SCHNORR®

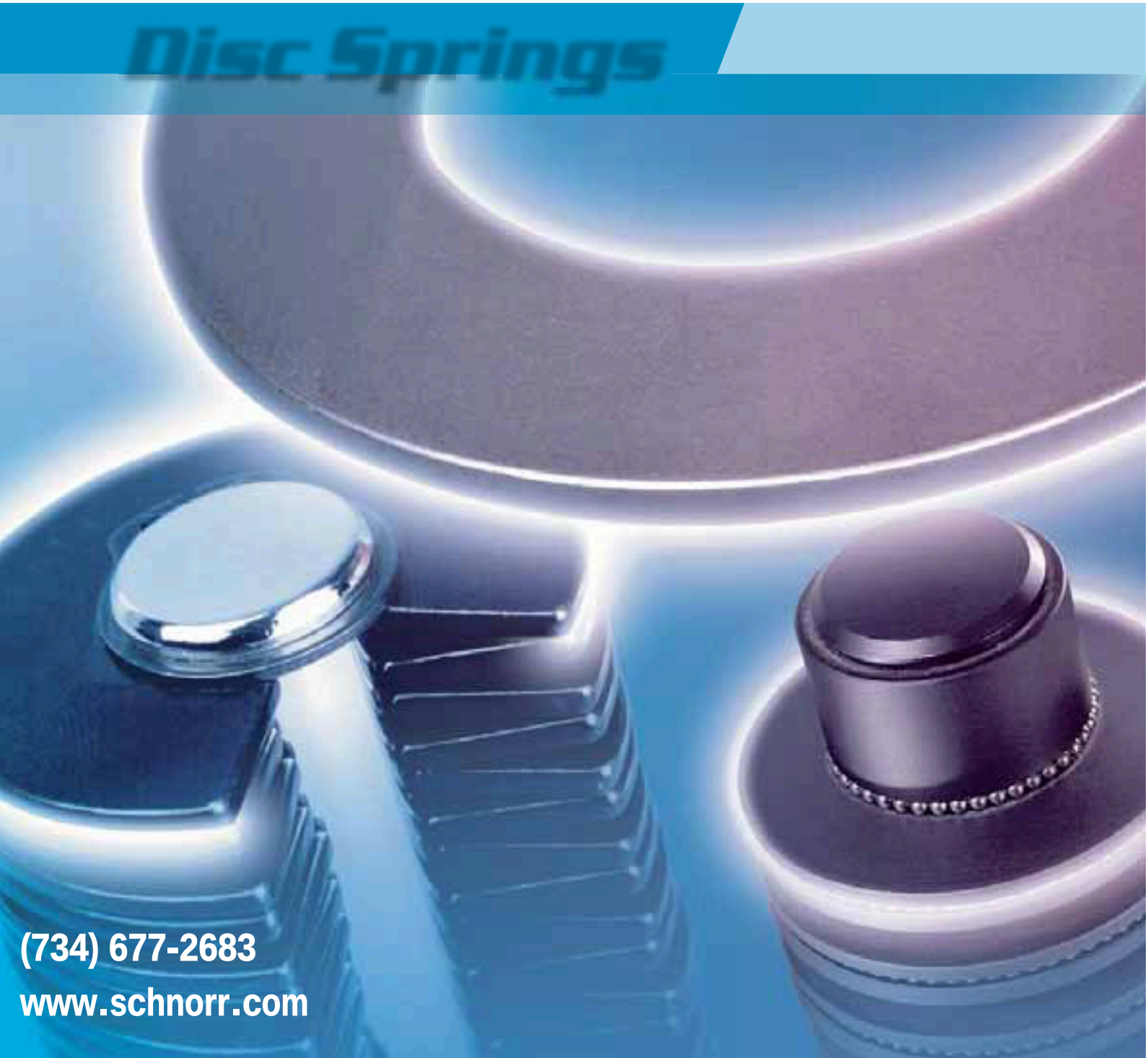
SPECIALIST MANUFACTURER OF DISC SPRINGS

ISO/TS 16949: 2002 certified

Materials & Tolerances

Inch Edition

Disc Springs



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Common Name AISI ASTM Ref.	AISI	Mat.-No.	Standard	Working Temperature °C	Tensile Strength N/mm²	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 a lso out of doors, if the springs are installed with weather protec-tion, 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.

			Tolerance for l_o	
	t [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

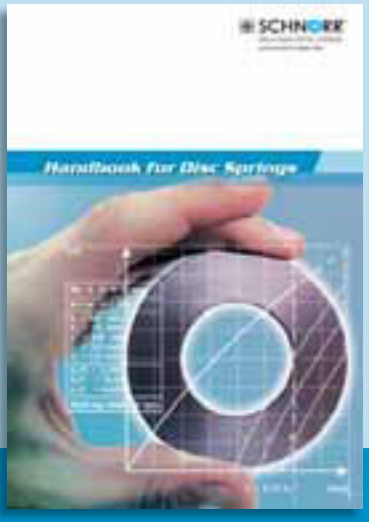
Load Tolerances

Single Disc Springs

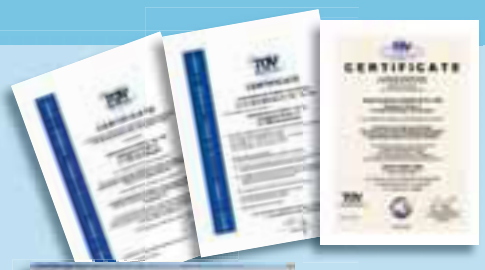
For single disc springs the following maximum deviations are allowed:

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 [mm]	[inch]	Tolerances for F at the test length $l_p = l_0 - 0.75\ h_0$
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 %



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



Additional information
and current quality certifications
on our website

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SCHNORR®
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ISO/TS 16949: 2002 certified

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