



Standard Specification for Alloy Steel Structural Shapes for Use in Building Framing¹

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This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers Grades 50 [345] and 65 [450] alloy steel “W” shapes (rolled wide flange shapes) intended for use in building framing. This steel is a low carbon, copper-containing, alloy steel with a bainitic microstructure that is developed through the control of chemical composition and the use of thermo-mechanical rolling followed by air cooling. The copper is present to enhance precipitation strengthening.

1.2 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 A 6/A 6M for information on weldability.

1.3 The shapes are not intended to be galvanized or to be post-weld heat treated at temperatures exceeding 750 °F [400 °C].

1.4 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI values 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.

1.5 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.

2. Referenced Documents

2.1 ASTM Standards:

A 6/A 6M Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling²

A 673/A 673M Specification for Sampling Procedure for Impact Testing of Structural Steel²

¹ 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 .

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² Annual Book of ASTM Standards, Vol 01.04.

3. General Requirements

3.1 Product furnished under this specification shall conform to the requirements of the current edition of Specification A 6/A 6M 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 made to fine grain practice.

4.2 The shapes shall be produced by a controlled process that incorporates thermo-mechanical rolling followed by air cooling to result in a precipitation-strengthened bainitic microstructure.

5. Chemical Composition

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

5.2 The product analysis shall conform to the requirements given in Table 1 subject to the variations in product analysis that are permitted in Specification A 6/A 6M.

5.3 Where the amount of tin is less than 0.02 %, it shall be permissible for the heat or product analysis, whichever is applicable, to be reported as “< 0.02 %.”

6. Mechanical Properties

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

6.2 *Impact Test*:

6.2.1 Charpy V-notch tests shall be made in accordance with Specification A 673/A 673M, Frequency H.

6.2.2 Test results for full-size test specimens shall meet a minimum average value of 40 ft-lbf [54 J] at 70 °F [21 °C] or a lower test temperature as specified in the purchase order.

7. Keywords

7.1 alloy steel; bainitic steel; building framing; copper; precipitation strengthening; shapes; structural shapes; welded construction

TABLE 1 Chemical Requirements (Heat Analysis)

Element	Composition, %
Carbon, max	0.07
Manganese	0.50 to 1.50
Phosphorus, max	0.035
Sulfur, max	0.025
Silicon	0.10 to 0.40
Nickel	0.40 to 0.70
Chromium, max	0.35
Molybdenum, max	0.07
Copper	0.70 to 1.30
Titanium, max	0.04
Vanadium, max	0.01
Boron	0.0005 to 0.003
Columbium	0.01 to 0.05
Nitrogen, max	0.012
Tin, max	0.03

TABLE 2 Tensile Requirements

	Grade 50 [345]	Grade 65 [450]
Tensile strength, min, ksi [MPa]	65 [450]	80 [550]
Yield point, ksi [MPa]	50 to 65 [345 to 450]	65 to 80 [450 to 550]
Yield to tensile ratio, max	0.85	0.85
Elongation in 8 in. [200 mm], min, % ^A	18	15
Elongation in 2 in. [50 mm], min, % ^A	21	17

^ASee the Elongation Requirement Adjustments subsection in the Tension Tests section of A 6/A 6M.

SUPPLEMENTARY REQUIREMENTS

Supplementary requirements shall not apply unless specified in the purchase order or contract. 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:

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| S1. Vacuum Treatment | S8. Ultrasonic Examination |
| S3. Simulated Post-Weld Heat Treatment of Mechanical Test Coupons | S30. Charpy V-Notch Impact Test for Structural Shapes: Alternate Core Location |

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