Designation: ~~A694/A694M – 14~~ A694/A694M – 16

Standard Specification for Carbon and Alloy Steel Forgings for Pipe Flanges, Fittings, Valves, and Parts for High-Pressure Transmission Service[1]

This standard is issued under the fixed designation A694/A694M; 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 forged or rolled steel pipe flanges, forged fittings, valves, and parts suitable for use with high-strength transmission-service pipe. Included are flanges, fittings, and similar parts ordered either to dimensions specified by the purchaser or to ASME or MSS dimensional standards referenced in Section 2.

1.2 Several grades of material, based on minimum yield strength requirements, are covered, as indicated in Table 1.

1.3 Supplementary Requirements are provided. Supplementary Requirement ~~S 1~~S1 is provided for use when purchaser approval is required for repair welding.

1.4 This specification is expressed in both inch-pound units and in SI units. However, unless the order specifies the applicable "M" specification designation (SI units), the material shall be furnished to inch-pound units.

1.5 The values stated in either SI units or 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 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 standard.

2. Referenced Documents

2.1 In addition to those reference documents listed in Specification A961/A961M, the following list of standards apply to this specification:

2.2 *ASTM Standards:*[2]

A53/A53M Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

A106/A106M Specification for Seamless Carbon Steel Pipe for High-Temperature Service

A381 Specification for Metal-Arc-Welded Steel Pipe for Use With High-Pressure Transmission Systems

A707/A707M Specification for Forged Carbon and Alloy Steel Flanges for Low-Temperature Service

A788/A788M Specification for Steel Forgings, General Requirements

A961/A961M Specification for Common Requirements for Steel Flanges, Forged Fittings, Valves, and Parts for Piping Applications

2.3 *ASME Standards:*

ASME B 16.5 Steel Pipe Flanges and Flanged Fittings[3]

ASME B 16.9 Steel Butt-Welding Fittings[3]

~~ASME B 16.10 Face-to-Face and End-to-End Dimensions of Ferrous Valves~~[3]

ASME B 16.11 Forged Steel Fittings, Socket Welding and Threaded[3]

~~ASME B 16.28 Wrought Steel Butt-Welding Short Radius Elbows~~[3]

ASME B 16.47 Large Diameter Steel Flanges[3]

2.4 *MSS Standards:*[4]

MSS SP-44 Standard for Steel Pipe Line Flanges

~~MSS SP-75 Specification for High-Test Welding Fittings~~

[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.

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

[4] 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**

TABLE 1 Tensile Requirements

Grade	Yield Strength (0.2 % Offset), min, ksi [MPa]	Tensile Strength, min, ksi [MPa]	Elongation in 2 in. or 50 mm, min %
F42	42 [290]	60 [415]	20
F46	46 [315]	60 [415]	20
F48	48 [330]	62 [425]	20
F50	50 [345]	64 [440]	20
F52	52 [360]	66 [455]	20
F56	56 [385]	68 [470]	20
F60	60 [415]	75 [515]	20
F65	65 [450]	77 [530]	20
F70	70 [485]	82 [565]	18

~~MSS SP-95 Swage (d) Nipples and Bull Plugs~~
MSS SP-97 Integrally Reinforced Forged Branch Outlet Fittings

2.5 *API Standard:*
5L Specification for Line Pipe[5]

3. Ordering Information

3.1 It is the purchaser's responsibility to specify in the purchase order all ordering information necessary to purchase the needed material. In addition to the ordering guidelines in Specification A961/A961M, orders should include the following information:

3.1.1 Additional requirements (see 8.1 and 11.1).

4. General Requirements

4.1 Product furnished to this specification shall conform to the requirements of Specification A961/A961M, including any supplementary requirements that are indicated in the purchase order. Failure to comply with the general requirements of Specification A961/A961M constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification A961/A961M, this specification shall prevail.

5. Manufacture

5.1 *Melting Process:*

5.1.1 The steel shall be made by any of the following processes: open hearth, electric furnace, or basic oxygen. The steel shall be fully deoxidized.

5.1.2 The steel shall be carbon steel, high-strength low-alloy steel, or alloy steel, as agreed upon between the manufacturer and purchaser. Analysis of the steel used, including all alloying ~~elements,~~ elements listed in Table 2, shall be reported by the manufacturer to the purchaser. The steel shall be suitable for field welding (as established by the purchaser) to other fittings, valve materials and flanges, and to pipe manufactured under the following ASTM specifications: Specification A53/A53M, Specification A106/A106M, Specification A381, and API Standard 5L pipe, as well as to fittings manufactured under MSS SP-75.

5.2 *Manufacturing Practice:*

5.2.1 Material for forgings shall consist of ingots or blooms, billets, slabs, or bars of forged or rolled form and cut to the required length by a suitable process.

5.2.2 The finished product shall be a forging as defined in the Terminology section of Specification A788/A788M.

5.2.3 Hot working shall be sufficient to develop a wrought structure throughout the part.

5.2.4 Flanges shall not be machined directly from plate nor from solid bar stock.

5.3 *Heat Treatment:*

5.3.1 All items shall be heat treated. Heat treatment of carbon steel and high-strength low-alloy steel may consist of normalizing, normalizing-and-tempering, or quenching-and-tempering. Heat treatment of alloy steel may consist of normalizing and precipitation heat treatment or quenching and precipitation heat treatment.

5.3.2 The tempering temperature shall be at least 1000 °F [540 °C]. The precipitation heat treatment of the alloy steel shall be in the range from 1000 to 1225 °F [540 to 665 °C].

6. Chemical Composition

6.1 A chemical heat analysis in accordance with Specification A961/A961M shall be made and conform to the requirements as to chemical composition prescribed in Table 2.

[5] Available from American Petroleum Institute (API), 1220 L. St., NW, Washington, DC 20005-4070, http://www.api.org.