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Standard Specification for Titanium-Stabilized Carbon Steel Forgings for Glass-Lined Piping and Pressure Vessel Service[1]

This standard is issued under the fixed designation A 836/A 836M; 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 nonstandard as-forged fittings, valve components, and parts for glass-lined piping and pressure vessel service. Mechanical properties are certified on the basis of test material subjected to heat treatments to simulate glass-coating operations.

1.2 The values stated in either inch-pound units or SI 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 not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the specification. The inch-pound units shall apply unless the "M" designation of this specification is specified in the order.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 788/A 788M Specification for Steel Forgings, General Requirements

A 961/A 961M Specification for Common Requirements for Steel Flanges, Forged Fittings, Valves, and Parts for Piping Applications

3. Ordering Information

3.1 Product furnished to this specification shall conform to the requirements of Specification A 961/A 961M, including any supplementary requirements that are indicated in the purchase order. Failure to comply with the requirements of Specification A 961/A 961M constitutes non-conformance with this specification.

3.2 It is the purchaser's responsibility to specify in the purchase order all ordering information necessary to purchase the needed material. Examples of such information include but are not limited to the ordering information in Specification A 961/A 961M and the following:

3.2.1 Supplementary requirements, and

3.2.2 Additional requirements (see 10.1, 12.1, 12.2, and 12.3).

3.3 If the requirements of this specification are in conflict with the requirements of Specification A 961/A 961M, the requirements of this specification shall prevail.

4. Materials and Manufacture

4.1 The material shall be forged by hammering, pressing, rolling, extruding, or upsetting, such that the finished product will be a forging as defined in the Terminology Section of Specification A 788/A 788M.

4.2 When specified in the order, the manufacturer shall submit for approval by the purchaser a sketch showing the shape of the rough forging before machining.

4.3 Forgings shall be protected against sudden or too rapid cooling from the rolling or forging while passing through the critical range.

4.4 Heat treatment of forgings is neither required nor prohibited. However, the test material for qualifying the forging or the welding procedure shall be heat treated to simulate glass-coating operations.

5. Chemical Composition

5.1 An analysis of each heat shall be made by the manufacturer to determine the percentages of the elements specified in Table 1. The chemical composition thus determined shall conform to the requirements in Table 1.

6. Mechanical Properties

6.1 The test material shall conform to the requirements as to tensile properties prescribed in Table 2.

[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 A01.22 on Steel Forgings and Wrought Fittings for Piping Applications and Bolting Materials for Piping and Special Purpose Applications.

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[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.

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TABLE 1 Chemical Requirements

Element	Composition, %
Carbon, max	0.20
Manganese, max	0.90
Phosphorus, max	0.05
Silicon, max	0.35
Sulfur, max	0.05
Titanium, min	4× carbon content
Titanium, max.	1.00

TABLE 2 Tensile Requirements

	Class I
Tensile strength, min, ksi [MPa]	55 [380]
Yield strength,[A] min, ksi [MPa]	25 [175]
Elongation in 2 in. or 50 mm, min, %	22
Reduction of area, min, %	35

[A] Determined by either the 0.2 % offset method or the 0.5 % extension-under-load method.

7. Number of Tests and Retests

7.1 One tension test shall be made from each heat.

7.2 If any test specimen is defectively machined, it may be discarded and another specimen substituted.

8. Retests

8.1 When one or more representative test specimens do not conform to specification requirements for the tested characteristic, only a single retest for each nonconforming characteristic may be performed to establish product acceptability. Retests shall be performed on twice the number of representative specimens that were originally nonconforming. When any retest specimen does not conform to specification requirements for the characteristic in question, the lot represented by that specimen shall be rejected, or the test material shall be heat treated or reheat-treated in accordance with 4.4, and tested in accordance with Sections 6 and 7.

9. Test Specimens

9.1 The test material to be used for qualifying the forgings shall be heat treated with the forgings represented by the test material, if the forgings are heat treated, then, the test material shall be normalized three times from a minimum temperature of 1550 °F [845 °C] prior to testing. This heat treatment simulates glass-coating operations.

10. Repair by Welding

10.1 Approval by the purchaser shall be required prior to weld repair.

10.2 The welded test plate used to qualify the procedure shall be normalized three times at 1550 °F [845 °C] prior to testing to simulate glass-coating operations.

10.3 The composition of the weld deposits shall be similar to the base metal and in accordance with the procedure qualification for the applicable material. Welding shall be accomplished with a weld procedure designed to produce low hydrogen in the weldment. Short-circuit gas metal arc welding is permissible only with the approval of the purchaser.

11. Rejection and Rehearing

11.1 Samples representing material rejected by the purchaser shall be preserved until disposition of the claim has been agreed upon by the manufacturer and the purchaser.

12. Certification

12.1 When specified in the purchase order or contract, a producer's or supplier's certification shall be furnished to the purchaser that the material was manufactured, sampled, tested, and inspected in accordance with this specification and has been found to meet the requirements. The specification designation included on test reports shall include year of issue and revision letter, if any.

12.2 When specified in the purchase order or contract, a report of the test results shall be furnished.

12.3 Upon request of the purchaser in the contract or order, a report of the test results and chemical analyses shall be furnished.

13. Marking of Forgings

13.1 Identification marks consisting of the manufacturer's symbol or name (Note), designation of service rating, this specification number, class, and size shall be legibly forged or stamped on each forging, and in such a position as not to injure the usefulness of the forgings.

13.2 *Bar Coding*—In addition to the requirements in 13.1, bar coding is acceptable as a supplemental identification method. The purchaser may specify in the order a specific bar coding system to be used. The bar coding system, if applied at the discretion of the supplier, should be consistent with one of the published industry standards for bar coding. If used on small parts, the bar code may be applied to the box or a substantially applied tag.

14. Keywords

14.1 carbon; pipe fittings; piping applications; pressure containing parts; pressure vessel service; steel; steel flanges; steel forgings; steel valves

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