



Designation: **F 844 – 9800**

## Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use<sup>1</sup>

This standard is issued under the fixed designation F 844; 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.

### 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 American National Standard 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:*

A 29/A29M Specification for Steel Bars, Carbon and Alloy, Hot-Wrought and Cold-Finished, General Requirements for<sup>2</sup>

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<sup>1</sup> This specification is under the jurisdiction of Committee F-16 on Fasteners and is the direct responsibility of Subcommittee F16.02 on Steel Bolts, Nuts, Rivets, and Washers.

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

- A 153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware<sup>3</sup>
- A 568/A568M Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for<sup>4</sup>
- A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products<sup>4</sup>
- B 633 Specification for Electrodeposited Coatings of Zinc on Iron and Steel<sup>5</sup>
- B 695 Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel<sup>5</sup>
- D 3951 Practice for Commercial Packaging<sup>6</sup>
- F 436 Specification for Hardened Steel Washers<sup>7</sup>
- F 436M Specification for Hardened Steel Washers [Metric]<sup>7</sup>
- F 606 Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets<sup>7</sup>
- F 1470 Guide for Fastener Sampling for Specified Mechanical Properties and Performance Inspection<sup>7</sup>
- 2.2 ANSI/ASME Standards:
  - B18.22.1 Plain Washers<sup>8</sup>
  - B18.24.1 Part Identifying Number (PIN) Code System<sup>9</sup>
- 2.3 Military Specification:
  - DOD-P-16232 Phosphate Coating for Ferrous Metals<sup>10</sup>
- 2.4 Federal Specification:
  - QQ-P-416 Plating, Cadmium (Electrodeposited)<sup>10</sup>

### 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 ANSI 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 B18.24.1.

### 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.
- 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.
    - 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.

<sup>2</sup> Annual Book of ASTM Standards, Vol 01.05.

<sup>3</sup> Annual Book of ASTM Standards, Vol 01.06.

<sup>4</sup> Annual Book of ASTM Standards, Vol 01.03.

<sup>5</sup> Annual Book of ASTM Standards, Vol 02.05.

<sup>6</sup> Annual Book of ASTM Standards, Vol 15.09.

<sup>7</sup> Annual Book of ASTM Standards, Vol 01.08.

<sup>8</sup> Available from American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.

<sup>9</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS. American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.

<sup>10</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

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, 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 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 ANSI 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 ANSI B18.22.1 .

## **8. Workmanship, Finish, and Appearance**

8.1 Within the limits of good manufacturing practice, the washers shall be smooth, and free of burrs, loose scale, sharp edges, and other injurious imperfections.

8.2 Where protective finishes are specified, the requirements for the finish shall be in accordance with the requirements of the referenced specification.

## **9. Number of Tests and Retests**

9.1 When mechanical requirements are specified, and for coating weight or thickness of coated products, the number of tests for each requirement specified shall be in accordance with Guide F 1470, sampling level for the detection process; unless the purchaser and manufacturer have mutually agreed to use the prevention process. See Guide F 1470 on Selection of Sampling Plans.

9.2 If the failure of a test specimen is due to improper preparation of the specimen or to incorrect testing technique, the specimen shall be discarded and another test specimen substituted.

## **10. Test Methods**

10.1 *Chemical Analysis*—The chemical composition shall be determined by commercial test method. In the event of disagreement, chemical tests shall be made in accordance with Test Methods A 751.

10.2 *Mechanical Tests*—Hardness tests, when required, shall be performed in accordance with Test Methods F 606.

## **11. Inspection**

11.1 The purchaser's representative representing the purchaser shall have free entry to all parts of the manufacturer's works that concern the manufacture of the material ordered. The manufacturer shall afford the purchaser's representative all reasonable facilities to satisfy that the material is being furnished in accordance with this specification. All tests and inspections required by the specification that are requested by the purchaser's representative shall be made prior to shipment, and shall be conducted so as not to interfere unnecessarily with the operation of the works.

## **12. Certification**

12.1 *Certificate of Compliance*—When specified in the contract or purchase order, the manufacturer shall furnish certification that the product was manufactured and tested in accordance with this specification and conforms to all specified requirements.

12.2 *Test Reports, Normal Inspection*—When test reports are specified on the purchase order for normal inspection as provided for by 9.1, the manufacturer shall furnish a test report certified to be the last complete set of mechanical tests for each stock size in each shipment.

12.3 *Test Reports, Individual Shipments*—When shipment lot testing in accordance with 9.2 is specified in the contract or purchase order, the manufacturer shall furnish a test report showing the results of the tests required for each lot shipped.

## **13. Responsibility**

13.1 The party responsible for the fastener shall be the organization that supplies the fastener to the purchaser and certifies that the fastener was manufactured, sampled, tested and inspected in accordance with this specification and meets all of its requirements.

## **14. Product Marking**

14.1 Individual washers are not required to be marked.

## **15. Packaging and Package Marking**

15.1 *Packaging*:

15.1.1 Unless otherwise specified, packaging shall be in accordance with Practice D 3951.

15.1.2 When special packaging requirements are required, they shall be defined at the time of the inquiry and order.

15.2 *Package Marking*:

15.2.1 Each shipping unit shall include or be plainly marked with the following information:

15.2.1.1 ASTM designation,

15.2.1.2 Size,

15.2.1.3 Name and brand or trademark of the manufacturer,

15.2.1.4 Number of pieces,

15.2.1.5 Purchase order number, and

15.2.1.6 Country of origin.

## **16. Keywords**

16.1 carbon steel; plain; steel; washers

## SUMMARY OF CHANGES

This section identifies the location of selected changes to this specification that have been incorporated since the last 98 issue. For the convenience of the user, Committee F16 has highlighted those changes that may impact the use of this specification. This section may also include descriptions of the changes or reasons for the changes, or both.

- ~~(1) Revised the following sections to change nonmandatory wording such as “may” and “should” to mandatory wording such as “shall” or total rephrasing in mandatory terms. Sections changed are 4.1, 4.3.2.4, 4.3.4.4, 5.1.2, 5.2, 5.3, 6.1, 6.2, 7.2, 7.4.2.2, 8.1, 10.1, and 11.1.~~
- ~~(2) In 4.3.4 added provision) Added 3.2.8, providing for Mechanical Plating.~~
- ~~(3) In 8.1 deleted the phrase “that may affect their serviceability.”~~
- ~~(4) In Section 9, revised to reference Guide F 1470 for number of tests. Deleted the previous 9.2 through 9.2.1.3 as not needed. Expanded 9.1 to provide for optional use of the detection process.~~
- ~~(5) In 11.1 changed “inspector” to “purchaser’s representative”.~~
- ~~(6) Added Section 16, Keywords: ASME B18.24.1, Part Identifying Number (PIN) Code System.~~

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