



Axle-Steel Deformed and Plain Bars for Concrete Reinforcement

AASHTO DESIGNATION: M 53M/M 53-95 (1999)¹
(ASTM DESIGNATION: A 617/A 617M-96a)

1. SCOPE

1.1 This specification covers deformed and plain axle-steel concrete reinforcement bars. A deformed bar is defined as a bar that is intended for use as reinforcement in reinforced concrete construction. The surface of the bar is provided with lugs or protrusions (hereinafter called *deformations*) which inhibit longitudinal movement of the bar relative to the concrete which surrounds the bar in such construction and conforms to the provisions of this specification. The standard sizes and dimensions of deformed bars and their number designations shall be those listed in Table 1a [Table 1b].

1.2 Bars are of two minimum yield levels: namely, 300 MPa [40000 psi] and 420 MPa [60000 psi], designated as Grade 300 [40] and Grade 420 [60], respectively.

1.3 Plain rounds, in sizes up to and including 50 mm [2 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 300 [40] and Grade 420 [60]. For bending properties test provisions of the nearest smaller nominal diameter deformed bar size shall apply. Those requirements providing for deformations and marking shall not be applicable.

1.4 The weldability of the steel is not part of this specification.

1.5 This specification is applicable for orders in either SI units (as Specification M 53M) or inch-pound units (as Specification M 53).

1.6 The values stated in either SI

units or inch-pound units are to be regarded as standard. Within the text, the inch-pound 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 AASHTO Standards:

- R 11 Indicating Which Places of Figures Are to Be Considered Significant in Specified Limiting Values
- T 244 Mechanical Testing of Steel Products
- T 285 Bend Test for Bars for Concrete Reinforcement

2.2 ASTM Standards:

- A 700 Recommended Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment

2.3 Military Standards:

- MIL-STD-129 Marking for Shipment and Storage
- MIL-STD-163 Steel Mill Products Preparation for Shipment and Storage

2.4 Federal Standard:

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

3. TERMINOLOGY

3.1 Description of Terms Specific to This Standard:

3.1.1 *Deformed bar*—steel bar with protrusions: a bar that is intended for use as reinforcement in reinforced concrete construction.

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*—protrusions on a deformed bar.

3.1.3 *Plain bar*—steel bar without protrusions.

4. ORDERING INFORMATION

4.1 Orders for material under this specification should include the following information:

- 4.1.1 Quantity mass (weight),
- 4.1.2 Name of material (axle-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 20), and
- 4.1.7 AASHTO designation and year of issue, and
- 4.1.8 Certified mill test reports (if desired). (See Section 18).

NOTE 1—A typical ordering description is as follows: 9 Mg axle-steel deformed and plain bars for concrete reinforcement, No. 25, 18 m long, deformed, Grade 420, in secured lifts, to AASHTO M 53M-_____. Certified mill test reports are required.

[10 tons, axle-steel deformed and plain bars for concrete reinforcement, No. 8, 30 ft 0 in. long, deformed, Grade 60, in secured lifts, to AASHTO M 53-_____. Certified mill test reports required.]

¹ Agrees with ASTM A 617/A 617M-96a except for SI units and the bend testing procedure, which is referenced to AASHTO T 285.

5. MATERIAL AND MANUFACTURE

5.1 The bars shall be rolled from carbon steel axles for railway cars and locomotives.

6. CARBON DETERMINATION

6.1 The manufacturer shall make a determination for the carbon content of each axle received by him for manufacture into reinforcement bars. Based on these carbon determinations, all steel axles shall be stocked for subsequent rolling in separated lots by carbon range. The ranges of carbon shall be determined

by the manufacturer as those best suited to meet the mechanical requirements.

6.2 When requested by the purchaser, the manufacturer shall report the carbon range for each lot of bars furnished.

7. REQUIREMENTS OF 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 and shape.

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 deformation is over 70°, a reversal in direction is not 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 percent of the nominal perimeter of the

TABLE 1a Deformed Bar Designation Numbers, Nominal Masses, Nominal Dimensions, and Deformation Requirements, SI Units

Bar Designation No. ^B	Nominal Mass, kg/m	Nominal Dimensions ^A			Deformation Requirements, mm		
		Diameter, mm	Cross-Sectional Area, mm ²	Perimeter, mm	Maximum Average Spacing	Minimum Average Height	Maximum Gap (Chord of 12.5% of Nominal Perimeter)
10	0.560	9.5	71	29.9	6.7	0.38	3.8
13	0.934	12.7	129	39.9	8.9	0.51	4.9
16	1.552	15.9	199	49.9	11.1	0.71	6.1
19	2.235	19.1	284	59.8	13.3	0.97	7.3
22	3.042	22.2	387	69.8	15.5	1.12	8.5
25	3.973	25.4	510	79.8	17.8	1.27	9.7
29	5.060	28.7	645	80.0	20.1	1.42	10.9
32	6.404	32.3	819	101.3	22.6	1.63	12.4
36	7.907	35.8	1006	112.5	25.1	1.80	13.7
43	11.38	43.0	1452	135.1	30.1	2.18	16.5
57	20.24	57.3	2581	180.1	40.1	2.59	21.9

^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.

^B Bar designation numbers approximate the number of millimeters of the nominal diameter of the bar.

TABLE 1b Deformed Bar Designation Numbers, Nominal Weights, Nominal Dimensions, and Deformation Requirements, Inch-Pound Units

Bar Designation No. ^B	Nominal Weight, lb./ft.	Nominal Dimensions ^A			Deformation Requirements, in.		
		Diameter, in.	Cross-Sectional Area, in. ²	Perimeter, in.	Maximum Average Spacing	Minimum Average Height	Maximum Gap (Chord of 12.5% of Nominal Perimeter)
3	0.376	0.375	0.11	1.178	0.262	0.015	0.143
4	0.668	0.500	0.20	1.571	0.350	0.020	0.191
5	1.043	0.625	0.31	1.963	0.437	0.028	0.239
6	1.502	0.750	0.44	2.356	0.525	0.038	0.286
7	2.044	0.875	0.60	2.749	0.612	0.044	0.334
8	2.670	1.000	0.79	3.142	0.700	0.050	0.383
9	3.400	1.128	1.00	3.544	0.790	0.056	0.431
10	4.303	1.270	1.27	3.990	0.889	0.064	0.487
11	5.313	1.410	1.56	4.430	0.987	0.071	0.540

^A 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.