



Designation: A821/A821M – 10

Standard Specification for Steel Wire, Hard-Drawn for Prestressed Concrete Tanks¹

This standard is issued under the fixed designation A821/A821M; 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 construction of prestressed concrete tanks and similar structures. In application, the wire is continuously wrapped on the structure maintaining tension by a device using a wire drawing die, or mechanical tensioning system without re-drawing.

1.2 This specification is applicable only to the condition of the wire as delivered to the purchaser. 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 re-drawing.

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

NOTE 1—Type A wire, when tensioned by drawing through a die, may not function properly if the purchaser 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 purchaser should ensure that proper wire drawing techniques are followed, including adequate lubrication, cooling, and proper die mechanics.

1.3 This specification is applicable for orders in either inch-pounds units (as Specification A821) or in SI units (as Specification A821M).

1.4 The values stated in either inch-pound units or SI units are to be regarded separately 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 standard.

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. Referenced Documents

2.1 *ASTM Standards*:²

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A510 Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

A700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Shipment

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

E29 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) [mass],

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

3.1.3 Wire diameter,

3.1.4 Certification, if required (12.1),

3.1.5 Marking (13.1),

3.1.6 Packaging (14.1), and

3.1.7 ASTM designation and year of issue.

3.2 Pre-lubrication, if required, shall be specified by the purchaser.

4. Manufacture

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

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

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.



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

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

5. Chemical Composition Requirements

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

5.2 *Heat Analysis*—Each 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 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 heat of steel. The chemical composition thus obtained shall conform to the product analysis requirements specified in Specification **A510** for the elements required or restricted.

5.4 Test Methods, Practices, and Terminology **A751** shall be used for chemical analysis.

6. Mechanical Property Requirements

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

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

6.3 The tensile strength test and wrap test shall be made in accordance with Test Methods and Definitions **A370**, Annex A4.

6.4 *Torsion Test*—Torsion requirements shall conform to those prescribed in **Table 5** for Type A wire and Type B wire. The test shall be completed within 15 to 30 seconds, and length change shall be unrestrained.

7. Permissible Variations in Diameter

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

7.2 For purposes of determining conformance with this specification, all specified limits are absolute as defined in Practice **E29**.

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

TABLE 1 Chemical Composition 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, in. [mm]	Tensile Strength, ksi [MPa]	
	Min	Max
0.162 [4.1]	218 [1500]	258 [1780]
0.177 [4.5]	213 [1470]	253 [1740]
0.192 [4.9]	210 [1450]	250 [1720]
0.207 [5.3]	208 [1430]	248 [1710]
0.225 [5.7]	204 [1410]	244 [1680]
0.235 [6.0]	202 [1390]	242 [1670]

^A Tensile strength values for intermediate diameters may be interpolated.

TABLE 3 Tensile Requirements (Type B)

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

TABLE 4 Wrap-Test Requirements

Diameter, in. [mm]	Mandrel Size
0.162 to 0.250 [4.1 to 6.4], incl	2X ^A

^A X is specified wire diameter.

TABLE 5 Torsion Requirements

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

TABLE 6 Permissible Variations in Wire Diameter

Diameter, in. [mm]	Permissible Variations, ±in. [mm]	Permissible Out-of-Round, in. [mm]
0.162 to 0.250 [4.1 to 6.4]	0.002 [0.05]	0.002 [0.05]

pitting of the wire surface visible to a person with normal or corrected vision after wiping or light cleaning, shall not be cause for rejection. 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.

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 at one time.