

As a global partner of the automobile industry, Mubea has divisions worldwide. We develop, manufacture, and sell high quality suspension springs and stabilizer bars, valve springs, disc springs, hose clamps, belt tensioner systems, tubular shafts, camshafts, wire form springs, flat coil springs, headrest supports, flat springs and Tailor Rolled Products.



Mubea
Disc Springs

Mubea

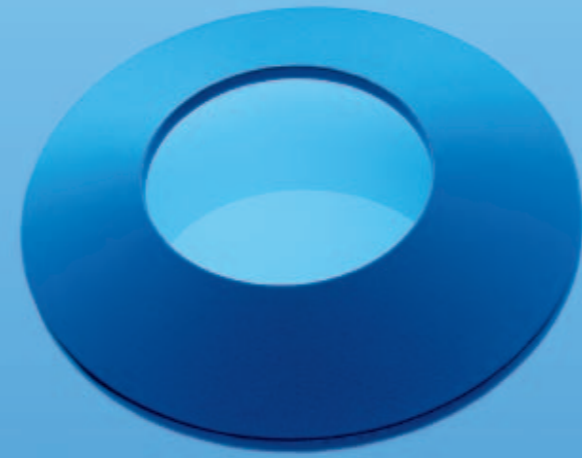
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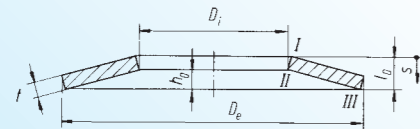
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Mubea
engineering for mobility

Disc Spring – High loads in small spaces

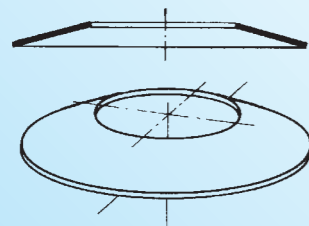


Disc Springs – High versatility



Disc Springs are shallow conical rings that are subjected to axial loads. Depending upon the application, disc springs can be subjected to static or dynamic loads and are defined by:

- outside diameter D_e ,
- inside diameter D_i ,
- material thickness t and
- overall height L_0



Disc springs are distinguished from other spring types by the following characteristics:

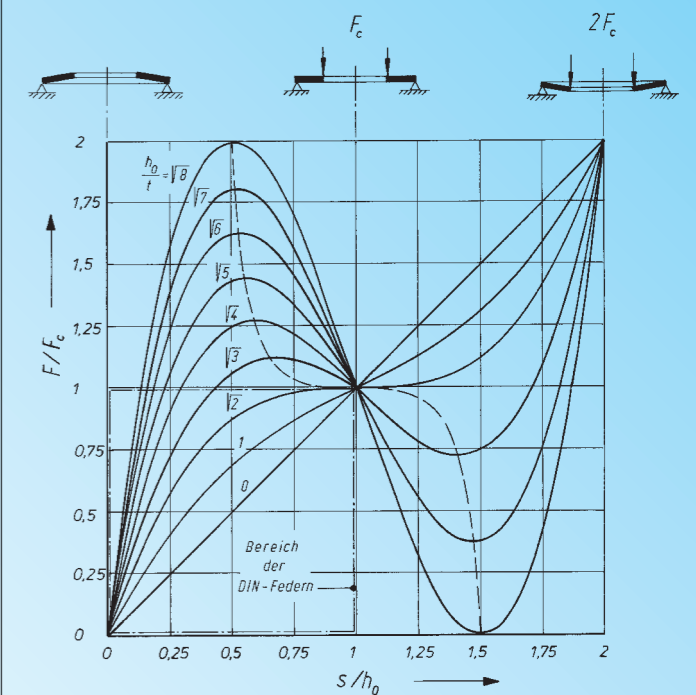
- high load capacity with a small spring deflection
- better space utilization when compared to other spring types
- different combinations of springs can be designed to achieve the desired load characteristics

Because of their versatility, disc springs are used extensively in a variety of applications, from safety valve systems 3000 m under the sea to satellites in space. Disc springs must function in temperatures from -269 C up to 500 C . Mubea stocks the necessary materials to meet the required load and fatigue life requirements even under these severe conditions. In addition, disc springs can be coated with highly durable surface protections to withstand and guarantee a long life in a corrosive atmosphere.

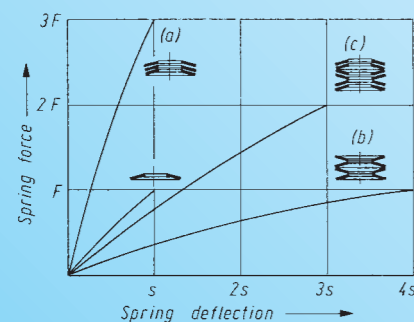
Due to the versatility of disc springs, they are used in a variety of applications including the machine-tool industry, the oil industry, the automobile industry, as well as the aerospace industry.

Typical applications of disc springs:

- boiler suspension systems in power plants
- safety valves
- clutches (overload and slip clutches)
- aerial cable cars
- machine tool clamping components
- safety brakes for lifts and elevators
- brakes for construction and railway vehicles
- backlash compensation for ball bearings



The relationship between disc spring height and material thickness (h_0/t) determines the characteristic load curve of the spring



In a parallel spring stack, the load is proportional to the number of individual springs (a). In a series spring stack the deflection of the stack is the sum of the deflection of the individual springs (b). It is possible to combine these methods of stacking (c).

Disc Springs – Mubea, your competent partner

Disc Springs – Highly stressed spring elements

Mubea		Disc Springs, Data Sheet																																									
group 2		part/drawing no.: 18 0124																																									
Stand 20.11.99		customer:																																									
28.05.04	Mühr und Bender, Tellerfedern und Spannelemente GmbH, Postfach 120, 57564 Daaden phone: sales 02743/806-184-194, Fax: -188, engineering: 02743/806-208-236-135, Fax: -292																																										
dimensions outer diam.: $D_e = 125,000$ mm inner diam.: $D_i = 51,000$ mm thickness: $t = 5,000$ mm red thickness: $t_r = 5,000$ mm spring height: $h_0 = 8,900$ mm																																											
stack: 2 springs 1 times against e.o.																																											
data $h_0/t = 0,780$ $h_0 = 3,900$ mm $h_0/t_r = 0,780$ $D_e/D_i = 2,451$		Wire centered springs wire diameter: 0,00 mm groove depth: 0,00 mm																																									
<table border="1"> <thead> <tr> <th colspan="2">load points of one spring</th> <th colspan="4">calculated stresses</th> <th colspan="2">load points of stack</th> </tr> <tr> <th>load-point</th> <th>height l mm</th> <th>travel s mm</th> <th>load F N</th> <th>σ_I</th> <th>σ_{II}</th> <th>σ_{III}</th> <th>σ_{OM}</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>8,900</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>1</td> <td>7,925</td> <td>0,975</td> <td>13063</td> <td>-913</td> <td>241</td> <td>420</td> <td>-357</td> </tr> <tr> <td>2</td> <td>6,170</td> <td>2,730</td> <td>29240</td> <td>-2314</td> <td>917</td> <td>1043</td> <td>-998</td> </tr> </tbody> </table>		load points of one spring		calculated stresses				load points of stack		load-point	height l mm	travel s mm	load F N	σ_I	σ_{II}	σ_{III}	σ_{OM}	0	8,900							1	7,925	0,975	13063	-913	241	420	-357	2	6,170	2,730	29240	-2314	917	1043	-998		
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Flat 5,000 3,900 37342 -3076 1541 1363 -1426 10,000 7,800 37342																																											
specification material: 50 CrV 4 Youngs-modulus: 206000 MPa surface finish: shot peening temperature: 20 °C corrosion prot.: phosphated and oiled																																											
fatigue life of Mubea springs > 2 Mio. load cycles ($P_0=99\%$) travel: 3,51 mm between l 1: 15,85 mm and l 2: 12,34 mm																																											
remarks Load tolerance: +10 / -5% at 75% of h_0 of one spring tolerance inner diam.: 51,000 mm to 51,300 mm tolerance outer diam.: 124,600 mm to 125,000 mm																																											

Mubea-disc spring calculation program

Disc Springs according to DIN

Mubea manufactures disc springs per the requirements of DIN 2093. These springs meet or exceed the highest requirements regarding material properties and surface quality. Mubea utilizes the most modern and efficient production processes available.

Mubea Engineering

As a first step, we can provide our design calculation program for disc springs. This program is based on the equations defined by DIN 2092 and can be downloaded from our website at www.mubea-discsprings.com. Additionally, we maintain a team of highly qualified engineers that is dedicated finding the optimal solution for every spring application, including the selection of the proper material and surface protection. Prototypes typically required during product development are manufactured in our sample shop, which is equipped with all necessary testing equipment.

Materials for Disc Springs

For standard applications, the spring materials 51CrV4 (No. 1.8159) is used. Furthermore, special materials can be used for applications at very high and low temperatures

or in a corrosive atmosphere. Depending upon the specific requirements, Mubea uses thermally stable materials (No. 1.4122, 1.2567, 1.4923), corrosion resistant materials (No. 1.4310, 1.4568, 1.4401), nickel based materials (2.4668, 2.4669, 2.4969) and beryllium copper alloys (2.1247, 2.4132).

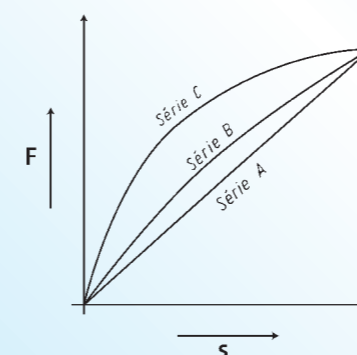
Increased Fatigue Life

Nearly all Mubea disc springs are shot-peened in house. Shot-peening creates residual compressive stresses that result in a considerably higher fatigue life than required by DIN 2093.

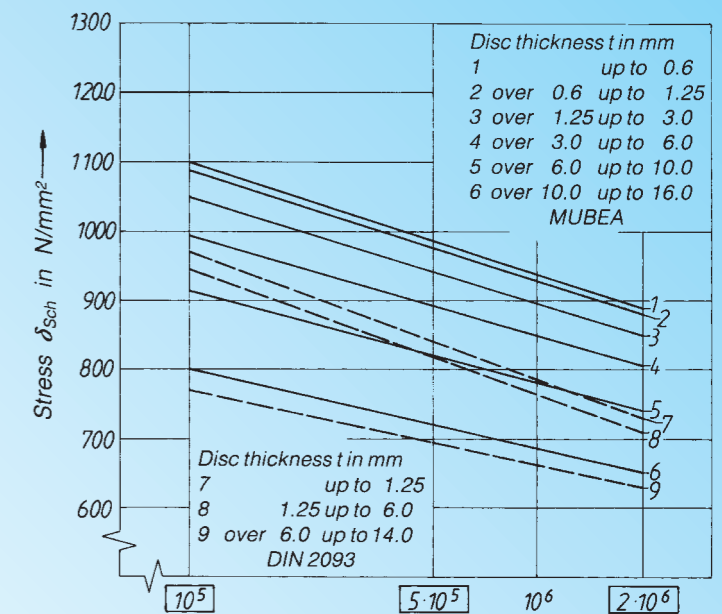
Corrosion protection for Disc Springs

The standard corrosion protection for disc springs is zinc-phosphating and oiling. If a higher level of corrosion protection is required due to the operating environment of the disc spring the following alternatives are available:

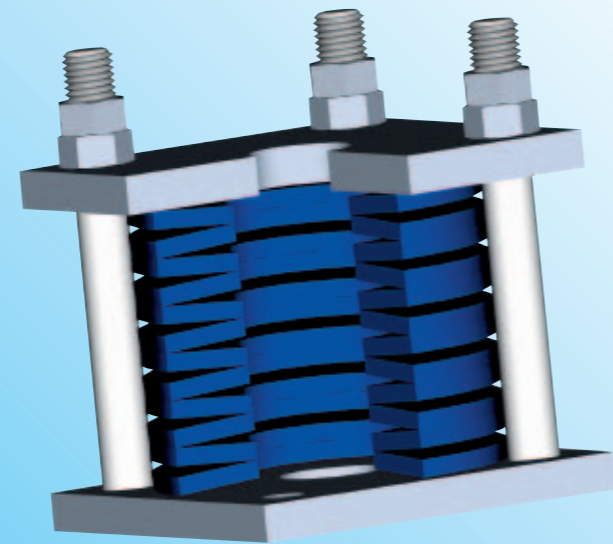
- Zinc-phosphate and waxing
- Galvanizing
- Mechanical zinc plating and chromate
- Delta Tone / Delta Seal Coating
- Dacromet Coating
- Chemical (Electroless) nickel plating



Calculated characteristic load curves for disc springs to DIN 2093, Series A, B, and C



Wehler diagrams showing comparison between Mubea and DIN 2093



Disc Springs – Highest Quality from Mubea

Complete In-House Production

It is Mubea's philosophy to control all manufacturing processes in order to insure the quality of the disc spring and to maintain the most stringent tolerances. Commonly used materials are manufactured in our own cold rolling mill, using the most modern rolling technology.

Fine Blanking

Disc Springs with material thickness between 1 mm and 6 mm are generally fine blanked. This method improves the fatigue life of the spring.

Heat Treatment

The heat treatment of disc springs is a fundamental production step for achieving the required spring characteristic. Depending upon the spring dimensions, modern continuous feed furnaces or chamber ovens are available. We have austempering and quenching and tempering processes available.

Pre-setting

Set loss can occur due to high stresses of the spring. In order to reduce the risk of set loss, Mubea pre-sets all disc springs at least to the flat position. This process greatly improves the quality of the spring and therefore is a requirement of the DIN 2093 standard.

Phosphating


The standard corrosion protection, zinc phosphating and oiling, is made with a fully automated continuous flow process, which guarantees uniform coating thickness at a reasonable cost.


Delivery of disc spring stacks


Disc springs are often used in pre-assembled stacks. Mubea is able to deliver pre-assembled stacks and if desired, install these stacks in the final assembly device. Mubea can also manufacture these assembly devices per customer request. Test certificates (e.g. 100% load testing) or certificates according to DIN EN 10204 (2.2/2.3/3.1B) can also be provided upon request.

Order No.	Dimensions (mm)			Order No.	Dimensions (mm)			Order No.	Dimensions (mm)			Order No.	Dimensions (mm)			Order No.	Dimensions (mm)		
	De	Di	t		De	Di	t		De	Di	t		De	Di	t		De	Di	t
17 0001	8	3,2	0,30	17 0058	20	10,2	0,40	17 0028	40	20,4	1,00	18 0084	71	36	2,00	18 0137	125	71	6,00
17 0002	8	3,2	0,40	17 0059	20	10,2	0,50	18 0031	40	20,4	1,500	18 0085	71	36	2,50	18 0138*	125	71	6,00
17 0003	8	3,2	0,50	17 0060	20	10,2	0,80	18 0032	40	20,4	2,00	18 0086	71	36	4,00	19 0005	125	71	8,00
17 0004	8	4,2	0,20	17 0061	20	10,2	0,90	18 0033	40	20,4	2,25	18 0087*	71	36	4,00	19 0006	125	71	10,00
17 0005	8	4,2	0,30	17 0062	20	10,2	1,00	18 0034	40	20,4	2,50	18 0088	80	30,5	2,50	18 0139	140	72	3,80
17 0006	8	4,2	0,40	17 0063	20	10,2	1,10	18 0035	45	22,4	1,25	18 0089	80	31	3,00	18 0140	140	72	5,00
17 0007	10	3,2	0,30	17 0064	22,5	11,2	0,60	18 0036	45	22,4	1,75	18 0090	80	31	4,00	18 0141*	140	72	5,00
17 0008	10	3,2	0,40	17 0065	22,5	11,2	0,80	18 0037	45	22,4	2,50	18 0091*	80	31	4,00	19 0007	140	72	8,00
17 0009	10	3,2	0,50	18 0001	22,5	11,2	1,25	18 0038	48	16,3	1,50	18 0092	80	35,5	4,00	18 0142	150	61	5,00
17 0010	10	4,2	0,10	17 0066	23	8,2	0,70	18 0039	50	18,4	1,25	18 0093*	80	35,5	4,00	18 0143*	150	61	5,00
17 0011	10	4,2	0,50	17 0067	23	8,2	0,80	18 0040	50	18,4	1,50	18 0094	80	36	3,00	18 0144	150	61	6,00
17 0012	10	4,2	0,60	17 0068	23	8,2	0,90	18 0041	50	18,4	2,00	18 0095	80	41	2,25	18 0145*	150	61	6,00
17 0013	10	5,2	0,25	17 0069	23	10,2	0,90	18 0042	50	18,4	2,50	18 0096	80	41	3,00	19 0008	150	61	7,00
17 0014	10	5,2	0,40	17 0070	23	10,2	1,00	18 0043	50	18,4	3,00	18 0097	80	41	4,00	18 0146	150	71	6,00
17 0015	10	5,2	0,50	17 0071	23	12,2	1,00	18 0044	50	20,4	2,00	18 0098*	80	41	4,00	18 0147*	150	71	6,00
17 0016	12	4,2	0,40	18 0002	23	12,2	1,25	18 0045	50	20,4	2,50	18 0099	80	41	5,00	19 0009	150	71	8,00
17 0017	12	4,2	0,50	18 0003	23	12,2	1,50	18 0046	50	22,4	2,00	18 0100*	80	41	5,00	19 0010	150	81	8,00
17 0018	12	4,2	0,60	17 0072	25	12,2	0,70	18 0047	50	22,4	2,50	18 0101	90	46	2,50	19 0011	150	81	10,00
17 0019	12	5,2	0,50	17 0073	25	12,2	0,90	18 0048	50	25,4	1,25	18 0102	90	46	3,50	18 0148	160	82	4,30
17 0020	12	5,2	0,60	18 0004	25	12,2	1,50	18 0049	50	25,4	1,50	18 0103	90	46	5,00	18 0149*	160	82	4,30
17 0021	12	6,2	0,50	17 0074	28	10,2	0,80	18 0050	50	25,4	2,00	18 0104*	90	46	5,00	18 0150	160	82	6,00
17 0022	12	6,2	0,60	17 0075	28	10,2	1,00	18 0051	50	25,4	2,25	18 0105	100	41	4,00	18 0151*	160	82	10,00
17 0023	12,5	6,2	0,35	18 0005	28	10,2	1,25	18 0052	50	25,4	2,50	18 0106*	100	41	4,00	19 0012	160	82	11,00
17 0024	12,5	6,2	0,50	18 0006	28	10,2	1,50	18 0053	50	25,4	3,00	18 0107	100	41	5,00	19 0013	160	82	4,80
17 0025	12,5	6,2	0,70	17 0076	28	12,2	1,00	18 0054	56	28,5	1,50	18 0108*	100	41	5,00	18 0152	180	92	4,80
17 0026	14	7,2	0,35	18 0007	28	12,2	1,25	18 0055	56	28,5	2,00	18 0109	100	51	2,70	18 0153*	180	92	6,00
17 0027	14	7,2	0,50	18 0008	28	12,2	1,50	18 0056	56	28,5	2,50	18 0110	100	51	3,50	18 0154	180	92	6,00
17 0028	14	7,2	0,60	17 0077	28	14,2	0,80	18 0057	56	28,5	3,00	18 0111	100	51	4,00	18 0155*	180	92	6,00
17 0029	15	5,2	0,40	17 0078	28	14,2	1,00	18 0058	60	20,5	2,00	18 0112*	100	51	4,00	19 0014	180	92	10,00
17 0030	15	5,2	0,50	18 0009	28	14,2	1,25	18 0059	60	20,5	2,50	18 0113	100	51	5,00	19 0015	180	92	13,00
17 0031	15	5,2	0,60	18 0010	28	14,2	1,50	18 0060	60	20,5	3,00	18 0114*	100	51	5,00	19 0016	200	82	8,00
17 0032	15	5,2	0,70	17 0079	31,5	16,3	0,80	18 0061	60	25,5	2,50	18 0115	100	51	6,00	19 0017	200	82	10,00
17 0033	15	6,2	0,50	18 0011	31,5	16,3	1,25	18 0062	60	25,5	3,00	18 0116*	100	51	6,00	19 0018	200	82	12,00
17 0034	15	6,2	0,60	18 0012	31,5	16,3	1,50	18 0063	60	30,5	2,50	19 0001	100	51	7,00	19 0019	200	92	10,00
17 0035	15	6,2	0,70	18 0013	31,5	16,3	1,75	18 0064	60	30,5	2,75	18 0117	112	57	3,00	19 0020	200	92	12,00
17 0036	15	8,2	0,70	18 0014	31,5	16,3	2,00	18 0065	60	30,5	3,00	18 0118	112	57	4,00	19 0021	200	92	14,00
17 0037	15	8,2	0,80	17 0080	34	12,3	1,00	18 0066	60	30,5	3,50	18 0119*	112	57	4,00	18 0156	200	102	5,50
17 0038	16	8,2	0,40	18 0015	34	12,3	1,25	18 0067	63	31	1,80	18 0120	112	57	6,00	18 0157*	200	102	5,50
17 0039	16	8,2	0,60	18 0016	34	12,3	1,50	18 0068	63	31	2,50	18 0121*	112	57	6,00	19 0022	200	102	8,00
17 0040	16	8,2	0,90	18 0017	34	14,3	1,25	18 0069	63	31	3,00	18 0122	125	51	4,00	19 0023	200	102	10,00
17 0041	18	6,2	0,40	18 0018	34	14,3	1,50	18 0070	63	31	3,50	18 0123*	125	51	4,00	19 0024	200	102	12,00
17 0042	18	6,2	0,50	18 0019	34	16,3	1,50	18 0071	70	24,5	3,00	18 0124	125	51	5,00	19 0025	200	102	14,00
17 0043	18	6,2	0,60	18 0020	34	16,3	2,00	18 0072	70	24,5	3,50	18 0125*	125	51	5,00	19 0026	200	112	12,00
17 0044	18	6,2	0,70	17 0081	35,5	18,3	0,90	18 0073	70	25,5	2,00	18 0126	125	51	6,00	19 0027	200	112	14,00
17 0045	18	6,2	0,80	18 0021	35,5	18,3	1,25	18 0074	70	30,5	2,50	18 0127*	125	51	6,00	19 0028	200	112	16,00
17 0046	18	8,2	0,70	18 0022	35,5	18,3	2,00	18 0075	70	30,5	3,00	18 0128	125	61	5,00	19 0029	225	112	6,50
17 0047	18	8,2	0,80	18 0023	40	14,3	1,25	18 0076	70	35,5	3,00	18 0129*	125	61	5,00	19 0030	225	112	8,00
17 0048	18	8,2	1,00	18 0024	40	14,3	1,50	18 0077	70	35,5	3,50	18 0130	125	61	6,00	19 0031	225	112	12,00
17 0049	18	9,2	0,45	18 0025	40	14,3	1,75	18 0078	70	35,5	4,00	18 0131*	125	61	6,00	19 0032	225	112	16,00
17 0050	18	9,2	0,70	18 0026	40	14,3	2,00	18 0079*	70	35,5	4,00	19 0002	125	61	8,00	19 0033	250	102	10,00
17 0051	18	9,2	1,00	18 0027	40	16,3	1,50	18 0080	70	40,5	4,00	18 0132	125	64	3,50	19 0034	250	102	12,00
17 0052	20	8,2	0,50	18 0028	40	16,3	1,75	18 0081*	70	40,5	4,00	18 0133	125	64	5,00	19 0035	250	127	7,00
17 0053	20	8,2	0,60	18 0029	40	16,3	2,00	18 0082	70	40,5	5,00	18 0134*	125	64	5,00	19 0036	250	127	8,00
17 0054	20	8,2	0,70	18 0030	40	18,3	2,00	18 0083*	70	40,5	5,00	18 0135	125	64	6,00	19 0037	250	127	10,00
17 0055	20	8,2	0,80									18 0136*	125	64	6,00	19 0038	250	127	12,00
17 0056	20	8,2	0,90									19 0003	125	64	7,00	19 0039	250	127	14,00
17 0057	20	8,2	1,00									19 0004	125	64	8,00	19 0040	250	127	16,00

List of disc springs in stock per DIN 2093

Group 1 

Group 2 

Group 3 

* Disc Springs with flat bearings and reduced disc thickness

De: outside diameter
Di: inside diameter
t: thickness



Certified to the highest quality standards

We specialize in the design and manufacture of custom disc springs