Designation: A958/A958M – 17

Standard Specification for Steel Castings, Carbon and Alloy, with Tensile Requirements, Chemical Requirements Similar to Standard Wrought Grades[1]

This standard is issued under the fixed designation A958/A958M; 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 carbon and low-alloy steel castings having chemical analyses similar to that of the standard wrought grades.

1.2 Several classes are covered and are designated by chemical composition as shown in Table 1.

1.3 Options for tensile properties are shown in Tables 2 and 3.

1.4 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.

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

1.5 *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]

A488/A488M Practice for Steel Castings, Welding, Qualifications of Procedures and Personnel

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 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 Steel 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 Orders for material under this specification should include the following information:

4.1.1 Quantity,

4.1.2 Specification, including year and date of issue,

4.1.3 Grade and class of steel,

4.1.4 Description of the casting by pattern number or drawing (Dimensional tolerances should be included on the casting drawing.),

4.1.5 Options in the specification, and

4.1.6 Supplementary requirements desired, including standards of acceptance.

5. Heat Treatment

5.1 All castings shall receive a heat treatment indicated in Table 4. Preliminary heat treatment prior to final heat treatment as well as multiple tempering is permitted.

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 May 1, 2017. Published May 2017. Originally approved in 1996. Last previous edition approved in 2015 as A958 – 15. DOI: 10.1520/A0958_A0958M-17.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. 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, Weight Percent

NOTE 1—Values are maximum unless a range is given.

Grade	C	Mn	P	S	Si	Ni	Cr	Mo
SC 1020	0.18/0.23	0.40/0.80	0.040	0.040	0.30/0.60	-	-	-
SC 1025	0.22/0.28	0.40/0.80	0.040	0.040	0.30/0.60	-	-	-
SC 1030	0.28/0.34	0.50/0.90	0.040	0.040	0.30/0.60	-	-	-
SC 1040	0.37/0.44	0.50/0.90	0.040	0.040	0.30/0.60	-	-	-
SC 1045	0.43/0.50	0.50/0.90	0.040	0.040	0.30/0.60	-	-	-
SC 4130	0.28/0.33	0.40/0.80	0.035	0.040	0.30/0.60	-	0.80/1.10	0.15/0.25
SC 4140	0.38/0.43	0.70/1.10	0.035	0.040	0.30/0.60	-	0.80/1.10	0.15/0.25
SC 4330	0.28/0.33	0.60/0.90	0.035	0.040	0.30/0.60	1.65/2.00	0.70/0.90	0.20/0.30
SC 4340	0.38/0.43	0.60/0.90	0.035	0.040	0.30/0.60	1.65/2.00	0.70/0.90	0.20/0.30
SC 8620	0.18/0.23	0.60/1.00	0.035	0.040	0.30/0.60	0.40/0.70	0.40/0.60	0.15/0.25
SC 8625	0.23/0.28	0.60/1.00	0.035	0.040	0.30/0.60	0.40/0.70	0.40/0.60	0.15/0.25
SC 8630	0.28/0.33	0.60/1.00	0.035	0.040	0.30/0.60	0.40/0.70	0.40/0.60	0.15/0.25

TABLE 2 Tensile Requirements

Class	65/35	70/36	80/40	80/50	90/60	105/85	115/95	130/115	135/125	150/135	160/145	165/150	210/180
Tensile, ksi Tensile, min. (MPa)	65 [450]	70 [485]	80 [550]	80 [550]	90 [620]	105 [725]	115 [795]	130 [895]	135 [930]	150 [1035]	160 [1105]	165 [1140]	210 [1450]
Yield, ksi Yield, min. (MPa)	35 [240]	36 [250]	40 [275]	50 [345]	60 [415]	85 [585]	95 [655]	115 [795]	125 [860]	135 [930]	145 [1000]	150 [1035]	180 [1240]
Elongation in 2 in. or 50 mm, min, %	24	22	18	22	18	17	14	11	9	7	6	5	4
Reduction of Area, min. %	35	30	30	35	35	35	30	25	22	18	12	10	8

TABLE 3 Tensile Requirements/Grade Suitability

Class	65/35	70/36	80/40	80/50	90/60	105/85	115/95	130/115	135/125	150/135	160/145	165/150	210/180
Grade													
SC 1020	X[A]	X											
SC 1025	X	X											
SC 1030	X	X	X	X									
SC 1040	X[B]	X	X	X	X								
SC 1045	X[B]	X[B]	X	X	X	X	X						
SC 4130	X[B]	X[B]	X	X	X	X	X	X	X	X			
SC 4140	X[B]	X[B]	X[B]	X[B]	X	X	X	X	X	X	X	X	
SC 4330	X[B]	X[B]	X[B]	X[B]	X	X	X	X	X	X	X	X	X
SC 4340	X[B]	X[B]	X[B]	X[B]	X[B]	X	X	X	X	X	X	X	X
SC 8620	X[B]	X[B]	X	X	X	X	X						
SC 8625	X[B]	X[B]	X	X	X	X	X	X	X				
SC 8630	X[B]	X[B]	X	X	X	X	X	X	X	X			

[A] "X" denotes that the properties may be achieved by at least one of the heat treatments referenced in 5. The effect of section thickness should be considered in making grade selections. The heat treatment requirements do not imply that all section thicknesses will be through hardened.
[B] These grades significantly exceed the minimum strength levels; therefore, they may be unsuitable for use due to weldability, and machinability issues.

5.3 The furnace temperature for heat treating shall be effectively controlled by the use of recording-type pyrometers.

6. Chemical Composition

6.1 The steel shall conform to the requirements of chemical composition as prescribed in Table 1.

6.2 The product analysis tolerances given in Specification A781/A781M, or for investment castings, Specification A957/A957M, shall apply to all product analyses performed on castings supplied to this specification.

7. Tensile Requirements

7.1 One tension test shall be made from each heat, for investment castings, each master heat, and shall conform to the tensile requirements specified for the grade selected in Tables 2 and 3.

8. Repair by Welding

8.1 Repairs shall be made using procedures and welders qualified in accordance with Practice A488/A488M.

8.2 Repair welds shall be inspected to the same quality standards that are used to inspect the castings. When castings are produced with Supplementary Requirement S1 specified, weld repairs shall be inspected by magnetic particle examination to the same standards that are used to inspect the castings. When castings are produced with Supplementary S2 or S4, or both, as specified, weld repairs in which the depth of the cavity prepared for weld repair exceeds 20 % of the wall thickness or 1 in. [25 mm], whichever is smaller, or in which the cavity prepared for welding is greater than approximately 10 in.^{2} [65 cm^2], shall be radiographed or ultrasonically tested, or both, to the same standards that are used to inspect the castings.

TABLE 4 Heat Treatment

NOTE 1—The effect of section thickness should be considered in making grade selections. The heat treatment requirements do not imply that all section thicknesses will be through hardened.

NOTE 2—Post-weld heat treatment must be at or below the final tempering temperature.

NOTE 3—Following quenching the castings must be cooled below 500 °F [260 °C] prior to tempering.

Grade	Class	Austenitizing Temperature, min, °F [°C]	Media	Tempering Temperature, min,° F [°C]
SC1020	65/35	1700 [925]	A[A]	–
	70/36	1700 [925]	A	–
SC1025	65/35	1700 [925]	A	–
	70/36	1700 [925]	A	–
SC1030	65/35	1650 [900]	A	–
	70/36	1650 [900]	A	1100 [595]
	80/40	1650 [900]	L[A]	1100 [595]
	80/50	1650 [900]	L	1100 [595]
SC1040	65/35[B]	1650 [900]	A	1150 [621]
	70/36	1650 [900]	A	1150 [621]
	80/40	1650 [900]	A	1150 [621]
	80/50	1650 [900]	A	1100 [595]
	90/60	1650 [900]	A	1100 [595]
SC1045	65/35[B]	1600 [870]	A	1150 [621]
	70/36[B]	1600 [870]	A	1150 [621]
	80/40	1600 [870]	A	1150 [621]
	80/50	1600 [870]	A	1150 [621]
	90/60	1600 [870]	A	1100 [595]
	105/85	1600 [870]	A	1100 [595]
	115/95	1600 [870]	A	1050 [565]
SC4130	65/35[B]	1650 [900]	A	1200 [650]
	70/36[B]	1650 [900]	A	1200 [650]
	80/40	1650 [900]	A	1200 [650]
	80/50	1650 [900]	A	1200 [650]
	90/60	1650 [900]	A or L	1150 [621]
	105/85	1650 [900]	L	1100 [595]
	115/95	1650 [900]	L	1100 [595]
	130/115	1650 [900]	L	1000 [538]
	135/125	1650 [900]	L	1000 [538]
	150/135	1650 [900]	L	1000 [538]
SC4140	65/35[B]	1600 [870]	A	1200 [650]
	70/36[B]	1600 [870]	A	1200 [650]
	80/40[B]	1600 [870]	A	1200 [650]
	80/50[B]	1600 [870]	A	1150 [621]
	90/60	1600 [870]	A	1150 [621]
	105/85	1600 [870]	A or L	1150 [621]
	115/95	1600 [870]	L	1050 [566]
	130/115	1600 [870]	L	1000 [538]
	135/125	1600 [870]	L	1000 [535]
	150/135	1600 [870]	L	950 [510]
	160/145	1600 [870]	L	950 [510]
	165/150	1600 [870]	L	950 [510]
SC4330	65/35[B]	1650 [870]	A	1200 [650]
	70/36[B]	1650 [870]	A	1200 [650]
	80/40[B]	1650 [870]	A	1200 [650]
	80/50[B]	1650 [870]	A	1200 [650]
	90/60	1650 [870]	A or L	1150 [620]
	105/85	1650 [870]	L	1100 [595]
	115/95	1650 [870]	L	1100 [595]
	130/115	1650 [870]	L	1000 [535]
	135/125	1650 [870]	L	1000 [535]
	150/135	1650 [870]	L	1000 [535]
	160/145	1650 [870]	L	950 [510]
	165/150	1650 [870]	L	950 [510]
	210/180	1650 [870]	L	900 [482]
SC4340	65/35[B]	1600 [870]	A	1200 [650]
	70/36[B]	1600 [870]	A	1200 [650]
	80/40[B]	1600 [870]	A	1200 [650]
	80/50[B]	1600 [870]	A	1150 [620]

TABLE 4 *Continued*

Grade	Class	Austenitizing Temperature, min, °F [°C]	Media	Tempering Temperature, min,° F [°C]
	90/60[B]	1600 [870]	A	1150 [620]
	105/85	1600 [870]	A	1150 [620]
	115/95	1600 [870]	A or L	1050 [565]
	130/115	1600 [870]	L	1000 [535]
	135/125	1600 [870]	L	1000 [535]
	150/135	1600 [870]	L	950 [510]
	160/145	1600 [870]	L	950 [510]
	165/150	1600 [870]	L	950 [510]
	210/180	1600 [870]	L	900 [480]
SC8620	65/35[B]	1700 [925]	A	1200 [650]
	70/36[B]	1700 [925]	A	1200 [650]
	80/40	1700 [925]	A	1150 [620]
	80/50	1700 [925]	A or L	1150 [620]
	90/60	1700 [925]	L	1150 [620]
	105/85	1700 [925]	L	1100 [595]
	115/95	1700 [925]	L	1050 [565]
SC8625	65/35[B]	1700 [925]	A	1200 [650]
	70/36[B]	1700 [925]	A	1200 [650]
	80/40	1700 [925]	A or L	1150 [620]
	80/50	1700 [925]	A or L	1150 [620]
	90/60	1700 [925]	A or L	1150 [620]
	105/85	1700 [925]	L	1100 [595]
	115/95	1700 [925]	L	1100 [595]
	130/115	1700 [925]	L	1100 [595]
	135/125	1700 [925]	L	1050 [565]
SC8630	65/35[B]	1650 [900]	A	1200 [650]
	70/36[B]	1650 [900]	A	1200 [650]
	80/40	1650 [900]	A	1150 [620]
	80/50	1650 [900]	A	1150 [620]
	90/60	1650 [900]	A or L	1150 [620]
	105/85	1650 [900]	L	1100 [595]
	115/95	1650 [900]	L	1100 [595]
	130/115	1650 [900]	L	1100 [595]
	135/125	1650 [900]	L	1050 [565]
	150/135	1650 [900]	L	1050 [565]

[A] A = air cool (normalize).
L = Liquid quench. (Steels with carbon levels of 0.33 % and higher may exhibit cracks when quenched in water).
[B] These grades are likely to significantly exceed the minimum strength levels, therefore, problems may be experienced when trying to produce castings to low hardness values.

8.3 For all classes of Grades SC1020, SC1025, and SC1030, welds exceeding 20 % of the wall thickness or 1 in. [25 mm], whichever is smaller, or exceeding approximately 10 in.^{2} [65 cm^2] in area, shall be thermally stress-relieved or completely reheat-treated. All other grades and classes shall be thermally stress-relieved or completely reheat-treated following any repair welds.

9. Test Coupons and Specimens

9.1 Test bars shall be poured from the same heat, for investment castings, the same master heat, as the castings represented.

9.2 When the bar from which the test piece is taken is not heat treated as part of the same heat-treatment load as the casting(s) it qualifies, the austenitizing temperatures for the bar shall be within 25 °F [15 °C] of those for the casting(s). The tempering temperature for the bar shall be no higher than 25 °F [15 °C] above that of the casting(s) and no higher than that permitted by the heat-treatment procedure for the material. The cycle time at each temperature shall not exceed that for the casting(s).

9.3 Test specimens may be cut from heat-treated castings at the producer's option, instead of from test bars.

9.4 If the results of the mechanical tests for any heat or lot or casting do not conform to the requirements agreed upon, retests are permitted in accordance with the applicable common requirements standard, either Specification A781/A781M or for investment castings, Specification A957/A957M, and their associated standards. At the manufacturer's option, castings may be reheat-treated and retested. Testing after reheat-treatment shall consist of the full number of specimens taken from locations complying with the specification or order.

SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements shall not apply unless specified in the purchase order. A list of standardized supplementary requirements for use at the option of the purchaser are included in Specifications A781/A781M and A957/A957M. Those which are ordinarily considered suitable for use with this specification are given as follows together with additional supplementary requirements that are applicable only to this specification. Other supplementary requirements enumerated in Specifications A781/A781M and A957/A957M may be used with this specification upon agreement between the manufacturer and the purchaser.

S1. Magnetic Particle Examination
S2. Radiographic Examination
S4. Ultrasonic Examination
S5. Examination of Weld Preparation
S6. Certification
S7. Prior Approval of Major Weld Repairs
S8. Marking
S9. Charpy Impact Test
S10. Hardness Test
S12. Test Report
S13. Unspecified Elements
S14. Tension Test from Casting
S15. Alternate Tension Test Coupons

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A958/A958M – 15) that may impact the use of this standard. (Approved May 1, 2017.)

(1) Deleted Specification A1067/A1067M from Section 2 and subsection 9.1.
(2) Deleted Practice E29 from Section 2.
(3) Deleted subsection 7.2.

Committee A01 has identified the location of selected changes to this standard since the last issue (A958/A958M – 14) that may impact the use of this standard. (Approved Dec. 1, 2015.)

(1) Deleted Test Method A370 from Section 2.
(2) Added Specification A1067/A1067M to Section 2.
(3) Inserted phrases in 6.2, 7.1, and 9.1 to address production of investment castings using this specification.
(4) Deleted 7.2, as it is covered the common requirements standards.
(5) Replaced obsolete reference to Fig. 1 of Specification A781/A781M with Specification A1067/A1067M in 9.1.
(6) Replaced reference to Test Method A370 in 9.4 (previously 9.5) with appropriate references to the common requirements standards.
(7) Deleted 9.2, since this is provided for in the common requirements standards.
(8) Deleted original 9.4, as this is provided for in the common requirements standards.
(9) Added appropriate references to Specification A957/A957M to the introductory paragraph of the Supplementary Requirements.
(10) Renumbered paragraphs as necessary.