



Designation: F 436M – 93 (Reapproved 2000)

METRIC

Standard Specification for Hardened Steel Washers [Metric]¹

This standard is issued under the fixed designation F 436M; 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.

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

1. Scope

1.1 This specification covers the chemical, mechanical, and dimensional requirements for metric hardened steel washers for use with fasteners having nominal thread diameters M12 through M100. These washers are intended for general-purpose mechanical and structural use with bolts, nuts, studs, and other internally and externally threaded fasteners. These washers are suitable for use with fasteners covered in Specifications A 325M, A 490M, A 563M and with fasteners of Specification F 568 property classes 8.8 and higher.

1.2 The types of washers covered in this specification are:

1.2.1 *Type 1*—Washers made of carbon steel.

1.2.2 *Type 3*—Washers made of steel having atmospheric corrosion resistance and weathering characteristics comparable to that of steels covered in Specifications A 242/A 242M, A 588/A 588M, and A 709. The atmospheric corrosion resistance of these steels is substantially better than that of carbon steel with or without copper addition. See 5.1. When properly exposed to the atmosphere, these steels can be used bare (uncoated) for many applications.

1.3 The styles of washers covered in this specification are:

1.3.1 *Circular Washers*—Circular washers in nominal sizes 12 mm through 100 mm, are suitable for applications where sufficient space exists and angularity permits.

1.3.2 *Beveled Washers*—Beveled washers are square and rectangular, in nominal sizes 12 mm through 36 mm, with a beveled 1:6 surface for use with American Standard beams and channels.

1.3.3 *Clipped Washers*—Clipped washers are circular or beveled for use where space limitations necessitate that one side be clipped.

NOTE 1—This specification is the metric counterpart of Specification F 436.

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

Current edition approved Feb. 15, 1993. Published April 1993. Originally published as F 436M – 83. Last previous edition F 436M – 91.

2. Referenced Documents

2.1 *ASTM Standards:*

A 153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware²

A 242/A 242M Specification for High-Strength Low-Alloy Structural Steel³

A 325M Specification for High-Strength Bolts for Structural Steel Joints [Metric]⁴

A 490M Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints [Metric]⁴

A 563M Specification for Carbon and Alloy Steel Nuts [Metric]⁴

A 588/A 588M Specification for High-Strength Low-Alloy Structural Steel with 50 ksi [345 MPa] Minimum Yield Point to 4 in. [100 mm] Thick³

A 709 Specification for Structural Steel for Bridges³

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products⁵

B 695 Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel⁶

D 3951 Practice for Commercial Packaging⁷

F 568 Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners⁴

F 606M Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets [Metric]⁴

G 101 Guide for Estimating the Atmospheric Corrosion Resistance of Low-Alloy Steels⁸

2.2 *ANSI Standard:*

² *Annual Book of ASTM Standards*, Vol 01.06.

³ *Annual Book of ASTM Standards*, Vol 01.04.

⁴ *Annual Book of ASTM Standards*, Vol 01.08.

⁵ *Annual Book of ASTM Standards*, Vols 01.01, 01.02, 01.03, 01.04, 01.05, and 01.05.

⁶ *Annual Book of ASTM Standards*, Vol 02.05.

⁷ *Annual Book of ASTM Standards*, Vol 15.09.

⁸ *Annual Book of ASTM Standards*, Vol 03.02.

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B 18.23.2M Metric Beveled Washers⁹

3. Ordering Information

3.1 Orders for washers under this specification shall include the following:

- 3.1.1 Quantity,
- 3.1.2 Name of product, (that is, circular washer, beveled washer, clipped circular washer, or clipped beveled washer),
- 3.1.3 Coating, if required (that is, hot-dip galvanized, mechanically galvanized, etc.),
 - 3.1.3.1 When galvanized washers are specified, the type of galvanizing, such as hot-dip or mechanical (see 6.1 and 6.3),
 - 3.1.3.1.1 When the type of galvanizing is not specified, the manufacturer, at his option, may furnish hot-dip or mechanically galvanized washers,
 - 3.1.4 Dimensions, nominal size, and other dimensions, if modified from those covered in this specification,
 - 3.1.5 Material type of washer (that is, Type 1 or Type 3),
 - 3.1.5.1 When the type is not specified, either Type 1 or Type 3 washers may be supplied when permitted by the purchaser.
 - 3.1.5.2 When atmospheric corrosion resistance is required, Type 3 washers shall be specified by the purchaser.
 - 3.1.6 Surface roughness control (see S1),
 - 3.1.7 ASTM designation and year of issue, and
 - 3.1.8 Any special requirements.

NOTE 2—Two examples of ordering descriptions follow: (1) 1000 pieces, circular washers, hot-dip galvanized, 24 mm, Type 1 ASTM F 436M, dated _____. (2) 5000 pieces, beveled washers, 22 mm, Type 3, ASTM, F 436M, dated _____.

4. Materials and Manufacture

- 4.1 Steel used in the manufacture of washers shall be produced by the open-hearth, basic-oxygen, or electric-furnace process.
- 4.2 All washers in nominal sizes 12 through 36 mm, shall be through-quenched-and-tempered. Washers in nominal sizes larger than 36 mm may be either through-quenched-and-tempered or carburized, quenched-and-tempered at the manufacturer's option.
- 4.3 Hot-dip galvanized washers shall be hot-dip galvanized in accordance with the requirements for Class C of Specification A 153. Mechanically galvanized washers shall be mechanically zinc-coated, and the coating and coated washers shall conform to the requirements for Class 50 of Specification B 695.
- 4.4 If washers are heat treated by a subcontractor, they shall be returned to the manufacturer for testing prior to shipment to the purchaser.

5. Chemical Composition

5.1 Type 1 and Type 3 washers shall conform to the chemical composition requirements specified in Table 1. For Type 3 see Guide G 101 for methods of estimating corrosion resistance of low alloy steels.

TABLE 1 Chemical Requirements

Element	Composition, %	
	Type 1	Type 3 ^A
Phosphorus, max		
Heat analysis	0.040	0.040
Product analysis	0.050	0.045
Sulfur, max		
Heat analysis	0.050	0.050
Product analysis	0.060	0.055
Silicon		
Heat analysis	...	0.15–0.35
Product analysis	...	0.13–0.37
Chromium		
Heat analysis	...	0.45–0.65
Product analysis	...	0.42–0.68
Nickel		
Heat analysis	...	0.25–0.45
Product analysis	...	0.22–0.48
Copper		
Heat analysis	...	0.25–0.45
Product analysis	...	0.22–0.48

^A Type 3 steel washers may also be manufactured from any of the steels listed in Table 2 of Specification F 568.

5.2 Product analysis may be made by the purchaser from finished material representing each lot of washers. The chemical composition shall conform to the requirements of 4.1 and 5.1.

5.3 Individual heats of steel are not identified in the finished product.

5.4 Chemical analyses shall be performed in accordance with Test Methods, Practices, and Terminology A 751.

6. Mechanical Properties

- 6.1 Through-quenched-and-tempered washers shall have a Rockwell hardness of 38 to 45 HRC, except when hot-dip galvanized, in which case they shall have a Rockwell hardness of 26 to 45 HRC.
- 6.2 Carburized, quenched-and-tempered washers shall be carburized to a minimum depth of 0.40 mm and shall have a Rockwell hardness of 69 to 73 HRA.
- 6.3 When mechanically galvanized, washers shall have the same hardness range as noncoated washers.

7. Dimensions and Tolerances

- 7.1 Circular and clipped circular washers shall conform to dimensions given in Table 2. All dimensions apply prior to plating or coating.
 - 7.1.1 The axis of the inside hole shall be located at true position with respect to the axis of the washer circumference within a tolerance zone having a diameter of 0.6 mm for washers of nominal sizes 16 mm and smaller and 0.9 mm for washers of nominal sizes 20 mm and larger.
 - 7.1.2 Washers shall be flat within 0.01 mm/mm outside diameter.
 - 7.1.3 As a result of the punching process, the inside diameter of the washer generally consists of three distinct sections. On the punch entry side of the washer there is some drawing in of the material resulting in a rounded corner section, following which is a substantially parallel section, and finally at the exit side a tapered breakout may occur (see Fig. 1). The parallel sided section of the washer inside diameter shall be within the

⁹ Available from American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.