

GENERAL INFORMATION & REFERENCE SPECIFICATIONS

FLAT WASHER AVAILABILITY - The flat washers listed in this catalog represent only a small portion of the many that are available. The WCL inventory contains over 7000 different sizes, in different materials, etc. All of these cannot be listed here because of space limitations. Source tooling is available for many others not shown. Pages 29 and 30 show some of the more commonly used specials that are available, cross-referenced to appropriate ordnance numbers.

QUALITY ASSURANCE - WCL has a Quality Assurance Department and Program to confirm the integrity of all the products it sells. We represent only those manufacturers that have an outstanding reputation for consistently providing high quality parts, and we maintain complete procurement data and certifications from our suppliers and processors on pertinent Stock Reference items.

SPECIFICATIONS, TESTING AND CERTIFICATIONS - A detailed explanation of the test requirements called for under the various military specifications and a listing of the many certifications available through WCL, appear on pages 8 and 9. WCL can be an indispensable source for parts conforming to all MIL-SPEC requirements. If parts are not tested to MIL-SPEC requirements, they are not MIL-SPEC parts. If parts are not plated to MIL-SPEC requirements, they are not MIL-SPEC parts.

NOMINAL DIMENSIONS - Nominal dimensions are provided on all flat washers and are so identified. They are provided for reference only. Parts are produced to standard commercial tolerance and are appropriate for all commercial applications. With regards to thickness dimensions indicated, parts conform to stamping industry standards. WCL frequently stocks popular washer sizes in more than one thickness and this is indicated in the charts. For specific tolerances and thicknesses on other referenced parts, please contact WCL. Parts with special tolerances and thicknesses can be provided as specified.

INSIDE DIAMETER PROFILE - The inside diameter of a conventional flat washer traditionally has three distinct profiles as a result of the punch press process. As the punch enters, there is some pushing in of the material which results in a rounded corner section (A). Then, as the punch advances, it creates a substantially parallel section until it approaches the exit point and a tapered breakout occurs (B). Dimensions given for inside diameters, and their accepted tolerances, apply to the parallel sections. At the break out side of the washer, the specified maximum inside diameter may be exceeded by a maximum of 25% of the specified thickness. (See figure 1.)

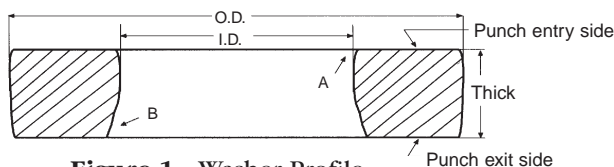


Figure 1 - Washer Profile
(Exaggerated for clarity)

MATERIALS AND PLATING - The charts on the following pages show the availability of washers in the more popular materials. Many of these washers are available in other non-ferrous materials and non-metallics. In the appropriate materials availability columns, standard dash reference numbers are used for AN, MS and NAS parts as well as for some commercial parts to indicate the availability of these parts in the designated materials and finishes. For commercial parts, an "X" designation is used. (See figure 2.)

METRIC WASHERS - The many metric flat washers available from WCL are designated with an (M-) prefix for the metric screw or bolt size in the "Size" column. Metric washers are available in either DIN or ANSI/ASME B18.22M specifications and the relevant specification is indicated in the particular "Reference" column. (Example of M6 see Figure 2.) Material thicknesses on metric parts generally conform to conventional U.S. washer manufacturing tolerances unless the parts have been stamped from material produced to metric thickness.

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WCL PART NUMBERS - Example: The Type A part shown in Figure 2 is expressed as follows:

FW - 0266-0625-049-ST1-ZN1 $\frac{FW}{Type}$ $\frac{0.266}{I.D.}$ $\frac{0.625}{O.D.}$ $\frac{0.049}{THK.}$ $\frac{ST1}{MAT.}$ $\frac{ZN1}{FIN.}$ MAT.=material ST1=commercial steel
 FIN.=finish ZN1=zinc and clear

CATALOG INFORMATION - Washers are grouped by type and listed by size, first by I.D., then by O.D., then thickness. (See Figure 2).

SYMBOLS AND ABBREVIATIONS - In the appropriate materials availability columns for the parts on the following pages, standard dash numbers are used for AN, MS, and NAS parts, and for some commercial references, to indicate the availability of these parts in designated materials and finishes. Other non-ferrous and non-metallic washers are also available, see pages 31-35.

EXAMPLE - Here is a listing for one of the MS parts that appear among the 1/4" diameter metallic flat washers on Page 17. In addition to the nominal dimensional data and basic part specifications, the listing shows the availability of this part in steel plated in the thickness specified (X), and in additional thickness as indicated by the * after the X. This specific part is also available in stainless steel, passivated and plated, as indicated by the appropriate dash numbers.

Size	Nominal Dimensions			Reference Part Number	Steel Plated	AN-MS-NAS Dash Numbers						
	I.D.	O.D.	Thick			Stainless Steel		Brass		Aluminum Alloy		
						Pass.	Plated	Plain	Plated	Plain	Chem Treat	Anodize
M6	.266	.504	.058	ANSI	X							
1/4	.266	.625	.032	MS15795	X*	852	852B					
1/4	.266	.625	.049	TYPE A	X*			X*		X*		

Figure 2

The **Type A** washer, shown here is available in steel, brass and aluminum alloy plain in the designated thickness, and also additional thicknesses designated by an (*) asterisk next to the X.

“AVAILABLE” - This designates standard commercial parts in the predominant dimensions shown and in the materials designated by an “X” in the appropriate columns. Call for availability.

REFERENCE PART NUMBERS - Washers listed in the charts on the following pages are referenced to appropriate commercial and government part numbers. The following observations on these particular references may be of help.

AMERICAN NATIONAL STANDARD WASHERS - Designated by ASME B18.22.1, these washers are of two types: A and B. Many washers are available in either narrow (-N), regular (-R), or wide (-W) series.

AN 960 - Most AN960 steel washers now in stock are made to Revision 21, which specifies steel to MIL-S-7952. Some remaining stock is made to Revision 18, which may still be used in accordance with the government’s “phase-in, phase-out” policy on most specification revisions. The entire 960 series will eventually be replaced by the NAS 1149 specification, which is now recommended for use in new designs. AN960 washers are stocked, in accordance with the specification, with CAD II plating. AN960 washers are also stocked in other materials and platings, including : Stainless Steel, passivated (-C) and black oxide (-XC); Brass (-B); Aluminum, plain (-D); Aluminum with a Chemical Film (-JD); and Aluminum Anodized (-KD).

AN 961 - washers, having the same dimensions as the AN960 washers, appear in the Brass column and are available with either a Tin (-T) or a Silver (-S) finish. Note the AN letters are not in the column and are designated by “961-1016.” (See Figure 3 Brass Plated column.)

AN 970 - washers have oversized outside diameters and are stocked in Steel, plated Cad II (yellow) or, commercially, with a zinc finish. (See Figure 3 for example in Steel and Stainless, AN 970-10 & -C10).

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NAS 620 - washers are used to mount small items with vent radii and other interferences, most commonly found in electronic components. Stocked in steel, stainless steel, brass and aluminum.

NAS 1149 - this new specification was introduced in 1992 to eventually replace the AN960 specification which is now classified, per revision 21, as “inactive for new design.” This means that on all new products NAS1149 washers may be specified. AN960 washers may continue to be ordered and used in the ongoing production or repair of already designed products. NAS1149 duplicates most of the AN960 parts, but additional, material options permit specification of Titanium and other special high strength alloy materials. Selected NAS1149 parts are referenced in the following charts as an indication of the availability of this series. WCL stocks many of these washers and can supply detailed information and prints when requested. Boeing is one particular used who requires this series. (See Figure 3).

Size	Nominal Dimensions			Reference Part Number	Steel Plated	AN-MS-NAS Dash Numbers						
	I.D.	O.D.	Thick			Stainless Steel		Brass		Aluminum Alloy		
						Pass.	Plated	Plain	Plated	Plain	Chem Treat	Anodize
5/8	.640	1.188	.063	AN960	1016	C1016	XC1016	B1016	961-1016	D1016	JD1016	KD1016
5/8	.640	1.188	.063	NAS1149	F1062P	C1063R	B1062H		D1063H	D1063J	D1063K	
5/8	.640	1.312	.010	STK STD	X							

Figure 3

MS 15795 - designates general purpose washers and the Dash Numbers show Stainless Steel, Brass and Aluminum. Other materials are available, as well as conventional plated steel. Not specifically listed, but also available from stock are Copper (-500 series) and Nickel Copper alloy (-400 series). The NASM series supercedes the MS15795, but the part numbers remain the same.

MS 27183 - specifies general purpose washers in Steel, grades 1008 through 1020 ASTM-A109, #4 temper with Cadmium II plating. This series is also available commercially with zinc and other finishes. MS27183 supersedes MS 15795-200 series.

MS 51496 - these Army and Air Force customer numbers have a reduced outside diameter (narrow series) and are made from Stainless Steel, 20 HRC minimum, passivated, with a 2.0 magnetic permeability or less. This specification may be subject to modification by the Committee on MIL Specifications as a result of difficulties experienced in meeting some dimensional, material and hardness requirements.

MS 9321 and MS 9549 - made from AMS 5510 stainless steel in a variety of sizes.

MS 14151 - washers are made from Stainless Type 304 and are normally used in electrical and other non-corrosive applications.

MS 16212 - specifies a medium series washer made from non-magnetic Stainless having minimum tensile strength of 50,000 psi.

N 400, N 401, N 402 - this series of washers are General Electric reference numbers for flat washers. Many of these G.E. part numbers cross over to MS series, but have tighter tolerances. WCL supplies MS series to G.E.'s tighter tolerances.

OTHER REFERENCED PART NUMBERS - washers meeting other specific OEM references are also shown. These include Martin Marietta, Boeing, Ordnance, etc. WCL offers many other Mil Spec parts, see High Strength-Heat Treated and Non-Metallic sections for numbers that fall under these categories.