



Designation: A1001 – 01 (Reapproved 2006)

## Standard Specification for High Strength Steel Castings in Heavy Sections<sup>1</sup>

This standard is issued under the fixed designation A1001; 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 cast alloy steels in the normalized and tempered or quenched and tempered condition, in section sizes through 37 in. (940 mm), suitable for high strain gradient conditions such as those encountered in hooks, shackles, support frames, and other lifting devices. The classes of steel in this specification are weldable only with qualified procedures.

1.2 Section range and class selection will depend on design and service conditions. Users should note that this specification contemplates mechanical property gradients.

1.3 The values stated in 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 must be used independently of the other. Combining values from the two systems may result in non-conformities with the specification. Inch-pound units are applicable for material ordered to this Specification and SI units for material ordered to this Specification.

1.4 If, by agreement, castings are to be supplied in a partially completed condition, that is, all of the provisions of the product specification have not been filled, then the material marking (see Section 15) and certification (see Section 14) are to reflect the extent to which the product specification requirements have been met.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

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

**A609/A609M** Practice for Castings, Carbon, Low-Alloy, and Martensitic Stainless Steel, Ultrasonic Examination Thereof

**A703/A703M** Specification for Steel Castings, General Requirements, for Pressure-Containing Parts

**E94** Guide for Radiographic Examination

**E165** Practice for Liquid Penetrant Examination for General Industry

**E709** Guide for Magnetic Particle Testing

**E1019** Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Various Combustion and Fusion Techniques

**E1447** Test Method for Determination of Hydrogen in Titanium and Titanium Alloys by Inert Gas Fusion Thermal Conductivity/Infrared Detection Method

**E1806** Practice for Sampling Steel and Iron for Determination of Chemical Composition

2.2 *Manufacturers Standardization of the Value and Fittings Industry Standards:*

**MSS SP-55** Quality Standard for Steel Castings – Visual Method<sup>2</sup>

### 3. General Conditions for Delivery

3.1 Materials furnished to this Specification shall conform to the applicable requirements of Specification **A703/A703M**, including the supplementary requirements that are indicated on the purchase order.

3.2 Terminology and test methods shall be in accordance with Test Methods and Definitions **A370**.

3.3 In the case of conflict between requirements of this specification and referenced specifications, the former shall prevail.

### 4. Ordering Information

4.1 It shall be the responsibility of the purchaser to specify all requirements that are necessary for material ordered under this specification. Such requirements to be considered include, but are not limited to, the following:

4.1.1 A description of the casting by pattern number or a fully dimensional and toleranced drawing,

4.1.2 ASTM designation and year of issue,

4.1.3 Section range and class of steel (see **Table 1**),

4.1.4 Definition of inspection methods, extent of examination, frequency, casting quality zones, and acceptance criteria (see Section 11).

4.1.5 Product marking locations (see Section 15),

4.1.6 Certification report options (see Section 14),

4.1.7 Options in the specification (see 1.4 and 11.6), and

4.1.8 The supplementary requirements desired.

<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 A01.18 on Castings.

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<sup>2</sup> Available from Manufacturers Standardization Society of the Valve and Fittings Industry (MSS), 127 Park St., NE, Vienna, VA 22180-4602.

TABLE 1 Required Mechanical Properties

Section Range	Class	Chemistry Grade <sup>A</sup>	Tensile Strength ksi (MPa)		Yield Strength, min ksi (MPa) at 0.2 % Offset		Elongation, 2 in (50 mm) or 4d, min, %		Reduction of Area, min %		Charpy V-Notch, Min Average, ft-lb (J)	
			T/8 <sup>B</sup>	3T/8 <sup>B</sup>	T/8 <sup>B</sup>	3T/8 <sup>B</sup>	T/8 <sup>B</sup>	3T/8 <sup>B</sup>	T/8 <sup>B</sup>	3T/8 <sup>B</sup>	T/8 <sup>B</sup>	3T/8 <sup>B</sup>
1	A	I, II	110 (760)	100 (690)	90 (620)	80 (550)	18	15	36	30	25 (34)	15 (20)
1	B	I	105 (725)	95 (655)	85 (585)	76 (525)	15	11	30	22	25 (34)	15 (20)
1	C	I	90 (620)	80 (550)	70 (485)	63 (435)	17	13	34	26	25 (34)	15 (20)
2	A	I	110 (760)	100 (690)	90 (620)	80 (550)	18	15	36	30	25 (34)	15 (20)
2	B	I	105 (725)	95 (655)	85 (585)	76 (525)	16	12	32	24	25 (34)	15 (20)
2	C	I	90 (620)	80 (550)	70 (485)	63 (435)	18	14	36	28	25 (34)	15 (20)
3	A	I, III	110 (760)	100 (690)	90 (620)	80 (550)	18	15	36	30	25 (34)	15 (20)
3	B	I	105 (725)	95 (655)	85 (585)	76 (525)	17	13	34	26	25 (34)	15 (20)
3	C	I	90 (620)	80 (550)	70 (485)	63 (435)	19	16	38	32	25 (34)	15 (20)
4	A	I, II	110 (760)	100 (690)	90 (620)	80 (550)	18	15	36	30	25 (34)	15 (20)
4	B	I	105 (725)	95 (655)	85 (585)	76 (525)	19	16	38	32	25 (34)	15 (20)
4	C	I	90 (620)	80 (550)	70 (485)	63 (435)	21	18	42	36	25 (34)	15 (20)
5	A	I, II	110 (760)	100 (690)	90 (620)	80 (550)	18	15	36	30	25 (34)	15 (20)
5	B	I	105 (725)	95 (655)	85 (585)	76 (525)	19	16	38	32	25 (34)	15 (20)
5	C	I	90 (620)	80 (550)	70 (485)	63 (435)	21	18	42	36	25 (34)	15 (20)
6	A	I	110 (760)	100 (690)	90 (620)	80 (550)	18	15	36	30	25 (34)	15 (20)
6	B	I	105 (725)	95 (655)	85 (585)	76 (525)	19	16	38	32	25 (34)	15 (20)
6	C	I	90 (620)	80 (550)	70 (485)	63 (435)	21	18	42	36	25 (34)	15 (20)
7	A	I	110 (760)	100 (690)	90 (620)	80 (550)	18	15	36	30	25 (34)	15 (20)
7	B	I	105 (725)	95 (655)	85 (585)	76 (525)	19	16	38	32	25 (34)	15 (20)
7	C	I	90 (620)	80 (550)	70 (485)	63 (435)	21	18	42	36	25 (34)	15 (20)

<sup>A</sup> See 7.1. Chemistry other than these listed can be used if properties are met.

<sup>B</sup> See Fig. 1

5. Test Block Requirements

5.1 The supplier shall produce a minimum of one test block for each heat.

5.2 Test block configuration shall be in accordance with Fig. 1. A standard draft angle is permitted over the length “L” of the test block provided the minimum cylinder diameter is greater than “T” given in Table 2.

5.3 Test block size shall be in accordance with Table 2 for specified section range. The section range selection made by the purchaser (see 4.1.3) should consider casting section size and geometry, service conditions, mechanical property correlations developed by the supplier, or other important factors.

5.4 Tension and Charpy impact tests shall be performed on specimens taken from both the 1/8T and 3/8T locations and shall be oriented within the 8-in. (203-mm) midsection as shown in Fig. 1.

5.5 Oxygen and nitrogen gas content tests shall be performed on specimens taken from the 3/8T location and shall be within the 8 in. (203 mm) midsection as shown in Fig. 1.

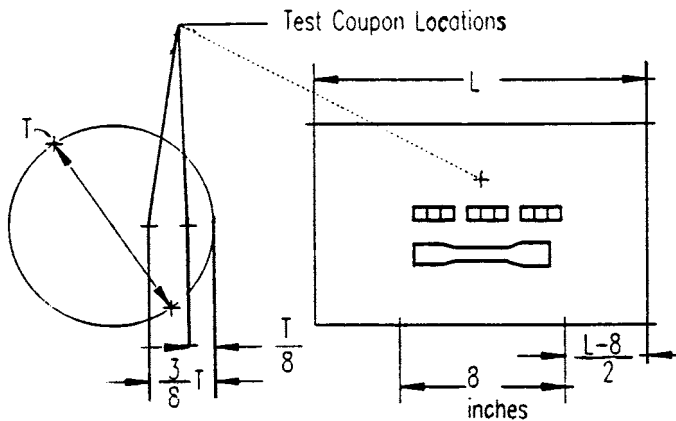


FIG. 1 Test Block Configuration

TABLE 2 Section Range Definition and Test Block Dimensions

Section Range	Section Size, in (mm)		Test Block Dimensions, in (mm) <sup>A</sup>	
	Over	Not Over	T	L
1	3 (76)	5 (127)	4 (102)	8 (203)
2	5 (127)	7 (178)	6 (152)	8 (203)
3	7 (178)	11 (279)	9 (229)	9 (229)
4	11 (279)	15 (381)	13 (330)	13 (330)
5	15 (381)	21 (533)	18 (457)	18 (457)
6	21 (533)	29 (737)	25 (635)	25 (635)
7	29 (737)	37 (940)	33 (813)	33 (813)

<sup>A</sup> See Fig. 1.

6. Materials and Manufacture

6.1 The steel shall be made by electric furnace process with methods to conform to the maximum gas levels given in Table 3. These methods may include a special refining process such as argon-oxygen-decarburization (AOD).

6.2 Heat treatment procedure shall be reported to the purchaser by the supplier for the specified section range, class, and grade.

6.2.1 Multiple austenitizing is permitted.

6.2.2 Multiple tempering is permitted. The minimum final tempering temperature shall not be less than 1100°F (593°C). Post weld heat treatment shall not be less than 1050°F (566°C).

TABLE 3 Maximum Gas Content Levels

Section Range	Nitrogen, ppm	Oxygen, ppm	Oxygen Analysis	Oxygen Analysis
			Tolerance, ppm	Limit, ppm <sup>A</sup>
1	110	100	30	130
2	110	100	30	130
3	100	90	27	117
4	100	90	27	117
5	90	80	24	104
6	80	70	21	91
7	70	60	18	78

<sup>A</sup>Specification compliance level is average value of three determinations, see 10.3