

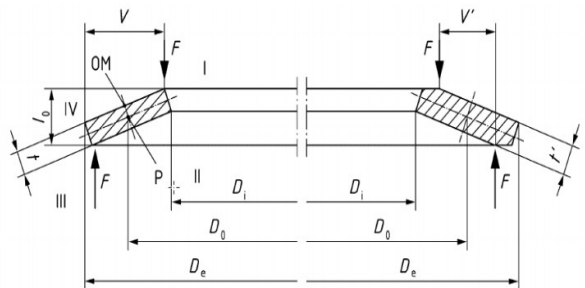
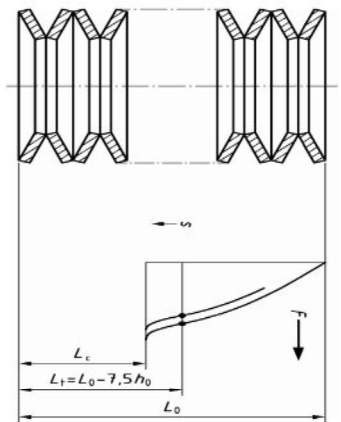
DIN EN 16983-2017-09

Disc springs

Amendant record:

DIN 2093:1957-07;1967-04;1990-09;1992-01;2006-03;2013-02;2013-12;
DIN 2093 Corrigendum 1:2007-07
DIN EN 13983:2017-02

The shown structure is for illustrative purposes only; the dimensions of the retaining ring and groove shall comply with the specifications in Table 1 and Table 2, with dimensional tolerances applicable to measurements prior to coating.

Figure 1	Tabelle-1 Disc spring group	Figure 2																						
 a) ohne Auflageflächen: Gruppe 1 Gruppe 2 b) mit Auflageflächen: Gruppe 3	<table><tr><th>group</th><th>t</th><th>Does it include a thinning support plane?</th></tr><tr><td>1</td><td>$t < 1.25$</td><td>No</td></tr><tr><td>2</td><td>$1.25 \leq t \leq 6$</td><td>No</td></tr><tr><td>3</td><td>$6 \leq t \leq 14$</td><td>Yes</td></tr></table> dimension series <table><tr><th colspan="2">Tabelle-2 Disc Spring Dimension Series</th></tr><tr><th>series</th><th>h_0/t</th></tr><tr><td>A</td><td>≈ 0.40</td></tr><tr><td>B</td><td>≈ 0.75</td></tr><tr><td>C</td><td>≈ 1.3</td></tr></table>	group	t	Does it include a thinning support plane?	1	$t < 1.25$	No	2	$1.25 \leq t \leq 6$	No	3	$6 \leq t \leq 14$	Yes	Tabelle-2 Disc Spring Dimension Series		series	h_0/t	A	≈ 0.40	B	≈ 0.75	C	≈ 1.3	
group	t	Does it include a thinning support plane?																						
1	$t < 1.25$	No																						
2	$1.25 \leq t \leq 6$	No																						
3	$6 \leq t \leq 14$	Yes																						
Tabelle-2 Disc Spring Dimension Series																								
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Size, nominal specifications, and design parameters

Tabelle-3 Series B

Disc Springs with: $D_e/t \approx 28$; $h_0/t \approx 0.75$; $E=206000\text{MPa}$; $\mu=0.3$

Group	De	Di	t or "t"①	ho	lo	F _t	l _t	σ _{III}	σ _{OM}
	h12	H12							
	8	4.2	0.3	0.25	0.55	118	0.36	1312	-1505
	10	5.2	0.4	0.3	0.7	209	0.47	1281	-1531
	12.5	6.2	0.5	0.35	0.85	294	0.59	1114	-1388

1	14	7.2	0.5	0.4	0.9	279	0.60	1101	-1293
	16	8.2	0.6	0.45	1.05	410	0.71	1109	-1333
	18	9.2	0.7	0.5	1.2	566	0.82	1114	-1363
	20	10.2	0.8	0.55	1.35	748	0.94	1118	-1386
2	22.5	11.2	0.8	0.65	1.45	707	0.96	1079	-1276
	25	12.2	0.9	0.7	1.6	862	1.07	1023	-1238
	28	14.2	1	0.8	1.8	1107	1.20	1086	-1282
	31.5	16.3	1.25	0.9	2.15	1913	1.47	1187	-1442
	35.5	18.3	1.25	1	2.25	1699	1.50	1073	-1258
	40	20.4	1.5	1.15	2.65	2622	1.79	1136	-1359
	45	22.4	1.75	1.3	3.05	3646	2.07	1144	-1396
	50	25.4	2	1.4	3.4	4762	2.35	1140	-1408
	56	28.5	2	1.6	3.6	4438	2.40	1092	-1284
	63	31	2.5	1.75	4.25	7189	2.94	1088	-1360
	71	36	2.5	2	4.5	6725	3.00	1055	-1246
	80	41	3	2.3	5.3	10518	3.57	1142	-1363
	90	46	3.5	2.5	6	14161	4.12	1114	-1363
	100	51	3.5	2.8	6.3	13070	4.20	1049	-1235
	112	57	4	3.2	7.2	17752	4.80	1090	-1284
	125	64	5	3.5	8.5	29908	5.87	1149	-1415
3	140	72	5	4	9	27920	6.00	1101	-1293
	160	82	6	4.5	10.5	41008	7.12	1109	-1333
	180	92	6	5.1	11.1	37502	7.27	1035	-1192
	200	102	8 (7.5)	5.6	13.6	76378	9.40	1254	-1409
	225	112	8 (7.5)	6.5	14.5	70749	9.62	1176	-1267
	250	127	10 (9.4)	7	17	119050	11.75	1244	-1406

- ① The marked thickness t represents the nominal thickness; when $t \geq 8\text{mm}$, in order to ensure that the compression amount $s \approx 0.75h_0$ reaches the specified load F , the thickness of the single disc spring needs to be reduced to obtain the actual effective thickness t' ; B size series: $t' \approx 0.94 \times t$;
- ② The listed values represent the maximum calculated tensile stress at the lower edge of the disc spring.
- ③ The listed values represent the maximum calculated tensile stress at point III.

Manufacturing Process and Surface Quality

Tabelle-4 Processing techniques and surface quality requirements

series	Manufacturing process	Surface roughness ^① on upper and bottom surfaces μm	Surface roughness ^① on outer and inner edges μm	Material as in
1	Stamping, cold forming, edge rounding	Ra<3.2	Ra<12.5	EN 10132-4
2	Stamping ^② , cold forming, De and Di turning, edge rounding or fine blanking ^③ , cold forming, edge rounding	Ra<6.3	Ra<6.3	EN 10132-4
		Ra<6.3	Ra<3.2	EN 10132-4
3	Cold or hot forming, turning on all sides, edge rounding or stamping ^② , cold forming, De and Di turning, edge rounding or fine blanking ^③ , cold forming, edge rounding	Ra<12.5	Ra<12.5	EN 10083/EN 10089
		Ra<12.5	Ra<12.5	EN 10132-4
		Ra<12.5	Ra<12.5	EN 10132-4

① The values specified do not apply to shot peened springs.

② Stamping without De and D, turning is not permitted.

③ Fine blanking in accordance with VDI/Guideline 2906 Part 5: Clean cut min. 75 %, scar category 2, tear off max. 25 %.

Heat treatment

To ensure satisfactory fatigue life with minimum relaxation, the hardness of disc springs shall lie within the range of 42 HRC to 52 HRC.

For Group 1 disc springs, the hardness shall be determined according to Vickers (425 HV10 to 510HV10).

After heat treatment, the disc spring shall not exhibit a depth of decarburization exceeding 3 % of its thickness.

Shot peening

shot peening according to ISO 26910-1 is recommended.

This procedure shall be the subject of agreement between customer and manufacturer.

Presetting

After heat treatment, each disc spring shall be loaded until it is in the flat position.

After loading the disc spring with twice of its test load F_t , the tolerances for the spring load as specified in Table 7 shall be met.

Appearance and corrosion protection

The surface shall be free from defects such as scars, cracks and corrosion. Phosphating and oiling is the standard corrosion protection for disc springs.

Spring material

Springs complying with this standard shall be made from steel as specified in the EN 10083 series, EN 10089 or EN 10132-4. Carbon steel shall only be used for the manufacture of Group 1 springs (see also Table 4). The design of disc springs made from steel as above shall be based on a modulus of elasticity, E , of 206 000 MPa.

Other materials as agreed between customer and supplier.

common			Table 5-Tolerances on thickness			Table 6 - Tolerances on free overall height, lo		
Table 5-Tolerances on diameter			Group	t	Tolerances	Group	t	Tolerances
			1	0.2≤t≤0.6	(+0.02/-0.06)	1	t<1.25	(+0.1/-0.05)
De: tolerance class h12;				0.6<t<1.25	(+0.03/-0.09)		1.25≤t≤2.0	(+0.15/-0.08)
Coaxiality tolerance for De≤ 50: 2 x IT11;			2	1.25≤t≤3.8	(+0.04/-0.12)	2	2.0<t≤3.0	(+0.20/-0.10)
Coaxiality tolerance for De > 50:2 x IT12;				3.8<t≤6.0	(+0.05/-0.15)		3.8<t≤6.0	(+0.30/-0.15)
Di: tolerance class H12.			3	6.0<t≤14.0	±0.1	3	6.0<t≤14.0	±0.3
Tolerances on spring load								
Single disc springs			Springs stacked in series				Clearance between disc spring and guiding element	
The spring load Ft shall be determined at test length lt=lo - 0,75 ho. The measurement is taken while loading between flat plates, using a suitable lubricant. The flat plates shall be hardened, ground, and polished.			Ten single disc springs stacked in series shall be used to determine the deviation in load between the loading curve and the unloading curve.Prior to testing, the disc spring shall be compressed to twice its test load, F. The individual disc springs shall be centred by a mandrel in compliance with Other. The clearance between disc springs and mandrel shall be as specified in Table 9. The flat plates shall meet the requirements specified in 8.4.1. At Lt=Lo - 7,5 ho, the spring load determined for the unloading curve shall make up at least the minimum percentages specified in Table 11 of the spring load determined for the loading curve (see also Figure 2). <i>Other : Where possible, the guiding element and the support plate shall be made from case-hardened materials,with a case depth of approximately 0,8 mm, and have a minimum hardness of 60 HRC. The surface of the guiding element should be smooth and perfectly finished. It shall be permitted to use unhardened guiding elements where the disc spring is subject to static loading</i>				A guiding element is necessary to keep the disc spring in position. This should be preferably a mandrel. In the case of external positioning, a sleeve is preferred.	
Table 7 - Tolerances on spring load							Table 9 - Recommended clearance between disc spring and guiding	
Group	t	Tolerances for Ft atlt=lo-0,75 ho,%	Table 8 - Minimum spring load at unloading, as a percentage of the spring load at loading at Lt				Di or De	Total clearance
1	t < 1.25	(+25/-7.5)						
2	1.25≤t≤3.0	(+15/-7.5)	Group	Series			≤16	0.2
				A	B	C	> 16 ~ ≤20	0.3
	3.8 < t≤6.0	(+10/-5)	1	90		85	> 20 ~ ≤26	0.4
							> 26 ~ ≤31.5	0.5
3	6.0 < t≤14.0	±5	2	92.5		87.5	> 31.5 ~ ≤50	0.6
							> 50 ~ ≤80	0.8
To comply with the specified load tolerances, it may be necessary to exceed the tolerance values specified for lo and t.			3	95		90	> 80 ~ ≤140	1.0
							> 140 ~ ≤250	1.6