Designation: A148/A148M – 24

Standard Specification for Steel Castings, High Strength, for Structural Purposes[1]

This standard is issued under the fixed designation A148/A148M; 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.

This standard has been approved for use by agencies of the U.S. 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 A27/A27M.

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

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

1.3.1 Within the text, the SI units are shown in brackets.

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

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A27/A27M Specification for Steel Castings, Carbon, for General Application

A781/A781M Specification for Castings, Steel and Alloy, Common Requirements, for General Industrial Use

A957/A957M Specification for Investment Castings, Steel and Alloy, Common Requirements, for General Industrial Use

3. General Conditions for Delivery

3.1 Except for castings produced by the investment casting process, material furnished to this specification shall conform to the requirements of Specification A781/A781M, including any supplementary requirements that are indicated in the purchase order. Failure to comply with the general requirements of Specification A781/A781M constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification A781/A781M, this specification shall prevail.

3.2 Investment castings furnished to this specification shall conform to the requirements of Specification A957/A957M, including any supplementary requirements that are indicated in the purchase order. Failure to comply with the general requirements of Specification A957/A957M constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification A957/A957M, Specification A957/A957M 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.

4.1.5 In the case of quench and tempered castings the ruling section, T.

5. Heat Treatment

5.1 All castings shall be heat treated either by 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.

[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 A01.18 on Castings.

Current edition approved July 1, 2024. Published July 2024. Originally approved in 1955. Last previous edition approved in 2020 as A148/A148M – 20. DOI: 10.1520/A0148_A0148M-24.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard**

TABLE 1 Chemical Composition Requirements[A]

Grade (UNS Number)	Element, %	
	Phosphorus	Sulfur
80-40 [550-275] (D50400)	0.05	0.06
80-50 [550-345] (D50500)	0.05	0.06
90-60 [620-415] (D50600)	0.05	0.06
105-85 [725-585] (D50850)	0.05	0.06
115-95 [795-655] (D50950)	0.05	0.06
130-115 [895-795] (D51150)	0.05	0.06
135-125 [930-860] (D51250)	0.05	0.06
150-135 [1035-930] (D51350)	0.05	0.06
160-145 [1105-1000] (D51450)	0.05	0.06
165-150 [1140-1035] (D51500)	0.020	0.020
165-150L [1140-1035L] (D51501)	0.020	0.020
210-180 [1450-1240] (D51800)	0.020	0.020
210-180L [1450-1240L] (D51801)	0.020	0.020
260-210 [1795-1450] (D52100)	0.020	0.020
260-210L [1795-1450L] (D52101)	0.020	0.020

[A] All values are maximums.

TABLE 2 Tensile Requirements[A]

Grade	Tensile strength, ksi [MPa]	Yield Strength, ksi [MPa][B]	Elongation in 2 in. or 50 mm, %	Reduction of Area, %
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]	165 [1140]	150 [1035]	5	20
210-180 [1450-1240]	210 [1450]	180 [1240]	4	15
210-180L [1450-1240L]	210 [1450]	180 [1240]	4	15
260-210 [1795-1450]	260 [1795]	210 [1450]	3	6
260-210L [1795-1450L]	260 [1795]	210 [1450]	3	6

[A] All values are minimums.
[B] Determine by the 0.2 % offset method.

6. Temperature Control

6.1 Furnace temperatures for heat treating shall be regulated 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. Tension Testing Requirements

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

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 A781/A781M.

9.2 The impact properties of each heat, for investment castings, each master heat, shall be determined by testing one set of three Charpy V-notch impact specimens at –40 ± 2 °F [–40 ± 1 °C]. The energy value of the three specimens shall not be less than shown in Table 3.

TABLE 3 Charpy V-Notch Impact Requirements

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