



Designation: A1114/A1114M – 20

Standard Specification for Low-Relaxation, Seven-Wire, Grade 240 [1655], Stainless Steel Strand for Prestressed Concrete¹

This standard is issued under the fixed designation A1114/A1114M; 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 low-relaxation, seven-wire, Grade 240 [1655], stainless steel strand for use in prestressed concrete construction. Grade 240 [1655] has a minimum tensile strength of 240 ksi [1655 MPa] based on the nominal area of the strand.

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

1.3 This specification is applicable for orders in either inch-pound units (as Specification A1114) or in SI units (as Specification A1114M).

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with this specification, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

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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2. Referenced Documents

2.1 *ASTM Standards:*²

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

A416/A416M Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete

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 Specification:*

3.1.1 *lay length, n*—the axial distance required to make one complete revolution of any outer wire of a strand.

3.1.2 *strand, n*—a group of wires having a center wire enclosed tightly by six helically placed outer wires.

3.1.2.1 *Discussion*—The direction of lay is either right-handed or left-handed.

3.1.3 *strand splice, n*—a production connection between two separate lengths of strand that is not intended to resist prestressing forces.

3.1.4 *wire weld, n*—a resistance butt-weld joining two separate lengths of wire after wire drawing and before the wire is formed into strand.

4. Ordering Information

4.1 Orders for low-relaxation, seven-wire, Grade 240 [1655], stainless steel strand under this specification shall contain the following information:

4.1.1 Quantity (feet [metres]),

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 DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, <http://quicksearch.dla.mil>.

TABLE 1 Breaking Strength Requirements

Nominal Diameter of Strand, in. [mm]	Minimum Breaking Strength of Strand, lbf [kN]	Steel Area of Strand, in. ² [mm ²]	Weight [Mass] of Strand, lb/1000 ft [kg/1000 m]
Grade 240 [1655]			
0.520 [13.2]	40 100 [179]	0.167 [108]	570 [840]
0.620 [15.7]	55 400 [248]	0.231 [150]	780 [1 200]

TABLE 2 Yield Strength Requirements

Nominal Diameter of Strand, in. [mm]	Initial Load, lbf [kN]	Minimum Load at 1.0 % Extension, lbf [kN]
Grade 240 [1655]		
0.520 [13.2]	4 010 [17.9]	36 100 [161.1]
0.620 [15.7]	5 540 [24.8]	49 860 [223.2]

TABLE 3 Diameter Relation Between Center and Outer Wires

Nominal Diameter of Strand, in. [mm]	Minimum Difference Between Center Wire Diameter and Diameter of Any Outer Wire, in. [mm]
Grade 240 [1655]	
0.520 [13.2]	0.003 [0.076]
0.620 [15.7]	0.004 [0.102]

4.1.2 Nominal diameter of strand (inches [millimetres]),

4.1.3 ASTM designation A1114 [A1114M] and year of issue.

4.2 The purchaser shall have the option to specify additional requirements, including but not limited to, the following:

4.2.1 Relaxation evidence for similarly dimensioned Grade 240 [1655] strand (6.5.1),

4.2.2 If specially dimensioned strand is permitted (7.5),

4.2.3 If strand splices are permitted (8.1.1)

4.2.4 Weldless strand (8.2.2),

4.2.5 Requirements for inspection (11.1),

4.2.6 Load-elongation curve (13.2),

4.2.7 Packaging and package marking (Section 14), and

4.2.8 Other special requirements, if any.

5. Materials and Manufacture

5.1 *Base Metal*—The base metal shall be duplex alloy 2205 (UNS S32205) stainless steel of such quality that when drawn to wire, fabricated into strand, and then thermally and mechanically treated, 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.

NOTE 1—This product is a composite of seven wires and is manufactured to meet the prescribed mechanical properties. It is possible that wire from more than one heat of steel may be used in the manufacture of a reel or reelless pack. Traceability is based on identity of reels or reelless packs as maintained and reported by the manufacturer.

5.3 *Treatment*—After stranding, strand shall be subjected to a continuous thermal-mechanical treatment to produce the prescribed mechanical properties. Temper colors which result

from the thermal-mechanical treatment are considered normal for the finished appearance of this strand.

6. Mechanical Property Requirements

6.1 Tests for mechanical properties shall be conducted in accordance with 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 pounds [kN] shall be measured at 1.0 % extension under load. The minimum yield strength shall be 90 % 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 not be less than 1.4 % 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. (**Warning**—The total elongation of this material is significantly less than a similar material; see Specification A416/A416M. As a result, special care and attention is needed when designing structural members. Also, appropriate safety precautions should be considered when stressing.)

6.5 *Relaxation Properties*—Strand shall have relaxation losses of not more than 2.5 % when initially loaded to 70 % of specified minimum breaking strength or not more than 3.5 % when loaded to 80 % of specified minimum breaking strength of the strand after 1000 hours of testing.

6.5.1 If required, relaxation evidence shall be provided from the manufacturer's records of tests on similarly dimensioned Grade 240 [1655] strand.

7. Dimensions and Permissible Variations

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

7.2 The diameter of the center wire of any strand shall be larger than the diameter of any outer wire in accordance with Table 3.

7.3 Lay length shall be between 12 and 16 times the nominal diameter of the strand.

7.4 Permissible Variations in Diameter:

7.4.1 The strand shall conform to a size tolerance of ± 0.016 in. [± 0.40 mm] from the nominal diameter measured across the crowns of the wires.

7.4.2 Variation in cross-sectional area and in unit stresses resulting therefrom shall not be cause for rejection provided that the diameter differences of the individual wires and the diameters of the strand are within the tolerances specified.

7.5 If requested by the purchaser, specially dimensioned strands with nominal diameters up to 0.750 in. [19 mm] can be