



Standard Specification for Steel Castings, High Strength, for Structural Purposes¹

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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 carbon steel, alloy steel, and martensitic stainless steel castings that are to be subjected to higher mechanical stresses than those covered in Specification A 27/A 27M.

1.2 Several grades of steel castings are covered, having the chemical composition and mechanical properties prescribed in Table 1 and Table 2.

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 nonconformance with the specification.

2. Referenced Documents

2.1 ASTM Standards:

A 27/A 27M Specification for Steel Castings, Carbon, for General Application²

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products³

A 781/A 781M Specification for Castings, Steel and Alloy, Common Requirements for General Industrial Use²

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁴

3. General Conditions for Delivery

3.1 Material furnished to this specification shall conform to the requirements of Specification A 781/A 781M, including any supplementary requirements that are indicated in the purchase order. Failure to comply with the general requirements of Specification A 781/A 781M constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification A 781/

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² Annual Book of ASTM Standards, Vol 01.02.

³ Annual Book of ASTM Standards, Vol 01.03.

⁴ Annual Book of ASTM Standards, Vol 14.02.

TABLE 1 Chemical Requirements

Grade	Composition, %	
	Sulfur, max	Phosphorus, max
80-40 [550-275]	0.06	0.05
80-50 [550-345]	0.06	0.05
90-60 [620-415]	0.06	0.05
105-85 [725-585]	0.06	0.05
115-95 [795-655]	0.06	0.05
130-115 [895-795]	0.06	0.05
135-125 [930-860]	0.06	0.05
150-135 [1035-930]	0.06	0.05
160-145 [1105-1000]	0.06	0.05
165-150 [1140-1035]	0.020	0.020
165-150L [1140-1035L]	0.020	0.020
210-180 [1450-1240]	0.020	0.020
210-180L [1450-1240L]	0.020	0.020
260-210 [1795-1450]	0.020	0.020
260-210L [1795-1450L]	0.020	0.020

A 781M, this specification shall prevail.

4. Ordering Information

4.1 The inquiry and order should include or indicate the following:

4.1.1 A description of the casting by pattern number or drawing (dimensional tolerances shall be included on the casting drawing),

4.1.2 Grade of steel,

4.1.3 Options in the specification, and

4.1.4 The supplementary requirements desired, including the standards of acceptance.

5. Heat Treatment

5.1 All castings shall be heat treated either by full annealing, normalizing, normalizing and tempering, or quenching and tempering. Unless otherwise specified in the inquiry, contract, or order, the castings may be heat treated by any of these heat treatments or combination of these heat treatments at the option of the manufacturer.

5.2 Heat treatment shall be performed after the castings have been allowed to cool below the transformation range.

6. Temperature Control

6.1 Furnace temperatures for heat-treating shall be regulated

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TABLE 2 Tensile Requirements

Grade	Tensile strength min, ksi [MPa]	Yield point min, ksi [MPa]	Elongation in 2 in. or 50 mm, min, % ^A	Reduction of Area, min, %
80-40 [550-275]	80 [550]	40 [275]	18	30
80-50 [550-345]	80 [550]	50 [345]	22	35
90-60 [620-415]	90 [620]	60 [415]	20	40
105-85 [725-585]	105 [725]	85 [585]	17	35
115-95 [795-655]	115 [795]	95 [655]	14	30
130-115 [895-795]	130 [895]	115 [795]	11	25
135-125 [930-860]	135 [930]	125 [860]	9	22
150-135 [1035-930]	150 [1035]	135 [930]	7	18
160-145 [1105-1000]	160 [1105]	145 [1000]	6	12
165-150 [1140-1035]	165 [1140]	150 [1035]	5	20
165-150L [1140-1035L] ^B	165 [1140]	150 [1035]	5	20
210-180 [1450-1240]	210 [1450]	180 [1240]	4	15
210-180L [1450-1240L] ^B	210 [1450]	180 [1240]	4	15
260-210 [1795-1450]	260 [1795]	210 [1450]	3	6
260-210L [1795-1450L] ^B	260 [1795]	210 [1450]	3	6

^A When ICI test bars are used in tensile testing as provided for in this specification, the gage length to reduced section diameter ratio shall be 4 to 1.

^B These grades must be Charpy impact tested as prescribed in Section 9, and with minimum values as shown in Table 3.

by the use of pyrometers.

7. Chemical Composition

7.1 The steel shall conform to sulfur and phosphorus requirements as prescribed in Table 1.

7.2 The content of carbon, manganese, silicon, and alloying elements may, by agreement, be prescribed by the purchaser. If not specified, the content may be selected by the manufacturer to obtain the required mechanical properties.

7.3 When the analysis of carbon, manganese, silicon, or any intentionally added alloying element is specifically requested in the contract or order, it shall be made by the manufacturer and reported to the purchaser. The results of these analyses shall not be used as a basis for rejection except by prior agreement.

8. Tensile Requirements

8.1 One tension test shall be made from each heat and shall conform to the tensile requirements specified in Table 2.

8.2 The test coupons and specimens shall conform to requirements specified in Section 11.

8.3 Tension test coupons shall be machined to the form and dimension shown in Fig. 5 of Test Methods and Definitions A 370 and tested in accordance with those test methods.

8.4 To determine conformance with the tension test requirements, an observed value or calculated value shall be rounded off in accordance with Practice E 29 to the nearest 500 psi [5 MPa] for yield point and tensile strength and to the nearest 1 % for elongation and reduction of area.

9. Charpy Impact Requirements

9.1 This section is applicable only to grades 165-150L [1140-1035L], 210-180L [1450-1240L], and 260-210L [1795-1450L].

NOTE 1—Other grades may be ordered to Charpy impact test requirements in accordance with Supplementary Requirement S9 of Specification A 781/A 781M.

9.2 The notched bar impact properties of each heat shall be determined by testing one set of three Charpy V-notch impact

specimens at $-40^{\circ} \pm 2^{\circ}\text{F}$ [$-40^{\circ} \pm 1^{\circ}\text{C}$]. The energy value of the three specimens shall not be less than shown in Table 3.

9.3 Test coupons and specimens shall conform to the requirements specified in Section 11.

9.4 Impact test specimens shall be machined to the form and dimensions shown in Test Methods and Definitions A 370, Type A, Charpy V-notch specimen, Fig. 11, and tested in accordance with those test methods.

10. Retests

10.1 If the results of the tensile or Charpy tests do not conform to the requirements specified, heat-treated castings may, at the manufacturer's option, be reheat treated. Testing after reheat treatment shall consist of the full number of specimens complying with the specification or order.

11. Test Coupons and Specimens

11.1 Test bars shall be poured from the same heat as the castings represented. Test coupons may be cast integrally with the castings or as separate blocks similar to those shown in Fig. 1 of Specification A 781/A 781M.

11.1.1 In the case of quenched and tempered castings where the ruling section of the casting exceeds three inches, supplementary requirement S 15 of Specification A 781/A 781M shall apply.

11.2 The bar from which the test piece is taken shall be heat treated in production furnaces with the castings or to the same procedure as the castings it represents.

TABLE 3 Impact Requirements

Grade	165-150L [1140-1035L]	210-180L [1450-1240L]	260-210L [1795-1450L]
Impact Requirements	20 [27]	15 [20]	6 [8]
Charpy V-notch			
Energy value, ft-lbf [J], min value for two specimens and minimum average of three specimens			
Energy value, ft-lbf [J], min for single specimen	16 [22]	12 [16]	4 [5]