



Designation: **A910/A910M – 10** **A910/A910M – 12**

## Standard Specification for Uncoated, Weldless, 2-2-Wire and 3-Wire Steel Strand for Prestressed Concrete<sup>1</sup>

This standard is issued under the fixed designation A910/A910M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope\*

1.1 This specification covers two types and two grades of 2-2-wire and 3-wire, uncoated steel strand for use in ~~pretensioned and posttensioned~~ prestressed concrete construction. The two types of strand are low-relaxation and stress-relieved (normal-relaxation). Low-relaxation ~~shall~~ is to be regarded as the standard type. Stress-relieved (normal-relaxation) strand will not be furnished unless specifically ordered, ~~or by arrangement between purchaser and supplier.~~ ordered. The two grades are ~~1725 (250) and 1860 (270)~~ 250 [1725] and 270 [1860]. Grades 250 [1725] and 270 [1860] have minimum tensile strengths of ~~1725 MPa (250 ksi) and 1860 MPa (270 ksi)~~ 250 ksi [1725 MPa] and 270 ksi [1860 MPa] respectively, based on the nominal area of the strand.

1.2 This specification is applicable for orders in either inch-pound units (as Specification A910) or in SI units (as Specification A910M).

1.3 The values stated in either inch-pound units or SI units are to be regarded ~~separately~~ as the standard. Within the text, the ~~inch-pound~~ SI units are shown in ~~parentheses~~ 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~~ non-conformance with the specification.

### 2. Referenced Documents

2.1 ~~ASTM Standards: Standard:~~<sup>2</sup>

[A1061/A1061M Test Methods for Testing Multi-Wire Steel Strand](https://standards.iteh.ai/A1061/A1061M)

2.2 ~~U.S. Military Standards: Standard:~~<sup>3</sup>

[MIL-STD-129 Marking for Shipment and Storage](#)

[MIL-STD-163 Steel Mill Products Preparation for Shipment and Storage](#)

2.3 ~~Federal Standards: Standard:~~<sup>3</sup>

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

### 3. Terminology

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

3.1.1 ~~strand, n—all strands shall be comprised of either two wires~~ Either two or three wires helically wound around each other; they shall have a other with uniform pitch of not less than 12 ~~nor~~ and not more than 16 times the nominal diameter of the strand.

<sup>1</sup> 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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<sup>2</sup> 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.

<sup>3</sup> 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.

~~3.1.2 Discussion—The direction of lay may be either right or left hand; however, strands of different lays shall not be spliced together.~~

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

#### 4. Ordering Information

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

- 4.1.1 Quantity (~~meters [feet]~~;~~feet [metres]~~),
- 4.1.2 Diameter-Nominal diameter and description of strand (~~Section (Table 17)~~),
- 4.1.3 Number of wires (2 or 3),
- 4.1.4 Grade of strand (see ~~Grade, 1.1 and Table 1 and Table 2~~),
- 4.1.5 Type of strand (see ~~low-relaxation 1.1 and/or stress-relieved Table 2~~);(~~normal relaxation~~)),
- 4.1.6 Inspection (11.1),
- 4.1.7 Load-elongation curve (13.2),
- 4.1.8 Packaging (~~Section (14.1.1)~~), and
- 4.1.9 ASTM designation and year of issue, ~~and issue~~.
- 4.1.8 Special requirements, if any.

NOTE 1—A typical ordering description is as follows: 100 000 m (325 000 ft) of 6.2 mm (0.244 in.) diameter, three wire, Grade 1860 MPa (270 ksi); low-relaxation strand in 10 000 m (32 500 ft) reelless packs conforming to ASTM A910/A910M-XX.

#### 5. Materials and Manufacture

5.1 *Base Metal*—The base metal shall be carbon steel of such quality that when drawn to wire, fabricated into strand and then 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 be round and have a dry-drawn finish.

**TABLE 1 Breaking Strength Requirements**

Description and Diameter of Strand				Breaking Strength of Strand		Steel Area of Strand		Weight of Strand	
in.		mm							
Description	Nominal Diameter	Description	Nominal Diameter	lbf	kN	in. <sup>2</sup>	mm <sup>2</sup>	lbs/1000 ft	kg/1000 m
GRADE 250 (1725 MPa)									
2 × 0.114	0.228	2 × 2.90	5.8	5000	22.2	0.020	13.2	69.9	104.0
3 × 0.089	0.189	3 × 2.25	4.8	4750	21.1	0.019	12.0	63.3	94.2
3 × 0.095	0.205	3 × 2.40	5.2	5250	23.4	0.021	13.6	71.9	107.0
3 × 0.114	0.244	3 × 2.90	6.2	7750	34.5	0.031	19.8	104.0	155.0
3 × 0.118	0.256	3 × 3.00	6.5	8250	36.7	0.033	21.3	112.0	167.0
3 × 0.138	0.295	3 × 3.50	7.5	11 250	50.0	0.045	29.0	153.0	228.0
3 × 0.158	0.340	3 × 4.00	8.6	14 500	64.5	0.058	37.4	200.6	298.4
GRADE 270 (1860 MPa)									
2 × 0.114	0.228	2 × 2.90	5.8	5400	24.0	0.020	13.2	69.9	104.0
3 × 0.089	0.189	3 × 2.25	4.8	5130	22.8	0.019	12.0	63.3	94.2
3 × 0.095	0.205	3 × 2.40	5.2	5670	25.2	0.021	13.6	71.9	107.0
3 × 0.114	0.244	3 × 2.90	6.2	8370	37.2	0.031	19.8	104.0	155.0
3 × 0.118	0.256	3 × 3.00	6.5	8910	39.6	0.033	21.3	112.0	167.0
3 × 0.138	0.295	3 × 3.50	7.5	12 150	54.0	0.045	29.0	153.0	228.0
3 × 0.158	0.340	3 × 4.00	8.6	15 660	69.7	0.058	37.4	200.6	298.4

**TABLE 1 Breaking Strength Requirements**

Description and Nominal Diameter of Strand				Breaking Strength of Strand		Steel Area of Strand		Weight [Mass] of Strand	
in.		[mm]							
Description	Nominal Diameter	Description	Nominal Diameter	lbf	[kN]	in. <sup>2</sup>	[mm <sup>2</sup> ]	lbs/1000 ft	[kg/1000 m]
GRADE 250 [1725 MPa]									
2 × 0.114	0.228	[2 × 2.90]	[5.8]	5000	[22.2]	0.020	[13.2]	69.9	[104.0]
3 × 0.089	0.189	[3 × 2.25]	[4.8]	4750	[21.1]	0.019	[12.0]	63.3	[94.2]
3 × 0.095	0.205	[3 × 2.40]	[5.2]	5250	[23.4]	0.021	[13.6]	71.9	[107.0]
3 × 0.114	0.244	[3 × 2.90]	[6.2]	7750	[34.5]	0.031	[19.8]	104.0	[155.0]
3 × 0.118	0.256	[3 × 3.00]	[6.5]	8250	[36.7]	0.033	[21.3]	112.0	[167.0]
3 × 0.138	0.295	[3 × 3.50]	[7.5]	11 250	[50.0]	0.045	[29.0]	153.0	[228.0]
3 × 0.158	0.340	[3 × 4.00]	[8.6]	14 500	[64.5]	0.058	[37.4]	200.6	[298.4]
GRADE 270 [1860 MPa]									
2 × 0.114	0.228	[2 × 2.90]	[5.8]	5400	[24.0]	0.020	[13.2]	69.9	[104.0]
3 × 0.089	0.189	[3 × 2.25]	[4.8]	5130	[22.8]	0.019	[12.0]	63.3	[94.2]
3 × 0.095	0.205	[3 × 2.40]	[5.2]	5670	[25.2]	0.021	[13.6]	71.9	[107.0]
3 × 0.114	0.244	[3 × 2.90]	[6.2]	8370	[37.2]	0.031	[19.8]	104.0	[155.0]
3 × 0.118	0.256	[3 × 3.00]	[6.5]	8910	[39.6]	0.033	[21.3]	112.0	[167.0]
3 × 0.138	0.295	[3 × 3.50]	[7.5]	12 150	[54.0]	0.045	[29.0]	153.0	[228.0]
3 × 0.158	0.340	[3 × 4.00]	[8.6]	15 660	[69.7]	0.058	[37.4]	200.6	[298.4]

NOTE 1—This product is a composite of two or three wires and is produced to ~~mechanical properties only~~, only to meet the prescribed mechanical properties, of which 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 *Treatment*—After stranding, low-relaxation strand shall be subjected to a continuous thermo-mechanical treatment to produce the prescribed mechanical properties. For stress-relieved (normal-relaxation) strand, only thermal treatment is necessary. Temper colors that result from the stress-relieving operation are considered normal for the finished appearance of this strand.

## 6. Mechanical Properties-Property Requirements

6.1 Tests for mechanical properties shall be conducted in accordance with Test Methods **A1061/A1061M**. Low-relaxation strand shall also be tested as prescribed in Test Methods **A1061/A1061M**.

6.2 *Breaking Strength*—The breaking strength of the finished strand shall conform to the requirements prescribed in **Table 1**.

6.3 *Yield Strength*—Yield strength in ~~kN (lbf)~~ [kN] shall be measured at 1 % extension under load, load in accordance with the test procedure delineated in Test Methods **A1061/A1061M**, Section 9.1. The minimum yield strength shall be 90 % for low-relaxation strand and 85 % for stress-relieved (normal-relaxation) (normal-relaxation) strand of the breaking strength listed in **Table 1**. Initial loads for the test and minimum yield strengths are listed in **Table 2**.

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

6.4 *Elongation*—The total elongation under load shall be determined in accordance with Test Methods **A1061/A1061M**, Section 9.2. The total elongation under load shall not be less than ~~3.5 %~~ 3.5 % using a gage length of not less than 24 in. [600 mm]. It

**TABLE 2 Yield Strength Requirements**

Description and Diameter of Strand				Minimum Load at 1 % Extension					
in.		mm		Initial Load		Stress-Relieved (Normal-Relaxation)		Low-Relaxation	
Description	Nominal Diameter	Description	Nominal Diameter	lbf	kN	lbf	kN	lbf	kN
GRADE 250 (1725 MPa)									
2 × 0.114	0.228	2 × 2.90	5.8	500	2.2	4250	18.9	4500	20.0
3 × 0.089	0.189	3 × 2.25	4.8	475	2.1	4038	18.0	4275	19.0
3 × 0.095	0.205	3 × 2.40	5.2	525	2.3	4463	20.0	4725	21.0
3 × 0.114	0.244	3 × 2.90	6.2	775	3.5	6588	29.3	6975	31.0
3 × 0.118	0.256	3 × 3.00	6.5	825	3.7	7013	32.2	7425	33.0
3 × 0.138	0.295	3 × 3.50	7.5	1250	5.0	9563	42.5	10 125	45.0
3 × 0.158	0.340	3 × 4.00	8.5	1450	6.5	12 325	54.8	13 050	41.7
GRADE 270 (1860 MPa)									
2 × 0.114	0.228	2 × 2.90	5.8	540	2.4	4590	20.4	4860	21.6
3 × 0.089	0.189	3 × 2.25	4.8	513	2.3	4360	19.4	4617	20.5
3 × 0.095	0.205	3 × 2.40	5.2	567	2.5	4820	21.4	5103	22.7
3 × 0.114	0.244	3 × 2.90	6.2	837	3.7	7115	31.6	7533	33.5
3 × 0.118	0.256	3 × 3.00	6.5	891	4.0	7574	33.7	8019	36.0
3 × 0.138	0.295	3 × 3.50	7.5	125	5.4	10 328	45.9	10 125	45.0
3 × 0.158	0.340	3 × 4.00	8.6	566	7.0	13 311	59.2	14 094	62.7

**TABLE 2 Yield Strength Requirements**

Description and Nominal Diameter of Strand				Minimum Load at 1 % Extension					
in.		[mm]		Initial Load		Stress-Relieved (Normal-Relaxation)		Low-Relaxation	
Description	Nominal Diameter	Description	Nominal Diameter	lbf	[kN]	lbf	[kN]	lbf	[kN]
GRADE 250 [1725 MPa]									
2 × 0.114	0.228	[2 × 2.90]	[5.8]	500	[2.2]	4250	[18.9]	4500	[20.0]
3 × 0.089	0.189	[3 × 2.25]	[4.8]	475	[2.1]	4038	[18.0]	4275	[19.0]
3 × 0.095	0.205	[3 × 2.40]	[5.2]	525	[2.3]	4463	[20.0]	4725	[21.0]
3 × 0.114	0.244	[3 × 2.90]	[6.2]	775	[3.5]	6588	[29.3]	6975	[31.0]
3 × 0.118	0.256	[3 × 3.00]	[6.5]	825	[3.7]	7013	[32.2]	7425	[33.0]
3 × 0.138	0.295	[3 × 3.50]	[7.5]	1250	[5.0]	9563	[42.5]	10 125	[45.0]
3 × 0.158	0.340	[3 × 4.00]	[8.5]	1450	[6.5]	12 325	[54.8]	13 050	[41.7]
GRADE 270 [1860 MPa]									
2 × 0.114	0.228	[2 × 2.90]	[5.8]	540	[2.4]	4590	[20.4]	4860	[21.6]
3 × 0.089	0.189	[3 × 2.25]	[4.8]	513	[2.3]	4360	[19.4]	4617	[20.5]
3 × 0.095	0.205	[3 × 2.40]	[5.2]	567	[2.5]	4820	[21.4]	5103	[22.7]
3 × 0.114	0.244	[3 × 2.90]	[6.2]	837	[3.7]	7115	[31.6]	7533	[33.5]
3 × 0.118	0.256	[3 × 3.00]	[6.5]	891	[4.0]	7574	[33.7]	8019	[36.0]
3 × 0.138	0.295	[3 × 3.50]	[7.5]	125	[5.4]	10 328	[45.9]	10 125	[45.0]
3 × 0.158	0.340	[3 × 4.00]	[8.6]	566	[7.0]	13 311	[59.2]	14 094	[62.7]