



Designation: A27/A27M – 20

Standard Specification for Steel Castings, Carbon, for General Application¹

This standard is issued under the fixed designation A27/A27M; 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 castings for general applications that require up to 70 ksi (485 MPa) minimum tensile strength.

NOTE 1—The grades covered by this specification represent materials that are suitable for assembly with other steel castings or wrought steel parts by fusion welding. It is not intended to imply that all these grades possess the same degree of weldability or that the same welding techniques can be used on all castings. It is the responsibility of the purchaser to establish for himself a suitable welding technique.

1.2 Several grades and two classes of steel castings are covered, as indicated below. The grade and class desired shall be specified by the purchaser.

1.2.1 *Grade N-1*—Chemical analysis only.

1.2.2 *Grade N-2*—Heat treated but not mechanically tested.

1.2.3 *Grade U-60-30* [415-205]—Mechanically tested but not heat treated.

1.2.4 *Grades 60-30* [415-205], *65-35* [450-240], *70-36* [485-250], and *70-40* [485-275]—Heat treated and mechanically tested.

1.2.5 Class 1 and Class 2 steel castings shall be specified in accordance with 9.2.

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.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standard-*

ization 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

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 steel investment castings, 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 the specification. In case of a 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 common 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 in proper sequence.

4.1.1 Quantity,

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, 2020. Published May 2020. Originally approved in 1901. Last previous edition approved in 2019 as A27/A27M – 19. DOI: 10.1520/A0027_A0027M-20.

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

4.1.2 Specification, grade (1.2), and class (9.2),

4.1.3 Description of the casting by pattern number or drawing,

4.1.4 Options in the specification, and

4.1.5 Supplementary requirements desired, including standards of acceptance.

5. Heat Treatment

5.1 All castings of Grades N-2, 60-30 [415-205], 65-35 [450-240], 70-36 [485-250], and 70-40 [485-275] shall be heat treated 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 one or combination of these heat treatments at the option of the manufacturer.

5.1.1 Heat treatment shall be performed after castings have been allowed to cool from the pouring temperature to below the transformation range.

5.2 Furnace temperatures for heat treating shall be regulated by the use of pyrometers.

6. Chemical Composition

6.1 The steel shall conform to the requirements as to chemical composition prescribed in Table 1. Product analysis tolerances shall conform to the Product Analysis Tolerances shown in Specification A781/A781M or Specification A957/A957M. When residual element chemical content is of interest to the purchaser, S54 may be considered.

7. Tensile Properties

7.1 Except for Grades N-1 and N-2, one tension test shall be performed on each heat and the mechanical properties shall conform to the requirements specified in Table 2.

7.2 Test coupons may be cut from the heat-treated (if required) castings at the producer's option.

8. Retests

8.1 If any specimen is machined improperly or if flaws are revealed by machining or during testing, the specimen may be discarded and another substituted from the same heat.

8.2 At the manufacturer's option, castings may be reheat treated and retested. When castings are reheat treated, they may not be re-austenitized more than three times without the approval of the purchaser. Testing after reheat treatment shall consist of the full number of specimens taken from locations complying with the specification or order.

9. Rework and Retreatment

9.1 All welds shall be inspected to the same quality standards as were used to inspect the casting.

9.2 If post-weld heat treatment is required, Class 1 must be specified along with the grade, and the welds to be heat treated must be defined. If post-weld heat treatment is not required, Class 2 must be specified along with the grade.

10. Keywords

10.1 castings; general application; steel

TABLE 1 Chemical Composition Requirements^A

Grade (UNS Number) ^B	Element, %				
	Carbon ^C	Manganese ^C	Phosphorus	Sulfur	Silicon
N-1 (J02500)	0.25	0.75	0.035	0.035	0.80
N-2 (J03500)	0.35	0.60	0.035	0.035	0.80
U-60-30 [415-205] (J02500)	0.25	0.75	0.035	0.035	0.80
60-30 [415-205] (J03000)	0.30	0.60	0.035	0.035	0.80
65-35 [450-240] (J03001)	0.30	0.70	0.035	0.035	0.80
70-36 [485-250] (J03501)	0.35	0.70	0.035	0.035	0.80
70-40 [485-275] (J02501)	0.25	1.20	0.035	0.035	0.80

^A All values are maximums.

^B Specify Class 1 or Class 2 in addition to grade designation (see 9.2).

^C For each reduction of 0.01 % carbon below the maximum specified, an increase of 0.04 % manganese above the maximum specified will be permitted to a maximum of 1.40 % for Grade 70-40 [485-275] and 1.00 % for the other grades.

TABLE 2 Tensile Requirements^A

Grade ^B	Tensile Strength, ksi (MPa)	Yield Strength, ksi (MPa) ^C	Elongation in 2 in. (50 mm), % ^D	Reduction of Area, %
U-60-30 (415-205)	60 (415)	30 (205)	22	30
60-30 (415-205)	60 (415)	30 (205)	24	35
65-35 (450-240)	65 (450)	35 (240)	24	35
70-36 (485-250)	70 (485)	36 (250)	22	30
70-40 (485-275) ^E	70 (485)	40 (275)	22	30

^A All values are minimums.

^B Specify Class 1 or Class 2 in addition to grade designation (see 9.2).

^C Determine by the 0.2 % offset method.

^D 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.

^E Grade 70-40 [485-275] may be used to meet the requirement of Grade 70-36 [485-250], when agreed upon between the manufacturer and the purchaser.

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 is included in Specification **A781/A781M** for sand castings, or in Specification **A957/A957M** for investment castings. Those which are ordinarily considered suitable for use with this specification are given below. Others enumerated in Specification **A781/A781M** or in Specification **A957/A957M** may be used with this specification upon agreement between the manufacturer and purchaser.

S1. Magnetic Particle Examination

S2. Radiographic Examination

S3. Liquid Penetrant Examination

S4. Ultrasonic Examination

S6. Certification

S8. Marking

S9. Charpy Impact Test

S10. Hardness Test

S12. Test Report

S13. Unspecified Elements

S14. Tension Test from Castings

S51. Permissible Variations in Dimensional Tolerances for Castings Made from Mounted Patterns

S51.1 Tolerances for commercial steel castings (S51.1.1) made from mounted patterns and the surfaces that are not to be machined shall be in accordance with **Table S51.1**. Metal match plate patterns and precise molding methods can produce closer tolerances than the values shown in **Table S51.1**. Complex casting designs may require different permissible variations than those listed in **Table S51.1**.

TABLE S51.1 Normally Expected Deviation of Linear Casting Dimensions from Design Dimensions

Blueprint Dimension, in. (mm)	Tolerances, in. (mm)	
Up to 3 (75), incl	+ ⁺ / ₃₂ (3)	- ⁻ / ₃₂ (2)
Over 3 to 7 (75 to 175), incl	+ ⁺ / ₃₂ (4)	- ⁻ / ₃₂ (3)
Over 7 to 20 (175 to 500), incl	+ ⁺ / ₃₂ (5)	- ⁻ / ₃₂ (4)
Over 20 to 100 (500 to 2500), incl	+ ⁺ / ₃₂ (6)	- ⁻ / ₃₂ (5)

S51.1.1 The term “commercial castings” does not cover castings requiring special fixtures for gaging, or finishing castings by grinding to special tolerance gages beyond the normal requirements as listed in **Table S51.1**.

S52. Gate and Riser Projections for Castings Made from Mounted Patterns

S52.1 Castings shall have gates and risers removed in such a manner that no riser or gate stub projects or a depression is made beyond or below the casting design contour in an amount that would exceed the values given in **Table S52.1**.

TABLE S52.1 Gate and Riser Projection Tolerances

Riser or Gate Maximum Dimension, in. (mm)	Maximum Projection, in. (mm)	Maximum Depression, in. (mm)
Up to 4 (100), incl	¹ / ₈ (3)	¹ / ₈ (3)
Over 4 to 8 (100 to 200), incl	¹ / ₄ (6)	¹ / ₈ (3)
Over 8 to 20 (200 to 500), incl	³ / ₈ (10)	¹ / ₈ (3)
Over 20 to 30 (500 to 750), incl	¹ / ₂ (13)	¹ / ₄ (6)
Over 30 (750)	³ / ₄ (19)	¹ / ₄ (6)