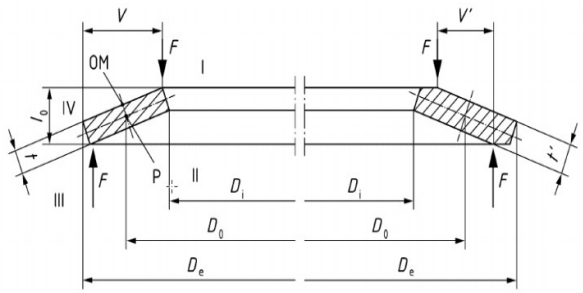
DIN EN 16983-2017-09
Disc springs

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



a) ohne Auflageflächen: Gruppe 1 Gruppe 2　　b) mit Auflageflächen: Gruppe 3

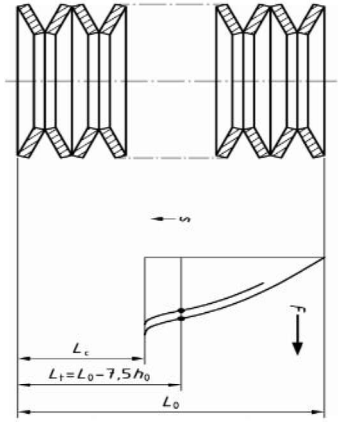
Tabelle-1 Disc spring group

group	t	Does it include a thinning support plane?
1	t＜1.25	No
2	1.25≤t≤6	No
3	6≤t≤14	Yes
dimension series		

Tabelle-2 Disc Spring Dimension Series

series	h_0/t
A	≈ 0.40
B	≈ 0.75
C	≈1.3

Figure 2



Size, nominal specifications, and design parameters

Tabelle-3 Series C

Disc Springs with：De/t≈40；h0/t≈1.3；E=206000MPa；μ=0.3

Group	De	Di	t or"t"①	ho	lo	F_t	l_t	σIII	σOM
	h12	H12				s approximately 0,75h_0			s=h0
	8	4.2	0.2	0.25	0.45	39	0.26	1034	-1003
	10	5.2	0.25	0.3	0.55	58	0.32	965	-957
	12.5	6.2	0.35	0.45	0.8	151	0.46	1278	-1250

1	14	7.2	0.35	0.45	0.8	123	0.46	1055	-1018
	16	8.2	0.4	0.5	0.9	154	0.52	1009	-988
	18	9.2	0.5	0.6	1.05	214	0.60	1106	-1052
	20	10.2	0.5	0.65	1.15	254	0.66	1063	-1024
	22.5	11.2	0.6	0.8	1.4	426	0.80	1227	-1178
	25	12.2	0.7	0.9	1.6	600	0.92	1259	-1238
	28	14.2	0.8	1	1.8	801	1.05	1304	-1282
	31.5	16.3	0.8	1.05	1.85	687	1.06	1130	-1077
	35.5	18.3	0.9	1.15	2.05	832	1.19	1078	-1042
	40	20.4	1	1.3	2.3	1017	1.32	1063	-1024
2	45	22.4	1.25	1.6	2.85	1891	1.65	1253	-1227
	50	25.4	1.25	1.6	2.85	1550	1.65	1035	-1006
	56	28.5	1.5	1.95	3.45	2622	1.99	1218	-1174
	63	31	1.8	2.35	4.15	4238	2.39	1351	-1315
	71	36	2	2.6	4.6	5144	2.65	1342	-1295
	80	41	2.25	2.95	5.2	6613	2.99	1370	-1311
	90	46	2.5	3.2	5.7	7684	3.30	1286	-1246
	100	51	2.7	3.5	6.2	8609	3.57	1235	-1191
	112	57	3	3.9	6.9	10489	3.97	1218	-1174
	125	64	3.5	4.5	8	15416	4.62	1318	-1273
	140	72	3.8	4.9	8.7	17195	5.02	1249	-1203
	160	82	4.3	5.6	9.9	21843	5.70	1238	-1189
	180	92	4.8	6.2	11	26442	6.35	1201	-1159
	200	102	5.5	7	12.5	36111	7.25	1247	-1213
3	225	112	6.5（6.2）	7.1	13.6	44580	8.27	1137	-1119
	250	127	7（6.7）	7.8	14.8	50466	8.95	1116	-1086

①The marked thickness t represents the nominal thickness; when t ≥ 8mm, in order to ensure that the compression amount s ≈ 0.75h0 reaches the specified load F, the thickness of the single disc spring needs to be reduced to obtain the actual effective thickness t'; C size series: t' ≈ 0.96 × t;
②The listed values represent the maximum calculated tensile stress at the lower edge of the disc spring.
③The 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 roughness① on upper and bottom surfaces μm	Surface roughness① 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	Stamping②,cold forming,De and Di turning, edge rounding or fine blanking③,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 stamping②, cold forming,De and Di turning, edge rounding or fine blanking③, 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

①The values specified do not apply to shot peened springs.
②Stamping without De and D, turning is not permitted.
③Fine 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 Ft, the tolerances for the spring load as specified in Table 7shall be met.

Appearanceand 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 10o83 series,EN 10089 or EN 10132-4. Carbon steel shall only be used for the manufacture of Group 1 springs (seealso 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 diameter

De: tolerance class h12;

Coaxiality tolerance for De≤ 50: 2 x IT11;

Coaxiality tolerance for De > 50:2 x IT12;

Di: tolerance class H12.

Table 5-Tolerances on thickness

Group	t	Tolerances
1	0.2≤t≤0.6	(+0.02/-0.06)
	0.6＜t＜1.25	(+0.03/-0.09)
2	1.25≤t≤3.8	(+0.04/-0.12)
	3.8＜t≤6.0	(+0.05/-0.15)
3	6.0＜t≤14.0	±0.1

Table 6 - Tolerances on free overall height, lo

Group	t	Tolerances
1	t＜1.25	(+0.1/-0.05)
	1.25≤t≤2.0	(+0.15/-0.08)
2	2.0＜t≤3.0	(+0.20/-0.10)
	3.8＜t≤6.0	(+0.30/-0.15)
3	6.0＜t≤14.0	±0.3

Tolerances on spring load

Single disc springs

The spring load Ft shall be determined at test length lt=lo - O,75 ho. The measurement is taken while loading between flat plates, using a suitable lubricant. The flat plates shall be hardened, ground, and polished.

Table 7 - Tolerances on spring load

Group	t	Tolerances for Ft atlt=l0-0,75 h_O,%
1	*t ＜1.25*	*(+25/-7.5)*
2	*1.25≤t≤3.0*	*(+15/-7.5)*
	3.8 ＜t≤6.0	*(+10/-5)*
3	*6.0 ＜t≤14.0*	*±5*

To comply with the specified load tolerances, it may be necessary to exceed the tolerance values specified for lo and t.

Springs stacked in series

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).

Other： Where possible, the guiding element and the support plate shall be made from case-hardened materials,with a case depth of approximately O,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

Table 8 - Minimum spring load at unloading, as a percentage of the spring load at loading at Lt

Group	Series A	Series B	Series C
1	*90*		*85*
2	*92.5*		*87.5*
3	*95*		*90*

Clearance between disc spring and guiding element

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 9 - Recommended clearance between disc spring and guiding element

Di or De	Total clearance
≤16	*0.2*
＞16 ～ ≤20	*0.3*
＞20 ～ ≤26	*0.4*
＞26 ～ ≤31.5	*0.5*
＞31.5 ～ ≤50	*0.6*
＞50 ～ ≤80	*0.8*
＞80 ～ ≤140	*1.0*
＞140 ～ ≤250	*1.6*