



Designation: ~~A487/A487M – 93 (Reapproved 2012)~~ A487/A487M – 14

Standard Specification for Steel Castings Suitable for Pressure Service¹

This standard is issued under the fixed designation A487/A487M; 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-~~Scope~~*

1.1 This specification² covers low-alloy steels and martensitic stainless steels in the normalized and tempered, or quenched and tempered, condition suitable for pressure-containing parts. The weldability of the classes in this specification varies from readily weldable to weldable only with adequate precautions, and the weldability of each class should be considered prior to assembly by fusion welding.

1.2 Selection will depend on design, mechanical, and service conditions. Users should note that hardenability of some of the grades mentioned may restrict the maximum size at which the required mechanical properties are obtained.

1.3 The values stated in either ~~inch-pound~~SI units or ~~SI~~inch-pound 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~~may not be exact equivalents; therefore, each system ~~must~~shall be used independently of the other. Combining values from the two systems may result in ~~nonconformance with the specification.~~nonconformance with the standard. ~~A487 and SI units for material ordered to Specification A487M.~~

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

2. Referenced Documents

2.1 *ASTM Standards*:³

[A370 Test Methods and Definitions for Mechanical Testing of Steel Products](#)

[A488/A488M Practice for Steel Castings, Welding, Qualifications of Procedures and Personnel](#)

[A703/A703M Specification for Steel Castings, General Requirements, for Pressure-Containing Parts](#)

[A985/A985M Specification for Steel Investment Castings General Requirements, for Pressure-Containing Parts](#)

[E165 Practice for Liquid Penetrant Examination for General Industry](#)

[E709 Guide for Magnetic Particle Testing](#)

2.2 *American Society of Mechanical Engineers*:⁴

[ASME Boiler and Pressure Vessel Code, Section IX](#)

2.3 *Manufacturers Standardization Society of the Valve and Fittings Industry Standards*:⁵

[SP-55 Quality Standard for Steel Castings-Visual Method](#)

3. General Conditions for Delivery

3.1 ~~Material~~Except for investment castings, castings furnished to this specification shall conform to the requirements of Specification [A703/A703M](#) including any supplementary requirements that are indicated in the purchase order. Failure to comply with the general requirements of Specification [A703/A703M](#) constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification [A703/A703M](#), this specification shall prevail.

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.

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² For ASME Boiler and Pressure Vessel Code applications see related Specifications SA-487 in Section II of that code.

³ 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.

⁴ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, ThreeTwo Park Ave., New York, NY 10016-5990, http://www.asme.org.

⁵ Available from Manufacturers Standardization Society of the Valve and Fittings Industry (MSS), 127 Park St., NE, Vienna, VA 22180-4602, http://www.mss-hq.com.

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



3.2 Investment castings furnished to this specification shall conform to the requirements of Specification **A985/A985M** including any supplementary requirements that are indicated in the purchase order. Failure to comply with the general requirements of Specification **A985/A985M** constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification **A985/A985M**, Specification **A985/A985M** 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 ASTM designation and year of issue,
- 4.1.3 Grade and class of steel,
- 4.1.4 Options in the specification, and
- 4.1.5 The supplementary requirements desired including the standard of acceptance.

5. Heat Treatment

5.1 All castings shall receive a heat treatment indicated in **Table 1**. Preliminary heat treatment prior to final heat treatment as

TABLE 1 Heat Treat Requirement

Grade	Class	Austenitizing Temperature, min, °F [°C]	Media ^A	Quenching Cool Below °F [°C]	Tempering Temperature, °F [°C] ^B
1	A	1600 [870]	A	450 [230]	1100 [595]
1	B	1600 [870]	L	500 [260]	1100 [595]
1	C	1600 [870]	A or L	500 [260]	1150 [620]
2	A	1600 [870]	A	450 [230]	1100 [595]
2	B	1600 [870]	L	500 [260]	1100 [595]
2	C	1600 [870]	A or L	500 [260]	1150 [620]
4	A	1600 [870]	A or L	500 [260]	1100 [595]
4	B	1600 [870]	L	500 [260]	1100 [595]
4	C	1600 [870]	A or L	500 [260]	1150 [620]
4	D	1600 [870]	L	500 [260]	1150 [620]
4	E	1600 [870]	L	500 [260]	1100 [595]
6	A	1550 [845]	A	500 [260]	1100 [595]
6	B	1550 [845]	L	500 [260]	1100 [595]
7	A	1650 [900]	L	600 [315]	1100 [595]
8	A	1750 [955]	L	500 [260]	1250 [675]
8	B	1750 [955]	L	500 [260]	1250 [675]
8	C	1750 [955]	L	500 [260]	1250 [675]
9	A	1600 [870]	A or L	500 [260]	1100 [595]
9	B	1600 [870]	L	500 [260]	1100 [595]
9	C	1600 [870]	A or L	500 [260]	1150 [620]
9	D	1600 [870]	L	500 [260]	1150 [620]
9	E	1600 [870]	L	500 [260]	1100 [595]
10	A	1550 [845]	A	500 [260]	1100 [595]
10	B	1550 [845]	L	500 [260]	1100 [595]
11	A	1650 [900]	A	600 [315]	1100 [595]
11	B	1650 [900]	L	600 [315]	1100 [595]
12	A	1750 [955]	A	600 [315]	1100 [595]
12	B	1750 [955]	L	400 [205]	1100 [595]
13	A	1550 [845]	A	500 [260]	1100 [595]
13	B	1550 [845]	L	500 [260]	1100 [595]
14	A	1550 [845]	L	500 [260]	1100 [595]
16 (J31200)	A	1600 [870] ^C	A	600 [315]	1100 [595]
CA15	A	1750 [955]	A or L	400 [205]	900 [480]
CA15	B	1750 [955]	A or L	400 [205]	1100 [595]
CA15	C	1750 [955]	A or L	400 [205]	1150 [620] ^{DE}
CA15	D	1750 [955]	A or L	400 [205]	1150 [620] ^{DE}
CA15M	A	1750 [955]	A or L	400 [205]	1100 [595]
CA6NM	A	1850 [1010]	A or L	200 [95]	1050–1150 [565–620]
CA6NM	B	1850 [1010]	A or L	200 [95]	1225–1275 [665–690] ^{E,F} 1050–1150 [565–620] ^G

^A A = air, L = Liquid.

^B Minimum temperature unless range is specified.

^C Double austenitize.

^D Double temper with the final temper at a lower temperature than the intermediate temper.

^E Air cool to below 200°F [95°C] after first temper.

^F Intermediate.

^G Final.



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.

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

6. Chemical Composition

6.1 The steel shall conform to the requirements as to chemical composition prescribed in Table 2. Product analysis tolerance

TABLE 2 Chemical Requirements (Maximum Percent Unless Range is Given)

Grade	1.	2.	4.	6.	7.	8.	9.	10.	11.	12.
Class Type	ABC Vanadium (J13002)	ABC Manganese-Molybdenum (J13005)	ABCDE Nickel-Chromium-Molybdenum (J13047)	AB Manganese-Nickel-Chromium-Molybdenum (J13855)	A Nickel-Chromium-Molybdenum-Vanadium ^A (J12084)	ABC Chromium-Molybdenum (J22091)	ABCDE Chromium-Molybdenum (J13345)	AB Nickel-Chromium-Molybdenum (J23015)	AB Nickel-Chromium-Molybdenum (J12082)	AB Nickel-Chromium-Molybdenum (J22000)
Carbon	0.30	0.30	0.30	0.05-0.38	0.05-0.20	0.05-0.20	0.05-0.33	0.30	0.05-0.20	0.05-0.20
Manganese	1.00	1.00-1.40	1.00	1.30-1.70	0.60-1.00	0.50-0.90	0.60-1.00	0.60 to 1.00	0.50-0.80	0.40-0.70
Phosphorus	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04
Phosphorus	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Sulfur	-0.045	-0.045	-0.045	-0.045	-0.045	-0.045	-0.045	-0.045	-0.045	-0.045
Sulfur	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Silicon	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.60	0.60
Nickel	...	...	0.40-0.80	0.40-0.80	0.70-1.00	...	...	1.40-2.00	0.70-1.10	0.60-1.00
Chromium	...	...	0.40-0.80	0.40-0.80	0.40-0.80	2.00-2.75	0.75-1.10	0.55-0.90	0.50-0.80	0.50-0.90
Molybdenum	...	0.10-0.30	0.15-0.30	0.30-0.40	0.40-0.60	0.90-1.10	0.15-0.30	0.20-0.40	0.45-0.65	0.90-1.20
Vanadium	0.04-0.12	...	...	...	0.03-0.10	...	...	...	...	...
Boron	...	...	...	...	0.002-0.006	...	...	...	...	...
Copper	...	...	...	...	0.15-0.50	...	...	...	...	...
Residual Elements:										
Copper	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Nickel	0.50	0.50	...	...	...	...	0.50	...	...	...
Chromium	0.35	0.35	...	...	...	...	...	...	...	...
Mo + W	0.25	...	...	...	...	...	...	...	...	...
Tungsten	...	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Vanadium	...	0.03	0.03	0.03	...	0.03	0.03	0.03	0.03	0.03
Total content of residual elements	1.00	1.00	0.60	0.60	0.60	0.60	1.00	0.60	0.50	0.50

Grade	13.	14.	16	CA15	CA15M	CA6NM
Class Type	AB Nickel-Molybdenum (J13080)	A Nickel-Molybdenum (J15580)	A Low Carbon Manganese-Nickel (J31200)	ABCD Martensitic Chromium (J91150)	A Martensitic Chromium (J91151)	AB Martensitic Chromium Nickel (J91540)
Carbon	0.30	0.55	0.12 ^B	0.15	0.15	0.06
Manganese	0.80-1.10	0.80-1.10	2.10 ^B	1.00	1.00	1.00
Phosphorus	-0.04	-0.04	-0.02	-0.040	-0.040	-0.04
Phosphorus	0.035	0.035	0.02	0.035	0.035	0.035
Sulfur	-0.045	-0.045	-0.02	-0.040	-0.040	-0.03
Sulfur	0.035	0.035	0.02	0.035	0.035	0.03
Silicon	0.60	0.60	0.50	1.50	0.65	1.00
Nickel	1.40-1.75	1.40-1.75	1.00-1.40	1.00	1.0	3.5-4.5
Chromium	...	...	...	11.5-14.0	11.5-14.0	11.5-14.0
Molybdenum	0.20-0.30	0.20-0.30	...	0.50	0.15-1.0	0.4-1.0
Boron	...	...	...	...	...	...
Copper	...	...	...	...	...	...
Residual Elements						
Copper	0.50	0.50	0.20	0.50	0.50	0.50
Nickel	...	...	...	...	...	...
Chromium	0.40	0.40	0.20	...	...	...
Molybdenum	...	...	0.10	...	...	...
Tungsten	0.10	0.10	0.10	0.10	0.10	0.10
Vanadium	0.03	0.03	0.02	0.05	0.05	0.05
Total content of residual elements	0.75	0.75	0.50	0.50	0.50	0.50

^A Proprietary steel composition.

^B For each reduction of 0.01 % below the specified maximum carbon content, an increase of 0.04 % manganese above the specified maximum will be permitted up to a maximum of 2.30 %.