
Standard Specification for Deformed and Plain Carbon and Low-Alloy Steel Bars for Concrete Reinforcement

AASHTO Designation: M 31M/M 31-21¹

Technically Revised: 2021

Technical Subcommittee: 4f, Metals

ASTM Designation: A615/A615M-20



**American Association of State Highway and Transportation Officials
555 12th Street NW, Suite 1000
Washington, D.C. 20004**

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1. SCOPE

- 1.1. This specification covers deformed and plain carbon and low-alloy steel concrete reinforcement bars in cut lengths or coils. Steel bars containing alloy additions, such as with the AISI and SAE series of alloy steels, are permitted if the resulting product meets all the other requirements of this specification. The standard sizes and dimensions of deformed bars and their number designations shall be those listed in Table 1. 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 this specification.
- 1.2. Bars are of three minimum yield strength levels: namely, 280 MPa [40,000 psi], 420 MPa [60,000 psi], and 550 MPa [80,000 psi], designated as Grade 280 [40], Grade 420 [60], and Grade 550 [80], respectively. Bars that have carbon contents limited to 0.30 percent or less, and that meet the carbon requirements of this specification, shall be designated as Type W. Bars that have carbon contents greater than 0.30 percent shall be designated as Type S.
- 1.3. Hot-rolled plain rounds, in sizes up to and including 63.5 mm [2½ in.] 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 280 [40], Grade 420 [60], and Grade 550 [80].
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. Welding of the material in this specification should be approached with caution since no specific provisions have been included to enhance its weldability. When the steel is to be welded, a welding procedure suitable for the chemical composition and intended use or service should be used (Note 1).
Note 1—The use of the latest edition of ANSI/AWS D1.4 is recommended for welding reinforcing bars. This document describes the proper selection of the filler metals and preheat/interpass temperatures, as well as performance and procedure qualification requirements.

Table 1—Deformed Bar Designation Numbers, Nominal Masses, Nominal Dimensions, and Deformation Requirements

Bar Designation No. ^b	Nominal Mass, kg/m [lb/ft]	Nominal Dimensions ^a			Deformation Requirements, mm [in.]		
		Diameter, mm [in.]	Cross-Sectional Area, mm ² [in. ²]	Perimeter, in. [mm]	Maximum Average Spacing	Minimum Average Height	Maximum Gap (Chord of 12.5% of Nominal Perimeter)
10 [3]	0.560 [0.376]	9.5 [0.375]	71 [0.11]	29.9 [1.178]	6.7 [0.262]	0.38 [0.015]	3.6 [0.143]
13 [4]	0.994 [0.668]	12.7 [0.500]	129 [0.20]	39.9 [1.571]	8.9 [0.350]	0.51 [0.020]	4.9 [0.191]
16 [5]	1.552 [1.043]	15.9 [0.625]	199 [0.31]	49.9 [1.963]	11.1 [0.437]	0.71 [0.028]	6.1 [0.239]
19 [6]	2.235 [1.502]	19.1 [0.750]	284 [0.44]	59.8 [2.356]	13.3 [0.525]	0.97 [0.038]	7.3 [0.286]
22 [7]	3.042 [2.044]	22.2 [0.875]	387 [0.60]	69.8 [2.749]	15.5 [0.612]	1.12 [0.044]	8.5 [0.334]
25 [8]	3.973 [2.670]	25.4 [1.000]	510 [0.79]	79.8 [3.142]	17.8 [0.700]	1.27 [0.050]	9.7 [0.383]
29 [9]	5.060 [3.400]	28.7 [1.128]	645 [1.00]	90.0 [3.544]	20.1 [0.790]	1.42 [0.056]	10.9 [0.431]
32 [10]	6.404 [4.303]	32.3 [1.270]	819 [1.27]	101.3 [3.990]	22.6 [0.889]	1.63 [0.064]	12.4 [0.487]
36 [11]	7.907 [5.313]	35.8 [1.410]	1006 [1.56]	112.5 [4.430]	25.1 [0.987]	1.80 [0.071]	13.7 [0.540]
43 [14]	11.38 [7.65]	43.0 [1.693]	1452 [2.25]	135.1 [5.32]	30.1 [1.185]	2.16 [0.085]	16.5 [0.648]
57 [18]	20.24 [13.60]	57.3 [2.257]	2581 [4.00]	180.1 [7.09]	40.1 [1.58]	2.59 [0.102]	21.9 [0.864]
64 [20]	24.84 [16.69]	63.5 [2.500]	3167 [4.91]	199.5 [7.85]	44.5 [1.75]	2.86 [0.113]	24.3 [0.957]

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

^b Bar numbers are based on the number of eighths of an inch included in the nominal diameter of the bars. [Bar designation numbers approximate the number of millimeters of the nominal diameter of the bar.]

1.5. This specification is applicable for orders in either SI units (M 31M) or in inch-pound units (M 31). SI units and inch-pound units are not necessarily equivalent; therefore, each system must be used independently of the other. Combining values from the two systems may result in non-conformance with the specification. Inch-pound units are shown in brackets in the text for clarity, but they are the applicable values when the material is ordered to M 31.

1.6. *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. REFERENCED DOCUMENTS

2.1. AASHTO Standards:

- T 244, Mechanical Testing of Steel Products
- T 285, Bend Test for Bars for Concrete Reinforcement

2.2. ASTM Standards:

- A6/A6M, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
- A510/A510M, Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel
- A700, Standard Guide for Packaging, Marking, and Loading Methods for Steel Products for Shipment
- A706/A706M, Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
- A751, Standard Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products
- E29, Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications