes may be produced with 61 wire construction of the appropriate wire size and with the corresponding change in overall diameter.

TABLE 4 Construction Requirements of Conductors Classes B, C, and D

NOTE 1—Sizes selected from Specification B682.

Conductor Size, mm²	Stranding: Class B Number of Wires[A]	Class B Diameter, mm	Class C Number of Wires[A]	Class C Diameter, mm	Class D Number of Wires[A]	Class D Diameter, mm	Nominal Diameter (mm): Reverse Concentric Compressed Class B	Unilay Compressed Class B	Direct Current Resistance Ω/km
2000	217	3.43	271	3.07	271	3.07	56.56	54.74	0.01437
1800	169	3.68	217	3.25	271	2.91	53.54	51.93	0.01596
1600	169	3.47	217	3.06	271	2.74	50.49	48.96	0.01796
1400	169	3.25	217	2.87	271	2.56	47.29	45.79	0.02053
1250	127	3.54	169	3.07	217	2.71	44.64	43.27	0.02299
1200[B]	127	3.47	169	3.01	217	2.65	43.76	42.40	0.02395
1120	127	3.35	169	2.90	217	2.56	42.24	40.96	0.02566
1000	127	3.17	169	2.74	217	2.42	39.97	38.70	0.02874
900	127	3.00	169	2.60	217	2.30	37.83	36.72	0.03193
800	91	3.35	127	2.83	169	2.46	35.74	34.62	0.03592
710	91	3.15	127	2.67	169	2.31	33.61	32.61	0.04047
630	91	2.97	127	2.51	169	2.18	31.69	29.98	0.04561
560	91	2.80	127	2.37	169	2.05	29.88	28.96	0.05131
500	61	3.23	91	2.64	127	2.24	28.20	27.37	0.05747
450	61	3.06	91	2.51	127	2.12	26.71	25.96	0.06386
400	61	2.89	91	2.37	127	2.00	25.23	24.48	0.07184
355	61	2.72	91	2.23	127	1.89	23.75	23.06	0.08094
315	61	2.56	91	2.10	127	1.78	22.35	21.72	0.09122
300[B]	61	2.50	91	2.05	127	1.73	21.83	21.20	0.09578
280	61	2.42	91	1.98	127	1.68	21.13	20.48	0.10263
250	37	2.93	61	2.28	91	1.87	19.89	19.35	0.11494
240[B]	37	2.87	61	2.24	91	1.83	19.49	18.96	0.11973
224	37	2.78	61	2.16	91	1.77	18.88	18.32	0.12828
200	37	2.62	61	2.04	91	1.67	17.79	17.31	0.14368
185[B]	37	2.52	61	1.97	91	1.61	17.11	16.65	0.15532
180	37	2.49	61	1.94	91	1.59	16.90	16.42	0.15964
160	37	2.35	61	1.83	91	1.50	15.96	15.48	0.17959
150[B]	37	2.27	61	1.77	91	1.45	15.41	14.99	0.19157
140	37	2.19	61	1.71	91	1.40	14.87	14.48	0.20525
125	37	2.07	61	1.62	91	1.32	14.06	13.68	0.22988
120[B]	37	2.03	61	1.58	91	1.30	13.78	13.41	0.23946
100	19	2.59	37	1.86	61	1.44	12.56	12.24	0.28735
95.0[B]	19	2.52	37	1.81	61	1.41	12.22	11.93	0.30247
80.0	19	2.32	37	1.66	61	1.29	11.25	10.95	0.35919
70.0[B]	19	2.17	37	1.55	61	1.21	10.52	10.24	0.4105
63.0	19	2.05	37	1.47	61	1.15	9.94	9.71	0.45611
50.0	19	1.83	37	1.31	61	1.02	8.88	8.65	0.5747
40.0	19	1.64	37	1.17	61	0.914	7.95	7.74	0.71838
35.0[B]	7	2.52	19	1.53	37	1.10	7.33	. . .	0.821
31.5	7	2.39	19	1.45	37	1.04	6.95	. . .	0.91222
25.0	7	2.13	19	1.29	37	0.928	6.20	. . .	1.1494
20.0	7	1.91	19	1.16	37	0.830	5.56	. . .	1.4368
16.0	7	1.71	19	1.04	37	0.742	4.98	. . .	1.7959
12.5	7	1.51	19	0.915	37	0.656	4.39	. . .	2.2988
10.0	7	1.35	19	0.819	37	0.587	3.93	. . .	2.8735
8.00	7	1.21	19	0.732	37	0.525	3.52	. . .	3.5919
6.30	7	1.07	19	0.650	37	0.466	3.11	. . .	4.5611
6.00[B]	7	1.04	19	0.634	37	0.454	3.03	. . .	4.7892
5.00	7	0.954	19	0.579	37	0.415	2.78	. . .	5.747
4.00	7	0.853	19	0.518	37	0.371	2.48	. . .	7.1838
3.15	7	0.757	19	0.459	37	0.329	2.20	. . .	9.1222
2.50	7	0.674	19	0.409	37	0.293	1.96	. . .	11.494
2.00	7	0.603	19	0.366	37	0.262	1.75	. . .	14.368
1.50[B]	7	0.522	19	0.317	37	0.227	1.52	. . .	19.157
1.00	7	0.426	19	0.259	. . .	. . .	1.24	. . .	28.735
0.800	7	0.381	. . .	. . .	. . .	. . .	1.11	. . .	35.919
0.750[B]	7	0.369	. . .	. . .	. . .	. . .	1.07	. . .	38.313
0.500	7	0.302	. . .	. . .	. . .	. . .	0.88	. . .	57.47

[A] For unidirectional/unilay stranded conductors, the number of wires shown are a minimum.
[B] Additional sizes shown as third preference sizes in Specification B682.

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

TABLE 5 Minimum Distance Between Joints in the Completed Conductor

Number of Wires in Conductor[A]	Distance Between Joints, min ft [m]					
	Class AA		Class A		Classes B, C, and D	
	ft	[m]	ft	[m]	ft	[m]
7	50[B]	[15][B]	50[C]	[15][C]	1	[0.3]
12	50	[15]	50	[15]	1	[0.3]
19	50	[15]	50	[15]	1	[0.3]
37	25	[7.5]	25	[7.5]	1[D]	[0.3][D]
61 and over	25	[7.5]	5	[1.5]	1[D]	[0.3][D]

[A] Conductors of an intermediate number of wires shall conform to those having the next smaller number.
[B] Only cold-pressure welds and electric-butt, cold-upset welds are permitted in the six outer wires of conductors composed of seven wires; no welds are permitted in the center or core wire.
[C] For bare overhead conductors only cold-pressure welds and electric-butt, cold-upset welds are permitted in the six outer wires, no welds are permitted in the center or core wire. For other uses, electric-butt welds, cold-pressure welds, and electric-butt, cold-upset welds may be used in any wire.
[D] In a layer.

TABLE 6 Rating Factors

Stranding		Rating Factor, %
Number of Wires in Conductor	Number of Layers	
7	1	96
19	2	93
37	3	91
61	4	90
91 and above	5 and above	89

TABLE 7 Standard Increments Due to Stranding

Size of Conductor, All Classes, cmils [mm^2]	Increment (Increase) of Mass and Electrical Resistance, %
4 000 000 to 3 000 001, incl [2000–1500, incl]	4
3 000 000 to 2 000 001,incl [Under 1500–1000, incl]	3
2 000 000 and under [Under 1000]	2

TABLE 8 Temperature Correction Factors for Conductor Resistance

Temperature, °C	Multiplying Factor for Conversion to 20°C
0	1.088
5	1.064
10	1.042
15	1.020
20	1.000
25	0.980
30	0.961
35	0.943
40	0.925
45	0.908
50	0.892
55	0.876
60	0.861
65	0.846
70	0.832
75	0.818
80	0.805
85	0.792
90	0.780

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).

14.3 Routine production testing of the aluminum wires after stranding is not required. However, when such tests are requested by the purchaser and agreed upon by the manufacturer at the time of ordering (or made for other reasons), the 1350-H19 wires removed from the completed conductor shall have tensile strengths of not less than 95 % of the minimum tensile strength specified for the individual tests in Specification B230/B230M. The 1350-H16, -H26, -H14, -H24, -H142, and -H242 wires shall have tensile strengths not less than 95 % of the minimum tensile strengths nor more than 105 % of the maximum tensile strengths prescribed in Specification B609/B609M. The electrical resistivity shall meet the minimum resistivity specified for the wire before stranding. Elongation tests may be made for information purposes only and no minimum values are assigned (Explanatory Note 7). The frequency of these tests shall be decided upon between the purchaser and the manufacturer.

14.4 All wires composing the conductors shall be capable of meeting the bending properties stated in Specification B230/B230M after stranding.

15. Mechanical and Electrical Tests of Conductors ANNEALED After Stranding

15.1 Tensile properties and electrical resistivity shall be determined on samples taken from 10 % of the reels or coils of conductor, but from not less than five (or all if the lot is less than five) reels or coils. Resistivity shall be determined as prescribed in Section 7 of Specification B230/B230M on one wire from each conductor sample except this test is not required if performed previously on the 1350-H19 wire. At the manufacturer's option, tension tests shall be made either on one of the inner 7 wires and one wire from each additional layer of each conductor sample to determine conformance with 15.2 or on the conductor as a unit to determine conformance with 15.3.

15.2 When wires removed from the completed conductor are tested, 1350-H26, -H24, and -H242 wires shall have tensile strengths not less than 95 % of the minimum tensile strength nor more than 105 % of the maximum tensile strength prescribed in Specification B609/B609M, as applicable (Explanatory Note 7).

TABLE 9 Dimensions of Standard Reels (For Information Only)

Reel Designation[A,B,C]	Reel Capacity, in. ^{3} [m^3]	Nominal Reel Dimensions				
		Flange Diameter, in. [m]	Drum Diameter, in. [m]	Width, in. [m]		Arbor Hole Diameter, in. [mm]
				Inside	Outside	
NR 36.22	16 800 [0.275]	36 [0.91]	18 [0.46]	22 [0.56]	25 [0.64]	3 to 3¼ [76–83]
NR 42.28	29 100 [0.477]	42 [1.07]	21 [0.53]	28 [0.71]	32½ [0.83]	3 to 3¼ [76–83]
NR 48.28	38 000 [0.623]	48 [1.22]	24 [0.61]	28 [0.71]	32½ [0.83]	3 to 3¼ [76–83]
RM 66.32[D]	76 900 [1.260]	66 [1.68]	36 [0.91]	32 [0.81]	38 [0.97]	3 to 3¼ [76–83]
RM 68.38[D]	99 300 [1.627]	68 [1.73]	36 [0.91]	38 [0.97]	44 [1.12]	3 to 3¼ [76–83]
RMT 84.45[E]	152 700 [2.502]	78 (84) [1.98 (2.13)]	42 [1.07]	45 [1.14]	52 [1.32]	5 to 5¼ [127–133]
RMT 90.45[E]	187 000 [3.064]	84 (90) [2.13 (2.29)]	42 [1.07]	45 [1.14]	52 [1.32]	5 to 5¼ [127–133]

[A] Prefix "NR" denotes wooden nonreturnable reel, "RM" metal returnable reel, and "RMT" metal returnable reel with I-beam tires.
[B] Pay-off equipment for reels NR 48.28 and smaller should be a minimum of 2 in. [50 mm] wider than the nominal outside reel width to provide for extension of bolts and for possible flange distortion. For reels 66.32 and larger, either wood or metal, pay-off equipment should not be less than 4 in. [100 mm] wider than the reel width.
[C] Reels are not designed to withstand the forces required for braking during tension stringing operations.
[D] Reels RM 66.32 and RM 68.38 have flat rims.
[E] Reels RMT 84.45 and RMT 90.45 have 3-in. [76-mm] I-beam tires. Indicated flange diameters are diameters under the tire; values in parentheses are diameters over the tire. Reels with similar dimensions except without I-beam tires are sometimes used.

15.3 When the completed conductor is tested as a unit, the breaking strengths of 1350-H26, -H24, and -H242 conductors shall conform with 9.2 through 9.4.

15.4 All wires composing the conductors shall be capable of meeting the bending properties stated in Specification B230/B230M after stranding. Routine production testing after stranding is not required unless requested by the purchaser and agreed upon by the manufacturer at the time of ordering.

16. Retests

16.1 If upon testing a sample from any reel or coil of conductor the results do not conform to the requirements of Sections 8 and 9, two additional samples shall be tested, and the average of the three tests shall determine the acceptance of the reel or coil.

17. Inspection

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

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

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

18. Packaging and Package Marking

18.1 Package sizes and kind of package, reels or coils, shall be agreed upon by the manufacturer and the purchaser at the time of placing the order. Recommended package sizes for Classes AA and A are shown in Table 1 or Table 2.

18.2 There shall be only one length of conductor on a reel when the conductor on the reel will not undergo further manufacturing processes.

18.3 The conductor 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.

18.4 The net mass, length (and number of lengths if more than one is included in a package), size, kind of conductor, stranding, and any other necessary identification shall be marked on a tag attached to the end of 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 each package.

NOTE 4—Multiple lengths per package are allowable only when the bare conductor is intended for remanufacture, such as adding a covering or insulation. In such cases the position of each end of a length is to be clearly marked and the length of each portion shall be shown on the tag attached to the end of the conductor.

19. Marking

19.1 The net mass, length (and number of lengths, if more than one length is included in a package), size, and kind of conductor shall be marked on a tag attached to the end of each conductor inside the package. The same information, together with the manufacturer's serial number (if any) and all shipping marks and other information required by the purchaser, all appear on the outside of each package.

20. Keywords

20.1 aluminum conductor; concentric-lay-stranded aluminum conductor; electrical conductors; electrical conductors, aluminum; stranded aluminum conductors

EXPLANATORY NOTES

NOTE 1—In this specification only concentric-lay-stranded conductor constructions manufactured from round aluminum 1350 wires are specifically designated.

NOTE 2—For definitions of terms relating to conductors, refer to Terminology B354.

NOTE 3—The behavior of properly spaced wire joints 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 with more than seven wires.

NOTE 4—Certain types of insulated conductors may require a shorter lay than other conductors. Special requirements regarding length of lay should be specified by the purchaser in such instances.

NOTE 5—The increment of mass or electrical resistance of a completed 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 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 stranding, that is, all wires parallel to the conductor axis. The stranding factor *m* for the completed stranded conductor 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 (mind) for any given wire in a concentric-lay-stranded conductor is:

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

where n = length of lay/diameter of helical path of the wire. The derivation of the above is given in *NBS Handbook 100.*

NOTE 6—To test stranded conductors for breaking strength successfully as a unit requires an adequate means of gripping the ends of the test specimen without causing damage that may result in failure below the actual strength of the conductor. Various means are available such as compression sleeves, split sleeves, and preformed grips, but ordinary jaws or clamping devices usually are not suitable.

NOTE 7—Wires 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 8—The dc resistance on a given construction shall be calculated using the following formula:
Inch-Pound Units:

$$R = \left(\frac{k}{100} + 1\right)\frac{\rho}{A}$$

or Metric Units:

$$R\left[\left(\frac{K}{100} + 1\right)\frac{\rho}{A}\right]1000$$

where:

R = conductor resistance in Ω/1000 ft (Ω/km),
k = increment due to stranding from Table 7 and Explanatory Note 5,
ρ = volume resistivity in ohms-cmil/ft (Ω-mm^2/m), determined in accordance with Test Method B193, and
A = cross-sectional area of conductor in kcmil (mm ^{2}) determined in accordance with Section 12 of this specification.