Designation: B 857 – 02

Standard Specification for Shaped Wire Compact Concentric-Lay-Stranded Aluminum Conductors, Coated-Steel Supported (ACSS/TW)[1]

This standard is issued under the fixed designation B 857; 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 shaped wire compact concentric-lay-stranded aluminum conductors, steel supported (ACSS/TW) for use as overhead electrical conductors (see Explanatory Note 1).

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 other. Combining values from the two systems may result in non-conformance with the specification. For conductor sizes designated by AWG or kcmil sizes, the requirements in SI units are numerically converted from the corresponding requirements in inch-pound units. For conductor sizes designation by AWG or kcmil, 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 temperature, the values stated in SI units are to be regarded as standard.

1.3 ACSS/TW is designed to increase the aluminum area for a given diameter of conductor by the use of trapezoidal shaped wires (TW). The conductors consist of a central core of round steel wire(s) surrounded by two or more layers of trapezoidal aluminum 1350-0 wires. 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 (see Table 1, Table 2, and Table 3). For the purpose of this specification, the sizes listed in Table 1 and Table 2 are tabulated on the basis of the finished conductor having an area or outside diameter equal to that of specified sizes of standard ACSR, ACSS, and ACSR/TW so as to facilitate conductor selection.

2. Referenced Documents

2.1 The following documents of the issue in effect on date of material purchase form part of this specification to the extent referenced herein:

2.2 *ASTM Standards:*

B 232 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 500/B 500M Specification for Metallic Coated Stranded Steel Core 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 609/B 609M Specification for Aluminum 1350 Round Wire, Annealed and Intermediate Tempers, for Electrical Purposes[2]

B 779 Specification for Shaped Wire Compact Concentric-Lay-Stranded Aluminum Conductors, Steel-Reinforced (ACSR/TW)[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]

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

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[2] *Annual Book of ASTM Standards*, Vol 02.03.
[3] *Annual Book of ASTM Standards*, Vol 14.02.

TABLE 1 Construction Requirements for Shaped Wire Compact Concentric-Lay-Stranded Aluminum Conductors, Coated Steel Supported[A]

NOTE 1—Sized to have area equal to ACSR or ACSS, Class AA.

ACSS/TW Conductor Size		Code Word[B]	Size and Stranding of ACSS with Equal Area		Aluminum Stranding		Steel Core Stranding		Nominal Mass ACSS/HS/TW, lb/1000 ft	Rated Strength (by type of steel core wire)			Nominal Outside Diameter in.
kcmil[C]	Type		kcmil	Standing	Number of Alumi-num Wires	Number of Layers	Number of Wires	Individual Strand Wire Diameter, in.		ACSS/HS/TW ACSS/MS/TW, KIPS	ACSS/GA/TW ACSS/MA/TW, KIPS	ACSS/AW/TW, KIPS	
477.0	13	Flicker/ACSS/TW	477.0	24/7	18	2	7	0.0940	612	14.2	13.0	12.5	0.78
477.0	16	Hawk/ACSS/TW	477.0	26/7	18	2	7	0.1053	655	17.1	15.6	14.9	0.79
556.5	13	Parakeet/ACSS/TW	556.5	24/7	18	2	7	0.1015	714	16.6	15.2	14.6	0.84
556.5	16	Dove/ACSS/TW	556.5	26/7	20	2	7	0.1138	764	19.9	18.2	17.5	0.85
636.0	13	Rook/ACSS/TW	636.0	24/7	18	2	7	0.1085	818	19.0	17.3	16.7	0.89
636.0	16	Grosbeak/ACSS/TW	636.0	26/7	20	2	7	0.1216	873	22.4	20.7	19.9	0.91
795.0	7	Tern/ACSS/TW	795.0	45/7	17	2	7	0.0886	891	15.2	14.2	13.5	0.96
795.0	10	Puffin/ACSS/TW	795.0	22/7	18	2	7	0.1108	974	20.6	18.9	18.3	0.98
795.0	13	Condor/ACSS/TW	795.0	54/7	20	2	7	0.1213	1020	23.3	21.7	20.9	0.99
795.0	16	Drake/ACSS/TW	795.0	26/7	20	2	7	0.1360	1091	28.0	25.9	24.4	1.01
954.0	5	Phoenix/ACSS/TW	954.0	42/7	30	3	7	0.0837	1028	15.2	14.2	13.6	1.05
954.0	7	Rail/ACSS/TW	954.0	45/7	32	3	7	0.0971	1074	18.0	16.7	16.2	1.06
954.0	13	Cardinal/ACSS/TW	954.0	54/7	20	2	7	0.1329	1227	28.0	26.0	24.6	1.08
1033.5	5	Snowbird/ACSS/TW	1033.5	42/7	30	3	7	0.0871	1114	16.4	15.4	14.8	1.09
1033.5	7	Ortolan/ACSS/TW	1033.5	45/7	32	3	7	0.1010	1163	19.5	18.1	17.6	1.10
1033.5	13	Curlew/ACSS/TW	1033.5	54/7	21	2	7	0.1383	1326	30.3	28.2	26.1	1.13
1113.0	5	Avocet/ACSS/TW	1113.0	42/7	30	3	7	0.0904	1199	17.5	16.3	15.9	1.13
1113.0	7	Bluejay/ACSS/TW	1113.0	45/7	33	3	7	0.1049	1253	21.0	19.5	18.9	1.14
1113.0	13	Finch/ACSS/TW	1113.0	54/19	38	3	19	0.0862	1427	33.2	30.4	28.8	1.19
1192.5	5	Oxbird/ACSS/TW	1192.5	42/7	30	3	7	0.0936	1285	18.7	17.5	17.0	1.17
1192.5	7	Bunting/ACSS/TW	1192.5	45/7	33	3	7	0.1085	1342	22.5	20.9	20.3	1.18
1192.5	13	Grackle/ACSS/TW	1192.5	54/19	38	3	19	0.0892	1529	35.5	32.6	30.8	1.22
1272.0	5	Scissortail/ACSS/TW	1272.0	42/7	30	3	7	0.0967	1371	20.0	18.7	18.2	1.20
1272.0	7	Bittern/ACSS/TW	1272.0	45/7	35	3	7	0.1121	1432	24.0	22.3	21.6	1.22
1272.0	13	Pheasant/ACSS/TW	1272.0	54/19	39	3	19	0.0921	1630	37.3	34.1	32.8	1.26
1351.5	7	Dipper/ACSS/TW	1351.5	45/7	35	3	7	0.1155	1521	25.5	23.7	23.0	1.26
1351.5	13	Martin/ACSS/TW	1351.5	54/19	39	3	19	0.0949	1732	39.6	36.2	34.9	1.30
1431.0	7	Bobolink/ACSS/TW	1431.0	45/7	36	3	7	0.1189	1611	27.0	25.1	24.3	1.29
1431.0	13	Plover/ACSS/TW	1431.0	54/19	39	3	19	0.0977	1834	41.9	38.4	36.9	1.34
1590.0	7	Lapwing/ACSS/TW	1590.0	45/7	36	3	7	0.1253	1790	29.6	27.9	27.0	1.36
1590.0	13	Falcon/ACSS/TW	1590.0	54/19	42	3	19	0.1030	2038	46.6	42.6	41.1	1.41
1780.0	8	Chukar/ACSS/TW	1780.0	84/19	37	3	19	0.0874	2061	38.2	35.3	33.6	1.45
2156.0	8	Bluebird/ACSS/TW	2156.0	84/19	64	4	19	0.0961	2512	45.5	42.1	40.7	1.61

[A] Conversion factors:
1 cmil = 5.067E−04 mm^2(0.0005067 mm^3)
1 in. = 2.54E+01 mm (25.4 mm)
1 lb/1000ft = 1.488 kg/km
1 ft = 3.048E−01 m (0.3048 m)
1 lb = 4.536E−01 kg (0.4536 kg)
1 lbf = 4.448E−03 kN (0.0044448 kN)

[B] 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 for information only.

[C] See Explanatory Note 4.

E 527 Practice for Numbering Metals and Alloys (UNS)[4]

2.3 *Other Standards:*

NBS *Handbook 100*—Copper Wire Tables of the National Bureau of Standards[5]

Aluminum Association Publication 50 Code Words for Overhead Aluminum Electrical Conductors[6]

3. Terminology

3.1 *Definitions:* For definitions of terms relating to conductors, also refer to definitions found in Specification B 354.

3.1.1 *aluminized*—aluminum coated.

3.1.2 *aluminum-clad*—aluminum bonded.

3.1.3 *galvanized*—zinc coated.

3.2 *Abbreviations:*

3.2.1 *ACSS/TW*—shaped wire aluminum conductor, steel supported.

3.2.2 *ACSS/TW/AZ*—supported with aluminized steel core wire in accordance with Specification B 341.

3.2.3 *ACSS/TW/AW*—supported with aluminum-clad core wire in accordance with Specification B 502.

3.2.4 *ACSS/TW/GA*—supported with galvanized steel core wire, coating Class A in accordance with Specification B 498.

3.2.5 *ACSS/TW/GB*—supported with galvanized steel core wire, coating Class B in accordance with Specification B 498.

[4] *Annual Book of ASTM Standards*, Vol 01.01.

[5] Available from National Technical Information Services, 5285 Port Royal Road, Springfield, VA 22161.

[6] Available from the Aluminum Association Inc., 900 19th Street NW, Suite 300, Washington, DC 20006.

TABLE 2 Construction Requirements for Shaped Wire Compact Concentric-Lay-Stranded Aluminum Conductors, Coated Steel Supported[A]

NOTE 1—Sized to have diameter equal to ACSR or ACSS, Class AA.

ACSS/TW Conductor Size		Code Word[B]	Size and Stranding of ACSS with Equal Diameter		Aluminum Stranding		Steel Core Stranding		Nominal Mass ACSS/HS/TW, lb/1000 ft	Rated Strength (by type of steel core wire)			Nominal Outside Diameter in.
kcmil[C]	Type		kcmil	Stranding	Number of Alumi-num Wires	Number of Layers	Number of Wires	Individual Strand Wire Diameter, in.		ACSS/HS/TW ACSS/MS/TW, KIPS	ACSS/GA/TW ACSS/MA/TW, KIPS	ACSS/AW/TW, KIPS	
571.7	13	Mohawk/ACSS/TW	477.0	24/7	18	2	7	0.1030	734	17.1	15.6	15.0	0.85
565.3	16	Calumet/ACSS/TW	477.0	26/7	20	2	7	0.1146	776	20.2	18.4	17.7	0.86
666.6	13	Mystic/ACSS/TW	556.5	24/7	20	2	7	0.1111	856	19.9	18.2	17.5	0.91
664.8	16	Oswego/ACSS/TW	556.5	26/7	20	2	7	0.1244	913	23.4	21.7	20.9	0.93
768.2	13	Maumee/ACSS/TW	636.0	24/7	20	2	7	0.1195	987	23.0	21.0	20.2	0.98
762.8	16	Wabash/ACSS/TW	636.0	26/7	20	2	7	0.1331	1047	26.8	24.9	23.4	0.99
957.2	7	Kettle/ACSS/TW	795.0	45/7	32	3	7	0.0973	1078	18.1	16.8	16.3	1.06
946.7	10	Fraser/ACSS/TW	795.0	22/7	35	3	7	0.1154	1140	22.9	21.1	20.3	1.08
966.2	13	Columbia/ACSS/TW	795.0	54/7	21	2	7	0.1338	1240	28.3	26.4	24.9	1.09
959.6	16	Suwannee/ACSS/TW	795.0	26/7	22	2	7	0.1493	1317	33.1	30.7	28.2	1.11
1080.0	7	. . .	900.0	45/7	20	2	7	0.1033	1211	20.4	18.9		1.13
1168.1	5	Cheyenne/ACSS/TW	954.0	42/7	30	3	7	0.0926	1259	18.3	17.2	16.7	1.16
1158.0	7	Genesee/ACSS/TW	954.0	45/7	33	3	7	0.1078	1307	22.1	20.5	19.9	1.17
1158.4	13	Hudson/ACSS/TW	954.0	54/7	25	2	7	0.1467	1488	33.5	31.1	28.7	1.20
1272.0	5	Catawba/ACSS/TW	1033.5	42/7	30	3	7	0.0967	1371	20.0	18.7	18.2	1.20
1257.1	7	Nelson/ACSS/TW	1033.5	45/7	35	3	7	0.1115	1416	23.8	22.1	21.4	1.21
1233.6	13	Yukon/ACSS/TW	1033.5	54/7	38	3	19	0.0910	1584	36.3	33.2	32.0	1.25
1372.5	5	Truckee/ACSS/TW	1113.0	42/7	30	3	7	0.1004	1479	21.5	20.2	19.6	1.25
1359.7	7	Mackenzie/ACSS/TW	1113.0	45/7	36	3	7	0.1159	1531	25.7	23.9	23.1	1.26
1334.6	13	Thames/ACSS/TW	1113.0	54/19	39	3	19	0.0944	1711	39.1	35.8	34.5	1.29
1467.8	5	St. Croix/ACSS/TW	1192.5	42/7	33	3	7	0.1041	1583	23.1	21.6	21.0	1.29
1455.3	7	Miramichi/ACSS/TW	1192.5	45/7	36	3	7	0.1200	1639	27.1	25.6	24.8	1.30
1433.6	13	Merrimack/ACSS/TW	1192.5	54/19	39	3	19	0.0978	1838	42.0	38.4	37.0	1.34
1569.0	5	Platte/ACSS/TW	1272.0	42/7	33	3	7	0.1074	1691	24.6	23.1	22.4	1.33
1557.4	7	Potomac/ACSS/TW	1272.0	45/7	36	3	7	0.1241	1754	29.0	27.3	26.5	1.35
1533.3	13	Rio Grande/ACSS/TW	1272.0	54/19	39	3	19	0.1012	1966	45.0	41.2	39.6	1.38
1657.4	7	Schuylkill/ACSS/TW	1351.5	45/7	36	3	7	0.1280	1866	30.9	29.1	28.2	1.39
1622.0	13	Pecos/ACSS/TW	1351.5	54/19	39	3	19	0.1064	2105	49.3	45.0	43.3	1.42
1758.6	7	Pee Dee/ACSS/TW	1431.0	45/7	37	3	7	0.1319	1980	32.8	30.9	29.4	1.43
1730.6	13	James/ACSS/TW	1431.0	54/19	39	3	19	0.1075	2219	50.8	46.4	44.7	1.47
1949.6	7	Athabaska/ACSS/TW	1590.0	45/7	42	3	7	0.1392	2197	36.5	34.3	31.7	1.50
1926.9	13	Cumberland/ACSS/TW	1590.0	54/19	42	3	19	0.1133	2469	56.4	51.6	49.7	1.55
2153.8	8	Powder/ACSS/TW	1780.0	84/19	64	4	19	0.0961	2510	45.5	42.1	40.7	1.60
2627.3	8	Santee/ACSS/TW	2156.0	84/19	64	4	19	0.1062	3063	55.6	51.3	49.7	1.76

[A] Conversion factors:
1 cmil = 5.067E−04 mm^2(0.0005067 mm^2)
1 in. = 2.54E+01 mm (25.4 mm)
1 lb/1000 ft = 1.488 kg/km
1 ft = 3.048E−01 m (0.3048 m)
1 lb = 4.536E−01 kg (0.4536 kg)
1 lbf = 4.448E−03 kN (0.004448 kN)

[B] 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 for information only.

[C] See Explanatory Note 4.

3.2.6 *ACSS/TW/GC*—supported with galvanized steel core wire, coating Class C in accordance with Specification B 498.

3.2.7 *ACSS/TW/HS*—supported with high-strength galvanized steel core wire in accordance with Specification B 606.

3.2.8 *ACSS/TW/MA*—supported with Zn-5A1-MM coated steel core wire, coating Class A in accordance with Specification B 802.

3.2.9 *ACSS/TW/MB*—supported with Zn-5A1-MM coated steel core wire, coating Class B in accordance with Specification B 802.

3.2.10 *ACSS/TW/MC*—supported with Zn-5A1-MM coated steel core wire, coating Class C in accordance with Specification B 802.

TABLE 3 Comparison of ACSS/TW With Equivalent Stranding of ACSR[A] and ACSS[B]

ACSS/TW Type Number[C]	Conventional ACSR and ACSS Stranding[D]
5	42/7
7	45/7
8	84/19
10	22/7
13	54/7
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 ACSS/TW type.

[B] The equivalent stranding is that stranding of conventional ACSS that has the same area of aluminum and steel as a given ACSS/TW type.

[C] ACSS/TW type number is the approximate ratio of the steel area to the aluminum area in percent.

[D] See Specifications B 232, B 549, and B 856.

3.2.11 *ACSS/TW/MS*—supported with high-strength Zn-5A1-MM coated steel core wire in accordance with Specification B 803.

3.2.12 *Zn-5A1-MM*—zinc-5 % aluminum-mischmetal alloy.

4. Ordering Information

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

4.1.1 Quantity of each size,

4.1.2 Conductor size, kcmil area and diameter,

4.1.3 Conductor type and number of wires, aluminum and steel, (Table 1 and Table 2),

4.1.4 Type of steel core wire and class (if applicable) of coating (see 5.2),

4.1.5 Direction of lay of outer layer of aluminum wires if other than right-hand (see 7.6),

4.1.6 Special tension test, if desired (see 14.3),

4.1.7 Package size and type (see 16.1),

4.1.8 Special package markings, if required (see 16.4),

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

4.1.10 Place of inspection (see Section 15).

5. Requirement for Wires

5.1 After stranding, the trapezoidal aluminum wires (see Definitions B 354) shall conform to the requirements of Specification B 609 except for shape and diameter tolerance requirements. The tensile strength and elongation requirements of trapezoidal wires shall be the same as for round wires of equal area. The area tolerances for trapezoidal wires shall be such that the finished conductor conforms to Section 13.

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

5.3 The stranded steel core shall meet the requirements of Specification B 500 or B 549, as applicable.

6. Joints

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

6.2 There shall be no joints of any kind made in the finished coated steel wires.

7. Lay

7.1 The preferred lay of the outside layer of aluminum wires of shaped wire compact aluminum conductors, steel supported, having a steel core of 7 or 19 wires and having multiple layers of aluminum wires is 11 times the outside diameter of the conductor but the lay shall not be less than 10 nor more than 13 times that diameter (see Explanatory Note 3).

7.2 The preferred lay of the layer immediately beneath the outside layer of aluminum wires is 13 times the outside diameter of such layer but the lay shall be not less than 10 nor more than 16 times that diameter.

7.3 The lay of the inner layers of aluminum wires shall be not less than 10 nor more than 17 times the outside diameter of such layer.

7.4 The preferred lay of the 6-wire layer of 7-wire and 19-wire steel cores is 25 times the outside diameter of the 6-wire layer, but the lay shall be not less than 18 nor more than 30 times that diameter.

7.5 The preferred lay of the 12-wire layer of 19-wire steel core is 20 times the outside diameter of the core, but the lay shall be not less than 16 nor more than 24 times that diameter.

7.6 The direction of lay of the outside layer of aluminum wires shall be right hand unless otherwise specified in the purchase order.

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

7.8 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, conductor type, the nominal number of aluminum wires, the number of layers, the number and diameter of the steel core wire, the mass, the rated strength, and the outside diameter of the shaped wire compact concentric-lay-stranded aluminum conductors, steel supported, shall be as shown in Table 1 and Table 2.

8.2 The ACSS/TW may be constructed using steel core wire with any one of ten types of protective coatings. The acceptable core wires are galvanized steel core wires, coating Classes A, B, or C in accordance with Specification B 498; high-strength galvanized steel core wire in accordance with Specification B 606; Zn-5A1-MM coated steel core wire, coating Classes A, B, or C, in accordance with Specification B 802; high-strength Zn-5A1-MM coated steel core wire in accordance with Specification B 803; aluminized steel core wire in accordance with Specification B 341; aluminum-clad core wire in accordance with Specification B 502.

9. Rated Strength of Conductor (see Explanatory Note 5)

9.1 The rated strength of ACSS/TW conductors, as shown in Table 1 and Table 2, shall be taken as the aggregate strength of the aluminum and steel components calculated as follows: The strength contribution of the aluminum 1350-0 wires shall be taken as the percentage, indicated in Table 4 in accordance with the number of aluminum layers, of the sum of the round wires having the same area as the trapezoidal wires used in the manufacture of the conductor and the appropriate minimum average tensile strength given in Specification B 609. The

TABLE 4 Rating Factors

Number of Layers		Number of Steel Wires	Rating Factor, %	
Aluminum	Steel			
Trapezoidal	Round		Aluminum	Steel
2	1	7	96	100
2	2	19	96	100
3	1	7	96	100
3	2	19	96	100
4	2	19	96	100

strength of the steel core wires shall be taken as the percentage, indicated in Table 4, of the sum of the strengths of the component steel wires, calculated from their specified nominal wire diameter and the appropriate minimum ultimate tensile strength given in Specifications B 341, B 498, B 502, B 606, B 802, or B 803, whichever is applicable.

9.1.1 The rated strengths of conductors calculated in accordance with 9.1 and 9.2 using Class A and Class A high-strength zinc-coated steel wires in accordance with Specification B 498 and B 606, respectively, are listed in Table 1 and Table 2.

9.1.2 The rated strengths of conductors calculated in accordance with 9.1 and 9.2 using Class A high-strength Zn-5A1-MM-coated steel wires in accordance with Specification B 803, are listed in Table 1 and Table 2. Clad steel wires in accordance with Specification B 502, are listed in Table 1 and Table 2.

9.2 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 E 29.

9.3 Tests to confirm that the rated strength of the conductor is met are not required by this specification but shall be made if agreed upon between the manufacturer and the purchaser at the time of placing an order. When tested, the breaking strength of the conductor shall be not less than the rated strength 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 strength if failure occurs inside or within 1 in. (25 mm) of the end of either gripping device.

10. Density

10.1 For the purpose of calculating mass, cross sections, and the like, the density of Aluminum 1350 shall be taken as 0.0975 lb/in.^{3} (2705 kg/m^3) at 20°C.

10.2 For the purpose of calculating mass, cross sections, and the like, the density of galvanized, aluminized, or Zn-5A1-MM alloy-coated steel wire shall be taken as 0.281 lb/in.^{3} (7780 kg/m^3) at 20°C.

10.3 For the purposes of calculating mass, cross sections, and the like, the density of aluminum-clad steel wire shall be taken as 0.2381 lb/in.^{3} (6590 kg/m^3) at 20°C.

11. Mass and Electrical Resistance

11.1 The mass and electrical resistance of a unit length of stranded conductor are a function of the length of lay. The approximate weight and electrical resistance may be determined using the standard increments shown in Table 5. When greater accuracy is desired, the increment based on the specific lay of the conductor may be calculated (see Explanatory Note 6).

11.2 In the calculation of the electrical resistance of a conductor, the zinc-coated, Zn-5A1-MM-coated, or aluminum-coated steel core wires shall be taken as 0.19157 Ω·mm^2/m at 20°C 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. The electrical resistance of the aluminum wires shall be taken as 0.0279 Ω·mm^2/m at 20°C.

12. Workmanship, Finish, and Appearance

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

TABLE 5 Standard Increments Due to Stranding

Stranding of ACSS/TW Type Number	Number of Steel Wires	Increment (Increase), % Mass and Electrical Resistance Aluminum	Steel
Two-Layer Designs			
5	7	2.0	0.4
7	7	2.0	0.4
10	7	2.1	0.4
13	7	2.15	0.4
13	19	2.15	0.6
16	7	2.25	0.4
Three-Layer Designs			
5	7	2.4	0.4
7	7	2.5	0.4
8	19	2.35	0.6
10	7	2.6	0.4
13	19	2.75	0.6
Four-Layer Designs			
8	19	3.2	0.6

13. Variation in Area and Diameter

13.1 The area of cross section of the aluminum wires of a conductor shall be not less than 98 % nor more than 102 % of the area specified in Column 1 of Table 1 and Table 2. The area of each wire shall be determined by Test Method B 263. In applying this method, the increment in mass resulting from stranding may be the applicable value specified in Table 5, or it may be calculated from the measured dimensions of the sample under test. In case of questions regarding area compliance, the actual mass increment due to stranding shall be calculated.

13.2 The diameter of the finished conductor shall be not less than 99 % nor more than 101 % of that shown in Table 1 and Table 2 when measured with a diameter tape between the closing die(s) and the capstan of the strander.

14. Mechanical and Electrical Tests

14.1 Tests for mechanical and electrical properties of aluminum wires shall be made after stranding (see Explanatory Note 7).

14.2 The electrical resistivity shall meet the minimum resistivity specified for the wire after stranding. The frequency of these tests shall be agreed upon between the purchaser and the manufacturer.

14.3 Tests for demonstration of rated strength of the completed conductor are not required by this specification but may be made if agreed upon between the manufacturer and the purchaser at the time of placing an order. If tested, the breaking strength of the completed conductor shall be not less than the rated strength 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 strength if failure occurs inside, or within 1 in. (25 mm) of the end of, either gripping device (see Explanatory Note 5).

14.4 Tests for all properties of zinc-coated, Zn-5A1-MM–coated, or aluminum-coated steel wires shall be made before stranding (see Explanatory Note 7).

15. Inspection

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

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 manufacture'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 purchase order.

16.4 The net mass, length, size, kind of conductors, conductor type, stranding, type of coating, class of coating 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 the package.

17. Keywords

17.1 aluminum conductors; concentric-lay stranded aluminum conductors; electrical conductors; electrical conductors; aluminum; steel-reinforced conductors; steel-supported aluminum conductors; stranded aluminum conductors

EXPLANATORY NOTES

NOTE 1—In this specification only shaped wire compact concentric-lay-stranded aluminum conductors, steel supported, 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—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 performance to that of a cold-pressure weld or an electric-butt, cold-upset weld in stranded conductors.

NOTE 3—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 4—Because the final design of a shaped wire compact conductor is contingent on several factors such as layer diameter, wire width and thickness, etc., the actual configuration of a given size may vary between manufacturers. This might result in a slight variation in the number of wires from that shown in Table 1 and Table 2, and also in dimensions of the individual wires.

NOTE 5—To obtain the actual breaking strength of ACSS/TW 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 jaws or clamping devices usually are not suitable.

NOTE 6—The increment of mass or electrical resistance of a completed concentric-lay-stranded conductor, k, in percent is given by the following equation:

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

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 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 (m_{ind}) 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. This is assumed to be the inside diameter + t for a given layer where t equals the thickness of the layer. To be more precise, for trapezoidal wire, this diameter should be that of the centroid (the center of mass of the wire) that is on a diameter slightly larger than the average layer diameter used in the preceding formula. Using the average layer diameter for the helical path of the wire introduces a small error which is considered to be negligible and may be ignored. The derivation of the preceding is given in *NBS Handbook 100.*[5] The factors (k) and (m) for composite conductors are to be determined separately for each different material involved (see Section 7).

NOTE 7—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.