Designation: A 475 – 03

Standard Specification for Zinc-Coated Steel Wire Strand[1]

This standard is issued under the fixed designation A 475; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This specification covers five grades of zinc-coated, steel wire strand, composed of a number of round, steel wires, with four weights of zinc coatings, suitable for use as guys, messengers, span wires, and for similar purposes.

1.2 The five grades covered are as follows:

1.2.1 Utilities,

1.2.2 Common,

1.2.3 Siemens-Martin,

1.2.4 High-Strength, and

1.2.5 Extra High-Strength.

1.2.6 Minimum breaking strengths of strand for each grade are described in Section 7.

1.3 The four weights of zinc coatings are: Class 1 and Classes A, B, and C. Minimum weights of zinc coatings are described in Section 10.

1.4 The values stated in inch-pound units are to be regarded as the standard. The values given in brackets are for information only.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 90/A 90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zonc-Alloy Coatings

A 902 Terminology Relating to Metallic Coated Steel Products

B 6 Specification for Zinc

3. Terminology

3.1 Definitions—For definitions of terms used in this standard, refer to Terminology A 902.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *strand*—the designation of the finished strand shall be expressed as the nominal diameter of the strand, the number of the wires in the strand, the minimum breaking strength of the strand (see Section 7), and the class of coating (see Section 10).

4. Ordering Information

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

4.1.1 Quantity of strand in feet,

4.1.2 Nominal strand diameter, number of wires, grade, and minimum breaking strength of strand (Section 7 and Table 1),

4.1.3 Weight (class) of zinc coating (Section 10 and Table 2),

4.1.4 Length of strand in coils or on reels (Section 18), and

4.1.5 ASTM designation and year of issue.

5. Materials and Manufacture

5.1 The base metal shall be steel made by any commercially accepted steel making process and of such quality and purity that, when drawn to the size of wire specified and coated with zinc, the finished strand and the individual wires shall be of uniform quality and have the properties and characteristics as prescribed in this specification.

5.2 The slab zinc, when used for the coating, shall be any grade of zinc conforming to Specification B 6.

6. Stranding

6.1 Unless otherwise specified, strand shall have a left lay. A left lay is defined as a counter-clockwise twist away from the observer. All wires shall be stranded with uniform tension. Stranding shall be sufficiently close to ensure no appreciable reduction in diameter when stressed to 10 % of the minimum breaking strength.

6.2 The 3-wire strand shall consist of three wires concentrically twisted with a uniform pitch of not less than 14 nor more than 20× the specified nominal diameter of the strand.

6.3 The 7-wire strand shall consist of a center wire with a 6-wire layer concentrically twisted over it with a uniform pitch of not more than 16× the specified nominal diameter of the strand.

6.4 The 19-wire strand shall consist of a center wire with a 6-wire layer concentrically twisted over it, having a right lay and a uniform pitch of not more than 16× the nominal diameter of this 7-wire core. The nominal diameter of this 7-wire core shall be considered to be 3× the nominal diameter

[1] This specification is under the jurisdiction of ASTM Committee A05 on Metallic Coated Iron and Steel Products and is the direct responsibility of Subcommittee A05.12 on Wire Specifications.

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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.

***A Summary of Changes section appears at the end of this standard.**

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TABLE 1 Physical Properties of Zinc-Coated Steel Wire Strand

NOTE 1—The numbers in boldface type indicate sizes and grades most commonly used and readily available.

Nominal Diameter of Strand, in. [mm]		Number of Wires in Strand	Nominal Diameter of Coated Wires in Strand, in. [mm]	Approximate Weight of Strand, lb/1000 ft [kg/km]		Minimum Breaking Strength of Strand, lbf [kN]				
						Utilities Grade[A]	Common Grade	Siemens-Martin Grade	High-Strength Grade	Extra High-Strength Grade
1/8	[3.18]	7	0.041 [1.04]	32	[48]	. . .	**540 [2.402]**	910 [4.048]	1 330 [5.916]	1 830 [8.140]
5/32	[3.97]	7	0.052 [1.32]	51	[76]	. . .	**870 [3.870]**	1 470 [6.539]	2 140 [9.519]	2 940 [13.078]
3/16	[4.76]	7	0.062 [1.57]	73	[109]	. . .	**1 150 [5.115]**	1 900 [8.452]	2 850 [12.677]	3 990 [17.748]
3/16	[4.76]	7	0.065 [1.65]	80	[119]	**2 400 [10.676]** (1)[B]	. . .	. . .	. . .	. . .
7/32	[5.56]	3	0.104 [2.64]	88	[131]	. . .	1 400 [6.228]	2 340 [10.409]	3 500 [15.569]	4 900 [21.796]
7/32	[5.56]	7	0.072 [1.83]	98	[146]	. . .	1 540 [6.850]	2 560 [11.387]	3 850 [17.126]	5 400 [24.020]
1/4	[6.35]	3	0.120 [3.05]	117	[174]	**3 150 [14.012]** (2)[B]	1 860 [8.274]	3 040 [13.523]	4 730 [21.040]	6 740 [29.981]
1/4	[6.35]	3	0.120 [3.05]	117	[174]	**4 500 [20.017]** (3)[B]	. . .	. . .	. . .	. . .
1/4	[6.35]	7	0.080 [2.03]	121	[180]	. . .	**1 900 [8.452]**	**3 150 [14.012]**	4 750 [21.129]	6 650 [29.581]
9/32	[7.14]	3	0.130 [3.30]	137	[204]	. . .	2 080 [9.252]	3 380 [15.035]	5 260 [23.398]	7 500 [33.362]
9/32	[7.14]	7	0.093 [2.36]	164	[244]	**4 600 [20.462]** (1)[B]	2 570 [11.432]	4 250 [18.905]	6 400 [28.469]	8 950 [39.812]
5/16	[7.94]	3	0.145 [3.68]	171	[255]	**6 500 [28.913]** (3)[B]	2 490 [11.076]	4 090 [18.193]	6 350 [28.246]	9 100 [40.479]
5/16	[7.94]	7	0.104 [2.64]	205	[305]	. . .	**3 200 [14.234]**	5 350 [23.798]	**8 000 [35.586]**	11 200 [49.820]
5/16	[7.94]	7	0.109 [2.77]	225	[335]	**6 000 [26.689]** (1)[B]	. . .	. . .	. . .	. . .
3/8	[9.52]	3	0.165 [4.19]	220	[328]	**8 500 [37.810]** (3)[B]	3 330 [14.813]	5 560 [24.732]	8 360 [37.187]	11 800 [52.489]
3/8	[9.52]	7	0.120 [3.05]	273	[407]	**11 500 [51.155]** (4)[B]	**4 250 [18.905]**	**6 950 [30.915]**	10 800 [48.040]	15 400 [68.503]
7/16	[11.11]	7	0.145 [3.68]	399	[595]	**18 000 [80.068]** (4)[B]	**5 700 [25.355]**	**9 350 [41.591]**	**14 500 [64.499]**	20 800 [92.523]
1/2	[12.70]	7	0.165 [4.19]	517	[770]	**25 000 [111.206]** (4)[B]	**7 400 [32.917]**	**12 100 [53.823]**	**18 800 [83.627]**	26 900 [119.657]
1/2	[12.70]	19	0.100 [2.54]	504	[751]	. . .	7 620 [33.895]	12 700 [56.492]	19 100 [84.961]	26 700 [118.768]
9/16	[14.29]	7	0.188 [4.78]	671	[1000]	. . .	9 600 [42.703]	15 700 [69.837]	24 500 [108.981]	35 000 [155.688]
9/16	[14.29]	19	0.113 [2.87]	637	[949]	. . .	9 640 [42.881]	16 100 [71.616]	24 100 [107.202]	33 700 [149.905]
5/8	[15.88]	7	0.207 [5.26]	813	[1211]	. . .	11 600 [51.599]	19 100 [84.961]	29 600 [131.667]	42 400 [188.605]
5/8	[15.88]	19	0.125 [3.18]	796	[1186]	. . .	11 000 [48.930]	18 100 [80.513]	28 100 [124.995]	40 200 [178.819]
3/4	[19.05]	19	0.150 [3.81]	1 155	[1721]	. . .	16 000 [71.172]	26 200 [116.543]	40 800 [181.487]	58 300 [259.331]
7/8	[22.22]	19	0.177 [4.50]	1 581	[2356]	. . .	21 900 [97.416]	35 900 [159.691]	55 800 [248.211]	79 700 [354.523]
1	[25.40]	19	0.200 [5.08]	2 073	[3089]	. . .	28 700 [127.664]	47 000 [209.066]	73 200 [325.610]	104 500 [464.839]
1	[25.40]	37	0.143 [3.63]	2 057	[3065]	. . .	28 300 [125.885]	46 200 [205.508]	71 900 [319.827]	102 700 [456.832]
1 1/8	[28.58]	37	0.161 [4.09]	2 691	[4010]	. . .	36 000 [160.136]	58 900 [262.000]	91 600 [407.457]	130 800 [581.827]
1 1/4	[31.75]	37	0.179 [4.55]	3 248	[4840]	. . .	44 600 [198.391]	73 000 [324.720]	113 600 [505.318]	162 200 [721.502]

[A] The utilities grade is used principally by communication and power and light industries.
[B] Refer to elongation requirements specified in Section 8.

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TABLE 2 Nominal Diameters and Minimum Weights of Coating for Zinc-Coated Steel Wires[A]

Nominal Diameter of Coated Wire in the Strand, in. [mm]	Minimum Weight of Coating, oz/ft² [g/m²] of Uncoated Wire Surface			
	Class 1[B]	Class A[C]	Class B[D]	Class C[D]
0.041 [1.04]	0.15 [46]	0.40 [122]	0.80 [244]	1.20 [366]
0.052 [1.32]	0.15 [46]	0.40 [122]	0.80 [244]	1.20 [366]
0.062 [1.57]	0.15 [46]	0.50 [153]	1.00 [305]	1.50 [458]
0.065 [1.65]	0.15 [46]	0.50 [153]	1.00 [305]	1.50 [458]
0.072 [1.83]	0.15 [46]	0.50 [153]	1.00 [305]	1.50 [458]
0.080 [2.03]	0.30 [92]	0.60 [183]	1.20 [366]	1.80 [549]
0.093 [2.36]	0.30 [92]	0.70 [214]	1.40 [427]	2.10 [641]
0.100 [2.54]	0.30 [92]	0.70 [214]	1.40 [427]	2.10 [641]
0.104 [2.64]	0.30 [92]	0.80 [244]	1.60 [488]	2.40 [732]
0.109 [2.77]	0.30 [92]	0.80 [244]	1.60 [488]	2.40 [732]
0.113 [2.87]	0.30 [92]	0.80 [244]	1.60 [488]	2.40 [732]
0.120 [3.05]	0.30 [92]	0.85 [259]	1.70 [519]	2.55 [778]
0.125 [3.18]	0.30 [92]	0.85 [259]	1.70 [519]	2.55 [778]
0.130 [3.30]	0.30 [92]	0.85 [259]	1.70 [519]	2.55 [778]
0.143 [3.63]	0.40 [122]	0.90 [275]	1.80 [549]	2.70 [824]
0.145 [3.68]	0.40 [122]	0.90 [275]	1.80 [549]	2.70 [824]
0.150 [3.81]	0.40 [122]	0.90 [275]	1.80 [549]	2.70 [824]
0.161 [4.09]	0.40 [122]	0.90 [275]	1.80 [549]	2.70 [824]
0.165 [4.19]	0.40 [122]	0.90 [275]	1.80 [549]	2.70 [824]
0.177 [4.50]	0.40 [122]	0.90 [275]	1.80 [549]	2.70 [824]
0.179 [4.55]	0.40 [122]	0.90 [275]	1.80 [549]	2.70 [824]
0.188 [4.78]	0.40 [122]	1.00 [305]	2.00 [610]	3.00 [915]
0.200 [5.08]	0.40 [122]	1.00 [305]	2.00 [610]	3.00 [915]
0.207 [5.26]	0.40 [122]	1.00 [305]	2.00 [610]	3.00 [915]

[A] For intermediate sizes of wire in the strand, the weight designations are the same as for the next finer size shown in this table.
[B] Class 1 (formerly "galvanized") coating applies to common grade of strand only.
[C] Class A, "extra galvanized" and "double galvanized" are equivalent terms.
[D] Class A, Class B, and Class C coatings apply to all grades of strand.

of the wires. A 12-wire outer layer, having a left lay shall be concentrically twisted over the 7-wire core and shall have a uniform pitch of not more than 16× the specified nominal diameter of the strand.

6.5 The 37-wire strand shall consist of a center wire with a 6-wire layer concentrically twisted over it, having a left lay and a uniform pitch of not more than 16× the nominal diameter of this 7-wire inner core. The nominal diameter of this 7-wire inner core shall be considered to be 3× the nominal diameter of the wire. An intermediate layer of 12 wires having a right lay shall be concentrically twisted over this 7-wire core and shall have a uniform pitch of not more than 16× the nominal diameter of this 19-wire core. The nominal diameter of this 19-wire core shall be considered as 5× the nominal diameter of the wires. An 18-wire outer layer, having a left lay shall be concentrically twisted over the 19-wire core and shall have a uniform pitch of not more than 16× the specified nominal diameter of the strand.

6.6 All wires in the strand shall lie naturally in their true positions in the completed strand and, when the strand is cut, the ends shall remain in position or be readily replaced by hand and then remain in position. This may be accomplished by any means or process, such as preforming, post forming, or form setting.

7. Breaking Strength and Weight

7.1 The approximate weight per unit length of strand and the minimum breaking strength of the finished strand shall be as specified in Table 1.

7.2 A test in which the breaking strength is below the minimum specified and which may have been caused by the slipping of the specimen in the jaws of the testing machine, by breaking within the jaws or within 1 in. [25.4 mm] of the jaws, or by the improper socketing of a specimen shall be disregarded and another sample from the same coil or reel shall be tested. Tests shall be made on lengths of strand that do not contain wire joints or splices.

8. Elongation

8.1 The elongation of the strand in 24 in. [610 mm] shall be not less than that specified in Table 3.

8.2 The elongation shall be determined as the percent increase in separation between the jaws of the testing machine from the position after application of the initial load to the position at the initial failure in the test specimen. The separation of the jaws of the testing machine shall be approximately 2 ft when under an initial load equal to 10 % of the required minimum breaking strength of the strand. The elongation values shall be recorded only for specimens which break over 1 in. from the jaws of the testing machine. Additional samples shall be taken from the same coil or reel when the previous tests are to be disregarded.

8.3 Elongation tests shall be made on lengths of strand which do not contain wire joints or splices.

9. Ductility of Steel

9.1 The zinc-coated wire shall not fracture when wrapped at a rate not exceeding 15 turns/min in a close helix of at least 2 turns around a cylindrical mandrel. The mandrel diameter for testing common and Siemens-Martin grade strand shall be equal to the nominal diameter of the individual wires of the strand. The mandrel diameter for utilities, high-strength, and extra high-strength grade strand, shall be equal to 3× the nominal diameter of the individual wires of the strand.

10. Weight of Coating

10.1 The weight of zinc coating shall not be less than that specified in Table 2.

10.2 The weight of the zinc coating shall be determined by a stripping test in accordance with Test Method A 90/A 90M.

11. Adherence of Coating

11.1 The zinc-coated wire shall be capable of being wrapped at a rate not exceeding 15 turns/min in a close helix

TABLE 3 Elongation Requirements for Grades of Strand

Grade of Strand	Elongation in 24 in. [610 mm], min, %
Utilities Grade (1)[A] and Common Strand	10
Utilities Grade (2)[A] and Siemens-Martin	8
Utilities Grade (3)[A] and High-Strength	5
Utilities Grade (4)[A] and Extra High-Strength	4

[A] See Table 1, Footnote *B*.

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of at least two turns around a cylindrical mandrel equal to 3× the nominal diameter of the wire under test, without cracking or delaminating the zinc coating to such an extent that any zinc can be removed by rubbing with the bare fingers. Loosening or detachment during the adhesion test of superficial small particles of zinc formed by mechanical polishing of the surface of zinc-coated wire shall not be considered cause for rejection.

12. Joints and Splices

12.1 Electric-welded butt joints made prior to the start of cold drawing of the wire are permitted; however, no electric-welded butt joints shall be made during the cold drawing operation. Electric-welded butt joints of the wire shall be permitted only as specified in 12.2.

12.2 In 3-wire strand, there shall be no joints made in the individual finished wire. In 7-wire strand, joints made in individual finished wires shall be acceptable provided there is not more than one joint in any 150-ft [45.7-m] section of the completed strand and the location of each joint is marked on the strand with paint or some other distinguishing mark. Factory joints made in the individual finished wires of 19 and 37-wire strand shall be kept well spaced and at a minimum in number.

12.3 Joints in the wires composing the strand shall be either the brazed-lap type or electric-butt-welded type. When the brazed type of joint is used, the length of the lap shall be not less than 3× the diameter of the wire and the overlapping faces shall be smooth, clean, properly fluxed, and completely covered by the brazing metal. When the electric-welded type of joint is used, care shall be taken to prevent injury to the wire during electric-butt welding. All joints shall be well made and shall be coated with zinc after completion so that the joints shall have protection from corrosion equivalent to that of the zinc-coated wire itself.

12.4 There shall be no strand joints or strand splices in any length of the completed strand unless specifically permitted by the purchaser.

13. Permissible Variations in Size

13.1 The diameter of the zinc-coated wire forming the strand specified in Table 1 shall be within the limits prescribed in Table 4.

14. Workmanship

14.1 The zinc-coated wire shall be free of imperfections not consistent with good commercial practice. The coating shall be continuous and reasonably uniform.

TABLE 4 Permissible Variations in Diameter of Individual Zinc-Coated Wires[A]

Nominal Diameter of Coated Wires in the Strand, in. [mm]	Permissible Variations, ±in. [mm]
0.041 to 0.060 [1.04 to 1.52]	0.002 [0.05]
0.061 to 0.090 [1.55 to 2.29]	0.003 [0.08]
0.091 to 0.120 [2.31 to 3.05]	0.004 [0.10]
0.121 and over [3.07 and over]	0.005 [0.13]

[A] It is recognized that the surfaces of heavy zinc coatings, particularly those produced by hot galvanizing, are not perfectly smooth and devoid of irregularities. If the tolerances shown in Table 4 are rigidly applied to such irregularities that are inherent to the product, unjustified rejections of wire that would actually be satisfactory for use could occur. Therefore, it is intended that these tolerances be used in gaging the uniform areas of the galvanized wire.

15. Sampling

15.1 Sampling for determination of compliance to this specification shall be performed on each lot of material. A lot shall consist of all the strand of one size and one grade in each shipment. The number of samples to be taken shall be as follows:

	Number of Samples
5000 ft [1524 m] or less	1
Over 5000 to 30 000 ft [1524 to 9144 m]	2
Over 30 000 to 150 000 ft [9144 to 45 720 m]	3
Over 150 000 ft [45 720 m]	4

15.2 Each sample taken shall be subjected to all tests prescribed in Sections 6, 7, and 8.

15.3 In addition to the strand testing in 15.2, the individual wires shall be tested. The number of individual wires to be selected from each sample of strand and tested to determine compliance with Sections 9, 10, 11, and 13 shall be as follows:

3-wire strand—3 wires
7-wire strand—4 wires
19-wire strand—3 wires from each layer (total of 6 wires)
37-wire strand—3 wires from each layer (total of 9 wires)

15.3.1 Individual wire samples selected for compliance to Section 13 shall be discarded if any distortion of the wire occurred during the stranding operation.

15.4 Instead of testing the wires from the completed strand in accordance with 15.3, the producer may elect to establish compliance with Sections 9, 10, 11, and 13 of this specification by tests made on the wires prior to stranding, unless otherwise stipulated by the purchaser. However, if the producer makes this election, the purchaser still reserves the right to test wires from the completed strand for compliance.

16. Inspection

16.1 The manufacturer shall afford the inspector representing the purchaser all reasonable facilities to satisfy him that the material is being furnished in accordance with this specification. All tests and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

17. Rejection

17.1 If the wire or strand fails in the first test to meet any requirement of this specification, two additional tests shall be made on samples of wire or strand from the same coil or reel. If failure occurs in either of these tests, the lot of wire or strand shall be rejected.

18. Packaging and Package Marking

18.1 Wire strand shall be furnished in standard lengths (see 18.1.1) and in compact coils or on reels (see 18.1.2) as specified by the purchaser; otherwise lengths shall be as agreed upon at the time of purchase. Only one length of strand shall be furnished in each coil or on each reel. Lengths of strand may vary between the standard (nominal) length and 10 % over the standard (nominal) length, unless otherwise specified by the purchaser.

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18.1.1 Standard lengths of strand are as follows: 250, 500, 1000, 2500, and 5000 ft [76, 152, 304, 760, and 1520 m].

18.1.2 Standard practice is to furnish all strand 7/16 in. [11.11 mm] and over in diameter on reels in lengths of 1000 ft [304 m] and over. Strand lengths of less than 1000 ft are regularly furnished in coils.

18.2 Each coil or reel shall have a strong weather-resistant tag securely fastened to it showing the length, nominal diameter, number of wires, grade of the strand, class of coating, ASTM Specification A 475, and the name or mark of the manufacturer. If additional information is required on the tag, it shall be so specified at the time of purchase.

19. Keywords

19.1 steel wire strand; wire; zinc-coated steel wire strand

SUMMARY OF CHANGES

Committee A05 has identified the location of selected changes to this standard since the last issue (A 475 - 98) that may impact the use of this standard.

A 475 - 03:

(*1*) Renumbered sections to meet Form and Style requirements.
(*2*) Editorial changes were made in paragraphs 2.1, 3.2.1, 4.1.3, 7.1, 8.3, 10.1, 10.2, 11.1, 18.2, Section 17, and Table 1.
(*3*) Changed Type 1 to Class 1 in paragraph 1.3 and Table 2
(*4*) Added paragraph 4.1.5.
(*5*) Changed "base metal" in paragraph 5.1 to "any commercially accepted steel making process."
(*6*) Incorporated Note 1 into paragraph 15.3.1.
(*7*) Incorporated Note 2 into paragraph 11.1.
(*8*) Changed Section 14 from "Finish" to "Workmanship."
(*9*) Changed "kg/304.8m" to "kg/km" in Column 4 heading and changed the metric values in Column 4 in Table 1.
(*10*) Added Summary of Changes section.

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