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Standard Specification for High-Strength Steel Bars for Prestressed Concrete[1]

This standard is issued under the fixed designation A722/A722M; 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 Type I and Type II high-strength steel bars intended for use in prestressed concrete construction or in prestressed ground anchors. Type I bars have a plain surface. Type II bars have surface deformations. Bars are of a minimum tensile strength level of 150 000 psi [1035 MPa].

1.2 A supplementary requirement (S1) is provided for use where bend tests of bars are required by the purchaser. The supplementary requirement applies only when specified in the purchase order.

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

1.4 This specification is applicable for orders in either inch-pound units (as Specification A722) or in SI units (as Specification A722M).

1.5 The values stated in either inch-pound 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 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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]
A370 Test Methods and Definitions for Mechanical Testing of Steel Products
A700 Guide for Packaging, Marking, and Loading Methods for Steel Products for Shipment
A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products
2.2 *Military Standard:*[3]
MIL-STD-129 Marking for Shipment and Storage
2.3 *U.S. Federal Standard:*[3]
Fed. Std. 123 Marking for Shipment (Civil Agencies)

3. Ordering Information

3.1 Orders for high-strength steel bars under this specification shall contain the following information:
3.1.1 Quantity,
3.1.2 Size and length,
3.1.3 Type I or Type II, and
3.1.4 ASTM designation A722 [A722M] and year-date of issue.

3.2 The purchaser shall have the option to specify additional requirements, including but not limited, to the following:
3.2.1 Report on chemical composition (5.1),

[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://www.dodssp.daps.mil.

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

3.2.2 Special inspection requirements (14.2),
3.2.3 Load-elongation curve (16.2),
3.2.4 Special preparation for delivery, if desired (see Section 17), and
3.2.5 Supplementary requirement (S1).

4. Materials and Manufacture

4.1 The bars shall be rolled from properly identified heats of mold-cast or strand-cast steel. The standard sizes and dimensions of Type I and II bars shall be those listed in Table 1 and Table 2, respectively.

4.2 The bars shall be subjected to cold-stressing to not less than 80 % of the minimum tensile strength, and then shall be stress-relieved, to produce the prescribed tensile properties.

5. Chemical Composition

5.1 A chemical analysis of each heat of steel shall be determined in accordance with Test Methods, Practices, and Terminology A751. The manufacturer shall make the analysis on test samples taken during the pouring of the heat. When requested in the purchase order or contract, the chemical composition determined shall be reported to the purchaser.

5.1.1 Choice and use of chemical composition and alloying elements, to produce the tensile properties of the bars prescribed in Section 6, shall be made by the manufacturer, subject to the limitations in 5.1.2.

5.1.2 On heat analysis, phosphorus and sulfur shall not exceed the following:

Phosphorus	0.040 %
Sulfur	0.050 %

5.2 A product analysis may be made by the purchaser from the bar representing each heat of steel. The phosphorus and sulfur contents thus determined shall not exceed the limits specified in 5.1.2 by 0.008 %.

6. Tensile Requirements

6.1 Tension tests shall be conducted in accordance with Test Methods and Definitions A370.

6.2 Bars shall have a minimum tensile strength of 150 000 psi [1035 MPa].

6.3 The minimum yield strength of Type I and Type II bars shall be 85 % and 80 %, respectively, of the minimum tensile strength of the bars. The yield strength shall be determined by either of the methods described in Test Methods and Definitions A370; however, in the extension under load method, the total strain shall be 0.7 %, and in the offset method the offset shall be 0.2 %.

6.4 The minimum elongation after rupture shall be 4.0 % in a gage length equal to 20 bar diameters, or 7.0 % in a gage length equal to 10 bar diameters.

~~6.5 The minimum reduction of area from the nominal area shall be 20 % for Type I plain bars.~~

7. Number of Tests

7.1 The number of tension test specimens shall be one from each 39 tons [36 tonnes] or fraction thereof, of each size of bar rolled from each heat but not less than two tension test specimens from each heat.

7.2 For Type II bars, one set of dimensional property tests including bar weight [mass], and spacing, height and projected area of deformations shall be made of each bar size rolled from each heat.

8. Retests

8.1 If any tensile property of any tension test specimen is less than that specified, and any part of the fracture is outside the middle third of the gage length, as indicated by scribe scratches marked on the test specimen before testing, a retest shall be permitted.

TABLE 1 Nominal Dimensions for Type I (Plain) Bars

Nominal Diameter		Nominal Weight (Mass)		Nominal Area[A]	
in.	mm	lb/ft	kg/m	$in.^2$	mm^2
¾	19	1.50	2.23	0.44	284
⅞	22	2.04	3.04	0.60	387
1	25	2.67	3.97	0.78	503
1⅛	29	3.38	5.03	0.99	639
1¼	32	4.17	6.21	1.23	794
1⅜	35	5.05	7.52	1.48	955

[A] Nominal area is determined from the nominal diameter in inches [millimetres].

TABLE 2 Nominal Dimensions for Type II (Deformed) Bars

Nominal Diameter[A]		Nominal Weight (Mass)		Nominal Area[B]	
in.	mm	lb/ft	kg/m	in.^{2}	mm^2
⅝	15	0.98	1.46	0.28	181
¾	20	1.49	2.22	0.42	271
1	26	3.01	4.48	0.85	548
1¼	32	4.39	6.54	1.25	806
1⅜	36	5.56	8.28	1.58	1019
1¾	46	9.10	13.54	2.58	1664
2½	65	18.20	27.10	5.16	3331
3	75	24.09	35.85	6.85	4419

[A] Nominal diameters are for identification only.
[B] Nominal area is determined from the bar weight [mass] less 3.50% for the weight [mass] of the deformations.

8.2 If the results of an original tension test specimen fail to meet specified requirements, two additional tests shall be made on specimens from the same heat and bar size, and if failure occurs in either of these tests, the bar size from that heat shall be rejected.

8.3 If any test specimen fails because of mechanical reasons such as failure of testing equipment, it shall be discarded and another specimen taken.

8.4 If any test specimen develops flaws, it shall be discarded and another specimen of the same size bar from the same heat substituted.

9. Test Specimens

9.1 Tension test specimens shall be the full section of the bar as rolled. Machined-reduced section test specimens are not permitted. All unit stress determinations shall be based on the nominal area shown in Table 1 or Table 2.

10. Requirements for Deformations

10.1 Type II bars shall have deformations spaced uniformly along the length of the bar. The deformations on opposite sides of the bar shall be similar in size and shape. The average spacing or distance between deformations on both sides of the bar shall not exceed seven-tenths of the nominal diameter of the bar.

10.2 The minimum height and minimum projected area of the deformations shall conform to the requirements shown in Table 3.

10.3 *Mechanical Coupling*—For those bars having deformations arranged in a manner to permit coupling of the bars with a screw-on type coupler, it shall be the responsibility of the finished-bar manufacturer to demonstrate that a bar cut at any point along its length may be coupled to any other length of bar and that a coupled joint is capable of developing the minimum specified tensile strength of the coupled bars.

11. Measurements of Deformations

11.1 The average spacing of deformations shall be determined by dividing a measured length of the bar specimen by the number of individual deformations and fractional parts of deformations on any one side of the bar specimen. A measured length of the bar specimen shall be considered the distance from a point on a deformation to a corresponding point on any other deformation on the same side of the bar.

TABLE 3 Deformation Dimensions for Type II Bars

Nominal Diameter		Deformation Dimensions					
		Maximum Average Spacing		Minimum Average Height		Minimum Projected Area[A]	
in.	mm	in.	mm	in.	mm	in.^{2}/in.	mm^2/mm
⅝	15	0.44	11.1	0.03	0.7	0.09	2.4
¾	20	0.52	13.3	0.04	1.0	0.13	3.4
1	26	0.70	17.8	0.05	1.3	0.17	4.4
1¼	32	0.89	22.5	0.06	1.6	0.21	5.4
1⅜	36	0.99	25.1	0.07	1.8	0.24	6.1
1¾	46	1.19	30.1	0.09	2.2	0.29	7.3
2½	65	1.75	44.5	0.11	2.9	0.38	9.7
3	75	2.00	50.8	0.13	3.3	0.46	11.7

[A] Calculated from equation, min projected area = $0.75\pi d\ h/s$
where:
d = nominal diameter,
h = minimum average height, and
s = maximum average spacing.