



SCHNORR® Product range

US

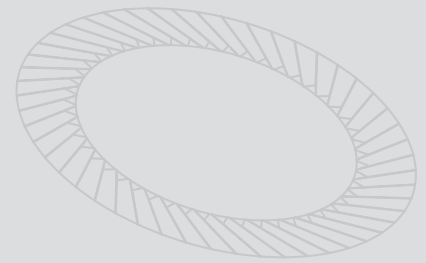
Disc springs  
Bolt locking systems



**SCHNORR**®  
DISC SPRING ENGINEERING



**SCHNORR**<sup>®</sup>  
DISC SPRING ENGINEERING



## Disc Spring Engineering

As a pioneer of the disc spring application Adolf Schnorr founded the family-owned company in 1908. Today, after more than 100 years of company history, SCHNORR has grown into an international leading problem solver in the field of disc springs and bolt locking systems and has a worldwide network of sales agencies.

In addition to the standard materials (C60S, C75S, 51CrV4) SCHNORR warehouses a variety of other materials in order to produce on the specific requirements of our customers and to ensure a high flexibility in our production.

With the merger of the HUGO BAUER Nachf. GmbH and the ADOLF SCHNORR GmbH & Co KG to the SCHNORR GmbH by August 1st 2011 additional resources were pooled and the range of parts, manufacturing technologies and production expertise was expanded.

Beside the longstanding experience in stamping and turning, the new company is now also equipped with the technology of fine-blanking, the expertise in manufacturing warp-critical disc springs and an additional product group - the wave spring as a drawing part.

Two strong brands under one roof means for customers and partners the availability of the full potential of two highly-performing companies with a single point of contact and thus the advantages of an even better knowledge and service.

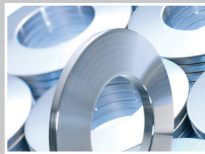
# SCHNORR® GmbH



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## Original SCHNORR® disc springs



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## SCHNORR Engineering & technical information



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## Facts and figures

Workforce:

**248** (by 31.12.2015)

Production area:

**approx. 5000** m<sup>2</sup>

Year of foundation:

**1908**

Headquarters:

**Stuttgarter Str. 37  
71069 Sindelfingen-Maichingen  
Germany**

Branch:

**Gottlieb-Daimler-Str. 9  
78234 Engen-Welschingen  
Germany**

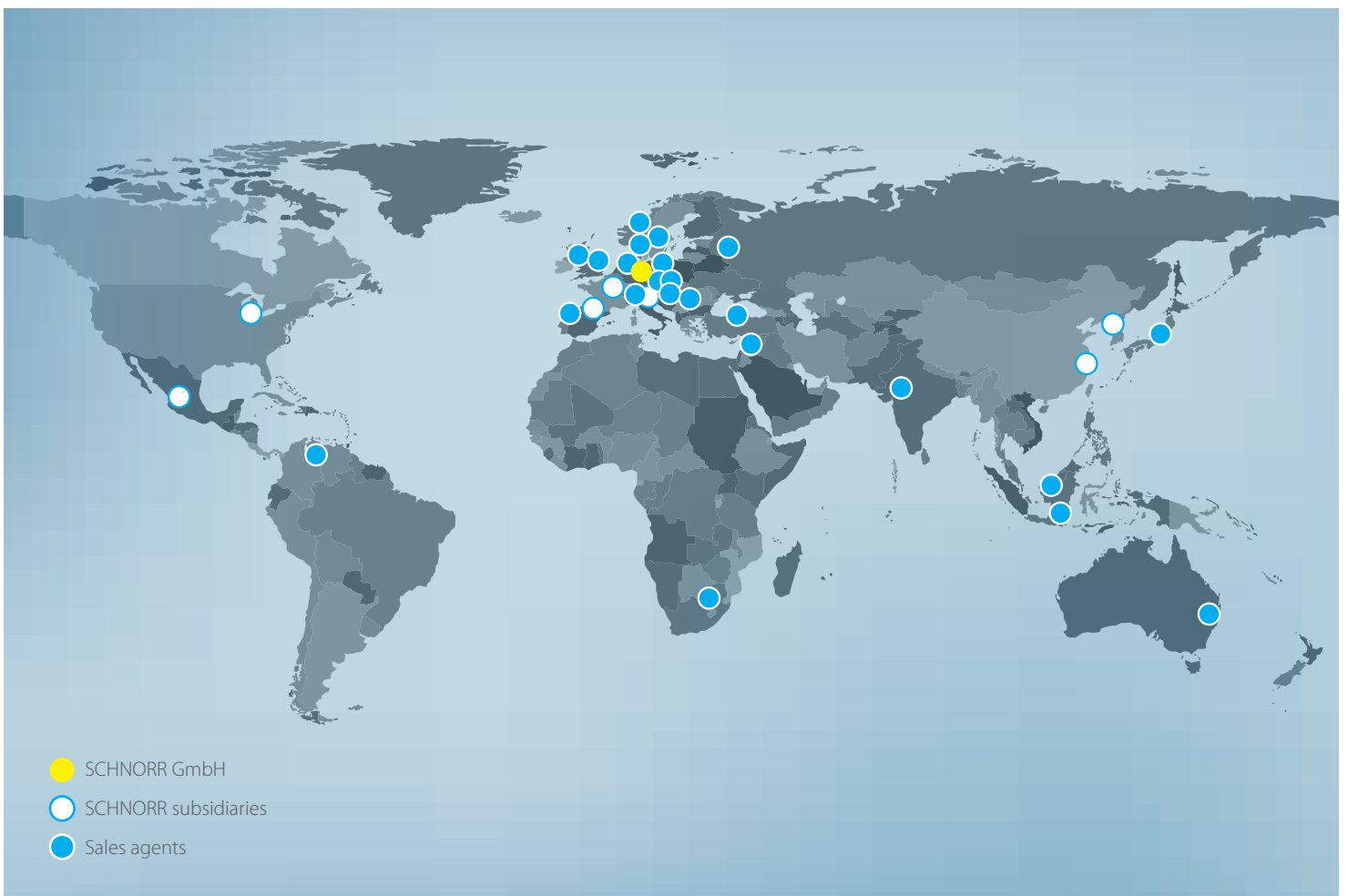
## Worldwide sales network

### 7 foreign subsidiaries

- **SCHNORR Corporation** | Ann Arbor, MI, United States
- **SCHNORR GROUP MEXICO S.DE R.L.DE C.V.** | Queretaro, Mexico
- **SCHNORR Shanghai Trading Co.,Ltd.** | Shanghai, China
- **SCHNORR Korea Co. Ltd** | Bisan-Dong, South Korea
- **SCHNORR Group France S.A.R.L.** | St Pierre du Perray, France
- **SCHNORR Italia s.r.l.** | Trezzano, Italy
- **SCHNORR Espana S.L.U.** | Figueras, Spain

### Further 28 foreign sales agencies worldwide

More information on our subsidiaries and sales agencies can be found on [www.schnorr.de](http://www.schnorr.de)





## History

1908

Adolf SCHNORR founds a workshop for stamping tools near Stuttgart

1920's

SCHNORR commences - as the first company ever - the industrial manufacturing of disc springs at the location near Stuttgart. Thus, Adolf SCHNORR is considered as the pioneer of the disc spring.

1956

Move to a new site in Sindelfingen-Maichingen

1960's

SCHNORR develops and launches the Original SCHNORR® Safety Washers

1972

Creation of an international sales network including the foundation of SCHNORR Corporation in the USA (Ann Arbor, MI)

1980

Foundation of SCHNORR Italia near Milan

1995

HUGO BAUER NACHF. GmbH becomes member of the SCHNORR Group

2005

Foundation of SCHNORR Espana in Figueras

2006

Foundation of SCHNORR Group France near Paris

2008

Foundation of the subsidiaries SCHNORR Shanghai and SCHNORR Group Mexico (Queretaro)

2010

Foundation of SCHNORR Korea near Seoul

2011

„Two strong brands under one roof“. The Adolf SCHNORR GmbH & Co. KG and the HUGI BAUER NACHF. GmbH merge to become SCHNORR GmbH

2013

New sales structure. In order to take care of our customers more effectively we subdivided the SCHNORR Sales structure into two divisions: Industrial and Automotive



# References

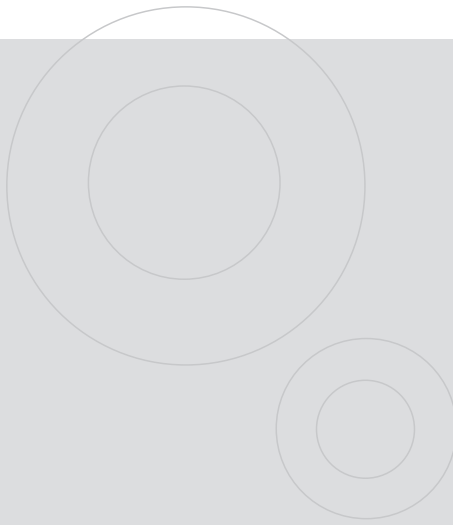
## Managing maximum force using minimum space.

SCHNORR® disc springs support a lot of dynamic processes in a skillful, safe and efficient way – often under extreme force and load conditions.

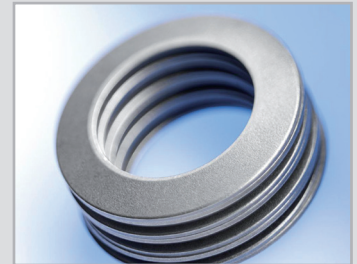
With the demand to develop and manufacture perfectly fitting solutions for various applications, SCHNORR®, offer an extensive standard range of disc springs, together with a multitude of special sizes as well as customer-oriented solutions and special developments.

### SCHNORR® disc springs excel by:

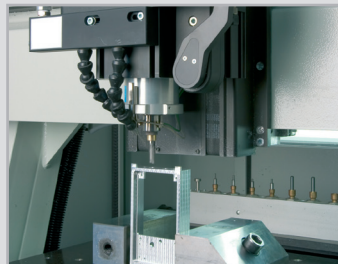
- An optionally linear, degressive or progressive course of the load deflection curve
- Long service life with dynamic load
- Use of high quality materials
- Precise adherence to force and dimension requirements



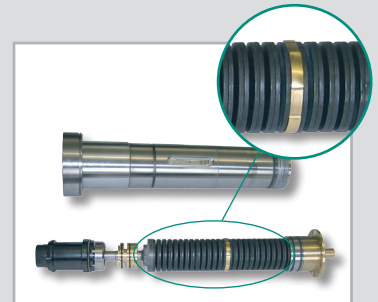
Percussion drilling machine



Overload limitation



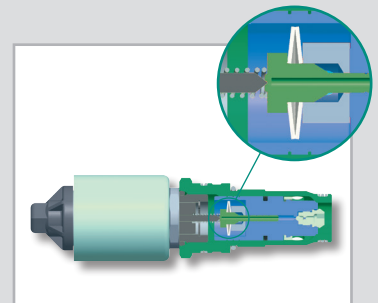
Machine tool



Spindle



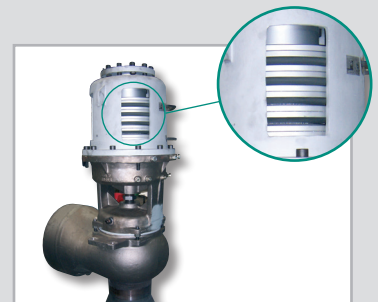
Actuator



Control valve



Pipelines subject to pressure

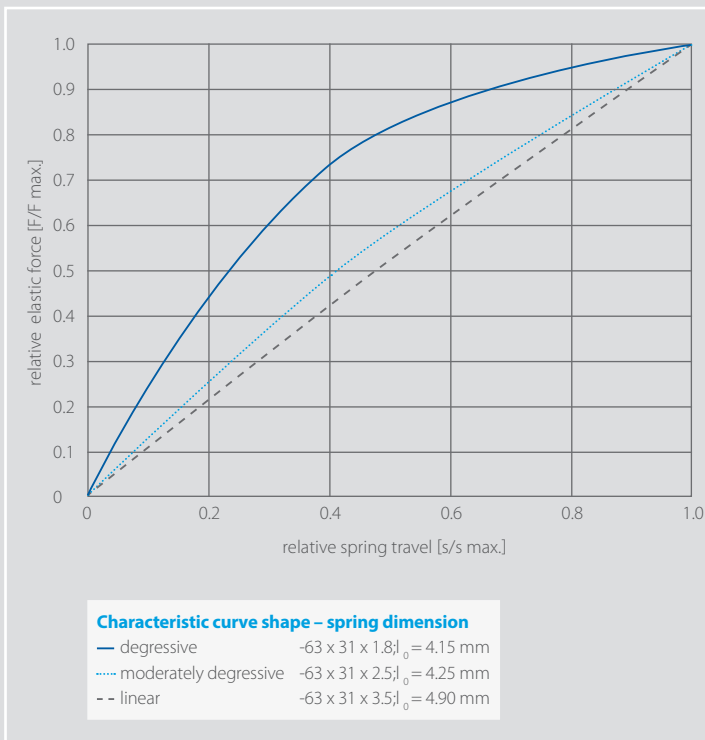


Pressure-relief valve

## Effect of spring forces

The importance of disc springs on machines and control systems is very often underestimated. At the same time, any change to the behaviour of these components may give rise to a malfunction or even failure of entire facilities.

Classification of the various spring type is often carried out according to the kind of load. The disc spring has a special place in the range of springs commonly available. By changing its geometric parameters it is possible to provide individual springs with characteristic curves from linear to strongly degressive according to the application needs.



A key advantage of the disc spring is that it can raise a high elastic force with a small spring travel. That is why it is used very often to store potential energy. Apart from this virtual static use, it is also often used in dynamic applications.

When using disc springs under sinusoidal oscillating loads, fatigue strength and time yield diagrams are available in order to enable a safe design. Wherever possible the spring arrangement applied should achieve a fatigue life in excess of 2 million cycles. Fundamental to the successful application of a disc spring under these conditions is observing the minimum preload requirements and that the springs are correctly guided.

SCHNORR® fatigue life estimates are based on a sinusoidal load input. For applications where step input (i.e. impact) is seen SCHNORR® can advise on fatigue life according to application.

## Original SCHNORR® disc springs

### The characteristic benefits of original SCHNORR® disc springs include:

- ① Load deflection curves of straight, progressive or degressive character according to the selection of spring arrangement and dimension.
- ② Simple adjustment of the spring stack length by the addition or removal of individual springs, thus altering the spring stack characteristic.
- ③ Efficient use of space with high spring forces obtainable with small deflections.
- ④ Largely self damping, particularly with parallel stacking.
- ⑤ No setting or fatigue under normal loads load.
- ⑥ Long service life
- ⑦ Flexibility in application of the disc springs can lead to a reduction in stock levels.

By means of these characteristics, the original SCHNORR® disc spring has developed such a wealth of application areas that nowadays there is scarcely an engineering area where it is not used.



## What should one look for when selecting disc springs?

The price of incorrect selection with warranty claims and loss of reputation is very often more than the initial cost of a quality disc spring in the first place. In order to help you, we think the following are the most important criteria:

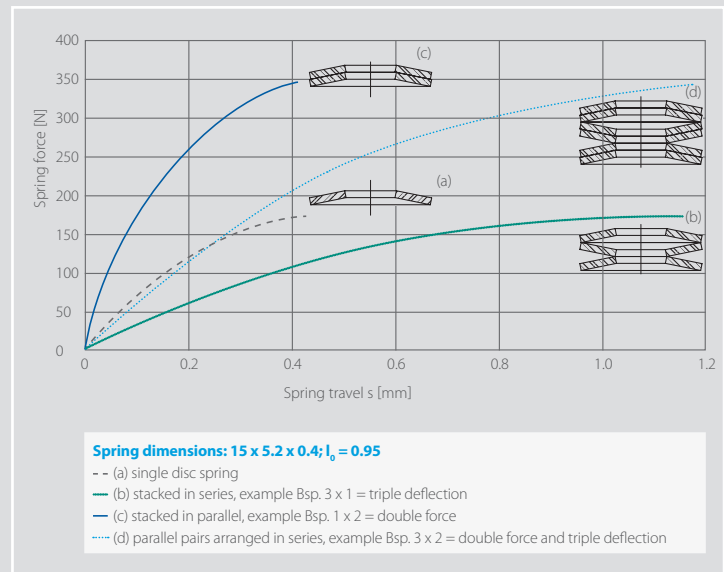
- ① Does the manufactured version comply with the quality requirements? One should pay attention to using a quality which complies with the requirements. We would be glad to advise you on the correct selection.
- ② Is the disc spring preset? Some suppliers in the low-price segment try to save this step. As a result, the disc spring will take a set after the first load.
- ③ Was a suitable material selected? In case of high temperatures or hostile environment, special materials need to be specified (see page 33).
- ④ Was a suitable surface treatment selected for corrosion protection (see page 34)?

Should individual consulting and design be carried out? We would be glad to support you with our experience and know-how.

V-Card Schnorr



The conical shape of the disc spring allows single springs to be combined in different ways. As a result, the characteristic of a spring combination can be varied in almost any way desired. In principle the following possibilities exist. In spring columns with single springs stacked in series, the spring deflections add up with constant load (b). In spring columns with springs stacked in parallel, the forces add up at the same deflection (c). In spring columns with combinations of serial and parallel stacking, various characteristic curves can be realized (d).



If disc springs of different thickness are stacked in a suitable way, then even progressive characteristic curves can be realized. For this, either several disc springs of different material thickness or identical disc springs with intermediate rings of different thickness or different layering types are used.

Due to this flexibility in the characteristic curve design, the disc spring can be used in a very wide spectrum.

Do you require assistance in specifying the correct disc spring either standard or special to your exact requirements?

Our engineering team will be pleased to help you in designing the most suitable disc spring solution according to your specifications.

The earlier we are involved in the development process, the better we can support you with our expertise.



## Original SCHNORR® disc springs

Today DIN EN 16983 (previously DIN 2093) divides three manufacturing methods depending on the relevant thickness:

- Group 1:**  $t < 1.25$ , punching, cold forming, rounding-off edges
- Group 2:**  $1.25 \leq t \leq 6$  mm, punching, cold forming, turning and rounding off edges or fine-blanking, cold forming and rounding off edge
- Group 3:**  $> 6 < t \leq 14$  mm, cold or hot forming, turning all sides, rounding off edges or punching, cold forming, turning and rounding off edges or fine-blanking, cold forming, rounding off edges.

### Notes on the disc spring table

The following tables, list the springs according to DIN EN 16983 (previously DIN 2093) as well as those to SCHNORR® Internal standards. Sizes according to DIN EN 16983 (previously DIN 2093) are shown in heavy type. The prefix A, B or C shows the corresponding series. All sizes listed are in production and normally available from stock. The Article number quoted is the normal manufacture from spring steel with phosphate finish.

The load and the corresponding stresses are given for the three points  $s = 0.25 h_0$ ,  $s = 0.5 h_0$ ,  $s = 0.75 h_0$ . From  $s > 0.75 h_0$ , the actual characteristic curve increases progressively, contrary to the calculation (the table contains calculated values).

Disc springs according to group 3 are provided with turned bearing surfaces and reduced disc thickness. The disc's force increased by the bearing surfaces which is compensated by means of the reduced disc thickness  $t'$ .

Disc thickness  $t'$  corresponds to the effective thickness of the spring and must be accounted for with parallel stacking for determining the column length. The elastic force applies to disc springs made of spring steel.

### Dimensional series

Dimensional series	$h_0/t$
A	~ 0.40
B	~ 0.75
C	~ 1.30

The following tolerances apply to springs made of standard materials (C75S and 51CrV4) (Tolerances for springs made of corrosion-resistant materials according to factory standard):

### Load tolerances

Nominal spring thickness		Admissible tolerances	
t or t' [mm]		F* [%]	
greater than	up to	max.	min.
0.20	1.25	+25	-7.5
1.25	3.00	+15	-7.5
3.00	6.00	+10	-5.0
6.00	16.00	+5	-5.0

Allowances for the spring load with springs according to DIN EN 16983 (previously DIN 2093)

\* F with test length  $l_p = l_0 - 0,75 \cdot h_0$

### Diameter tolerances

Nominal dimension		Admissible tolerances				
D <sub>e</sub> or D <sub>i</sub> [mm]		D <sub>e</sub> [mm]		D <sub>i</sub> [mm]		concentricity [mm]
greater	up to	max.	min.	max.	min.	max.
3	6	0	-0.12	+0.12	0	0.15
6	10	0	-0.15	+0.15	0	0.18
10	18	0	-0.18	+0.18	0	0.22
18	30	0	-0.21	+0.21	0	0.26
30	50	0	-0.25	+0.25	0	0.32
50	80	0	-0.30	+0.30	0	0.60
80	120	0	-0.35	+0.35	0	0.70
120	180	0	-0.40	+0.40	0	0.80
180	250	0	-0.46	+0.46	0	0.92

Allowances for external and internal diameters and concentricity with springs according to DIN EN 16983 (previously DIN 2093)

### Thickness tolerances

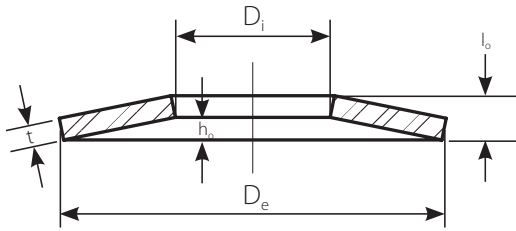
Nominal spring thickness		Admissible tolerances	
t or t' [mm]		t or t' [mm]	
greater than	up to	greater than	up to
0.20	0.60	+0.02	-0.06
0.60	1.25	+0.03	-0.09
1.25	3.80	+0.04	-0.12
3.80	6.00	+0.05	-0.15
6.00	16.00	+0.10	-0.10

Allowances for spring thickness with springs according to DIN EN 16983 (previously DIN 2093)

### Overall height tolerances

Nominal spring thickness		Admissible tolerances	
t or t' [mm]		l <sub>0</sub> [mm]	
greater than	up to	max.	min.
0.20	1.25	+0.10	-0.05
1.25	2.00	+0.15	-0.08
2.00	3.00	+0.20	-0.10
3.00	6.00	+0.30	-0.15
6.00	16.00	+0.30	-0.30

Allowances for the overall height with springs according to DIN EN 16983 (previously DIN 2093)



### Reference for a disc spring

$D_e = 40 \text{ mm}$ ,  $D_i = 20.4 \text{ mm}$ ,  $t = 1.5 \text{ mm}$ :  
 Disc spring 40 x 20.4 x 1.5  
 according to DIN 16983: DIN EN 16983-B 40  
 or Article no. 012 800

## Original SCHNORR® disc springs

### The following dimension tables describe:

- > Standard materials (C75S and 51CrV4)
- > Corrosion-resistant materials (X10 CrNi 18-8)
- > Corrosion-resistant materials (X7 CrNiAl 17-7)

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### Further versions:

- Furthermore, we also manufacture from special materials, such as:
- > Steel grades for higher temperatures (X22 CrMoV 12-1, X39 CrMo 17-1)
  - > Copper alloys (CuSn 8, CuBe 2)
  - > Nickel and cobalt alloys (Nimonic 90, Inconel X750, Inconel 718)
  - > and other material grades

For this, please see our material grade overview table on pages 42 and 43

Original SCHNORR® disc springs standard material												Ø 6 - 15 mm			
Article number / Order reference	Ordering Dimensions										Weight per 1000 pieces [kg]	Spring deflection s and force F			
	$D_e$ [mm]	$D_i$ [mm]	t [mm]	$t'$ [mm]	$D_e$ [inch]	$D_i$ [inch]	t [inch]	$t'$ [inch]	$l_0$ [inch]	$h_0$ [inch]		Group acc. to DIN EN 16983	at $s = 0.75 h_0$	at $s = h_0$	
												s [inch]	F [lbf]	s [inch]	F [lbf]
000100	6.00	3.20	0.30		0.236	0.126	0.012		0.018	0.006	1	0.004	27	0.006	35
000200	8.00	3.20	0.20		0.315	0.126	0.008		0.016	0.008	1	0.006	6	0.008	7
000300	8.00	3.20	0.30		0.315	0.126	0.012		0.022	0.010	1	0.007	23	0.010	28
000400	8.00	3.20	0.40		0.315	0.126	0.016		0.024	0.008	1	0.006	42	0.008	54
000550 C	<b>8.00</b>	<b>4.20</b>	0.20		0.315	0.165	0.008		0.018	0.010	1	0.007	9	0.010	9
000600 B	<b>8.00</b>	<b>4.20</b>	0.30		0.315	0.165	0.012		0.022	0.010	1	0.007	27	0.010	32
000700 A	<b>8.00</b>	<b>4.20</b>	0.40		0.315	0.165	0.016		0.024	0.008	1	0.006	47	0.008	61
000800	10.00	3.20	0.30		0.394	0.126	0.012		0.026	0.014	1	0.010	22	0.014	24
000900	10.00	3.20	0.40		0.394	0.126	0.016		0.028	0.012	1	0.009	40	0.012	50
001000	10.00	3.20	0.50		0.394	0.126	0.020		0.030	0.010	1	0.007	63	0.010	81
001100	10.00	4.20	0.40		0.394	0.165	0.016		0.028	0.012	1	0.009	43	0.012	52
001200	10.00	4.20	0.50		0.394	0.165	0.020		0.030	0.010	1	0.007	66	0.010	85
001300 C	<b>10.00</b>	<b>5.20</b>	0.25		0.394	0.205	0.010		0.022	0.012	1	0.009	13	0.012	14
001400 B	<b>10.00</b>	<b>5.20</b>	0.40		0.394	0.205	0.016		0.028	0.012	1	0.009	47	0.012	58
001500 A	<b>10.00</b>	<b>5.20</b>	0.50		0.394	0.205	0.020		0.030	0.010	1	0.007	73	0.010	94
001600	12.00	4.20	0.40		0.472	0.165	0.016		0.031	0.016	1	0.012	40	0.016	46
001700	12.00	4.20	0.50		0.472	0.165	0.020		0.033	0.014	1	0.010	64	0.014	79
001800	12.00	4.20	0.60		0.472	0.165	0.024		0.039	0.016	1	0.012	125	0.016	157
001900	12.00	5.20	0.50		0.472	0.205	0.020		0.035	0.016	1	0.012	79	0.016	96
002000	12.00	5.20	0.60		0.472	0.205	0.024		0.037	0.014	1	0.010	114	0.014	145
002100	12.00	6.20	0.50		0.472	0.244	0.020		0.033	0.014	1	0.010	73	0.014	91
002200	12.00	6.20	0.60		0.472	0.244	0.024		0.037	0.014	1	0.010	124	0.014	158
002300	12.50	5.20	0.50		0.492	0.205	0.020		0.033	0.014	1	0.010	61	0.014	76
002050 C	<b>12.50</b>	<b>6.20</b>	0.35		0.492	0.244	0.014		0.031	0.018	1	0.013	34	0.018	36
002500 B	<b>12.50</b>	<b>6.20</b>	0.50		0.492	0.244	0.020		0.033	0.014	1	0.010	66	0.014	82
002700 A	<b>12.50</b>	<b>6.20</b>	0.70		0.492	0.244	0.028		0.039	0.012	1	0.009	148	0.012	193
002750 C	<b>14.00</b>	<b>7.20</b>	0.35		0.551	0.283	0.014		0.031	0.018	1	0.013	28	0.018	29
002800 B	<b>14.00</b>	<b>7.20</b>	0.50		0.551	0.283	0.020		0.035	0.016	1	0.012	63	0.016	76
002900 A	<b>14.00</b>	<b>7.20</b>	0.80		0.551	0.283	0.031		0.043	0.012	1	0.009	179	0.012	235
003000	15.00	5.20	0.40		0.591	0.205	0.016		0.037	0.022	1	0.016	39	0.022	41
003100	15.00	5.20	0.50		0.591	0.205	0.020		0.039	0.020	1	0.015	63	0.020	72
003200	15.00	5.20	0.60		0.591	0.205	0.024		0.041	0.018	1	0.013	92	0.018	113
003300	15.00	5.20	0.70		0.591	0.205	0.028		0.043	0.016	1	0.012	125	0.016	159
003500	15.00	6.20	0.50		0.591	0.244	0.020		0.039	0.020	1	0.015	65	0.020	75
003600	15.00	6.20	0.60		0.591	0.244	0.024		0.041	0.018	1	0.013	95	0.018	117
003700	15.00	6.20	0.70		0.591	0.244	0.028		0.043	0.016	1	0.012	130	0.016	165
003800	15.00	8.20	0.70		0.591	0.323	0.028		0.043	0.016	1	0.012	150	0.016	191
003900	15.00	8.20	0.80		0.591	0.323	0.031		0.047	0.016	1	0.012	221	0.016	285

## Original SCHNORR® disc springs standard material

Ø 16 - 23 mm

Article number / Order reference	Ordering Dimensions											Weight	Spring deflection s and force F			
	D <sub>e</sub>	D <sub>i</sub>	t	t'	D <sub>e</sub>	D <sub>i</sub>	t	t'	l <sub>0</sub>	h <sub>0</sub>	Group acc. to		per 1000 pieces	at s = 0.75 h <sub>0</sub>		at s = h <sub>0</sub>
	[mm]	[mm]	[mm]	[mm]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	DIN EN 16983	[kg]	s	F	s	F
<b>004100 C</b>	<b>16.00</b>	<b>8.20</b>	0.40		0.630	0.323	0.016		0.035	0.020	1	0.979	0.015	35	0.020	37
<b>004300 B</b>	<b>16.00</b>	<b>8.20</b>	0.60		0.630	0.323	0.024		0.041	0.018	1	1.482	0.013	92	0.018	113
<b>004400</b>	16.00	8.20	0.70		0.630	0.323	0.028		0.045	0.018	1	1.733	0.013	143	0.018	180
<b>004500</b>	16.00	8.20	0.80		0.630	0.323	0.031		0.047	0.016	1	1.958	0.012	186	0.016	239
<b>004600 A</b>	<b>16.00</b>	<b>8.20</b>	0.90		0.630	0.323	0.035		0.049	0.014	1	2.209	0.010	228	0.014	298
<b>004700</b>	18.00	6.20	0.40		0.709	0.244	0.016		0.039	0.024	1	1.493	0.018	31	0.024	31
<b>004800</b>	18.00	6.20	0.50		0.709	0.244	0.020		0.043	0.024	1	1.874	0.018	55	0.024	60
<b>004900</b>	18.00	6.20	0.60		0.709	0.244	0.024		0.047	0.024	1	2.258	0.018	90	0.024	104
<b>005000</b>	18.00	6.20	0.70		0.709	0.244	0.028		0.049	0.022	1	2.639	0.016	124	0.022	152
<b>005100</b>	18.00	6.20	0.80		0.709	0.244	0.031		0.051	0.020	1	2.983	0.015	163	0.020	206
<b>005200</b>	18.00	8.20	0.50		0.709	0.323	0.020		0.043	0.024	1	1.680	0.018	60	0.024	65
<b>005300</b>	18.00	8.20	0.70		0.709	0.323	0.028		0.049	0.022	1	2.366	0.016	134	0.022	164
<b>005400</b>	18.00	8.20	0.80		0.709	0.323	0.031		0.051	0.020	1	2.674	0.015	176	0.020	222
<b>005500</b>	18.00	8.20	1.00		0.709	0.323	0.039		0.055	0.016	1	3.360	0.012	266	0.016	347
<b>005550 C</b>	<b>18.00</b>	<b>9.20</b>	0.45		0.709	0.362	0.018		0.041	0.024	1	1.435	0.018	48	0.024	50
<b>005600 B</b>	<b>18.00</b>	<b>9.20</b>	0.70		0.709	0.362	0.028		0.047	0.020	1	2.202	0.015	127	0.020	158
<b>005700 A</b>	<b>18.00</b>	<b>9.20</b>	1.00		0.709	0.362	0.039		0.055	0.016	1	3.126	0.012	282	0.016	368
<b>005800</b>	20.00	8.20	0.60		0.787	0.323	0.024		0.051	0.028	1	2.626	0.021	93	0.028	102
<b>005900</b>	20.00	8.20	0.70		0.787	0.323	0.028		0.053	0.026	1	3.071	0.019	128	0.026	151
<b>006000</b>	20.00	8.20	0.80		0.787	0.323	0.031		0.055	0.024	1	3.470	0.018	169	0.024	208
<b>006100</b>	20.00	8.20	0.90		0.787	0.323	0.035		0.057	0.022	1	3.915	0.016	214	0.022	271
<b>006200</b>	20.00	8.20	1.00		0.787	0.323	0.039		0.061	0.022	1	4.361	0.016	291	0.022	372
<b>006300 C</b>	<b>20.00</b>	<b>10.20</b>	0.50		0.787	0.402	0.020		0.045	0.026	1	1.931	0.019	57	0.026	61
<b>006400 B</b>	<b>20.00</b>	<b>10.20</b>	0.80		0.787	0.402	0.031		0.053	0.022	1	3.073	0.016	168	0.022	210
<b>006500</b>	20.00	10.20	0.90		0.787	0.402	0.035		0.057	0.022	1	3.468	0.016	236	0.022	299
<b>006600</b>	20.00	10.20	1.00		0.787	0.402	0.039		0.061	0.022	1	3.862	0.016	320	0.022	410
<b>006700 A</b>	<b>20.00</b>	<b>10.20</b>	1.10		0.787	0.402	0.043		0.061	0.018	1	4.217	0.013	342	0.018	446
<b>506 800</b>	20.00	10.20	1.25		0.787	0.402	0.049		0.069	0.020	2 <sup>f</sup>	4.808	0.015	557	0.020	727
<b>506 900</b>	20.00	10.20	1.50		0.787	0.402	0.059		0.071	0.012	2 <sup>f</sup>	5.754	0.009	567	0.012	754
<b>007000 C</b>	<b>22.50</b>	<b>11.20</b>	0.60		0.886	0.441	0.024		0.055	0.031	1	3.000	0.024	96	0.031	100
<b>007100 B</b>	<b>22.50</b>	<b>11.20</b>	0.80		0.886	0.441	0.031		0.057	0.026	1	3.966	0.019	159	0.026	193
<b>507200 A</b>	<b>22.50</b>	<b>11.20</b>	1.25		0.886	0.441	0.049		0.069	0.020	2 <sup>f</sup>	6.204	0.015	434	0.020	566
<b>007400</b>	23.00	8.20	0.70		0.906	0.323	0.028		0.059	0.031	1	4.275	0.024	122	0.031	136
<b>007500</b>	23.00	8.20	0.80		0.906	0.323	0.031		0.061	0.030	1	4.833	0.022	162	0.030	190
<b>007600</b>	23.00	8.20	0.90		0.906	0.323	0.035		0.063	0.028	1	5.450	0.021	207	0.028	253
<b>007700</b>	23.00	8.20	1.00		0.906	0.323	0.039		0.067	0.028	1	6.069	0.021	279	0.028	347
<b>007800</b>	23.00	10.20	0.90		0.906	0.402	0.035		0.065	0.030	1	5.004	0.022	238	0.030	287
<b>007900</b>	23.00	10.20	1.00		0.906	0.402	0.039		0.067	0.028	1	5.571	0.021	296	0.280	368
<b>508 000</b>	23.00	10.20	1.25		0.906	0.402	0.049		0.075	0.026	2 <sup>f</sup>	6.993	0.019	519	0.026	667
<b>008100</b>	23.00	12.20	1.00		0.906	0.480	0.039		0.063	0.024	1	4.971	0.018	274	0.024	347
<b>508 200</b>	23.00	12.20	1.25		0.906	0.480	0.049		0.073	0.024	2 <sup>f</sup>	6.188	0.018	524	0.024	677
<b>508 350</b>	23.00	12.20	1.50		0.906	0.480	0.059		0.079	0.020	2 <sup>f</sup>	7.405	0.015	741	0.020	975

2<sup>g</sup> = according to group 2 (DIN EN 16983) - manufacturing process turned (De/Di)    2<sup>f</sup> = according to group 2 (DIN EN 16983) - manufacturing process fine blanked

Article number / Order reference	Ordering Dimensions										Weight per 1000 pieces [kg]	Spring deflection s and force F				
	D <sub>e</sub>	D <sub>i</sub>	t	t'	D <sub>e</sub>	D <sub>i</sub>	t	t'	l <sub>0</sub>	h <sub>0</sub>		Group acc. to DIN EN 16983	at s = 0.75 h <sub>0</sub>		at s = h <sub>0</sub>	
	[mm]	[mm]	[mm]	[mm]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]			s	F	s	F
008600	25.00	10.20	1.00		0.984	0.402	0.039		0.069	0.030	1	6.845	0.022	263	0.030	324
008700 C	<b>25.00</b>	<b>12.20</b>	0.70		0.984	0.480	0.028		0.063	0.035	1	4.396	0.027	135	0.035	143
008800 B	<b>25.00</b>	<b>12.20</b>	0.90		0.984	0.480	0.035		0.063	0.028	1	5.606	0.021	194	0.028	237
008900	25.00	12.20	1.00		0.984	0.480	0.039		0.071	0.031	1	6.243	0.024	305	0.024	372
509000	25.00	12.20	1.25		0.984	0.480	0.049		0.077	0.028	2 <sup>f</sup>	7.773	0.021	498	0.028	635
509100 A	<b>25.00</b>	<b>12.20</b>	1.50		0.984	0.480	0.059		0.081	0.022	2 <sup>f</sup>	9.301	0.016	658	0.022	863
009200	28.00	10.20	0.80		1.102	0.402	0.031		0.069	0.037	1	7.128	0.028	149	0.037	163
009300	28.00	10.20	1.00		1.102	0.402	0.039		0.075	0.035	1	8.955	0.027	254	0.035	302
509400	28.00	10.20	1.25		1.102	0.402	0.049		0.081	0.031	2 <sup>f</sup>	11.149	0.024	417	0.031	524
509500	28.00	10.20	1.50		1.102	0.402	0.059		0.087	0.028	2 <sup>f</sup>	13.340	0.021	612	0.028	792
009600	28.00	12.20	1.00		1.102	0.480	0.039		0.077	0.037	1	8.353	0.028	285	0.037	335
509700	28.00	12.20	1.25		1.102	0.480	0.049		0.083	0.033	2 <sup>f</sup>	10.399	0.025	468	0.033	585
509800	28.00	12.20	1.50		1.102	0.480	0.059		0.089	0.030	2 <sup>f</sup>	12.445	0.022	692	0.03	891
009900 C	<b>28.00</b>	<b>14.20</b>	0.80		1.102	0.559	0.031		0.071	0.039	1	6.085	0.030	180	0.039	194
010000 B	<b>28.00</b>	<b>14.20</b>	1.00		1.102	0.559	0.039		0.071	0.031	1	7.646	0.024	249	0.031	303
510100	28.00	14.20	1.25		1.102	0.559	0.049		0.083	0.033	2 <sup>f</sup>	9.517	0.025	503	0.033	629
510200 A	<b>28.00</b>	<b>14.20</b>	1.50		1.102	0.559	0.059		0.085	0.026	2 <sup>f</sup>	11.389	0.019	639	0.026	831
010300	31.50	12.20	1.00		1.240	0.480	0.039		0.083	0.043	1	11.100	0.032	262	0.043	295
510400	31.50	12.20	1.25		1.240	0.480	0.049		0.087	0.037	2 <sup>f</sup>	13.819	0.028	406	0.037	498
510500	31.50	12.20	1.50		1.240	0.480	0.059		0.093	0.033	2 <sup>f</sup>	16.537	0.025	604	0.033	770
010650 C	<b>31.50</b>	<b>16.30</b>	0.80		1.240	0.642	0.031		0.073	0.041	1	7.588	0.031	154	0.041	163
510700 B	<b>31.50</b>	<b>16.30</b>	1.25		1.240	0.642	0.049		0.085	0.035	2 <sup>f</sup>	11.870	0.027	430	0.035	533
510800	31.50	16.30	1.50		1.240	0.642	0.059		0.094	0.035	2 <sup>f</sup>	14.204	0.027	726	0.035	920
510900 A	<b>31.50</b>	<b>16.30</b>	1.75		1.240	0.642	0.069		0.096	0.028	2 <sup>f</sup>	16.636	0.021	870	0.028	1140
511000	31.50	16.30	2.00		1.240	0.642	0.079		0.108	0.030	2 <sup>f</sup>	18.971	0.022	1388	0.03	1820
011100	34.00	12.30	1.00		1.339	0.484	0.039		0.089	0.049	1	13.241	0.037	264	0.049	284
511200	34.00	12.30	1.25		1.339	0.484	0.049		0.093	0.043	2 <sup>f</sup>	16.484	0.032	409	0.043	488
511300	34.00	12.30	1.50		1.339	0.484	0.059		0.098	0.039	2 <sup>f</sup>	19.727	0.030	613	0.039	767
511400	34.00	14.30	1.25		1.339	0.563	0.049		0.094	0.045	2 <sup>f</sup>	15.595	0.034	448	0.045	530
511500	34.00	14.30	1.50		1.339	0.563	0.059		0.100	0.041	2 <sup>f</sup>	18.662	0.031	672	0.041	836
511600	34.00	16.30	1.50		1.339	0.642	0.059		0.100	0.041	2 <sup>f</sup>	17.441	0.031	709	0.041	882
511700	34.00	16.30	2.00		1.339	0.642	0.079		0.112	0.033	2 <sup>f</sup>	23.303	0.025	1300	0.033	1690
011850 C	<b>35.50</b>	<b>18.30</b>	0.90		1.398	0.720	0.035		0.081	0.045	1	10.917	0.034	187	0.045	200
511900 B	<b>35.50</b>	<b>18.30</b>	1.25		1.398	0.720	0.049		0.089	0.039	2 <sup>f</sup>	15.135	0.030	382	0.039	465
512000 A	<b>35.50</b>	<b>18.30</b>	2.00		1.398	0.720	0.079		0.110	0.031	2 <sup>f</sup>	24.185	0.024	1166	0.031	1520
512100	40.00	14.30	1.25		1.575	0.563	0.049		0.104	0.055	2 <sup>f</sup>	22.928	0.041	400	0.055	448
512200	40.00	14.30	1.50		1.575	0.563	0.059		0.108	0.049	2 <sup>f</sup>	27.448	0.037	572	0.049	691
512300	40.00	14.30	2.00		1.575	0.563	0.079		0.120	0.041	2 <sup>f</sup>	36.663	0.031	1072	0.041	1380
512400	40.00	16.30	1.50		1.575	0.642	0.059		0.110	0.051	2 <sup>f</sup>	26.213	0.038	618	0.051	741
512500	40.00	16.30	2.00		1.575	0.642	0.079		0.122	0.043	2 <sup>f</sup>	35.031	0.032	1162	0.043	1490
512600	40.00	18.30	2.00		1.575	0.720	0.079		0.124	0.045	2 <sup>f</sup>	33.157	0.034	1271	0.045	1620
012700 C	<b>40.00</b>	<b>20.40</b>	1.00		1.575	0.803	0.039		0.091	0.051	1	15.580	0.038	229	0.051	242
512800 B	<b>40.00</b>	<b>20.40</b>	1.50		1.575	0.803	0.059		0.104	0.045	2 <sup>f</sup>	23.215	0.034	589	0.045	723
512900	40.00	20.40	2.00		1.575	0.803	0.079		0.122	0.043	2 <sup>f</sup>	30.997	0.032	1282	0.043	1640
513 000 A	<b>40.00</b>	<b>20.40</b>	2.25		1.575	0.803	0.089		0.124	0.035	2 <sup>f</sup>	34.657	0.027	1461	0.035	1910
513100	40.00	20.40	2.50		1.575	0.803	0.098		0.136	0.037	2 <sup>f</sup>	38.625	0.028	2111	0.037	2760
513250 C	<b>45.00</b>	<b>22.40</b>	1.25		1.772	0.882	0.049		0.112	0.063	2 <sup>f</sup>	25.000	0.047	425	0.063	453
513300 B	<b>45.00</b>	<b>22.40</b>	1.75		1.772	0.882	0.069		0.120	0.051	2 <sup>f</sup>	35.031	0.038	820	0.051	1010
513400 A	<b>45.00</b>	<b>22.40</b>	2.50		1.772	0.882	0.098		0.138	0.039	2 <sup>f</sup>	50.199	0.030	1735	0.039	2270

2<sup>9</sup> = according to group 2 (DIN EN 16983) - manufacturing process turned (De/Di)    2<sup>f</sup> = according to group 2 (DIN EN 16983) - manufacturing process fine blanked



## Original SCHNORR® disc springs standard material

Ø 50 - 80 mm

Article number / Order reference	Ordering Dimensions										Weight per 1000 pieces [kg]	Spring deflection s and force F				
					Group acc. to DIN EN 16983							at s = 0.75 h <sub>0</sub>		at s = h <sub>0</sub>		
	D <sub>e</sub> [mm]	D <sub>i</sub> [mm]	t [mm]	t' [mm]	D <sub>e</sub> [inch]	D <sub>i</sub> [inch]	t [inch]	t' [inch]	l <sub>0</sub> [inch]	h <sub>0</sub> [inch]		s [inch]	F [lbf]	s [inch]	F [lbf]	
513500	50.00	18.40	1.25		1.969	0.724	0.049		0.112	0.063	2 <sup>f</sup>	35.561	0.047	309	0.063	329
513600	50.00	18.40	1.50		1.969	0.724	0.059		0.130	0.071	2 <sup>f</sup>	42.571	0.053	586	0.071	640
513700	50.00	18.40	2.00		1.969	0.724	0.079		0.138	0.059	2 <sup>f</sup>	56.857	0.044	1028	0.059	1260
513800	50.00	18.40	2.50		1.969	0.724	0.098		0.161	0.063	2 <sup>f</sup>	70.856	0.047	2094	0.063	2630
513900	50.00	18.40	3.00		1.969	0.724	0.118		0.173	0.055	2 <sup>f</sup>	84.547	0.041	3077	0.055	3980
514000	50.00	20.40	2.00		1.969	0.803	0.079		0.138	0.059	2 <sup>f</sup>	54.785	0.044	1054	0.059	1300
514100	50.00	20.40	2.50		1.969	0.803	0.098		0.152	0.053	2 <sup>f</sup>	68.277	0.040	1780	0.053	2280
514200	50.00	22.40	2.00		1.969	0.882	0.079		0.142	0.063	2 <sup>f</sup>	52.514	0.047	1174	0.063	1430
514300	50.00	22.40	2.50		1.969	0.882	0.098		0.154	0.055	2 <sup>f</sup>	65.433	0.041	1913	0.055	2440
514400 C	<b>50.00</b>	<b>25.40</b>	1.25		1.969	1.000	0.049		0.112	0.063	2 <sup>f</sup>	30.468	0.047	348	0.063	371
514500	50.00	25.40	1.50		1.969	1.000	0.059		0.122	0.063	2 <sup>f</sup>	36.464	0.047	565	0.063	642
514600 B	<b>50.00</b>	<b>25.40</b>	2.00		1.969	1.000	0.079		0.134	0.055	2 <sup>f</sup>	48.700	0.041	1071	0.055	1330
514 700	50.00	25.40	2.50		1.969	1.000	0.098		0.154	0.055	2 <sup>f</sup>	60.671	0.041	2037	0.055	2600
514800 A	<b>50.00</b>	<b>25.40</b>	3.00		1.969	1.000	0.118		0.161	0.043	2 <sup>f</sup>	72.422	0.032	2692	0.043	3530
514950 C	<b>56.00</b>	<b>28.50</b>	1.50		2.205	1.122	0.059		0.136	0.077	2 <sup>f</sup>	45.966	0.058	589	0.077	624
515000 B	<b>56.00</b>	<b>28.50</b>	2.00		2.205	1.122	0.079		0.142	0.063	2 <sup>f</sup>	61.310	0.047	998	0.063	1210
515100 A	<b>56.00</b>	<b>28.50</b>	3.00		2.205	1.122	0.118		0.169	0.051	2 <sup>f</sup>	91.646	0.038	2560	0.051	3330
515200	60.00	20.50	2.00		2.362	0.807	0.079		0.161	0.083	2 <sup>f</sup>	84.128	0.062	1063	0.083	1210
515300	60.00	20.50	2.50		2.362	0.807	0.098		0.169	0.071	2 <sup>f</sup>	105.138	0.053	1642	0.071	2030
515400	60.00	20.50	3.00		2.362	0.807	0.118		0.185	0.067	2 <sup>f</sup>	125.752	0.050	2603	0.067	3320
515500	60.00	25.50	2.50		2.362	1.004	0.098		0.173	0.075	2 <sup>f</sup>	97.444	0.056	1838	0.075	2260
515600	60.00	25.50	3.00		2.362	1.004	0.118		0.183	0.065	2 <sup>f</sup>	116.536	0.049	2649	0.065	3390
515700	60.00	30.50	2.50		2.362	1.201	0.098		0.169	0.071	2 <sup>f</sup>	88.053	0.053	1875	0.071	2320
515 800	60.00	30.50	3.00		2.362	1.201	0.118		0.185	0.067	2 <sup>f</sup>	105.315	0.050	2973	0.067	3790
515 900	60.00	30.50	3.50		2.362	1.201	0.138		0.197	0.059	2 <sup>f</sup>	121.475	0.044	4081	0.059	5310
516050 C	<b>63.00</b>	<b>31.00</b>	1.80		2.480	1.220	0.071		0.163	0.093	2 <sup>f</sup>	71.716	0.069	953	0.093	1010
516100 B	<b>63.00</b>	<b>31.00</b>	2.50		2.480	1.220	0.098		0.167	0.069	2 <sup>f</sup>	98.877	0.052	1616	0.069	2010
516200	<b>63.00</b>	<b>31.00</b>	3.00		2.480	1.220	0.118		0.189	0.071	2 <sup>f</sup>	118.741	0.053	2818	0.071	3570
516300 A	<b>63.00</b>	<b>31.00</b>	3.50		2.480	1.220	0.138		0.193	0.055	2 <sup>f</sup>	136.973	0.041	3378	0.055	4410
516400	70.00	25.50	2.00		2.756	1.004	0.079		0.177	0.098	2 <sup>f</sup>	111.951	0.074	998	0.098	1070
516500	70.00	30.50	2.50		2.756	1.201	0.098		0.193	0.094	2 <sup>f</sup>	131.241	0.071	1805	0.094	2110
516600	70.00	30.50	3.00		2.756	1.201	0.118		0.201	0.083	2 <sup>f</sup>	156.947	0.062	2569	0.083	3190
516700	70.00	35.50	3.00		2.756	1.398	0.118		0.201	0.083	2 <sup>f</sup>	143.763	0.062	2762	0.083	3440
516800	70.00	35.50	4.00		2.756	1.398	0.157		0.228	0.071	2 <sup>f</sup>	189.884	0.053	5378	0.071	6980
516900	70.00	40.50	4.00		2.756	1.594	0.157		0.220	0.063	2 <sup>f</sup>	169.844	0.047	5250	0.063	6860
517000	70.00	40.50	5.00		2.756	1.594	0.197		0.244	0.047	2 <sup>f</sup>	209.770	0.035	7570	0.047	10000
517100 C	<b>71.00</b>	<b>36.00</b>	2.00		2.795	1.417	0.079		0.181	0.102	2 <sup>f</sup>	98.458	0.077	1156	0.102	1220
517200 B	<b>71.00</b>	<b>36.00</b>	2.50		2.795	1.417	0.098		0.177	0.079	2 <sup>f</sup>	123.701	0.059	1512	0.079	1840
517300 A	<b>71.00</b>	<b>36.00</b>	4.00		2.795	1.417	0.157		0.220	0.063	2 <sup>f</sup>	195.395	0.047	4616	0.063	6030
517400	80.00	31.00	2.50		3.150	1.220	0.098		0.209	0.110	2 <sup>f</sup>	180.801	0.083	1627	0.110	1820
517500	80.00	31.00	3.00		3.150	1.220	0.118		0.217	0.098	2 <sup>f</sup>	216.075	0.074	2327	0.098	2810
517600	80.00	31.00	4.00		3.150	1.220	0.157		0.240	0.083	2 <sup>f</sup>	286.601	0.062	4360	0.083	5600
517700	80.00	36.00	3.00		3.150	1.417	0.118		0.224	0.106	2 <sup>f</sup>	202.649	0.080	2679	0.106	3180
517800	80.00	36.00	4.00		3.150	1.417	0.157		0.244	0.087	2 <sup>f</sup>	268.743	0.065	4811	0.087	6150
517850 C	<b>80.00</b>	<b>41.00</b>	2.25		3.150	1.614	0.089		0.205	0.116	2 <sup>f</sup>	140.082	0.087	1487	0.116	1570
517900 B	<b>80.00</b>	<b>41.00</b>	3.00		3.150	1.614	0.118		0.209	0.091	2 <sup>f</sup>	187.216	0.068	2365	0.091	2900
518000	80.00	41.00	4.00		3.150	1.614	0.157		0.244	0.087	2 <sup>f</sup>	248.240	0.065	5142	0.087	6570
518100 A	<b>80.00</b>	<b>41.00</b>	5.00		3.150	1.614	0.197		0.264	0.067	2 <sup>f</sup>	307.544	0.050	7544	0.067	9920

2<sup>g</sup> = according to group 2 (DIN EN 16983) - manufacturing process turned (De/Di)    2<sup>f</sup> = according to group 2 (DIN EN 16983) - manufacturing process fine blanked

Article number / Order reference	Ordering Dimensions											Weight	Spring deflection s and force F			
	D <sub>e</sub>	D <sub>i</sub>	t	t'	D <sub>e</sub>	D <sub>i</sub>	t	t'	l <sub>0</sub>	h <sub>0</sub>	Group acc. to DIN EN 16983		per 1000 pieces	at s = 0.75 h <sub>0</sub>		at s = h <sub>0</sub>
	[mm]	[mm]	[mm]	[mm]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]		[kg]	s	F	s	F
<b>518200 C</b>	<b>90.00</b>	<b>46.00</b>	2.50		3.543	1.811	0.098		0.224	0.126	2 <sup>f</sup>	197.843	0.094	1727	0.126	1840
<b>518300 B</b>	<b>90.00</b>	<b>46.00</b>	3.50		3.543	1.811	0.138		0.236	0.098	2 <sup>f</sup>	276.239	0.074	3183	0.098	3950
<b>518400 A</b>	<b>90.00</b>	<b>46.00</b>	5.00		3.543	1.811	0.197		0.276	0.079	2 <sup>f</sup>	391.541	0.059	7049	0.079	9210
<b>518500</b>	100.00	41.00	4.00		3.937	1.614	0.157		0.283	0.126	2 <sup>f</sup>	440.924	0.094	4553	0.126	5540
<b>518600</b>	100.00	41.00	5.00		3.937	1.614	0.197		0.305	0.108	2 <sup>f</sup>	548.730	0.081	7275	0.108	9300
<b>518750 C</b>	<b>100.00</b>	<b>51.00</b>	2.70		3.937	2.008	0.106		0.244	0.138	2 <sup>f</sup>	264.775	0.103	1935	0.138	2050
<b>518800 B</b>	<b>100.00</b>	<b>51.00</b>	3.50		3.937	2.008	0.138		0.248	0.110	2 <sup>f</sup>	342.598	0.083	2938	0.11	3580
<b>518900</b>	100.00	51.00	4.00		3.937	2.008	0.157		0.276	0.118	2 <sup>f</sup>	391.541	0.089	4648	0.118	5720
<b>519000</b>	100.00	51.00	5.00		3.937	2.008	0.197		0.307	0.110	2 <sup>f</sup>	487.441	0.083	8169	0.11	10400
<b>519150 A</b>	100.00	51.00	6.00		3.937	2.008	0.236		0.323	0.087	2 <sup>f</sup>	579.374	0.065	10796	0.087	14200
<b>019160</b>	100.00	51.00	7.00	6.55	3.937	2.008	0.276		0.362	0.087	3	661.386	0.065	17050	0.087	22061
<b>519250 C</b>	<b>112.00</b>	<b>57.00</b>	3.00		4.409	2.244	0.118		0.272	0.154	2 <sup>f</sup>	370.376	0.115	2358	0.154	2500
<b>519300 B</b>	<b>112.00</b>	<b>57.00</b>	4.00		4.409	2.244	0.157		0.283	0.126	2 <sup>f</sup>	490.969	0.094	3991	0.126	4860
<b>519450 A</b>	<b>112.00</b>	<b>57.00</b>	6.00		4.409	2.244	0.236		0.335	0.098	2 <sup>f</sup>	732.154	0.074	9826	0.098	12800
<b>519500</b>	125.00	41.00	4.00		4.921	1.614	0.157		0.323	0.165	2 <sup>f</sup>	745.382	0.124	3899	0.165	4450
<b>519600</b>	125.00	51.00	4.00		4.921	2.008	0.157		0.335	0.177	2 <sup>f</sup>	695.778	0.133	4455	0.177	4980
<b>519700</b>	125.00	51.00	5.00		4.921	2.008	0.197		0.350	0.154	2 <sup>f</sup>	863.109	0.115	6895	0.154	8430
<b>519850</b>	125.00	51.00	6.00		4.921	2.008	0.236		0.370	0.134	2 <sup>f</sup>	1026.912	0.100	9961	0.134	12700
<b>519900</b>	125.00	61.00	5.00		4.921	2.402	0.197		0.354	0.157	2 <sup>f</sup>	788.372	0.118	7636	0.157	9290
<b>520050</b>	125.00	61.00	6.00		4.921	2.402	0.236		0.378	0.142	2 <sup>f</sup>	937.845	0.106	11403	0.142	14500
<b>520200 C</b>	<b>125.00</b>	<b>64.00</b>	3.50		4.921	2.520	0.138		0.315	0.177	2 <sup>f</sup>	534.179	0.133	3466	0.177	3690
<b>520300 B</b>	<b>125.00</b>	<b>64.00</b>	5.00		4.921	2.520	0.197		0.335	0.138	2 <sup>f</sup>	763.239	0.103	6724	0.138	8360
<b>520550</b>	125.00	71.00	6.00		4.921	2.795	0.236		0.366	0.130	2 <sup>f</sup>	833.126	0.097	11534	0.13	14700
<b>020100</b>	125.00	61.00	8.00	7.50	4.921	2.402	0.315	0.295	0.429	0.114	3	1206.589	0.086	21037	0.114	27600
<b>020350</b>	125.00	64.00	7.00	6.55	4.921	2.520	0.276	0.258	0.394	0.118	3	1029.117	0.089	15111	0.118	19174
<b>020400 A</b>	<b>125.00</b>	<b>64.00</b>	8.00	7.50	4.921	2.520	0.315	0.295	0.417	0.102	3	1168.228	0.077	19317	0.102	25400
<b>020600</b>	125.00	71.00	8.00	7.40	4.921	2.795	0.315	0.291	0.409	0.094	3	1057.336	0.071	19220	0.094	25400
<b>020700</b>	125.00	71.00	10.00	9.20	4.921	2.795	0.394	0.362	0.465	0.071	3	1314.615	0.053	27904	0.071	37200
<b>520850 C</b>	<b>140.00</b>	<b>72.00</b>	3.80		5.512	2.835	0.150		0.343	0.193	2 <sup>f</sup>	726.863	0.145	3866	0.193	4110
<b>020900 B</b>	<b>140.00</b>	<b>72.00</b>	5.00		5.512	2.835	0.197		0.354	0.157	2 <sup>9</sup>	955.041	0.118	6277	0.157	7640
<b>021000 A</b>	<b>140.00</b>	<b>72.00</b>	8.00	7.50	5.512	2.835	0.315	0.295	0.441	0.126	3	1461.663	0.094	19165	0.126	25000
<b>021100</b>	150.00	61.00	5.00		5.906	2.402	0.197		0.406	0.209	2 <sup>9</sup>	1245.610	0.156	6978	0.209	7950
<b>021250</b>	150.00	61.00	6.00		5.906	2.402	0.236		0.425	0.189	2 <sup>9</sup>	1492.087	0.142	10219	0.189	12400
<b>021350</b>	150.00	71.00	6.00		5.906	2.795	0.236		0.425	0.189	2 <sup>9</sup>	1386.486	0.142	10826	0.189	13200
<b>021400</b>	150.00	71.00	8.00	7.50	5.906	2.795	0.315	0.295	0.472	0.157	3	1771.633	0.118	20199	0.157	26000
<b>021500</b>	150.00	81.00	8.00	7.50	5.906	3.189	0.315	0.295	0.461	0.146	3	1615.766	0.109	20128	0.146	25390
<b>021600</b>	150.00	81.00	10.00	9.30	5.906	3.189	0.394	0.366	0.512	0.118	3	2003.559	0.089	31277	0.118	41300
<b>521650 C</b>	<b>160.00</b>	<b>82.00</b>	4.30		6.299	3.228	0.169		0.390	0.220	2 <sup>f</sup>	1085.114	0.165	4910	0.22	5200
<b>021750 B</b>	<b>160.00</b>	<b>82.00</b>	6.00		6.299	3.228	0.236		0.413	0.177	2 <sup>9</sup>	1498.701	0.133	9219	0.177	11300
<b>021800 A</b>	<b>160.00</b>	<b>82.00</b>	10.00	9.40	6.299	3.228	0.394	0.370	0.531	0.138	3	2400.831	0.103	31098	0.138	40900
<b>021850 C</b>	<b>180.00</b>	<b>92.00</b>	4.80		7.087	3.622	0.189		0.433	0.244	2 <sup>9</sup>	1554.918	0.183	5944	0.244	6310
<b>021950 B</b>	<b>180.00</b>	<b>92.00</b>	6.00		7.087	3.622	0.236		0.437	0.201	2 <sup>9</sup>	1901.485	0.151	8431	0.201	10100
<b>022000 A</b>	<b>180.00</b>	<b>92.00</b>	10.00	9.40	7.087	3.622	0.394	0.370	0.551	0.157	3	3044.580	0.118	28195	0.157	36800
<b>022050</b>	180.00	92.00	13.00	12.10	7.087	3.622	0.512	0.476	0.650	0.138	3	3947.372	0.103	53478	0.138	69573

2<sup>9</sup> = according to group 2 (DIN EN 16983) - manufacturing process turned (De/Di)    2<sup>f</sup> = according to group 2 (DIN EN 16983) - manufacturing process fine blanked

Original SCHNORR® disc springs standard material												Ø 200 - 250 mm				
Article number / Order reference	Ordering Dimensions										Weight per 1000 pieces [kg]	Spring deflection s and force F				
	D <sub>e</sub> [mm]	D <sub>i</sub> [mm]	t [mm]	t' [mm]	D <sub>e</sub> [inch]	D <sub>i</sub> [inch]	t [inch]	t' [inch]	l <sub>0</sub> [inch]	h <sub>0</sub> [inch]		Group acc. to DIN EN 16983	at s = 0.75 h <sub>0</sub> s F [inch] [lbf]		at s = h <sub>0</sub> s F [inch] [lbf]	
022100 C	200.00	82.00	8.00	7.60	7.874	3.228	0.315	0.299	0.559	0.244	3	3425.979	0.183	17543	0.244	21500
022200 B	200.00	82.00	10.00	9.60	7.874	3.228	0.394	0.378	0.610	0.217	3	4325.464	0.162	29100	0.217	37200
022300	200.00	82.00	12.00	11.50	7.874	3.228	0.472	0.453	0.654	0.181	3	5183.062	0.136	41081	0.181	53800
022400 A	200.00	92.00	10.00	9.50	7.874	3.622	0.394	0.374	0.614	0.220	3	4056.501	0.165	30953	0.22	39500
022500	200.00	92.00	12.00	11.40	7.874	3.622	0.472	0.449	0.661	0.189	3	4867.801	0.142	44798	0.189	58500
022600	200.00	92.00	14.00	13.10	7.874	3.622	0.551	0.516	0.713	0.161	3	5593.121	0.121	60075	0.161	79400
022650	200.00	102.00	5.50		7.874	4.016	0.217		0.492	0.276	2 <sup>9</sup>	2203.077	0.207	8118	0.276	8670
022700	200.00	102.00	8.00	7.50	7.874	4.016	0.315	0.295	0.535	0.220	3	3004.897	0.165	17170	0.22	21400
022800	200.00	102.00	10.00	9.40	7.874	4.016	0.394	0.370	0.614	0.220	3	3765.491	0.165	32678	0.22	41700
022900	200.00	102.00	12.00	11.25	7.874	4.016	0.472	0.443	0.638	0.165	3	4506.243	0.124	41145	0.165	54000
023000	200.00	102.00	14.00	13.10	7.874	4.016	0.551	0.516	0.717	0.165	3	5246.996	0.124	65011	0.165	85800
023100	200.00	112.00	12.00	11.10	7.874	4.409	0.472	0.437	0.638	0.165	3	4122.639	0.124	44024	0.165	57800
023200	200.00	112.00	14.00	12.90	7.874	4.409	0.551	0.508	0.689	0.138	3	4790.639	0.103	57722	0.138	76500
023300	200.00	112.00	16.00	14.80	7.874	4.409	0.630	0.583	0.740	0.110	3	5496.118	0.083	68589	0.11	91400
023350 C	225.00	112.00	6.50	6.20	8.858	4.409	0.256	0.244	0.535	0.280	3	3196.699	0.210	10022	0.28	11300
023400 B	225.00	112.00	8.00	7.50	8.858	4.409	0.315	0.295	0.571	0.256	3	3866.903	0.192	15905	0.256	19300
023500 A	225.00	112.00	12.00	11.25	8.858	4.409	0.472	0.443	0.669	0.197	3	5800.355	0.148	38446	0.197	50100
023550	225.00	112.00	16.00	15.00	8.858	4.409	0.630	0.591	0.807	0.177	3	6779.207	0.133	80839	0.177	105158
023600	250.00	102.00	10.00	9.60	9.843	4.016	0.394	0.378	0.709	0.315	3	8119.615	0.236	28413	0.315	34600
023700	250.00	102.00	12.00	11.50	9.843	4.016	0.472	0.453	0.748	0.276	3	4208.620	0.207	41131	0.276	52300
023750 C	250.00	127.00	7.00	6.70	9.843	5.000	0.276	0.264	0.583	0.307	3	5903.972	0.230	11345	0.307	12700
023800 B	250.00	127.00	10.00	9.40	9.843	5.000	0.394	0.370	0.669	0.276	3	7065.807	0.207	26764	0.276	33300
023900	250.00	127.00	12.00	11.25	9.843	5.000	0.472	0.443	0.760	0.287	3	8227.642	0.216	47391	0.287	60000
024000 A	250.00	127.00	14.00	13.10	9.843	5.000	0.551	0.516	0.772	0.220	3	9420.341	0.165	55939	0.22	73100
024100	250.00	127.00	16.00	15.00	9.843	5.000	0.630	0.591	0.858	0.228	3	0.000	0.171	86106	0.228	113000

2<sup>9</sup> = according to group 2 (DIN EN 16983) - manufacturing process turned (De/Di)    2<sup>1</sup> = according to group 2 (DIN EN 16983) - manufacturing process fine blanked

Corrosion-resistant SCHNORR® disc springs, material 1.4310 (X10 CrNi 18-8)										Ø 6 - 12 mm				
Article number / Order reference	Ordering Dimensions									Weight per 1000 pieces [lbs.]	Spring deflection s and force F			
	D <sub>e</sub> [mm]	D <sub>i</sub> [mm]	t [mm]	D <sub>e</sub> [inch]	D <sub>i</sub> [inch]	t [inch]	l <sub>0</sub> [inch]	h <sub>0</sub> [inch]	at s = 0.75 h <sub>0</sub> s F [inch] [lbf]		at s = h <sub>0</sub> s F [inch] [lbf]			
024650	6.00	3.20	0.30	0.236	0.126	0.012	0.018	0.006	0.104	0.004	25	0.006	32	
025250	8.00	3.20	0.20	0.315	0.126	0.008	0.016	0.008	0.146	0.006	5	0.008	6	
025400	8.00	3.20	0.30	0.315	0.126	0.012	0.022	0.010	0.216	0.007	22	0.010	26	
025700	8.00	3.20	0.40	0.315	0.126	0.016	0.022	0.006	0.289	0.004	28	0.006	37	
026300	8.00	3.20	0.50	0.315	0.126	0.020	0.028	0.008	0.366	0.006	74	0.008	96	
026700	8.00	4.20	0.20	0.315	0.165	0.008	0.018	0.010	0.126	0.007	8	0.010	9	
027100	8.00	4.20	0.30	0.315	0.165	0.012	0.020	0.008	0.187	0.006	19	0.008	24	
027400	8.00	4.20	0.40	0.315	0.165	0.016	0.024	0.008	0.249	0.006	43	0.008	56	
028910	10.00	3.20	0.30	0.394	0.126	0.012	0.026	0.014	0.364	0.010	20	0.014	22	
029101	10.00	3.20	0.40	0.394	0.126	0.016	0.028	0.012	0.485	0.009	37	0.012	46	
029301	10.00	3.20	0.50	0.394	0.126	0.020	0.028	0.008	0.604	0.006	46	0.008	59	
029602	10.00	4.20	0.40	0.394	0.165	0.016	0.028	0.012	0.445	0.009	39	0.010	40	
029701	10.00	4.20	0.50	0.394	0.165	0.020	0.028	0.008	0.556	0.006	48	0.008	62	
030290	10.00	5.20	0.25	0.394	0.205	0.010	0.022	0.012	0.247	0.009	12	0.012	13	
030800	10.00	5.20	0.40	0.394	0.205	0.016	0.026	0.010	0.395	0.007	35	0.010	44	
031000	10.00	5.20	0.50	0.394	0.205	0.020	0.028	0.008	0.492	0.006	53	0.008	69	

## Corrosion-resistant SCHNORR® disc springs, material 1.4310 (X10 CrNi 18-8)

Ø 6 - 18 mm

Article number / Order reference	Ordering Dimensions								Weight per 1000 pieces [lbs.]	Spring deflection s and force F			
	D <sub>e</sub> [mm]	D <sub>i</sub> [mm]	t [mm]	D <sub>e</sub> [inch]	D <sub>i</sub> [inch]	t [inch]	l <sub>0</sub> [inch]	h <sub>0</sub> [inch]		at s = 0.75 h <sub>0</sub>		at s = h <sub>0</sub>	
									s [inch]	F [lbf.]	s [inch]	F [lbf.]	
024650	6.00	3.20	0.30	0.236	0.126	0.012	0.018	0.006	0.104	0.004	25	0.006	32
025250	8.00	3.20	0.20	0.315	0.126	0.008	0.016	0.008	0.146	0.006	5	0.008	6
025400	8.00	3.20	0.30	0.315	0.126	0.012	0.022	0.010	0.216	0.007	22	0.010	26
025700	8.00	3.20	0.40	0.315	0.126	0.016	0.022	0.006	0.289	0.004	28	0.006	37
026300	8.00	3.20	0.50	0.315	0.126	0.020	0.028	0.008	0.366	0.006	74	0.008	96
026700	8.00	4.20	0.20	0.315	0.165	0.008	0.018	0.010	0.126	0.007	8	0.010	9
027100	8.00	4.20	0.30	0.315	0.165	0.012	0.020	0.008	0.187	0.006	19	0.008	24
027400	8.00	4.20	0.40	0.315	0.165	0.016	0.024	0.008	0.249	0.006	43	0.008	56
028910	10.00	3.20	0.30	0.394	0.126	0.012	0.026	0.014	0.364	0.010	20	0.014	22
029101	10.00	3.20	0.40	0.394	0.126	0.016	0.028	0.012	0.485	0.009	37	0.012	46
029301	10.00	3.20	0.50	0.394	0.126	0.020	0.028	0.008	0.604	0.006	46	0.008	59
029602	10.00	4.20	0.40	0.394	0.165	0.016	0.028	0.012	0.445	0.009	39	0.010	40
029701	10.00	4.20	0.50	0.394	0.165	0.020	0.028	0.008	0.556	0.006	48	0.008	62
030290	10.00	5.20	0.25	0.394	0.205	0.010	0.022	0.012	0.247	0.009	12	0.012	13
030800	10.00	5.20	0.40	0.394	0.205	0.016	0.026	0.010	0.395	0.007	35	0.010	44
031000	10.00	5.20	0.50	0.394	0.205	0.020	0.028	0.008	0.492	0.006	53	0.008	69
032040	12.00	4.20	0.40	0.472	0.165	0.016	0.031	0.016	0.681	0.012	37	0.016	43
032500	12.00	4.20	0.50	0.472	0.165	0.020	0.031	0.012	0.851	0.009	49	0.012	62
032704	12.00	4.20	0.60	0.472	0.165	0.024	0.033	0.010	1.021	0.007	69	0.010	90
033400	12.00	5.20	0.50	0.472	0.205	0.020	0.031	0.012	0.787	0.009	52	0.012	66
033500	12.00	5.20	0.60	0.472	0.205	0.024	0.033	0.010	0.946	0.007	73	0.010	95
034200	12.00	6.20	0.50	0.472	0.244	0.020	0.033	0.014	0.712	0.010	68	0.014	84
034550	12.00	6.20	0.60	0.472	0.244	0.024	0.033	0.010	0.853	0.007	80	0.010	103
035040	12.50	5.20	0.50	0.492	0.205	0.020	0.033	0.014	0.871	0.010	56	0.014	70
035103	12.50	6.20	0.35	0.492	0.244	0.014	0.031	0.018	0.558	0.013	31	0.018	33
035400	12.50	6.20	0.50	0.492	0.244	0.020	0.033	0.014	0.796	0.010	61	0.014	75
035601	12.50	6.20	0.70	0.492	0.244	0.028	0.037	0.010	1.111	0.007	113	0.010	148
038353	14.00	7.20	0.35	0.551	0.283	0.014	0.031	0.018	0.683	0.013	26	0.018	27
038600	14.00	7.20	0.50	0.551	0.283	0.020	0.035	0.016	0.974	0.012	58	0.016	70
039040	14.00	7.20	0.80	0.551	0.283	0.031	0.041	0.010	1.556	0.007	137	0.010	180
039500	15.00	5.20	0.40	0.591	0.205	0.016	0.037	0.022	1.071	0.016	36	0.022	38
039800	15.00	5.20	0.50	0.591	0.205	0.020	0.039	0.020	1.338	0.015	58	0.020	67
039971	15.00	5.20	0.60	0.591	0.205	0.024	0.041	0.018	1.605	0.013	84	0.018	103
040130	15.00	5.20	0.70	0.591	0.205	0.028	0.043	0.016	1.872	0.012	115	0.014	128
040950	15.00	6.20	0.50	0.591	0.244	0.020	0.039	0.020	1.261	0.015	60	0.020	69
041301	15.00	6.20	0.60	0.591	0.244	0.024	0.039	0.016	1.515	0.012	77	0.016	96
041700	15.00	6.20	0.70	0.591	0.244	0.028	0.041	0.014	1.766	0.010	104	0.014	133
042400	15.00	8.20	0.70	0.591	0.323	0.028	0.039	0.012	1.493	0.009	101	0.012	131
042601	15.00	8.20	0.80	0.591	0.323	0.031	0.043	0.012	1.704	0.009	150	0.012	196
043750	16.00	8.20	0.40	0.630	0.323	0.016	0.035	0.020	1.023	0.015	32	0.020	34
044000	16.00	8.20	0.60	0.630	0.323	0.024	0.041	0.018	1.532	0.013	85	0.018	104
044101	16.00	8.20	0.70	0.630	0.323	0.028	0.041	0.014	1.788	0.010	100	0.014	129
044201	16.00	8.20	0.80	0.630	0.323	0.031	0.043	0.012	2.041	0.009	126	0.012	165
044400	16.00	8.20	0.90	0.630	0.323	0.035	0.047	0.012	2.297	0.009	179	0.012	234
045800	18.00	6.20	0.40	0.709	0.244	0.016	0.039	0.024	1.548	0.018	29	0.024	28
046003	18.00	6.20	0.50	0.709	0.244	0.020	0.043	0.024	1.936	0.018	51	0.024	55
046252	18.00	6.20	0.60	0.709	0.244	0.024	0.047	0.024	2.321	0.018	83	0.024	96
046400	18.00	6.20	0.70	0.709	0.244	0.028	0.049	0.022	2.707	0.016	115	0.022	139
046505	18.00	6.20	0.80	0.709	0.244	0.031	0.051	0.020	3.093	0.015	150	0.020	189
046924	18.00	8.20	0.50	0.709	0.323	0.020	0.043	0.024	1.739	0.018	55	0.024	60
047070	18.00	8.20	0.70	0.709	0.323	0.028	0.047	0.020	2.434	0.015	111	0.020	137
047300	18.00	8.20	0.80	0.709	0.323	0.031	0.049	0.018	2.782	0.013	144	0.018	183
047691	18.00	8.20	1.00	0.709	0.323	0.039	0.053	0.014	3.474	0.010	213	0.014	279
047910	18.00	9.20	0.45	0.709	0.362	0.018	0.041	0.024	1.459	0.018	44	0.024	46
048050	18.00	9.20	0.70	0.709	0.362	0.028	0.047	0.020	2.269	0.015	117	0.020	145
048098	18.00	9.20	1.00	0.709	0.362	0.039	0.053	0.014	3.239	0.010	226	0.014	296



## Corrosion-resistant SCHNORR® disc springs, material 1.4310 (X10 CrNi 18-8)

Ø 20 - 31.5 mm

Article number / Order reference	Ordering Dimensions								Weight per 1000 pieces [lbs.]	Spring deflection s and force F			
	D <sub>e</sub> [mm]	D <sub>i</sub> [mm]	t [mm]	D <sub>e</sub> [inch]	D <sub>i</sub> [inch]	t [inch]	l <sub>0</sub> [inch]	h <sub>0</sub> [inch]		at s = 0.75 h <sub>0</sub>		at s = h <sub>0</sub>	
									s [inch]	F [lbf.]	s [inch]	F [lbf.]	
048051	20.00	8.20	0.50	0.787	0.323	0.020	0.045	0.026	2.269	0.019	48	0.026	51
051100	20.00	8.20	0.60	0.787	0.323	0.024	0.051	0.028	2.703	0.021	85	0.028	94
052270	20.00	8.20	0.70	0.787	0.323	0.028	0.053	0.026	3.153	0.019	118	0.026	138
051450	20.00	8.20	0.80	0.787	0.323	0.031	0.055	0.024	3.602	0.018	156	0.022	175
051701	20.00	8.20	0.90	0.787	0.323	0.035	0.057	0.022	4.052	0.016	198	0.022	249
051761	20.00	8.20	1.00	0.787	0.323	0.039	0.057	0.018	4.502	0.013	216	0.018	280
052803	20.00	10.20	0.50	0.787	0.402	0.020	0.045	0.026	2.006	0.019	53	0.026	56
052804	20.00	10.20	0.60	0.787	0.402	0.024	0.047	0.024	2.421	0.018	77	0.024	89
053500	20.00	10.20	0.80	0.787	0.402	0.031	0.053	0.022	3.206	0.016	155	0.022	193
053701	20.00	10.20	0.90	0.787	0.402	0.035	0.055	0.020	3.605	0.015	196	0.020	249
053901	20.00	10.20	1.00	0.787	0.402	0.039	0.055	0.016	4.006	0.012	210	0.016	274
054380	20.00	10.20	1.10	0.787	0.402	0.043	0.059	0.016	4.405	0.012	279	0.016	364
055280	20.00	10.20	1.25	0.787	0.402	0.049	0.061	0.012	5.002	0.009	303	0.012	401
055650	20.00	10.20	1.50	0.787	0.402	0.059	0.069	0.010	5.999	0.007	435	0.010	577
057710	22.50	11.20	0.60	0.886	0.441	0.024	0.055	0.031	3.100	0.024	88	0.031	92
057903	22.50	11.20	0.80	0.886	0.441	0.031	0.057	0.026	4.129	0.019	147	0.026	177
058050	22.50	11.20	1.25	0.886	0.441	0.049	0.065	0.016	6.446	0.012	317	0.016	416
058950	23.00	8.20	0.70	0.906	0.323	0.028	0.059	0.031	4.381	0.024	113	0.031	125
059210	23.00	8.20	0.80	0.906	0.323	0.031	0.061	0.030	5.007	0.022	149	0.030	175
059400	23.00	8.20	0.90	0.906	0.323	0.035	0.063	0.028	5.631	0.021	191	0.028	232
059504	23.00	8.20	1.00	0.906	0.323	0.039	0.063	0.024	6.257	0.018	216	0.024	273
060460	23.00	10.20	0.90	0.906	0.402	0.035	0.061	0.026	5.185	0.019	185	0.030	264
060600	23.00	10.20	1.00	0.906	0.402	0.039	0.063	0.024	5.761	0.018	229	0.024	290
060901	23.00	10.20	1.25	0.906	0.402	0.049	0.067	0.018	7.196	0.013	325	0.018	424
001922	23.00	12.20	1.00	0.906	0.480	0.039	0.063	0.024	5.152	0.018	252	0.024	319
061600	23.00	12.20	1.25	0.906	0.480	0.049	0.065	0.016	6.435	0.012	316	0.016	415
061951	23.00	12.20	1.50	0.906	0.480	0.059	0.073	0.014	7.718	0.010	474	0.014	627
063872	25.00	10.20	1.00	0.984	0.402	0.039	0.067	0.028	7.066	0.021	224	0.028	278
064400	25.00	12.20	0.70	0.984	0.480	0.028	0.063	0.035	4.524	0.027	124	0.035	132
064900	25.00	12.20	0.90	0.984	0.480	0.035	0.063	0.028	5.814	0.021	179	0.028	218
065104	25.00	12.20	1.00	0.984	0.480	0.039	0.065	0.026	6.457	0.019	222	0.026	277
065129	25.00	12.20	1.25	0.984	0.480	0.049	0.069	0.020	8.069	0.015	320	0.020	417
065400	25.00	12.20	1.50	0.984	0.480	0.059	0.077	0.018	9.676	0.013	493	0.016	576
071600	28.00	10.20	0.80	1.102	0.402	0.031	0.069	0.037	7.388	0.028	137	0.037	150
071752	28.00	10.20	1.00	1.102	0.402	0.039	0.075	0.035	9.233	0.027	234	0.035	277
007791	28.00	10.20	1.25	1.102	0.402	0.049	0.077	0.028	11.127	0.021	331	0.028	421
072105	28.00	10.20	1.50	1.102	0.402	0.059	0.083	0.024	13.838	0.018	480	0.024	624
072750	28.00	12.20	1.00	1.102	0.480	0.039	0.077	0.037	8.622	0.028	263	0.037	307
072860	28.00	12.20	1.25	1.102	0.480	0.049	0.077	0.028	10.774	0.021	348	0.028	442
073300	28.00	12.20	1.50	1.102	0.480	0.059	0.081	0.022	12.923	0.016	460	0.022	600
075260	28.00	14.20	0.80	1.102	0.559	0.031	0.071	0.039	6.327	0.030	166	0.039	178
075700	28.00	14.20	1.00	1.102	0.559	0.039	0.071	0.031	7.906	0.024	230	0.031	278
075925	28.00	14.20	1.25	1.102	0.559	0.049	0.075	0.026	9.877	0.019	345	0.026	442
076160	28.00	14.20	1.50	1.102	0.559	0.059	0.081	0.022	11.845	0.016	494	0.026	763
082253	31.50	12.20	1.00	1.240	0.480	0.039	0.083	0.043	11.444	0.032	242	0.043	271
081505	31.50	12.20	1.25	1.240	0.480	0.049	0.085	0.035	14.299	0.027	352	0.035	434
082303	31.50	12.20	1.50	1.240	0.480	0.059	0.089	0.030	17.154	0.022	487	0.030	624
082801	31.50	16.30	0.80	1.240	0.642	0.031	0.073	0.041	7.886	0.031	142	0.041	150
004842	31.50	16.30	1.25	1.240	0.642	0.049	0.079	0.030	11.848	0.022	323	0.030	408
083800	31.50	16.30	1.50	1.240	0.642	0.059	0.085	0.026	14.767	0.019	471	0.026	611
084493	31.50	16.30	1.75	1.240	0.642	0.069	0.091	0.022	17.220	0.016	625	0.022	820
084800	31.50	16.30	2.00	1.240	0.642	0.079	0.098	0.020	19.672	0.015	843	0.020	1.113

## Corrosion-resistant SCHNORR® disc springs, material 1.4310 (X10 CrNi 18-8)

Ø 34 - 90 mm

Article number / Order reference	Ordering Dimensions								Weight per 1000 pieces [lbs.]	Spring deflection s and force F			
	D <sub>e</sub> [mm]	D <sub>i</sub> [mm]	t [mm]	D <sub>e</sub> [inch]	D <sub>i</sub> [inch]	t [inch]	l <sub>0</sub> [inch]	h <sub>0</sub> [inch]		at s = 0.75 h <sub>0</sub>		at s = h <sub>0</sub>	
									s [inch]	F [lbf.]	s [inch]	F [lbf.]	
087900	34.00	12.30	1.00	1.339	0.484	0.039	0.089	0.049	13.640	0.037	243	0.049	261
088046	34.00	12.30	1.25	1.339	0.484	0.049	0.093	0.043	17.046	0.032	377	0.043	448
088300	34.00	12.30	1.50	1.339	0.484	0.059	0.094	0.035	20.448	0.027	502	0.035	634
089321	34.00	14.30	1.25	1.339	0.563	0.049	0.091	0.041	16.140	0.031	370	0.041	444
089400	34.00	14.30	1.50	1.339	0.563	0.059	0.093	0.033	19.363	0.025	490	0.033	622
090500	34.00	16.30	1.50	1.339	0.642	0.059	0.091	0.031	18.113	0.024	484	0.031	617
091100	34.00	16.30	2.00	1.339	0.642	0.079	0.102	0.024	24.132	0.018	835	0.024	1.098
004543	35.50	18.30	0.90	1.398	0.720	0.035	0.081	0.045	11.314	0.034	173	0.045	183
004616	35.50	18.30	1.25	1.398	0.720	0.049	0.089	0.039	15.106	0.030	352	0.039	427
094000	35.50	18.30	1.25	1.398	0.720	0.049	0.089	0.039	15.706	0.030	352	0.035	384
093683	35.50	18.30	2.00	1.398	0.720	0.079	0.104	0.026	25.100	0.019	867	0.026	1.137
099423	40.00	14.30	1.25	1.575	0.563	0.049	0.104	0.055	23.704	0.041	369	0.055	411
099461	40.00	14.30	1.50	1.575	0.563	0.059	0.108	0.049	28.437	0.037	528	0.049	635
099833	40.00	14.30	2.00	1.575	0.563	0.079	0.114	0.035	37.895	0.027	838	0.035	1.083
100503	40.00	16.30	1.50	1.575	0.642	0.059	0.106	0.047	27.187	0.035	518	0.047	628
100801	40.00	16.30	2.00	1.575	0.642	0.079	0.114	0.035	36.229	0.027	864	0.035	1.116
101755	40.00	18.30	2.00	1.575	0.720	0.079	0.112	0.033	34.357	0.025	847	0.033	1.099
102531	40.00	20.40	1.00	1.575	0.803	0.039	0.091	0.051	16.094	0.038	211	0.051	222
103000	40.00	20.40	1.50	1.575	0.803	0.059	0.102	0.043	24.123	0.032	516	0.043	635
103500	40.00	20.40	2.00	1.575	0.803	0.079	0.110	0.031	32.143	0.024	841	0.031	1.095
103953	40.00	20.40	2.25	1.575	0.803	0.089	0.116	0.028	36.149	0.021	1.038	0.028	1.364
104465	40.00	20.40	2.50	1.575	0.803	0.098	0.124	0.026	40.151	0.019	1.316	0.026	1.737
004443	45.00	22.40	1.25	1.772	0.882	0.049	0.114	0.065	25.772	0.049	410	0.065	429
110412	45.00	22.40	1.25	1.772	0.882	0.049	0.114	0.065	25.895	0.049	410	0.063	416
110501	45.00	22.40	1.75	1.772	0.882	0.069	0.116	0.047	36.231	0.035	690	0.047	857
110901	45.00	22.40	2.50	1.772	0.882	0.098	0.132	0.033	51.714	0.025	1.351	0.033	1.769
115970	50.00	18.40	1.25	1.969	0.724	0.049	0.112	0.063	36.771	0.047	285	0.063	303
116300	50.00	18.40	1.50	1.969	0.724	0.059	0.130	0.071	44.117	0.053	540	0.071	588
116653	50.00	18.40	2.00	1.969	0.724	0.079	0.136	0.057	58.795	0.043	911	0.057	1.123
116901	50.00	18.40	2.50	1.969	0.724	0.098	0.144	0.045	73.465	0.034	1.348	0.045	1.740
117400	50.00	20.40	2.00	1.969	0.803	0.079	0.134	0.055	56.681	0.041	898	0.055	1.112
117703	50.00	20.40	2.50	1.969	0.803	0.098	0.142	0.043	70.819	0.032	1.318	0.043	1.706
118401	50.00	22.40	2.00	1.969	0.882	0.079	0.130	0.051	54.348	0.038	853	0.051	1.066
014401	50.00	25.40	1.25	1.969	1.000	0.049	0.112	0.063	30.406	0.047	321	0.063	341
003023	50.00	22.40	2.50	1.969	0.882	0.098	0.138	0.039	67.902	0.030	1.232	0.039	1.602
120103	50.00	25.40	1.50	1.969	1.000	0.059	0.122	0.063	37.849	0.047	521	0.063	590
120400	50.00	25.40	2.00	1.969	1.000	0.079	0.130	0.051	50.437	0.038	908	0.051	1.136
120801	50.00	25.40	2.50	1.969	1.000	0.098	0.138	0.039	63.012	0.030	1.312	0.039	1.706
128599	56.00	28.50	1.50	2.205	1.122	0.059	0.136	0.077	47.388	0.058	544	0.077	573
128600	56.00	28.50	2.00	2.205	1.122	0.079	0.142	0.063	63.154	0.047	920	0.063	1.116
131001	60.00	20.50	2.00	2.362	0.807	0.079	0.161	0.083	86.498	0.062	981	0.083	1.116
003158	60.00	20.50	2.50	2.362	0.807	0.098	0.159	0.061	108.086	0.046	1.279	0.061	1.608
131801	60.00	25.50	2.50	2.362	1.004	0.098	0.161	0.063	100.246	0.047	1.393	0.063	1.746
113193	60.00	30.50	2.50	2.362	1.201	0.098	0.157	0.059	90.736	0.044	1.408	0.059	1.778
138221	63.00	31.00	1.80	2.480	1.220	0.071	0.161	0.091	73.676	0.068	853	0.091	906
138503	63.00	31.00	2.50	2.480	1.220	0.098	0.163	0.065	102.270	0.049	1.394	0.065	1.741
144401	70.00	25.50	2.00	2.756	1.004	0.079	0.177	0.098	115.696	0.074	920	0.098	986
146250	70.00	30.50	2.50	2.756	1.201	0.098	0.185	0.087	135.068	0.065	1.496	0.087	1.779
153014	71.00	36.00	2.00	2.795	1.417	0.079	0.181	0.102	101.961	0.077	1.067	0.102	1.125
153110	71.00	36.00	2.50	2.795	1.417	0.098	0.177	0.079	127.403	0.059	1.394	0.079	1.690
159600	80.00	31.00	2.50	3.150	1.220	0.098	0.209	0.110	185.190	0.083	1.501	0.110	1.673
161220	80.00	41.00	2.25	3.150	1.614	0.089	0.205	0.116	144.592	0.087	1.371	0.116	1.441
169200	90.00	46.00	2.50	3.543	1.811	0.098	0.224	0.126	203.641	0.094	1.593	0.126	1.691

**Corrosion-resistant SCHNORR® disc springs, material 1.4568 (X7 CrNiAl 17-7)**

**Ø 31.5 - 90 mm**

Article number / Order reference	Ordering Dimensions								Weight per 1000 pieces [lbs.]	Spring deflection s and force F			
	D <sub>e</sub> [mm]	D <sub>i</sub> [mm]	t [mm]	D <sub>e</sub> [inch]	D <sub>i</sub> [inch]	t [inch]	l <sub>0</sub> [inch]	h <sub>0</sub> [inch]		at s = 0.75 h <sub>0</sub>		at s = h <sub>0</sub>	
									s [inch]	F [lbf]	s [inch]	F [lbf]	
084150	31.50	16.30	1.75	1.240	0.642	0.069	0.091	0.022	17.196	0.02	641	0.022	842
094210	35.50	18.30	2.00	1.398	0.720	0.079	0.104	0.026	25.133	0.02	889	0.026	1.167
103515	40.00	20.40	2.00	1.575	0.803	0.079	0.110	0.031	32.187	0.02	863	0.031	1.123
104295	40.00	20.40	2.25	1.575	0.803	0.089	0.116	0.028	36.156	0.02	1.066	0.028	1.399
110601	45.00	22.40	1.75	1.772	0.882	0.069	0.110	0.041	36.376	0.03	609	0.041	769
110870	45.00	22.40	2.50	1.772	0.882	0.098	0.130	0.031	51.809	0.02	1.302	0.031	1.709
120520	50.00	25.40	2.00	1.969	1.000	0.079	0.124	0.045	50.486	0.03	813	0.045	1.031
001889	50.00	25.40	2.50	1.969	1.000	0.098	0.138	0.039	63.052	0.03	1.346	0.039	1.751
120955	50.00	25.40	3.00	1.969	1.000	0.118	0.152	0.033	75.839	0.03	1.953	0.033	2.572
128656	56.00	28.50	2.00	2.205	1.122	0.079	0.134	0.055	63.273	0.04	809	0.055	1.002
129025	56.00	28.50	3.00	2.205	1.122	0.118	0.159	0.041	94.799	0.03	1.938	0.041	2.536
000637	63.00	31.00	2.50	2.480	1.220	0.098	0.156	0.057	102.294	0.04	1.239	0.057	1.570
153061	71.00	36.00	2.50	2.795	1.417	0.098	0.167	0.069	127.427	0.05	1.226	0.069	1.518
000136	80.00	41.00	3.00	3.150	1.614	0.118	0.193	0.075	192.684	0.06	1.800	0.075	2.258
001041	90.00	46.00	2.50	3.543	1.811	0.098	0.199	0.100	203.707	0.08	1.206	0.100	1.383

**Original SCHNORR® disc springs type „Z“, standard material**

**Ø 9.53 - 60.33 mm**

Article number / Order reference	Ordering Dimensions											Spring deflection s and force F			
	Bolt	Size	D <sub>e</sub> [mm]	D <sub>i</sub> [mm]	t [mm]	D <sub>e</sub> [inch]	D <sub>i</sub> [inch]	t [inch]	l <sub>0</sub> [inch]	h <sub>0</sub> [inch]	h <sub>0</sub> /t [inch]	at s = 0.75 h <sub>0</sub>		at s = h <sub>0</sub>	
			s [inch]	F [lbf]	s [inch]	F [lbf]									
248500	Z 1	3/16 "	9.53	4.96	0.40	0.375	0.195	0.016	0.028	0.012	0.762	0.009	52	0.012	64
248600	Z 2	1/4 "	12.70	6.55	0.50	0.500	0.258	0.020	0.035	0.016	0.813	0.012	76	0.016	93
248700	Z 3	1/4 "	12.70	6.55	0.60	0.500	0.258	0.024	0.039	0.016	0.677	0.012	128	0.016	160
249000	Z 6	5/16 "	19.05	8.13	0.70	0.750	0.320	0.028	0.051	0.024	0.871	0.018	129	0.024	155
249100	Z 7	5/16 "	19.05	8.13	0.80	0.750	0.320	0.031	0.055	0.024	0.762	0.018	189	0.024	231
248800	Z 4	3/8 "	17.46	9.70	0.60	0.687	0.382	0.024	0.043	0.02	0.847	0.015	93	0.020	112
248900	Z 5	3/8 "	17.46	9.70	0.70	0.687	0.382	0.028	0.047	0.02	0.726	0.015	144	0.020	177
249200	Z 8	3/8 "	19.05	9.70	0.80	0.750	0.382	0.031	0.053	0.022	0.699	0.017	185	0.022	230
249300	Z 9	3/8 "	19.05	9.70	0.90	0.750	0.382	0.035	0.057	0.022	0.621	0.017	260	0.022	327
249400	Z 10	7/16 "	25.40	11.30	0.90	1.000	0.445	0.035	0.067	0.031	0.875	0.023	211	0.031	251
249500	Z 11	7/16 "	25.40	11.30	1.00	1.000	0.445	0.039	0.071	0.031	0.787	0.023	284	0.031	344
249600	Z 12	7/16 "	25.40	11.30	1.25	1.000	0.445	0.049	0.075	0.026	0.528	0.020	426	0.026	545
249700	Z 12a	1/2 "	28.00	13.00	1.00	1.102	0.512	0.039	0.075	0.035	0.889	0.026	274	0.035	324
249800	Z 12b	1/2 "	28.00	13.00	1.25	1.102	0.512	0.049	0.083	0.033	0.671	0.025	481	0.033	598
249900	Z 12c	1/2 "	28.00	13.00	1.50	1.102	0.512	0.059	0.087	0.028	0.474	0.021	659	0.028	850
250000	Z 13	5/8 "	34.92	16.18	1.25	1.375	0.637	0.049	0.094	0.045	0.914	0.034	441	0.045	519
250100	Z 14	5/8 "	34.92	16.18	1.50	1.375	0.637	0.059	0.102	0.043	0.728	0.032	698	0.043	858
250200	Z 15	5/8 "	34.92	16.18	2.00	1.375	0.637	0.079	0.11	0.031	0.394	0.023	1138	0.031	1480
250300	Z 16	3/4 "	38.10	19.35	1.50	1.500	0.762	0.059	0.114	0.055	0.931	0.041	821	0.055	963
250400	Z 17	3/4 "	38.10	19.35	2.00	1.500	0.762	0.079	0.122	0.043	0.546	0.032	1409	0.043	1794
250500	Z 18	3/4 "	38.10	19.35	2.50	1.500	0.762	0.098	0.134	0.035	0.356	0.026	2194	0.035	2867
250600	Z 19	1 "	50.80	25.80	2.00	2.000	1.016	0.079	0.138	0.059	0.749	0.044	1123	0.059	1376
250700	Z 20	1 "	50.80	25.80	2.50	2.000	1.016	0.098	0.157	0.059	0.599	0.044	2129	0.059	2688
250800	Z 21	1 "	50.80	25.80	3.00	2.000	1.016	0.118	0.165	0.047	0.398	0.035	2856	0.047	3715
250900	Z 22	1 "	60.33	25.80	2.00	2.375	1.016	0.079	0.157	0.079	1.003	0.059	1041	0.079	1201
251000	Z 23	1 "	60.33	25.80	2.50	2.375	1.016	0.098	0.177	0.079	0.803	0.059	1935	0.079	2345
251100	Z 24	1 "	60.33	25.80	3.00	2.375	1.016	0.118	0.181	0.063	0.533	0.047	2539	0.063	3242

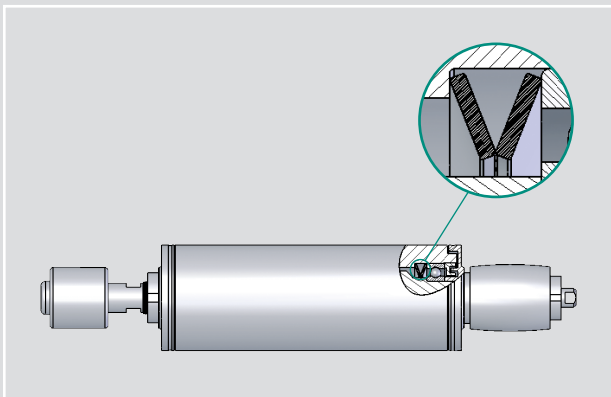
## Original SCHNORR® bearing preload spring

### The optimal supplement for ball bearings

Two problems continually occupy design engineers using bearings, the reduction in noise and the elimination of play in ball bearings. A solution of both these problems has been achieved by Schnorr working in close cooperation with well-known ball bearings manufacturers. The fitting of a special version of our disc springs effectively reduces both problems and frequently results in simpler designs.

### Fitting of bearing preload springs

The drawing illustrates how the outer ring of the ball bearing usually is correctly preloaded using a disc spring "K" series. Depending on the requirements of the design, one or more disc springs can be used. In some cases it is preferable to preload the inner ring of the bearing. That is why the bore holes of disc springs for ball bearings were chosen in such a way that they match the internal diameter of an other ball bearing size. That way, a disc spring suitable for pushing the external ring of the ball bearing 6302, for example, can also be used to pretension the inner rings of the ball bearings 6205 and 6305.



Bearing preload spring

### Key advantages speak for bearing preload springs

An important advantage of "K" disc springs is being round. That ensures an equal bearing surface when multiple discs are installed. As with standard disc springs, here it also applies that in alternating arrangement with the constant force the spring deflections add up, while in case of parallel layering (same laying in) with constant spring deflection the loads add up (see figure page 7). As all springs have a strongly digressive spring characteristic (great  $h_0/t$ ), the spring force continues to be almost constant over a large deflection range.

### Apart from the compensation for play, this brings the following advantages:

- The tolerance built up in the assembly can be accommodated without significant change in preload.
- Length variations due to heat impact are absorbed.
- Any subsequent axial movement of the assembly does not alter the preload significantly.





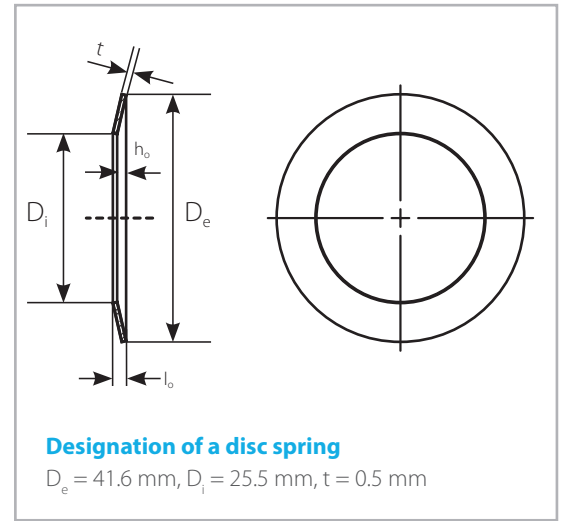
# Original SCHNORR® bearing preload springs type “K”, non-slotted

## How to order

When ordering “K” disc springs to preload the outer ring of the ball bearing please quote the ball bearing size or the article number. In all other cases, please give application details.

## Notes on the table

The “K” disc spring sizes listed in the following tables are our standard production and comply with ball bearing series EL, R, 62 and 63. The load and deflections given are at spring deflection of 75 % of the free height  $h_0$ . This is the recommended preload for installation of the “K” disc springs.



## Original SCHNORR® bearing preload springs type „K”, non-slotted Ø 9.8 - 99 mm

Article number / Order reference	Ordering Dimensions										Spring deflection s & force F		Weight per 1000 pieces [lb]	Ball bearing type		Ball bearing		
	$D_e$ [mm]	$D_i$ [mm]	t [mm]	$D_e$ [inch]	$D_i$ [inch]	t [inch]	$l_0$ [inch]	$h_0$ [inch]	$h_0/t$ [inch]	at $s = 0.75 h_0$		ext. dia [inch]		internal dia [inch]				
										s [inch]	F [lbf]							
241200	9.80	6.20	0.20	0.386	0.244	0.008	0.016	0.008	1.00	0.006	5.171	0.150	623 (EL3)		0.394	0.118		
241400	12.80	7.20	0.25	0.504	0.283	0.010	0.020	0.010	1.00	0.007	6.519	0.368	624 (EL4)		0.512	0.157		
241600	15.80	8.20	0.25	0.622	0.323	0.010	0.022	0.012	1.20	0.009	5.171	0.606	625 (EL5) 634 (R4)		0.630	0.197	0.157	
241700	18.80	9.20	0.30	0.740	0.362	0.012	0.026	0.014	1.17	0.010	6.969	1.074	626 (EL6) 635 (R5)		0.630	0.236	0.197	
241800	18.80	10.20	0.35	0.740	0.402	0.014	0.028	0.014	1.00	0.010	11.465	1.160	607 (EL7)		0.748	0.276		
241900	21.80	12.30	0.35	0.858	0.484	0.014	0.030	0.016	1.14	0.012	10.341	1.508	608 (EL8) 627 (R7)		0.866	0.315	0.276	
242100	23.70	14.30	0.40	0.933	0.563	0.016	0.035	0.020	1.25	0.015	18.210	1.900	609 (EL9)		0.945	0.354		
242200	25.70	14.30	0.40	1.012	0.563	0.016	0.035	0.020	1.25	0.015	14.163	2.436	6000 629 (R9)		1.024	0.394	0.354	
242300	27.70	17.30	0.40	1.091	0.681	0.016	0.039	0.024	1.50	0.018	17.985	2.496	6001		1.102	0.472		
242500	29.70	17.40	0.40	1.169	0.685	0.016	0.043	0.028	1.75	0.021	18.659	3.100	6200		1.181		0.394	
242600	31.70	20.40	0.40	1.248	0.803	0.016	0.043	0.028	1.75	0.021	18.210	3.135	6002 6201		1.260	0.591	0.472	
242800	34.60	20.40	0.40	1.362	0.803	0.016	0.043	0.028	1.75	0.021	13.713	4.176	6300		1.378			0.394
242900	34.60	22.40	0.50	1.362	0.882	0.020	0.047	0.028	1.40	0.021	26.527	4.636	6003 6202		1.378	0.669	0.591	
243000	36.60	20.40	0.50	1.441	0.803	0.020	0.051	0.031	1.60	0.024	24.729	6.184	6301		1.457			0.472
243100	39.60	25.50	0.50	1.559	1.004	0.020	0.051	0.031	1.60	0.024	24.729	6.135	6203		1.575		0.669	
243200	41.60	25.50	0.50	1.638	1.004	0.020	0.055	0.035	1.80	0.027	25.403	7.236	6004 6302		1.654	0.787		0.591
243300	46.50	30.50	0.60	1.831	1.201	0.024	0.059	0.035	1.50	0.027	34.396	9.890	6005 6204 6303		1.850	0.984	0.787	0.669
243400	51.50	35.50	0.60	2.028	1.398	0.024	0.059	0.035	1.50	0.027	30.349	11.153	6205 6304		2.047		0.984	0.787
243500	54.50	40.50	0.60	2.146	1.594	0.024	0.059	0.035	1.50	0.027	31.698	10.631	6006		2.165	1.181		
243600	61.50	40.50	0.70	2.421	1.594	0.028	0.071	0.043	1.57	0.032	39.566	20.108	6007 6206 6305		2.441	1.378	1.181	0.984
243700	67.50	50.50	0.70	2.657	1.988	0.028	0.067	0.039	1.43	0.030	36.194	18.750	6008		2.677	1.575		
243800	71.50	45.50	0.70	2.815	1.791	0.028	0.083	0.055	2.00	0.041	41.590	28.638	6306		2.835			1.181
243900	71.50	50.50	0.70	2.815	1.988	0.028	0.083	0.055	2.00	0.041	49.008	24.030	6207		2.835		1.378	
244000	74.50	55.50	0.80	2.933	2.185	0.031	0.075	0.043	1.38	0.032	47.435	26.433	6009		2.953	1.772		
244100	79.50	50.50	0.80	3.130	1.988	0.031	0.091	0.059	1.88	0.044	51.256	40.565	6307		3.150			1.378
244200	79.50	55.50	0.80	3.130	2.185	0.031	0.091	0.059	1.88	0.044	59.125	34.789	6010 6208		3.150	1.969	1.575	
244300	84.50	60.50	0.90	3.327	2.382	0.035	0.098	0.063	1.78	0.047	80.706	41.998	6209		3.346		1.772	
244400	89.50	60.50	0.90	3.524	2.382	0.035	0.098	0.063	1.78	0.047	64.745	52.602	6308		3.543			1.575
244500	89.50	65.50	0.90	3.524	2.579	0.035	0.098	0.063	1.78	0.047	75.311	44.886	6011 6210		3.543	2.165	1.969	
244600	94.50	75.50	1.00	3.720	2.972	0.039	0.087	0.047	1.20	0.035	73.063	43.144	6012		3.740	2.362		
244700	99.00	65.50	1.00	3.898	2.579	0.039	0.102	0.063	1.60	0.047	65.644	74.163	6309		3.937			1.772
244800	99.00	70.50	1.00	3.898	2.776	0.039	0.102	0.063	1.60	0.047	74.637	64.904	6013 6211		3.937	2.559	2.165	

## Original SCHNORR® bearing preload springs type „K“, non-slotted

Ø 109 - 358 mm

Article number / Order reference	Ordering Dimensions									Spring deflection s & force F		Weight	Ball bearing type			Ball bearing			
	D <sub>e</sub>	D <sub>i</sub>	t	D <sub>e</sub>	D <sub>i</sub>	t	l <sub>0</sub>	h <sub>0</sub>	h <sub>0</sub> /t	at s = 0.75 h <sub>0</sub>			per 1000 pieces			6310	ext. dia		internal dia
	[mm]	[mm]	[mm]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	s	F	[lb]					[inch]	[inch]	
244900	109.00	70.50	1.25	4.291	2.776	0.049	0.106	0.057	1.16	0.043	80.257	116.404			6310	4.331			1.969
245000	109.00	75.50	1.25	4.291	2.972	0.049	0.106	0.057	1.16	0.043	89.474	103.992	6014	6212		4.331	2.756	2.362	
245100	114.00	90.50	1.25	4.488	3.563	0.049	0.096	0.047	0.96	0.035	89.474	80.447	6015			4.528	2.953		
245200	119.00	75.50	1.25	4.685	2.972	0.049	0.110	0.061	1.24	0.046	71.939	142.661			6311	4.724			2.165
245300	119.00	85.50	1.25	4.685	3.366	0.049	0.110	0.061	1.24	0.046	88.350	115.258		6213		4.724		2.559	
245400	124.00	90.50	1.25	4.882	3.563	0.049	0.118	0.069	1.40	0.052	100.040	120.703	6016	6214		4.921	3.150	2.756	
245500	129.00	85.50	1.25	5.079	3.366	0.049	0.126	0.077	1.56	0.058	91.048	157.145			6312	5.118			2.362
245600	129.00	95.50	1.25	5.079	3.760	0.049	0.126	0.077	1.56	0.058	112.404	126.347	6017	6215		5.118	3.346	2.953	
245700	139.00	90.50	1.25	5.472	3.563	0.049	0.128	0.079	1.60	0.059	79.582	187.635			6313	5.512			2.559
245800	139.00	101.00	1.25	5.472	3.976	0.049	0.128	0.079	1.60	0.059	96.443	153.397	6018	6216		5.512	3.543	3.150	
245900	149.00	95.50	1.50	5.866	3.760	0.059	0.126	0.067	1.13	0.050	85.203	264.775			6314	5.906			2.756
246000	149.00	106.00	1.50	5.866	4.173	0.059	0.126	0.067	1.13	0.050	101.164	221.564	6020	6217		5.906	3.937	3.346	
246100	159.00	101.00	1.50	6.260	3.976	0.059	0.138	0.079	1.33	0.059	92.621	305.340			6315	6.299			2.953
246200	159.00	111.00	1.50	6.260	4.370	0.059	0.138	0.079	1.33	0.059	107.234	262.129	6021	6218		6.299	4.134	3.543	
246300	169.00	111.00	1.50	6.654	4.370	0.059	0.150	0.091	1.53	0.068	105.660	328.929			6316	6.693			3.150
246400	169.00	121.00	1.50	6.654	4.764	0.059	0.150	0.091	1.53	0.068	122.746	281.530	6022	6219		6.693	4.331	3.740	
246500	179.00	121.00	2.00	7.047	4.764	0.079	0.165	0.087	1.10	0.065	194.235	469.805			6317	7.087			3.740
246600	179.00	126.00	2.00	7.047	4.961	0.079	0.165	0.087	1.10	0.065	208.623	436.074	6024	6220		7.087	4.724	3.937	
246700	189.00	121.00	2.00	7.441	4.764	0.079	0.169	0.091	1.15	0.068	170.630	569.453			6318	7.480			3.543
246800	189.00	131.00	2.00	7.441	5.157	0.079	0.169	0.091	1.15	0.068	192.886	500.669		6221		7.480		4.134	
246900	198.00	131.00	2.00	7.795	5.157	0.079	0.177	0.098	1.25	0.074	182.545	595.247			6319	7.874			3.740
247000	198.00	141.00	2.00	7.795	5.551	0.079	0.177	0.098	1.25	0.074	207.499	521.172	6026	6222		7.874	5.118	4.331	
247100	213.00	151.00	2.25	8.386	5.945	0.089	0.177	0.089	1.00	0.066	211.545	685.416		6224	6320	8.465		4.724	3.937
247200	223.00	161.00	2.25	8.780	6.339	0.089	0.181	0.093	1.04	0.069	211.770	723.115	6030		6321	8.858	5.906		4.134
247300	228.00	161.00	2.25	8.976	6.339	0.089	0.195	0.106	1.20	0.080	232.902	791.900		6226		9.055		5.118	
247400	238.00	161.00	2.25	9.370	6.339	0.089	0.207	0.118	1.33	0.089	229.530	934.318	6032		6322	9.449	6.299		4.331
247500	248.00	171.00	2.50	9.764	6.732	0.098	0.197	0.098	1.00	0.074	225.933	1.090.185		6228		9.843		5.512	
247600	258.00	171.00	2.50	10.157	6.732	0.098	0.217	0.118	1.20	0.089	248.639	1.261.484	6034		6324	10.236	6.693		4.724
247700	268.00	181.00	2.50	10.551	7.126	0.098	0.224	0.126	1.28	0.094	259.654	1.319.906		6230		10.630		5.906	
247800	278.00	181.00	2.50	10.945	7.126	0.098	0.236	0.138	1.40	0.103	259.654	1.505.094	6036		6326	11.024	7.087		5.118
247900	288.00	191.00	2.75	11.339	7.520	0.108	0.226	0.118	1.09	0.089	257.406	1.727.761	6038	6232		11.417	7.480	6.299	
248000	298.00	191.00	2.75	11.732	7.520	0.108	0.250	0.142	1.31	0.106	293.825	1.946.679			6328	11.811			5.512
248100	308.00	202.00	3.00	12.126	7.953	0.118	0.240	0.122	1.03	0.092	292.252	2.194.038	6040	6234		12.205	7.874	6.693	
248200	318.00	212.00	3.00	12.520	8.346	0.118	0.244	0.126	1.07	0.094	292.701	2.279.577		6236	6330	12.598		7.087	5.906
248300	338.00	232.00	3.00	13.307	9.134	0.118	0.260	0.142	1.20	0.106	318.105	2.451.537	6044	6238	6332	13.386	8.661	7.480	6.299
248400	358.00	242.00	3.00	14.094	9.528	0.118	0.276	0.157	1.33	0.118	320.128	2.824.118	6048	6240	6334	14.173	9.449	7.874	6.693

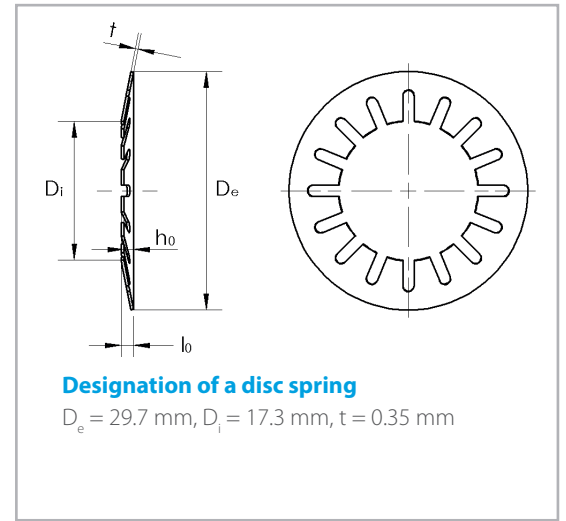
## Original SCHNORR® bearing preload springs type "K", with slots

### How to order

When ordering these sizes to preload the outer ring of the bearing, please quote the bearing size and the suffix "slotted" or the article number. In all other cases, please give application details.

### Slotted version

This special design generates very small loads and accommodates large deflections.



## Original SCHNORR® bearing preload springs type „K“ slotted

Ø 9.8 - 94.5 mm

Article number / Order reference	Ordering Dimensions									Spring deflection s & force F		Weight per 1000 pieces [lb]	Ball bearing type			Ball bearing		
	$D_e$ [mm]	$D_i$ [mm]	t [mm]	$D_e$ [inch]	$D_i$ [inch]	t [inch]	$l_0$ [inch]	$h_0$ [inch]	$h_0/t$ [inch]	s [inch]	F [lbf]		ext. dia [inch]	internal dia [inch]				
241150	9.80	6.20	0.15	0.386	0.244	0.006	0.024	0.018	1.00	0.014	2.923	0.110	623(EL3)			39.370	0.118	
241350	12.80	7.20	0.20	0.504	0.283	0.008	0.026	0.018	0.92	0.014	4.047	0.287	624(EL4)			51.181	0.157	
241650	15.80	8.20	0.25	0.622	0.323	0.010	0.030	0.020	0.74	0.016	4.496	0.617	625(EL5)	634(R4)		62.992	0.197	0.157
241675	18.80	9.20	0.25	0.740	0.362	0.010	0.039	0.030	0.97	0.022	4.496	0.970	626(EL)	635(R5)		62.992	0.236	0.197
241750	18.80	10.20	0.25	0.740	0.402	0.010	0.041	0.031	1.15	0.024	5.395	0.705	607(EL7)			74.803	0.276	
241850	21.80	12.30	0.25	0.858	0.484	0.010	0.049	0.039	1.47	0.030	5.395	0.926	608(EL8)	627(R7)		86.614	0.315	0.276
242050	23.70	14.30	0.30	0.933	0.563	0.012	0.051	0.039	1.21	0.030	5.620	1.455	609(EL9)			94.488	0.354	
242150	25.70	14.30	0.30	1.012	0.563	0.012	0.055	0.043	1.19	0.031	6.295	1.543	6000	629(R9)		102.362	0.394	0.354
242250	27.70	17.30	0.35	1.091	0.681	0.014	0.057	0.043	1.03	0.031	6.969	2.169	6001			110.236	0.472	
242450	29.70	17.30	0.35	1.169	0.681	0.014	0.061	0.047	1.30	0.035	7.194	2.646		6200		118.110		0.394
242550	31.70	20.40	0.35	1.248	0.803	0.014	0.061	0.047	1.30	0.035	7.419	2.800	6002	6201		125.984	0.591	0.472
242750	34.60	20.40	0.40	1.362	0.803	0.016	0.065	0.049	1.10	0.039	7.194	3.638			6300	137.795		0.394
242850	34.60	22.40	0.35	1.362	0.882	0.014	0.061	0.047	1.18	0.035	7.194	3.307	6003	6202		137.795	0.669	0.591
242950	36.60	20.40	0.40	1.441	0.803	0.016	0.075	0.059	1.44	0.043	7.868	5.027			6301	145.669		0.472
243050	39.60	25.50	0.40	1.559	1.004	0.016	0.075	0.059	1.22	0.043	8.318	4.233		6203		157.480		0.669
243150	41.60	25.50	0.45	1.638	1.004	0.018	0.081	0.063	1.13	0.047	8.768	5.512	6004		6302	165.354	0.787	0.591
243250	46.50	30.50	0.45	1.831	1.201	0.018	0.081	0.063	1.11	0.047	9.892	6.261	6005	6204	6303	185.039	0.984	0.787
243350	51.50	35.50	0.45	2.028	1.398	0.018	0.083	0.065	1.26	0.049	10.566	6.768		6205	6304	204.724		0.984
243450	54.50	40.50	0.45	2.146	1.594	0.018	0.085	0.067	1.75	0.051	11.915	7.055	6006			216.535	1.181	
243550	61.50	40.50	0.55	2.421	1.594	0.022	0.100	0.079	1.21	0.059	12.140	13.338	6007	6206	6305	244.094	1.378	1.181
243650	67.50	50.50	0.55	2.657	1.988	0.022	0.102	0.081	1.36	0.063	17.535	12.125	6008			267.717	1.575	
243750	71.50	45.50	0.60	2.815	1.791	0.024	0.114	0.091	1.47	0.067	16.636	21.164			6306	283.465		1.181
243850	71.50	50.50	0.60	2.815	1.988	0.024	0.114	0.091	1.83	0.067	28.551	18.078		6207		283.465	1.378	
243950	74.50	55.50	0.60	2.933	2.185	0.024	0.114	0.091	1.31	0.067	20.458	16.711	6009			295.276	1.772	
244125	79.50	50.50	0.70	3.130	1.988	0.028	0.122	0.094	1.36	0.071	18.659	35.847			6307	314.961		1.378
244150	79.50	55.50	0.70	3.130	2.185	0.028	0.114	0.087	1.51	0.065	28.551	31.967	6010	6208		314.961	1.969	1.575
244250	84.50	60.50	0.75	3.327	2.382	0.030	0.124	0.094	0.87	0.071	17.535	28.660		6209		334.646		1.772
244350	89.50	60.50	0.80	3.524	2.382	0.031	0.130	0.098	1.08	0.075	23.380	39.904			6308	354.331		1.575
244450	89.50	65.50	0.80	3.524	2.579	0.031	0.134	0.102	1.35	0.077	42.489	35.274	6011	6210		354.331	2.165	1.969
244550	94.50	75.50	0.80	3.720	2.972	0.031	0.136	0.104	1.39	0.079	46.311	29.321	6012			374.016	2.362	

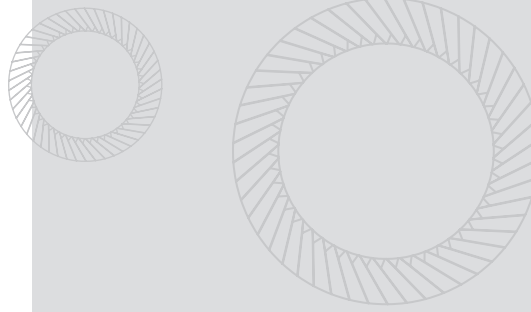
# References

## Original SCHNORR® safety washers.

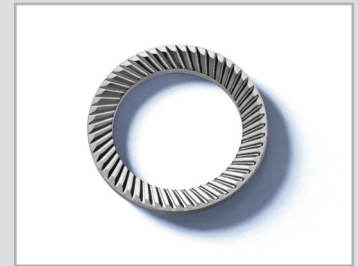
The original SCHNORR® safety washers were developed as a reliable and economic bolt locking device with the basic principle of a disc spring. This ingenious form combines the advantage of security through friction and mechanical locking.

Original SCHNORR® safety washers are now used world wide where secure fastening connections to counter the effect of vibration are required.

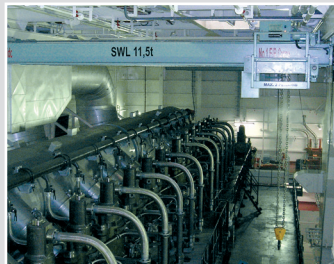
Applications are manifold, from automotive engineering to machine, aggregate and plant engineering. SCHNORR® safety washers are used, for example, in mowing machines, textile machines, machine tools and a lot of other applications..



Mowing machine



Safety washer



Heavy-duty crane



Safety washer



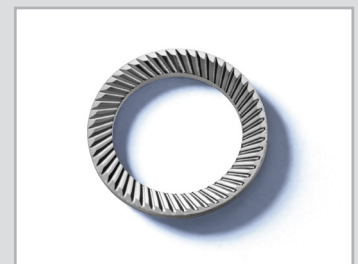
Motorbike



Safety washer



Photovoltaics



Safety washer

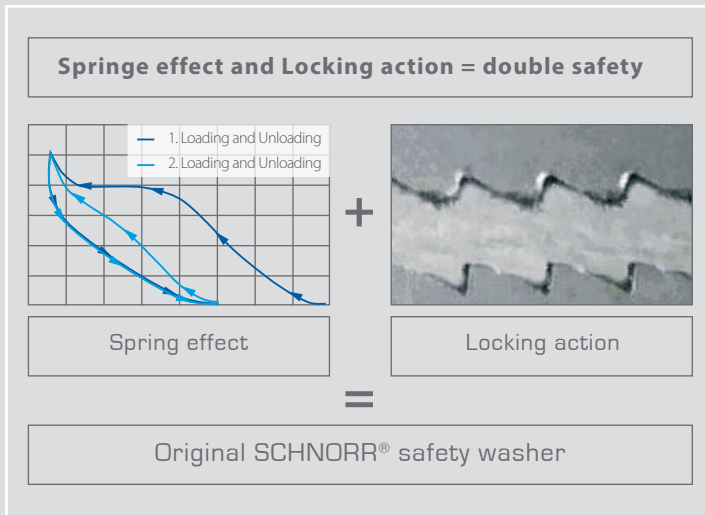
The original SCHNORR® safety washers are in the form of a disc spring but with a trapezoidal cross-section and serrations on both sides. The outer diameter is matched to the head diameter of the pan head and socket head cap screws.

SCHNORR® safety washers are available in two versions:

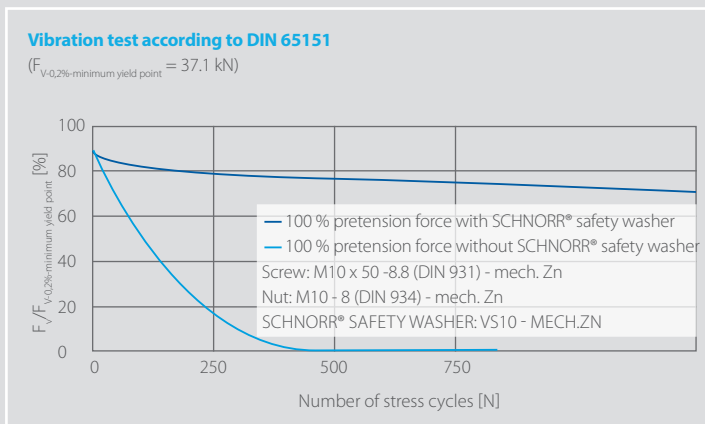
The standard safety washer type "S" is available for screws of sizes M1.6 to M36 and of the property classes up to 8.8.

For screws of property classes 8.8 and 10.9, higher pretension forces might be necessary. These are covered by our reinforced washers type "VS".

Due to the conical form, optimal traction is achieved at highest positive locking due to the helical gearing.



### Vibration test according to DIN 65151



Extensive test series carried out at independent public material research laboratories prove that the original SCHNORR® safety washer brings about a clear improvement of the safety properties

### Conclusions

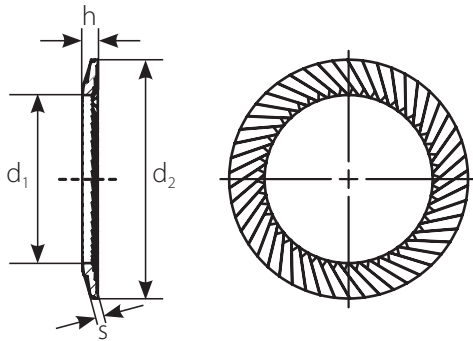
- Connections secured using a SCHNORR® safety washer maintains the pretension force also after 1,500 cycles.
- An unsecured screw connection has lost its pretension already after less than 500 cycles.

## Die original SCHNORR® safety washer

### Offer the following advantages:

- ① High resistance to vibration due to positive locking of the serrations..
- ② Concentrical force transmission and uniform axial load eliminate bending torques and deformation of the bolt stem..
- ③ The design of the serrations prevents friction and damage to components when tightening.
- ④ Extremely high safety against loss of pretension force and loosening.
- ⑤ Wide variety for materials and different finishes.
- ⑥ The closed ring form results in high degree of pretensioning, while avoiding burst-open effect.
- ⑦ Development and design of the washers take place on the basis of the screw geometrics, tightening torque as well as the constructive circumstances..





**Sketch of an original SCHNORR® safety washer type „S“:**

Size 8 made of spring steel = safety washer S 8 FSt.

## Original SCHNORR® safety washer type „S“

The Original SCHNORR® safety washer „S“ is suitable for normal requirements and available for bolt sizes from M 1.6 to M 36 in grades up to 8.8. Please enquire should you require an item with different dimensions, material or surface treatment.

### Explanations on the table:

<b>Article-no.:</b>	applies to the normal version made of spring steel, hardened, blackened; mechanically plate
<b>h max.:</b>	maximum dimension as delivered
<b>h min.:</b>	minimum dimension after load test
<b>Available material gra.:</b>	spring steel acc. to DIN EN 10132-4; corrosion-resistant steel 1.4301; Phosphorus Bronze CuSn8; nickel cobalt alloy; creep-resistant steel 1.4122; Inconel
<b>Surface treatments:</b>	blackened (standard), bronzed, phosphated, zinc-coated, zinc lamellar coatings

## Original SCHNORR safety washers type „S“, material 1.1211 (C60S)

Article-number/ Order reference	Finish	Size		Ordering dimensions							Packaging		
		NM [mm]	[Inch]	d <sub>1</sub> [mm]	d <sub>2</sub> [mm]	s [mm]	d <sub>1</sub> [inch]	d <sub>2</sub> [inch]	s [inch]	h <sub>min.</sub> [mm]	h <sub>max.</sub> [mm]	Unit [pcs.]	Weight per 1000 pieces [lbs.]
402300 450000	blackened Gal.Zn8 + passivation	1.6		1.7	3.2	0.35	0.067	0.126	0.014	0.016	0.024	2000	0.029
404400 450100	blackened Gal.Zn8 + passivation	2		2.2	4	0.35	0.087	0.157	0.014	0.016	0.024	2000	0.046
406800 450200	blackened Gal.Zn8 + passivation	2.5		2.7	4.8	0.45	0.106	0.189	0.018	0.020	0.035	2000	0.086
409400 450300	blackened Gal.Zn8 + passivation	3	1/8"	3.2	5.5	0.45	0.126	0.217	0.018	0.020	0.035	2000	0.108
411200 450400	blackened Gal.Zn8 + passivation	3.5		3.7	6	0.5	0.146	0.236	0.020	0.022	0.035	2000	0.121
412700 450500	blackened Zn8M + passivation	4	5/32"	4.3	7	0.5	0.169	0.276	0.020	0.022	0.039	1000	0.187
414500 450600	blackened Zn8M + passivation	5	3/16"	5.3	9	0.6	0.209	0.354	0.024	0.024	0.043	1000	0.368
416300 450700	blackened Zn8M + passivation	6		6.4	10	0.6	0.252	0.394	0.024	0.028	0.047	1000	0.441
418100 450800	blackened Zn8M + passivation	6.35	1/4"	6.7	9.5	0.6	0.264	0.374	0.024	0.026	0.047	1000	0.331
419200 450900	blackened Zn8M + passivation	7		7.4	12	0.7	0.291	0.472	0.028	0.031	0.051	1000	0.783
420400 451000	blackened Zn8M + passivation	8	5/16"	8.4	13	0.7	0.331	0.512	0.028	0.035	0.055	1000	0.864
423000 451100	blackened Zn8M + passivation	10	3/8"	10.5	16	0.9	0.413	0.630	0.035	0.043	0.063	1000	1.653
425100 451200	blackened Zn8M + passivation	11.1	7/16"	11.6	15.9	0.9	0.457	0.626	0.035	0.041	0.063	500	1.312
426200 451300	blackened Zn8M + passivation	12		13	18	1	0.512	0.709	0.039	0.045	0.067	500	1.938
427900 451400	blackened Zn8M + passivation	12.7	1/2"	13.7	19	1	0.539	0.748	0.039	0.049	0.071	500	2.152
429100 451500	blackened Zn8M + passivation	14		15	22	1.1	0.591	0.866	0.043	0.053	0.079	500	3.618



### Original SCHNORR safety washers type „S“, material 1.1211 (C60S)

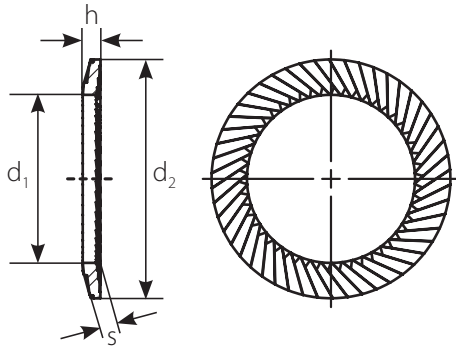
Article-number/ Order reference	Finish	Size		Ordering dimensions							Packaging		
		NM [mm]	[Inch]	d <sub>1</sub> [mm]	d <sub>2</sub> [mm]	s [mm]	d <sub>1</sub> [inch]	d <sub>2</sub> [inch]	s [inch]	h <sub>min.</sub> [mm]	h <sub>max.</sub> [mm]	Unit [pcs.]	Weight per 1000 pieces [lbs.]
430700 451600	blackened Gal.Zn8 + passivation	16	5/8"	17	24	1.2	0.669	0.945	0.047	0.061	0.083	500	4.374
432400 451700	blackened Gal.Zn8 + passivation	18		19	27	1.4	0.748	1.063	0.055	0.069	0.091	250	6.548
433800 451800	blackened Gal.Zn8 + passivation	19	3/4"	20	30	1.4	0.787	1.181	0.055	0.075	0.098	250	9.039
435100 451900	blackened Gal.Zn8 + passivation	20		21	30	1.4	0.827	1.181	0.055	0.073	0.098	250	8.250
436600 452000	blackened Gal.Zn8 + passivation	22	7/8"	23	33	1.4	0.906	1.299	0.055	0.077	0.106	100	9.936
437900 452100	blackened Zn8M + passivation	24		25.6	36	1.6	1.008	1.417	0.063	0.085	0.114	100	13.029
439200 452200	blackened Zn8M + passivation	25.4	1"	27	38	1.8	1.063	1.496	0.071	0.093	0.122	100	16.422
440300 452300	blackened Zn8M + passivation	27		28.6	39	1.8	1.126	1.535	0.071	0.093	0.122	100	16.246
441500 452400	blackened Zn8M + passivation	30	1 1/8"	31.6	45	1.8	1.244	1.772	0.071	0.102	0.142	100	23.766
442730 452500	blackened Zn8M + passivation	36	1 3/8"	38	54	2.5	1.496	2.126	0.098	0.126	0.165	50	46.914

We would be glad to offer you safety washers type "S" with different size finish on request.

Our surfaces are Cr 6-free and comply with the EU "Old Car" (2000/53/EG) RoHS-(2002/95/CE) Directive as well as the WEEE Directive (2002/96/EC)

### Original SCHNORR® safety washers type „S“, material 1.4301 (X5CrNi18.10)

Article-number/ Order reference	Size		Ordering dimensions							Packaging		
	NM [mm]	[Inch]	d <sub>1</sub> [mm]	d <sub>2</sub> [mm]	s [mm]	d <sub>1</sub> [inch]	d <sub>2</sub> [inch]	s [inch]	h <sub>min.</sub> [mm]	h <sub>max.</sub> [mm]	Unit [pcs.]	Weight per 1000 pieces [lbs.]
403221	1.6		1.7	3.2	0.5	0.067	0.126	0.020	0.022	0.030	1000	0.042
405420	2		2.2	4	0.5	0.087	0.157	0.020	0.022	0.030	2000	0.064
407660	2.5		2.7	4.8	0.5	0.106	0.189	0.020	0.022	0.037	2000	0.093
410750	3	1/8"	3.2	5.5	0.5	0.126	0.217	0.020	0.022	0.037	2000	0.093
412500	3.5		3.7	6	0.7	0.146	0.236	0.028	0.030	0.045	2000	0.185
414200	4	5/32"	4.3	7	0.7	0.169	0.276	0.028	0.030	0.047	1000	0.179
416100	5	3/16"	5.3	9	0.7	0.209	0.354	0.028	0.030	0.047	1000	0.461
417900	6		6.4	10	0.7	0.252	0.394	0.028	0.030	0.047	1000	0.425
418104	6.35	1/4"	6.7	9.5	0.7	0.264	0.374	0.028	0.030	0.047	1000	0.379
422700	8	5/16"	8.4	13	1	0.331	0.512	0.039	0.047	0.063	1000	1.228
424900	10	3/8"	10.5	16	1	0.413	0.630	0.039	0.043	0.063	1000	1.612
425110	11.1	7/16"	11.6	15.9	1.3	0.457	0.626	0.051	0.051	0.073	1000	1.819
427600	12		13	18	1.3	0.512	0.709	0.051	0.051	0.073	500	2.423
428950	12.7	1/2"	13.7	19	1.3	0.539	0.748	0.051	0.055	0.077	500	2.694
430500	14		15	22	1.5	0.591	0.866	0.059	0.065	0.091	500	4.947
432200	16	5/8"	17	24	1.5	0.669	0.945	0.059	0.069	0.091	500	5.483
433650	18		19	27	1.8	0.748	1.063	0.071	0.081	0.102	250	8.472
433821	19	3/4"	20	30	1.8	0.787	1.181	0.071	0.087	0.102	250	11.671
436400	20		21	30	1.8	0.827	1.181	0.071	0.085	0.110	250	8.649
437810	22	7/8"	23	33	1.8	0.906	1.299	0.071	0.091	0.118	100	12.992
439091	24		25.6	36	2	1.008	1.417	0.079	0.093	0.122	100	16.552
439170	25.4	1"	27	38	2.5	1.063	1.496	0.098	0.112	0.142	100	23.166
441410	27		28.6	39	2.5	1.126	1.535	0.098	0.112	0.142	100	22.708
442711	30	1 1/8"	31.6	45	2.5	1.244	1.772	0.098	0.122	0.161	100	33.477
442790	36	1 3/8"	38	54	3	1.496	2.126	0.118	0.146	0.185	50	57.801



**Designation of an original SCHNORR® safety washer type „VS“:**  
 Size 16 made of spring steel, surface mechanically plated  
 = safety washer VS 16 FSt. for 8 M + passivation

## Original SCHNORR® safety washers type „VS“

The Original SCHNORR® Safety Washer “VS” can be used with high-strength bolts of the grade 10.9 without any restrictions. This very strong safety washer has a greater thickness for higher pre-tensioning loads. The outside and inside diameters as well as the serrations are the same as the “S” type. It can be delivered for screws M 5 to M 30. Special sizes, materials and surfaces are also available upon request.

### Explanations on the table:

<b>Article-no.:</b>	applies to the normal version made of spring steel, hardened, blackened; mechanically plated
<b>h max.:</b>	maximum dimension in delivery condition
<b>h min.:</b>	minimum dimension after load test
<b>Available material grad.:</b>	spring steel acc. to DIN EN 10132-4; corrosion-resistant steel 1.4301; Phosphorus Bronze CuSn8; nickel cobalt alloy, creep-resistant steel 1.4122; Inconel
<b>Available surfaces:</b>	blackened (standard), bronzed, phosphated, zinc-coated, zinc lamellar coatings

## Original SCHNORR® safety washers type “VS” material 1.1211 (C60S)

Article-number/ Order reference	Finish	Size		Ordering dimensions							Packaging		
		NM [mm]	[Inch]	d <sub>1</sub> [mm]	d <sub>2</sub> [mm]	s [mm]	d <sub>1</sub> [Inch]	d <sub>2</sub> [Inch]	s [Inch]	h <sub>min.</sub> [mm]	h <sub>max.</sub> [mm]	Unit [pcs.]	Weight per 1000 pieces [lbs.]
414600	blackened	5	3/16"	5.3	9	0.9	0.209	0.354	0.035	0.037	0.051	1000	0.602
450650	Zn8M + passivation												
416400	blackened	6		6.4	10	0.9	0.252	0.394	0.035	0.037	0.055	1000	0.661
450750	Zn8M + passivation												
420500	blackened	8	5/16"	8.4	13	1.1	0.331	0.512	0.043	0.045	0.067	1000	1.356
451050	Zn8M + passivation												
423100	blackened	10	3/8"	10.5	16	1.4	0.413	0.630	0.055	0.059	0.079	1000	2.573
451150	Zn8M + passivation												
426300	blackened	12		13	18	1.4	0.512	0.709	0.055	0.061	0.083	500	2.696
451350	Zn8M + passivation												
429200	blackened	14		15	22	1.4	0.591	0.866	0.055	0.065	0.087	500	4.605
451550	Zn8M + passivation												
430800	blackened	16	5/8"	17	24	1.9	0.669	0.945	0.075	0.081	0.102	250	6.927
451650	Zn8M + passivation												
432500	blackened	18		19	27	1.9	0.748	1.063	0.075	0.085	0.106	250	8.909
451750	Zn8M + passivation												
435300	blackened	20		21	30	1.9	0.827	1.181	0.075	0.083	0.110	250	11.169
451950	Zn8M + passivation												
436700	blackened	22	7/8"	23	33	1.9	0.906	1.299	0.075	0.091	0.118	100	13.486
452050	Zn8M + passivation												
438000	blackened	24		25.6	36	2.4	1.008	1.417	0.094	0.106	0.134	100	19.544
452150	Zn8M + passivation												
400974	blackened	25.4	1"	27	38	2.4	1.063	1.496	0.094	0.116	0.134	100	23.325
401260	Zn8M + passivation												
440400	blackened	27		28.6	39	2.4	1.126	1.535	0.094	0.110	0.138	100	21.453
452350	Zn8M + passivation												
441600	blackened	30	1 1/8"	31.6	45	2.4	1.244	1.772	0.094	0.120	0.150	100	31.702
452450	Zn8M + passivation												
442801	blackened	36	1 3/8"	38	54	3	1.496	2.126	0.118	0.148	0.177	50	60.023
401051	Zn8M + passivation												

We would be glad to offer you safety washers type „VS“ with different finish on request.

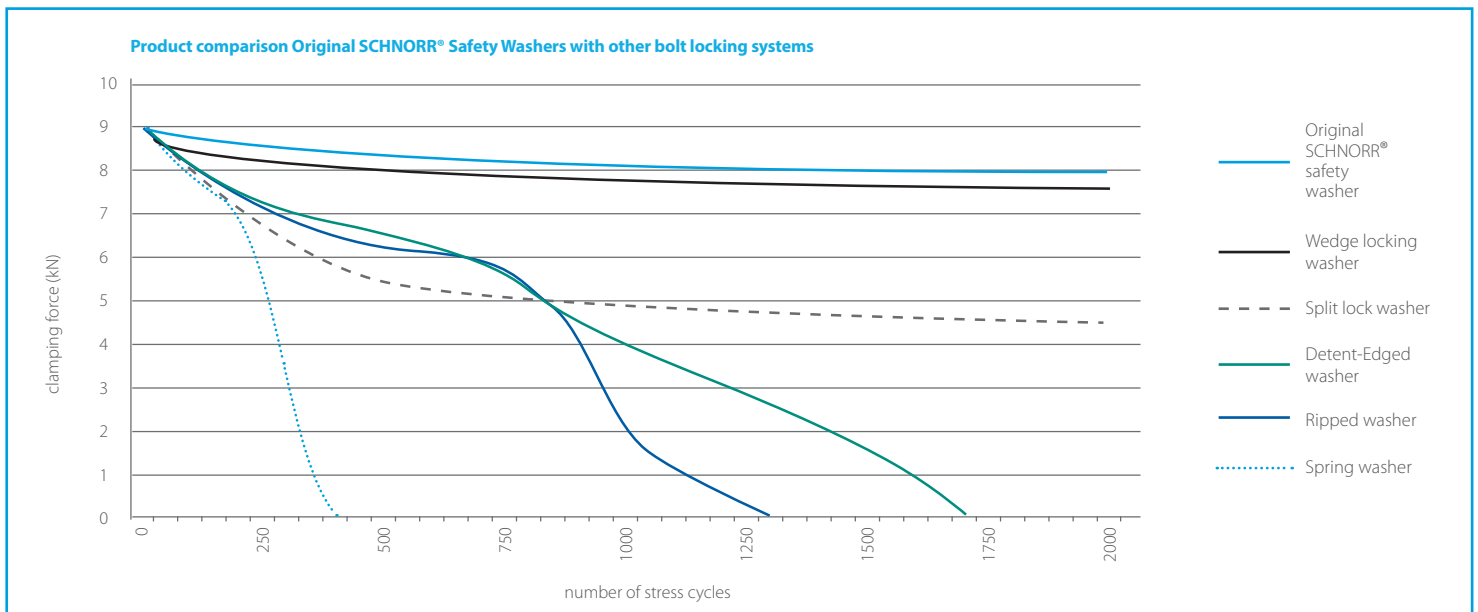
Our surfaces are Cr 6-free and comply with the EU „Old Car“ (2000/53/EG) RoHS-(2002/95/CE) Directive as well as the WEEE Directive (2002/96/EC)

## Original SCHNORR® safety washers type „VS“, material 1.4301 (X5CrNi18.10)

Article-number/ Order reference	Size		Ordering dimensions								Packaging	
	NM [mm]	[Inch]	d <sub>1</sub> [mm]	d <sub>2</sub> [mm]	s [mm]	d <sub>1</sub> [inch]	d <sub>2</sub> [inch]	s [inch]	h <sub>min</sub> [mm]	h <sub>max</sub> [mm]	Unit [pcs.]	Weight per 1000 pieces [lbs.]
416201	5	3/16"	5.3	9	1	0.209	0.354	0.039	0.041	0.051	1000	0.657
418001	6		6.4	10	1	0.252	0.394	0.039	0.043	0.055	1000	0.728
422901	8	5/16"	8.4	13	1.5	0.331	0.512	0.059	0.063	0.079	1000	1.843
425020	10	3/8"	10.5	16	1.8	0.413	0.630	0.071	0.075	0.091	1000	3.309
427700	12		13	18	1.8	0.512	0.709	0.071	0.075	0.094	500	3.816
430660	14		15	22	1.8	0.591	0.866	0.071	0.077	0.098	500	5.937
430750	16	5/8"	17	24	2.5	0.669	0.945	0.098	0.102	0.122	250	9.138
433621	18		19	27	2.5	0.748	1.063	0.098	0.104	0.126	250	11.766
435250	20		21	30	2.5	0.827	1.181	0.098	0.106	0.130	250	14.791
436721	22		23	33	2.5	0.906	1.299	0.098	0.106	0.134	100	18.043
438021	24		25.6	36	3	1.008	1.417	0.118	0.126	0.154	100	24.828
441420	27		28.6	39	3	1.126	1.535	0.118	0.130	0.157	100	27.249
441621	30	1 1/8"	31.6	45	3	1.244	1.772	0.118	0.140	0.169	100	40.173

We would be glad to offer you safety washers type „VS“ with different finish on request.

### Vibration test according to DIN 65151



## Tightening torques for Original SCHNORR® Safety Washers

### Table is valid for

- Shank bolts with metric standard thread acc. to DIN ISO 262
- Head dimensions of hexagonal bolts acc. to DIN EN ISO 4014 to 4018
- Hexalobular external driving head bolts acc. to DIN 34800
- Cylindrical bolts acc. to DIN EN ISO 4762 and hole "medium" acc. to DIN EN 20273"

To reach the same initial force when using a SCHNORR safety washer type "S" (blackened), the initial torque has to be higher (+10%) than for a bolt without a securing device (see table)

The same applies to SCHNORR safety washers type "VS".

For more detailed information concerning assembly preload and tightening torque please see also VDI 2230.

Nominal size	Tightening torque (Nm)	
	Strength grade	
	8.8	10.9
M 4	3.6	5.3
M 5	7.2	10.5
M 6	12.4	18.2
M 7	20.6	30.3
M 8	30.0	44.1
M 10	59.4	86.9
M 12	102.3	150.7
M 14	162.8	239.8
M 16	253.0	371.8
M 18	361.9	515.9
M 20	510.4	727.1
M 22	697.4	994.4
M 24	877.8	1249.6
M 27	1293.6	1841.4
M 30	1756.7	2501.4
M 33	2377.1	3385.8
M 36	3055.8	4352.7

## Original SCHNORR® load washers acc. to DIN 6796

These SCHNORR® load washers have been specially developed for high-strength bolts of grades 8.8 - 10.9. This represents the most powerful form of safety washer in the form of a disc spring. The load of the washers have been matched to these bolts and are 70 to 90% of the bolt load in the flat state.

These load washers conform to DIN 6796, edition Oct. 1987, and are designed for high demands on the protection of bolt joints. As a highly progressive load increase occurs at the end of the spring deflection when the load washer is flattened the load has been indicated as double the calculated value. Tests have shown that these values are comparable with the measured values.

For the protection of bolted joints only that load is available which remains after the load washer has initially set.

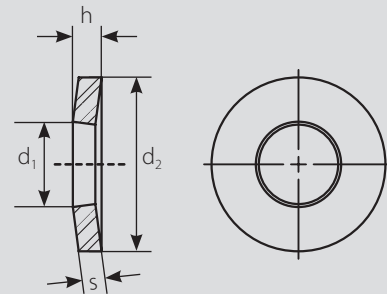
The table indicates the respective minimum height after the initial loading of the washer. Thus the maximum loss of height due to setting is limited.

### Particular advantages of the SCHNORR® load washer:

- ① High axial load
- ② Optimum compensation for setting in the joint
- ③ Reduction of the dynamic loading of the screw.
- ④ Uniform concentric loading and high safety through a high degree of spring action
- ⑤ Suitable for captive fitting on a wide range of bolts (combi bolts)

### Explanations on the table:

<b>Technical requirements:</b>	according to DIN 267, Part 26
<b>Available material grad.:</b>	spring steel acc. to DIN EN 10132-4, other materials on request
<b>Available surfaces:</b>	hardened, blank and oiled; mechanically plated; other materials on request
<b>Article-no.:</b>	applies to the normal version made of spring steel
<b>h max.:</b>	maximum dimension in delivery condition
<b>h min.:</b>	minimum dimension after setting test according to DIN 267, Part 26
<b>Contact force:</b>	contact forces for the setting test according to DIN 267, Part 26
<b>Min. residual spring load:</b>	spring load, which rests after load with the contact pressure acc. to DIN 267, Part 26 and subsequent relieving of 20 µm



### Designation of an original SCHNORR® load washer DIN 6796:

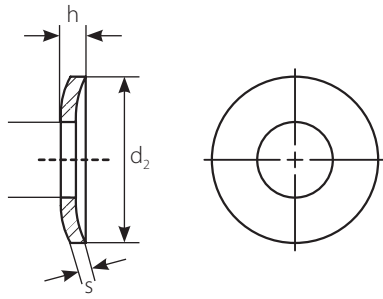
Size 8 made of spring steel  
= load washer DIN 6796-8 FSt.

**Original SCHNORR® load washers acc. to DIN 6796, material 1.1211 (C60S)**

Article-number/ Order reference	Finish	Size	Ordering dimensions					Contact Force		Minimum residual spring load		Packaging		
			NM [mm]	d <sub>1</sub> [mm]	d <sub>2</sub> [mm]	s [mm]	d <sub>1</sub> [inch]	d <sub>2</sub> [inch]	s [inch]	h <sub>min.</sub> [mm]	h <sub>max.</sub> [mm]	F [lbf.]	F [lbf.]	Unit [pcs.]
<b>700000</b> <b>702110</b>	blank. oiled Zn12M + passivation	2	2.2	5	0.4	0.087	0.197	0.016	0.020	0.024	*	*	10000	0.110
<b>700100</b> <b>702120</b>	blank. oiled Zn12M + passivation	2.5	2.7	6	0.5	0.106	0.236	0.020	0.024	0.028	*	*	10000	0.196
<b>700200</b> <b>702130</b>	blank. oiled Zn12M + passivation	3	3.2	7	0.6	0.126	0.276	0.024	0.028	0.033	*	*	10000	0.315
<b>700300</b> <b>702140</b>	blank. oiled Zn12M + passivation	3.5	3.7	8	0.8	0.146	0.315	0.031	0.036	0.042	*	*	10000	0.547
<b>700400</b> <b>702150</b>	blank. oiled Zn12M + passivation	4	4.3	9	1	0.169	0.354	0.039	0.044	0.051	989	315	5000	0.849
<b>700500</b> <b>702160</b>	blank. oiled Zn12M + passivation	5	5.3	11	1.2	0.209	0.433	0.047	0.053	0.061	1,619	517	2500	1.515
<b>700600</b> <b>702170</b>	blank. oiled Zn12M + passivation	6	6.4	14	1.5	0.252	0.551	0.059	0.067	0.079	2,293	944	2500	3.161
<b>700700</b> <b>702180</b>	blank. oiled Zn12M + passivation	7	7.4	17	1.75	0.291	0.669	0.069	0.079	0.091	3,327	1,394	1000	5.571
<b>700800</b> <b>702190</b>	blank. oiled Zn12M + passivation	8	8.4	18	2	0.331	0.709	0.079	0.088	0.102	4,181	1,731	1000	6.598
<b>700900</b> <b>702200</b>	blank. oiled Zn12M + passivation	10	10.5	23	2.5	0.413	0.906	0.098	0.110	0.126	6,654	2,788	250	13.671
<b>701000</b> <b>702210</b>	blank. oiled Zn12M + passivation	12	13	29	3	0.512	1.142	0.118	0.135	0.156	9,667	4,047	250	26.566
<b>701100</b> <b>702220</b>	blank. oiled Zn12M + passivation	14	15	35	3.5	0.591	1.378	0.138	0.159	0.183	13,286	5,620	100	47.576
<b>701200</b> <b>702230</b>	blank. oiled Zn12M + passivation	16	17	39	4	0.669	1.535	0.157	0.180	0.207	18,187	7,644	100	65.279
<b>701300</b> <b>702240</b>	blank. oiled Zn12M + passivation	18	19	42	4.5	0.748	1.654	0.177	0.200	0.228	22,931	12,814	100	83.621
<b>701400</b> <b>702250</b>	blank. oiled Zn12M + passivation	20	21	45	5	0.827	1.772	0.197	0.220	0.252	29,225	16,411	50	105.006
<b>701500</b> <b>702260</b>	blank. oiled Zn12M + passivation	22	23	49	5.5	0.906	1.929	0.217	0.242	0.278	36,419	20,458	25	136.775
<b>701600</b> <b>702270</b>	blank. oiled Zn12M + passivation	24	25	56	6	0.984	2.205	0.236	0.267	0.305	42,264	27,427	20	200.356
<b>701700</b> <b>702280</b>	blank. oiled Zn12M + passivation	27	28	60	6.5	1.102	2.362	0.256	0.287	0.329	55,303	36,194	20	243.611
<b>701800</b> <b>702290</b>	blank. oiled Zn12M + passivation	30	31	70	7	1.220	2.756	0.276	0.315	0.362	67,443	44,063	-	367.951

We would be glad to offer you safety washers type „VS“ with different finish on request.

Our surfaces are Cr 6-free and comply with the EU „Old Car“ (2000/53/EG) RoHS-(2002/95/CE) Directive as well as the WEEE Directive (2002/96/EC)



### Description of an original SCHNORR® HS-Washer:

Size 12 made of spring steel:  
= Safety Washer HS 12 FSt.  
phosphated and oiled

## The original SCHNORR® HS-Washer

This bolt locking device is, in principle, a load washer with a smaller outer diameter than those acc. to DIN 6796. A notable feature of these washers is the slightly curved form which provides a progressively increasing characteristic curve. Despite the smaller outside diameter dimensions this makes it possible to achieve the same load as the load washers acc. to DIN 6796. These washers are primarily used when the space available is insufficient for standardised load washers.

### Explanations on the table:

<b>Technical requirements:</b>	according to DIN 267, Part 26
<b>Available material grades:</b>	spring steel acc. to DIN EN 10132-4, other materials on request
<b>Available surfaces:</b>	phosphated and oiled; mechanically plated, other materials on request
<b>Article no.:</b>	applies to the normal version made of spring steel
<b>h max.:</b>	maximum dimension in delivery condition
<b>h min.:</b>	minimum dimension after setting test according to DIN 267, Part 26
<b>Contact force:</b>	contact forces for the setting test according to DIN 267, Part 26
<b>Minimum residual spring load :</b>	spring load, which rests after load with the contact pressure acc. to DIN 267, Part 26 and subsequent relieving of 20 µm.

### Original SCHNORR® HS-Washers, material 1.1211 (C60S)

Article-number/ Order reference	Finish	Size	Ordering dimensions								Contact Force	Minimum residual spring load	Packaging	
			d <sub>1</sub> [mm]	d <sub>2</sub> [mm]	s [mm]	d <sub>1</sub> [inch]	d <sub>2</sub> [inch]	s [inch]	h <sub>min.</sub> [mm]	h <sub>max.</sub> [mm]			Unit [pcs.]	Weight per 1000 pieces [lbs.]
<b>416320</b> <b>431510</b>	Phosphated and oiled Zn20M + passivation	6	6.4	12	1.5	0.252	0.472	0.059	0.065	0.075	2,293	944	1000	2.079
<b>416520</b> <b>431520</b>	Phosphated and oiled Zn20M + passivation	8	8.4	17	2	0.331	0.669	0.079	0.087	0.100	4,181	1,731	500	5.375
<b>423220</b> <b>431530</b>	Phosphated and oiled Zn20M + passivation	10	10.5	21	2.5	0.413	0.827	0.098	0.108	0.124	6,654	2,788	250	10.836
<b>426400</b> <b>431540</b>	Phosphated and oiled Zn20M + passivation	12	13	24	3	0.512	0.945	0.118	0.129	0.148	9,667	4,047	250	15.860
<b>429320</b> <b>431550</b>	Phosphated and oiled Zn20M + passivation	14	15	28	3.5	0.591	1.102	0.138	0.150	0.171	13,286	5,620	100	25.596
<b>430900</b> <b>431560</b>	Phosphated and oiled Zn20M + passivation	16	17	30	4	0.669	1.181	0.157	0.170	0.195	18,187	7,644	100	31.967
<b>433750</b> <b>431570</b>	Phosphated and oiled Zn20M + passivation	18	19	33	4.5	0.748	1.299	0.177	0.189	0.217	22,931	12,814	100	42.681
<b>435320</b> <b>431580</b>	Phosphated and oiled Zn20M + passivation	20	21	36	5	0.827	1.417	0.197	0.209	0.234	29,225	16,411	50	55.843
<b>436620</b> <b>431590</b>	Phosphated and oiled Zn20M + passivation	22	23	40	5.5	0.906	1.575	0.217	0.232	0.264	36,419	20,458	50	77.316
<b>439150</b> <b>431600</b>	Phosphated and oiled Zn20M + passivation	24	25	45	6	0.984	1.772	0.236	0.254	0.287	42,264	27,427	25	110.848
<b>440100</b> <b>431610</b>	Phosphated and oiled Zn20M + passivation	27	28	50	6.5	1.102	1.969	0.256	0.276	0.315	55,303	36,194	20	147.577
<b>442650</b> <b>431620</b>	Phosphated and oiled Zn20M + passivation	30	31	58	7	1.220	2.283	0.276	0.301	0.350	67,443	44,063	-	222.667

We would be glad to offer you HS-Washers with different finish on request.



## Materials

### Standard materials

- **C60S (1.1211):**

This spring steel is a quality steel according to DIN EN 10132-4. We use this spring steel exclusively for our original SCHNORR® safety washers and load washers according to DIN 6796.

- **C67S (1.1231) und C75S (1.1248):**

These spring steel grades according to DIN EN 10132-4 are used as cold rolled strip for disc springs of group 1 according to DIN EN 16983 (previously DIN 2093) up to a thickness of  $t < 1.25$  mm and for our disc springs of the "K" series.

- **51CrV4 (1.8159):**

This chromium-vanadium alloyed spring steel is used in rolled condition (according to DIN 10132-4 or acc. to DIN 10089) for disc springs with a thickness between 1.25 mm to 6 mm. Normally this stainless steel is processed in forged form for disk thicknesses of more than 6 mm.

### Materials for special requirements

Corrosive, high temperature and other aggressive environments require the use of materials. These materials, in general, have lower tensile strength than standard materials and should only be specified if absolutely necessary. These springs have a lower overall height than comparable sizes made of standard materials, resulting in lower spring force. This must be taken into consideration when using these materials.

### Corrosion-resistant materials

- **X10 CrNi 18-8 (1.4310):**

This chromium-nickel alloyed steel according to DIN EN 10151 is the most commonly used material for disc springs up to a thickness of  $t = 3.0$  mm. Unfortunately, the cold forming process makes it magnetic.

- **X7 CrNiAl 17-7 (1.4568):**

This steel alloy according to DIN EN 10151 is a precipitation-hardened spring steel which is processed in cold-strained condition up to a thickness of approx. 2.5 mm. The cold forming process makes this material magnetic.

### High-temperature materials

- **X22 CrMoV 12-1 (1.4923):**

This chromium-molybdenum-vanadium steel according to DIN EN 10269 that can be quenched and tempered has proved very well for the use of heat-resistant disc springs.

Please bear in mind that both steel grades mentioned are not considered as corrosion-resistant steel grades.

### Anti-magnetic and corrosion-resistant materials

- **CuSn 8 (2.1030):**

Tin bronze according to DIN EN 1654 is an alloy consisting of copper and tin, maintaining its spring characteristics due to cold forming. Please bear in mind that the strength values and the spring forces resulting from it are considerably lower than with the standard material.

- **CuBe 2 (2.1247):**

Copper-beryllium according to DIN EN 1654 is an excellent spring material grade which is suitable for extremely low temperatures up to the vicinity of the absolute zero point.

These copper alloys are absolutely anti-magnetic, and they have a very good electric conductivity. Furthermore they show a high corrosion resistance against many media.

### Heat-resistant special materials with a very good corrosion resistance

Due to their composition, these nickel-base alloys show an excellent resistance against a lot of media. Unfortunately, they are expensive and often hard to procure. As these material grades are often used under extreme operational conditions, a potential creeping under load might lead to a loss of installation height/loss of force of the disc spring. This creeping is a function of temperature, time and tension. A disc spring can be used at higher temperatures, for example, when either a low load is chosen or the exposure time is accordingly short. Thus a maximum working temperature cannot be stated. The values stated in the material grade overview table can therefore serve as a guiding value only.

- **NiCr 20 Co 18 Ti (NIMONIC 90) (2.4632):**

This nickel-cobalt alloy shows very good high temperature strength characteristics and can be used for higher temperatures with corresponding dimensioning.

- **NiCr 15 Fe 7 TiAl (INCONEL X 750) (2.4669) und NiCr 19 NbMo (INCONEL 718) (2.4668):**

These nickel-chromium alloys are virtually cobalt-free and for this reason they are often used in nuclear reactor technology.

Furthermore, we process special material grades within the SCHNORR® plant which are not listed in detail here. In case of any queries in terms of special material grades, please contact our engineering department.

## Materials – synoptic table

Material no.	Short name	Standard / AISI ASTM	Physical and mechanical properties			
			Young's modulus in kN/mm <sup>2</sup> at RT	Working Temperature C°	Thickness range in mm	Tensile strength in N/mm <sup>2</sup>
<b>Steel grades for normal operating demands</b>						
<b>Standard material grades</b>						
1.1248	C 75S	DIN EN 10132-4	206	-20...+100	0.1...1.5	1320...1870
1.8159	51 CrV 4	DIN EN 10132-4	206	-50...+200	0.3...80	1400...2000
<b>Special material grades for particular operating demands</b>						
<b>Corrosion-resistant steel grades</b>						
1.4310	X 10 CrNi 18-8	DIN EN 10151	190	-200...+200	0.2...2.5	1100...1500
1.4568	X 7 CrNiAl 17-7	DIN EN 10151	195	-200...+300	0.2...4.0	1100...1800
<b>Heat-resistant steel grades</b>						
1.4923	X 22 CrMoV 12-1	DIN EN 10269	216	-50...+500	1.5...20	1200...1400
1.4122	X 39 CrMo 17-1	DIN EN 10088-1	215	-50...+400	0.3...6.0	1200...1400
<b>Copper alloys</b>						
2.1030	CuSn 8	DIN EN 1654	115	-50...+100	0.1...6.0	590...690
2.1247	CuBe 2	DIN EN 1654	135	-260...+200	0.1...2.5	1270...1450
<b>Nickel and cobalt alloys</b>						
2.4632 / 2.4969	NiCr 20 Co 18 Ti (Nimonic 90)	HEV6/5829C (AMS)	220	-200...+700	up to 6.35	≥1100
2.4668	NiCr 19 NbMo (Inconel 718)	5596J (AMS)	199	-200...+600	up to 6.35	≥1240

# Surfaces

## Surface protection

Disc springs are used in many applications where corrosive media is common. When used in outdoor areas, the spring steel is attacked by condensation, rain, river and sea water.

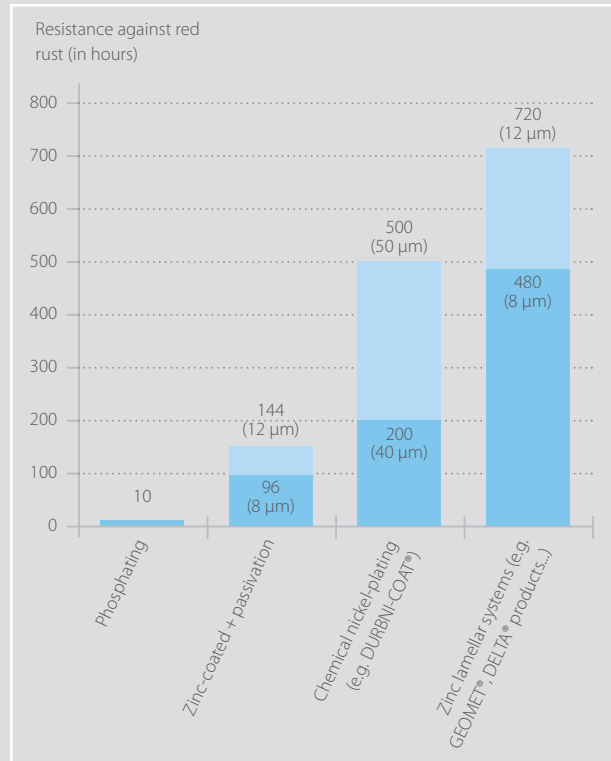
Further applications can be found in automotive building, the food industry, household appliances (e.g. washing machine), bridge building, the aerospace industry etc.

Besides watery or chloride-containing solutions, acids and leaches in various concentrations get in contact with the disc springs here.

In those cases the standard spring steels do not provide sufficient protection and need specific surface treatment to have suitable protection for the working environments.

The criteria given in the following tables are intended to help you find the surface protection best suited for your applications.

## Surfaces in the salt spray test according to DIN EN ISO 9227

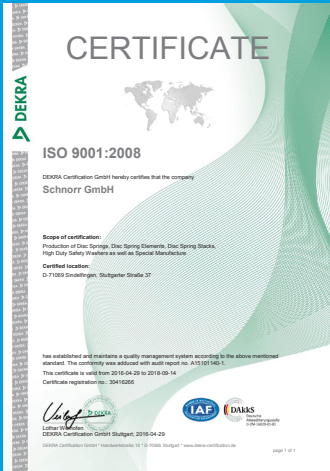


Surface systems**	Layer thickness (µm)	Dimensions (in mm)	Salt spray test DIN 9227 in hours*		Temperature resistance (°C)*	Sea water use	Equal coating	Resistance to atmospheric corrosion	Resistance according to VDA 621-421	Frictional coefficients, adjustable	Domestic standards	Foreign standards	
<b>Phosphating</b>	8 - 10	De < 600	10	RT	-	+	-	-	N		DIN EN 12476	DIN EN 12476	BOSCH, MIL, DBL
<b>Zinc-coated + passivation</b>	8 - 12	Ø 10-125 problematic: < Ø 10 and very thin disc springs	96 - 144	150	-	-	o	o	J		DIN EN ISO 12683, DIN 50961	ASTM B 695-04, DIN EN ISO 12683	
<b>Chemical nickel-plating</b>	40 - 50	De < 1000	200 - 500	155	-	+	o	o	J		DIN EN ISO 4527	DIN EN ISO 4527	
<b>Zinc lamellar systems</b>	8 - 10	De < 1000 problematic: < Ø 10 and very thin disc springs	480 - 720	250 - 300	+	+	+	+	J		DIN EN ISO 10683	DIN EN ISO 10683, ASTM F 1136, MIL, DIN EN 13858	All common automotive standards VDA 235-104

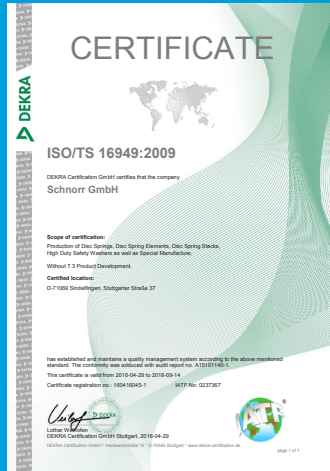
good (+); medium (o); poor (-)

\* In case of extreme demands on resistance, we offer the relevant corrosion-resistant material grades.

\*\* We would be glad to offer you further surfaces on request. Please contact our engineering department.



certified according to  
ISO 9001-2008



certified according to  
ISO/TS 16949:2009



certified according to  
ISO 50001:2011



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DISC SPRING ENGINEERING