Designation: A 36/A 36M – 96

AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 Barr Harbor Dr., West Conshohocken, PA 19428

Standard Specification for Carbon Structural Steel[1]

This standard is issued under the fixed designation A 36/A 36M; 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. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

1. Scope

1.1 This specification[2] covers carbon steel shapes, plates, and bars of structural quality for use in riveted, bolted, or welded construction of bridges and buildings, and for general structural purposes.

1.2 Supplemental requirements are provided where improved internal quality and notch toughness are important. These shall apply only when specified by the purchaser in the order.

1.3 When the steel is to be welded, it is presupposed that a welding procedure suitable for the grade of steel and intended use or service will be utilized. See Appendix X3 of Specification A 6/A 6M for information on weldability.

1.4 The purchaser should consider specifying supplemental requirements, such as fine austenitic grain size and Charpy V-Notch Impact requirements, when Group 4 or Group 5 wide flange shapes are specified for use in other than column or compression applications.

1.5 The values stated in either inch-pound units or SI (metric) units are to be regarded separately 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 independent of the other. Combining values from the two systems may result in nonconformance with this 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[3]

A 27/A 27M Specification for Steel Castings, Carbon, for General Application[4]

A 307 Specification for Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength[5]

A 325 Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength[5]

A 325M Specification for High-Strength Bolts for Structural Steel Joints [Metric][5]

A 500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes[6]

A 501 Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing[6]

A 502 Specification for Steel Structural Rivets[5]

A 563 Specification for Carbon and Alloy Steel Nuts[5]

A 563M Specification for Carbon and Alloy Steel Nuts [Metric][5]

A 570/A 570M Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality[7]

A 668 Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use[8]

F 568M Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners[5]

TABLE 1 Appurtenant Material Specifications

NOTE—The specifier should be satisfied of the suitability of these materials for the intended application. Composition and/or mechanical properties may be different than specified in A 36/A 36M.

Material	ASTM Designation
Steel rivets	A 502, Grade 1
Bolts	A 307, Grade A or F 568M, Class 4.6
High-strength bolts	A 325 or A 325M
Steel nuts	A 563 or A 563M
Cast steel	A 27/A 27M, Grade 65–35 [450–240]
Forgings (carbon steel)	A 668, Class D
Hot-rolled sheets and strip	A 570/A 570M, Grade 36
Cold-formed tubing	A 500, Grade B
Hot-formed tubing	A 501

3. Appurtenant Materials

3.1 When components of a steel structure are identified with this ASTM designation but the product form is not listed in the scope of this specification, the material shall conform to one of the standards listed in Table 1 unless otherwise specified by the purchaser. Table 1 does not provide any specification requirements to a manufacturer or processor. Orders to a manufacturer or processor should describe the required ASTM designation for product forms not listed in the scope of this specification. Unless otherwise specified, all plain and threaded bars used for anchorage purposes shall be subjected to mechanical tests and shall conform to the tensile requirements of Section 8; headed bolts used for anchorage purposes shall conform to Specification A 307 or F 568M; and all nuts shall conform to the

[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 A01.02 on Structural Steel for Bridges, Buildings, Rolling Stock, and Ships.
Current edition approved May 10, 1996. Published July 1996. Originally published as A 36 – 60 T. Last previous edition A 36/A 36M – 94.

[2] For ASME Boiler and Pressure Vessel Code Applications, see related Specifications SA-36 in Section II of that Code.

[3] *Annual Book of ASTM Standards*, Vol 01.04.

[4] *Annual Book of ASTM Standards*, Vol 01.02.

[5] *Annual Book of ASTM Standards*, Vol 15.08.

[6] *Annual Book of ASTM Standards*, Vol 01.01.

[7] *Annual Book of ASTM Standards*, Vol 01.03.

[8] *Annual Book of ASTM Standards*, Vol 01.05.

TABLE 2 Chemical Requirements

NOTE—Where ". . ." appears in this table there is no requirement. The heat analysis for manganese shall be determined and reported as described in the heat analysis section of Specification A 6/ A 6M.

Product	Shapes[A]	Plates[B]					Bars			
Thickness, in. [mm]	All	To ¾ [20], incl	Over ¾ to 1½ [20 to 40], incl	Over 1½ to 2½ [40 to 65], incl	Over 2½ to 4 [65 to 100], incl	Over 4 [100]	To ¾ [20], incl	Over ¾ to 1½ [20 to 40], incl	Over 1½ to 4 [100], incl	Over 4 [100]
Carbon, max, %	0.26	0.25	0.25	0.26	0.27	0.29	0.26	0.27	0.28	0.29
Manganese, %	...	...	0.80–1.20	0.80–1.20	0.85–1.20	0.85–1.20	...	0.60–0.90	0.60–0.90	0.60–0.90
Phosphorus, max, %	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Sulfur, max, %	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Silicon, %	0.40 max	0.40 max	0.40 max	0.15–0.40	0.15–0.40	0.15–0.40	0.40 max	0.40 max	0.40 max	0.40 max
Copper, min, % when copper steel is specified	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

[A] Manganese content of 0.85–1.35 % and silicon content of 0.15–0.40 % is required for shapes over 426 lb/ft [634 kg/m].

[B] For each reduction of 0.01 % below the specified carbon maximum, an increase of 0.06 % manganese above the specified maximum will be permitted up to the maximum of 1.35 %.

requirements of Specification A 563, Grade A, or A 563M, Class 5.

4. General Requirements for Delivery

4.1 Material furnished under this specification shall conform to the requirements of the current edition of Specification A 6/A 6M, for the ordered material, unless a conflict exists in which case this specification shall prevail.

5. Bearing Plates

5.1 Unless otherwise specified, plates used as bearing plates for bridges shall be subjected to mechanical tests and shall conform to the tensile requirements of Section 8.

5.2 Unless otherwise specified, mechanical tests shall not be required for plates over 1½ in. [40 mm] in thickness used as bearing plates in structures other than bridges, subject to the requirement that they shall contain 0.20 to 0.33 % carbon by heat analysis, that the chemical composition shall conform to the requirements of Table 2 in phosphorus and sulfur content, and that a sufficient discard shall be made to secure sound plates.

6. Process

6.1 The steel shall be made by one or more of the following processes: open-hearth, basic-oxygen, or electric-furnace.

6.2 No rimmed or capped steel shall be used for plates and bars over ½ in. [12.5 mm] thick or for shapes other than Group 1.

7. Chemical Requirements

7.1 The heat analysis shall conform to the requirements prescribed in Table 2, except as specified in 5.2.

7.2 The steel shall conform on product analysis to the requirements prescribed in Table 2, subject to the product analysis tolerances in Specification A 6/A 6M.

7.3 When tension tests are waived in accordance with 8.2, chemistry consistent with the requirements in Table 2, and with the mechanical properties desired must be applied.

TABLE 3 Tensile Requirements[A]

Plates, Shapes,[B] and Bars:	
Tensile strength, ksi [MPa]	58–80 [400–550]
Yield point, min, ksi [MPa]	36 [250][C]
Plates and Bars[D,E]:	
Elongation in 8 in. [200 mm], min, %	20
Elongation in 2 in. [50 mm], min, %	23
Shapes:	
Elongation in 8 in. [200 mm], min, %	20
Elongation in 2 in. [50 mm], min, %	21[B]

[A] See Specimen Orientation under the Tension Tests section of Specification A 6/A 6M.

[B] For wide flange shapes over 426 lb/ft [634 kg/m], the 80 ksi [550 MPa] maximum tensile strength does not apply and a minimum elongation in 2 in. [50 mm] of 19 %, applies.

[C] Yield point 32 ksi [220 MPa] for plates over 8 in. [200 mm] in thickness.

[D] Elongation not required to be determined for floor plate.

[E] For plates wider than 24 in. [600 mm], the elongation requirement is reduced two percentage points. See elongation requirement adjustments under the Tension Tests section of Specification A 6/A 6M.

8. Tensile Requirements

8.1 The material as represented by the test specimen, except as specified in 5.2 and 8.2, shall conform to the requirements as to the tensile properties prescribed in Table 3.

8.2 Shapes less than 1 in.^{2} [645 mm^2] in cross section and bars, other than flats, less than ½ in. [12.5 mm] in thickness or diameter need not be subjected to tension tests by the manufacturer.

9. Keywords

9.1 bars; bolted construction; bridges; buildings; carbon; plates; riveted construction; shapes; steel; structural steel; welded construction

SUPPLEMENTARY REQUIREMENTS

These requirements shall not apply unless specified in the order.
Standardized supplementary requirements for use at the option of the purchaser are listed in Specification A 6/A 6M. Those that are considered suitable for use with this specification are listed by title:

S5. Charpy V-Notch Impact Test.

S14. Bend Test.

ADDED SUPPLEMENTARY REQUIREMENTS

In addition, the following optional supplementary requirements are also suitable for use with this specification.

S91. Fine Austenitic Grain Size

S91.1 The steel shall be killed and have a fine austenitic grain size.

S97. Limitation on Rimmed or Capped Steel

S97.1 The steel shall be other than rimmed or capped.