



Designation: A668/A668M – 22

American Association State  
Highway and Transportation Officials Standard  
AASHTO No.: M 102M/M 102

# Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use<sup>1</sup>

This standard is issued under the fixed designation A668/A668M; 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 ( $\epsilon$ ) 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 untreated and heat-treated carbon and alloy steel forgings for general industrial use. Other ASTM specifications for forgings are available for specific applications such as pressure vessels, railroad use, turbine generators, gearing, and others involving special temperature requirements.

1.2 Hot-rolled or cold finished bars are not within the scope of this specification.

1.3 Six classes of carbon steel and seven classes of alloy steel forgings are listed (see Section 7), which indicates their required heat treatments, as well as mechanical properties.

1.4 Provision, with the suffix H for certification and marking, for the supply of forgings after hardness testing only.

1.5 Supplementary requirements, including those in Specification A788/A788M, of an optional nature are provided. These shall apply only when specified by the purchaser.

1.6 Appendix X1 lists the current classes corresponding to the various classes of Specifications A235, A237, and A243, which have been superseded by this specification.

1.7 The values stated in either SI units or inch-pound units are to be regarded separately as standard; within the text and tables, the SI units are shown in brackets. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.8 Unless the order specifies the applicable “M” specification, the forgings shall be furnished to the inch-pound units.

1.9 *This international standard was developed in accordance with internationally recognized principles on standardization 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:<sup>2</sup>

A275/A275M Practice for Magnetic Particle Examination of Steel Forgings

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A388/A388M Practice for Ultrasonic Examination of Steel Forgings

A788/A788M Specification for Steel Forgings, General Requirements

E290 Test Methods for Bend Testing of Material for Ductility

E340 Practice for Macroetching Metals and Alloys

## 3. Terminology

3.1 The terminology section of Specification A788/A788M is applicable to this specification.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *class*—a description of steel forgings based on heat treatment, mechanical properties and composition.

3.2.2 *controlling cross section thickness* ( $T_C$ )—the diameter of the largest theoretical sphere which can be inscribed within the volume of the forging.

3.2.3  $T_P$ —designates prolongations which have a size other than the controlling cross section thickness ( $T_C$ ).

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

Current edition approved May 15, 2022. Published May 2022. Originally approved in 1972. Last previous edition approved in 2021 as A668/A668M-21a. DOI: 10.1520/A0668\_A0668M-22.

<sup>2</sup> 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. Ordering Information and General Requirements

4.1 Material supplied to this specification shall conform to the requirements of Specification **A788/A788M** which outlines additional ordering information, manufacturing requirements, testing and retesting methods and procedures, marking, certification, product analysis variations and additional supplementary requirements.

4.1.1 If the requirements of this specification are in conflict with the requirements of Specification **A788/A788M**, the requirements of this specification shall prevail.

4.2 When this specification is to be applied to an inquiry, contract, or order, the purchaser should furnish the following information:

4.2.1 The ordering information required by Specification **A788/A788M**,

4.2.2 The class of forging desired as listed in **Table 1**,

4.2.3 Location(s) of areas of significant loading if test specimens are to be located in accordance with **7.1.4.5**,

4.2.4 The options which may be selected as found in **5.3.2**, **6.1**, and **7.3**, and

4.2.5 Any applicable supplementary requirements.

## 5. Materials and Manufacture

5.1 *Discard*—Sufficient discard shall be made from each ingot to secure freedom from piping and undue segregation.

### 5.2 Forging Process:

5.2.1 The forging shall be brought as close as practical to finished shape and size by hot mechanical work.

5.2.2 Supplementary Requirements S2, S14, and S15 may be specified by the purchaser to satisfy concerns about the utility of the proposed forging.

### 5.3 Heat Treatment:

5.3.1 All forgings, other than Class A, shall be heat treated. See Section **7**.

5.3.2 Where options exist within a class, the choice of heat treatment shall be left to the discretion of the manufacturer, unless the purchaser specifies one of the available options.

## 6. Chemical Composition

6.1 The steel shall conform to the requirements prescribed in **Table 1**.

6.2 The choice of chemical composition is left to the discretion of the manufacturer, unless otherwise specified by the purchaser. See **Appendix X2**.

### 6.3 Heat Analysis:

6.3.1 An analysis of each heat shall be made by the manufacturer.

6.4 *Product Analysis*—An analysis may be made by the purchaser according to the requirements of Specification **A788/A788M**. If a standard grade has been used to manufacture the forging the permissible variations in composition of Specification **A788/A788M** shall apply. If a non-standard grade of steel has been used, and composition limits have not been supplied, the product analysis can be used only to confirm the type of steel supplied.

## 7. Mechanical Properties

### 7.1 Tensile Requirements:

7.1.1 The material shall conform to the tensile and hardness properties prescribed in **Table 2**. See Test Methods and Definitions **A370**.

7.1.2 *All Forgings*—The dimensions of the controlling cross section thickness ( $T_C$ ) of the forging at time of heat treatment determine the mechanical properties to be met within each class (see **Table 2**) except as noted in **7.1.4.2**.

7.1.3 *Number of Tests*—Unless the purchaser specifies that forgings shall be furnished in accordance with the requirements of **7.3**, the number of tension tests performed shall be as follows:

7.1.3.1 For all classes of heat-treated forgings with as-heat treated weights (excluding test prolongations) less than 5000 lb [2250 kg] each, one test shall be made from each controlling cross section thickness ( $T_C$ ) represented in each heat and heat-treating charge. For untreated forgings (Class A) weighing less than 5000 lb [2250 kg] each, one test from each heat shall be made.

7.1.3.2 On all classes, for forgings with as-heat treated weights (excluding test prolongations) of 5000 lb [2250 kg] or more, at least one test from each forging shall be made.

7.1.3.3 On all classes, for forgings with as-heat treated weights (excluding test prolongations) of 7000 lb [3200 kg] or more, two tests will be taken: on ring and disk forgings 180° apart; on shafts and long hollow cylinders (over 80 in. [2.0 m] in length excluding test material), one from each end and offset 180°. Shafts and cylinder forgings 80 in. [2.0 m] or less in length (excluding test material) may have both tests located at one end 180° apart.

7.1.3.4 When forgings are made in multiple as a single forging, that is, forged as one piece and divided after heat treatment, the multiple forging shall be considered as one forging, and the number of tests required shall be as designated in **7.1.3.1**, **7.1.3.2**, and **7.1.3.3**.

### 7.1.4 Prolongations:

7.1.4.1 A sufficient number of the forgings shall have prolongations for extracting specimens for testing. Examples of test locations for various forging configurations are shown in **Figures 1 and 2**.

NOTE 1—Figures provided demonstrate the concept of controlling cross section thickness ( $T_C$ ) but do not encompass all possible test prolongation configurations which meet the requirements of Section **7**.

7.1.4.2 For all forgings of non-uniform cross section in classes A, B, C, D, E, G, H, and J (when class J is provided in the normalized and tempered condition): the prolongation(s) may be extensions of sections other than the controlling cross section thickness ( $T_C$ ), that is  $T_P \neq T_C$ . In this case, the dimension of  $T_P$  shall determine the mechanical properties to be met within each class. In the case of forgings requiring prolongations on both ends, the prolongations may or may not have the same  $T_P$ . If  $T_P$  is not the same, and the prolongations fall into different size categories, the manufacturer may elect to work to either the larger or smaller set of mechanical properties for both prolongations. It is not necessary for a forging with prolongations falling into two different size classifications to meet the requirements of both size classifications. When  $T_P \neq$