

SOME TECHNICAL NOTES ON THE WASHERS.

BACK

The following types of washers are available from AHC (Camberley Ltd

PLAIN EDGE(PE) WASHERS
 MUDGUARD REPAIR WASHERS
 SPRING WASHERS
 SHAKEPROOF WASHERS
 CRINKLE WASHERS
 SQUARE PLATE WASHERS
 TAPERED WASHERS
 TIMBER DOG CONNECTOR
 SURFACE CUPS
 INSERT CUPS
 RIVET WASHERS

PLAIN EDGE (PE) WASHERS



There are 3 engineering families of washer to fit metric, imperial, and BA types of fasteners. There are others covering structural and aircraft but they are not covered here.

Metric washers are specified by British Standard BS4320 (types A, B, C & D) and the German Standard DIN125A for A type only.

For a specified bolt size, there are four types of metric PE washer, namely, types A, B, C & D. All have the same internal dimension but differ in thickness and outside diameter.

Types A and B have the same dimensions except Type A is thicker.

Types C and D have the same dimensions except Type C is thicker.

Types C and D have a larger outside diameter than Types A and B.

The actual dimensions for a given bolt size is shown below:

Nominal Size Of Bolt	Washer I/D	Washer O/D For Types A & B	Washer O/D For Types C & D	Washer Thickness For Types A & C	Washer Thickness For Types B & D
M1.6	1.7	4.0	—	0.3	—
M2.0	2.2	5.0	—	0.3	—

M2.2	2.4	5.0	—	0.5	—
M2.5	2.7	6.5	—	0.5	—
M3	3.2	7.0	—	0.5	—
M3.5	3.7	7.0	—	0.5	—
M4	4.3	9.0	10.0	0.8	—
M4.5	4.8	9.0	—	0.8	—
M5	5.3	10.0	12.5	1.0	—
M6	6.4	12.5	14.0	1.6	0.8
M7	7.4	14.0	—	1.6	0.8
M8	8.4	17.0	21.0	1.6	1.0
M10	10.5	21.0	24.0	2.0	1.3
M12	13.0	24.0	28.0	2.5	1.6
M14	15.0	28.0	30.0	2.5	1.6
M16	17.0	30.0	34.0	3.0	2.0
M18	19.0	34.0	37.0	3.0	2.0
M20	21.0	37.0	39.0	3.0	2.0
M22	23.0	39.0	44.0	3.0	2.0
M24	25.0	44.0	50.0	4.0	2.5
M27	28.0	50.0	56.0	4.0	2.5
M30	31.0	56.0	60.0	4.0	2.5
M33	34.0	60.0	66.0	5.0	3.0
M36	37.0	66.0	72.0	5.0	3.0

Four sizes of imperial plain edge (PE) washers are available. They are specified in two thicknesses (heavy and light gauge) and two outside diameters to fit a specified bolt size. Standard imperial sizes are covered by BS3410, Tables 1 to 4 as follows:

Table 1 - small BA

Table 2 - large BA

Table 3 - small size for Imperial and American bolts

Table 4 - large size for Imperial and American bolts

Small Bright Washers, BS3410, Table 1.							
(For Use with BA And American Number Fasteners)							
BA Size	USA No Size	Internal Diameter		External Diameter		Washer Thickness	
		Min	Max	Min	Max	swg	inches
8	2	0.099	0.094	0.185	0.18	25	0.02
7	3	0.111	0.106	0.208	0.203	24	0.022
6	4	0.123	0.118	0.233	0.228	23	0.024
5	5	0.14	0.135	0.268	0.263	23	0.024

4	6	0.157	0.152	0.301	0.296	22	0.028
3	8	0.177	0.172	0.341	0.336	22	0.028
2	10	0.202	0.197	0.391	0.386	21	0.032
1	12	0.228	0.223	0.443	0.438	20	0.036
0	—	0.256	0.251	0.5	0.495	19	0.04

Large Bright Washers, BS3410, Table 2.

(For Use with BA And American Number Fasteners)

BA Size	USA No Size	Internal Diameter		External Diameter		Washer Thickness	
		Min	Max	Min	Max	swg	inches
14		0.049	0.044	0.097	0.092	27	0.016
12	—	0.061	0.056	0.13	0.125	27	0.016
10	0	0.078	0.073	0.176	0.171	27	0.016
9	1	0.086	0.081	0.197	0.192	27	0.016
8	2	0.099	0.094	0.228	0.223	25	0.02
7	3	0.111	0.106	0.257	0.252	22	0.028
6	4	0.123	0.118	0.288	0.283	20	0.036
5	5	0.14	0.135	0.335	0.33	20	0.036
4	6	0.157	0.152	0.378	0.373	19	0.04
3	8	0.177	0.172	0.432	0.427	19	0.04
2	10	0.202	0.197	0.5	0.495	18	0.048
1	12	0.228	0.223	0.565	0.56	18	0.048
0	—	0.256	0.251	0.625	0.62	17	0.056

Light And Heavy Small Bright Washers, BS3410, Table 3.

(For Use with BSW, BSF, UNC & UNF Fasteners)

Bolt Size	Internal Diameter		External Diameter		Heavy Thickness		Light Thickness	
	Min	Max	Min	Max	swg	inches	swg	inches
1/4	0.270	0.265	0.562	0.557	17	0.056	20	0.03
5/16	0.333	0.328	0.625	0.620	15	0.072	19	0.04
3/8	0.395	0.390	0.750	0.745	15	0.072	18	0.048
7/16	0.458	0.453	0.875	0.870	13	0.092	18	0.048
1/2	0.520	0.515	1.000	0.995	13	0.092	17	0.056
9/16	0.593	0.588	1.125	1.115	12	0.104	17	0.056
5/8	0.656	0.651	1.250	1.240	11	0.116	15	0.072
3/4	0.781	0.776	1.500	1.490	10	0.128	15	0.072
7/8	0.906	0.901	1.625	1.615	9	0.144	15	0.072
1	1.031	1.026	1.875	1.865	8	0.16	15	0.072
1.1/8	1.156	1.151	2.125	2.115	7	0.176	13	0.092

1.1/4	1.281	1.276	2.375	2.355	7	0.176	11	0.116
1.3/8	1.406	1.401	2.625	2.605	6	0.192	—	—
1.1/2	1.531	1.526	2.875	2.855	6	0.192	—	—
1.3/4	1.781	1.776	3.375	3.345	5	0.212	—	—
2	2.031	2.026	3.625	3.595	5	0.212	—	—

Light & Heavy Large Bright Washers, BS3410, Table 4.
 (For Use with BSW, BSF, UNC & UNF Fasteners)

Bolt Size	Internal Diameter		External Diameter		Heavy Thickness		Light Thickness	
	Min	Max	Min	Max	swg	inches	swg	inches
1/4	0.270	0.265	0.625	0.620	17	0.056	19	0.040
5/16	0.333	0.328	0.750	0.745	15	0.072	18	0.048
3/8	0.395	0.390	0.875	0.870	15	0.072	18	0.048
7/16	0.458	0.453	1.000	0.995	13	0.092	17	0.056
1/2	0.520	0.515	1.125	1.115	13	0.092	17	0.056
9/16	0.593	0.588	1.250	1.240	12	0.104	17	0.056
5/8	0.656	0.651	1.375	1.365	11	0.116	15	0.072
3/4	0.781	0.776	1.625	1.615	10	0.128	15	0.072
7/8	0.906	0.901	1.875	1.865	9	0.144	15	0.072
1	1.031	1.026	2.125	2.115	8	0.160	13	0.092
1.1/8	1.156	1.151	2.375	2.355	7	0.176	12	0.104
1.1/4	1.281	1.276	2.625	2.605	7	0.176	11	0.116
1.3/8	1.406	1.401	2.875	2.855	6	0.192	10	0.128
1.1/2	1.531	1.526	3.125	3.095	6	0.192	10	0.128
1.3/4	1.781	1.776	3.625	3.595	5	0.212	10	0.128
2	2.031	2.026	4.125	4.095	5	0.212	10	0.128

Standard productions are in brass, steel and stainless steel. Washers are also available in nylon copper and fibre but the tolerances may not be to the above BS Specifications.

LARGE DIAMETER REPAIR WASHERS

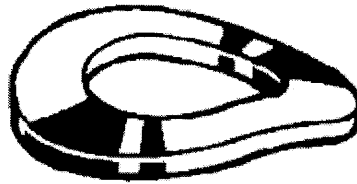
(ALSO KNOWN AS MUDGUARD OR PENNY WASHERS)



These are characterised by the outside diameter being many times that of the internal diameter. In all cases the thickness is usually thin except for 1/2" and above.

Available in zinc plated and self colour steel, stainless steel, and nylon. Note that the range is more limited for stainless steel and nylon.

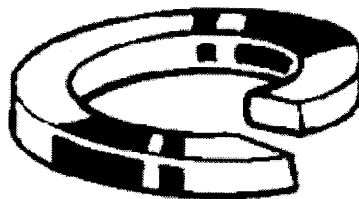
SPRING WASHERS



Spring washers are used for: taking-up slackness where there are large tolerance variations in assemblies, anti-rattle, end-play eliminators, cushioning for light loads, etc.

There are many forms, e.g. crinkle, Bellville, disc springs. The most common is the crinkle washer, which is manufactured from beryllium copper and from stainless steel.

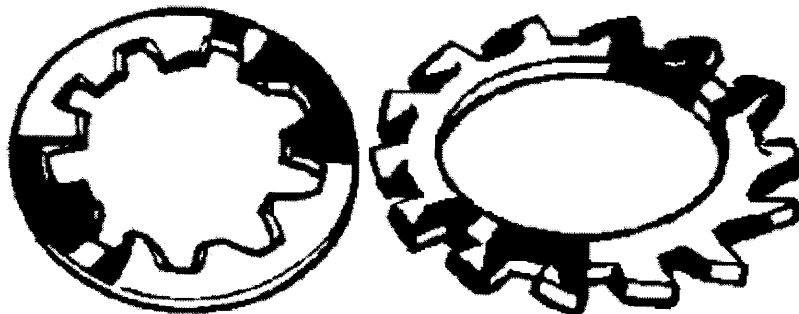
HELICAL SPRUNG STEEL S-COIL WASHERS



Helical spring washers feature spring take-up for locking action. The hardened thrust bearing surfaces reduce the friction between the bearing faces to facilitate tightening and/or disassembly. They are available in square and rectangular section. Square section is used where there is a need to keep the washer protruding beyond the diameter of the screw head e.g. socket cap screws and machine screws. Rectangular section is used with hexagon headed bolts and setscrews. They are available carbon steel (self colour and zinc plated) and in A2 and A4 stainless steel.

Double coil washers (D-Coil) are also available for even greater locking action.

SERRATED SHAKEPROOF WASHERS



Shakeproof washers are designed with tooth forms designed to indent and grip on the bearing surfaces when tightened down to provide a locking action resistant to loosening by vibration. They are normally made from carbon steel or stainless steel.

Internal and external types are the most common but others are available e.g. serrated countersunk.

Internal shakeproof are mainly intended for use with small head screws and for those applications where it is desirable to hide the teeth.

External washers should be used wherever possible as the teeth are on the largest radius, thereby providing greater torsional resistance. They should be used with fasteners having heads large enough to contact the lock washer teeth, such as round or pan head.

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