



Standard Specification for Vacuum-Treated Carbon and Alloy Steel Forgings For Turbine Rotors and Shafts¹

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This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers vacuum-treated carbon and alloy steel forgings for turbine rotors and shafts.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

2. Referenced Documents

2.1 ASTM Standards:

A 275/A 275M Test Method for Magnetic Particle Examination of Steel Forgings²

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products³

A 418 Test Method for Ultrasonic Examination of Turbine and Generator Steel Rotor Forgings²

A 472 Test Method for Heat Stability of Steam Turbine Shafts and Rotor Forgings²

A 751 Test Methods, Practices and Terminology for Chemical Analysis of Steel Products³

A 788 Specification for Steel Forgings, General Requirements²

E 139 Test Methods for Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials⁴

3. Ordering Information and General Requirements

3.1 Material supplied to this specification shall conform to the requirements of Specification A 788, which outlines additional ordering information, manufacturing methods and procedures, marking, certification, production analysis variations, and additional supplementary requirements.

3.2 In addition to the ordering information required by Specification A 788, the purchaser shall include with the inquiry and order, the class of steel, the choice of yield strength offset (0.2 or 0.02 %) and any tests, supplementary requirements, and purchase options desired.

3.3 *Forging Drawing*—Each forging shall be manufactured in accordance with a drawing furnished by the purchaser showing the dimensions of the forging and bore hole, if any, and the location of mechanical test specimens.

3.4 *Supplementary Requirements*—Supplementary requirements are provided. These requirements shall apply only when specified in the purchase order.

3.5 If the requirements of this specification are in conflict with the requirements of Specification A 788, the requirements of this specification shall prevail.

4. Manufacture

4.1 Melting Process:

4.1.1 The steel shall be made by the basic electric-furnace process.

4.1.2 Provisions for subsequent secondary melting of the steel by the consumable electrode-electroslag or vacuum-arc remelting processes are included in Supplementary Requirement S7.

4.2 *Vacuum Treatment*—The vacuum degassing requirements of Specification A 788 are mandatory.

4.3 *Discard*—Sufficient discard shall be taken from each ingot to secure freedom from pipe and harmful segregation in the finished forging.

4.4 *Forging Process*—The forging shall receive its hot mechanical work under a press of ample power to adequately work the metal throughout the maximum section of the forging. It is important to maintain the axial center of the forging in common with the axial center of the ingot.

4.5 Heat Treatment:

4.5.1 After forging and before reheating for heat treatment for mechanical properties, the forging shall be allowed to cool in a manner designed to prevent injury and accomplish transformation.

4.5.2 The heat treatment for mechanical properties shall consist of double-normalizing and tempering for Classes 2, 3, 4, 8, and 9 and normalizing, quenching, and tempering for Classes 5, 6, and 7. In normalizing treatments, the forging may be cooled in still air or in an air blast at the manufacturer's option. Faster cooling rates for Classes 2, 3, 4, 8, and 9 may be used if authorized by the purchaser. These rates are obtained by liquid quenching, or by the addition of water sprays of fog to the air blast.

¹ This specification is under the jurisdiction of ASTM Committee A-1 on Steel, Stainless Steel, and Related Alloys and is the direct responsibility of Subcommittee A01.06 on Steel Forgings and Billets.

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² *Annual Book of ASTM Standards*, Vol 01.05.

³ *Annual Book of ASTM Standards*, Vol 01.03.

⁴ *Annual Book of ASTM Standards*, Vol 03.01.