



Designation: **A886/A886M—10 A886/A886M – 12**

Standard Specification for Steel Strand, Indented, Seven-Wire Stress-Relieved for Prestressed Concrete¹

This standard is issued under the fixed designation A886/A886M; 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 seven-wire uncoated, indented, stress-relieved~~ This specification covers two types and two grades of indented seven-wire uncoated, steel strand for use in ~~pretensioned~~ prestressed concrete construction. ~~Grade 250I~~ The two types of strand are low-relaxation and stress-relieved (normal-relaxation). Grade 250I [1725I] and Grade 270I [1860I] have minimum ~~ultimate~~ tensile strengths of 250 ksi [1725 MPa] and 270 ksi [1860 MPa], respectively, based on the nominal area of the strand.

1.2 ~~Supplement I describes low-relaxation strand and relaxation testing for that product. Low-relaxation strand shall be furnished when specifically ordered and furnished in place of stress-relieved strand if mutually agreed to by the purchaser and supplier.~~

1.2 This specification is applicable for orders in either inch-pound units (as Specification A886) or in SI units (as Specification A886M).

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

2. Referenced Documents

2.1 ~~ASTM Standards: Standard:~~²

A1061/A1061M Test Methods for Testing Multi-Wire Steel Strand

2.2 ~~U.S. Military Standards: Standard:~~

MIL-STD-129 Marking for Shipment and Storage³

~~MIL-STD-163 Steel Mill Products Preparation for Shipment and Storage~~^{3,2}

2.3 ~~U.S. Federal Standards: Standard:~~

Fed. Std. No. 123 Marking for Shipments (Civil Agencies)³

3. Terminology

3.1 ~~Definitions~~ Definition of Terms ~~Term Specific to This Standard:~~ this Specification:

3.1.1 ~~strand, n—~~ all strand shall be of the seven-wire type a group of wires having a center wire enclosed tightly by six helically placed outer wires with uniform pitch of not less than 12 and not more than 16 times the nominal diameter of the strand.

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 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 U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, http://www.access.gpo.gov.

3.1.1.1 Discussion—

The direction of lay may be either right- or left-hand; however, strands of different lays should not be spliced together.

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



TABLE 1 Nominal Dimensions of Indentations

Fig.	Wire Diameter, <i>d</i>		Strand Diameter		Depth, <i>a</i>			Length, <i>L</i>		Pitch, <i>P</i>	
	mm in.	mm	in.	mm	in.	mm	in.	mm	in.		
1-(a)	2.6 and below	{0.104 and below}	7.9	{0.312}	0.05 to 0.10	{0.002 to 0.004}	2.0	{0.079}	5.6	{0.220}	
1-(a)	over 3.2	{over 0.125}	9.5	{0.375}	0.05 to 0.13	{0.002 to 0.005}	2.7	{0.108}	5.6	{0.220}	
1-(b)	3.2 and below	{0.125 and below}	9.5	{0.375}	0.05 to 0.15	{0.002 to 0.006}	2.9	{0.115}	5.6	{0.220}	

TABLE 1 Nominal Dimensions of Indentations

Fig.	Wire Diameter, <i>d</i>		Nominal Diameter of Strand		Depth, <i>a</i>		Length, <i>L</i>		Pitch, <i>P</i>	
	in.	[mm]	in.	[mm]	in.	[mm]	in.	[mm]	in.	[mm]
1 (a)	≤ 0.104	[≤ 2.6]	0.312	[7.9]	0.002 to 0.004	[0.05 to 0.10]	0.079	[2.0]	0.220	[5.6]
1 (a)	> 0.125	[> 3.2]	0.375	[9.5]	0.002 to 0.005	[0.05 to 0.13]	0.108	[2.7]	0.220	[5.6]
			0.438	[11.1]						
			0.500	[12.7]						
1 (b)	≤ 0.125	[≤ 3.2]	0.375	[9.5]	0.002 to 0.006	[0.05 to 0.15]	0.115	[2.9]	0.220	[5.6]

4. Ordering Information

4.1 It shall be the responsibility of the purchaser to specify all requirements that are necessary for material ordered ~~to~~ under this specification. Such requirements ~~shall to be considered~~ include, but are not limited to, the following:

- 4.1.1 Quantity ~~(metres [feet]), (feet [metres])~~,
- 4.1.2 Diameter ~~Nominal diameter of strand (millimetres [inches]), (inches [millimetres])~~,
- 4.1.3 Grade of strand,
- 4.1.4 Packaging, Type of strand (low-relaxation or stress-relieved (normal-relaxation)),
- 4.1.5 Other types of indented wire (7.4.2),
- 4.1.6 If joints or splices are permitted (8.1.1),
- 4.1.7 Weldless, if desired (8.1.4),
- 4.1.8 Inspection (11.1),
- 4.1.9 Load-elongation curve, if desired (13.2),
- 4.1.10 Packaging (4.1), and
- 4.1.11 ASTM designation and year of issue, and issue.
- 4.1.6 Special requirements, if any.

NOTE 1—A typical ordering description is as follows: 25 600 m (84 000 ft) 12.70-mm (0.5-in.), Grade 1860I (2701) strand, in 3658-m (12 000-ft) spoolless packs to ASTM A886/A886M _____.

5. Materials and Manufacture

5.1 *Base Metal*—The base metal shall be carbon steel of such quality that when it is drawn to wire, subjected to the indentation process, fabricated into strand, and then ~~stress-relieved, thermally treated~~, it shall have the properties and characteristics prescribed in this specification.

5.2 *Wire*—The wire from which the strand is to be fabricated shall have a common dry-drawn finish.

NOTE 1—This product is a composite of seven wires and is produced to ~~mechanical properties only, the only the prescribed mechanical properties~~. The chemical composition of all wires or any individual wire is not pertinent to this application, and heat identity is not necessarily maintained. It is possible that wire from more than one heat may be used in the manufacture of a reel or reelless pack. Traceability is based on ~~pack identity~~ the identity of reels or reelless packs as maintained and reported by the manufacturer.

5.3 *Indentations*—The outer wires shall have indentations ~~designed to reduce that inhibit~~ longitudinal movement of the strand ~~within the concrete, and relative to the concrete surrounding the strand in prestressed concrete construction~~. Indentations shall conform to the provisions in Section 7.4. The surface of the outer wires shall be suitably deformed mechanically by rolling to produce a series of indentations. Indentations shall be in two or more lines spaced uniformly around the wire. Indentations in adjacent lines shall be staggered throughout the length of the wire. At least 90 % of the indentations in any 0.6 m (2 ft) 2 ft [0.6 m] length of strand shall meet the pitch and shape requirements of Table 1. The center wire need not be indented.

5.4 *Stress-Relieving—Treatment*—After stranding, a ~~low-relaxation~~ strand shall be subjected to a ~~stress-relieving~~ continuous ~~heat~~ thermal-mechanical treatment to produce the prescribed mechanical properties. ~~For stress-relieved (normal-relaxation) strand, only thermal treatment is necessary~~. Temper colors which result from the stress-relieving operation are considered normal for the finished appearance of this strand.



TABLE 2 Breaking Strength Requirements

Diameter of Strand		Breaking Strength of Strand, kN [lbf]	Steel Area of Strand, mm ² [in. ²]	Mass [Weight] of Strand, kg/1000 m [lb/1000 ft]	
mm	in.				
Grade 1725 [250]					
6.4	[0.250]	40.0	[9.000]	23.2 [0.036]	182 [122]
7.9	[0.313]	64.5	[14.500]	37.4 [0.058]	294 [197]
9.5	[0.375]	89.0	[20.000]	51.6 [0.080]	405 [272]
11.1	[0.438]	120.1	[27.000]	69.7 [0.108]	548 [367]
12.7	[0.500]	160.1	[36.000]	92.9 [0.144]	730 [490]
15.2	[0.600]	240.2	[54.000]	139.4 [0.216]	1094 [737]
Grade 1860 [270]					
7.9	[0.313]	74.3	[16.500]	39.4 [0.061]	313 [210]
9.5	[0.375]	102.3	[23.000]	54.8 [0.085]	432 [290]
11.1	[0.438]	137.9	[31.000]	74.2 [0.115]	582 [390]
12.7	[0.500]	183.7	[41.300]	98.7 [0.153]	775 [520]
15.2	[0.600]	266.7	[58.600]	140.0 [0.217]	1102 [740]

TABLE 2 Breaking Strength Requirements

Nominal Diameter of Strand		Breaking Strength of Strand, lbf [kN]	Steel Area of Strand, in. ² [mm ²]	Mass [Weight] of Strand, lb/1000 ft [kg/1000 m]	
in.	[mm]				
Grade 250 [1725]					
0.250	[6.4]	9 000	[40.0]	0.036 [23.2]	122 [182]
0.313	[7.9]	14 500	[64.5]	0.058 [37.4]	197 [294]
0.375	[9.5]	20 000	[89.0]	0.080 [51.6]	272 [405]
0.438	[11.1]	27 000	[120.1]	0.108 [69.7]	367 [548]
0.500	[12.7]	36 000	[160.3]	0.144 [92.9]	490 [730]
0.600	[15.2]	54 000	[240.5]	0.216 [139.4]	737 [1094]
Grade 270 [1860]					
0.313	[7.9]	16 500	[74.3]	0.061 [39.4]	210 [313]
0.375	[9.5]	23 000	[101.9]	0.085 [54.8]	290 [432]
0.438	[11.1]	31 000	[138.0]	0.115 [74.2]	390 [582]
0.500	[12.7]	41 300	[183.6]	0.153 [98.7]	520 [775]
0.600	[15.2]	58 600	[260.4]	0.217 [140.0]	740 [1102]

6. Mechanical Property Requirements

6.1 Tests for mechanical properties shall be conducted in accordance with Test Methods A1061/A1061M.

6.2 *Breaking Strength*—The breaking strength of the finished strand shall conform to the requirements prescribed in Table 2.

6.3 *Yield Strength*—Yield strength in kN (lb) [kN] shall be measured at 1 % extension under load. The load at this extension shall be recorded as the yield strength. Minimum yield strength shall be 90 % for low-relaxation strand and 85 % for stress-relieved (normal-relaxation) strand of the breaking strength listed in Table 2 and shall meet the requirements prescribed. Initial loads for the test and minimum yield strengths are listed in Table 3.

6.3.1 The extension under load shall be measured by an extensometer calibrated with the smallest division not larger than 0.0001 mm/mm (0.001 in./in.) [in./in. [0.0001 mm/mm]] of gage length.

6.4 *Elongation*—The total elongation under load shall not be less than 3.5 % using a gage length of not less than 600 mm (24 in.) [600 mm]. It shall be permissible to determine the total elongation value by adding to the 1 % yield extension the percent extension or movement between the jaws gripping the strand after yield determination. The percent is calculated on the new base length of jaw-to-jaw distance.

6.5 *Relaxation Properties*—Low-relaxation strand shall have relaxation losses of not more than 2.5 % when initially loaded to 70 % of specified minimum breaking strength or not more than 3.5 % when loaded to 80 % of specified minimum breaking strength of the strand after 1000 hours of testing.

6.5.1 If required, relaxation evidence shall be provided from the manufacturer's records of tests on similarly dimensioned strand of the same grade.



TABLE 3 Yield Strength Requirements^A

Diameter of Strand		Initial Load, kN [lbf]	Minimum Load at 1 % Extension, kN [lbf]
mm	[in.]		
Grade 1725I [250I]			
6.4	[0.250]	4.0 [900]	34.0 [7 650]
7.9	[0.313]	6.5 [1 450]	54.7 [12 300]
9.5	[0.375]	8.9 [2 000]	75.6 [17 000]
11.1	[0.438]	12.0 [2 700]	102.3 [23 000]
12.7	[0.500]	16.0 [3 600]	136.2 [30 600]
15.2	[0.600]	24.0 [5 400]	204.2 [45 900]
Grade 1860I [270I]			
7.9	[0.313]	7.3 [1 650]	62.4 [14 030]
9.5	[0.375]	10.2 [2 300]	87.0 [19 550]
11.1	[0.438]	13.8 [3 100]	117.2 [26 350]
12.7	[0.500]	18.4 [4 130]	156.1 [35 000]
15.2	[0.600]	26.1 [5 860]	221.5 [49 800]

TABLE 3 Yield Strength Requirements^A

Nominal Diameter of Strand		Initial Load, lbf [kN]	Minimum Load at 1 % Extension, kN [lbf]	
in.	[mm]		Stress-Relieved (Normal Relaxation) ^A	Low Relaxation ^B
Grade 1725I [250I]				
0.250	[6.4]	900 [4.0]	7 650 [34.0]	8 100 [36.0]
0.313	[7.9]	1 450 [6.5]	12 300 [54.8]	13 050 [58.1]
0.375	[9.5]	2 000 [8.9]	17 000 [75.6]	18 000 [80.1]
0.438	[11.1]	2 700 [12.0]	23 000 [102.3]	24 300 [108.2]
0.500	[12.7]	3 600 [16.0]	30 600 [136.2]	32 400 [144.3]
0.600	[15.2]	5 400 [24.0]	45 900 [204.4]	48 600 [216.5]
Grade 1860I [270I]				
0.313	[7.9]	1 650 [7.3]	14 030 [63.2]	14 850 [66.9]
0.375	[9.5]	2 300 [10.2]	19 550 [86.6]	20 700 [91.7]
0.438	[11.1]	3 100 [13.8]	26 350 [117.3]	27 900 [124.2]
0.500	[12.7]	4 130 [18.4]	35 000 [156.1]	37 170 [165.2]
0.600	[15.2]	5 860 [26.1]	49 800 [221.3]	52 740 [234.4]

^AYield strength minimum—Minimum yield strength is 85 % of specified minimum breaking strength.

^B Minimum yield strength is 90 % of specified minimum breaking strength.

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7. Dimensions and Permissible Variations

7.1 The size of the finished strand shall be expressed as the nominal diameter of the strand in decimals of an inch [millimetre], inches [mm]. All nominal dimensional requirements for wires and strands shall refer to the wire and strand before indenting.

7.2 The diameter of the center wire of any strand must shall be larger than the diameter of any outer wire in accordance with Table 4.

7.3 Permissible Variations in Diameter:

7.3.1 All Grade 250I [1725I] strand shall conform to a size tolerance of ±0.40 mm (±0.016 in.) ±0.016 in. [±0.40 mm] from the nominal diameter measured across the crowns of the wire.

7.3.2 All Grade 270I [1860I] strand shall conform to a size tolerance of +0.65 mm, -0.15 mm (+0.026 in., -0.006 in.) +0.026 in., -0.006 in. [+0.65 mm, -0.15 mm] from the nominal diameter measured across the crowns of the wire.

7.3.3 Variation in cross-sectional area and in stress resulting therefrom shall not be cause for rejection provided the diameter differences of the individual wires and the diameters of the strand are within the tolerances specified.

7.4 Indentations:

7.4.1 Two acceptable types of indented wire are shown in Fig. 1 (a) and (b) with dimensions given in Table 1.

7.4.2 Other types of indented wire are permitted, by agreement between the purchaser and supplier manufacturer.

8. Workmanship, Finish, and Appearance

8.1 Joints:

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

8.1.2 During the process of manufacture of the individual wires for stranding, welding is permitted only prior to or at the size of the last thermal treatment, for example, patenting or control cooling. There shall be no welds in the wire after it has been drawn through the first die in the wire drawing except as provided in 8.1.3.