



Standard Specification for High Strength Steel Castings in Heavy Sections¹

This standard is issued under the fixed designation A 1001; 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.

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:

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products²

A 488/A 488M Practice for Steel Castings, Welding, Qualifications of Procedures and Personnel²

A 609/A 609M Practice for Castings, Carbon, Low-Alloy, and Martensitic Stainless Steel, Ultrasonic Examination Thereof²

A 703/A 703M Specification for Steel Castings, General Requirements, for Pressure-Containing Parts²

E 94 Guide for Radiographic Testing³

E 165 Test Method for Liquid Penetrant Examination³

¹ This specification is under the jurisdiction of ASTM Committee A-01 on Steel, Stainless Steel, and Related Alloys and is the direct responsibility of Subcommittee A01.18 on Castings.

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² Annual Book of ASTM Standards, Vol 01.02.

³ Annual Book of ASTM Standards, Vol 03.03.

E 709 Practice for Magnetic Particle Examination³

E 1019 Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen, in Steel and in Iron, Nickel, and Cobalt Alloys⁴

E 1447 Test Method for Determination of Hydrogen in Titanium and Titanium Alloys by the Inert Gas Fusion Thermal Conductivity Method⁴

E 1806 Practice for Sampling Steel and Iron for Determination of Chemical Composition⁴

2.2 ASNT Standard:

SNT-TC-1A Recommended Practice for Non-Destructive Testing Personnel Qualification and Certification⁵

2.3 Manufacturers Standardization of the Value and Fittings Industry Standards:

MSS SP-55 Quality Standard for Steel Castings – Visual Method⁶

3. General Conditions for Delivery

3.1 Materials furnished to this Specification shall conform to the applicable requirements of Specification A 703/A 703M, 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 A 370.

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 Annual Book of ASTM Standards, Vol 03.06.

⁵ Available from American Society for Nondestructive Testing, 1711 Arlingate Plaza, PO Box 28518, Columbus, OH 43228-0518.

⁶ Available from Manufacturers' Standardization Society of the Valve and Fittings Industry, 1815 N. Fort Myer Drive, Arlington, VA 22209.

TABLE 1 Required Mechanical Properties

Section Range	Class	Chemistry Grade ^A	Tensile Strength		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 ^B	3T/8 ^B	T/8 ^B	3T/8 ^B	T/8 ^B	3T/8 ^B	T/8 ^B	3T/8 ^B	T/8 ^B	3T/8 ^B
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)

^A See 7.1. Chemistry other than these listed can be used if properties are met.

^B See Fig. 1

- 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.

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.

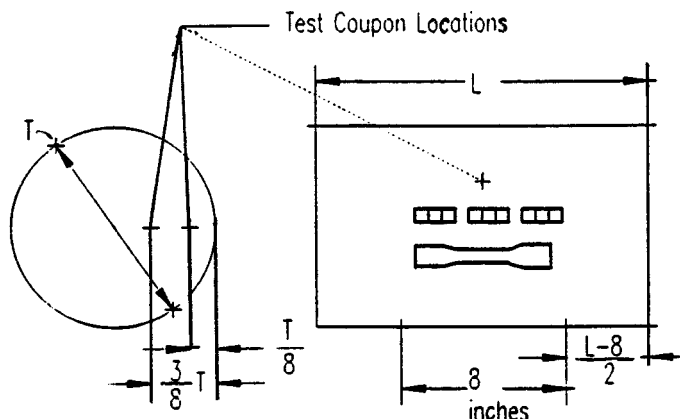


FIG. 1 Test Block Configuration

TABLE 2 Section Range Definition and Test Block Dimensions

Section Range	Section Size, in (mm)		Test Block Dimensions, in (mm) ^A	
	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)

^A See 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.

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.

TABLE 3 Maximum Gas Content Levels

Section Range	Nitrogen, ppm	Oxygen, ppm	Oxygen Analysis Tolerance, ppm	Oxygen Analysis Limit, ppm ^A
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

^A Specification compliance level is average value of three determinations, see 10.3