



Designation: ~~A 995/A 995M-98 (Reapproved 2007)~~ Designation: A995/A995M – 09

Standard Specification for Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts¹

This standard is issued under the fixed designation A995/A995M; 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 austenitic-ferritic (duplex) stainless steel castings for valves, flanges, fittings, and other pressure-containing parts.

1.2 The duplex stainless steels offer a combination of enhanced mechanical properties and corrosion resistance when properly balanced in composition and properly heat treated. Ferrite levels are not specified, but these grades will develop a range of approximately 30 to 60 % ferrite with the balance austenite. It is the responsibility of the purchaser to determine which grade shall be furnished depending on design and service conditions, mechanical properties, and corrosion-resistant characteristics.

NOTE 1—Because of the possibility of precipitation of embrittling phases, the grades included in this specification are not recommended for service at temperatures above 600°F [315°C].

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 non-conformance with the ~~specification.~~ standard.

2. Referenced Documents

2.1 *ASTM Standards:*²

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

A703/A703M Specification for Steel Castings, General Requirements, for Pressure-Containing Parts

E125 Reference Photographs for Magnetic Particle Indications on Ferrous Castings

E165 Practice for Liquid Penetrant Examination for General Industry

E562 Test Method for Determining Volume Fraction by Systematic Manual Point Count

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *duplex stainless steel*—an iron-chromium-nickel-molybdenum alloy which when properly heat treated consists of approximately 30 to 60 % ferrite with the balance austenite.

4. General Conditions for Delivery

4.1 Material furnished to this specification shall conform to the applicable requirements of Specification ~~A-703/A-703M~~A703/A703M, including the supplementary requirements that are indicated on the purchaser order. Failure to comply with the general requirements of Specification ~~A-703/A-703M~~A703/A703M constitutes nonconformance with this specification. In case of conflict between the requirements of the specification and Specification ~~A-703/A-703M~~A703/A703M, this specification shall prevail.

5. Ordering Information

5.1 It is the responsibility of the purchaser to specify all requirements that are necessary for material ordered under this specification. Such requirements may included, but are not limited to, the following:

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 Nov. 1, 2007. Published December 2007. Originally approved in 1998. Last previous edition approved in 2003 as A 995-98 (2003).

Current edition approved May 1, 2009. Published June 2009. Originally approved in 1998. Last previous edition approved in 2007 as A995/A995M – 98 (2007). DOI: 10.1520/A0995_A0995M-09.

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 Heat Treatment Requirements

Grade	Heat Treatment
1B	Heat to 1900°F [1040°C] minimum, hold for sufficient time to heat casting uniformly to temperature, quench in water or rapid cool by other means.
2A	Heat to 2050°F [1120°C] minimum, hold for sufficient time to heat casting uniformly to temperature, quench in water or rapid cool by other means.
3A	Heat to 1950°F [1070°C] minimum, hold for sufficient time to heat casting uniformly to temperature, quench in water or rapid cool by other means.
4A	Heat to 2050°F [1120°C] minimum for sufficient time to heat casting uniformly to temperature and water quench, or the casting may be furnace cooled to 1850°F [1010°C] minimum, hold for 15 min minimum and then water quench. A rapid cool by other means may be employed in lieu of water quench.
5A	Heat to 2050°F [1120°C] minimum, hold for sufficient time to heat casting to temperature, furnace cool to 1910°F [1045°C] minimum, quench in water or rapid cool by other means.
6A	Heat to 2010°F [1100°C] minimum, hold for sufficient time to heat casting uniformly to temperature, quench in water or cool rapidly by other means.

TABLE 2 Chemical Requirements

Grade	1B	2A	3A	4A	5A ^A	6A ^A
Type	25Cr-5Ni-Mo-Cu-N	24Cr-10Ni-Mo-N	25Cr-5Ni-Mo-N	22Cr-5Ni-Mo-N	25Cr-7Ni-Mo-N	25Cr-7Ni-Mo-N
UNS	J93372	J93345	J93371	J92205	J93404	J93380
ACI	CD4MCuN	CE8MN	CD6MN	CD3MN	CE3MN	CD3MWCuN
Composition:						
Carbon, max	0.040	0.080	0.060	0.030	0.030	0.030
Manganese, max	1.00	1.00	1.00	1.50	1.50	1.00
Silicon, max	1.00	1.50	1.00	1.00	1.00	1.00
Phosphorus, max	0.040	0.040	0.040	0.040	0.040	0.030
Sulfur, max	0.040	0.040	0.040	0.020	0.040	0.025
Chromium	24.5-26.5	22.5-25.5	24.0-27.0	21.0-23.5	24.0-26.0	24.0-26.0
Nickel	4.7-6.0	8.0-11.0	4.0-6.0	4.5-6.5	6.0-8.0	6.5-8.5
Molybdenum	1.70-2.30	3.0-4.5	1.75-2.50	2.5-3.5	4.0-5.0	3.0-4.0
Copper	2.7-3.3	1.00, max	...	0.50-1.00
Tungsten	0.50-1.00
Nitrogen	0.10-0.25	0.10-0.30	0.15-0.25	0.10-0.30	0.10-0.30	0.20-0.30

^A% Cr + 3.3 % Mo + 16 % N ≥ 40.

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<https://standards.iteh.ai/catalog/standards/sist/87415477-ab00-4523-8713-b83069b2a317/astm-a995-a995m-09>
TABLE 3 Tensile Requirements

Grade	1B	2A	3A	4A	5A	6A
Type	25Cr-5Ni-Mo-Cu-N	24Cr-10Ni-Mo-N	25Cr-5Ni-Mo-N	22Cr-5Ni-Mo-N	25Cr-7Ni-Mo-N	25Cr-7Ni-Mo-N
Tensile strength, ksi [MPa], min	100 [690]	95 [655]	95 [655]	90 [620]	100 [690]	100 [690]
Yield strength (0.2 % offset), ksi [MPa], min	70 [485]	65 [450]	65 [450]	60 [415]	75 [515]	65 [450]
Elongation in 2 in. [50 mm], %, min ^A	16	25	25	25	18	25

^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 4:1.

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

5.1.2 Quantity (weight and number of castings),

5.1.3 Specification designation and date of issue,

5.1.4 Grade of steel,

5.1.5 Supplementary requirements including acceptance criteria, and

5.1.6 Additional requirements.

6. Process

6.1 The steel shall be made by the electric furnace process with or without separate refining.

7. Heat Treatment

7.1 All castings shall be heat treated in accordance with Table 1.

8. Chemical Composition

8.1 The steel shall conform to the requirements as to chemical composition prescribed in Table 2.