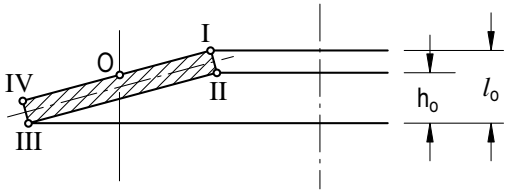
LOADING STRESSES

CRITICAL STRESS POINTS

When the disc is loaded, compressive stresses result at Points I and IV. Compressive stresses typically act on the upper surface of the disc.

At the theoretical Point (**O**) between Points I and IV, the stress must not exceed the yield strength of the disc material (1400 – 1600 N/mm^2 for the DIN 2093 specified materials) to ensure that there will be no "set."

Tensile stresses at Points II and III are the basis for fatigue life calculations. Tensile stresses typically act on the lower surface of the disc.



STATIC LOADING

Static loading is defined as carrying a constant load or an occasionally changing load at relatively long time intervals not exceeding ten thousand cycles per design life. In these cases the highest calculated stress at Point O is most critical and should not exceed 1400 – 1600 N/mm^2 in the flat ($s = h_o$) position for the DIN 2093 specified materials.

The standard range of Disc Springs may be used in static loading conditions without the need to perform theoretical stress calculations. Under these conditions, spring set is not a factor with stresses up to F = 0.75 h_o.

DYNAMIC LOADING

Residual manufacturing tensile stresses occur at the upper inside diameter edge Point I. These revert to compressive stresses when the disc is deflected by 15% to 20% of the total cone height (h_o). Fatigue life will be drastically reduced by stress reversals and therefore discs in dynamic applications must be preloaded by a minimum of 15% to 20%.

The maximum deflection limit of 75% of total deflection (s = 0.75 h_o) must be observed.

To increase fatigue life 1) reduce maximum stress, 2) increase pre-stress, or 3) both.

Dynamically loaded Disc Springs are generally divided into two categories:

1. Limited Life – Discs which should achieve 2 x 10^6 cycles without failure.
2. Practically Unlimited Life – Discs which should exceed 2 x 10^6 cycles without failure.

Detailed design calculations can be provided by **SPIROL** to determine estimated fatigue life. At a minimum, the following information is required:

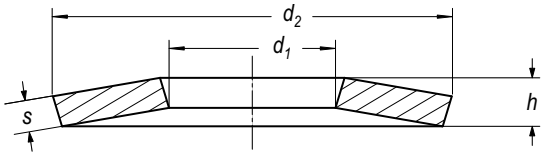
1. Mounting space available
2. Maximum load
3. Type of load – static, intermittent, dynamic
4. Cycle life expected
5. Operating conditions – temperature, corrosion

SPIROL®

CONICAL SPRING WASHERS

Designed in accordance with DIN 6796 for use with high tensile bolts in Classes 8.8 and higher.

Since the spring force exerted is predictable, Spring Washers provide a simple effective means of determining bolt tension required to achieve a properly torqued assembly. In addition, tension, which would otherwise be lost to expansion, wear, or compression set, is maintained.



Nominal Size	d_1 H14	d_2 h14	s	h max[1]	h min[2]	Force N Test[3]	Force N[4]
2	2.2	5	0.4	0.6	0.5	920	628
2.5	2.7	6	0.5	0.72	0.61	1540	946
3	3.2	7	0.6	0.85	0.72	2350	1320
3.5	3.7	8	0.8	1.06	0.92	3160	2410
4	4.3	9	1	1.3	1.12	4050	3770
5	5.3	11	1.2	1.55	1.35	6700	5480
6	6.4	14	1.5	2	1.7	9400	8590
7	7.4	17	1.75	2.3	2	13700	11300
8	8.4	18	2	2.6	2.24	17200	14900
10	10.5	23	2.5	3.2	2.8	27500	22100
12	13	29	3	3.95	3.43	40000	34100
14	15	35	3.5	4.65	4.04	55000	46000
16	17	39	4	5.25	4.58	75000	59700
18	19	42	4.5	5.8	5.08	95000	74400
20	21	45	5	6.4	5.6	122000	93200
22	23	49	5.5	7.05	6.15	152000	113700
24	25	56	6	7.75	6.77	175000	131000
27	28	60	6.5	8.35	7.3	230000	154000
30	31	70	7	9.2	8	280000	172000

1) Maximum height at delivery
2) Minimum height after test for permanent set as specified in DIN 267 Part 26
3) Compression test load
4) Calculated spring force at deflection equals h_{min} - s

MATERIAL	**B**	Spring steel heat treated to HV 420-510 (HRC 43-50)
FINISH	**K**	Plain (natural), oiled

TO ORDER: Product / d_2 x d_1 x t / material code / finish code
EXAMPLE: LWR 9 x 4.3 x 1 B K

Produced to order only.

ISO/TS 16949:2009 Certified
ISO 9001:2008 Certified

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