Designation: ~~A821/A821M – 15~~ A821/A821M – 21

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

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~~diameter 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 The text of this ~~standard~~specification references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in ~~tables and figures)~~ tables) shall not be considered as requirements of the ~~standard.~~specification.

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

1.5 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.~~specification.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

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

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

~~A510~~A510/A510M Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon ~~Steel (Metric) A0510 A0510M~~ Steel, and Alloy Steel

~~A700 Guide for Packaging, Marking, and Loading Methods for Steel Products for Shipment~~

A938 Test Method for Torsion Testing of Wire

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.2 *Military Standard:*[3]

MIL-STD-129 Military Marking for Shipment and Storage

2.3 *Federal Standard:*[3]

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

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:~~Orders for hard-drawn steel wire under this specification shall contain the following information:

3.1.1 Quantity ~~(weight) [mass],~~ (lb [kg]),

3.1.2 Wire diameter (inches [millimetres]),

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

~~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~~

3.1.4 ASTM designation A821 [A821M] and year of issue.

3.2 ~~Pre-lubrication, if required, shall be specified by the purchaser (see~~The purchaser shall have the option to ~~Note 2).~~ specify additional requirements, including but not limited to, the following:

~~NOTE 2—Pre-lubrication refers to the intentional addition or residue of solid lubricant on the wire surface prior to shipment to facilitate redrawing for Type A wire. Pre-lubrication is not used in Type B wire.~~

3.2.1 Special wire diameters (7.2)

3.2.2 Pre-lubrication of Type A wire (8.6)

3.2.3 Number of tests (9.2.1)

3.2.4 Requirements for inspection (10.1),

3.2.5 Certification (12.1),

3.2.6 Packaging, package marking and loading for shipment (Section 14), and

[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~~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, Washington, DC 20401-0001, http://www.access.gpo.gov.

3.2.7 Other special requirements, if any.

4. Manufacture

4.1 The steel may be made by any commercially accepted steel-making process. The steel may be either ingot cast or strand cast.

4.2 The steel shall 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 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 An analysis of each heat of steel shall be furnished by the manufacturer showing the percentages of all the elements specified in Table 1. The wire shall be subject to permissible variation for product analysis specified in Specification ~~A510~~A510/A510M, Table 7.

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 conducted according to Test Method A938.

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 If wire diameters other than those specified in Table 2, Table 3, and Table 5 are ordered, tensile strength values and torsion values may be interpolated.

7.3 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,~~ received by the purchaser, shall be smooth and generally free of rust (see Note ~~3~~2). A light oxidation film that does not cause pitting of the wire surface visible to a person with normal or corrected vision after wiping

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)

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]

TABLE 3 Tensile Requirements (Type B)

Diameter, in. [mm]	Minimum Tensile Strength, ksi [MPa]	
	Min	Max
~~Decimal Size, in. [mm]~~	~~Minimum Tensile Strength, ksi [MPa]~~	
	~~Min~~	~~Max~~
0.162 [4.1]	231 [1590]	262 [1810]
0.192 [4.9]	222 [1530]	252 [1740]
0.250 [6.4]	211 [1450]	241 [1660]

TABLE 4 Wrap-Test Requirements

Diameter, in. [mm]	Mandrel ~~Size~~Diameter
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]	Minimum Number of Turns to Failure in 8 in. [200 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]

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.

NOTE 2—The wire should be protected to help mitigate the formation of oxidation on the surface of the wire during storage and transportation.

8.6 Pre-lubrication, if required, for Type A wire, shall be specified by the purchaser.