



Designation: A1112/A1112M – 18

# Standard Specification for Cold-Formed Welded High Strength Carbon Steel or High-Strength Low-Alloy Steel Hollow Structural Sections (HSS) in Rounds and Shapes<sup>1</sup>

This standard is issued under the fixed designation A1112/A1112M; 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

1.1 This specification covers cold-formed welded high strength carbon steel or high strength low-alloy steel Hollow Structural Sections (HSS) or special shape structural tubing for welded, riveted, or bolted construction of bridges, buildings, and for structural purposes.

1.2 This HSS is produced in welded sizes with a periphery of 64 in. [1626 mm] or less, and a specified wall thickness of 0.625 in. [16 mm] or less.

NOTE 1—Products manufactured to this specification may not be suitable for those applications such as dynamic loaded elements in welded structures, etc. where low-temperature notch-toughness properties may be important. Inquire if dynamic loaded elements are required.

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

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard. The inch-pound units shall apply unless the “M” designation of this specification is specified in the order.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recom-*

<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 A01.09 on Carbon Steel Tubular Products.

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*mendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

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

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A700 Guide for Packaging, Marking, and Loading Methods for Steel Products for Shipment

A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

A1058 Test Methods for Mechanical Testing of Steel Products—Metric

### 2.2 Military Standard:<sup>3</sup>

MIL-STD-129 Marking for Shipment and Storage

### 2.3 Federal Standard:<sup>3</sup>

FED-STD-123 Marking for Shipment (Civil Agencies)

### 2.4 AIAG Standard:<sup>4</sup>

B-1 Bar Code Symbology Standard 1112-a1112m-18

## 3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, refer to Terminology A941.

## 4. Ordering Information

4.1 Orders for material under this specification shall contain information concerning as many of the following items as are required to describe the material adequately:

4.1.1 Quantity (feet [meters] or number of lengths),

4.1.2 Name of material (cold-formed HSS),

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

<sup>3</sup> Available from U.S. Government Printing Office, Superintendent of Documents, 732 N. Capitol St., NW, Washington, DC 20401-0001, <http://www.access.gpo.gov>.

<sup>4</sup> Available from Automotive Industry Action Group (AIAG), 26200 Lahser Rd., Suite 200, Southfield, MI 48033-7156, <http://www.aiag.org>.

4.1.3 Size (outside diameter and wall thickness for round HSS, and outside dimensions and wall thickness for square and rectangular HSS),

4.1.4 Grade/Class (70, 80, 90, 100, or 110),

4.1.5 Length (random, multiple, specific; see 11.3),

4.1.6 End condition (see 16.3),

4.1.7 Burr removal (see 16.3),

4.1.8 Certification (see Section 18),

4.1.9 ASTM specification designation and year of issue,

4.1.10 End use,

4.1.11 Bar coding (see 19.3),

4.1.12 Packing, Marking, and Loading (see Section 21), and

4.1.13 Special Requirements.

## 5. Process

5.1 The steel shall be made by a commercially available process.

5.2 When steels of different grades are sequentially strand cast, the steel producer shall identify the resultant transition material and remove it using an established procedure that positively separates the grades.

## 6. Manufacture

6.1 HSS shall be made from flat-rolled steel by the electric-resistance-welding process. The longitudinal butt joint of welded tubing shall be welded across its thickness in such a manner that the structural design of the tubing section is assured. No transverse coil splices are permitted in the furnished product.

6.2 Annealing is permissible. If heat treatment is performed, mechanical testing shall be conducted after heat treatment.

6.3 The weld shall not be located within the radius of the corners of any shaped tube unless specified by purchaser.

NOTE 2—Welded HSS is normally furnished without removal of the inside flash.

## 7. Heat Analysis

7.1 Each heat analysis shall conform to the requirements in Table 1.

7.2 The maximum permissible carbon equivalent shall be 0.45 %. The carbon equivalent shall be based upon the heat analysis. The required heat analysis and the carbon equivalent shall be reported. The carbon equivalent shall be calculated using the following formula:

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

## 8. Product Analysis

8.1 When product tests are conducted the HSS shall conform to the requirements of Table 1.

8.2 If product analyses are made, they shall be made using test specimens taken from two lengths of HSS from each lot of 500 lengths, or fraction thereof, or two pieces of flat-rolled stock from each lot of a corresponding quantity of flat-rolled stock. Methods and practices relating to chemical analysis shall be in accordance with Test Methods, Practices, and Terminology A751.

8.3 If both product analyses representing a lot fail to conform to the specified requirements, the lot shall be rejected.

8.4 If only one product analysis representing a lot fails to conform to the specified requirements, product analyses shall be made using two additional test specimens taken from the lot. Both the additional product analyses shall conform to the specified requirements or the lot shall be rejected.

## 9. Tensile Requirements

9.1 The material, as represented by the test specimen, shall conform to the requirements as to tensile properties prescribed in Table 2.

## 10. Flattening Test or Cone Flare Test

10.1 The flattening test or cone flare test shall be made on HSS.

10.2 *Flattening Test*—A test specimen at least 4 in. [100 mm] in length shall be flattened cold between parallel plates in three steps, with the weld located 90° from the line of direction of force. During the first step, which is a test for ductility of the weld, no cracks or breaks on the inside or outside surfaces of the test specimen shall be present until the distance between the plates is less than two-thirds of the specified outside diameter of the tubing. For the second step, no cracks or breaks on the inside or outside parent metal surfaces of the test specimen, except as provided for in 10.4, shall be present until the distance between the plates is less than one-half of the specified outside diameter of the tubing. During the third step, which is a test for soundness, the flattening shall be continued until the test specimen breaks or the opposite walls of the test specimen meet. Evidence of laminated or unsound material or incomplete weld that is revealed during the entire flattening test shall be cause for rejection.

**TABLE 1 Chemical Requirements**

NOTE 1—Where an ellipses (...) appears in the table, requirements have not been defined.

NOTE 2—If material is to be hot-dip galvanized, this shall be listed on the purchase order and the Si content must be reported.

NOTE 3—The steels contain the strengthening elements columbium (niobium), vanadium, titanium, and molybdenum added singly or in combination. The minimum requirements only apply to the microalloy elements selected for strengthening of the steel.

Designation	% Heat Analysis, Element Maximum Unless Otherwise Shown											
	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V	Nb <sup>4</sup>	Ti
Grade 70/80	0.15	1.65	0.02	0.025	...	0.20	0.20	0.15	0.16	0.005 min	0.005 min	0.005 min
Grade 90	0.15	2.00	0.02	0.025	...	0.20	0.20	0.15	0.16	0.005 min	0.005 min	0.005 min
Grade 100/110	0.15	2.00	0.02	0.025	...	0.20	0.20	0.15	0.40	0.005 min	0.005 min	0.005 min

<sup>4</sup>Element 41 has been identified as columbium and niobium. A01 considers them interchangeable and both acceptable. Subcommittee A01.09 has chosen to use niobium.