Standard Specification
for

Rail-Steel Deformed and Plain Bars for Concrete Reinforcement

AASHTO DESIGNATION: M 42M/M 42-95 (1999)[1]
(ASTM DESIGNATION: A 616/A 616M-96a)

1. SCOPE

1.1 This specification covers deformed and plain rail-steel concrete reinforcement bars. 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, 350 MPa [50000 psi] and 420 MPa [60000 psi], designated as Grade 350 [50] and 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 350 [50] 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 42M) or in inch-pound units (as Specification M 42). SI units and inch-pound units are not necessarily equivalent. 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 42.

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 *Descriptions 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 (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), and
4.1.7 Supplementary requirements (if desired),
4.1.8 AASHTO designation and date of issue,
4.1.9 Certified mill test reports (if desired) (See Section 17).

NOTE 1—A typical ordering description is as follows: 9 Mg rail-steel deformed and plain bars for concrete reinforcement, No. 25, 18 m long, deformed, Grade 420, in secured lifts, to AASHTO M 42M-_____. Certified mill test reports are required. [10 tons rail-steel deformed and plain bars for concrete reinforcement, No. 8, 30 ft. 0 in. long, deformed, Grade 60, in secured lifts, to AASHTO M 42-_____. Certified mill test reports are required.]

5. MATERIAL AND MANUFACTURE

5.1. The bars shall be rolled from standard section Tee rails. No other ma-

[1] Agrees with ASTM A 616/A 616M-96a except for bend test procedure which is referenced to AASHTO T 285 and Sections 8.1, 8.2.1, 8.2.2, 8.3, and S1.1.

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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	0.994	12.7	129	39.9	8.9	0.51	4.9
18	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	90.0	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, mm		
		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.

terials such as those known by the terms *rerolled, rail-steel equivalent,* and *rail-steel quality* shall be substituted.

6. 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 and shape.

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 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.

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 percent 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 percent of the nominal perimeter of the bar; furthermore, the summation of gaps shall not exceed 25 percent 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 1a [Table 1b].

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