



SPECIALIST MANUFACTURER OF DISC SPRINGS

ISO/TS 16949: 2002 certified

Inch Edition

Disc Springs



The benefits of SCHNORR® Disc Springs

also known as Belleville Springs result in design engineers continually increasing preference for them:

1. Load/deflection curve of straight, progressive or regressive character, according to the design requirements.
2. Alteration of spring performance as desired by the addition or removal of single discs.
3. Space saving.
4. Largely self-damping, particularly with parallel stacking, giving good shock absorption and energy dissipation.
5. No deformation or fatigue under normal loads.
6. Long service life.
7. The large range of possible applications for individual spring sizes simplifies stock-keeping.

Standards for SCHNORR® Disc Springs

The following tables list the springs which are included in DIN 2093 standard as well as Schnorr works standard sizes.

Load/Deflection curves for the various spring sizes can be drawn by plotting the four points where $s = 0.25 h_0$, $s = 0.50 h_0$, $s = 0.75 h_0$ and $s = h_0$. The table is based on calculated values: in practice the slope of the curve increases progressively from $s = 0.75 h_0$ onwards.

According to DIN Standard 2093, there are three different groups of execution

Group 1: t under 1.25 mm
no machining

Group 2: t from 1.25 up to 6.0 mm
 $D_e + D_i$ machined

Group 3: t over 6 up to 14 mm
machined all over
with Contact Flats
and reduced thickness.

Permissible loadings

Static Loading:

The figures given in the following table ensure that the springs can be compressed flat without damage under static load conditions. It should be noted that the loads increase progressively above the theoretical value after $s = 0.75 h_0$. The loads quoted are those calculated for spring steel.

Dynamic Loading:

To ensure that springs subjected to dynamic loads will have the maximum life, i.e. a working life of at least 2 million load changes, the following values for the spring deflection are recommended:

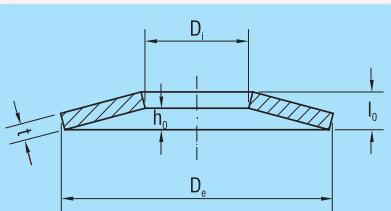
Pre-load deflection 15%
= Total deflection 45–51%

Pre-load deflection 25%
= Total deflection 50–56%

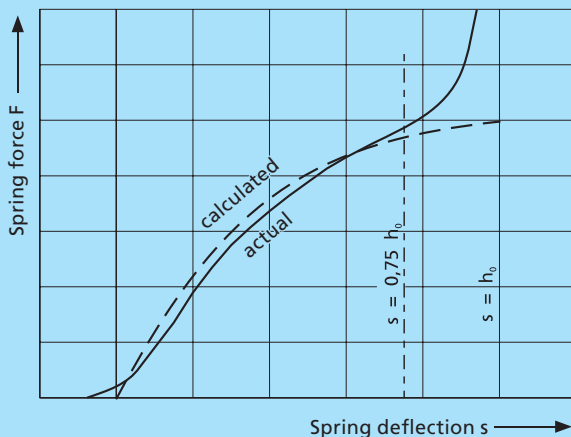
Pre-load deflection 50%
= Total deflection 63–68%

Engineering notes:

- Standard SCHNORR® Disc Springs and Z springs are preset to eliminate setting losses.
- Corrosion resisting Zinc Phosphate coating standard.
- Shot Peening available for added fatigue resistance.
- Mechanic Zinc plating available for additional corrosion resistance.
- Other coatings per customer requirements available.



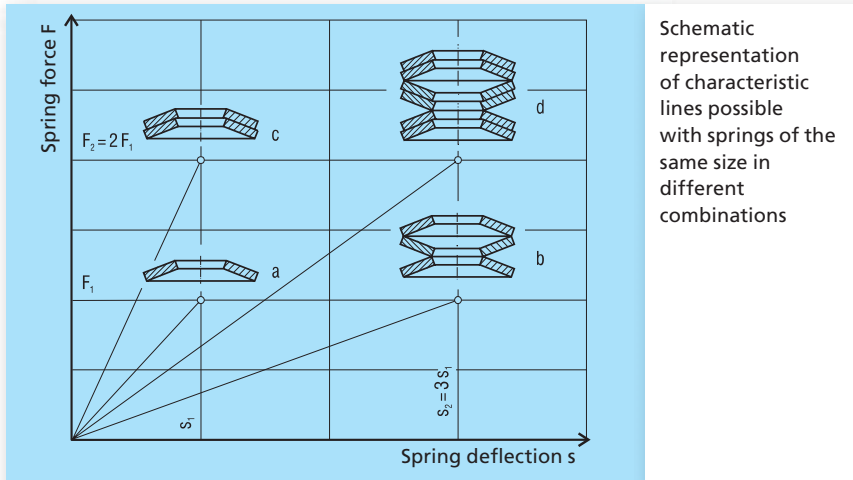
Specifying a SCHNORR® Disc Spring
 $D_e = 40$ mm, $D_i = 20.4$ mm, $t = 1.5$ mm
Disc Spring = 40 x 20.4 x 1.5
or Art. No. 012 800



Test points on the loading/unloading characteristic curve

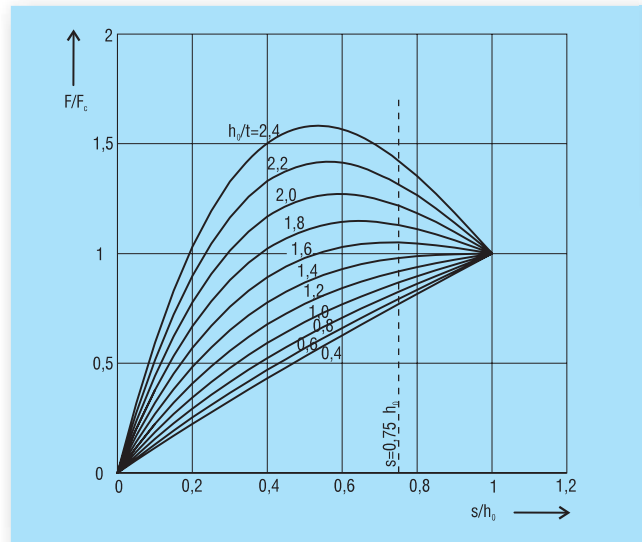
For the normal arrangement of disc springs a progressive increase in the spring force occurs at deflections of $s > 0.75 h_0$ which deviates from the calculated value. This results from the shift in the load points to smaller lever arms, because the disc springs roll on each other or on the abutments. Therefore, it is recommended that only approx. 75 to 80 % of the spring deflection is utilised. For this reason, the spring force is only indicated at $s \approx 0.75 h_0$ in DIN 2093

Spring Stacks and their Features



Progressive Spring Characteristics

In many cases it is a requirement that the spring load increases progressively as the deflection increases, i.e. the rate of the characteristic increases instead of (as it is typical for disc springs) decreasing. Such characteristic curves can be achieved in various ways.

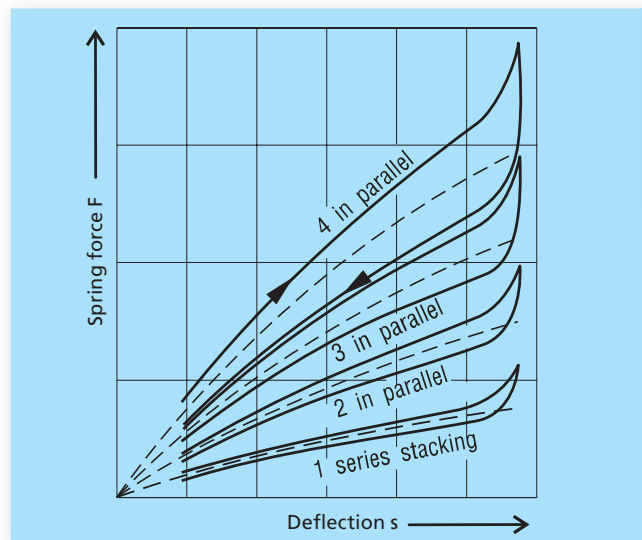


Friction

However, from many tests with various spring sizes a figure has been derived of $\pm 2.5\%$ per parallel spring (+ loading, - unloading). This results in the following values:

Influence of friction on spring load	
1 single spring	$\pm 2 \dots 3 \%$
2 in parallel	$\pm 4 \dots 6 \%$
3 in parallel	$\pm 6 \dots 9 \%$
4 in parallel	$\pm 8 \dots 12 \%$
5 in parallel	$\pm 10 \dots 15 \%$

This figure shows the principal load variations for one to four springs in parallel.



Common Name	AISI ASTM Ref.	Mat.-No.	Standard	Working Temperature °C	Tensile Strength N/mm ²	Thickness range mm	Availability
Steel for normal applications							
Standard materials							
C 60S	1060	1.1211	DIN EN 10132-4	-20...+100	1150-1750	0,2...7,0	easy
C 67S	1070	1.1231	DIN EN 10132-4	-20...+100	1200-1800	0,1...2,5	easy
C 75S	1078	1.1248	DIN EN 10132-4	-20...+100	1200-1800	0,1...1,5	easy
51 CrV 4	6150	1.8159	DIN EN 10132-4	-50...+200	1200-1800	0,3...80	easy
			DIN 17221				
Special materials for particular demands							
Corrosion Resistant Steel							
X 10 CrNi 18-8	301	1.4310	DIN EN 10151	-200...+200	1150-1500	0,2...3,0	easy
X 7 CrNiAl 17-7	631	1.4568	DIN EN 10151	-200...+300	1150-1700	0,2...4,0	less easy
X 5 CrNiMo 17-12-2	316	1.4401	DIN EN 10151	-200...+200	1000-1500	0,2...1,6	difficult
X 5 CrNi 18-10	304	1.4301	DIN EN 10151	-200...+200	1000-1500	0,2...1,6	less easy
Heat resistant steel							
X 22 CrMoV 12-1	-	1.4923	DIN EN 10269	-50...+500	1200-1400	1,5...20	easy
X 39 CrMo 17-1	-	1.4122	DIN EN 10088-2	-50...+400	1200-1400	0,3...6,0	easy
Copper alloys							
CuSn 8	-	2.1030	DIN EN 1654	-50...+100	590-690	0,1...6,0	easy
CuBe 2	-	2.1247	DIN EN 1654	-260...+200	1270-1450	0,1...2,5	easy
Nickel and cobalt alloys							
NiCr 20 Co 18 Ti	HEV6	2.4632 / 2.4969		-200...+700	≥ 1100	to 6,35	difficult
(Nimonic 90)	5829C (AMS)						
NiCr 15 Fe 7 TiAl	688	2.4669		-200...+600	≥ 1170	to 6,35	difficult
(Inconel X 750)	5542L (AMS)						
NiCr 19 NbMo	5596J (AMS)	2.4668		-200...+600	≥ 1240	to 6,35	difficult
(Inconel 718)							
Duratherm 600	-	-		-200...+550	1150-1550	0,1...2,0	difficult

Corrosion Protection

Phosphating

This is the standard process generally applied to all low alloy steels unless otherwise agreed. A zinc phosphate layer is produced on the surface, which is then impregnated with corrosion-protection oil. The protection achieved in this way is sufficient in the vast majority of all cases. Primarily for inside applications, but also out of doors, if the springs are installed with weather protection, no additional protection is required.

According to DIN 50960, the designation for phosphate treatment is: Surface coating as per DIN 50942 Fe/Znph r10 f.

Mechanical or Peen Plating

With this process the parts to be treated are moved in a barrel together with peening bodies, e.g. glass beads, and a so-called promoter and the coating metal (preferably zinc) is added in powdered form. This powder is deposited on the surface and is compacted by the peening bodies. An even, mat coating results, which can then be chromated like a galvanic coating. The usual layer thickness is 8 µm, however thicknesses of up to 40 µm are possible. It is of particular importance that no hydrogen embrittlement can occur when the process is carried out properly.

Chemical Nickel Plating

With this treatment, also known as "electroless nickeling", a nickel-phosphor alloy is precipitated onto the surface with a chemical method.

Dacromet Coating

This is an inorganic silver-grey metallic coating of zinc and aluminium flakes in a chromatic compound. The parts are treated in a barrel or on racks and the coating then baked on at over 280°C.

Disc Springs Tolerances

The following maximum deviations are laid down in DIN 2093. They are valid for all SCHNORR® Disc Springs as per the DIN and our works standards. In

general we also apply these tolerances to special sizes, however, if they deviate greatly from the DIN springs, wider tolerances must be specified. This applies,

for example, to our ball-bearing disc springs. If closer tolerances are required than those specified in DIN 2093, please consult us.

Diameter Tolerances

For the outside diameter D_e , the tolerance field h12 is applied, and for the inner diameter D_i it is H12.

For the concentricity the tolerances applied are:

for D_e to 50 mm: 2 · IT 11

for D_e over 50 mm: 2 · IT 12

D_e or D_i		Permissible deviation					
		D_e		D_i		Concentricity	
[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]
over 3 to 6	0.118–0.236	0/–0,12	0/–0.005	+0,12/0	+0.005/0	0,15	0.006
over 6 to 10	0.236–0.394	0/–0,15	0/–0.006	+0,15/0	+0.006/0	0,18	0.007
over 10 to 18	0.394–0.709	0/–0,18	0/–0.007	+0,18/0	+0.007/0	0,22	0.009
over 18 to 30	0.709–1.181	0/–0,21	0/–0.008	+0,21/0	+0.008/0	0,26	0.010
over 30 to 50	1.181–1.969	0/–0,25	0/–0.010	+0,25/0	+0.010/0	0,32	0.013
over 50 to 80	1.969–3.150	0/–0,30	0/–0.012	+0,30/0	+0.012/0	0,60	0.024
over 80 to 120	3.150–4.724	0/–0,35	0/–0.014	+0,35/0	+0.014/0	0,70	0.028
over 120 to 180	4.724–7.087	0/–0,40	0/–0.016	+0,40/0	+0.016/0	0,80	0.031
over 180 to 250	7.087–9.843	0/–0,46	0/–0.018	+0,46/0	+0.018/0	0,92	0.036
over 250 to 315	9.843–12.402	0/–0,52	0/–0.020	+0,52/0	+0.020/0	1,04	0.041
over 315 to 400	12.402–15.478	0/–0,57	0/–0.022	+0,57/0	+0.022/0	1,14	0.045
over 400 to 500	15.748–19.685	0/–0,63	0/–0.025	+0,63/0	+0.025/0	1,26	0.050

Thickness Tolerances

Tolerances allowed in DIN 2093 are shown in the table (right).

For springs in group 3 the tolerance is applied to the reduced thickness t' .

We use the thickness to ensure that spring loads are within tolerance and therefore will in some cases deviate from the above figures.

	t or t'		Tolerance for t	
	[mm]	[inch]	[mm]	[inch]
Group 1	0,2 to 0,6	0.008–0.024	+0,02/–0,06	+0.001/–0.002
	> 0,6 to < 1,25	0.024–0.049	+0,03/–0,09	+0.001/–0.004
Group 2	1,25 to 3,8	0.049–0.150	+0,04/–0,12	+0.002/–0.005
	> 3,8 to 6,0	0.150–0.236	+0,05/–0,15	+0.002/–0.006
Group 3	> 6,0 to 14,0	0.236–0.551	+0,10/–0,10	+0.004/–0.004

Overall Height Tolerances

To ensure the specified spring forces, DIN 2093 allows the overall height tolerance to be slightly exceeded.

	t		Tolerance for l_0	
	[mm]	[inch]	[mm]	[inch]
Group 1	< 1,25	0.049	+0,10/–0,05	+0.004/–0.002
Group 2	1,25 to 2,0	0.049–0.079	+0,15/–0,08	+0.006/–0.003
	> 2,0 to 3,0	0.079–0.118	+0,20/–0,10	+0.008/–0.004
	> 3,0 to 6,0	0.118–0.236	+0,30/–0,15	+0.012/–0.006
Group 3	> 6,0 to 14,0	0.236–0.551	+0,30/–0,30	+0.012/–0.012

Load Tolerances

Single Disc Springs

For single disc springs the following maximum deviations are allowed:

With a single spring the spring force must be checked at the height $l_0 - s$. This should be carried out with the spring pressed between two lubricated, hardened, ground and polished plates. Measurements are always taken in loading direction.

	t		Tolerances for F at the test length $l_p = l_0 - 0.75 h_0$
	[mm]	[inch]	
Group 1	< 1,25	0.049	+25 % / –7.5 %
Group 2	1,25 to 3,0	0.049–0.118	+15 % / –7.5 %
	> 3,0 to 6,0	0.118–0.236	+10 % / –5 %
Group 3	> 6,0 to 14,0	0.236–0.551	+5 % / –5 %

Standard SCHNORR® Disc Springs

Article No.	Order Reference mm			Size inch						Spring Deflection s in inch and Spring Load F in lb							
										at s = 0.25 h ₀		at s = 0.50 h ₀		at s ≈ 0.75 h ₀		at s = h ₀	
	D _e	D _i	t	D _e	D _i	t	l ₀	h ₀	h ₀ /t	s	F	s	F	s	F	s	F
000100	6	3,2	0,3	.236	.126	.012	.018	.006	.500	.001	10	.003	19	.004	27	.006	35
000200	8	3,2	0,2	.315	.126	.008	.016	.008	1.000	.002	3	.004	5	.006	6	.008	7
000300	8	3,2	0,3	.315	.126	.012	.022	.010	.833	.002	10	.005	18	.007	24	.010	28
000400	8	3,2	0,4	.315	.126	.016	.024	.008	.500	.002	16	.004	29	.006	42	.008	54
000550 C	8	4,2	0,2	.315	.165	.008	.018	.010	1.250	.002	5	.005	8	.007	9	.010	9
000600 B	8	4,2	0,3	.315	.165	.012	.022	.010	.833	.002	12	.005	20	.007	27	.010	32
000700 A	8	4,2	0,4	.315	.165	.016	.024	.008	.500	.002	18	.004	33	.006	47	.008	61
000800	10	3,2	0,3	.394	.126	.012	.026	.014	1.167	.003	12	.007	18	.010	22	.014	24
000900	10	3,2	0,4	.394	.126	.016	.028	.012	.750	.003	17	.006	30	.009	40	.012	50
001000	10	3,2	0,5	.394	.126	.020	.030	.010	.500	.002	23	.005	44	.007	63	.010	81
001100	10	4,2	0,4	.394	.165	.016	.028	.012	.750	.003	18	.006	32	.009	43	.012	52
001200	10	4,2	0,5	.394	.165	.020	.030	.010	.500	.002	25	.005	47	.007	66	.010	85
001300 C	10	5,2	0,25	.394	.205	.010	.022	.012	1.200	.003	7	.006	11	.009	13	.012	14
001400 B	10	5,2	0,4	.394	.205	.016	.028	.012	.750	.003	20	.006	35	.009	47	.012	58
001500 A	10	5,2	0,5	.394	.205	.020	.030	.010	.500	.002	27	.005	52	.007	73	.010	94
001600	12	4,2	0,4	.472	.165	.016	.031	.016	1.000	.004	19	.008	32	.012	40	.016	46
001700	12	4,2	0,5	.472	.165	.020	.033	.014	.700	.003	26	.007	47	.010	64	.014	79
001800	12	4,2	0,6	.472	.165	.024	.039	.016	.667	.004	51	.008	91	.012	126	.016	157
001900	12	5,2	0,5	.472	.205	.020	.035	.016	.800	.004	34	.008	59	.012	79	.016	96
002000	12	5,2	0,6	.472	.205	.024	.037	.014	.583	.003	44	.007	82	.010	114	.014	145
002100	12	6,2	0,5	.472	.244	.020	.033	.014	.700	.003	30	.007	54	.010	74	.014	91
002200	12	6,2	0,6	.472	.244	.024	.037	.014	.583	.003	48	.007	89	.010	125	.014	158
002300	12,5	5,2	0,5	.492	.205	.020	.033	.014	.700	.003	25	.007	45	.010	61	.014	76
002050 C	12,5	6,2	0,35	.492	.244	.014	.031	.018	1.286	.004	19	.009	29	.013	34	.018	36
002500 B	12,5	6,2	0,5	.492	.244	.020	.033	.014	.700	.003	27	.007	49	.010	66	.014	82
002700 A	12,5	6,2	0,7	.492	.244	.028	.039	.012	.429	.003	54	.006	103	.009	149	.012	193
002750 C	14	7,2	0,35	.551	.283	.014	.031	.018	1.286	.004	15	.009	24	.013	28	.018	29
002800 B	14	7,2	0,5	.551	.283	.020	.035	.016	.800	.004	27	.008	47	.012	63	.016	76
002900 A	14	7,2	0,8	.551	.283	.031	.043	.012	.375	.003	64	.006	124	.009	180	.012	235
003000	15	5,2	0,4	.591	.205	.016	.037	.022	1.375	.005	23	.011	35	.016	40	.022	41
003100	15	5,2	0,5	.591	.205	.020	.039	.020	1.000	.005	30	.010	50	.015	63	.020	72
003200	15	5,2	0,6	.591	.205	.024	.041	.018	.750	.004	39	.009	68	.013	92	.018	113
003300	15	5,2	0,7	.591	.205	.028	.043	.016	.571	.004	48	.008	89	.012	125	.016	159
003500	15	6,2	0,5	.591	.244	.020	.039	.020	1.000	.005	31	.010	52	.015	65	.020	75
003600	15	6,2	0,6	.591	.244	.024	.041	.018	.750	.004	40	.009	71	.013	96	.018	117
003700	15	6,2	0,7	.591	.244	.028	.043	.016	.571	.004	50	.008	93	.012	130	.016	165
003800	15	8,2	0,7	.591	.323	.028	.043	.016	.571	.004	58	.008	107	.012	150	.016	191
003900	15	8,2	0,8	.591	.323	.031	.047	.016	.500	.004	83	.008	156	.012	222	.016	285
004100 C	16	8,2	0,4	.630	.323	.016	.035	.020	1.250	.005	19	.010	30	.015	35	.020	37
004300 B	16	8,2	0,6	.630	.323	.024	.041	.018	.750	.004	39	.009	69	.013	93	.018	113
004400	16	8,2	0,7	.630	.323	.028	.045	.018	.643	.004	57	.009	104	.013	144	.018	180
004500	16	8,2	0,8	.630	.323	.031	.047	.016	.500	.004	70	.008	131	.012	186	.016	239
004600 A	16	8,2	0,9	.630	.323	.035	.049	.014	.389	.003	82	.007	157	.010	229	.014	298
004700	18	6,2	0,4	.709	.244	.016	.039	.024	1.500	.006	19	.012	28	.018	31	.024	31
004800	18	6,2	0,5	.709	.244	.020	.043	.024	1.200	.006	29	.012	46	.018	55	.024	60
004900	18	6,2	0,6	.709	.244	.024	.047	.024	1.000	.006	43	.012	72	.018	90	.024	104
005000	18	6,2	0,7	.709	.244	.028	.049	.022	.786	.005	53	.011	93	.016	125	.022	152
005100	18	6,2	0,8	.709	.244	.031	.051	.020	.625	.005	65	.010	118	.015	164	.020	206
005200	18	8,2	0,5	.709	.323	.020	.043	.024	1.200	.006	32	.012	50	.018	60	.024	65
005300	18	8,2	0,7	.709	.323	.028	.049	.022	.786	.005	57	.011	101	.016	135	.022	164
005400	18	8,2	0,8	.709	.323	.031	.051	.020	.625	.005	70	.010	127	.015	177	.020	222
005500	18	8,2	1	.709	.323	.039	.055	.016	.400	.004	96	.008	184	.012	267	.016	347
005550 C	18	9,2	0,45	.709	.362	.018	.041	.024	1.333	.006	27	.012	42	.018	48	.024	50
005600 B	18	9,2	0,7	.709	.362	.028	.047	.020	.714	.005	53	.010	94	.015	128	.020	158
005700 A	18	9,2	1	.709	.362	.039	.055	.016	.400	.004	102	.008	195	.012	283	.016	368
005800	20	8,2	0,6	.787	.323	.024	.051	.028	1.167	.007	48	.014	77	.021	93	.028	102
005900	20	8,2	0,7	.787	.323	.028	.053	.026	.929	.006	59	.013	100	.019	128	.026	151
006000	20	8,2	0,8	.787	.323	.031	.055	.024	.750	.006	71	.012	126	.018	170	.024	208

Article No.	Order Reference mm			Size inch						Spring Deflection s in inch and Spring Load F in lb							
										at $s = 0.25 h_0$		at $s = 0.50 h_0$		at $s \approx 0.75 h_0$		at $s = h_0$	
	D_e	D_i	t	D_e	D_i	t	l_0	h_0	h_0/t	s	F	s	F	s	F	s	F
006100	20	8,2	0,9	.787	.323	.035	.057	.022	.611	.005	84	.011	155	.016	215	.022	271
006200	20	8,2	1	.787	.323	.039	.061	.022	.550	.005	111	.011	207	.016	292	.022	372
006300 C	20	10,2	0,5	.787	.402	.020	.045	.026	1.300	.006	32	.013	49	.019	57	.026	61
006400 B	20	10,2	0,8	.787	.402	.031	.053	.022	.688	.005	69	.011	123	.016	169	.022	210
006500	20	10,2	0,9	.787	.402	.035	.057	.022	.611	.005	93	.011	170	.016	237	.022	299
006600	20	10,2	1	.787	.402	.039	.061	.022	.550	.005	123	.011	228	.016	322	.022	410
006700 A	20	10,2	1,1	.787	.402	.043	.061	.018	.409	.004	124	.009	237	.013	343	.018	446
006800	20	10,2	1,25	.787	.402	.049	.069	.020	.400	.005	201	.010	385	.015	559	.020	727
006900	20	10,2	1,5	.787	.402	.059	.071	.012	.200	.003	193	.006	383	.009	569	.012	754
007000 C	22,5	11,2	0,6	.886	.441	.024	.055	.031	1.333	.008	54	.016	84	.024	96	.031	100
007100 B	22,5	11,2	0,8	.886	.441	.031	.057	.026	.813	.006	69	.013	120	.019	160	.026	193
007200 A	22,5	11,2	1,25	.886	.441	.049	.069	.020	.400	.005	156	.010	300	.015	435	.020	566
007400	23	8,2	0,7	.906	.323	.028	.059	.031	1.143	.008	63	.016	101	.024	123	.031	136
007500	23	8,2	0,8	.906	.323	.031	.061	.030	.938	.007	75	.015	126	.022	162	.030	190
007600	23	8,2	0,9	.906	.323	.035	.063	.028	.778	.007	88	.014	155	.021	207	.028	253
007700	23	8,2	1	.906	.323	.039	.067	.028	.700	.007	115	.014	205	.021	280	.028	347
007800	23	10,2	0,9	.906	.402	.035	.065	.030	.833	.007	105	.015	181	.022	239	.030	287
007900	23	10,2	1	.906	.402	.039	.067	.028	.700	.007	122	.014	218	.021	297	.028	368
008000	23	10,2	1,25	.906	.402	.049	.075	.026	.520	.006	196	.013	367	.019	521	.026	667
008100	23	12,2	1	.906	.480	.039	.063	.024	.600	.006	107	.012	197	.018	275	.024	347
008200	23	12,2	1,25	.906	.480	.049	.073	.024	.480	.006	195	.012	368	.018	526	.024	677
008350	23	12,2	1,5	.906	.480	.059	.079	.020	.333	.005	262	.010	508	.015	744	.020	975
008600	25	10,2	1	.984	.402	.039	.069	.030	.750	.007	111	.015	196	.022	265	.030	324
008700 C	25	12,2	0,7	.984	.480	.028	.063	.035	1.286	.009	75	.018	116	.027	135	.035	143
008800 B	25	12,2	0,9	.984	.480	.035	.063	.028	.778	.007	83	.014	145	.021	195	.028	237
008900	25	12,2	1	.984	.480	.039	.071	.031	.800	.008	132	.016	230	.024	307	.031	372
009000	25	12,2	1,25	.984	.480	.049	.077	.028	.560	.007	192	.014	355	.021	500	.028	635
009100 A	25	12,2	1,5	.984	.480	.059	.081	.022	.367	.005	235	.011	453	.016	660	.022	863
009200	28	10,2	0,8	1.102	.402	.031	.069	.037	1.188	.009	79	.019	125	.028	149	.037	163
009300	28	10,2	1	1.102	.402	.039	.075	.035	.900	.009	116	.018	197	.027	255	.035	302
009400	28	10,2	1,25	1.102	.402	.049	.081	.031	.640	.008	166	.016	302	.024	418	.031	524
009500	28	10,2	1,5	1.102	.402	.059	.087	.028	.467	.007	226	.014	429	.021	615	.028	792
009600	28	12,2	1	1.102	.480	.039	.077	.037	.950	.009	133	.019	224	.028	286	.037	335
009700	28	12,2	1,25	1.102	.480	.049	.083	.033	.680	.008	190	.017	343	.025	470	.033	585
009800	28	12,2	1,5	1.102	.480	.059	.089	.030	.500	.007	259	.015	487	.022	695	.030	891
009900 C	28	14,2	0,8	1.102	.559	.031	.071	.039	1.250	.010	98	.020	154	.030	181	.039	194
010000 B	28	14,2	1	1.102	.559	.039	.071	.031	.800	.008	108	.016	188	.024	250	.031	303
010100	28	14,2	1,25	1.102	.559	.049	.083	.033	.680	.008	205	.017	369	.025	506	.033	629
010200 A	28	14,2	1,5	1.102	.559	.059	.085	.026	.433	.006	233	.013	445	.019	641	.026	831
010300	31,5	12,2	1	1.240	.480	.039	.083	.043	1.100	.011	132	.022	215	.032	263	.043	295
010400	31,5	12,2	1,25	1.240	.480	.049	.087	.037	.760	.009	172	.019	303	.028	407	.037	498
010500	31,5	12,2	1,5	1.240	.480	.059	.093	.033	.567	.008	233	.017	432	.025	607	.033	770
010650 C	31,5	16,3	0,8	1.240	.642	.031	.073	.041	1.313	.010	87	.021	134	.031	155	.041	163
010700 B	31,5	16,3	1,25	1.240	.642	.049	.085	.035	.720	.009	178	.018	318	.027	432	.035	533
010800	31,5	16,3	1,5	1.240	.642	.059	.094	.035	.600	.009	284	.018	522	.027	729	.035	920
010900 A	31,5	16,3	1,75	1.240	.642	.069	.096	.028	.400	.007	314	.014	602	.021	874	.028	1 140
011000	31,5	16,3	2	1.240	.642	.079	.108	.030	.375	.007	496	.015	957	.022	1 390	.030	1 820
011100	34	12,3	1	1.339	.484	.039	.089	.049	1.250	.012	144	.025	225	.037	265	.049	284
011200	34	12,3	1,25	1.339	.484	.049	.093	.043	.880	.011	184	.022	315	.032	410	.043	488
011300	34	12,3	1,5	1.339	.484	.059	.098	.039	.667	.010	248	.020	447	.030	615	.039	767
011400	34	14,3	1,25	1.339	.563	.049	.094	.045	.920	.011	206	.023	349	.034	450	.045	530
011500	34	14,3	1,5	1.339	.563	.059	.100	.041	.700	.010	276	.021	495	.031	675	.041	836
011600	34	16,3	1,5	1.339	.642	.059	.100	.041	.700	.010	291	.021	522	.031	712	.041	882
011700	34	16,3	2	1.339	.642	.079	.112	.033	.425	.008	473	.017	904	.025	1 310	.033	1 690
011850 C	35,5	18,3	0,9	1.398	.720	.035	.081	.045	1.278	.011	103	.023	161	.034	188	.045	200
011900 B	35,5	18,3	1,25	1.398	.720	.049	.089	.039	.800	.010	165	.020	288	.030	383	.039	465
012000 A	35,5	18,3	2	1.398	.720	.079	.110	.031	.400	.008	421	.016	807	.024	1 170	.031	1 520
012100	40	14,3	1,25	1.575	.563	.049	.104	.055	1.120	.014	204	.028	329	.041	402	.055	448

Article No.	Order Reference mm			Size inch						Spring Deflection s in inch and Spring Load F in lb							
										at $s = 0.25 h_0$		at $s = 0.50 h_0$		at $s \approx 0.75 h_0$		at $s = h_0$	
	D_e	D_i	t	D_e	D_i	t	l_0	h_0	h_0/t	s	F	s	F	s	F	s	F
012200	40	14,3	1,5	1.575	.563	.059	.108	.049	.833	.012	251	.025	436	.037	575	.049	691
012300	40	14,3	2	1.575	.563	.079	.120	.041	.525	.010	406	.021	759	.031	1 080	.041	1 380
012400	40	16,3	1,5	1.575	.642	.059	.110	.051	.867	.013	276	.026	475	.038	621	.051	741
012500	40	16,3	2	1.575	.642	.079	.122	.043	.550	.011	445	.022	827	.032	1 170	.043	1 490
012600	40	18,3	2	1.575	.720	.079	.124	.045	.575	.011	492	.023	910	.034	1 280	.045	1 620
012700 C	40	20,4	1	1.575	.803	.039	.091	.051	1.300	.013	128	.026	198	.038	229	.051	242
012800 B	40	20,4	1,5	1.575	.803	.059	.104	.045	.767	.011	250	.023	441	.034	592	.045	723
012900	40	20,4	2	1.575	.803	.079	.122	.043	.550	.011	491	.022	912	.032	1 290	.043	1 640
013000 A	40	20,4	2,25	1.575	.803	.089	.124	.035	.400	.009	527	.018	1 010	.027	1 470	.035	1 910
013100	40	20,4	2,5	1.575	.803	.098	.136	.037	.380	.009	756	.019	1 460	.028	2 120	.037	2 760
013250 C	45	22,4	1,25	1.772	.882	.049	.112	.063	1.280	.016	235	.031	366	.047	427	.063	453
013300 B	45	22,4	1,75	1.772	.882	.069	.120	.051	.743	.013	344	.026	610	.038	823	.051	1 010
013400 A	45	22,4	2,5	1.772	.882	.098	.138	.039	.400	.010	626	.020	1 200	.030	1 740	.039	2 270
013500	50	18,4	1,25	1.969	.724	.049	.112	.063	1.280	.016	171	.031	266	.047	310	.063	329
013600	50	18,4	1,5	1.969	.724	.059	.130	.071	1.200	.018	311	.035	493	.053	588	.071	640
013700	50	18,4	2	1.969	.724	.079	.138	.059	.750	.015	423	.030	766	.044	1 030	.059	1 260
013800	50	18,4	2,5	1.969	.724	.098	.161	.063	.640	.016	836	.031	1 520	.047	2 100	.063	2 630
013900	50	18,4	3	1.969	.724	.118	.173	.055	.467	.014	1 140	.028	2 150	.041	3 090	.055	3 980
014000	50	20,4	2	1.969	.803	.079	.138	.059	.750	.015	444	.030	785	.044	1 060	.059	1 300
014100	50	20,4	2,5	1.969	.803	.098	.152	.053	.540	.013	679	.027	1 260	.040	1 790	.053	2 280
014200	50	22,4	2	1.969	.882	.079	.142	.063	.800	.016	507	.031	886	.047	1 180	.063	1 430
014300	50	22,4	2,5	1.969	.882	.098	.154	.055	.560	.014	736	.028	1 360	.041	1 920	.055	2 440
014400 C	50	25,4	1,25	1.969	1.000	.049	.112	.063	1.280	.016	193	.031	300	.047	350	.063	371
014500	50	25,4	1,5	1.969	1.000	.059	.122	.063	1.067	.016	280	.031	458	.047	567	.063	642
014600 B	50	25,4	2	1.969	1.000	.079	.134	.055	.700	.014	440	.028	788	.041	1 070	.055	1 330
014700	50	25,4	2,5	1.969	1.000	.098	.154	.055	.560	.014	784	.028	1 450	.041	2 050	.055	2 600
014800 A	50	25,4	3	1.969	1.000	.118	.161	.043	.367	.011	960	.022	1 850	.032	2 700	.043	3 530
014950 C	56	28,5	1,5	2.205	1.122	.059	.136	.077	1.300	.019	329	.038	510	.058	592	.077	624
015000 B	56	28,5	2	2.205	1.122	.079	.142	.063	.800	.016	431	.031	753	.047	1 000	.063	1 210
015100 A	56	28,5	3	2.205	1.122	.118	.169	.051	.433	.013	935	.026	1 780	.038	2 570	.051	3 330
015200	60	20,5	2	2.362	.807	.079	.161	.083	1.050	.021	523	.041	858	.062	1 070	.083	1 210
015300	60	20,5	2,5	2.362	.807	.098	.169	.071	.720	.018	681	.035	1 210	.053	1 650	.071	2 030
015400	60	20,5	3	2.362	.807	.118	.185	.067	.567	.017	1 000	.033	1 860	.050	2 610	.067	3 320
015500	60	25,5	2,5	2.362	1.004	.098	.173	.075	.760	.019	778	.037	1 370	.056	1 850	.075	2 260
015600	60	25,5	3	2.362	1.004	.118	.183	.065	.550	.016	1 010	.032	1 890	.049	2 660	.065	3 390
015700	60	30,5	2,5	2.362	1.201	.098	.169	.071	.720	.018	778	.035	1 390	.053	1 880	.071	2 320
015800	60	30,5	3	2.362	1.201	.118	.185	.067	.567	.017	1 150	.033	2 120	.050	2 990	.067	3 790
015900	60	30,5	3,5	2.362	1.201	.138	.197	.059	.429	.015	1 490	.030	2 840	.044	4 100	.059	5 310
016050 C	63	31	1,8	2.480	1.220	.071	.163	.093	1.306	.023	534	.046	826	.069	957	.093	1 010
016100 B	63	31	2,5	2.480	1.220	.098	.167	.069	.700	.017	664	.034	1 190	.052	1 620	.069	2 010
016200	63	31	3	2.480	1.220	.118	.189	.071	.600	.018	1 100	.035	2 030	.053	2 830	.071	3 570
016300 A	63	31	3,5	2.480	1.220	.138	.193	.055	.400	.014	1 220	.028	2 340	.041	3 390	.055	4 410
016400	70	25,5	2	2.756	1.004	.079	.177	.098	1.250	.025	544	.049	851	.074	1 000	.098	1 070
016500	70	30,5	2,5	2.756	1.201	.098	.193	.094	.960	.024	848	.047	1 420	.071	1 810	.094	2 110
016600	70	30,5	3	2.756	1.201	.118	.201	.083	.700	.021	1 060	.041	1 890	.062	2 580	.083	3 190
016700	70	35,5	3	2.756	1.398	.118	.201	.083	.700	.021	1 130	.041	2 030	.062	2 770	.083	3 440
016800	70	35,5	4	2.756	1.398	.157	.228	.071	.450	.018	1 980	.035	3 750	.053	5 400	.071	6 980
016900	70	40,5	4	2.756	1.594	.157	.220	.063	.400	.016	1 890	.031	3 630	.047	5 270	.063	6 860
017000	70	40,5	5	2.756	1.594	.197	.244	.047	.240	.012	2 610	.024	5 130	.035	7 600	.047	10 000
017100 C	71	36	2	2.795	1.417	.079	.181	.102	1.300	.026	646	.051	1 000	.077	1 160	.102	1 220
017200 B	71	36	2,5	2.795	1.417	.098	.177	.079	.800	.020	653	.039	1 140	.059	1 520	.079	1 840
017300 A	71	36	4	2.795	1.417	.157	.220	.063	.400	.016	1 670	.031	3 200	.047	4 640	.063	6 030
017400	80	31	2,5	3.150	1.220	.098	.209	.110	1.120	.028	830	.055	1 340	.083	1 630	.110	1 820
017500	80	31	3	3.150	1.220	.118	.217	.098	.833	.025	1 020	.049	1 770	.074	2 340	.098	2 810
017600	80	31	4	3.150	1.220	.157	.240	.083	.525	.021	1 650	.041	3 090	.062	4 380	.083	5 600
017700	80	36	3	3.150	1.417	.118	.224	.106	.900	.027	1 220	.053	2 080	.080	2 690	.106	3 180
017800	80	36	4	3.150	1.417	.157	.224	.087	.550	.022	1 840	.043	3 420	.065	4 830	.087	6 150
017850 C	80	41	2,25	3.150	1.614	.089	.205	.116	1.311	.029	835	.058	1 290	.087	1 490	.116	1 570

Article No.	Order Reference mm				Size inch				Spring Deflection s in inch and Spring Load F in lb											
									at s = 0.25 h ₀		at s = 0.50 h ₀		at s ≈ 0.75 h ₀		at s = h ₀					
	D _e	D _i	t	t'	D _e	D _i	t	t'	l ₀	h ₀	h ₀ /t	s	F	s	F	s	F	s	F	
017900	B	80	41	3	3.150	1.614	.118	.209	.091	.767	.023	1 000	.045	1 770	.068	2 370	.091	2 900		
018000		80	41	4	3.150	1.614	.157	.244	.087	.550	.022	1 970	.043	3 660	.065	5 160	.087	6 570		
018100	A	80	41	5	3.150	1.614	.197	.264	.067	.340	.017	2 670	.033	5 180	.050	7 580	.067	9 920		
018200	C	90	46	2,5	3.543	1.811	.098	.224	.126	1.280	.031	955	.063	1 490	.094	1 730	.126	1 840		
018300	B	90	46	3,5	3.543	1.811	.138	.236	.098	.714	.025	1 320	.049	2 350	.074	3 200	.098	3 950		
018400	A	90	46	5	3.543	1.811	.197	.276	.079	.400	.020	2 540	.039	4 880	.059	7 080	.079	9 210		
018500		100	41	4	3.937	1.614	.157	.283	.126	.800	.031	1 970	.063	3 440	.094	4 570	.126	5 540		
018600		100	41	5	3.937	1.614	.197	.305	.108	.550	.027	2 790	.054	5 180	.081	7 300	.108	9 300		
018750	C	100	51	2,7	3.937	2.008	.106	.244	.138	1.296	.034	1 080	.069	1 670	.103	1 940	.138	2 050		
018800	B	100	51	3,5	3.937	2.008	.138	.248	.110	.800	.028	1 270	.055	2 220	.083	2 950	.110	3 580		
018900		100	51	4	3.937	2.008	.157	.276	.118	.750	.030	1 960	.059	3 460	.089	4 670	.118	5 720		
019000		100	51	5	3.937	2.008	.197	.307	.110	.560	.028	3 140	.055	5 830	.083	8 200	.110	10 400		
019150	A	100	51	6	3.937	2.008	.236	.323	.087	.367	.022	3 850	.043	7 430	.065	10 800	.087	14 200		
019250	C	112	57	3	4.409	2.244	.118	.272	.154	1.300	.038	1 320	.077	2 040	.115	2 370	.154	2 500		
019300	B	112	57	4	4.409	2.244	.157	.283	.126	.800	.031	1 720	.063	3 010	.094	4 010	.126	4 860		
019450	A	112	57	6	4.409	2.244	.236	.335	.098	.417	.025	3 570	.049	6 820	.074	9 870	.098	12 800		
019500		125	41	4	4.921	1.614	.157	.323	.165	1.050	.041	1 920	.083	3 150	.124	3 920	.165	4 450		
019600		125	51	4	4.921	2.008	.157	.335	.177	1.125	.044	2 280	.089	3 670	.133	4 470	.177	4 980		
019700		125	51	5	4.921	2.008	.197	.350	.154	.780	.038	2 950	.077	5 180	.115	6 920	.154	8 430		
019850		125	51	6	4.921	2.008	.236	.370	.134	.567	.033	3 840	.067	7 110	.100	10 000	.134	12 700		
019900		125	61	5	4.921	2.402	.197	.354	.157	.800	.039	3 300	.079	5 760	.118	7 670	.157	9 290		
020500		125	61	6	4.921	2.402	.236	.378	.142	.600	.035	4 470	.071	8 200	.106	11 400	.142	14 500		
020100		125	61	8	7,5	4.921	2.402	.315	.295	.429	.114	.362	.029	7 490	.057	14 500	.086	21 100	.114	27 600
020200	C	125	64	3,5	4.921	2.520	.138	.315	.177	1.286	.044	1 920	.089	2 990	.133	3 480	.177	3 690		
020300	B	125	64	5	4.921	2.520	.197	.335	.138	.700	.034	2 760	.069	4 950	.103	6 750	.138	8 360		
020400	A	125	64	8	7,5	4.921	2.520	.315	.295	.417	.102	.325	.026	6 800	.051	13 200	.077	19 400	.102	25 400
020550		125	71	6	4.921	2.795	.236	.366	.130	.550	.032	4 410	.065	8 190	.097	11 600	.130	14 700		
020600		125	71	8	7,4	4.921	2.795	.315	.291	.409	.094	.300	.024	6 720	.047	13 100	.071	19 300	.094	25 400
020700		125	71	10	9,2	4.921	2.795	.394	.362	.465	.071	.180	.018	9 490	.035	18 800	.053	28 000	.071	37 200
020850	C	140	72	3,8	5.512	2.835	.150	.343	.193	1.289	.048	2 150	.096	3 330	.145	3 880	.193	4 110		
020900	B	140	72	5	5.512	2.835	.197	.354	.157	.800	.039	2 710	.079	4 740	.118	6 300	.157	7 640		
021000	A	140	72	8	7,5	5.512	2.835	.315	.295	.441	.126	.400	.031	6 920	.063	13 300	.094	19 200	.126	25 000
021100		150	61	5	5.906	2.402	.197	.406	.209	1.060	.052	3 450	.104	5 650	.156	7 010	.209	7 950		
021250		150	61	6	5.906	2.402	.236	.425	.189	.800	.047	4 420	.094	7 710	.142	10 300	.189	12 400		
021350		150	71	6	5.906	2.795	.236	.425	.189	.800	.047	4 680	.094	8 170	.142	10 900	.189	13 200		
021400		150	71	8	7,5	5.906	2.795	.315	.295	.472	.157	.500	.039	7 570	.079	14 200	.118	20 300	.157	26 000
021500		150	81	8	7,5	5.906	3.189	.315	.295	.461	.146	.462	.036	7 430	.073	14 100	.109	20 200	.146	26 100
021600		150	81	10	9,3	5.906	3.189	.394	.366	.512	.118	.300	.030	10 900	.059	21 300	.089	31 400	.118	41 300
021650	C	160	82	4,3	6.299	3.228	.169	.390	.220	1.302	.055	2 750	.110	4 250	.165	4 930	.220	5 200		
021750	B	160	82	6	6.299	3.228	.236	.413	.177	.750	.044	3 880	.089	6 870	.133	9 260	.177	11 300		
021800	A	160	82	10	9,4	6.299	3.228	.394	.370	.531	.138	.350	.034	11 000	.069	21 400	.103	31 200	.138	40 900
021850	C	180	92	4,8	7.087	3.622	.189	.433	.244	1.292	.061	3 310	.122	5 130	.183	5 970	.244	6 310		
021950	B	180	92	6	7.087	3.622	.236	.437	.201	.850	.050	3 740	.100	6 440	.151	8 470	.201	10 100		
022000	A	180	92	10	9,4	7.087	3.622	.394	.370	.551	.157	.400	.039	10 200	.079	19 500	.118	28 300	.157	36 800
022100		200	82	8	7,6	7.874	3.228	.315	.299	.559	.244	.775	.061	7 480	.122	13 200	.183	17 600	.244	21 500
022200		200	82	10	9,6	7.874	3.228	.394	.378	.610	.217	.550	.054	11 100	.108	20 700	.162	29 200	.217	37 200
022300		200	82	12	11,5	7.874	3.228	.472	.453	.654	.181	.383	.045	14 700	.091	28 400	.136	41 200	.181	53 800
022400		200	92	10	9,5	7.874	3.622	.394	.374	.614	.220	.560	.055	11 900	.110	22 100	.165	31 100	.220	39 500
022500		200	92	12	11,4	7.874	3.622	.472	.449	.661	.189	.400	.047	16 200	.094	31 000	.142	45 000	.189	58 500
022600		200	92	14	13,1	7.874	3.622	.551	.516	.713	.161	.293	.040	21 000	.081	41 000	.121	60 300	.161	79 400
022650	C	200	102	5,5	7.874	4.016	.217	.492	.276	1.273	.069	4 470	.138	6 970	.207	8 150	.276	8 670		
022700	B	200	102	8	7,5	7.874	4.016	.315	.295	.535	.220	.700	.055	7 050	.110	12 600	.165	17 200	.220	21 400
022800		200	102	10	9,4	7.874	4.016	.394	.370	.614	.220	.560	.055	12 600	.110	23 300	.165	32 800	.220	41 700
022900	A	200	102	12	11,25	7.874	4.016	.472	.443	.638	.165	.350	.041	14 600	.083	28 300	.124	41 300	.165	54 000
023000		200	102	14	13,1	7.874	4.016	.551	.516	.717	.165	.300	.041	22 700	.083	44 400	.124	65 300	.165	85 800
023100		200	112	12	11,1	7.874	4.409	.472	.437	.638	.165	.350	.041	15 600	.083	30 200	.124	44 200	.165	57 800
023200		200	112	14	12,9	7.874	4.409	.551	.508	.689	.138	.250	.034	19 900	.069	39 200	.103	58 000	.138	76 500
023300		200	112	16	14,8	7.874	4.409	.630	.583	.740	.110	.175	.028	23 300	.055	46 200	.083	68 900	.110	91 400

Standard SCHNORR® Disc Springs

Article No.	Order Reference mm				Size inch							Spring Deflection s in inch and Spring Load F in lb							
												at s = 0.25 h ₀		at s = 0.50 h ₀		at s ≈ 0.75 h ₀		at s = h ₀	
	D _e	D _i	t	t'	D _e	D _i	t	t'	l ₀	h ₀	h ₀ /t	s	F	s	F	s	F	s	F
023350 C	225	112	6,5	6,2	8.858	4.409	.256	.244	.535	.280	1.092	.070	5 040	.140	8 180	.210	10 100	.280	11 300
023400 B	225	112	8	7,5	8.858	4.409	.315	.295	.571	.256	.813	.064	6 920	.128	12 000	.192	16 000	.256	19 300
023500 A	225	112	12	11,25	8.858	4.409	.472	.443	.669	.197	.417	.049	14 000	.098	26 700	.148	38 600	.197	50 100
023600	250	102	10	9,6	9.843	4.016	.394	.378	.709	.315	.800	.079	12 300	.157	21 400	.236	28 500	.315	34 600
023700	250	102	12	11,5	9.843	4.016	.472	.453	.748	.276	.583	.069	16 000	.138	29 500	.207	41 300	.276	52 300
023750 C	250	127	7	6,7	9.843	5.000	.276	.264	.583	.307	1.114	.077	5 770	.154	9 320	.230	11 400	.307	12 700
023800 B	250	127	10	9,4	9.843	5.000	.394	.370	.669	.276	.700	.069	11 000	.138	19 700	.207	26 900	.276	33 300
023900	250	127	12	11,25	9.843	5.000	.472	.443	.760	.287	.608	.072	18 600	.144	34 200	.216	47 600	.287	60 000
024000 A	250	127	14	13,1	9.843	5.000	.551	.516	.772	.220	.400	.055	20 200	.110	38 700	.165	56 200	.220	73 100
024100	250	127	16	15	9.843	5.000	.630	.591	.858	.228	.363	.057	30 700	.114	59 300	.171	86 500	.228	113 000



Original SCHNORR® "Z" Disc Springs

The Z Springs are manufactured to DIN 2093 specifications.

Article No.	Ref.	Bolt Size inch	Size mm			Size inch						Spring Deflection s in inch and Spring Load F in lb							
			D _e	D _i	t	D _e	D _i	t	l ₀	h ₀	h ₀ /t	s = 0.25 h ₀		s = 0.50 h ₀		s ≈ 0.75 h ₀		s = h ₀	
												s	F	s	F	s	F	s	F
248500	Z 1	3/16"	9,53	4,96	0,4	.375	.195	.016	.028	.012	.750	.003	22	.006	38	.009	52	.012	64
248600	Z 2	1/4"	12,7	6,55	0,5	.500	.258	.020	.035	.016	.800	.004	33	.008	57	.012	76	.016	93
248700	Z 3	1/4"	12,7	6,55	0,6	.500	.258	.024	.039	.016	.667	.004	52	.008	93	.012	128	.016	160
249000	Z 6	5/16"	19,05	8,13	0,7	.750	.320	.028	.051	.024	.857	.006	57	.012	99	.018	129	.024	155
249100	Z 7	5/16"	19,05	8,13	0,8	.750	.320	.031	.055	.024	.774	.006	79	.012	140	.018	189	.024	231
248800	Z 4	3/8"	17,46	9,7	0,6	.6875	.382	.024	.043	.020	.833	.005	41	.010	70	.015	93	.020	112
248900	Z 5	3/8"	17,46	9,7	0,7	.6875	.382	.028	.047	.020	.714	.005	59	.010	106	.015	144	.020	177
249200	Z 8	3/8"	19,05	9,7	0,8	.750	.382	.031	.053	.022	.710	.006	75	.011	135	.017	185	.022	230
249300	Z 9	3/8"	19,05	9,7	0,9	.750	.382	.035	.057	.022	.629	.006	102	.011	187	.017	260	.022	327
249400	Z 10	7/16"	25,4	11,3	0,9	1.000	.445	.035	.067	.031	.886	.008	95	.016	162	.023	211	.031	251
249500	Z 11	7/16"	25,4	11,3	1	1.000	.445	.039	.071	.031	.795	.008	122	.016	213	.023	284	.031	344
249600	Z 12	7/16"	25,4	11,3	1,25	1.000	.445	.049	.075	.026	.531	.007	161	.013	300	.020	426	.026	545
249700	Z 12a	1/2"	28,0	13	1	1.100	.512	.039	.075	.035	.897	.009	124	.018	211	.026	274	.035	324
249800	Z 12b	1/2"	28,0	13	1,25	1.100	.512	.049	.083	.033	.673	.008	195	.017	351	.025	481	.033	598
249900	Z 12c	1/2"	28,0	13	1,5	1.100	.512	.059	.087	.028	.475	.007	243	.014	460	.021	659	.028	850
250000	Z 13	5/8"	34,92	16,18	1,25	1.375	.637	.049	.094	.045	.918	.011	202	.023	342	.034	441	.045	519
250100	Z 14	5/8"	34,92	16,18	1,5	1.375	.637	.059	.102	.043	.729	.011	290	.022	516	.032	698	.043	858
250200	Z 15	5/8"	34,92	16,18	2	1.375	.637	.079	.110	.031	.392	.008	409	.016	784	.023	1138	.031	1480
250300	Z 16	3/4"	38,1	19,35	1,5	1.500	.762	.059	.114	.055	.932	.014	378	.028	639	.041	821	.055	963
250400	Z 17	3/4"	38,1	19,35	2	1.500	.762	.079	.122	.043	.544	.011	538	.022	999	.032	1409	.043	1794
250500	Z 18	3/4"	38,1	19,35	2,5	1.500	.762	.098	.134	.035	.357	.009	778	.018	1503	.026	2194	.035	2867
250600	Z 19	1	50,8	25,8	2	2.000	1.016	.079	.138	.059	.747	.015	471	.030	833	.044	1123	.059	1376
250700	Z 20	1	50,8	25,8	2,5	2.000	1.016	.098	.157	.059	.602	.015	831	.030	1525	.044	2129	.059	2688
250800	Z 21	1	50,8	25,8	3	2.000	1.016	.118	.165	.047	.398	.012	1026	.024	1969	.035	2856	.047	3715
250900	Z 22	1	60,33	25,8	2	2.375	1.016	.079	.157	.079	1.000	.020	497	.040	825	.059	1041	.079	1201
251000	Z 23	1	60,33	25,8	2,5	2.375	1.016	.098	.177	.079	.806	.020	832	.040	1454	.059	1935	.079	2345
251100	Z 24	1	60,33	25,8	3	2.375	1.016	.118	.181	.063	.534	.016	962	.032	1794	.047	2539	.063	3242

SCHNORR® "K" Disc Springs English

Article No.	Bolt Size inch	Order Reference mm			Size inch						Force at 75% deflection inch lb s F	Ball-Bearing Type	Ball-Bearing Dimension				
		D _e	D _i	t	D _e	D _i	t	l ₀	h ₀	h ₀ /t			outer dia.		inner dia.		
													mm	inch	mm	inch	
241100	1/8"	9,3	5,8	0,2	.366	.228	.0079	.0158	.0079	1.0	.0059	5.7	English R 2	9,53	.375	3,18	.125
241300	3/16"	12,5	8,1	0,25	.492	.319	.0098	.0196	.0098	1.0	.0074	8.2	English R 3	12,70	.500	4,76	.1875
241500	1/4"	15,7	10,3	0,25	.618	.406	.0098	.0216	.0118	1.2	.0089	6.5	English R 4	15,88	.625	6,35	.250
242000	3/8"	21,9	13,7	0,5	.862	.539	.0138	.0295	.0157	1.14	.0118	11.4	English R 6	22,23	.875	9,53	.375
242400	1/2"	28,2	18,4	0,4	1.110	.724	.0158	.0433	.0275	1.74	.0207	23.2	English R 8	28,58	1.125	12,70	.500
242700	5/8"	34,5	25,4	0,5	1.358	1.000	.0197	.0473	.0276	1.4	.0207	34.6	English R 10	34,93	1.375	15,88	.625

Explanation of the table

The "K" Disc Spring Sizes listed in the following table comply with the ball bearing series EL, R, 62 and 63 which are most frequently used. Springs can also be supplied to other series of ball bearings.

In the table are shown all the springs of our standard production. The loads and deflections given are at spring deflection of 75% of free height h_0 , which is the recommended preload.

How to order "K" Disc Springs

When ordering "K" Disc Springs to preload the outer ring of the bearing it is sufficient to quote the bearing size. In all other cases please give application details.

Article No.	Order Reference mm			Size inch						Force at 75% deflection		Ball-Bearing Type		Ball-Bearing Dimension			
	D _e	D _i	t	D _e	D _i	t	l ₀	h ₀	h ₀ /t	s	F			outer dia.	inner dia.		
241200	9,8	6,2	0,2	.386	.244	.008	.016	.008	1,00	.006	5	623(EL3)		.394	.118	-	-
241400	12,8	7,2	0,25	.504	.283	.010	.020	.010	1,00	.007	7	624(EL4)		.512	.157	-	-
241600	15,8	8,2	0,25	.622	.323	.010	.022	.012	1,20	.009	5	625(EL5) 634		.630	.197	.157	-
241700	18,8	9,2	0,3	.740	.362	.012	.026	.014	1,17	.010	7	626(EL6) 635		.630	.236	.197	-
241800	18,8	10,2	0,35	.740	.402	.014	.028	.014	1,00	.010	11	607(EL7)		.748	.276	-	-
241900	21,8	12,3	0,35	.858	.484	.014	.030	.016	1,14	.012	10	608(EL8) 627		.866	.315	.276	-
242100	23,7	14,3	0,4	.933	.563	.016	.035	.020	1,25	.015	18	609(EL9)		.945	.354	-	-
242200	25,7	14,3	0,4	1.012	.563	.016	.035	.020	1,25	.015	14	6000 629		1.024	.394	.354	-
242300	27,7	17,3	0,4	1.091	.681	.016	.039	.024	1,50	.018	18	6001		1.102	.472	-	-
242500	29,7	17,4	0,4	1.169	.685	.016	.043	.028	1,75	.021	19	6200		1.181	-	.394	-
242600	31,7	20,4	0,4	1.248	.803	.016	.043	.028	1,75	.021	18	6002 6201		1.260	.591	.472	-
242800	34,6	20,4	0,4	1.362	.803	.016	.043	.028	1,75	.021	14	6300	1.378	-	-	.394	
242900	34,6	22,4	0,5	1.362	.882	.020	.047	.028	1,40	.021	27	6003 6202	1.378	.669	.591	-	
243000	36,6	20,4	0,5	1.441	.803	.020	.051	.031	1,60	.024	25	6301	1.457	-	-	.472	
243100	39,6	25,5	0,5	1.559	1.004	.020	.051	.031	1,60	.024	25	6203	1.575	-	.669	-	
243200	41,6	25,5	0,5	1.638	1.004	.020	.055	.035	1,80	.027	25	6004 6302	1.654	.787	-	.591	
243300	46,5	30,5	0,6	1.831	1.201	.024	.059	.035	1,50	.027	34	6005 6204 6303	1.850	.984	.787	.669	
243400	51,5	35,5	0,6	2.028	1.398	.024	.059	.035	1,50	.027	30	6205 6304	2.047	-	.984	.787	
243500	54,5	40,5	0,6	2.146	1.594	.024	.059	.035	1,50	.027	32	6006	2.165	1.181	-	-	
243600	61,5	40,5	0,7	2.421	1.594	.028	.071	.043	1,57	.033	40	6007 6206 6305	2.441	1.378	1.181	.984	
243700	67,5	50,5	0,7	2.657	1.988	.028	.067	.039	1,43	.030	36	6008	2.677	1.575	-	-	
243800	71,5	45,5	0,7	2.815	1.791	.028	.083	.055	2,00	.041	42	6306	2.835	-	-	1.181	
243900	71,5	50,5	0,7	2.815	1.988	.028	.083	.055	2,00	.041	49	6207	2.835	-	1.378	-	
244000	74,5	55,5	0,8	2.933	2.185	.031	.075	.043	1,38	.033	47	6009	2.953	1.772	-	-	
244100	79,5	50,5	0,8	3.130	1.988	.031	.091	.059	1,88	.044	51	6307	3.150	-	-	1.378	
244200	79,5	55,5	0,8	3.130	2.185	.031	.091	.059	1,88	.044	59	6010 6208	3.150	1.969	1.575	-	
244300	84,5	60,5	0,9	3.327	2.382	.035	.098	.063	1,78	.047	81	6209	3.346	-	1.772	-	
244400	89,5	60,5	0,9	3.524	2.382	.035	.098	.063	1,78	.047	65	6308	3.543	-	-	1.575	
244500	89,5	65,5	0,9	3.524	2.579	.035	.098	.063	1,78	.047	75	6011 6210	3.543	2.165	1.969	-	
244600	94,5	75,5	1	3.720	2.972	.039	.087	.047	1,20	.035	73	6012	3.740	2.362	-	-	
244700	99	65,5	1	3.898	2.579	.039	.102	.063	1,60	.047	66	6309	3.937	-	-	1.772	
244800	99	70,5	1	3.898	2.776	.039	.102	.063	1,60	.047	75	6013 6211	3.937	2.559	2.165	-	
244900	109	70,5	1,25	4.291	2.776	.049	.106	.057	1,16	.043	80	6310	4.331	-	-	1.969	
245000	109	75,5	1,25	4.291	2.972	.049	.106	.057	1,16	.043	89	6014 6212	4.331	2.756	2.362	-	
245100	114	90,5	1,25	4.488	3.563	.049	.096	.047	0,96	.035	89	6015	4.528	2.953	-	-	
245200	119	75,5	1,25	4.685	2.972	.049	.110	.061	1,24	.046	72	6311	4.724	-	-	2.165	
245300	119	85,5	1,25	4.685	3.366	.049	.110	.061	1,24	.046	88	6213	4.724	-	2.559	-	
245400	124	90,5	1,25	4.882	3.563	.049	.118	.069	1,40	.052	100	6016 6214	4.921	3.150	2.756	-	
245500	129	85,5	1,25	5.079	3.366	.049	.126	.077	1,56	.057	91	6312	5.118	-	-	2.362	
245600	129	95,5	1,25	5.079	3.760	.049	.126	.077	1,56	.057	112	6017 6215	5.118	3.346	2.953	-	
245700	139	90,5	1,25	5.472	3.563	.049	.128	.079	1,60	.059	80	6313	5.512	-	-	2.559	
245800	139	101	1,25	5.472	3.976	.049	.128	.079	1,60	.059	96	6018 6216	5.512	3.543	3.150	-	
245900	149	95,5	1,5	5.866	3.760	.059	.126	.067	1,13	.050	85	6314	5.906	-	-	2.756	
246000	149	106	1,5	5.866	4.173	.059	.126	.067	1,13	.050	101	6020 6217	5.906	3.937	3.346	-	
246100	159	101	1,5	6.260	3.976	.059	.138	.079	1,33	.059	93	6315	6.299	-	-	2.953	
246200	159	111	1,5	6.260	4.370	.059	.138	.079	1,33	.059	107	6021 6218	6.299	4.134	3.543	-	
246300	169	111	1,5	6.654	4.370	.059	.150	.091	1,53	.068	106	6316	6.693	-	-	3.150	
246400	169	121	1,5	6.654	4.764	.059	.150	.091	1,53	.068	123	6022 6219	6.693	4.331	3.740	-	
246500	179	121	2	7.047	4.764	.079	.165	.087	1,10	.065	194	6317	7.087	-	-	3.346	

Article No.	Order Reference mm			Size inch							Force at 75% deflection		Ball-Bearing Type			Ball-Bearing Dimension			
	D _e	D _i	t	D _e	D _i	t	l ₀	h ₀	h ₀ /t	s	F				outer dia.	inner dia.			
246600	179	126	2	7.047	4.961	.079	.165	.087	1,10	.065	209	6024	6220		7.087	4.724	3.937	-	
246700	189	121	2	7.441	4.764	.079	.169	.091	1,15	.068	171		6318		7.480	-	-	3.543	
246800	189	131	2	7.441	5.157	.079	.169	.091	1,15	.068	193		6221		7.480	-	4.134	-	
246900	198	131	2	7.795	5.157	.079	.177	.098	1,25	.074	183		6319		7.874	-	-	3.740	
247000	198	141	2	7.795	5.551	.079	.177	.098	1,25	.074	207	6026	6222		7.874	5.118	4.331	-	
247100	213	151	2,25	8.386	5.945	.089	.177	.089	1,00	.067	212		6224	6320	8.465	-	4.724	3.937	
247200	223	161	2,25	8.780	6.339	.089	.181	.093	1,04	.069	212	6030	6321		8.858	5.906	-	4.134	
247300	228	161	2,25	8.976	6.339	.089	.195	.106	1,20	.080	233		6226		9.055	-	5.118	-	
247400	238	161	2,25	9.370	6.339	.089	.207	.118	1,33	.089	230	6032	6322		9.449	6.299	-	4.331	
247500	248	171	2,5	9.764	6.732	.098	.197	.098	1,00	.074	226		6228		9.843	-	5.512	-	
247600	258	171	2,5	10.157	6.732	.098	.217	.118	1,20	.089	249	6034	6324		10.236	6.693	-	4.724	
247700	268	181	2,5	10.551	7.126	.098	.224	.126	1,28	.094	260		6230		10.630	-	5.906	-	
247800	278	181	2,5	10.945	7.126	.098	.236	.138	1,40	.104	260	6036	6326		11.024	7.087	-	5.118	
247900	288	191	2,75	11.339	7.520	.108	.226	.118	1,09	.089	257	6038	6232		11.417	7.480	6.299	-	
248000	298	191	2,75	11.732	7.520	.108	.250	.142	1,31	.106	294		6328		11.811	-	-	5.512	
248100	308	202	3	12.126	7.953	.118	.240	.122	1,03	.092	292	6040	6234		12.205	7.874	6.693	-	
248200	318	212	3	12.520	8.346	.118	.244	.126	1,07	.094	293		6236	6330	12.598	-	7.087	5.906	
248300	338	232	3	13.307	9.134	.118	.260	.142	1,20	.106	318	6044	6238	6332	13.386	8.661	7.480	6.299	
248400	358	242	3	14.094	9.528	.118	.276	.157	1,33	.118	320	6048	6240	6334	14.173	9.449	7.874	6.693	

Also available:
Slotted Disc Springs

The inclusion of slots on either the inner or outer diameter creates a lever which works on the unslotted portion of the spring. This has the effect of reducing the spring load and increasing the

deflection. The resulting spring has a softer characteristic with a large deflection and in proportion to the outside diameter smaller spring loads. It is most important with this type of spring that

the permissible stresses in the annular portion are not exceeded and, if necessary, the outside diameter must be increased to compensate.

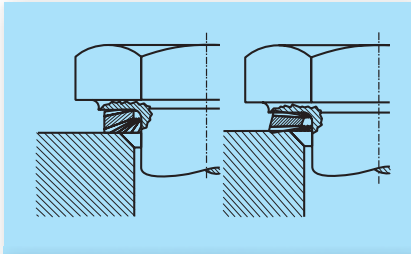


SCHNORR® Bolting Series Washers

- Original SCHNORR® Safety Washers: S and VS series
- Heavy Duty Safety Washers DIN 6796: HDS series
- High Load Safety Washers: HS series



Original SCHNORR® Safety Washers



Bolt with SCHNORR® Safety Washer loose and tightened

Very often our disc springs are considered for use as safety washers for bolted connections to maintain a preload and prevent loosening. High quality disc springs are too expensive for this application and the sizes of normal disc springs do not match screw and bolt sizes. We have therefore developed special safety elements for this application.

These safety washers are in the form of a disc spring which is serrated on both sides and of trapezoidal cross section. Their diameters are matched to screw dimensions. The outer diameter of the washer is matched to the head diameter of pan-head and hexagon socket head cap screws. As a result, the safety washer can be used with practically any screw and bolt type, including those with recessed heads. The only exception are countersunk screws.

The ingenious form of the Original SCHNORR® Safety Washer combines the advantages of security through friction and mechanical locking. They offer the following advantages to the designer:

1. The shape of the cross section ensures the locking effect is at the outside diameter which ensures the greatest resistance to loosening.
2. High resistance to vibration due to positive locking of the serrations.

3. The closed ring form results in a high degree of pretensioning, i.e. an excellent frictional connection.
4. Concentric application of force eliminates bending in the bolts.
5. Sliding surfaces allow tightening without damaging the surfaces.
6. No splitting during tightening with proper transitional radius between bolt shaft and bolt head.
7. Suitable for captive fitting on a wide range of bolts (combi bolts for which a range with special dimensions is available).
8. Universal application minimises stocks.
9. SCHNORR® Safety Washers can be supplied in a variety of materials and different finishes.

The Original SCHNORR® Safety Washer is available in two series:

The "S" series is suitable for normal duty and available for screws of size M1.6 to M36. The reinforced safety washer of the "VS" series is thicker, and therefore achieves higher pretensioning loads. The inner and outer diameters are the same as for the "S" series. These washers are available for screws M 5 to M 30.

The Original SCHNORR® Safety Washer is protected by patents at home and abroad.

The term "safety washer" is used to describe a washer element in the form of a disc spring which achieves its locking effect solely by means of the frictional connection. These are intended to compensate for loosening of the screwed connection, e.g. due to setting, by maintaining a sufficiently high pretension in the connection with spring force. They are therefore especially suitable for primarily axially loaded, short bolts.

SCHNORR® HDS Washers offer the following advantages:

1. High axial load
2. Optimum compensation for setting in the joint
3. Reduction of the dynamic loading of the screw due to higher elasticity of the joint
4. Uniform concentric loading eliminates bending in the bolt
5. Greater safety with high degree of spring action
6. Suitable for captive fitting on a wide range of bolts (combi bolts)

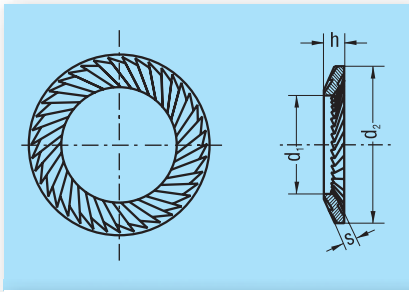
These high loads naturally require large cross-sections, which is why the outside diameter of the load washer is considerably larger than that of our Original SCHNORR® Safety Washer. As a result, the area required for a design with load washers cannot be ignored.

As a highly progressive load increase occurs at the end of the spring deflection when the washer is flattened, the load has been indicated as double the calculated value in the following table. Tests have shown that these values are comparable with the measured values.

For the security of the bolted connection, only the force is available which is still present after a full compression of the load washer and the related setting. Therefore, the table indicates the minimum height after the loading test. This limits the height loss caused by setting.

The load washers contained in the table conform to DIN 6796, Edition October 1987 "Conical spring washers for bolted connections." The test specifications are laid down in DIN 267 Part 26 "Fasteners; technical specifications for elements made of spring steel for bolted connections."

Original SCHNORR® Safety Washers type "S"



Original SCHNORR® Safety Washers type "S"

The "S" series is suitable for normal duty and available for screws of size M1.6 to M36.

Available materials:

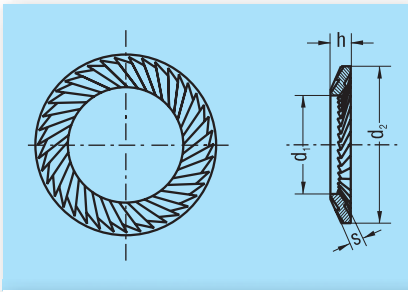
Carbon steel SAE 1060
Stainless steel
Phosphor bronze

Available finishes:

phosphated (Standard) – in stock
zinc-plated clear (ZC) – in stock
zinc-plated yellow (ZY) – in stock
stainless steel – in stock

Order Reference	Bolt Size		d ₁ mm	d ₂ mm	s mm	h		d ₁ inch	d ₂ inch	s inch	h		Packaging [pieces per box]
	metric mm	imperial inch				max. mm	min. mm				max. inch	min. inch	
S 1.6	1,6		1,7	3,2	0,35	0,6	0,38	.067	.126	.014	.024	.015	2000
S 2	2		2,2	4	0,35	0,6	0,39	.087	.157	.014	.024	.015	2000
S 2.5	2,5		2,7	4,8	0,45	0,9	0,49	.106	.189	.018	.035	.019	2000
S 3	3	1/8"	3,2	5,5	0,45	0,9	0,51	.126	.217	.018	.035	.020	2000
S 3.5	3,5		3,7	6	0,45	0,9	0,52	.146	.236	.018	.035	.020	2000
S 4	4	5/32"	4,3	7	0,5	1	0,59	.169	.276	.020	.039	.023	1000
S 5	5	3/16"	5,3	9	0,6	1,1	0,73	.209	.354	.024	.043	.029	1000
S 6	6		6,4	10	0,7	1,2	0,82	.252	.394	.028	.047	.032	1000
S 6.35	6,35	1/4"	6,7	9,5	0,7	1,2	0,79	.264	.374	.028	.047	.031	1000
S 7	7		7,4	12	0,7	1,3	0,89	.291	.472	.028	.051	.035	1000
S 8	8	5/16"	8,4	13	0,8	1,4	0,98	.331	.512	.031	.055	.039	1000
S 10	10	3/8"	10,5	16	1	1,6	1,21	.413	.630	.039	.063	.048	1000
S 11.1	11,1	7/16"	11,6	15,9	1	1,6	1,18	.457	.626	.039	.063	.046	500
S 12	12		13	18	1,1	1,7	1,31	.512	.709	.043	.067	.052	500
S 12.7	12,7	1/2"	13,7	19	1,1	1,8	1,33	.539	.748	.043	.071	.052	500
S 14	14	9/16"	15	22	1,2	2	1,52	.591	.866	.047	.079	.060	500
S 16	16	5/8"	17	24	1,3	2,1	1,63	.669	.945	.051	.083	.064	500
S 18	18		19	27	1,5	2,3	1,85	.748	1.063	.059	.091	.073	250
S 19	19	3/4"	20	30	1,5	2,5	1,98	.787	1.181	.059	.098	.078	250
S 20	20		21	30	1,5	2,5	1,94	.827	1.181	.059	.098	.076	250
S 22	22	7/8"	23	33	1,5	2,7	2,08	.906	1.299	.059	.106	.082	100
S 24	24		25,6	36	1,8	2,9	2,32	1.008	1.417	.071	.114	.091	100
S 25.4	25,4	1"	27	38	2	3,1	2,52	1.063	1.299	.079	.122	.099	100
S 27	27		28,6	39	2	3,1	2,52	1.126	1.535	.079	.122	.099	100
S 30	30	1 1/8"	31,6	45	2	3,6	2,78	1.244	1.772	.079	.142	.109	100
S 33	33	1 1/4"	34,6	50	2,5	4,0	3,26	1.362	1.969	.098	.157	.128	100
S 36	36	1 3/8"	38	54	2,5	4,2	3,38	1.496	2.126	.098	.165	.133	50

Original SCHNORR® Safety Washers "VS"



Original SCHNORR® Safety Washers type "VS"

The reinforced safety washer of the "VS" series is thicker, and therefore achieves higher pretensioning loads. The inner and outer diameters are the same as for the "S" series. These washers are available for screws M 5 to M 36.

Available materials:

- Carbon steel SAE 1060
- Stainless steel
- Phosphor bronze

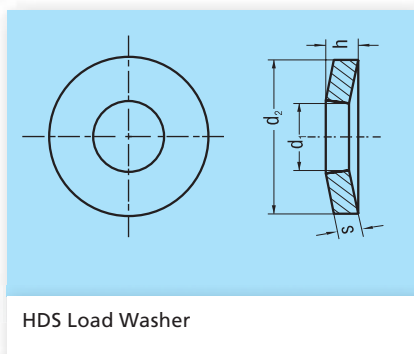
Available finishes:

- phosphated (Standard) – in stock
- zinc-plated clear (ZC) – in stock
- zinc-plated yellow (ZY) – in stock
- stainless steel – in stock

Order Reference	Bolt Size		d ₁ mm	d ₂ mm	s mm	h		d ₁ inch	d ₂ inch	s inch	h		Packaging [pieces per box]
	metric mm	imperial inch				max. mm	min. mm				max. inch	min. inch	
VS 5	5	3/16"	5,3	9	1	1,3	1,07	.209	.354	.039	.051	.042	1000
VS 6	6		6,4	10	1	1,4	1,08	.252	.394	.039	.055	.043	1000
VS 8	8	5/16"	8,4	13	1,2	1,7	1,32	.331	.512	.047	.067	.052	1000
VS 10	10	3/8"	10,5	16	1,5	2	1,64	.413	.630	.059	.079	.065	1000
VS 12	12		13	18	1,5	2,1	1,65	.512	.709	.059	.083	.065	500
VS 14	14	9/16"	15	22	1,5	2,2	1,76	.591	.866	.059	.087	.069	500
VS 16	16	5/8"	17	24	2	2,6	2,21	.669	.945	.079	.102	.087	250
VS 18	18		19	27	2	2,7	2,27	.748	1.063	.079	.106	.089	250
VS 20	20		21	30	2	2,8	2,34	.827	1.181	.079	.110	.092	250
VS 22	22	7/8"	23	33	2	3,0	2,42	.906	1.299	.079	.118	.095	100
VS 24	24		25,6	36	2,5	3,4	2,87	1.008	1.417	.098	.134	.113	100
VS 25.4	25,4	1"	27	38	2,5	3,4	2,95	1.063	1.496	.098	.134	.116	100
VS 27	27		28,6	39	2,5	3,5	2,91	1.126	1.535	.098	.138	.115	100
VS 30	30	1 1/8"	31,6	45	2,5	3,8	3,12	1.244	1.772	.098	.150	.123	100
VS 33	33	1 1/4"	34,6	50	3,0	4,5	3,65	1.362	1.969	.098	.157	.128	100
VS 36	36	1 3/8"	38	54	3,0	4,5	3,72	1.496	2.126	.098	.157	.146	50



SCHNORR® HDS Load Washers as per DIN 6796



These load washers have been specifically developed for high-strength bolts in the strength classes 8.8–10.9 as per DIN ISO 898 Part 1 (SAE Grade 5). The loads of the washers have been matched to these bolts and are 70 to 90% of the bolt load in the flat state.

Available materials:

Carbon steel SAE 1060
Stainless steel 17-7 PH

Available finishes:

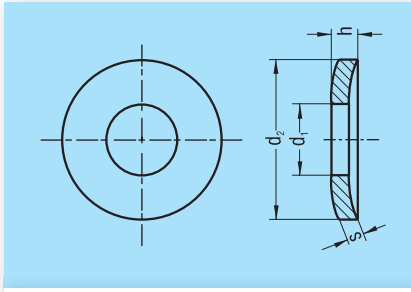
phosphated (Standard) – in stock
zinc-plated clear (ZC) – in stock
zinc-plated yellow (ZY) – in stock

Order Reference	Bolt Size		d ₁ mm	d ₂ mm	s mm	h		d ₁ inch	d ₂ inch	s inch	h		Steel Flat Load lbs
	metric mm	imperial inch				max. mm	min. mm				max. inch	min. inch	
HDS 2	2		2,2	5	0,4	0,6	0,5	.087	.197	.016	.024	.020	141
HDS 2.5	2,5		2,7	6	0,5	0,72	0,61	.106	.236	.020	.028	.024	213
HDS 3	3	1/8"	3,2	7	0,6	0,85	0,72	.126	.276	.024	.033	.028	297
HDS 3.5	3,5		3,7	8	0,8	1,06	0,92	.146	.315	.031	.042	.036	542
HDS 4	4	5/32"	4,3	9	1	1,3	1,12	.169	.354	.039	.051	.044	848
HDS 5	5	3/16"	5,3	11	1,2	1,55	1,35	.209	.433	.047	.061	.053	1232
HDS 6	6	1/4"	6,4	14	1,5	2	1,7	.252	.551	.059	.079	.067	1931
HDS 7	7		7,4	17	1,75	2,3	2	.291	.669	.069	.091	.079	2540
HDS 8	8	5/16"	8,4	18	2	2,6	2,24	.331	.709	.079	.102	.088	3350
HDS 10	10	3/8"	10,5	23	2,5	3,2	2,8	.413	.906	.098	.126	.110	4968
HDS 12	12	1/2"	13	29	3	3,95	3,43	.512	1.142	.118	.156	.135	7666
HDS 14	14	9/16"	15	35	3,5	4,65	4,04	.591	.378	.138	.183	.159	10341
HDS 16	16	5/8"	17	39	4	5,25	4,58	.669	1.535	.157	.207	.180	13421
HDS 18	18		19	42	4,5	5,8	5,08	.748	1.654	.177	.228	.200	16726
HDS 20	20	3/4"	21	45	5	6,4	5,6	.827	1.772	.197	.252	.220	20952
HDS 22	22	7/8"	23	49	5,5	7,05	6,15	.906	1.929	.217	.278	.242	25561
HDS 24	24		25	56	6	7,75	6,77	.984	2.205	.236	.305	.267	29450
HDS 27	27	1"	28	60	6,5	8,35	7,3	1.102	2.362	.256	.329	.287	34621
HDS 30	30	1 1/8"	31	70	7	9,2	8	1.220	2.756	.276	.362	.315	38667

Technical notes and explanations

- h max is spring height as received
- h min is spring height after compression
- load information for design reference only
- figures based on spring steel, values will be different for other materials
- to be used for static applications only not stack in series or parallel
- S and VS are designed for use in light and medium duty applications

SCHNORR® High Load Safety Washers "HS"



Original SCHNORR® High Load Safety Washer "HS"

This safety washer is in principle a load washer with a smaller outer diameter than those in DIN 6796.

A notable feature of these washers is the slightly curved form, which provides a progressively increasing characteristic curve. Despite the smaller outside

dimensions, this makes it possible to achieve the same load as the load washers as per DIN 6796.

These washers are primarily used when the space available is insufficient for standardized load washers.

Available materials:

Spring steel
as per DIN 17221 or 17222

Available finishes:

phosphated and oiled

Order Reference	Bolt Size		d ₁ mm	d ₂ mm	s mm	h		d ₁ inch	d ₂ inch	s inch	h		Steel Flat Load lbs
	metric mm	imperial inch				max. mm	min. mm				max. inch	min. inch	
HS 6	6	1/4"	6,4	12	1,5	1,9	1,64	.252	.472	.059	.075	.065	2005
HS 8	8	5/16"	8,4	17	2	2,55	2,21	.331	.669	.079	.100	.087	3395
HS 10	10	3/8"	10,5	21	2,5	3,15	2,75	.413	.827	.098	.124	.108	5216
HS 12	12	1/2"	13	24	3	3,75	3,27	.512	.945	.118	.148	.129	7823
HS 14	14	9/16"	15	28	3,5	4,35	3,8	.591	1.102	.138	.171	.150	10071
HS 16	16	5/8"	17	30	4	4,95	4,31	.669	1.181	.157	.195	.170	14118
HS 18	18		19	33	4,5	5,5	4,8	.748	1.299	.177	.217	.189	16321
HS 20	20	3/4"	21	36	5	5,95	5,3	.827	1.417	.197	.234	.209	20727
HS 22	22	7/8"	23	40	5,5	6,7	5,9	.906	1.575	.217	.264	.232	26977
HS 24	24		25	45	6	7,3	6,45	.984	1.772	.236	.287	.254	30349
HS 27	27	1"	28	50	6,5	8	7	1.102	1.969	.256	.315	.276	34845
HS 30	30	1 1/8"	31	58	7	8,9	7,65	1.220	2.283	.276	.350	.301	40466

Standards

DIN EN 10048	Hot-rolled narrow steel strip – Tolerances on dimensions and shape
DIN EN 10140	Colled rolled steel
DIN 2092	Disc springs; calculation
DIN 2093	Disc springs; dimensions and quality specifications
DIN 7521	Steel forgings; technical terms of delivery
DIN 17221	Hot rolled steels for quenched and tempered springs
DIN EN 10132-4	Cold-rolled narrow steel strip for heat-treatment Part 4: Spring steels and other applications
DIN EN 10151	Wire and strip of stainless steels for springs
DIN EN 10269	Steel and nickel alloys for fasteners with specified elevated and / or low temperature properties

DIN EN 1652	Copper and copper alloys – Plate, sheet, strip and circles for general purposes
DIN EN 1654	Copper and copper alloys – Strip for springs and connectors
DIN 50938	Alkaline blackening (black finishing) of iron materials
DIN 50942	Phosphating of metals
DIN 50960	Electroplated and chemical coatings; designation and specification in technical documents
DIN EN 10258	Cold-rolled stainless steel narrow strip and cut lengths – Tolerances on dimensions and shape
DIN EN 10029	Hot rolled steel plates 3 mm thick or above; Tolerances on dimensions, shape and mass
DIN EN 10088-2	Stainless steels

Disc spring enquiry sheet

(Please copy and complete, mark with cross where applicable)

1. Application: _____

2. Purpose of the springs: _____

3. Installation space (Max. D_e , min. D_i , length): _____

4. Loads and deflections:

L1= _____ inch	s1= _____ inch	F1= _____ lb
L2= _____ inch	s2= _____ inch	F2= _____ lb
L3= _____ inch	s3= _____ inch	F3= _____ lb

5. Type of load: static dynamic

6. Form of load: impact sinusoidal

7. Number of cycles required: _____

8. Working temperature (at the springs): _____

9. Guide: inner outer

10. Position of the spring stack: vertical horizontal

11. Is corrosion protection necessary? _____

12. Aggressive medium: _____

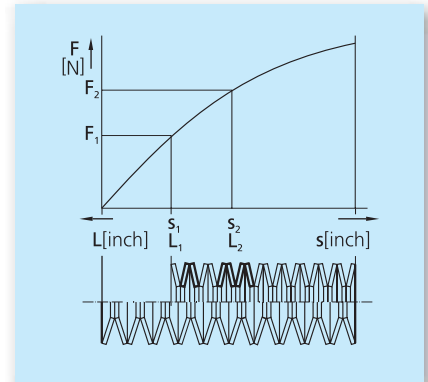
13. Remarks: _____

14. Estimated annual usage: _____

Compiled by: _____

Telephone: _____ Telefax: _____

Company, signature



Please send your enquiry sheet to:

SCHNORR Corporation
 4355 Varsity Drive Suite A
 Ann Arbor, MI 48108

Phone 734 677-2683
 Fax 734 975-0408
 eMail sales@schnorr.com



SPECIALIST MANUFACTURER OF DISC SPRINGS
ISO/TS 16949: 2002 certified

For further information contact

SCHNORR Corporation
4355 Varsity Drive Suite A
Ann Arbor, MI 48108

Phone 734-677-2683

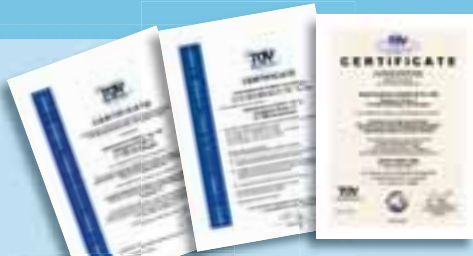
Fax 734-975-0408

E-Mail sales@schnorr.com

Internet www.schnorr.com



Handbook for Disc Springs
150 page engineering handbook
available upon request.



Additional information
and current quality certifications
on our website



Company

Contact

Address

Telephone

Telefax

E-Mail

