



Standard Specification for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement¹

This standard is issued under the fixed designation A 616/A 616M; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers deformed and plain rail-steel bars concrete-reinforcement. The standard sizes and dimensions of deformed bars and their number designations shall be those listed in **Table 1**.

1.1.1 A supplementary requirement (S1) of an optional nature is provided. It shall apply only when specified by the purchaser.

1.1.2 The text of this specification references notes and footnotes that provide explanatory material. These notes and footnotes, excluding those in tables and figures, shall not be considered as requirements of the specification.

1.2 Bars are of two minimum yield levels: namely, 50 000 psi [350 MPa] and 60 000 psi [420 MPa], designated as Grade 50 [350] and Grade 60 [420], respectively.

1.3 Plain rounds, in sizes up to and including 2 in. [50.8 mm] in diameter, in coils or cut lengths, when specified for dowels, spirals and structural ties or supports shall be furnished under this specification in Grade 50 [350] and Grade 60 [420]. For ductility properties (elongation and bending) test provisions of the nearest smaller nominal diameter deformed bar size shall apply. Requirements providing for deformations and marking shall not be applicable.

1.4 The weldability of the steel is not a requirement of this specification.

1.5 This specification is applicable for orders in either inch-pound units (as Specification A 616) or in SI units [as Specification A 616M].

1.6 The values stated in either inch-pound units or SI units are to be regarded as standard. Within the text, the SI units are shown in brackets. 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:*

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products²

A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment³

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁴

2.2 *Military Standards:*

MIL-STD-129 Marking for Shipment and Storage⁵

MIL-STD-163 Steel Mill Products Preparation for Shipment and Storage⁵

2.3 *Federal Standard:*

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)⁵

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *deformed bar*, *n*—steel bar with protrusions; a bar that is intended for use as reinforcement in reinforced concrete construction.

3.1.2 *Discussion*—The surface of the bar is provided with lugs or protrusions that inhibit longitudinal movement of the bar relative to the concrete surrounding the bar in such construction. The lugs or protrusions conform to the provisions of this specification.

3.1.3 *deformations*, *n*—protrusions on a deformed bar.

3.1.4 *plain bar*, *n*—steel bar without protrusions.

3.1.5 *rib*, *n*—longitudinal protrusion on a deformed bar.

4. Ordering Information

4.1 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:

¹ This specification is under the jurisdiction of ASTM Committee A-1 on Steel, Stainless Steel, and Related Alloys and is the direct responsibility of Subcommittee A01.05 on Steel Reinforcement.

Current edition approved July 10, 1996. Published September 1996. Originally published as A 616 – 68. Last previous edition A 616/A 616M – 96.

² *Annual Book of ASTM Standards*, Vol 01.03.

³ *Annual Book of ASTM Standards*, Vol 01.05.

⁴ *Annual Book of ASTM Standards*, Vol 14.02.

⁵ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

**TABLE 1 Deformed Bar Designation Numbers, Nominal Weights [Masses], Nominal Dimensions, and Deformation Requirements**

Bar Designation No. ^A	Nominal Weight, lb/ft [Nominal Mass, kg/m]	Nominal Dimensions ^B			Deformation Requirements, in. [mm]		
		Diameter, in. [mm]	Cross-Sectional Area in. ² [mm ²]	Perimeter, in. [mm]	Maximum Average Spacing	Minimum Average Height	Maximum Gap (Chord of 12.5 % of Nominal Perimeter)
3 [10]	0.376 [0.560]	0.375 [9.5]	0.11 [71]	1.178 [29.9]	0.262 [6.7]	0.015 [0.38]	0.143 [3.6]
4 [13]	0.668 [0.994]	0.500 [12.7]	0.20 [129]	1.571 [39.9]	0.350 [8.9]	0.020 [0.51]	0.191 [4.9]
5 [16]	1.043 [1.552]	0.625 [15.9]	0.31 [199]	1.963 [49.9]	0.437 [11.1]	0.028 [0.71]	0.239 [6.1]
6 [19]	1.502 [2.235]	0.750 [19.1]	0.44 [284]	2.356 [59.8]	0.525 [13.3]	0.038 [0.97]	0.286 [7.3]
7 [22]	2.044 [3.042]	0.875 [22.2]	0.60 [387]	2.749 [69.8]	0.612 [15.5]	0.044 [1.12]	0.334 [8.5]
8 [25]	2.670 [3.973]	1.000 [25.4]	0.79 [510]	3.142 [79.8]	0.700 [17.8]	0.050 [1.27]	0.383 [9.7]
9 [29]	3.400 [5.060]	1.128 [28.7]	1.00 [645]	3.544 [90.0]	0.790 [20.1]	0.056 [1.42]	0.431 [10.9]
10 [32]	4.303 [6.404]	1.270 [32.3]	1.27 [819]	3.990 [101.3]	0.889 [22.6]	0.064 [1.63]	0.487 [12.4]
11 [36]	5.313 [7.907]	1.410 [35.8]	1.56 [1006]	4.430 [112.5]	0.987 [25.1]	0.071 [1.80]	0.540 [13.7]

^ABar numbers are based on the number of eighths of an inch included in the nominal diameter of the bars [bar numbers approximate the number of millimetres of the nominal diameter of the bar].

^BThe nominal dimensions of a deformed bar are equivalent to those of a plain round bar having the same weight [mass] per foot [metre] as the deformed bar.

4.1.1 Quantity (weight) [mass],

4.1.2 Name of material (rail-steel deformed and plain bars for concrete reinforcement),

4.1.3 Size and length,

4.1.4 Deformed or plain,

4.1.5 Grade,

4.1.6 Packaging (see Section 19),

4.1.7 Supplementary requirements (if desired),

4.1.8 ASTM designation and year of issue, and

4.1.9 Certified mill test reports (if desired). (See Section 17.)

NOTE 1—A typical ordering description is as follows: 20 tons rail-steel deformed and plain bars for concrete reinforcement, No. 8, 30 ft 0 in. long, deformed, Grade 60, in secured lifts, including Supplementary Requirement S 1, to ASTM A 616 – . Certified mill test reports are required.

[19 tonnes, rail-steel deformed and plain bars for concrete reinforcement, No. 25, 18.3 m long, deformed, Grade 420, in secured lifts, including Supplementary Requirement S 1, to ASTM A 616M – . Certified mill test reports are required.]

5. Material and Manufacture

5.1 The bars shall be rolled from standard section Tee rails. No other materials such as those known by the terms *rerolled*, *rail-steel equivalent*, and *rail-steel quality* shall be substituted.

6. Requirements for Deformations Requirements for Deformations

6.1 Deformations shall be spaced along the bar at substantially uniform distances. The deformations on opposite sides of the bar shall be similar in size, shape, and pattern.

6.2 The deformations shall be placed with respect to the axis of the bar so that the included angle is not less than 45°. Where the line of deformations forms an included angle with the axis of the bar of from 45 to 70° inclusive, the deformations shall reverse alternately in direction on each side, or those on one side shall be reversed in direction from those on the opposite side. Where the line of deformations is over 70°, a reversal in direction shall not be required.

6.3 The average spacing or distance between deformations on each side of the bar shall not exceed seven tenths of the nominal diameter of the bar.

6.4 The overall length of deformations shall be such that the gap between the ends of the deformations on opposite sides of

the bar shall not exceed 12.5 % of the nominal perimeter of the bar. Where the ends terminate in a longitudinal rib, the width of longitudinal rib shall be considered the gap. Where more than two longitudinal ribs are involved, the total width of all longitudinal ribs shall not exceed 25 % of the nominal perimeter of the bar; furthermore, the summation of gaps shall not exceed 25 % of the nominal perimeter of the bar. The nominal perimeter of the bar shall be 3.14 times the nominal diameter.

6.5 The spacing, height, and gap of deformations shall conform to the requirements prescribed in Table 1.

7. Measurements of Deformations

7.1 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. Spacing measurements shall not be made over a bar area containing bar marking symbols involving letters or numbers.

7.2 The average height of deformations shall be determined from measurements made on not less than two typical deformations. Determinations shall be based on three measurements per deformation, one at the center of the overall length and the other two at the quarter points of the overall length.

7.3 Insufficient height, insufficient circumferential coverage, or excessive spacing of deformations shall not constitute cause for rejection unless it has been clearly established by determinations on each lot (Note 2) tested that typical deformation height, gap or spacing do not conform to the minimum requirements prescribed in Section 6. No rejection shall be made on the basis of measurements if fewer than ten adjacent deformations on each side of the bar are measured.

NOTE 2—A lot is defined as all the bars of one bar number and pattern of deformation contained in an individual shipping release or shipping order.

8. Tensile Requirements

8.1 *Grade 50 [350] and Grade 60 [420]*—The material as represented by the test specimens shall conform to the requirements for tensile properties prescribed in Table 2.