Designation: B 778 – 97

Standard Specification for Shaped Wire Compact Concentric-Lay-Stranded Aluminum Conductors (AAC/TW)[1]

This standard is issued under the fixed designation B 778; 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 conductor (AAC/TW) and its component wires for use as overhead electrical conductors (Explanatory Note 1 and Note 2).

1.2 The values stated in inch-pound units are to be regarded as the standard with the exception of temperature and resistivity. The SI equivalents of inch-pound units may be approximate.

NOTE 1—AAC/TW is designed to increase the aluminum area for a given diameter of conductor by the use of trapezoidally shaped wires (TW). The conductors consist of a central core of one round aluminum wire or a seven-strand compact round core surrounded by two or more layers of trapezoidal aluminum 1350-H19 wires. For the purposes of this specification, the sizes listed are tabulated on the basis of the finished conductor having an area equal to that of specific sizes of standard AAC (Table 1) or in fixed diameter increments (Table 2) so as to facilitate conductor selection.

NOTE 2—The aluminum and temper designations conform to ANSI Standard H 35.1. Aluminum 1350 corresponds to Unified Numbering System (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:*

B 230 Specification for Aluminum 1350-H19 Wire for Electrical Purposes[2]

B 263 Test Method for Determination of Cross-Sectional Area of Stranded Conductors[2]

B 354 Terminology Relating to Uninsulated Metallic Electrical Conductors[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 Documents:*

ANSI H35.1 American National Standard Alloy and Temper Designation Systems for Aluminum[5]

NBS *Handbook 100*—Copper Wire Tables [6]

TABLE 1 Construction Requirements for Shaped Wire Compact Concentric-Lay-Stranded Aluminum Conductors Sized to Have Areas Equal to AAC Size

AAC/TW Conductor Size, kcmil	Nominal Outside Diameter, in.[A]	Number of Aluminum Wires	Number of Layers	Nominal Mass, lb/1000 ft	Rated Strength, 1000 lbf
336.4	0.612	17	2	315.3	6.02
397.5	0.661	17	2	372.6	6.96
477.0	0.720	17	2	447.1	8.36
500.0	0.736	17	2	468.7	8.76
556.5	0.775	17	2	521.6	9.75
600.0	0.803	17	2	562.4	10.52
636.0	0.825	17	2	596.1	11.1
700.0	0.864	17	2	656.1	12.3
750.0	0.893	17	2	702.1	13.1
795.0	0.919	17	2	745.1	13.6
900.0	0.990	31	3	843.6	15.4
954.0	1.018	31	3	894.2	16.4
1000.0	1.041	31	3	937.3	17.1
1033.5	1.057	31	3	968.7	17.7
1113.0	1.095	31	3	1043.2	19.1
1192.5	1.132	31	3	1117.7	20.4
1272.0	1.168	31	3	1192.2	21.8
1351.5	1.202	31	3	1266.3	23.2
1431.0	1.236	31	3	1341.3	24.0
1590.0	1.315	49	4	1490.3	27.0
1750.0	1.377	49	4	1640.3	29.7
2000.0	1.468	49	4	1893.0	33.9
2500.0	1.648	71	5	2366.2	41.9
3000.0	1.799	71	5	2839.5	50.3

[A] 1 in. = 25.4 mm.

3. Ordering Information

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

3.1.1 Quantity of each size,

3.1.2 Conductor size: kcmil area and diameter (Table 1 and Table 2),

3.1.3 Special tension test, if required (see 8.2),

3.1.4 Place of inspection (Section 15),

3.1.5 Package size and type (see 15.1),

[1] This specification is under the jurisdiction of ASTM Committee B-1 on Electrical Conductors and is the direct responsibility of Subcommittee B 01.07on Conductors of Light Metals.

Current edition approved Oct. 10, 1997. Published December 1997. Originally published as B 778 – 87. Last previous edition B 778 – 92.

[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 Street, 13th Floor, New York, NY 10036.

[6] Available from National Institute of Standards and Technology (NIST), Gaithersburg, MD 20899.

TABLE 2 Construction Requirements for Shaped Wire Compact Concentric-Lay-Stranded Aluminum Conductors, in Fixed-Diameter Increments

AAC/TW Conductor Size, kcmil	Nominal Outside Diameter, in.	Number of Aluminum Wires	Number of Layers	Nominal Mass, lb/1000 ft	Rated Strength, 1000 lbf
322.5	0.60	17	2	302.3	5.88
384.5	0.65	17	2	360.4	6.74
449.4	0.70	17	2	421.2	7.88
521.7	0.75	17	2	489.0	9.14
595.8	0.80	17	2	558.4	10.44
678.2	0.85	17	2	635.7	11.88
761.5	0.90	17	2	713.7	13.07
854.2	0.95	17	2	800.6	14.86
918.8	1.00	31	3	861.2	15.76
1020.0	1.05	31	3	956.0	17.50
1123.1	1.10	31	3	1052.7	19.26
1234.2	1.15	31	3	1156.8	21.17
1346.8	1.20	31	3	1262.3	23.10
1467.9	1.25	31	3	1375.9	24.65
1583.2	1.30	34	3	1483.9	26.59
1682.7	1.35	49	4	1577.5	28.55
1812.7	1.40	49	4	1699.0	30.74
1954.3	1.45	49	4	1832.1	33.16
2093.6	1.50	49	4	1981.6	35.51
2245.4	1.55	49	4	2125.7	37.30
2388.1	1.60	52	4	2260.3	39.67
2514.8	1.65	71	5	2379.5	42.17
2667.2	1.70	71	5	2524.5	44.74
2844.5	1.75	71	5	2692.2	47.70
3006.2	1.80	71	5	2873.0	50.43

3.1.6 Special package markings, if required (Section 15), and

3.1.7 Heavy wood lagging, if required (see 15.3).

4. Requirement for Wires

4.1 Before stranding, the trapezoidal aluminum wires shall conform to the requirements of Specification B 230 except for shape and diameter tolerance. 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 11.

5. Joints

5.1 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).

6. Lay

6.1 The preferred lay of the outside layer of aluminum wires of shaped wire aluminum conductors, 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 14 times that diameter (Explanatory Note 1).

6.2 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.

6.3 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.

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

6.5 The direction of lay of the aluminum wires shall be reversed in successive layers.

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

7. Construction

7.1 The nominal aluminum cross-sectional area, the outside diameter, the nominal number of aluminum wires, the number of layers, the linear density, and the rated strength, of the shaped wire compact concentric-lay-stranded aluminum conductors, shall be as shown in Table 1 and Table 2.

NOTE 3—Exception to 7.1. Because the final design of a shaped wire compact conductor is contingent on several factors such as layer diameter, wire width and thickness, and the like, the actual configuration of a given size may vary between manufacturers. This might result in a slight variation in the number of wires and number of layers, from that shown in Table 1 and Table 2, and also in the dimensions of the individual wires.

8. Rated Strength of Conductor

8.1 The rated strength of a conductor, as shown in Table 1 and Table 2, 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 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 230.

8.1.1 The rated strengths of conductors calculated in accordance with 8.1 and 8.3 are listed in Table 1 and Table 2.

8.2 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. of the end of either gripping device (Explanatory Note 2).

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

9. Density

9.1 For the purpose of calculating mass per unit length, 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. Mass and Electrical Resistance

10.1 The mass per unit length and electrical resistance of a unit length of stranded conductor are a function of the length of

TABLE 3 Rating Factors

Number of Layers	Rating Factor, %
2	0.93
3	0.91
4	0.90
5 and above	0.89