

BRITISH FASTENERS

British Standard Square and Hexagon Bolts, Screws and Nuts.—Important dimensions of precision hexagon bolts, screws and nuts (B.S.W. and B.S.F. threads) as covered by British Standard 1083:1965 are given in Tables 1 and 2. The use of fasteners in this standard will decrease as fasteners having Unified inch and ISO metric threads come into increasing use. Dimensions of Unified precision hexagon bolts, screws and nuts (UNC and UNF threads) are given in BS 1768:1963 (obsolescent); of Unified black hexagon bolts, screws and nuts (UNC and UNF threads) in BS 1769:1951 (obsolescent); and of Unified black square and hexagon bolts, screws and nuts (UNC and UNF threads) in BS 2708:1956 (withdrawn). Unified nominal and basic dimensions in these British Standards are the same as the comparable dimensions in the American Standards, but the tolerances applied to these basic dimensions may differ because of rounding-off practices and other factors. For Unified dimensions of square and hexagon bolts and nuts as given in ANSI/ASME B18.2.1-1996 and ANSI/ASME B18.2.2-1987 (R1999) see Tables 1 to 4, and 7 to 10 starting on page 1494. ISO metric precision hexagon bolts, screws and nuts are specified in the British Standard BS 3692:1967 (obsolescent) (see *British Standard ISO Metric Precision Hexagon Bolts, Screws and Nuts* starting on page 1559), and ISO metric black hexagon bolts, screws and nuts are covered by British Standard BS 4190:1967 (obsolescent).

British Standard Screwed Studs.—General purpose screwed studs are covered in British Standard 2693: Part 1:1956. The aim in this standard is to provide for a stud having tolerances which would not render it expensive to manufacture and which could be used in association with standard tapped holes for most purposes. Provision has been made for the use of both Unified Fine threads, Unified Coarse threads, British Standard Fine threads, and British Standard Whitworth threads as shown in the table on page 1554.

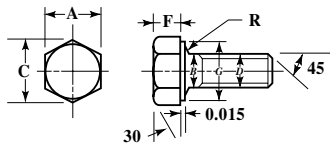
Designations: The *metal end* of the stud is the end which is screwed into the component. The *nut end* is the end of the screw of the stud which is not screwed into the component. The *plain portion* of the stud is the unthreaded length.

Recommended Fitting Practices for Metal End of Stud: It is recommended that holes tapped to Class 3B limits (see Table 3 on page 1716) in accordance with B.S. 1580 “Unified Screw Threads” or to Close Class limits in accordance with B.S. 84 “Screw Threads of Whitworth Form” as appropriate, be used in association with the metal end of the stud specified in this standard. Where fits are not critical, however, holes may be tapped to Class 2B limits (see table on page 1716) in accordance with B.S. 1580 or Normal Class limits in accordance with B.S. 84.

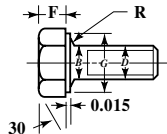
It is recommended that the B.A. stud specified in this standard be associated with holes tapped to the limits specified for nuts in B.S. 93, 1919 edition. Where fits for these studs are not critical, holes may be tapped to limits specified for nuts in the current edition of B.S. 93.

In general, it will be found that the amount of oversize specified for the studs will produce a satisfactory fit in conjunction with the standard tapping as above. Even when interference is not present, locking will take place on the thread runout which has been carefully controlled for this purpose. Where it is considered essential to assure a true interference fit, higher grade studs should be used. It is recommended that standard studs be used even under special conditions where selective assembly may be necessary.

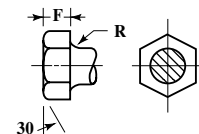
British Standard Whitworth (B.S.W.) and Fine (B.S.F.) Precision Hexagon Bolts, Screws, and Nuts



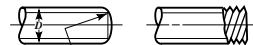
Hexagon Head Bolt, Washer Faced



Hexagon Head Screw, Washer Faced

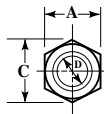


Alternative Full-Bearing Head



1/4" D Rad. Approx.

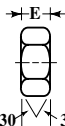
Rounded End Rolled Thread End
Alternative Ends



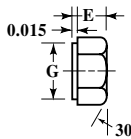
Hexagon Nut, Full



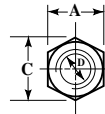
Ordinary Bearing



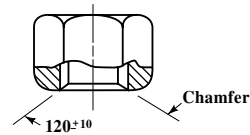
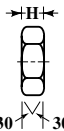
Double Chamfered



Washer Faced

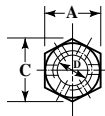


Hexagon Lock-Nut

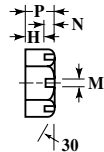


Enlarged View of Nut Countersink

Alternative Hexagon Ordinary Nuts



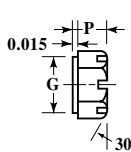
Hexagon Slotted Nut, Full Bearing



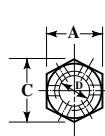
Double Chamfered



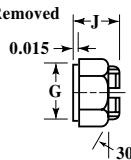
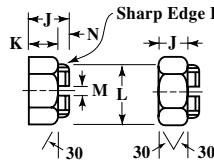
Washer Faced



Alternative Hexagon Slotted Nuts



Hexagon Castle Nut, Full Bearing
Double Chamfered
Washer Faced



Alternate Hexagon Castle Nuts

For dimensions, see Tables 1 and 2.

Table 1. British Standard Whitworth (B.S.W.) and Fine (B.S.F.) Precision Hexagon Slotted and Castle Nuts BS 1083:1965 (obsolescent)

Nominal Size <i>D</i>	Number of Threads per Inch		Bolts, Screws, and Nuts					Bolts and Screws						Nuts			
			Width			Diameter of Washer Face <i>G</i>	Radius Under Head <i>R</i>	Diameter of Unthreaded Portion of Shank <i>B</i>		Thickness		Thickness					
			Across Flats <i>A</i>		Across Corners <i>C</i>							Head <i>F</i>		Ordinary <i>E</i>		Lock <i>H</i>	
	B.S.W.	B.S.F.	Max.	Min. ^a	Max.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
¼	20	26	0.445	0.438	0.51	0.428	0.418	0.025	0.015	0.2500	0.2465	0.176	0.166	0.200	0.190	0.185	0.180
⅜	18	22	0.525	0.518	0.61	0.508	0.498	0.025	0.015	0.3125	0.3090	0.218	0.208	0.250	0.240	0.210	0.200
½	16	20	0.600	0.592	0.69	0.582	0.572	0.025	0.015	0.3750	0.3715	0.260	0.250	0.312	0.302	0.260	0.250
⅝	14	18	0.710	0.702	0.82	0.690	0.680	0.025	0.015	0.4375	0.4335	0.302	0.292	0.375	0.365	0.275	0.265
¾	12	16	0.820	0.812	0.95	0.800	0.790	0.025	0.015	0.5000	0.4960	0.343	0.333	0.437	0.427	0.300	0.290
⅞	12	16	0.920	0.912	1.06	0.900	0.890	0.045	0.020	0.5625	0.5585	0.375	0.365	0.500	0.490	0.333	0.323
1	11	14	1.010	1.000	1.17	0.985	0.975	0.045	0.020	0.6250	0.6190	0.417	0.407	0.562	0.552	0.375	0.365
1 ⅛	10	12	1.200	1.190	1.39	1.175	1.165	0.045	0.020	0.7500	0.7440	0.500	0.480	0.687	0.677	0.458	0.448
1 ¼	9	11	1.300	1.288	1.50	1.273	1.263	0.065	0.040	0.8750	0.8670	0.583	0.563	0.750	0.740	0.500	0.490
1 ½	8	10	1.480	1.468	1.71	1.453	1.443	0.095	0.060	1.0000	0.9920	0.666	0.636	0.875	0.865	0.583	0.573
1 ⅝	7	9	1.670	1.640	1.93	1.620	1.610	0.095	0.060	1.1250	1.1170	0.750	0.710	1.000	0.990	0.666	0.656
1 ¾	7	9	1.860	1.815	2.15	1.795	1.785	0.095	0.060	1.2500	1.2420	0.830	0.790	1.125	1.105	0.750	0.730
1 ⅞ ^b	...	8	2.050	2.005	2.37	1.985	1.975	0.095	0.060	1.3750	1.3650	0.920	0.880	1.250	1.230	0.833	0.813
2	6	8	2.220	2.175	2.56	2.155	2.145	0.095	0.060	1.5000	1.4900	1.000	0.960	1.375	1.355	0.916	0.896
2 ¼	5	7	2.580	2.520	2.98	2.495	2.485	0.095	0.060	1.7500	1.7400	1.170	1.110	1.625	1.605	1.083	1.063
2 ½	4.5	7	2.760	2.700	3.19	2.675	2.665	0.095	0.060	2.0000	1.9900	1.330	1.270	1.750	1.730	1.166	1.146

^a When bolts from ¼ to 1 inch are hot forged, the tolerance on the width across flats shall be two and a half times the tolerance shown in the table and shall be unilaterally minus from maximum size. For dimensional notation, see diagram on page 1552.

^b Noted standard with B.S.W. thread.

All dimensions in inches except where otherwise noted.

Table 2. British Standard Whitworth (B.S.W.) and Fine (B.S.F.) Precision Hexagon Slotted and Castle Nuts BS 1083:1965 (obsolescent)

Nominal Size <i>D</i>	Number of Threads per Inch		Slotted Nuts				Castle Nuts						Slotted and Castle Nuts		
			Thickness <i>P</i>		Lower Face to Bottom of Slot <i>H</i>		Total Thickness <i>J</i>		Lower Face to Bottom of Slot <i>K</i>		Castellated Portion		Slots		
	Diameter <i>L</i>												Width <i>M</i>		Depth <i>N</i>
B.S.W.	B.S.F.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Approx.	
¼	20	26	0.200	0.190	0.170	0.160	0.290	0.280	0.200	0.190	0.430	0.425	0.100	0.090	0.090
⅝ ₁₆	18	22	0.250	0.240	0.190	0.180	0.340	0.330	0.250	0.240	0.510	0.500	0.100	0.090	0.090
⅜	16	20	0.312	0.302	0.222	0.212	0.402	0.392	0.312	0.302	0.585	0.575	0.100	0.090	0.090
7 ₁₆	14	18	0.375	0.365	0.235	0.225	0.515	0.505	0.375	0.365	0.695	0.685	0.135	0.125	0.140
½	12	16	0.437	0.427	0.297	0.287	0.577	0.567	0.437	0.427	0.805	0.795	0.135	0.125	0.140
9 ₁₆	12	16	0.500	0.490	0.313	0.303	0.687	0.677	0.500	0.490	0.905	0.895	0.175	0.165	0.187
⅝	11	14	0.562	0.552	0.375	0.365	0.749	0.739	0.562	0.552	0.995	0.985	0.175	0.165	0.187
¾	10	12	0.687	0.677	0.453	0.443	0.921	0.911	0.687	0.677	1.185	1.165	0.218	0.208	0.234
7 ₈	9	11	0.750	0.740	0.516	0.506	0.984	0.974	0.750	0.740	1.285	1.265	0.218	0.208	0.234
1	8	10	0.875	0.865	0.595	0.585	1.155	1.145	0.875	0.865	1.465	1.445	0.260	0.250	0.280
1 ₈	7	9	1.000	0.990	0.720	0.710	1.280	1.270	1.000	0.990	1.655	1.635	0.260	0.250	0.280
1¼	7	9	1.125	1.105	0.797	0.777	1.453	1.433	1.125	1.105	1.845	1.825	0.300	0.290	0.328
1 ₈ ^a	...	8	1.250	1.230	0.922	0.902	1.578	1.558	1.250	1.230	2.035	2.015	0.300	0.290	0.328
1½	6	8	1.375	1.355	1.047	1.027	1.703	1.683	1.375	1.355	2.200	2.180	0.300	0.290	0.328
1¾	5	7	1.625	1.605	1.250	1.230	2.000	1.980	1.625	1.605	2.555	2.535	0.343	0.333	0.375
2	4.5	7	1.750	1.730	1.282	1.262	2.218	2.198	1.750	1.730	2.735	2.715	0.426	0.416	0.468

^a Not standard with B.S.W. thread. For widths across flats, widths across corners, and diameter of washer face see Table 1. For dimensional notation, see diagram on page 1552.

All dimensions in inches except where otherwise noted.

Table 1. British Standard ISO Metric Precision Hexagon Bolts, Screws and Nuts
BS 3692:1967 (obsolescent)

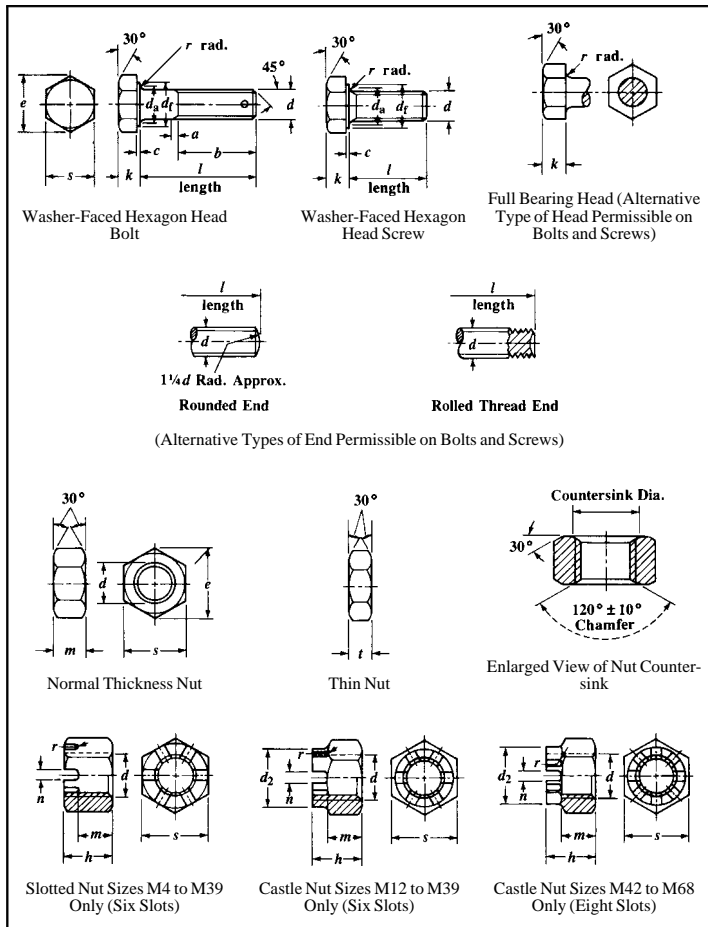


Table 2. British Standard ISO Metric Precision Hexagon Bolts and Screws BS 3692:1967 (obsolescent)

Nom. Size and Thread Dia. ^a <i>d</i>	Pitch of Thread (Coarse Pitch-Series)	Thread Runout <i>a</i>		Dia. of Unthreaded Shank <i>d</i>		Width Across Flats <i>s</i>		Width Across Corners <i>e</i>		Dia. of Washer Face <i>d_f</i>		Depth of Washer Face <i>c</i>	Transition Dia. ^b <i>d_u</i>		Radius Under Head ^b <i>r</i>		Height of Head <i>k</i>		Eccentricity of Head	Eccentricity of Shank and Split Pin Hole to the Thread
		Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.		Max.	Min.	Max.	Min.	Max.	Min.		
M1.6	0.35	0.8		1.6	1.46	3.2	3.08	3.7	3.48	...	...	...	2.0	0.2	0.1	1.225	0.975	0.18	0.14
M2	0.4	1.0		2.0	1.86	4.0	3.88	4.6	4.38	...	...	...	2.6	0.3	0.1	1.525	1.275	0.18	0.14
M2.5	0.45	1.0		2.5	2.36	5.0	4.88	5.8	5.51	...	...	...	3.1	0.3	0.1	2.125	1.875	0.18	0.14
M3	0.5	1.2		3.0	2.86	5.5	5.38	6.4	6.08	5.08	4.83	0.1	3.6	0.3	0.1	2.125	1.875	0.18	0.14	
M4	0.7	1.6		4.0	3.82	7.0	6.85	8.1	7.74	6.55	6.30	0.1	4.7	0.35	0.2	2.925	2.675	0.22	0.18	
M5	0.8	2.0		5.0	4.82	8.0	7.85	9.2	8.87	7.55	7.30	0.2	5.7	0.35	0.2	3.650	3.35	0.22	0.18	
M6	1	2.5		6.0	5.82	10.0	9.78	11.5	11.05	9.48	9.23	0.3	6.8	0.4	0.25	4.15	3.85	0.22	0.18	
M8	1.25	3.0		8.0	7.78	13.0	12.73	15.0	14.38	12.43	12.18	0.4	9.2	0.6	0.4	5.65	5.35	0.27	0.22	
M10	1.5	3.5		10.0	9.78	17.0	16.73	19.6	18.90	16.43	16.18	0.4	11.2	0.6	0.4	7.18	6.82	0.27	0.22	
M12	1.75	4.0		12.0	11.73	19.0	18.67	21.9	21.10	18.37	18.12	0.4	14.2	1.1	0.6	8.18	7.82	0.33	0.27	
(M14)	2	5.0		14.0	13.73	22.0	21.67	25.4	24.49	21.37	21.12	0.4	16.2	1.1	0.6	9.18	8.82	0.33	0.27	
M16	2	5.0		16.0	15.73	24.0	23.67	27.7	26.75	23.27	23.02	0.4	18.2	1.1	0.6	10.18	9.82	0.33	0.27	
(M18)	2.5	6.0		18.0	17.73	27.0	26.67	31.2	30.14	26.27	26.02	0.4	20.2	1.1	0.6	12.215	11.785	0.33	0.27	
M20	2.5	6.0		20.0	19.67	30.0	29.67	34.6	33.53	29.27	28.80	0.4	22.4	1.2	0.8	13.215	12.785	0.33	0.33	
(M22)	2.5	6.0		22.0	21.67	32.0	31.61	36.9	35.72	31.21	30.74	0.4	24.4	1.2	0.8	14.215	13.785	0.39	0.33	
M24	3	7.0		24.0	23.67	36.0	35.38	41.6	39.98	34.98	34.51	0.5	26.4	1.2	0.8	15.215	14.785	0.39	0.33	
(M27)	3	7.0		27.0	26.67	41.0	40.38	47.3	45.63	39.98	39.36	0.5	30.4	1.7	1.0	17.215	16.785	0.39	0.33	
M30	3.5	8.0		30.0	29.67	46.0	45.38	53.1	51.28	44.98	44.36	0.5	33.4	1.7	1.0	19.26	18.74	0.39	0.33	
(M33)	3.5	8.0		33.0	32.61	50.0	49.38	57.7	55.80	48.98	48.36	0.5	36.4	1.7	1.0	21.26	20.74	0.39	0.39	
M36	4	10.0		36.0	35.61	55.0	54.26	63.5	61.31	53.86	53.24	0.5	39.4	1.7	1.0	23.26	22.74	0.46	0.39	
(M39)	4	10.0		39.0	38.61	60.0	59.26	69.3	66.96	58.86	58.24	0.6	42.4	1.7	1.0	25.26	24.74	0.46	0.39	
M42	4.5	11.0		42.0	41.61	65.0	64.26	75.1	72.61	63.76	63.04	0.6	45.6	1.8	1.2	26.26	25.74	0.46	0.39	
(M45)	4.5	11.0		45.0	44.61	70.0	69.26	80.8	78.26	68.76	68.04	0.6	48.6	1.8	1.2	28.26	27.74	0.46	0.39	
M48	5	12.0		48.0	47.61	75.0	74.26	86.6	83.91	73.76	73.04	0.6	52.6	2.3	1.6	30.26	29.74	0.46	0.39	
(M52)	5	12.0		52.0	51.54	80.0	79.26	92.4	89.56	...	...	...	56.6	2.3	1.6	33.31	32.69	0.46	0.46
M56	5.5	19.0		56.0	55.54	85.0	84.13	98.1	95.07	...	...	...	63.0	3.5	2.0	35.31	34.69	0.54	0.46
(M60)	5.5	19.0		60.0	59.54	90.0	89.13	103.9	100.72	...	...	...	67.0	3.5	2.0	38.31	37.69	0.54	0.46
M64	6	21.0		64.0	63.54	95.0	94.13	109.7	106.37	...	...	...	71.0	3.5	2.0	40.31	39.69	0.54	0.46
(M68)	6	21.0		68.0	67.54	100.0	99.13	115.5	112.02	...	...	...	75.0	3.5	2.0	43.31	42.69	0.54	0.46

^a Sizes shown in parentheses are non-preferred.

^b A true radius is not essential provided that the curve is smooth and lies wholly within the maximum radius, determined from the maximum transitional diameter, and the minimum radius specified.

All dimensions are in millimeters. For illustration of bolts and screws see Table 1.

Table 3. British Standard ISO Metric Precision Hexagon Nuts and Thin Nuts BS 3692:1967 (obsolescent)

Nominal Size and Thread Diameter ^a <i>d</i>	Pitch of Thread (Coarse Pitch Series)	Width Across Flats <i>s</i>		Width Across Corners <i>e</i>		Thickness of Normal Nut <i>m</i>		Tolerance on Squareness of Thread to Face of Nut ^b	Eccentricity of Hexagon	Thickness of Thin Nut <i>t</i>	
		Max.	Min.	Max.	Min.	Max.	Min.	Max.		Max.	Min.
M1.6	0.35	3.20	3.08	3.70	3.48	1.30	1.05	0.05	0.14	...	...
M2	0.4	4.00	3.88	4.60	4.38	1.60	1.35	0.06	0.14	...	...
M2.5	0.45	5.00	4.88	5.80	5.51	2.00	1.75	0.08	0.14	...	...
M3	0.5	5.50	5.38	6.40	6.08	2.40	2.15	0.09	0.14	...	...
M4	0.7	7.00	6.85	8.10	7.74	3.20	2.90	0.11	0.18	...	...
M5	0.8	8.00	7.85	9.20	8.87	4.00	3.70	0.13	0.18	...	...
M6	1	10.00	9.78	11.50	11.05	5.00	4.70	0.17	0.18	...	...
M8	1.25	13.00	12.73	15.00	14.38	6.50	6.14	0.22	0.22	5.0	4.70
M10	1.5	17.00	16.73	19.60	18.90	8.00	7.64	0.29	0.22	6.0	5.70
M12	1.75	19.00	18.67	21.90	21.10	10.00	9.64	0.32	0.27	7.0	6.64
(M14)	2	22.00	21.67	25.4	24.49	11.00	10.57	0.37	0.27	8.0	7.64
M16	2	24.00	23.67	27.7	6.75	13.00	12.57	0.41	0.27	8.0	7.64
(M18)	2.5	27.00	26.67	31.20	30.14	15.00	14.57	0.46	0.27	9.0	8.64
M20	2.5	30.00	29.67	34.60	33.53	16.00	15.57	0.51	0.33	9.0	8.64
(M22)	2.5	32.00	31.61	36.90	35.72	18.00	17.57	0.54	0.33	10.0	9.64
M24	3	36.00	35.38	41.60	39.98	19.00	18.48	0.61	0.33	10.0	9.64
(M27)	3	41.00	40.38	47.3	45.63	22.00	21.48	0.70	0.33	12.0	11.57
M30	3.5	46.00	45.38	53.1	51.28	24.00	23.48	0.78	0.33	12.0	11.57
(M33)	3.5	50.00	49.38	57.70	55.80	26.00	25.48	0.85	0.39	14.0	13.57
M36	4	55.00	54.26	63.50	61.31	29.00	28.48	0.94	0.39	14.0	13.57
(M39)	4	60.00	59.26	69.30	66.96	31.00	30.38	1.03	0.39	16.0	15.57
M42	4.5	65.00	64.26	75.10	72.61	34.00	33.38	1.11	0.39	16.0	15.57
(M45)	4.5	70.00	69.26	80.80	78.26	36.00	35.38	1.20	0.39	18.0	17.57
M48	5	75.00	74.26	86.60	83.91	38.00	37.38	1.29	0.39	18.0	17.57
(M52)	5	80.00	79.26	92.40	89.56	42.00	41.38	1.37	0.46	20.0	19.48
M56	5.5	85.00	84.13	98.10	95.07	45.00	44.38	1.46	0.46	...	...
(M60)	5.5	90.00	89.13	103.90	100.72	48.00	47.38	1.55	0.46	...	...
M64	6	95.00	94.13	109.70	106.37	51.00	50.26	1.63	0.46	...	...
(M68)	6	100.00	99.13	115.50	112.02	54.00	53.26	1.72	0.46	...	...

^a Sizes shown in parentheses are non-preferred.

^b As measured with the nut squareness gage described in the text and illustrated in Appendix A of the Standard and a feeler gage.

All dimensions are in millimeters. For illustration of hexagon nuts and thin nuts see Table 1.

Table 4. British Standard ISO Metric Precision Hexagon Slotted Nuts and Castle Nuts BS 3692:1967 (obsolescent)

Nominal Size and Thread Diameter ^a <i>d</i>	Width Across Flats <i>s</i>		Width Across Corners <i>e</i>		Diameter <i>d</i> ₂		Thickness <i>h</i>		Lower Face of Nut to Bottom of Slot <i>m</i>		Width of Slot <i>n</i>		Radius (0.25 <i>n</i>) <i>r</i>	Eccentricity of the Slots
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Min.	Max.
M4	7.00	6.85	8.10	7.74	...	...	5	4.70	3.2	2.90	1.45	1.2	0.3	0.18
M5	8.00	7.85	9.20	8.87	...	...	6	5.70	4.0	3.70	1.65	1.4	0.35	0.18
M6	10.00	9.78	11.50	11.05	...	...	7.5	7.14	5	4.70	2.25	2	0.5	0.18
M8	13.00	12.73	15.00	14.38	...	...	9.5	9.14	6.5	6.14	2.75	2.5	0.625	0.22
M10	17.00	16.73	19.60	18.90	...	...	12	11.57	8	7.64	3.05	2.8	0.70	0.22
M12	19.00	18.67	21.90	21.10	17	16.57	15	14.57	10	9.64	3.80	3.5	0.875	0.27
(M14)	22.00	21.67	25.4	24.49	19	18.48	16	15.57	11	10.57	3.80	3.5	0.875	0.27
M16	24.00	23.67	27.7	26.75	22	21.48	19	18.48	13	12.57	4.80	4.5	1.125	0.27
(M18)	27.00	26.67	31.20	30.14	25	24.48	21	20.48	15	14.57	4.80	4.5	1.125	0.27
M20	30.00	29.67	34.60	33.53	28	27.48	22	21.48	16	15.57	4.80	4.5	1.125	0.33
(M22)	32.00	31.61	36.90	35.72	30	29.48	26	25.48	18	17.57	5.80	5.5	1.375	0.33
M24	36.00	35.38	41.60	39.98	34	33.38	27	26.48	19	18.48	5.80	5.5	1.375	0.33
(M27)	41.00	40.38	47.3	45.63	38	37.38	30	29.48	22	21.48	5.80	5.5	1.375	0.33
M30	46.00	45.38	53.1	51.28	42	41.38	33	32.38	24	23.48	7.36	7	1.75	0.33
(M33)	50.00	49.38	57.70	55.80	46	45.38	35	34.38	26	25.48	7.36	7	1.75	0.39
M36	55.00	54.26	63.50	61.31	50	49.38	38	37.38	29	28.48	7.36	7	1.75	0.39
(M39)	60.00	59.26	69.30	66.96	55	54.26	40	39.38	31	30.38	7.36	7	1.75	0.39
M42	65.00	64.26	75.10	72.61	58	57.26	46	45.38	34	33.38	9.36	9	2.25	0.39
(M45)	70.00	69.26	80.80	78.26	62	61.26	48	47.38	36	35.38	9.36	9	2.25	0.39
M48	75.00	74.26	86.60	83.91	65	64.26	50	49.38	38	37.38	9.36	9	2.25	0.39
(M52)	80.00	79.26	92.40	89.56	70	69.26	54	53.26	42	41.38	9.36	9	2.25	0.46
M56	85.00	84.13	98.10	95.07	75	74.26	57	56.26	45	44.38	9.36	9	2.25	0.46
(M60)	90.00	89.13	103.90	100.72	80	79.26	63	62.26	48	47.38	11.43	11	2.75	0.46
M64	95.00	94.13	109.70	106.37	85	84.13	66	65.26	51	50.26	11.43	11	2.75	0.46
(M68)	100.00	99.13	115.50	112.02	90	89.13	69	68.26	54	53.26	11.43	11	2.75	0.46

^aSizes shown in parentheses are non-preferred.

All dimensions are in millimeters. For illustration of hexagon slotted nuts and castle nuts see Table 1.

After several years of use of BS 2693:Part 1:1956 (obsolescent), it was recognized that it would not meet the requirements of all stud users. The thread tolerances specified could result in clearance of interference fits because locking depended on the run-out threads. Thus, some users felt that true interference fits were essential for their needs. As a result, the British Standards Committee has incorporated the Class 5 interference fit threads specified in American Standard ASA B1.12 into the BS 2693:Part 2:1964, "Recommendations for High Grade Studs."

British Standard ISO Metric Precision Hexagon Bolts, Screws and Nuts.—This British Standard BS 3692:1967 (obsolescent) gives the general dimensions and tolerances of precision hexagon bolts, screws and nuts with ISO metric threads in diameters from 1.6 to 68 mm. It is based on the following ISO recommendations and draft recommendations: R 272, R 288, DR 911, DR 947, DR 950, DR 952 and DR 987. Mechanical properties are given only with respect to carbon or alloy steel bolts, screws and nuts, which are not to be used for special applications such as those requiring weldability, corrosion resistance or ability to withstand temperatures above 300°C or below -50°C. The dimensional requirements of this standard also apply to non-ferrous and stainless steel bolts, screws and nuts.

Finish: Finishes may be dull black which results from the heat-treating operation or may be bright finish, the result of bright drawing. Other finishes are possible by mutual agreement between purchaser and producer. It is recommended that reference be made to BS 3382 "Electroplated Coatings on Threaded Components" in this respect.

General Dimensions: The bolts, screws and nuts conform to the general dimensions given in Tables 1, 2, 3 and 4.

Nominal Lengths of Bolts and Screws: The nominal length of a bolt or screw is the distance from the underside of the head to the extreme end of the shank including any chamfer or radius. Standard nominal lengths and tolerances thereon are given in Table 5.

Table 5. British Standard ISO Metric Bolt and Screw Nominal Lengths
BS 3692:1967 (obsolescent)

Nominal Length ^a <i>l</i>	Tolerance	Nominal Length ^a <i>l</i>	Tolerance	Nominal Length ^a <i>l</i>	Tolerance	Nominal Length ^a <i>l</i>	Tolerance
5	± 0.24	30	± 0.42	90	± 0.70	200	± 0.925
6	± 0.24	(32)	± 0.50	(95)	± 0.70	220	± 0.925
(7)	± 0.29	35	± 0.50	100	± 0.70	240	± 0.925
8	± 0.29	(38)	± 0.50	(105)	± 0.70	260	± 1.05
(9)	± 0.29	40	± 0.50	110	± 0.70	280	± 1.05
10	± 0.29	45	± 0.50	(115)	± 0.70	300	± 1.05
(11)	± 0.35	50	± 0.50	120	± 0.70	325	± 1.15
12	± 0.35	55	± 0.60	(125)	± 0.80	350	± 1.15
14	± 0.35	60	± 0.60	130	± 0.80	375	± 1.15
16	± 0.35	65	± 0.60	140	± 0.80	400	± 1.15
(18)	± 0.35	70	± 0.60	150	± 0.80	425	± 1.25
20	± 0.42	75	± 0.60	160	± 0.80	450	± 1.25
(22)	± 0.42	80	± 0.60	170	± 0.80	475	± 1.25
25	± 0.42	85	± 0.70	180	± 0.80	500	± 1.25
(28)	± 0.42	...	...	190	± 0.925	...	...

^a Nominal lengths shown in parentheses are non-preferred.

All dimensions are in millimeters.

Bolt and Screw Ends: The ends of bolts and screws may be finished with either a 45-degree chamfer to a depth slightly exceeding the depth of thread or a radius approximately

equal to $1\frac{1}{4}$ times the nominal diameter of the shank. With rolled threads, the lead formed at the end of the bolt by the thread rolling operation may be regarded as providing the necessary chamfer to the end; the end being reasonably square with the center line of the shank.

Screw Thread Form: The form of thread and diameters and associated pitches of standard ISO metric bolts, screws, and nuts are in accordance with BS 3643:Part 1:1981 (1998), "Principles and Basic Data" The screw threads are made to the tolerances for the medium class of fit (6H/6g) as specified in BS 3643:Part 2:1981 (1998), "Specification for Selected Limits of Size."

Length of Thread on Bolts: The length of thread on bolts is the distance from the end of the bolt (including any chamfer or radius) to the leading face of a screw ring gage which has been screwed as far as possible onto the bolt by hand. Standard thread lengths of bolts are $2d + 6$ mm for a nominal length of bolt up to and including 125 mm, $2d + 12$ mm for a nominal bolt length over 125 mm up to and including 200 mm, and $2d + 25$ mm for a nominal bolt length over 200 mm. Bolts that are too short for minimum thread lengths are threaded as screws and designated as screws. The tolerance on bolt thread lengths are plus two pitches for all diameters.

Length of Thread on Screws: Screws are threaded to permit a screw ring gage being screwed by hand to within a distance from the underside of the head not exceeding two and a half times the pitch for diameters up to and including 52 mm and three and a half times the pitch for diameters over 52 mm.

Angularity and Eccentricity of Bolts, Screws and Nuts: The axis of the thread of the nut is square to the face of the nut subject to the "squareness tolerance" given in Table 3.

In gaging, the nut is screwed by hand onto a gage, having a truncated taper thread, until the thread of the nut is tight on the thread of the gage. A sleeve sliding on a parallel extension of the gage, which has a face of diameter equal to the minimum distance across the flats of the nut and exactly at 90 degrees to the axis of the gage, is brought into contact with the leading face of the nut. With the sleeve in this position, it should not be possible for a feeler gage of thickness equal to the "squareness tolerance" to enter anywhere between the leading nut face and sleeve face.

The hexagon flats of bolts, screws and nuts are square to the bearing face, and the angularity of the head is within the limits of 90 degrees, plus or minus 1 degree. The eccentricity of the hexagon flats of nuts relative to the thread diameter should not exceed the values given in Table 3 and the eccentricity of the head relative to the width across flats and eccentricity between the shank and thread of bolts and screws should not exceed the values given in Table 2.

Chamfering, Washer Facing and Countersinking: Bolt and screw heads have a chamfer of approximately 30 degrees on their upper faces and, at the option of the manufacturer, a washer face or full bearing face on the underside. Nuts are countersunk at an included angle of 120 degrees plus or minus 10 degrees at both ends of the thread. The diameter of the countersink should not exceed the nominal major diameter of the thread plus 0.13 mm up to and including 12 mm diameter, and plus 0.25 mm above 12 mm diameter. This stipulation does not apply to slotted, castle or thin nuts.

Strength Grade Designation System for Steel Bolts and Screws: This Standard includes a strength grade designation system consisting of two figures. The first figure is one tenth of the minimum tensile strength in kgf/mm², and the second figure is one tenth of the ratio between the minimum yield stress (or stress at permanent set limit, $R_{0.2}$) and the minimum tensile strength, expressed as a percentage. For example with the strength designation grade 8.8, the first figure 8 represents $\frac{1}{10}$ the minimum tensile strength of 80 kgf/mm² and the second figure 8 represents $\frac{1}{10}$ the ratio

$$\frac{\text{stress at permanent set limit } R_{0.2}\%}{\text{minimum tensile strength}} = \frac{1}{10} \times \frac{64}{80} \times \frac{100}{1}$$

the numerical values of stress and strength being obtained from the accompanying table.

Strength Grade Designations of Steel Bolts and Screws

Strength Grade Designation	4.6	4.8	5.6	5.8	6.6	6.8	8.8	10.9	12.9	14.9
Tensile Strength (R_m), Min.	40	40	50	50	60	60	80	100	120	140
Yield Stress (R_e), Min.	24	32	30	40	36	48	...	...	...	...
Stress at Permanent Set Limit ($R_{0.2}$), Min.	...	...	...	...	...	...	64	90	108	126

All stress and strength values are in kgf/mm² units.

Strength Grade Designation System for Steel Nuts: The strength grade designation system for steel nuts is a number which is one-tenth of the specified proof load stress in kgf/mm². The proof load stress corresponds to the minimum tensile strength of the highest grade of bolt or screw with which the nut can be used.

Strength Grade Designations of Steel Nuts

Strength Grade Designation	4	5	6	8	12	14
Proof Load Stress (kgf/mm ²)	40	50	60	80	120	140

Recommended Bolt and Nut Combinations

Grade of Bolt	4.6	4.8	5.6	5.8	6.6	6.8	8.8	10.9	12.9	14.9
Recommended Grade of Nut	4	4	5	5	6	6	8	12	12	14

Note: Nuts of a higher strength grade may be substituted for nuts of a lower strength grade.

Marking: The marking and identification requirements of this Standard are only mandatory for steel bolts, screws and nuts of 6 mm diameter and larger; manufactured to strength grade designations 8.8 (for bolts or screws) and 8 (for nuts) or higher. Bolts and screws are identified as ISO metric by either of the symbols "ISO M" or "M", embossed or indented on top of the head. Nuts may be indented or embossed by alternative methods depending on their method of manufacture.

Designation: Bolts 10 mm diameter, 50 mm long manufactured from steel of strength grade 8.8, would be designated:

"Bolts M10 × 50 to BS 3692 — 8.8."

Brass screws 8 mm diameter, 20 mm long would be designated:

"Brass screws M8 × 20 to BS 3692."

Nuts 12 mm diameter, manufactured from steel of strength grade 6, cadmium plated could be designated:

"Nuts M12 to BS 3692 — 6, plated to BS 3382: Part 1."

Miscellaneous Information: The Standard also gives mechanical properties of steel bolts, screws and nuts [i.e., tensile strengths; hardnesses (Brinell, Rockwell, Vickers); stresses (yield, proof load); etc.], material and manufacture of steel bolts, screws and nuts; and information on inspection and testing. Appendices to the Standard give information on gaging; chemical composition; testing of mechanical properties; examples of marking of bolts, screws and nuts; and a table of preferred standard sizes of bolts and screws, to name some.

British Standard General Purpose Studs BS 2693:Part 1:1956 (obsolescent)

Limits for End Screwed into Component (All threads except B.A.)														
Nom. Dia. D.	Major Dia.	Thds. per in.	Major Dia.		Effective Diameter		Minor Diameter		Thds. per in.	Major Dia.	Effective Diameter		Minor Dia.	
			Max.	Min.	Max.	Min.	Max.	Min.			Max.	Min.	Max.	Min.
UN THREADS			UNF THREADS						UNC THREADS					
1/4	0.2500	28	0.2435	0.2294	0.2265	0.2088	0.2037	20	0.2419	0.2201	0.2172	0.1913	0.1849	
5/16	0.3125	24	0.3053	0.2883	0.2852	0.2643	0.2586	18	0.3038	0.2793	0.2762	0.2472	0.2402	
3/8	0.3750	24	0.3678	0.3510	0.3478	0.3270	0.3211	16	0.3656	0.3375	0.3343	0.3014	0.2936	
7/16	0.4375	20	0.4294	0.4084	0.4050	0.3796	0.3729	14	0.4272	0.3945	0.3911	0.3533	0.3447	
1/2	0.5000	20	0.4919	0.4712	0.4675	0.4424	0.4356	13	0.4891	0.4537	0.4500	0.4093	0.4000	
9/16	0.5625	18	0.5538	0.5302	0.5264	0.4981	0.4907	12	0.5511	0.5122	0.5084	0.4641	0.4542	
5/8	0.6250	18	0.6163	0.5929	0.5889	0.5608	0.5533	11	0.6129	0.5700	0.5660	0.5175	0.5069	
3/4	0.7500	16	0.7406	0.7137	0.7094	0.6776	0.6693	10	0.7371	0.6893	0.6850	0.6316	0.6200	
7/8	0.8750	14	0.8647	0.8332	0.8286	0.7920	0.7828	9	0.8611	0.8074	0.8028	0.7433	0.7306	
1	1.0000	12	0.9886	0.9510	0.9459	0.9029	0.8925	8	0.9850	0.9239	0.9188	0.8517	0.8376	
1 1/8	1.1250	12	1.1136	1.0762	1.0709	1.0281	1.0176	7	1.1086	1.0375	1.0322	0.9550	0.9393	
1 1/4	1.2500	12	1.2386	1.2014	1.1959	1.1533	1.1427	7	1.2336	1.1627	1.1572	1.0802	1.0644	
1 1/2	1.3750	12	1.3636	1.3265	1.3209	1.2784	1.2677	6	1.3568	1.2723	1.2667	1.1761	1.1581	
1 3/4	1.5000	12	1.4886	1.4517	1.4459	1.4036	1.3928	6	1.4818	1.3975	1.3917	1.3013	1.2832	
B.S. THREADS			B.S.F. THREADS						B.S.W. THREADS					
1/4	0.2500	26	0.2455	0.2280	0.2251	0.2034	0.1984	20	0.2452	0.2206	0.2177	0.1886	0.1831	
5/16	0.3125	22	0.3077	0.2863	0.2832	0.2572	0.2517	18	0.3073	0.2798	0.2767	0.2442	0.2383	
3/8	0.3750	20	0.3699	0.3461	0.3429	0.3141	0.3083	16	0.3695	0.3381	0.3349	0.0981	0.2919	
7/16	0.4375	18	0.4320	0.4053	0.4019	0.3697	0.3635	14	0.4316	0.3952	0.3918	0.3495	0.3428	
1/2	0.5000	16	0.4942	0.4637	0.4600	0.4237	0.4172	12	0.4937	0.4503	0.4466	0.3969	0.3897	
9/16	0.5625	16	0.5566	0.5263	0.5225	0.4863	0.4797	12	0.5560	0.5129	0.5091	0.4595	0.4521	
5/8	0.6250	14	0.6187	0.5833	0.5793	0.5376	0.5305	11	0.6183	0.5708	0.5668	0.5126	0.5050	
3/4	0.7500	12	0.7432	0.7009	0.6966	0.6475	0.6398	10	0.7428	0.6903	0.6860	0.6263	0.6182	
7/8	0.8750	11	0.8678	0.8214	0.8168	0.7632	0.7551	9	0.8674	0.8085	0.8039	0.7374	0.7288	
1	1.0000	10	0.9924	0.9411	0.9360	0.8771	0.8686	8	0.9920	0.9251	0.9200	0.8451	0.8360	
1 1/8	1.1250	9	1.1171	1.0592	1.0539	0.9881	0.9792	7	1.1164	1.0388	1.0335	0.9473	0.9376	
1 1/4	1.2500	9	1.2419	1.1844	1.1789	1.1133	1.1042	7	1.2413	1.1640	1.1585	1.0725	1.0627	
1 1/2	1.3750	8	1.3665	1.3006	1.2950	1.2206	1.2110	6	...	...	...	...	...
1 3/4	1.5000	8	1.4913	1.4258	1.4200	1.3458	1.3360	0.	1.4906	1.3991	1.3933	1.2924	1.2818	

Limits for End Screwed into Component (B.A. Threads)*

Designation No.	Pitch	Major Diameter		Effective Diameter		Minor Diameter	
		Max.	Min.	Max.	Min.	Max.	Min.
		2	0.8100 mm 0.03189 in.	4.700 mm 0.1850 in.	4.580 mm 0.1803 in.	4.275 mm 0.1683 in.	4.200 mm 0.1654 in.	3.790 mm 0.1492 in.	3.620 mm 0.1425 in.
4	0.6600 mm 0.2598 in.	3.600 mm 0.1417 in.	3.500 mm 0.1378 in.	3.260 mm 0.1283 in.	3.190 mm 0.1256 in.	2.865 mm 0.1128 in.	2.720 mm 0.1071 in.

* Approximate inch equivalents are shown below the dimensions given in mm.

Minimum Nominal Lengths of Studs*

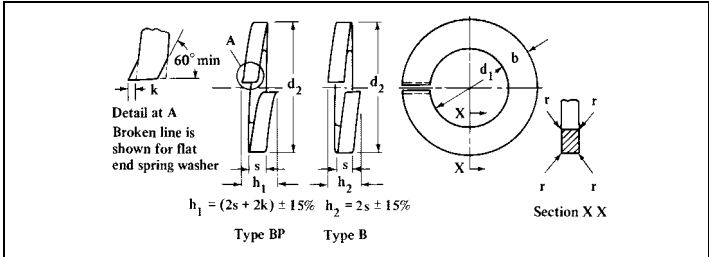
Nom. Stud. Dia.	For Thread Length (Component End) of		Nom. Stud. Dia.	For Thread Length (Component End) of		Nom. Stud. Dia.	For Thread Length (Component End) of	
	1D	1.5D		1D	1.5D		1D	1.5D
	1/4	3/8		1	5/16		2	2 3/8	1 1/4	4	4 3/4
5/16	1 1/8	1 3/8	3/8	2 1/4	2 3/8	1 1/2	4 3/4	5 1/2
3/8	1 3/8	1 5/8	3/4	2 5/8	3	1 3/4	5	5 3/4
7/16	1 5/8	1 7/8	7/8	3 1/8	3 3/8	1 3/4	5 1/2	6
1/2	1 3/4	2	1	3 1/2	4	...	...	...

* The standard also gives preferred and standard lengths of studs: Preferred lengths of studs: 7/8, 1, 1 1/8, 1 1/4, 1 3/8, 1 1/2, 1 3/4, 2, 2 1/4, 2 1/2, 2 3/8, 3, 3 1/4, 3 1/2 and for lengths above 3 1/2 the preferred increment is 1/2. Standard lengths of studs: 7/8, 1, 1 1/8, 1 1/4, 1 3/8, 1 1/2, 1 5/8, 1 3/4, 1 7/8, 2, 2 1/8, 2 1/4, 2 3/8, 2 1/2, 2 5/8, 2 3/4, 2 7/8, 3, 3 1/8, 3 1/4, 3 3/8, 3 1/2 and for lengths above 3 1/2 the standard increment is 1/4.

All dimensions are in inches except where otherwise noted.

See page 1786 for interference-fit threads.

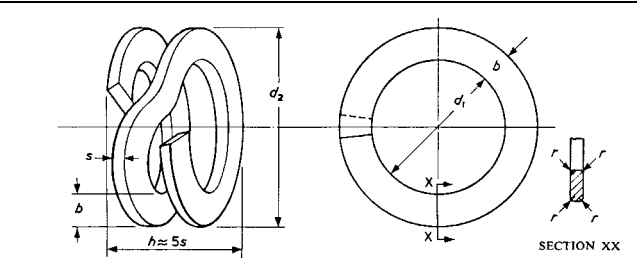
**British Standard Single Coil Rectangular Section Spring Washers; Metric Series —
Types B and BP BS 4464:1969 (1998)**



Nom. Size & Thread Dia., <i>d</i>	Inside Dia., <i>d</i> ₁		Width, <i>b</i>	Thickness, <i>s</i>	Outside Dia., <i>d</i> ₂ Max	Radius, <i>r</i> Max	<i>k</i> (Type BP Only)
	Max	Min					
M1.6	1.9	1.7	0.7 ± 0.1	0.4 ± 0.1	3.5	0.15	...
M2	2.3	2.1	0.9 ± 0.1	0.5 ± 0.1	4.3	0.15	...
(M2.2)	2.5	2.3	1.0 ± 0.1	0.6 ± 0.1	4.7	0.2	...
M2.5	2.8	2.6	1.0 ± 0.1	0.6 ± 0.1	5.0	0.2	...
M3	3.3	3.1	1.3 ± 0.1	0.8 ± 0.1	6.1	0.25	...
(M3.5)	3.8	3.6	1.3 ± 0.1	0.8 ± 0.1	6.6	0.25	0.15
M4	4.35	4.1	1.5 ± 0.1	0.9 ± 0.1	7.55	0.3	0.15
M5	5.35	5.1	1.8 ± 0.1	1.2 ± 0.1	9.15	0.4	0.15
M6	6.4	6.1	2.5 ± 0.15	1.6 ± 0.1	11.7	0.5	0.2
M8	8.55	8.2	3 ± 0.15	2 ± 0.1	14.85	0.65	0.3
M10	10.6	10.2	3.5 ± 0.2	2.2 ± 0.15	18.0	0.7	0.3
M12	12.6	12.2	4 ± 0.2	2.5 ± 0.15	21.0	0.8	0.4
(M14)	14.7	14.2	4.5 ± 0.2	3 ± 0.15	24.1	1.0	0.4
M16	16.9	16.3	5 ± 0.2	3.5 ± 0.2	27.3	1.15	0.4
(M18)	19.0	18.3	5 ± 0.2	3.5 ± 0.2	29.4	1.15	0.4
M20	21.1	20.3	6 ± 0.2	4 ± 0.2	33.5	1.3	0.4
(M22)	23.3	22.4	6 ± 0.2	4 ± 0.2	35.7	1.3	0.4
M24	25.3	24.4	7 ± 0.25	5 ± 0.2	39.8	1.65	0.5
(M27)	28.5	27.5	7 ± 0.25	5 ± 0.2	43.0	1.65	0.5
M30	31.5	30.5	8 ± 0.25	6 ± 0.25	48.0	2.0	0.8
(M33)	34.6	33.5	10 ± 0.25	6 ± 0.25	55.1	2.0	0.8
M36	37.6	36.5	10 ± 0.25	6 ± 0.25	58.1	2.0	0.8
(M39)	40.8	39.6	10 ± 0.25	6 ± 0.25	61.3	2.0	0.8
M42	43.8	42.6	12 ± 0.25	7 ± 0.25	68.3	2.3	0.8
(M45)	46.8	45.6	12 ± 0.25	7 ± 0.25	71.3	2.3	0.8
M48	50.0	48.8	12 ± 0.25	7 ± 0.25	74.5	2.3	0.8
(M52)	54.1	52.8	14 ± 0.25	8 ± 0.25	82.6	2.65	1.0
M56	58.1	56.8	14 ± 0.25	8 ± 0.25	86.6	2.65	1.0
(M60)	62.3	60.9	14 ± 0.25	8 ± 0.25	90.8	2.65	1.0
M64	66.3	64.9	14 ± 0.25	8 ± 0.25	93.8	2.65	1.0
(M68)	70.5	69.0	14 ± 0.25	8 ± 0.25	99.0	2.65	1.0

All dimensions are given in millimeters. Sizes shown in parentheses are non-preferred, and are not usually stock sizes.

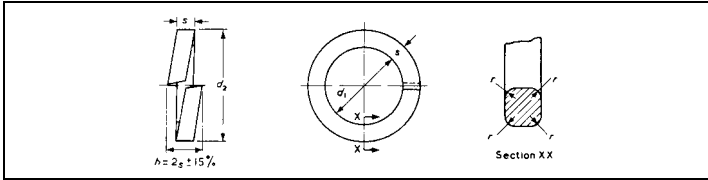
**British Standard Double Coil Rectangular Section Spring Washers; Metric Series —
Type D BS 4464:1969 (1998)**



Nom. Size, <i>d</i>	Inside Dia., <i>d</i> ₁		Width, <i>b</i>	Thickness, <i>s</i>	O.D., <i>d</i> ₂ Max	Radius, <i>r</i> Max
	Max	Min				
M2	2.4	2.1	0.9 ± 0.1	0.5 ± 0.05	4.4	0.15
(M2.2)	2.6	2.3	1.0 ± 0.1	0.6 ± 0.05	4.8	0.2
M2.5	2.9	2.6	1.2 ± 0.1	0.7 ± 0.1	5.5	0.23
M3.0	3.6	3.3	1.2 ± 0.1	0.8 ± 0.1	6.2	0.25
(M3.5)	4.1	3.8	1.6 ± 0.1	0.8 ± 0.1	7.5	0.25
M4	4.6	4.3	1.6 ± 0.1	0.8 ± 0.1	8.0	0.25
M5	5.6	5.3	2 ± 0.1	0.9 ± 0.1	9.8	0.3
M6	6.6	6.3	3 ± 0.15	1 ± 0.1	12.9	0.33
M8	8.8	8.4	3 ± 0.15	1.2 ± 0.1	15.1	0.4
M10	10.8	10.4	3.5 ± 0.20	1.2 ± 0.1	18.2	0.4
M12	12.8	12.4	3.5 ± 0.2	1.6 ± 0.1	20.2	0.5
(M14)	15.0	14.5	5 ± 0.2	1.6 ± 0.1	25.4	0.5
M16	17.0	16.5	5 ± 0.2	2 ± 0.1	27.4	0.65
(M18)	19.0	18.5	5 ± 0.2	2 ± 0.1	29.4	0.65
M20	21.5	20.8	5 ± 0.2	2 ± 0.1	31.9	0.65
(M22)	23.5	22.8	6 ± 0.2	2.5 ± 0.15	35.9	0.8
M24	26.0	25.0	6.5 ± 0.2	3.25 ± 0.15	39.4	1.1
(M27)	29.5	28.0	7 ± 0.25	3.25 ± 0.15	44.0	1.1
M30	33.0	31.5	8 ± 0.25	3.25 ± 0.15	49.5	1.1
(M33)	36.0	34.5	8 ± 0.25	3.25 ± 0.15	52.5	1.1
M36	40.0	38.0	10 ± 0.25	3.25 ± 0.15	60.5	1.1
(M39)	43.0	41.0	10 ± 0.25	3.25 ± 0.15	63.5	1.1
M42	46.0	44.0	10 ± 0.25	4.5 ± 0.2	66.5	1.5
M48	52.0	50.0	10 ± 0.25	4.5 ± 0.2	72.5	1.5
M56	60.0	58.0	12 ± 0.25	4.5 ± 0.2	84.5	1.5
M64	70.0	67.0	12 ± 0.25	4.5 ± 0.2	94.5	1.5

All dimensions are given in millimeters. Sizes shown in parentheses are non-preferred, and are not usually stock sizes. The free height of double coil washers before compression is normally approximately five times the thickness but, if required, washers with other free heights may be obtained by arrangement with manufacturer.

**British Standard Single Coil Square Section Spring Washers; Metric Series —
Type A-1 BS 4464:1969 (1998)**



**British Standard Single Coil Square Section Spring Washers; Metric Series —
Type A-2 BS 4464:1969 (1998)**

Nom. Size, d	Inside Dia., d_1		Thickness & Width, s	O.D., d_2 Max	Radius, r Max
	Max	Min			
M3	3.3	3.1	1 ± 0.1	5.5	0.3
(M3.5)	3.8	3.6	1 ± 0.1	6.0	0.3
M4	4.35	4.1	1.2 ± 0.1	6.95	0.4
M5	5.35	5.1	1.5 ± 0.1	8.55	0.5
M6	6.4	6.1	1.5 ± 0.1	9.6	0.5
M8	8.55	8.2	2 ± 0.1	12.75	0.65
M10	10.6	10.2	2.5 ± 0.15	15.9	0.8
M12	12.6	12.2	2.5 ± 0.15	17.9	0.8
(M14)	14.7	14.2	3 ± 0.2	21.1	1.0
M16	16.9	16.3	3.5 ± 0.2	24.3	1.15
(M18)	19.0	18.3	3.5 ± 0.2	26.4	1.15
M20	21.1	20.3	4.5 ± 0.2	30.5	1.5
(M22)	23.3	22.4	4.5 ± 0.2	32.7	1.5
M24	25.3	24.4	5 ± 0.2	35.7	1.65
(M27)	28.5	27.5	5 ± 0.2	38.9	1.65
M30	31.5	30.5	6 ± 0.2	43.9	2.0
(M33)	34.6	33.5	6 ± 0.2	47.0	2.0
M36	37.6	36.5	7 ± 0.25	52.1	2.3
(M39)	40.8	39.6	7 ± 0.25	55.3	2.3
M42	43.8	42.6	8 ± 0.25	60.3	2.65
(M45)	46.8	45.6	8 ± 0.25	63.3	2.65
M48	50.0	48.8	8 ± 0.25	66.5	2.65

All dimensions are in millimeters. Sizes shown in parentheses are nonpreferred and are not usually stock sizes.

British Standard for Metric Series Metal Washers.—BS 4320:1968 (1998) specifies bright and black metal washers for general engineering purposes.

Bright Metal Washers: These washers are made from either CS4 cold-rolled strip steel BS 1449:Part 3B or from CZ 108 brass strip B.S. 2870:1980, both in the hard condition. However, by mutual agreement between purchaser and supplier, washers may be made available with the material in any other condition, or they may be made from another material, or may be coated with a protective or decorative finish to some appropriate British Standard. Washers are reasonably flat and free from burrs and are normally supplied unchamfered. They may, however, have a 30-degree chamfer on one edge of the external diameter. These washers are made available in two size categories, normal and large diameter, and in two thicknesses, normal (Form A or C) and light (Form B or D). The thickness of a light-range washer is from $\frac{1}{2}$ to $\frac{2}{3}$ the thickness of a normal range washer.

Black Metal Washers: These washers are made from mild steel, and can be supplied in three size categories designated normal, large, and extra large diameters. The normal-diameter series is intended for bolts ranging from M5 to M68 (Form E washers), the large-diameter series for bolts ranging from M8 to M39 (Form F washers), and the extra large series for bolts from M5 to M39 (Form G washers). A protective finish can be specified by the purchaser in accordance with any appropriate British Standard.

Washer Designations: The Standard specifies the details that should be given when ordering or placing an inquiry for washers. These details are the general description, namely, bright or black washers; the nominal size of the bolt or screw involved, for example, M5; the designated form, for example, Form A or Form E; the dimensions of any chamfer required on bright washers; the number of the Standard BS 4320:1968 (1998), and coating information if required, with the number of the appropriate British Standard and the coating thickness needed. As an example, in the use of this information, the designation for a chamfered, normal-diameter series washer of normal-range thickness to suit a 12-mm diameter bolt would be: Bright washers M12 (Form A) chamfered to B.S. 4320.

British Standard Bright Metal Washers — Metric Series BS 4320:1968 (1998)

NORMAL DIAMETER SIZES												
Nominal Size of Bolt or Screw	Inside Diameter			Outside Diameter			Thickness					
							Form A (Normal Range)			Form B (Light Range)		
	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min
M 1.0	1.1	1.25	1.1	2.5	2.5	2.3	0.3	0.4	0.2	...	...	...
M 1.2	1.3	1.45	1.3	3.0	3.0	2.8	0.3	0.4	0.2	...	...	...
(M 1.4)	1.5	1.65	1.5	3.0	3.0	2.8	0.3	0.4	0.2	...	...	...
M 1.6	1.7	1.85	1.7	4.0	4.0	3.7	0.3	0.4	0.2	...	...	...
M 2.0	2.2	2.35	2.2	5.0	5.0	4.7	0.3	0.4	0.2	...	...	...
(M 2.2)	2.4	2.55	2.4	5.0	5.0	4.7	0.5	0.6	0.4	...	...	...
M 2.5	2.7	2.85	2.7	6.5	6.5	6.2	0.5	0.6	0.4	...	...	...
M3	3.2	3.4	3.2	7	7	6.7	0.5	0.6	0.4	...	...	...
(M 3.5)	3.7	3.9	3.7	7	7	6.7	0.5	0.6	0.4	...	...	...
M4	4.3	4.5	4.3	9	9	8.7	0.8	0.9	0.7	...	...	...
(M 4.5)	4.8	5.0	4.8	9	9	8.7	0.8	0.9	0.7	...	...	...
M 5	5.3	5.5	5.3	10	10	9.7	1.0	1.1	0.9	...	...	...
M 6	6.4	6.7	6.4	12.5	12.5	12.1	1.6	1.8	1.4	0.8	0.9	0.7
(M 7)	7.4	7.7	7.4	14	14	13.6	1.6	1.8	1.4	0.8	0.9	0.7
M 8	8.4	8.7	8.4	17	17	16.6	1.6	1.8	1.4	1.0	1.1	0.9
M 10	10.5	10.9	10.5	21	21	20.5	2.0	2.2	1.8	1.25	1.45	1.05
M 12	13.0	13.4	13.0	24	24	23.5	2.5	2.7	2.3	1.6	1.80	1.40
(M 14)	15.0	15.4	15.0	28	28	27.5	2.5	2.7	2.3	1.6	1.8	1.4
M 16	17.0	17.4	17.0	30	30	29.5	3.0	3.3	2.7	2.0	2.2	1.8
(M 18)	19.0	19.5	19.0	34	34	33.2	3.0	3.3	2.7	2.0	2.2	1.8
M 20	21	21.5	21	37	37	36.2	3.0	3.3	2.7	2.0	2.2	1.8
(M 22)	23	23.5	23	39	39	38.2	3.0	3.3	2.7	2.0	2.2	1.8
M24	25	25.5	25	44	44	43.2	4.0	4.3	3.7	2.5	2.7	2.3
(M 27)	28	28.5	28	50	50	49.2	4.0	4.3	3.7	2.5	2.7	2.3
M30	31	31.6	31	56	56	55.0	4.0	4.3	3.7	2.5	2.7	2.3
(M 33)	34	34.6	34	60	60	59.0	5.0	5.6	4.4	3.0	3.3	2.7
M 36	37	37.6	37	66	66	65.0	5.0	5.6	4.4	3.0	3.3	2.7
(M 39)	40	40.6	40	72	72	71.0	6.0	6.6	5.4	3.0	3.3	2.7
LARGE DIAMETER SIZES												
Nominal Size of Bolt or Screw	Inside Diameter			Outside Diameter			Thickness					
							Form C (Normal Range)			Form D (Light Range)		
	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min
M 4	4.3	4.5	4.3	10.0	10.0	9.7	0.8	0.9	0.7	...	...	...
M 5	5.3	5.5	5.3	12.5	12.5	12.1	1.0	1.1	0.9	...	...	...
M 6	6.4	6.7	6.4	14	14	13.6	1.6	1.8	1.4	0.8	0.9	0.7
M 8	8.4	8.7	8.4	21	21	20.5	1.6	1.8	1.4	1.0	1.1	0.9
M 10	10.5	10.9	10.5	24	24	23.5	2.0	2.2	1.8	1.25	1.45	1.05
M 12	13.0	13.4	13.0	28	28	27.5	2.5	2.7	2.3	1.6	1.8	1.4
(M 14)	15.0	15.4	15	30	30	29.5	2.5	2.7	2.3	1.6	1.8	1.4
M 16	17.0	17.4	17	34	34	33.2	3.0	3.3	2.7	2.0	2.2	1.8
(M 18)	19.0	19.5	19	37	37	36.2	3.0	3.3	2.7	2.0	2.2	1.8
M 20	21	21.5	21	39	39	38.2	3.0	3.3	2.7	2.0	2.2	1.8
(M 22)	23	23.5	23	44	44	43.2	3.0	3.3	2.7	2.0	2.2	1.8
M 24	25	25.5	25	50	50	49.2	4.0	4.3	3.7	2.5	2.7	2.3
(M 27)	28	28.5	28	56	56	55	4.0	4.3	3.7	2.5	2.7	2.3
M 30	31	31.6	31	60	60	59	4.0	4.3	3.7	2.5	2.7	2.3
(M 33)	34	34.6	34	66	66	65	5.0	5.6	4.4	3.0	3.3	2.7
M 36	37	37.6	37	72	72	71	5.0	5.6	4.4	3.0	3.3	2.7
(M 39)	40	40.6	40	77	77	76	6.0	6.6	5.4	3.0	3.3	2.7

All dimensions are in millimeters.

Nominal bolt or screw sizes shown in parentheses are nonpreferred.

British Standard Black Metal Washers — Metric Series BS 4320:1968 (1998)

NORMAL DIAMETER SIZES (Form E)									
Nom Bolt or Screw Size	Inside Diameter			Outside Diameter			Thickness		
	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min
M 5	5.5	5.8	5.5	10.0	10.0	9.2	1.0	1.2	0.8
M 6	6.6	7.0	6.6	12.5	12.5	11.7	1.6	1.9	1.3
(M 7)	7.6	8.0	7.6	14.0	14.0	13.2	1.6	1.9	1.3
M 8	9.0	9.4	9.0	17	17	16.2	1.6	1.9	1.3
M 10	11.0	11.5	11.0	21	21	20.2	2.0	2.3	1.7
M 12	14	14.5	14	24	24	23.2	2.5	2.8	2.2
(M 14)	16	16.5	16	28	28	27.2	2.5	2.8	2.2
M 16	18	18.5	18	30	30	29.2	3.0	3.6	2.4
(M 18)	20	20.6	20	34	34	32.8	3.0	3.6	2.4
M 20	22	22.6	22	37	37	35.8	3.0	3.6	2.4
(M 22)	24	24.6	24	39	39	37.8	3.0	3.6	2.4
M 24	26	26.6	26	44	44	42.8	4	4.6	3.4
(M 27)	30	30.6	30	50	50	48.8	4	4.6	3.4
M 30	33	33.8	33	56	56	54.5	4	4.6	3.4
(M 33)	36	36.8	36	60	60	58.5	5	6.0	4.0
M 36	39	39.8	39	66	66	64.5	5	6.0	4.0
(M 39)	42	42.8	42	72	72	70.5	6	7.0	5.0
M 42	45	45.8	45	78	78	76.5	7	8.2	5.8
(M 45)	48	48.8	48	85	85	83	7	8.2	5.8
M 48	52	53	52	92	92	90	8	9.2	6.8
(M 52)	56	57	56	98	98	96	8	9.2	6.8
M 56	62	63	62	105	105	103	9	10.2	7.8
(M 60)	66	67	66	110	110	108	9	10.2	7.8
M 64	70	71	70	115	115	113	9	10.2	7.8
(M 68)	74	75	74	120	120	118	10	11.2	8.8
LARGE DIAMETER SIZES (Form F)									
M 8	9	9.4	9.0	21	21	20.2	1.6	1.9	1.3
M 10	11	11.5	11	24	24	23.2	2	2.3	1.7
M 12	14	14.5	14	28	28	27.2	2.5	2.8	2.2
(M 14)	16	16.5	16	30	30	29.2	2.5	2.8	2.2
M 16	18	18.5	18	34	34	32.8	3	3.6	2.4
(M 18)	20	20.6	20	37	37	35.8	3	3.6	2.4
M 20	22	22.6	22	39	39	37.8	3	3.6	2.4
(M 22)	24	24.6	24	44	44	42.8	3	3.6	2.4
M 24	26	26.6	26	50	50	48.8	4	4.6	3.4
(M 27)	30	30.6	30	56	56	54.5	4	4.6	3.4
M 30	33	33.8	33	60	60	58.5	4	4.6	3.4
(M 33)	36	36.8	36	66	66	64.5	5	6.0	4
M 36	39	39.8	39	72	72	70.5	5	6.0	4
(M 39)	42	42.8	42	77	77	75.5	6	7	5
EXTRA LARGE DIAMETER SIZES (Form G)									
M 5	5.5	5.8	5.5	15	15	14.2	1.6	1.9	1.3
M 6	6.6	7.0	6.6	18	18	17.2	2	2.3	1.7
(M 7)	7.6	8.0	7.6	21	21	20.2	2	2.3	1.7
M 8	9	9.4	9.0	24	24	23.2	2	2.3	1.7
M 10	11	11.5	11.0	30	30	29.2	2.5	2.8	2.2
M 12	14	14.5	14.0	36	36	34.8	3	3.6	2.4
(M 14)	16	16.5	16.0	42	42	40.8	3	3.6	2.4
M 16	18	18.5	18	48	48	46.8	4	4.6	3.4
(M 18)	20	20.6	20	54	54	52.5	4	4.6	3.4
M 20	22	22.6	22	60	60	58.5	5	6.0	4
(M 22)	24	24.6	24	66	66	64.5	5	6.0	4
M 24	26	26.6	26	72	72	70.5	6	7	5
(M 27)	30	30.6	30	81	81	79	6	7	5
M 30	33	33.8	33	90	90	88	8	9.2	6.8
(M 33)	36	36.8	36	99	99	97	8	9.2	6.8
M 36	39	39.8	39	108	108	106	10	11.2	8.8
(M39)	42	42.8	42	117	117	115	10	11.2	8.8

All dimensions are in millimeters.

Nominal bolt or screw sizes shown in parentheses are nonpreferred.