

FEDERAL SPECIFICATION

WASHER, FLAT (PLAIN)

This specification was approved by the Commissioner, Federal Supply Services, General Services Administration, for the use of all Federal Agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers plain, flat washers.

1.2 Classification. Flat washers covered by this specification shall be of the following types, grades and classes, as specified (see 6.2).

Type:

- A - Round washer
- B - Square washer

Grade.

- I - General assembly purpose washer
- II - Aeronautical assembly purpose washer

Class:

- A - Carbon steel washer
- B - Corrosion-resisting steel washer
- C - Aluminum washer
- D - Aluminum alloy washer
- E - Brass washer
- F - Copper washer
- G - Nickel-copper alloy washer
- H - Plastic (nylon) washer

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

Federal Specifications

- QQ-A-250/1 - Aluminum 1100, Plate and Sheet.
- QQ-A-250/2 - Aluminum Alloy 3003, Plate and Sheet.
- QQ-A-250/5 - Aluminum Alloy Alclad 2024, Plate and Sheet.
- QQ-B-613 - Brass, Leaded and Non-Leaded: Flat Products (Plate, Bar, Sheet and Strip).
- QQ-C-576 - Copper Flat Products with Slit, Slit and Edge-Rolled, Sheared, Sawed or Machined Edges (Plate, Bar, Sheet and Strip).
- QQ-N-281 - Nickel-Copper Alloy Bar, Plate, Rod, Sheet, Strip, Wire, Forgings and Structural and Special Shaped Sections.
- QQ-N-290 - Nickel Plating (Electrodeposited).
- QQ-P-35 - Passivation Treatments for Corrosion-Resisting Steel.
- QQ-P-416 - Plating, Cadmium (Electrodeposited).
- QQ-Z-325 - Zinc Coating, Electrodeposited, Requirements For.
- PPP-H-1581 - Hardware (Fasteners and Related Items), Packaging and Packing for Shipment and Storage of.

Federal Standards

- Fed. Std. No. 66 - Steel: Chemical Composition and Hardenability
- Fed. Std. No. 123 - Marking For Domestic Shipment (Civil Agencies)

(Activities outside the Federal Government may obtain copies of Federal Specifications and Standards as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC, 20402.

(Single copies of this specification and other product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Atlanta, Chicago, Kansas City, MO, Dallas, Denver, San Francisco, Los Angeles, Seattle and Washington, DC.

(Federal Government activities may obtain copies of Federal Specifications and Standards and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Specifications

- MIL-F-495 - Finish, Chemical, Black, For Copper Alloys.
- MIL-A-8625 - Anodic Coatings, For Aluminum and Aluminum Alloys
- MIL-T-10727 - Tin Plating, Electrodeposited or hot-Dipped. For Ferrous and Non-Ferrous Metals.
- MIL-C-13924 - Coating, Oxide, Black, For Ferrous Metals.

- MIL-P-16232 - Phosphate Coatings, Heavy, Manganese or Zinc Base (For Ferrous Metals).
- MIL-I-17214 - Indicator, Permeability, Low-Mu (Go-No Go).
- MIL-M-20693 - Molding Plastic, Polyamide (Nylon), Rigid.
- MIL-C-81562 - Coating, Cadmium and Zinc (Mechanically Deposited).

Military Standards:

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-129 - Marking For Shipment and Storage.

Air Force - Navy Aeronautical Standard:

- AN960 - Washer, Flat

(Copies of specifications, standards, drawings and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

American National Standards Institute (ANSI) Standard:

- ANSI B27.2 - Plain Washers

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY, 10018.)

American Society for Testing and Materials (ASTM) Standard:

- ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA, 19103.)

3. REQUIREMENTS

3.1 Material.

3.1.1 Class A - Carbon steel. Carbon steel washers shall be low carbon steel in accordance with Fed. Std. No. 66.

3.1.2 Class B - Corrosion-resisting steel. Corrosion-resisting steel washers shall be type 301, 302 or 316 in accordance with Fed. Std. No. 66.

FF-W-92B

3.1.2.1 Magnetic permeability. Magnetic permeability shall be 2.0 maximum (air = 1.0) for a field strength of $H = 200$ oersteds when using a magnetic indicator per MIL-I-17214.

3.1.3 Class C - Aluminum. Aluminum washers shall be in accordance with QQ-A-250/1 or QQ-A-250/2, temper H18 or H28.

3.1.4 Class D - Aluminum alloy. Aluminum alloy washers shall be in accordance with QQ-A-250/5, temper T4.

3.1.5 Class E - Brass. Brass washers shall be in accordance with QQ-B-613, composition 11, temper half-hard.

3.1.6 Class F - Copper. Copper washers shall be in accordance with QQ-C-576, temper cold-rolled, hard.

3.1.7 Class G - Nickel-copper alloy. Nickel-Copper alloy washers shall be in accordance with QQ-N-281, Class A, cold rolled, annealed.

3.1.8 Class H - Plastic (nylon). Plastic (nylon) washers shall be in accordance with MIL-M-20693, Type I, natural color.

3.2 Protective finish. Unless otherwise specified (see 6.2), washers shall be furnished plain, with no protective finish. When finishes are specified, they shall be in accordance with the following paragraphs.

3.2.1 Class A - Carbon steel washers.

3.2.1.1 Cadmium plating. Cadmium plating shall be in accordance with QQ-P-416, Type II, Class 3 or MIL-C-81562, Type II, Class 3.

3.2.1.2 Zinc coating. Zinc coating shall be in accordance with QQ-Z-325, Type II or MIL-C-81562, Type II. The thickness on washers for bolt sizes thru 0.250 inch shall be Class 3 and on washers for bolt sizes over 0.250 inch shall be Class 2.

3.2.1.3 Galvanized zinc. Hot-dip galvanizing shall be in accordance with ASTM A153. The thickness shall be 0.00045 inch minimum.

3.2.1.4 Phosphate coating. Phosphate coating shall be in accordance with MIL-P-16232, Type 2, Class 2.

3.2.2 Class B - Corrosion-resisting steel washers.

3.2.2.1 Passivation. Passivation treatment shall be in accordance with QQ-P-35.

3.2.2.2 Black oxide. Black oxide coating shall be in accordance with MIL-C-13924, Class 4.

3.2.3 Classes C and D - Aluminum and aluminum alloy washers.

3.2.3.1 Anodizing. Anodizing shall be in accordance with MIL-A-8625, Type I or II, Class 1.

3.2.4 Classes E and F - Brass and copper washers.

3.2.4.1 Tin plating. Tin plating shall be in accordance with MIL-T-10727.

3.2.4.2 Nickel plating. Nickel plating shall be in accordance with QQ-N-290, Class 1, Grade F.

3.2.4.3 Black chemical. Black chemical finish shall be in accordance with MIL-F-495.

3.3 Dimensions.

3.3.1 Type A, round washers.

3.3.1.1 Grade I. Grade I, general assembly purpose washers shall be in accordance with the dimensions in the applicable military standard and ANSI B27.2.

3.3.1.2 Grade II. Grade II, aeronautical assembly purpose washers shall be in accordance with the dimensions in AN 960.

3.3.1.3 Washer faces shall be parallel within 0.002 inch. Washer faces shall be flat within:

0.007 inch for bolt sizes thru 0.500 inch.

0.010 inch for bolt sizes 0.5625 thru 1.250 inches.

0.015 inch for bolts sizes over 1.250 inches.

3.3.1.4 Concentricity. The inside diameter and the outside diameter shall be concentric within the tolerance of the inside diameter.

3.3.2 Type B - Square washers. Square washers shall be in accordance with the dimensions in Table I.

3.4 Workmanship. Washers shall be flat and smooth and free from burrs, loose scale, sharp edges and all other defects that may affect their serviceability.

Table I - Type B, grade I square washers

Nom. bolt size	Inside diameter		Outside width		Thickness	
	Min.	Max.	Min.	Max.	Min.	Max.
.375	.438	.469	1.50	1.56	.125	.156
.4375	.500	.531	1.75	1.81	.125	.156
.500	.562	.594	2.00	2.06	.188	.219
.625	.719	.750	2.25	2.31	.250	.281
.750	.844	.875	2.50	2.56	.250	.281
.875	.969	1.000	3.00	3.06	.250	.281
1.000	1.094	1.125	3.50	3.56	.375	.406
1.125	1.250	1.312	4.00	4.12	.375	.406
1.250	1.375	1.438	4.50	4.62	.375	.406
1.375	1.500	1.562	5.00	5.12	.375	.406
1.500	1.625	1.688	5.00	6.12	.375	.406
1.750	1.875	1.938	6.50	6.62	.375	.406
2.000	2.125	2.188	7.00	7.12	.375	.406

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Lot. - lot shall consist of all washers of the same type, grade, class, size and protective finish, produced under the same conditions and offered for acceptance at one time.

4.3 Sampling

4.3.1 Sampling for examination. A random sample of washers shall be selected from each lot in accordance with MIL-STD-105, inspection level S-2. The Acceptable Quality Level (AQL) shall be 4.0 percent defective.

4.3.2 Sampling for tests. A random sample of washers shall be selected from each lot in accordance with MIL-STD-105, inspection level S-1. The AQL shall be 2.5 percent defective

4.4 Examination. Samples selected in accordance with 4.3.1 shall be visually examined for material (3.1), protective finish (3.2), dimensions (3.3) and workmanship (3.4). Corrosion-resisting steel washers shall be checked for magnetic permeability (3.1.2.1). Any washer containing one or more defects shall be rejected, and if the number of defective washers exceed the acceptance number, the lot represented by the sample shall be rejected.

4.5 Tests.

4.5.1 Protective finish. Tests for protective finishes shall be in accordance with the applicable specification of 3.2.

4.5.2 Preparation for delivery. Tests for preparation for delivery shall be in accordance with PPP-H-1581 to verify conformance with Section 5.

5. PREPARATION FOR DELIVERY

5.1 Packaging and packing. Packaging shall be Level A or C and packing shall be Level A, B or C in accordance with PPP-H-1581, as specified (see 6.2).

5.2 Marking.

5.2.1 Civil agencies. In addition to marking required by the contract or order, all interior packages and shipping containers shall be marked in accordance with Fed. Std. No. 123.

5.2.2 Military agencies. In addition to marking required by the contract or order, all interior packages and shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. Flat washers are intended for automotive, aircraft and general bolt, nut and screw application. Their purpose is to provide an increased bearing surface and to prevent galling of the base material.

FF-W-92B

6.2 Ordering data. Purchasers should select the preferred options permitted herein and include the following information in procurement documents.

- (a) Title, number and date of this specification.
- (b) Type, grade and class (1.2).
- (c) Protective finish, if required (3.2).
- (d) Dimensions (3.3).
- (e) Selection of applicable levels of packaging and packing (5.1).
- (f) Applicable MS or AN part number.

Military Custodians:

Army - WC
Navy - OS
Air Force - 82

Preparing Activity:

Army - WC

Project No. 5310-0846

Reviewer Activities

Army - AT, AV, CE, ME
Navy - None
Air Force - None
DSA - IS

Civil Agency Coordinating Activity:

GSA - FSS

User Activities:

Army - MU, WT
Navy - AS, MC, SH, YD
Air Force - None

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Orders for this publication are to be placed with General Services Administration, acting as an agent for the Superintendent of Documents. See section 2 of this specification to obtain copies and other documents referenced herein Price 10 cents each.

INSTRUCTIONS. In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (*DO NOT STAPLE*), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

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OTHER (Specify): _____

3b. ADDRESS (Street, City, State ZIP Code)

5. PROBLEM AREAS

a. Paragraph Number and Wording.

b. Recommended Wording.

c. Reason/Justification for Recommendation

6. REMARKS

7a. NAME OF SUBMITTER (Last, First, MI) - Optional

8. WORK TELEPHONE NUMBER (Include Area Code) - Optional

7b. MAILING ADDRESS (Street, City, State ZIP Code) - Optional

9. DATE OF SUBMISSION (YYMMDD)