



# Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement<sup>1</sup>

This standard is issued under the fixed designation A 615/A 615M; 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 ( $\epsilon$ ) 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 billet-steel bars for concrete reinforcement in cut lengths and coils. The standard sizes and dimensions of deformed bars and their number designations are given in Table 1. 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.

1.2 Bars are of three minimum yield levels: namely, 40 000 [300 MPa], 60 000 [420 MPa], and 75 000 psi [520 MPa], designated as Grade 40 [300], Grade 60 [420], and Grade 75 [520], respectively.

1.3 Hot-rolled 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 40 [300], Grade 60 [420], and Grade 75 [520]. 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.

NOTE 1—Welding of the material in this specification should be approached with caution since no specific provisions have been included to enhance its weldability. When steel is to be welded, a welding procedure suitable for the chemical composition and intended use or service should be used. The use of the latest edition of ANSI/AWS D 1.4 is recommended. This document describes the proper selection of the filler metals, preheat/interpass temperatures, as well as, performance and procedure qualification requirements.

1.4 This specification is applicable for orders in either inch-pound units (as Specification A 615) or in SI units (as Specification A 615M).

1.5 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 inde-

pendently of the other. Combining values from the two systems may result in nonconformance with the specification.

## 2. Referenced Documents

### 2.1 ASTM Standards:

A 6/A 6M Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling<sup>2</sup>

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products<sup>3</sup>

A 510 Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel<sup>3</sup>

A 510M Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel (Metric)<sup>3</sup>

A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment<sup>4</sup>

A 706/A 706M Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement<sup>2</sup>

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications<sup>5</sup>

### 2.2 AWS Standard:

ANSI/AWS D 1.4 Structural Welding Code—Reinforcing Steel<sup>6</sup>

### 2.3 U.S. Military Standards:

MIL-STD-129 Marking for Shipment and Storage<sup>7</sup>

MIL-STD-163 Steel Mill Products Preparation for Shipment and Storage<sup>7</sup>

### 2.4 U.S. Federal Standard:

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)<sup>7</sup>

## 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.

<sup>2</sup> Annual Book of ASTM Standards, Vol 01.04.

<sup>3</sup> Annual Book of ASTM Standards, Vol 01.03.

<sup>4</sup> Annual Book of ASTM Standards, Vol 01.05.

<sup>5</sup> Annual Book of ASTM Standards, Vol 14.02.

<sup>6</sup> Available from American Welding Society, 550 N.W. LeJeune Road, P.O. Box 351040, Miami, FL 33135.

<sup>7</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

<sup>1</sup> 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.

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

| Bar Designation No. <sup>A</sup> | Nominal Weight, lb/ft [Nominal Mass, kg/m] | Nominal Dimensions <sup>B</sup> |   |                     | Deformation Requirements, in. [mm] |                        |  |
|----------------------------------|--|---------------------------------|---|---------------------|------------------------------------|------------------------|--|
|                                  |  | Diameter, in. [mm]              | Cross-Sectional Area, in. <sup>2</sup> [mm <sup>2</sup> ] | 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]                                       |
| 14 [43]                          | 7.65 [11.38]                               | 1.693 [43.0]                    | 2.25 [1452]   | 5.32 [135.1]        | 1.185 [30.1]                       | 0.085 [2.16]           | 0.648 [16.5]                                       |
| 18 [57]                          | 13.60 [20.24]                              | 2.257 [57.3]                    | 4.00 [2581]   | 7.09 [180.1]        | 1.58 [40.1]                        | 0.102 [2.59]           | 0.864 [21.9]                                       |

<sup>A</sup>Bar 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].

<sup>B</sup>The 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.

3.1.1.1 *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.

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

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

3.1.4 *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:

4.1.1 Quantity (weight) [mass],

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

4.1.3 Size,

4.1.4 Cut lengths or coils,

4.1.5 Deformed or plain,

4.1.6 Grade,

4.1.7 Packaging (see Section 21),

4.1.8 ASTM designation and year of issue, and

4.1.9 Certified mill test reports (if desired). (See Section 16.)

NOTE 2—A typical ordering description is as follows: 20 tons, deformed and plain billet-steel bars for concrete reinforcement, No. 8, 60 ft 0 in. long, deformed, Grade 60, in secured lifts, to ASTM A 615 — . Certified mill test reports are required.

[19 tons, deformed and plain billet-steel bars for concrete reinforcement, No. 25, 18.3-m long, deformed, Grade 420, in secured lifts to ASTM A 615M — . Certified mill test reports are required.]

#### 5. Material and Manufacture

5.1 The bars shall be rolled from properly identified heats of mold cast or strand cast steel using the open-hearth, basic-oxygen, or electric-furnace process.

#### 6. Chemical Composition

6.1 An analysis of each heat of steel shall be made by the manufacturer from test samples taken preferably during the pouring of the heats. The percentages of carbon, manganese,

phosphorus, and sulfur, shall be determined. The phosphorus content thus determined shall not exceed 0.06 %.

6.2 An analysis may be made by the purchaser from finished bars. The phosphorus content thus determined shall not exceed that specified in 6.1 by more than 25 %.

#### 7. Requirements for Deformations

7.1 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.

7.2 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 from 45 to 70° inclusive, the deformations shall alternately reverse 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.

7.3 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.

7.4 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 12½ % of the nominal perimeter of the bar. Where the ends terminate in a longitudinal rib, the width of the 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.

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

#### 8. Measurements of Deformations

8.1 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