Designation: A 821/A 821M – 05

Standard Specification for Steel Wire, Hard Drawn for Prestressing Concrete Tanks[1]

This standard is issued under the fixed designation A 821/A 821M; 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 uncoated, high-strength, hard-drawn steel wire for use in the manufacture of prestressed concrete tanks and similar structures. In application, the wire is continuously wrapped on the structure maintaining tension by a device employing a wire drawing die, or mechanical tensioning system without redrawing.

1.2 This specification is applicable only to the condition of the wire as delivered to the user. It is not applicable to the properties or condition of the wire after application.

1.2.1 Type A wire is to be tensioned by drawing through a wire drawing die or by a mechanical system without redrawing.

1.2.2 Type B wire is drawn to finished size by the manufacturer for tensioning by a mechanical system without redrawing.

NOTE 1—Type A wire, when tensioned by drawing through a die, may not function properly if the user does not ensure that during application the surface of the wire is free of rust and foreign materials that can be detrimental to good wire drawing practice. Further, the user should ensure that proper wire drawing techniques are followed, including adequate lubrication, cooling, and proper die mechanics.

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

2. Referenced Documents

2.1 *ASTM Standards:* [2]

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

A 510 Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

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

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

3. Ordering Information

3.1 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:

3.1.1 Quantity (weight),

3.1.2 Name of material (hard-drawn steel wire for prestressing concrete tanks, Type A or B),

3.1.3 Wire diameter (see Section 7),

3.1.4 Marking (see Section 13),

3.1.5 Certification, if required (see 12.1), and

3.1.6 ASTM designation and year of issue.

NOTE 2—A typical ordering description is as follows: 100 000 kg, Hard-Drawn Steel Wire for Prestressed Concrete Tanks Type A or B, 4.9 mm in diameter, 680 kg coils for shipment on returnable coil carriers, shrouded, conforming to ASTM A 821/A 821M-XX [220 000 lb, Hard-Drawn Steel Wire for Prestressed Concrete Tanks Type A or B, 0.192 in. in diameter, 1500 lb, coils for shipment on returnable coil carriers, shrouded, conforming to ASTM A 821/A 821M-XX].

3.2 Prelubrication, if required, shall be specified by the purchaser.

4. Manufacture

4.1 The steel shall be made by the open-hearth, basic-oxygen or electric-furnace process.

4.2 The steel should be of such quality, that the finished wire shall be free of detrimental pipe and undue segregation.

4.3 The wire shall be cold-drawn to produce the desired mechanical properties.

4.4 There shall be no welds or joints in the finished wire. Welds or joints made during drawing to promote continuity of operations shall be removed.

[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.

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

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5. Chemical Requirements

5.1 The steel shall conform to the chemical composition requirements specified in Table 1.

5.2 *Cast or Heat Analysis*—Each cast or heat of steel shall be analyzed by the manufacturer. This analysis shall be made from a test specimen preferably taken during the pouring of the cast or heat; when requested, this analysis shall be reported to the purchaser.

5.3 *Product Analysis*—The purchaser shall have the right to make an analysis from the finished wire representing each cast or heat of steel. The chemical composition thus obtained shall conform to the product analysis requirements specified in Specification A 510 for the elements required or restricted.

5.4 Methods, Practices, and Definitions A 751 shall be used for chemical analysis.

6. Mechanical Requirements

6.1 *Tensile Strength Test*—Type A material as represented by the test specimens shall conform to the requirements prescribed in Table 2. Type B material as represented by the test specimens shall conform to the requirements in Table 3.

6.2 *Wrap Test*—The material as represented by the wrap test specimens shall conform to the requirements specified in Table 4.

6.3 The tensile strength test and wrap test shall be made in accordance with Methods and Definitions A 370.

6.4 *Torsion Test*—Torsion requirements shall conform to those prescribed in Table 5 for Type A and Type B.

7. Permissible Variations in Diameter

7.1 The wire shall be specified as any diameter from 4.1 to 6.0 mm (0.162 to 0.235 in.), inclusive.

7.2 The diameter of the wire shall not vary from that specified by more than the tolerances shown in Table 6.

8. Workmanship, Finish, and Appearance

8.1 The surface of the wire, as received, shall be smooth and generally free of rust. A light oxidation film that does not cause pitting of the wire surface visible to the unaided eye after wiping or light cleaning, shall not be cause for rejection. The microstructure of Type A wire shall be suitable for further reasonable reduction of cross-sectional area during application. Coils of wire with visible pitting shall be rejected.

8.2 The wire shall not have piping, cross checking, torn surfaces, chatter marks, splits, die marks, scratches, pits, or seams that are detrimental to its application.

8.3 The wire shall not be kinked, improperly cast, or show a wavy condition.

8.4 Each coil shall be one continuous length of wire, properly coiled.

TABLE 1 Chemical Requirements

Element	Composition, %
Carbon	0.50 to 0.85
Manganese	0.60 to 1.10
Phosphorus, max	0.040
Sulfur, max	0.050
Silicon	0.10 to 0.35

TABLE 2 Tensile Requirements (Type A)[A]

Diameter, mm (in.)	Tensile Strength, MPa (ksi)	
	Min	Max
4.1 (0.162)	1500 (218)	1780 (258)
4.5 (0.177)	1470 (213)	1740 (253)
4.9 (0.192)	1450 (210)	1720 (250)
5.3 (0.207)	1430 (208)	1710 (248)
5.7 (0.225)	1410 (204)	1680 (244)
6.0 (0.235)	1390 (202)	1670 (242)

[A]Tensile strength values for intermediate diameters may be interpolated.

TABLE 3 Tensile Requirements (Type B)

Decimal Size		Minimum Tensile Strength		Maximum Tensile Strength	
mm	(in.)	MPa	(ksi)	MPa	(ksi)
4.1	0.162	1590	231	1810	262
4.9	0.192	1530	222	1740	252
6.4	0.250	1450	211	1450	241

TABLE 4 Wrap Test Requirements

Diameter, mm (in.)	Mandrel Size
4.1 to 6.0 (0.162 to 0.235), incl	$2X^A$

[A]*X* is specified wire diameter.

TABLE 5 Torsion Requirements

Diameter, mm (in.)	Number of Turns in 203 mm (8 in.)
4.1 (0.162)	9
4.5 (0.177)	8
4.9 (0.192)	7
5.3 (0.207)	6
5.7 (0.225)	5
6.0 (0.235)	5
6.4 (0.250)	4

TABLE 6 Permissible Variations in Wire Diameter

NOTE 1—For purposes of determining conformance with this specification, all specified limits are absolute as defined in Practice E 29.

Diameter, mm (in.)	Permissible Variations, ± mm (in.)	Permissible Out-of-Round, mm (in.)
4.1 to 6.0 (0.162 to 0.235)	0.05 (0.002)	0.05 (0.002)

8.5 The wire shall not be oiled or greased.

9. Sampling and Number of Tests

9.1 A lot shall consist of all the coils of wire of the same size and class and offered for inspection of one time.

9.2 One test specimen shall be taken for each ten coils, or fraction thereof, in a lot. Each heat in a given lot shall be tested.

9.3 Test specimens cut from either end of the coil are permitted.

9.4 Any test specimen showing the presence of an obvious defect, shall be discarded and another specimen substituted.

9.5 Test specimens shall be tested for tensile strength (6.1), wrap test (6.2), and torsion test (6.4).

10. Inspection

10.1 Unless otherwise specified in the contract or purchase order, the manufacturer shall be responsible for the performance of all inspection and test requirements specified in this

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specification. Except as otherwise specified in the contract or purchase order, the manufacturer shall be permitted to use one's own or any other suitable facilities for the performance of the inspection and test requirements unless disapproved by the purchaser at the time the order is placed. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification when such inspections and tests are deemed necessary to assure that the material conforms to prescribed requirements.

11. Rejection and Rehearing

11.1 Material that fails to conform to the requirements of this specification shall be subject to rejection. Rejections shall be reported to the manufacturer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the manufacturer or supplier shall have the right to make claim for a rehearing.

11.2 The material shall be adequately protected and correctly identified so that the producer or supplier can make a proper investigation.

12. Certification

12.1 When specified in the purchase order or contract, a producer's or supplier's certification shall be furnished to the purchaser that the material was manufactured, tested, and inspected in accordance with this specification and has been found to meet the requirements. The certification shall include the specification number, year/date of issue and revision letter, if any.

12.2 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 must meet the requirements of the invoked ASTM standard(s) and conform to any existing EDI agreement between the purchaser and the supplier. Notwithstanding the absence of a signature, the organization submitting the EDI transmission is responsible for the content of the report.

NOTE 3—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.

13. Marking

13.1 The size of the wire, purchase order number, ASTM specification designation, cast or heat number, and name or make of the manufacturer shall be marked on a weather-resistant tag securely attached to each coil of wire.

14. Packaging

14.1 When specified in the purchase order, packaging shall be in accordance with the procedures in Practices A 700.

15. Keywords

15.1 prestressed concrete; steel wire

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A 821/A 821M – 99) that may impact the use of this standard.

(1) Revised sections 3.1, 5.1, 5.3, 7.1, 9.3, 9.4, 10.1, 11.1, and 11.2.

(2) Added section 12.2 and Note 3.

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