



Designation: F 844 – 04^{e1}

Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use¹

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

^{e1} NOTE—Sections 2.2 and 3.2.8 were editorially revised in October 2006.

1. Scope*

1.1 This specification covers round and miscellaneous shape steel plain (flat) washers furnished in an unhardened condition.

1.2 The washers are intended for general use bolt, nut, and stud applications to provide increased bearing surface, spacing, and to prevent galling.

1.3 Unless otherwise specified, the washers are furnished with dimensions conforming to B18.22.1, Type A, Tables 1A and Tables 1B.

1.4 Hardened washers for use with heat-treated structural bolts are covered by Specifications F 436 and F 436M.

2. Referenced Documents

2.1 *ASTM Standards:*²

A 29/A 29M Specification for Steel Bars, Carbon and Alloy, Hot-Wrought, General Requirements for

A 153/A 153M Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

A 568/A 568M Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for

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

B 633 Specification for Electrodeposited Coatings of Zinc on Iron and Steel

B 695 Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

D 3951 Practice for Commercial Packaging

F 436 Specification for Hardened Steel Washers

F 436M Specification for Hardened Steel Washers [Metric]

F 606 Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners,

Washers, Direct Tension Indicators, and Rivets

F 1470 Guide for Fastener Sampling for Specified Mechanical Properties and Performance Inspection

2.2 *ASME Standards:*³

B18.22.1 Plain Washers

B18.24 Part Identifying Number (PIN) Code System Standard for B18 Fastener Products

2.3 *Military Specification:*

DOD-P-16232 Phosphate Coating for Ferrous Metals⁴

2.4 *Federal Specification:*

QQ-P-416 Plating, Cadmium (Electrodeposited)⁴

3. Ordering Information

3.1 Orders for washers under this specification shall include:

3.1.1 Quantity (number of pieces of same item and size).

3.1.2 Name of item (steel plain washers).

3.1.3 Size (Nominal inside diameter and thickness. Include outside diameter, when required).

3.2 The following requirements are optional and may be specified when required:

3.2.1 Dimensions if other than B18.22.1, Type A.

3.2.2 Finish if other than oiled (see 4.3 through 4.3.6).

3.2.3 Chemical composition, if required (see 5.1.2).

3.2.4 Hardness, if required (see 6.2).

3.2.5 Shipment lot Testing, if required (see 9.2).

3.2.6 Test Reports, if required (see Section 12).

3.2.7 Marking, if required (see 14.1).

3.2.8 For establishment of a part identifying system, see ASME B18.24.

4. Materials and Manufacture

4.1 *Material*—The washers shall be punched from hot-rolled, hot-rolled and pickled, or cold-rolled steel; or shall be machined from bar stock or tubing; or shall be forged at the manufacturer's option.

¹ This specification is under the jurisdiction of Committee F16 on Fasteners and is the direct responsibility of Subcommittee F16.02 on Steel Bolts, Nuts, Rivets and Washers.

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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, Three Park Ave., New York, NY 10016-5990.

⁴ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098

*A Summary of Changes section appears at the end of this standard.

4.2 *Burr Removal*—The washers shall be tumbled, vibrated, or otherwise processed to minimize burrs.

4.3 *Protective Finishes:*

4.3.1 *Unprotected Washers*—Unless otherwise specified, the washer shall be furnished plain, with no protective finish other than oil to minimize rusting.

4.3.2 *Zinc Coatings, Hot-Dip and Mechanically Deposited:*

4.3.2.1 When zinc-coated washers are required, the purchaser shall specify the zinc-coating process, such as “hot dip,” “mechanically deposited,” or “no preference.”

4.3.2.2 When “hot-dip” is specified, the washers shall be zinc-coated by hot dipping in accordance with the requirements of Class C of Specification **A 153/A 153M**.

4.3.2.3 When “mechanically deposited” is specified, the washers shall be zinc-coated by mechanical deposition in accordance with the requirements of Class 50 of Specification **B 695**.

4.3.2.4 When “no preference” is specified, the supplier shall furnish either a hot-dip zinc coating in accordance with Specification **A 153/A 153M**, Class C or a mechanically deposited zinc coating in accordance with Specification **B 695**, Class 50.

4.3.3 *Cadmium Plating*—Cadmium plated washers shall be cadmium plated by electrodeposition and yellow chromate treated in accordance with Federal Specification **QQ-P-416**, Type II, Class 3.

4.3.4 *Zinc Plating, Electroplated and Mechanically Deposited:*

4.3.4.1 When zinc plated washers are required, the purchaser shall specify the zinc plating process such as “electroplating” or “mechanical plating” or “no preference”.

4.3.4.2 When “electroplating” is specified, the washer shall be zinc plated by electrodeposition in accordance with Specification **B 633**, Class Fe/Zn 5, Type II unless otherwise specified. See Specification **B 633** for other thickness classes and finish types.

4.3.4.3 When “mechanical plating” is specified, the washer shall be zinc plated by mechanical deposition in accordance with Specification **B 695**, Class 5, Type II unless otherwise specified. See Specification **B 695** for other thickness classes and finish types.

4.3.4.4 When “no preference” is specified, the supplier, at his option, shall furnish either an electroplated finish in accordance with Specification **B 633**, Class Fe/Zn 5, Type II, or a mechanically plated finish in accordance with Specification **B 695**, Class 5, Type II.

4.3.5 *Phosphate Coating*—Phosphate coated washers shall be coated in accordance with Military Specification **DOD-P-16232**, Type Z, Class 2.

4.3.6 *Other Coatings*—Other protective coatings shall be as specified by the purchaser.

5. Chemical Composition

5.1 *Composition Limits:*

5.1.1 The washers shall be steel, and unless otherwise specified, shall have no specified chemical composition requirements.

5.1.2 When required, the washers shall be specified to conform to specific chemical requirements.

5.2 *Manufacturer’s Analysis*—When specific chemical requirements have been specified and test reports are required, the manufacturer shall make individual analyses of randomly selected washers from the product to be shipped and report the results to the purchaser. In addition, if heat and lot identities have been maintained, the analysis of the raw material from which the fasteners have been manufactured shall, at the option of the manufacturer, be reported instead of product analysis.

5.3 *Product Analysis*—When specific chemical requirements have been specified, the purchaser reserves the right to conduct product analyses on the finished washers or request the manufacturer to conduct product analyses. The chemical composition thus determined shall conform to the specified requirements subject to the standard permissible variations for product analysis in Specification **A 568/A 568M** for washers punched from sheet; and Specification **A 29/A 29M** for washers machined from bar and tubing, or forged.

6. Mechanical Properties

6.1 Unless otherwise specified, the washers are not furnished to mechanical requirements.

6.2 When required and specified, the washers shall conform to the specified hardness.

7. Dimensions, Mass, and Permissible Variations

7.1 *Standard Dimensions*—Unless otherwise specified, the dimension shall be in accordance with **B18.22.1**, Tables 1A and Tables 1B for Type A washers. Where narrow (N) and wide (W) washers are provided for, the narrow type shall be furnished unless otherwise specified.

7.2 *Non-Standard Dimensions*—Other washers covered by this specification are generally referred to as US standard washers, SAE washers, light steel washers, riveting washers, fender washers, machinery bushing washers, machine screw washers, and similar designations. When specified, washers shall be furnished to these standards or shall be manufactured to the purchasers drawing requirements.

7.3 *Parallelism*—Washer faces shall be parallel within 0.005 in.

7.4 *Flatness:*

7.4.1 Washer faces shall be flat within the following requirements:

Outside Diameter, inches	Out of Flat, inches, maximum
0.500 and less	0.007
0.5625 through 1.250	0.010
over 1.250	0.015

7.4.2 Flatness shall be measured by laying a flat or concave side of the washer, if there is one, on a surface plate (so it rests on its outside diameter), and measuring the maximum difference in height of the other side above the surface plate. If both sides are convex, or if the washer is bent, both sides could be checked in the same manner, but:

7.4.2.1 A convex side will rest on the edge of the hole.

7.4.2.2 A bent (curved) washer shall be restrained to minimize the readings.

7.5 *Runout*—The runout of the outside diameter relative to the inside diameter shall not exceed a full indicator movement (FIM) equal to the inside diameter tolerance of **B18.22.1**.