Designation: A779/A779M – 16

Standard Specification for Steel Strand, Seven-Wire, Uncoated, Compacted for Prestressed Concrete[1]

This standard is issued under the fixed designation A779/A779M; 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 two types and three grades of compacted, seven-wire, uncoated strand for use in prestressed concrete construction. The two types of strand are low-relaxation and stress-relieved (normal-relaxation). The three grades are 245 [1700], 260 [1800] and 270 [1860].

1.2 This specification is applicable for orders in either inch-pound units (as Specification A779) or in SI units (as Specification A779M).

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

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

A994 Guide for Editorial Procedures and Form of Product Specifications for Steel, Stainless Steel, and Related Alloys

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

2.2 *U.S. Military Standard*[3]

MIL-STD-129 Marking for Shipment and Storage

2.3 *U.S. Federal Standard*[3]

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

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *compacted strand*—strand that has been compacted by drawing through a die or a similar compacting process and subsequently stress-relieved prior to winding into reels or reelless packs.

3.1.2 *lot*—all of the compacted strand of the same grade in the reels or reelless packs produced on the same production equipment and submitted for inspection at the same time.

3.1.3 *strand*—a group of wires having a center wire enclosed tightly by six helically placed outer wires with a uniform pitch of not less than 14 and not more than 18 times the nominal diameter of the strand.

4. Classification

4.1 *Grade 245 [1700]*—Nominal diameter of 0.7 in. [18.0 mm] with tensile strength of 247 ksi [1705 MPa] based on nominal area of the strand.

4.2 *Grade 260 [1800]*—Nominal diameter of 0.6 in. [15.2 mm] with tensile strength of 263 ksi [1815 MPa] based on nominal area of the strand.

4.3 *Grade 270 [1860]*—Nominal diameter of 0.5 in. [12.7 mm] with tensile strength of 270 ksi [1860 MPa] based on nominal area of the strand.

5. Ordering Information

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

5.1.1 Quantity (feet [metres]),

5.1.2 Type of strand (low-relaxation or stress-relieved (normal-relaxation)),

5.1.3 Grade and nominal diameter of strand (Section 4),

5.1.4 Load-elongation curve, if desired (12.2.1),

5.1.5 Outside inspection, if required (Section 13),

5.1.6 Packaging (16.1), and

5.1.7 ASTM designation and date of issue.

[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 Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://dodssp.daps.dla.mil.

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

TABLE 1 Breaking Strength Requirements

Nominal Diameter of Strand		Specified Minimum Breaking Strength of Strand, lbf [kN]	Nominal Steel Area of Strand		Nominal Mass (Weight) of Strands lb/1000 ft [kg/1000 m]
in.	[mm]		in.^{2}	[mm^2]	
		Grade 270 [1860]			
0.5	[12.7]	47 000 [209]	0.174	[112]	600 [890]
		Grade 260 [1800]			
(0.6	[15.2]	67 440 [300]	0.256	[165]	873 [1295]
		Grade 245 [1700]			
0.7	[18.0]	85 430 [380]	0.346	[223]	1176 [1750]

6. Materials and Manufacture

6.1 The steel shall be of such quality that, when processed, the finished wire shall be free of detrimental flaws and undue segregation.

6.2 Wire from which the strand is to be fabricated shall be in the cold-drawn condition and have a common dry-drawn finish.

6.3 After stranding and compacting, all low-relaxation strand shall be subjected to a continuous 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.

7. Chemical Requirements

7.1 The chemical analysis of each heat shall be determined in accordance with Test Methods, Practices, and Terminology A751.

7.2 Variations in production processes and equipment necessitate the individual selection of an appropriate chemical composition at the discretion of the manufacturer.

7.3 Phosphorus and sulfur values shall not exceed the following:

Phosphorus 0.040 % max
Sulfur 0.050 % max

8. Mechanical Property Requirements

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

8.2 *Breaking Strength*—The breaking strength of the finished strand shall conform to the values specified in Table 1.

8.3 *Yield Strength*—Yield strength in pounds [kN] shall be measured at 1 % extension under load. The minimum load at 1 % extension shall conform to the specified values shown in Table 2. Initial loads are listed in Table 2.

8.3.1 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.

8.4 *Elongation*—The total elongation of the strand under maximum load shall not be less than 3.5 % using a gage length of not less than 24 in. [600 mm]. It shall be permissible to determine the total elongation value by adding, to the 1.0 % 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.

8.5 *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 after 1000 hours of testing.

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

9. Dimensions and Permissible Variations

9.1 The size of the finished strand shall be expressed as the nominal diameter of the strand in inches [millimetres].

9.2 Prior to compacting, the diameter of the center wire of any strand shall be larger than the diameter of any outer wire by a minimum of 2 %.

9.3 After compacting, the strand shall conform to a size tolerance of plus 0.016 in. [0.4 mm] or minus 0.008 in. [0.2 mm] from the nominal diameter when measured across the crowns of the wire.

10. Workmanship

10.1 *Joints:*

10.1.1 There shall be no strand joints or strand splices in any length of the completed strand.

10.1.2 During the process of manufacture of individual wires for stranding, welding shall be permitted only prior to the start of wire drawing.

10.2 The finished compacted strand shall be uniform in diameter and shall be free of imperfections.

10.3 When the strand is cut without seizings, the wires shall not fly out of position. If a wire or wires flies out of position and can be replaced by hand, the strand will be considered satisfactory.

10.4 The strand shall not be oiled or greased. Slight rusting, provided it is not sufficient to cause pits visible to a person with normal or corrected vision, shall not be cause for rejection.

10.5 Curvature of the finished compact strand shall be not more than 3 in. [75 mm] in a length of 3 ft [1 m] when lying on a flat surface.

11. Sampling

11.1 Test specimens cut from either end of reels or reelless packs are permitted.

TABLE 2 Yield Strength Requirements

Nominal Strand Diameter		Initial Load, lbf [kN]	Specified Minimum Load at 1 % Extension, lbf [kN]	
in.	[mm]		Normal-Relaxation	Low-Relaxation
			Grade 270 [1860]	
0.5	[12.7]	4700 [20.9]	40 900 [182]	42 300 [188]
			Grade 260 [1800]	
0.6	[15.2]	6740 [30.0]	58 700 [261]	60 700 [270]
			Grade 245 [1700]	
0.7	[18.0]	8540 [38.0]	74 300 [330]	76 900 [342]

12. Number of Tests

12.1 One test specimen shall be taken from each 30-ton [27-tonne] production lot of finished strand, and tested for breaking strength, yield strength, and elongation.

12.2 Typical load-elongation curves, based on accumulated data, shall be delivered to the purchaser on each lot shipped.

12.2.1 When specified in the purchase order or contract, a load-elongation curve shall be made from one test specimen representing the lot.

13. Inspection

13.1 If outside inspection is required, the manufacturer shall afford the inspector representing the purchaser reasonable access to the facilities, which concern the manufacture of the material ordered, to satisfy the inspector that the material being furnished is in accordance with this specification. All tests and inspections shall be made at the place of manufacture prior to shipment, and shall be so conducted as not to interfere unnecessarily with the manufacturer's operations.

14. Rejection

14.1 Failure of any test specimen to comply with the requirements of the specification shall constitute grounds for rejection of the lot represented by the specimen.

14.2 The lot shall be resubmitted for inspection by testing a specimen from each reel or reelless pack and sorting out non-conforming material.

14.3 If there is a reasonable doubt in the initial testing as to the ability of the strand to meet any requirement of this specification, two additional tests shall be made on specimens of strand from the same reel or reelless pack, and if failure occurs in either of these tests, the strand shall be rejected.

15. Certification

15.1 If outside inspection is not required, a manufacturer's certification that the material has been tested in accordance with, and meets the requirements of this specification, shall be the basis of acceptance of the material. The certification shall include the specification number, year-date of issue, and revision letter, if any.

15.2 A material test report, certificate of inspection, or similar document printed from or used in electronic form from an electronic data interchange (EDI) transmission shall be regarded as having the same validity as a counterpart printed in the certifier's facility. The content of the EDI transmitted document shall meet the requirements of the invoked ASTM standard(s) and conform to any existing EDI agreement between the purchaser and the manufacturer. Notwithstanding the absence of a signature, the organization submitting the EDI transmission is responsible for the content of the report.

NOTE 1—The industry definition as invoked here is: EDI is the computer-to-computer exchange of business information in a standard format such as ANSI ASC X12.

16. Packaging and Package Marking

16.1 The strand shall be furnished on reels or in reelless packs having a minimum inside diameter of 36 in. [910 mm]. The length of strand on reels or reelless packs shall be as agreed upon at time of purchase. The strand shall be well protected from mechanical damage during shipment. Each reel or reelless pack shall have two durable tags securely fastened to it showing the grade, length, type (low-relaxation or stress-relieved (normal-relaxation)), lot number, ASTM A779/A779M, and the name of the manufacturer. One tag shall be positioned where it will not be inadvertently lost during transit, such as the core of a reelless pack. The other tag shall be placed on the outside for easy identification. Special packaging, protection, or tagging shall be agreed upon between the purchaser and manufacturer at the time of purchase.

16.2 When specified in the contract or purchase order, and for direct procurement by or direct shipment to the U.S. government, marking for shipment, in addition to requirements specified in the contract or purchase order, shall be in accordance with Fed. Std. No. 123 for civil agencies and MIL-STD-129 for military agencies.

17. Keywords

17.1 compacted strand (tendon); prestressed concrete; steel wire

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A779/A779M – 12) that may impact the use of this standard. (Approved Sept. 1, 2016.)

(1) Revised 12.1.