



Designation: **A1043/A1043M – 05 (Reapproved 2009) A1043/A1043M – 14**

## Standard Specification for Structural Steel with Low Yield to Tensile Ratio for Use in Buildings<sup>1</sup>

This standard is issued under the fixed designation A1043/A1043M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope—Scope\*

1.1 This specification covers two grades, 36 [250] and 50 [345] of rolled steel structural shapes and plates with low yield to tensile ratio for use in building framing or for general structural purposes.

1.2 All shape profiles with a flange width of 6 in. [150 mm] and greater described in Specification **A6/A6M<sub>2</sub>**, Annex A2<sub>2</sub> and plates up to and including 5 in. [125 mm] thick are included in this specification.

1.3 Supplementary requirements are provided for use where additional testing or additional restrictions are required by the purchaser. Such requirements apply only when specified in the purchase order.

1.4 When the steel is to be welded, a welding procedure suitable for the grade of steel and intended use or service is to be utilized. See Appendix X3 of Specification **A6/A6M** for information on weldability.

1.5 The text of this specification contains notes or footnotes, or both, that provide explanatory material; such notes and footnotes, excluding those in tables and figures, do not contain any mandatory requirements.

1.6 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.

### 2. Referenced Documents

2.1 *ASTM Standards*:<sup>2</sup>

**A6/A6M** Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

**A370** Test Methods and Definitions for Mechanical Testing of Steel Products

**A673/A673M** Specification for Sampling Procedure for Impact Testing of Structural Steel

**A770/A770M** Specification for Through-Thickness Tension Testing of Steel Plates for Special Applications

### 3. General Requirements for Delivery

3.1 Product furnished under this specification shall conform to the requirements of the current edition of Specification **A6/A6M** for the ordered product, unless a conflict exists, in which case this specification shall prevail.

### 4. Materials and Manufacture

4.1 The steel shall be killed, and such shall be affirmed in the test report by a statement of *killed steel*, a value of 0.10 % or more for the silicon content, a value of 0.015 % or more for the total aluminum content, or a value of 0.006 % or more for the titanium content.

### 5. Chemical Composition

5.1 The heat analysis shall conform to the requirements given in **Table 1**.

5.2 The steel shall conform on product analysis to the requirements given in **Table 1**, subject to the product analysis tolerances in Specification **A6/A6M**.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee **A01** 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 ~~Oct. 1, 2009~~ Oct. 1, 2014, Published ~~December 2009~~ October 2014. Originally approved in 2005. Last previous edition approved in ~~2005~~ 2009 as ~~A1043/A1043M – 05~~ **A1043/A1043M – 05 (2009)**. DOI: ~~10.1520/A1043\_A1043M-05R09~~ 10.1520/A1043\_A1043M-14.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

\*A Summary of Changes section appears at the end of this standard

**TABLE 1 Chemical Requirements (Heat Analysis)**

Element	Thickness	Composition, %	
		Grade 36 [250]	Grade 50 [345]
Carbon, max	2 in. [50 mm] and less in thickness	0.20	0.20
	Over 2 in. [50 mm] in thickness	0.22	0.22
Manganese	0.50–1.40	0.50–1.60	
Phosphorus, max		0.035	
Sulfur, max		0.045	
Silicon, max		0.35	
Nitrogen, max		0.012	
Nickel, max		0.45	
Chromium, max		0.35	
Molybdenum, max		0.15	
Copper, max		0.50	
Vanadium, max		0.15 <sup>A</sup>	
Columbium, max		0.05 <sup>A</sup>	
Titanium, max		0.03	

**TABLE 1 Chemical Requirements (Heat Analysis)**

Element	Thickness	Composition, %	
		Grade 36 [250]	Grade 50 [345]
Carbon, max	2 in. [50 mm] and less in thickness	0.20	0.20
	Over 2 in. [50 mm] in thickness	0.22	0.22
Manganese		0.50–1.40	0.50–1.60
Phosphorus, max		0.030	0.030
Sulfur, max		0.030	0.030
Silicon, max		0.35	0.55
Nitrogen, max		0.012	0.012
Nickel, max		0.45	0.45
Chromium, max		0.35	0.35
Molybdenum, max		0.15	0.15
Copper, max		0.50	0.50
Vanadium, max		0.15 <sup>A</sup>	0.15 <sup>A</sup>
Columbium, max		0.05 <sup>A</sup>	0.05 <sup>A</sup>
Titanium, max		0.03	0.03

<sup>A</sup> The sum of columbium and vanadium shall not exceed 0.15 %.

5.3 The maximum permissible carbon equivalent values shall be:

Grade	Thickness of Plate and Shape Flange	CE Value max %
36 [250]	All	0.37
50 [345]	≤ 2 in. [50 mm]	0.45
50 [345]	> 2 in. [50 mm]	0.47

5.3.1 The carbon equivalent value shall be based upon heat analysis. The required chemical analysis as well as the carbon equivalent shall be reported. The carbon equivalent shall be calculated using the following formula:

$$CE = C + (Mn)/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 \quad (1)$$

## 6. Tensile Requirements

6.1 The product as represented by the test specimens shall conform to the requirements for tensile properties given in **Table 2**.

## 7. Charpy Impact Requirements

7.1 Charpy V-notch tests shall be conducted in accordance with Specification **A673/A673M**, frequency H. The test results for full-size test specimens shall conform to the following minimum average value for Grades 36 [250] and 50 [345]:

$$40 \text{ ft}\cdot\text{lb}_f [54 \text{ J}] \text{ at } 70^\circ\text{F} [21^\circ\text{C}]$$

or a lower test temperature as specified in the purchase order.

7.2 For shapes with a flange thickness equal to or greater than 1½ in. [38.1 mm] the test specimens shall be taken from the Alternate Core Location as defined in Specification **A673/A673M**.

## 8. Keywords

8.1 building framing; low yield to tensile ratio; plates; shapes; structural steel; welded construction