



Designation: A 6/A 6M – 00a

## Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling<sup>1</sup>

This standard is issued under the fixed designation A 6/A 6M; 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.*

### 1. Scope

1.1 This specification<sup>2</sup> covers a group of common requirements that, unless otherwise specified in the material specification, apply to rolled steel plates, shapes, sheet piling, and bars under each of the following specifications issued by ASTM:

ASTM Designation <sup>3</sup>	Title of Specification
A 36/A 36M	Carbon Structural Steel
A 131/A 131M	Structural Steel for Ships
A 242/A 242M	High-Strength Low-Alloy Structural Steel
A 283/A 283M	Low and Intermediate Tensile Strength Carbon Steel Plates
A 328/A 328M	Steel Sheet Piling
A 514/A 514M	High-Yield Strength, Quenched and Tempered Alloy Steel Plate Suitable for Welding
A 529/A 529M	High-Strength Carbon-Manganese Steel of Structural Quality
A 572/A 572M	High-Strength Low-Alloy Columbium-Vanadium Steel
A 573/A 573M	Structural Carbon Steel Plates of Improved Toughness
A 588/A 588M	High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. [100 mm] Thick
A 633/A 633M	Normalized High-Strength Low-Alloy Structural Steel Plates
A 656/A 656M	Hot-Rolled Structural Steel, High-Strength Low-Alloy Plate with Improved Formability
A 678/A 678M	Quenched-and-Tempered Carbon and High-Strength Low-Alloy Structural Steel Plates
A 690/A 690M	High-Strength Low-Alloy Steel H-Piles and Sheet Piling for Use in Marine Environments
A 709/A 709M	Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates, and Bars and Quenched-and-Tempered Alloy Structural Steel Plates for Bridges
A 710/A 710M	Age-Hardening Low-Carbon Nickel-Copper-Chromium-Molybdenum-Columbium Alloy Structural Steel Plates
A 769/A 769M	Carbon and High-Strength Electric Resistance Welded Steel Structural Shapes
A 786/A 786M	Rolled Steel Floor Plates
A 808/A 808M	High-Strength Low-Alloy Carbon, Manganese, Columbium, Vanadium Steel of Structural Quality with Improved Notch Toughness
A 827/A 827M	Plates, Carbon Steel, for Forging and Similar Applications
A 829/A 829M	Plates, Alloy Steel, Structural Quality

A 830/A 830M	Plates, Carbon Steel, Structural Quality, Furnished to Chemical Composition Requirements
A 852/A 852M	Quenched and Tempered Low-Alloy Structural Steel Plate with 70 ksi [485 Mpa] Minimum Yield Strength to 4 in. [100 mm] Thick
A 857/A 857M	Steel Sheet Piling, Cold Formed, Light Gage
A 871/A 871M	High-Strength Low Alloy Structural Steel Plate with Atmospheric Corrosion Resistance
A 913/A 913M	Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process (QST)
A 945/A 945M	Specification for High-Strength Low-Alloy Structural Steel Plate with Low Carbon and Restricted Sulfur for Improved Weldability, Formability, and Toughness
A 992/A 992M	Specification for Steel for Structural Shapes for Use in Building Framing

1.2 Annex A1 lists permitted variations in dimensions and mass (Note 1) in SI units. The values listed are not exact conversions of the values in Tables 1 to 31 inclusive but are, instead, rounded or rationalized values. Conformance to Annex A1 is mandatory when the “M” specification designation is used.

NOTE 1—The term “weight” is used when inch-pound units are the standard; however, under SI, the preferred term is “mass.”

1.3 Annex A2 lists the dimensions of some shape profiles.

1.4 Appendix X1 provides information on coiled product as a source of structural plates, shapes, sheet piling, and bars.

1.5 Appendix X2 provides information on the variability of tensile properties in plates and structural shapes.

1.6 Appendix X3 provides information on weldability.

1.7 Appendix X4 provides information on cold bending of plates, including suggested minimum inside radii for cold bending.

1.8 This specification also covers a group of supplementary requirements that are applicable to several of the above specifications as indicated therein. Such requirements are provided for use where additional testing or additional restrictions are required by the purchaser, and apply only when specified individually in the purchase order.

1.9 In case of any conflict in requirements, the requirements of the individual material specification shall prevail over those of this general specification.

1.10 Additional requirements that are specified in the purchase order and accepted by the supplier are permitted,

<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 A01.02 on Structural Steel for Bridges, Buildings, Rolling Stock, and Ships.

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<sup>2</sup> For ASME Boiler and Pressure Vessel Code applications, see related Specification SA-6/SA-6M in Section II of that Code.

provided that such requirements do not negate any of the requirements of this general specification or the individual material specification.

1.11 For purposes of determining conformance with this specification and the various material specifications referenced in 1.1, values shall be rounded to the nearest unit in the right-hand place of figures used in expressing the limiting values in accordance with the rounding method of Practice E 29.

1.12 The values stated in either inch-pound units or SI 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 is to be used independently of the other, without combining values in any way.

1.13 This specification and the applicable material specifications are expressed in both inch-pound units and SI units; however, unless the order specifies the applicable “M” specification designation (SI units), the material shall be furnished to inch-pound units.

1.14 The text of this specification contains notes and/or footnotes that provide explanatory material. Such notes and footnotes, excluding those in tables and figures, do not contain any mandatory requirements.

## 2. Referenced Documents

### 2.1 ASTM Standards:

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

A 673/A 673M Specification for Sampling Procedure for Impact Testing of Structural Steel<sup>4</sup>

A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment<sup>5</sup>

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products<sup>3</sup>

A 829 Specification for Plates, Alloy Steel, Structural Quality<sup>4</sup>

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications<sup>6</sup>

E 112 Test Methods for Determining Average Grain Size<sup>7</sup>

E 208 Test Method for Conducting Drop-Weight Test to Determine Nil-Ductility Transition Temperature of Ferritic Steels<sup>7</sup>

### 2.2 American Welding Society Standards:

A5.1 Mild Steel Covered Arc-Welding Electrodes<sup>8</sup>

A5.5 Low-Alloy Steel Covered Arc-Welding Electrodes<sup>8</sup>

### 2.3 U.S. Military Standards:

MIL-STD-129 Marking for Shipment and Storage<sup>9</sup>

MIL-STD-163 Steel Mill Products Preparation for Shipment and Storage<sup>9</sup>

### 2.4 U.S. Federal Standard:

Fed. Std. No. 123 Marking for Shipments (Civil Agencies)<sup>9</sup>

### 2.5 AIAG Standard:

B-1 Bar Code Symbology Standard<sup>10</sup>

## 3. Terminology

### 3.1 Definitions of Terms Specific to This Standard:

3.1.1 *Plates* (other than floor plates or coiled product)—Flat, hot-rolled steel, classified as follows:

#### 3.1.1.1 When Ordered to Thickness:

(1) Over 8 in. [200 mm] in width and 0.230 in. or over [over 6 mm] in thickness.

(2) Over 48 in. [1200 mm] in width and 0.180 in. or over [over 4.5 mm] in thickness.

#### 3.1.1.2 When Ordered to Weight [Mass]:

(1) Over 8 in. [200 mm] in width and 9.392 lb/ft<sup>2</sup> [47.10 kg/m<sup>2</sup>] or heavier.

(2) Over 48 in. [1200 mm] in width and 7.350 lb/ft<sup>2</sup> [35.32 kg/m<sup>2</sup>] or heavier.

3.1.1.3 Slabs, sheet bars, and skelp, though frequently falling in the foregoing size ranges, are not classed as plates.

3.1.1.4 Coiled product is excluded from qualification to individual material specifications governed by this specification until decoiled, leveled, cut to length, and, if required, properly tested by the processor in accordance with ASTM specification requirements (see 5.4.2 and the individual material specification).

#### 3.1.2 Shapes (Flanged Sections):

3.1.2.1 *structural-size shapes*—rolled flanged sections having at least one dimension of the cross section 3 in. [75 mm] or greater. Structural shape size groupings used for tensile property classification are listed in Table A.

3.1.2.2 *bar-size shapes*—rolled flanged sections having a maximum dimension of the cross section less than 3 in. [75 mm].

3.1.2.3 “W” shapes—doubly-symmetric, wide-flange shapes with inside flange surfaces that are substantially parallel.

3.1.2.4 “HP” shapes—are wide-flange shapes generally used as bearing piles whose flanges and webs are of the same nominal thickness and whose depth and width are essentially the same.

3.1.2.5 “S” shapes—doubly-symmetric beam shapes with inside flange surfaces that have a slope of approximately 16⅔ %.

3.1.2.6 “M” shapes—doubly-symmetric shapes that cannot be classified as “W,” “S,” or “HP” shapes.

3.1.2.7 “C” shapes—channels with inside flange surfaces that have a slope of approximately 16⅔ %.

3.1.2.8 “MC” shapes—channels that cannot be classified as “C” shapes.

3.1.2.9 “L” shapes—shapes having equal-leg and unequal-leg angles.

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

<sup>4</sup> Annual Book of ASTM Standards, Vol 01.04.

<sup>5</sup> Annual Book of ASTM Standards, Vol 01.05.

<sup>6</sup> Annual Book of ASTM Standards, Vol 14.02.

<sup>7</sup> Annual Book of ASTM Standards, Vol 03.01.

<sup>8</sup> Available from the American Welding Society, 550 N.W. LaJeune Rd., Miami, FL 33135.

<sup>9</sup> Available from the procuring activity or as directed by the contracting office or from the Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094 Attn: NPODS.

<sup>10</sup> Available from the Automotive Industry Action Group, 26200 Lahser Road, Suite 200, Southfield, MI 48034.

**TABLE A Shape Size Groupings for Tensile Property Classification**

NOTE 1—SI designations, from Annex A2, are shown in brackets. Tees cut from W, M, and S shapes fall within the same group as the shape from which they are cut.

Shape Type	Group 1	Group 2	Group 3	Group 4	Group 5
W Shapes	W24 × 55 & 62 [W610 × 82& 92] W21 × 44 to 57 incl [W530 × 66 to 85 incl] W18 × 35 to 71 incl [W460 × 52 to 106 incl] W16 × 26 to 57 incl [W410 × 38.8 to 85 incl] W14 × 22 to 53 incl [W360 × 32.9 to 79 incl] W12 × 14 to 58 incl [W310 × 21.0 to 86 incl] W10 × 12 to 45 incl [W250 × 17.9 to 67 incl] W8 × 10 to 48 incl [W200 × 15.0 to 71 incl] W6 × 9 to 25 incl [W150 × 13.5 to 37.1 incl] W5 × 16 & 19 [W130 × 23.8& 28.1] W4 × 13 [W100 × 19.3]	W40 × 149 to 268 incl [W1000 × 222 to 399 incl] W36 × 135 to 210 incl [W920 × 201 to 313 incl] W33 × 118 to 152 incl [W840 × 176 to 226 incl] W30 × 90 to 211 incl [W760 × 134 to 314 incl] W27 × 84 to 178 incl [W690 × 125 to 263 incl] W24 × 68 to 162 incl [W610 × 101 to 241 incl] W21 × 62 to 147 incl [W530 × 92 to 219 incl] W18 × 76 to 143 incl [W460 × 113 to 213 incl] W16 × 67 to 100 incl [W410 × 100 to 149 incl] W14 × 61 to 132 incl [W360 × 91 to 196 incl] W12 × 65 to 106 incl [W310 × 97 to 158 incl] W10 × 49 to 112 incl [W250 × 73 to 167 incl] W8 × 58 & 67 [W200 × 86 & 100]	W40 × 277 to 328 incl [W1000 × 412 to 488 incl] W36 × 230 to 300 incl [W920 × 342 to 446 incl] W33 × 201 to 291 incl [W840 × 299 to 433 incl] W30 × 235 to 261 incl [W760 × 350 to 389 incl] W27 × 194 to 258 incl [W690 × 289 to 384 incl] W24 × 176 to 229 incl [W610 × 262 to 341 incl] W21 × 166 to 223 incl [W530 × 248 to 331 incl] W18 × 158 to 192 incl [W460 × 235 to 286 incl] W14 × 145 to 211 incl [W360 × 216 to 314 incl] W12 × 120 to 190 incl [W310 × 179 to 283 incl]	W40 × 362 to 655 incl [W1000 × 539 to 976 incl] W36 × 328 to 798 incl [W920 × 488 to 1188 incl] W33 × 318 to 619 incl [W920 × 473 to 922 incl] W30 × 292 to 581 incl [W760 × 434 to 865 incl] W27 × 281 to 539 incl [W690 × 419 to 802 incl] W24 × 250 to 492 incl [W610 × 372 to 732 incl] W21 × 248 to 402 incl [W530 × 370 to 599 incl] W18 × 211 to 311 incl [W460 × 315 to 464 incl] W14 × 233 to 550 incl [W360 × 347 to 818 incl] W12 × 210 to 336 incl [W310 × 313 to 500 incl]	W36 × 920 [W920 × 1369] W14 × 605 to 873 incl [W360 × 900 to 1299 incl]
M Shapes	to 18.9 lb/ft, incl [to 28.1 kg/m, incl]				
S Shapes	to 35 lb/ft, incl [to 52 kg/m, incl]				
HP Shapes		over 35 lb/ft [over 52 kg/m]	over 102 lb/ft [over 152 kg/m]		
C Shapes	to 20.7 lb/ft, incl [to 30.8 kg/m, incl]	over 20.7 lb/ft [over 30.8 kg/m]			
MC Shapes	to 28.5 lb/ft, incl [to 42.4 kg/m, incl]	over 28.5 lb/ft [over 42.4 kg/m]			
L Shapes	to ½ in., incl [to 13 mm, incl]	over ½ to ¾ in., incl [over 13 to 19 mm, incl]	over ¾ in. [over 19 mm]		

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3.1.3 *sheet piling*—rolled steel sections that are capable of being interlocked, forming a continuous wall when individual pieces are driven side by side.

3.1.4 *bars*—rounds, squares, and hexagons, of all sizes; flats  $\frac{13}{64}$  in. (0.203 in.) and over [over 5 mm] in specified thickness, not over 6 in. [150 mm] in specified width; and flats 0.230 in. and over [over 6 mm] in specified thickness, over 6 to 8 in. [150 to 200 mm] inclusive, in specified width.

3.1.5 *exclusive*—when used in relation to ranges, as for ranges of thickness in the tables of permissible variations in dimensions, is intended to exclude only the greater value of the range. Thus, a range from 60 to 72 in. [1500 to 1800 mm] exclusive includes 60 in. [1500 mm], but does not include 72 in. [1800 mm].

3.1.6 *rimmed steel*—steel containing sufficient oxygen to give a continuous evolution of carbon monoxide during solidification, resulting in a case or rim of metal virtually free of voids.

3.1.7 *semi-killed steel*—incompletely deoxidized steel containing sufficient oxygen to form enough carbon monoxide during solidification to offset solidification shrinkage.

3.1.8 *capped steel*—rimmed steel in which the rimming action is limited by an early capping operation. Capping is

carried out mechanically by using a heavy metal cap on a bottle-top mold or chemically by an addition of aluminum or ferrosilicon to the top of the molten steel in an open-top mold.

3.1.9 *killed steel*—steel deoxidized, either by addition of strong deoxidizing agents or by vacuum treatment, to reduce the oxygen content to such a level that no reaction occurs between carbon and oxygen during solidification.

3.1.10 *groupings for tensile property classification*—in some of the material specifications, the tensile property requirements vary for different sizes of shapes due to mass effect, etc. For the convenience of those using the specifications, the various sizes of shapes have been divided into groups based on section thickness at the standard tension test location (webs of beams, channels, and zees; legs of angles; and stems of tees). The material specifications designate shape sizes by reference to the group designations. The groupings are shown in Table A.

3.1.11 *mill edge*—the normal edge produced by rolling between horizontal finishing rolls. A mill edge does not conform to any definite contour. Mill edge plates have two mill edges and two trimmed edges.

3.1.12 *universal mill edge*—the normal edge produced by rolling between horizontal and vertical finishing rolls. Universal mill plates, sometimes designated UM Plates, have two

universal mill edges and two trimmed edges.

3.1.13 *sheared edge*—the normal edge produced by shearing. Sheared edge plates are trimmed on all edges.

3.1.14 *gas cut edge*—the edge produced by gas flame cutting.

3.1.15 *special cut edge*—usually the edge produced by gas flame cutting involving special practices such as pre-heating or post-heating, or both, in order to minimize stresses, avoid thermal cracking and reduce the hardness of the gas cut edge. In special instances, special cut edge is used to designate an edge produced by machining.

3.1.16 *sketch*—when used to describe a form of plate, denotes a plate other than rectangular, circular, or semi-circular. Sketch plates may be furnished to a radius or with four or more straight sides.

3.1.17 *normalizing*—a heat treating process in which a steel plate is reheated to a uniform temperature above the upper critical temperature and then cooled in air to below the transformation range.

3.1.18 *plate-as-rolled*—when used in relation to the location and number of tests, the term refers to the unit plate rolled from a slab or directly from an ingot. It does not refer to the condition of the plate.

3.1.19 *fine grain practice*—a steelmaking practice that is intended to produce a killed steel that is capable of meeting the requirements for fine austenitic grain size.

3.1.19.1 *Discussion*—It normally involves the addition of one or more austenitic grain refining elements in amounts that have been established by the steel producer as being sufficient. Austenitic grain refining elements include, but are not limited to, aluminum, columbium, titanium, and vanadium.

## 4. Ordering Information

4.1 Information items to be considered, if appropriate, for inclusion in purchase orders are as follows:

4.1.1 ASTM specification designation (see 1.1) and year of issue,

4.1.2 Name of material (plates, shapes, bars, or sheet piling),

4.1.3 Shape designation, or size and thickness or diameter,

4.1.4 Grade, class, and type designation, if applicable,

4.1.5 Condition (see Section 6), if other than as-rolled,

4.1.6 Quantity (weight [mass] or number of pieces),

4.1.7 Length,

4.1.8 Exclusion of either structural product from coil or discrete cut lengths of flat product (see 5.3 and Appendix X1), if applicable,

4.1.9 Heat treatment requirements (see 6.2 and 6.3), if any,

4.1.10 Testing for fine austenitic grain size (see 8.3.2),

4.1.11 Mechanical property test report requirements (see Section 14), if any,

4.1.12 Special packaging, marking, and loading for shipment requirements (see Section 19), if any,

4.1.13 Supplementary requirements, if any, including any additional requirements called for in the supplementary requirements,

4.1.14 End use, if there are any end-use-specific requirements (see 18.1, 11.3.4, Table 22 or Table A1.22, and Table 24 or Table A1.24)

4.1.15 Special requirements (see 1.10), if any,

4.1.16 Repair welding requirements (see 9.5), if any, and

4.1.17 Color Marking of plates (see 18.1.5).

## 5. Materials and Manufacture

5.1 The steel shall be made in an open-hearth, basic-oxygen, or electric-arc furnace, possibly followed by additional refining in a ladle metallurgy furnace (LMF), or secondary melting by vacuum-arc remelting (VAR) or electroslag remelting (ESR).

5.2 The steel shall be strand cast or cast in stationary molds.

5.2.1 *Strand Cast:*

5.2.1.1 When heats of the same nominal chemical composition are consecutively strand cast at one time, the heat number assigned to the cast product need not be changed until all of the steel in the cast product is from the following heat.

5.2.1.2 When two consecutively strand cast heats have different nominal chemical composition ranges, the manufacturer shall remove the transition material by an established procedure that positively separates the grades.

5.3 Structural products are produced in either discrete cut lengths of flat product or from coils.

5.3.1 Structural products produced from coil means structural products that have been cut to individual lengths from a coiled product and are furnished without heat treatment. For the purposes of this paragraph, stress relieving is not considered to be a heat treatment.

5.3.2 Structural products that are heat treated (except stress relieving) after decoiling shall be considered to be discrete cut lengths of flat product.

5.4 When structural products are produced from coils:

5.4.1 The manufacturer directly controls one or more of the operations (that is, melting, rolling, coiling, etc.), that affect the chemical composition or the mechanical properties, or both, of the material.

5.4.2 The processor decoils, forms, cuts to length, and marks; performs and certifies tests, examinations, repairs, and inspection; and except as allowed by Section 6, performs operations not intended to affect the properties of the material. Specific sections of this specification for which the processor is responsible are 9, 10, 11, 18, 12, 15, 13, 14, and 19.

5.4.3 When part of a heat is rolled into discrete lengths of flat product and the balance of the heat into coiled product, each part must be tested separately.

5.4.4 Structural products produced from coils shall not contain splice welds, unless previously approved by the purchaser.

## 6. Heat Treatment

6.1 When material is required to be heat treated, such heat treatment shall be performed by the manufacturer, the processor, or the fabricator, unless otherwise specified in the material specification.

NOTE 2—When no heat treatment is required, the manufacturer or processor has the option of heat treating the products by normalizing, stress relieving, or normalizing then stress relieving to meet the material specification.

6.2 When heat treatment is to be performed by other than the material manufacturer, the order shall so state.

6.2.1 When heat treatment is to be performed by other than