Designation: A 496 – 01

Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement[1]

This standard is issued under the fixed designation A 496; 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 deformed steel wire which has been cold-worked by drawing, rolling, or both drawing and rolling, to be used as produced, or in fabricated form, for the reinforcement of concrete in sizes having nominal cross-sectional areas not less than 6.45 mm^2 (0.01 $in.^2$).

1.2 Supplement S1 describes high-strength wire, which shall be furnished when specifically ordered. It shall be permissible to furnish high-strength wire in place of regular wire if mutually agreed to by the purchaser and supplier.

1.3 The values stated in either inch-pound units or SI units are to be regarded as standard. Within the text the inch-pound units are shown in brackets. The value stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values may result in nonconformance with the specification.

2. Referenced Documents

2.1 *ASTM Standards:*

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products[2]

A 497 Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete[3]

A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment[4]

E 83 Practice for Verification and Classification of Extensometers[5]

2.2 *Military Standards:*

MIL-STD-129 Marking for Shipment and Storage[6]

MIL-STD-163 Steel Mill Products Preparation for Shipment and Storage[6]

2.3 *Federal Standard:*

Fed. Std. No. 123 Marking for Shipments (Civil Agencies)[6]

2.4 *Other Standard:*

ACI 318 Building Code Requirements for Structural Concrete[7]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *deformed steel wire for reinforcement—as used within the scope and intent of this specification*, shall mean any cold-worked, deformed steel wire intended for use as reinforcement in concrete construction, the wire surface having deformations that: (1) inhibit longitudinal movement of the wire in such construction; and (2) conform to the provisions of Section 5. It shall be permissible for the deformations to be raised indented.

3.1.2 *size number—as used in this specification*, refers to the numerical designation of the wire as tabulated in Table 1 and Table 2 under the column headed Deformed Wire Size Number, or a number indicating the nominal cross-sectional area of the deformed wire in hundredths of a square inch.

4. Ordering Information

4.1 When deformed wire is ordered by size number, the dimensional requirements shall be as given in Table 1. When deformed wire is ordered to dimensions other than the sizes shown, the nominal dimensions shall be developed from the applicable unit weight per foot of the section.

4.2 Orders for material to this specification should include the following information:

4.2.1 Quantity (weight),

4.2.2 Name of material (deformed steel wire for concrete reinforcement),

4.2.3 Wire diameter (see Table 1 and Table 2),

4.2.4 Packaging (see Section 16), and

4.2.5 ASTM designation and year of issue.

4.2.6 Special requirements, if any. (See Supplement S1.)

NOTE 1—A typical ordering description is as follows: 50 000 lb

[1] This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel, and related Alloys and is the direct responsibility of Subcommittee A01.05 on Steel Reinforcement.

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[2] *Annual Book of ASTM Standards*, Vol 01.03

[3] *Annual Book of ASTM Standards*, Vol 01.04

[4] *Annual Book of ASTM Standards*, Vol 01.05

[5] *Annual Book of ASTM Standards*, Vol 03.01

[6] Available from Standardization Documents Order Desk, Building 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111–5094

[7] Available from American Concrete Institute, P.O. Box 9094, Farmington Hills, MI 48333-9094.

TABLE 1 Dimensional Requirements for Deformed Wire for Concrete Reinforcement in SI Units

Deformed Wire Size[A,B,C]	(D in.^{2}) (× 100)	Nominal Dimensions: Unit Wt.		Nominal Dimensions: Diameter[D]		Nominal Dimensions: Cross-Sectional Area[2E]		Nominal Dimensions: Perimeter		Deformation Requirements: Spacing, Maximum		Deformation Requirements: Spacing, Minimum		Deformation Requirements: Min. Avg. Height of Deformations	
		kg/m	(lbs/ft.)	mm	(in.)	mm^2	(in.^{2})	mm	(in.)	mm	(in.)	mm	(in.)	mm[F]	(in.)
MD 25	(D 3.9)	0.1962	(0.133)	5.60	(0.220)	25	(0.039)	17.59	(0.692	7.24	(0.285)	4.62	(0.182)	0.252	(0.010)
MD 30	(D 4.6	0.2355	(0.156)	6.20	(0.244)	30	(0.046)	19.48	(0.767)	7.24	(0.285)	4.62	(0.182)	0.279	(0.011)
MD 35	(D 5.4)	0.2747	(0.184)	6.70	(0.264)	35	(0.054)	21.05	(0.829)	7.24	(0.285)	4.62	(0.182)	0.302	(0.012)
MD 40	(D 6.2)	0.3140	(0.211)	7.10	(0.280)	40	(0.062)	22.31	(0.878)	7.24	(0.285)	4.62	(0.182)	0.320	(0.013)
MD 45	(D 7.0)	0.3532	(0.238)	7.60	(0.299)	45	(0.070)	23.88	(0.940)	7.24	(0.285)	4.62	(0.182)	0.342	(0.014)
MD 50	(D 7.7)	0.3925	(0.262)	8.00	(0.315)	50	(0.077)	25.13	(0.989)	7.24	(0.285)	4.62	(0.182)	0.360	(0.014)
MD 55	(D 8.5)	0.4317	(0.289)	8.40	(0.331)	55	(0.085)	26.39	(1.039)	7.24	(0.285)	4.62	(0.182)	0.378	(0.015)
MD 60	(D 9.3)	0.4709	(0.316)	8.70	(0.343)	60	(0.093)	27.33	(1.076)	7.24	(0.285)	4.62	(0.182)	0.392	(0.015)
MD 65	(D 10.1)	0.5102	(0.343)	9.10	(0.358)	65	(0.101)	28.59	(1.126)	7.24	(0.285)	4.62	(0.182)	0.455	(0.018)
MD 70	(D 10.8)	0.5494	(0.367)	9.40	(0.370)	70	(0.108)	29.53	(1.163)	7.24	(0.285)	4.62	(0.182)	0.470	(0.018)
MD 80	(D 12.4)	0.6279	(0.422)	10.10	(0.397)	80	(0.124)	31.70	(1.248)	7.24	(0.285)	4.62	(0.182)	0.505	(0.020)
MD 90	(D 13.9)	0.7064	(0.473)	10.70	(0.421)	90	(0.139)	33.62	(1.324)	7.24	(0.285)	4.62	(0.182)	0.535	(0.021)
MD 100	(D 15.5)	0.7849	(0.527)	11.30	(0.445)	100	(0.155)	35.50	(1.398)	7.24	(0.285)	4.62	(0.182)	0.565	(0.022)
MD 120	(D 18.6)	0.9419	(0.632)	12.40	(0.488)	120	(0.186)	38.96	(1.534)	7.24	(0.285)	4.62	(0.182)	0.620	(0.024)
MD 130	(D 20.1)	1.0204	(0.683)	12.90	(0.508)	130	(0.201)	40.53	(1.596)	7.24	(0.285)	4.62	(0.182)	0.645	(0.025)
MD 200	(D 31.0)	1.5700	(1.054)	15.95	(0.628)	200	(0.310)	50.27	(1.979)	7.24	(0.285)	4.62	(0.182)	0.800	(0.031)
MD 290	(D 45.0)	2.27	(1.530)	19.22	(0.757)	290	(0.450)	60.37	(2.378)	7.24	(0.285)	4.62	(0.182)	0.961	(0.0379)

[A]The number following the prefix indicates the nominal cross-sectional area of the deformed wire in square millimeters.

[B]For sizes other than those shown above, the Size Number shall be the number of one hundredths of a square inch in the nominal area of the deformed wire cross section, prefixed by the letters MD.

[C]These sizes represent the most readily available sizes in the welded wire reinforcement industry. Other wire sizes are available and many manufacturers can produce them in 1–mm^2 (0.0015–in.^{2}) increments.

[D] The nominal diameter of a deformed wire is equivalent to the diameter of a plain wire having the same mass per metre as the deformed wire.

[E]The cross-sectional area is based on the nominal diameter. The area in square millimetres may be calculated by dividing the unit mass in kg/mm by 7×10^{-6} (mass of 1 mm^3 of steel or by dividing the unit mass in kg/m by 0.007849 (mass of steel 1 mm square and 1 m long).

[F]The minimum average height of the deformations shall be determined from measurements made on not less than two typical deformations from each line of deformations on the wire. Measurements shall be made at the center of indentation as described in 7.7.

TABLE 2 Dimensional Requirements for Deformed Steel Wire for Concrete Reinforcement—US Customary Units Wire Sizes

	Nominal Dimensions			Deformation Requirements			
Deformed Wire Size Number[A,B]	Unit Weight, lb/ft(kg/m)	Diameter, in.(mm)[C]	Cross-sectional Area, in.^{2}(mm^2)[D]	Perimeter, in.(mm)	Maximum, in.(mm)	Minimum, in.(mm)	Minimum Average Height of Deformations, in.(mm)[E,F]
D-1	0.034 (0.0510)	0.113 (2.87)	0.01 (6.45)	0.355 (9.02)	0.285 (7.24)	0.182 (4.62)	0.0045 (0.114)
D-2	0.068 (0.1013)	0.159 (4.04)	0.02 (12.90)	0.499 (12.67)	0.285 (7.24)	0.182 (4.62)	0.0063 (0.160)
D-3	0.102 (0.1523)	0.195 (4.95)	0.03 (19.35)	0.162 (15.54)	0.285 (7.24)	0.182 (4.62)	0.0078 (0.198)
D-4	0.136 (0.2025)	0.225 (5.72)	0.04 (25.81)	0.706 (17.93)	0.285 (7.24)	0.182 (4.62)	0.0101 (0.257)
D-5	0.170 (0.2532)	0.252 (6.40)	0.05 (32.26)	0.791 (20.09)	0.285 (7.24)	0.182 (4.62)	0.0113 (0.287)
D-6	0.204 (0.3038)	0.276 (7.01)	0.06 (38.71)	0.867 (22.02)	0.285 (7.24)	0.182 (4.62)	0.0124 (0.315)
D-7	0.238 (0.3548)	0.299 (7.57)	0.07 (45.16)	0.936 (23.77)	0.285 (7.24)	0.182 (4.62)	0.0134 (0.304)
D-8	0.272 (0.4051)	0.319 (8.10)	0.08 (51.61)	1.002 (25.45)	0.285 (7.24)	0.182 (4.62)	0.0143 (0.363)
D-9	0.0306 (0.4561)	0.338 (8.59)	0.09 (58.96)	1.061 (26.95)	0.285 (7.24)	0.182 (4.62)	0.0152 (0.386)
D-10	0.340 (0.5063)	0.356 (9.04)	0.10 (64.52)	1.118 (28.40)	0.285 (7.24)	0.182 (4.62)	0.0160 (0.406)
D-11	0.374 (0.5574)	0.374 (9.50)	0.11 (70.97)	1.174 (29.82)	0.285 (7.24)	0.182 (4.62)	0.0187 (0.475)
D-12	0.408 (0.6076)	0.390 (9.91)	0.12 (77.42)	1.225 (31.13)	0.285 (7.24)	0.182 (4.62)	0.0195 (0.495)
D-13	0.442 (0.6586)	0.406 (10.31)	0.13 (83.87)	1.275 (32.39)	0.285 (7.24)	0.182 (4.62)	0.0203 (0.516)
D-14	0.476 (0.7089)	0.422 (10.72)	0.14 (90.32)	1.325 (33.66)	0.285 (7.24)	0.182 (4.62)	0.0211 (0.536)
D-15	0.510 (0.7599)	0.437 (11.10)	0.15 (96.77)	1.372 (34.85)	0.285 (7.24)	0.182 (4.62)	0.0218 (0.554)
D-16	0.544 (0.8101)	0.451 (11.46)	0.16 (103.23)	1.416 (35.97)	0.285 (7.24)	0.182 (4.62)	0.0225 (0.572)
D-17	0.578 (0.8611)	0.465 (11.81)	0.17 (109.68)	1.460 (37.08)	0.285 (7.24)	0.182 (4.62)	0.0232 (0.589)
D-18	0.612 (0.9114)	0.478 (12.14)	0.18 (116.13)	1.501 (38.13)	0.285 (7.24)	0.182 (4.62)	0.0239 (0.607)
D-19	0.646 (0.9624)	0.491 (12.47)	0.19 (122.58)	1.542 (37.17)	0.285 (7.24)	0.182 (4.62)	0.0245 (0.622)
D-20	0.680 (1.0127)	0.504 (12.80)	0.20 (129.03)	1.583 (40.21)	0.285 (7.24)	0.182 (4.62)	0.0252 (0.604)
D-21	0.714 (1.0637)	0.517 (13.13)	0.21 (135.48)	1.624 (41.25)	0.285 (7.24)	0.182 (4.62)	0.0259 (0.658)
D-22	0.748 (1.1139)	0.529 (13.44)	0.22 (141.94)	1.662 (42.21)	0.285 (7.24)	0.182 (4.62)	0.0265 (0.673)
D-23	0.782 (1.1649)	0.541 (13.74)	0.23 (148.39)	1.700 (43.18)	0.285 (7.24)	0.182 (4.62)	0.0271 (0.688)
D-24	0.816 (1.2152)	0.553 (14.05)	0.24 (154.84)	1.737 (44.12)	0.285 (7.24)	0.182 (4.62)	0.0277 (0.704)
D-25	0.850 (1.2662)	0.564 (14.33)	0.25 (161.29)	1.772 (45.01)	0.285 (7.24)	0.182 (4.62)	0.0282 (0.716)
D-26	0.884 (1.3164)	0.575 (14.61)	0.26 (167.74)	1.806 (45.87)	0.285 (7.24)	0.182 (4.62)	0.0288 (0.732)
D-27	0.918 (1.3675)	0.586 (14.88)	0.27 (174.19)	1.841 (48.76)	0.285 (7.24)	0.182 (4.62)	0.0293 (0.744)
D-28	0.952 (1.4177)	0.597 (15.16)	0.28 (180.64)	1.876 (47.65)	0.285 (7.24)	0.182 (4.62)	0.0299 (0.759)
D-29	0.986 (1.4687)	0.608 (15.44)	0.29 (187.10)	1.910 (48.51)	0.285 (7.24)	0.182 (4.62)	0.0304 (0.772)
D-30	1.020 (1.5190)	0.618 (15.70)	0.30 (193.55)	1.942 (49.33)	0.285 (7.24)	0.182 (4.62)	0.0309 (0.785)
D-31	1.054 (1.5700)	0.628 (15.95)	0.31 (200.00)	1.973 (50.11)	0.285 (7.24)	0.182 (4.62)	0.0314 (0.798)
D-45	1.530 (2.276)	0.757 (19.23)	0.45 (290.32)	2.378 (60.40)	0.285 (7.24)	0.182 (4.62)	0.0379 (0.961)

[A] The number following the prefix indicates the nominal cross-sectional area of the deformed wire in square inches (square millimeters).

[B] For sizes other than those shown above, the Size Number shall be the number of one hundredths of a square inch in the nominal area of the deformed wire cross section, prefixed by the letter D.

[C] The nominal diameter of a deformed wire is equivalent to the diameter of a plain wire having the same weight per foot as the deformed wire.

[D] The cross-sectional area is based on the nominal diameter. The area in square inches may be calculated by dividing the unit weight in pounds by 0.2833 (weight of 1 in.^{3} of steel), or by dividing the unit weight per linear foot of specimen in pounds by 3.4 (weight of steel 1 in. square and 1 foot long).

[E] The minimum average height of the deformations shall be determined from measurements made on not less than two typical deformations from each line of deformations on the wire. Measurements shall be made at the center of indentation as described in 6.2.

[F] These sizes represent the most readily available sizes in the welded wire reinforcement industry. Other wire sizes are available and many manufacturers can produce them in 0.0015–in^2 (1–mm^2) increments.

deformed steel wire for concrete reinforcement, size No. D-12, on pipe carriers, polyethylene shrouded, the ASTM A 496 –____ .

5. Materials and Manufacture

5.1 The steel shall be made by one of the following processes: open-hearth, electric furnace, or basic oxygen.

5.2 The deformed steel wire shall be produced from rods or bars that have been hot rolled from billets.

6. Requirements

6.1 Deformations shall be spaced along the wire at a substantially uniform distance and shall be symmetrically disposed around the perimeter of the section. The deformations on all longitudinal lines of the wire shall be similar in size and shape. A minimum of 25 % of the total surface area shall be deformed by measurable deformations.

6.2 Deformed wire shall have two or more lines of deformations.

6.3 The average longitudinal spacing of deformations shall be not less than 3.5 nor more than 5.5 deformations per inch in each line of deformations on the wire.

6.4 The minimum average height of the center of typical deformations based on the nominal wire diameters shown in Table 1 and Table 2 shall be as follows:

Wire Sizes	Minimum Average Height of Deformations, Percent of Nominal Wire Diameter
D-3 and finer	4
Coarser than D-3 through D–10	4 ½
Coarser than D-10	5

6.5 The deformations shall be placed in respect to the axis of the wire so that the included angle is not less than 45°; or if deformations are curvilinear, the angle formed by the transverse axis of the deformation and the wire axis shall be not less than 45°. Where the line of deformations forms an included angle with the axis of the wire from 45 to 70° inclusive, the deformations shall alternately reverse in direction on each side,