HOBSON ENGINEERING

WASHERS

Red Fibre HEC	Z/P AS1237:1973 Mild Steel	HDG HEC Mild Steel	Z/P HEC Mild Steel	PLN HEC Mild Steel	Z/P HEC Mild Steel	ZYP DIN 125A Mild Steel
						
METRIC FLAT ROUND	METRIC ENGINEERS WASHER	METRIC FLAT ROUND	METRIC FLAT ROUND	METRIC FLAT ROUND	IMPERIAL FLAT ROUND	METRIC FLAT ROUND
WRRFPM	WEMSZM	WRMSGM	WRMSZM	WRMSPM	WRMSZ	WRMSYM

SS 304 HEC	SS 304 DIN 125A	SS 304 HEC	SS 316 HEC	SS 316 DIN 125A	SS 316 HEC	Brass HEC BS 3410
						
METRIC FLAT ROUND	METRIC FLAT ROUND	IMPERIAL FLAT ROUND	METRIC FLAT ROUND	METRIC FLAT ROUND	IMPERIAL FLAT ROUND	IMPERIAL FLAT ROUND
WR04PM	WR04TM	WR04P	WR16PM	WR16TM	WR16P	WRBRP

HDG AS1237.1-2002 Mild Steel	Z/P AS1237.1-2002 Mild Steel	Z/P AS 1237.1-2002 Mild Steel	Z/P HEC Mild Steel	SS 304 DIN 9021	SS 316 DIN 9021	Brass HEC AS 1237
						
METRIC X LARGE FLAT ROUND	METRIC X LARGE FLAT ROUND	METRIC PANEL	IMPERIAL MUDGUARD	METRIC MUDGUARD	METRIC MUDGUARD	METRIC FLAT ROUND
WXMSGM	WXMSZM	WPMSZM	WRMSZU	WR04MM	WR16MM	WRBRPM

Z/P HEC Mild Steel	PLN HEC Mild Steel	HDG HEC Mild Steel	SS 304 ANSI B18.21.1	SS 304 HEC 127B	SS 316 ANSI B18.21.1	SS 316 HEC 127B
						
LARGE FLAT RND SUPA® WASHER	LARGE FLAT RND SUPA® WASHER	LARGE FLAT RND SUPA® WASHER	IMPERIAL SPRING FLAT SECTION	METRIC SPRING FLAT SECTION	IMPERIAL SPRING FLAT SECTION	METRIC SPRING FLAT SECTION
WRMSZLM	WRMSPLM	WRMSGLM	WR04S0	WR04SM	WR16S	WR16SM

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WASHERS

HDG HEC 127B Spring Steel	Z/P HEC 127B Spring Steel	ZYP HEC 127B Spring Steel	Z/P ANSI B18.21.1 Spring Steel	Z/P HEC 7980 Spring Steel	ZYP HEC 7980 Spring Steel	HDG ANSI B18.21.1 Spring Steel
						
METRIC SPRING FLAT SECTION	METRIC SPRING FLAT SECTION	METRIC SPRING FLAT SECTION	IMPERIAL SPRING FLAT SECTION	METRIC SPRING SQ SECTION	METRIC SPRING SQ SECTION	IMPERIAL SPRING SQ SECTION
WRMSGSM	WRMSZSM	WRMSYSM	WRMSZS	WRMSZSQM	WRMSYSQM	WRMSGSQ

Z/P ANSI B18.21.1 Spring Steel	Z/P IFI 532 Type A	Z/P IFI 532 Type A	Z/P ASME B18.21.1 Type A	Z/P ASME B18.21.1 Type A	SS 304 DIN 6797 Type A	SS 304 DIN 6797 Type J
						
IMPERIAL SPRING SQ SECTION	LOCK INTERNAL TOOTH	LOCK EXTERNAL TOOTH	LOCK INTERNAL TOOTH	LOCK EXTERNAL TOOTH	LOCK EXTERNAL TOOTH	LOCK INTERNAL TOOTH
WRMSZSQ	WLMSZTIM	WLMSZTEM	WLMSZTI	WLMSZTE	WL04TEM	WL04TIM

SS 316 DIN 6798 Type A	SS 304 DIN 6798 Type A	SS 304 DIN 6798 Type J	SS 304 HEC	SS 304 HEC	SS 316 HEC	HDG HEC Mild Steel
						
LOCK EXT SERR TOOTH	LOCK EXT SERR TOOTH	LOCK INT SERR TOOTH	CUP WASHER	METRIC BELLEVILLE WASHER	METRIC SQUARE	METRIC SQUARE
WL16SEM	WL04SEM	WL04SIM	WR04C	WR04BM	WS16PM	WSMSGM

ZYP HEC Mild Steel	HOBKOTE® HEC Mild Steel	HDG HEC Mild Steel	PLN HEC 38-45 HRC	Z/P ASTM F436M 38-45 HRC	PLN ASTM F436 38-45 HRC	ZYP ASTM F436 38-45 HRC
						
METRIC SQUARE	METRIC SQUARE	SQUARE WASHER SQUARE HOLE	METRIC FLAT ROUND SAMPSON™	METRIC FLAT ROUND SAMPSON™	IMPERIAL FLAT ROUND SAMPSON™	IMPERIAL FLAT ROUND SAMPSON™
WSMSYM	WSMSHM	WSMSGQ	WR43PM	WR43ZM	WR43P	WR43Y

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WASHERS

Xylan Blue HEC 38-45 HRC	HDG AS 1237 35-41 HRC	H9 IMPACT™ 43-49 HRC	PLN HEC 43-49 HRC	ZYP HEC 43-49 HRC
				
IMPERIAL FLAT ROUND SAMPSON™	METRIC FLAT ROUND HARDENED		IMPERIAL FLAT ROUND	IMPERIAL FLAT ROUND
WR43B	WRHTGM		WRH9P	WRH9Y

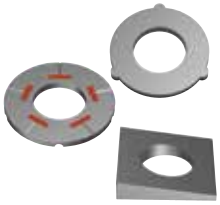
PLN AS 1085.7	HDG HEC Mild Steel	SS 316 HEC
		
FISHBOLT SPRING WASHER	METRIC SECURITY MESH CLIP	VOLUTE SPRING WASHER
DWRHTPSM	HWCMSGM	WV16PM

Washers Gauge Converter

gauge no.	inch	mm
8	0.1570"	3.988
9	0.1398"	3.551
10	0.1250"	3.175
12	0.0991"	2.517
14	0.0785"	1.994
16	0.0625"	1.588
18	0.0495"	1.257
19	0.0420"	1.0668
20	0.0350"	0.8890
21	0.0320"	0.8128
22	0.0290"	0.7366
30	0.0123"	0.3124

Other Washers

Hobson Engineering have a wide variety of specialised Washers, more of which can be found here:



Structural  **p10**

Bumax  **p34**

Nord-Lock  **p36**

Schnorr  **p38**

Nylon  **p44**

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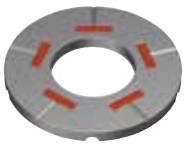
WASHERS

Types of Washers

Standard Washers

A standard washer is a thin plate typically round or square with a hole that is normally in the centre. They are used for two main reasons:

1. To minimise scouring or scratch damage to mating material as a result of nut rotation.
2. To increase the effective bearing surface of the bolt and or nut. That is, to distribute the load of a threaded fastener over a larger area and prevent deformation of the bearing surfaces.



Squirter Washers (DTIs)

Direct tension indicating (DTI) washers are used to ensure the required pre-load tension in a joint is achieved. They are hardened washers with protruding lugs or bumps on the bearing face. When the bolt assembly is tightened, these lugs are deformed to a prescribed level and hence indicate that the required tension in the assembly has been achieved. During the lug deformation process, silicone is squeezed out, giving a visible sign of correct tension in the bolt assembly.

Load Indicating Washers (LIWs)

Work much the same as Squirter Washers (DTIs) minus the silicone process.

Split type

Developed 110 years ago, the split type spring washer was the first washer that offered a solution to the loosening of bolted assemblies. These are hardened washers that are split with out of plane deformations. They should be used under the head of the bolt with the assembly being tensioned by rotating the nut. If they need to be used on the nut side, another hardened flat round washer should be used between the nut and the split washer.

When the washers are flattened, a prescribed tension is achieved in the assembly. Naturally, these washers do not indicate any over-tightening of the bolt assembly. The split-lock washers are made from hardened spring steel that strongly resists compression. When the threaded fasteners are tightened, the protruding corner edges of the split-lock washers bite into both compressing surfaces in a manner that resists counter-clockwise rotation to vibration in a manner similar to a ratchet .

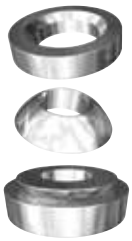
Spring Washers

"Threaded assemblies inherently involve the mating of inclined planes under load. These inclined planes consist of the lead and flank angle of the screw or bolt thread and the angle of the mating thread in the nut plate. There is a natural tendency for these mating threads to slide "downhill" until tension is lost in an assembly. If assembled materials are soft or yield under load, or if thermocycling causes expansion and contraction of the materials, essential tension dissipates fairly quickly"[1]. There are various types of spring washers that are designed to prevent loosening of bolted assemblies.

Belleville Washer

A Belleville washer, also known as a coned-disc spring or conical washer and cupped spring washer, is a type of spring shaped like a washer. It has a frusto-conical shape which gives the washer a spring characteristic. The Belleville name comes from the inventor Jullian F. Belleville. In the initial tightening, the effect on the joint is similar to a split type spring washer. However, as the tightening continues and the washer is flattened, it actually reduces the applied load in the bolt assembly. In this way, if the joint is loosened, the load will increase and hence counteract the loosening of the joint.

Multiple Belleville washers may be stacked to modify the spring constant or amount of deflection.



Spherical Washers

Spherical washers are designed to accommodate a 10-15 degree variation in the alignment of a joint. A cone washer fits inside a cup washer and they slide against each other to reduce bending stresses in the bolt. One application for these washers is in racing kart seats where the chassis twists dramatically.

Lock Washers

A toothed lock washer, also known as a star washer, has teeth or prongs which extend radially inward and/or outward. This maintains tension and opposes any loosening influence on the fastener. The flexed teeth absorb shock, vibration and slipping. These washers are designed to retain fasteners by achieving an increased friction between the fastener and the mating material through mechanical interlocking or interference. They also provide some tension, as with spring washers but at a vastly reduced magnitude. There are two main types, teeth twisted out of plane (Type A) and edges of the teeth folded in opposite directions (Type B).

Lock Washers – 2 piece type (Nord-Lock)

Two piece lock washers that are designed to prevent bolt assemblies loosening through vibration. They consist of two disks with interposing ramps. "Sharp ridges on the upper and lower surfaces of the disks grab the nut and joint surfaces. If the nut backs off a little it drags its disc along with it; the ramps on its disk climb the ramps on the lower disk. The interaction of these ramp or cam surfaces prevent loss of tension in the bolt"[2].

References:
Ajax technical note AFI/02/007
1 Charles F Jacobs. American Fastener Journal 1997
2 An Introduction to the design and behaviour of bolted joints. John H Bickford
Nuts, Bolts, Fasteners and Plumbing Handbook. Carroll Smith
Wikipedia

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