



SCHNORR®

SPECIALIST MANUFACTURER OF DISC SPRINGS

ISO/TS 16949: 2002 certified

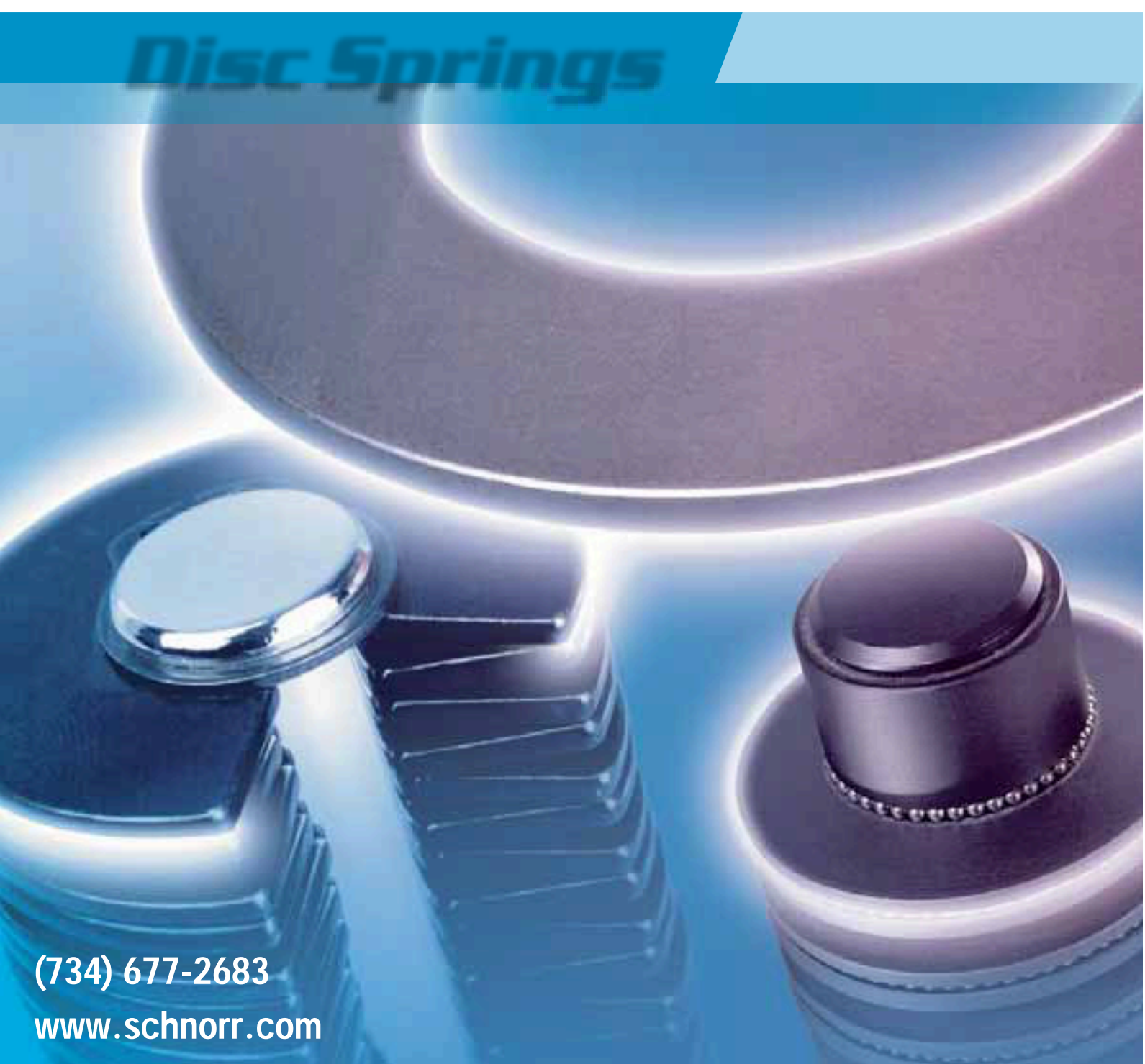
Safety Washers & Heavy Duty Safety Washers

Inch Edition

Disc Springs

(734) 677-2683

www.schnorr.com

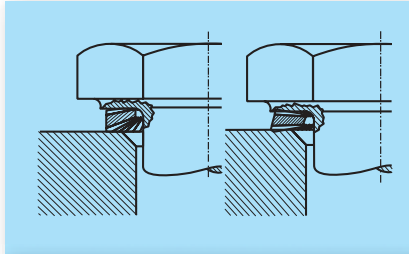


SCHNORR® Bolting Series Washers

- Original SCHNORR® Safety Washers: S and VS series
- Heavy Duty Safety Washers DIN 6796: HDS series
- High Load Safety Washers: HS series



Original SCHNORR® Safety Washers



Bolt with SCHNORR® Safety Washer loose and tightened

Very often our disc springs are considered for use as safety washers for bolted connections to maintain a preload and prevent loosening. High quality disc springs are too expensive for this application and the sizes of normal disc springs do not match screw and bolt sizes. We have therefore developed special safety elements for this application.

These safety washers are in the form of a disc spring which is serrated on both sides and of trapezoidal cross section. Their diameters are matched to screw dimensions. The outer diameter of the washer is matched to the head diameter of pan-head and hexagon socket head cap screws. As a result, the safety washer can be used with practically any screw and bolt type, including those with recessed heads. The only exception are countersunk screws.

The ingenious form of the Original SCHNORR® Safety Washer combines the advantages of security through friction and mechanical locking. They offer the following advantages to the designer:

1. The shape of the cross section ensures the locking effect is at the outside diameter which ensures the greatest resistance to loosening.
2. High resistance to vibration due to positive locking of the serrations.

3. The closed ring form results in a high degree of pretensioning, i.e. an excellent frictional connection.
4. Concentric application of force eliminates bending in the bolts.
5. Sliding surfaces allow tightening without damaging the surfaces.
6. No splitting during tightening with proper transitional radius between bolt shaft and bolt head.
7. Suitable for captive fitting on a wide range of bolts (combi bolts for which a range with special dimensions is available).
8. Universal application minimises stocks.
9. SCHNORR® Safety Washers can be supplied in a variety of materials and different finishes.

The Original SCHNORR® Safety Washer is available in two series:

The "S" series is suitable for normal duty and available for screws of size M1.6 to M36. The reinforced safety washer of the "VS" series is thicker, and therefore achieves higher pretensioning loads. The inner and outer diameters are the same as for the "S" series. These washers are available for screws M 5 to M 30.

The Original SCHNORR® Safety Washer is protected by patents at home and abroad.

The term "safety washer" is used to describe a washer element in the form of a disc spring which achieves its locking effect solely by means of the frictional connection. These are intended to compensate for loosening of the screwed connection, e.g. due to setting, by maintaining a sufficiently high pretension in the connection with spring force. They are therefore especially suitable for primarily axially loaded, short bolts.

SCHNORR® HDS Washers offer the following advantages:

1. High axial load
2. Optimum compensation for setting in the joint
3. Reduction of the dynamic loading of the screw due to higher elasticity of the joint
4. Uniform concentric loading eliminates bending in the bolt
5. Greater safety with high degree of spring action
6. Suitable for captive fitting on a wide range of bolts (combi bolts)

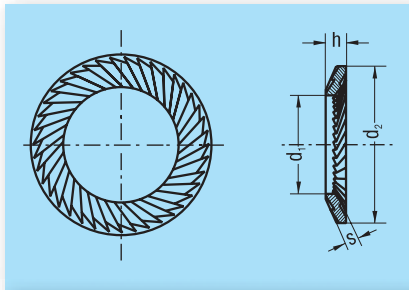
These high loads naturally require large cross-sections, which is why the outside diameter of the load washer is considerably larger than that of our Original SCHNORR® Safety Washer. As a result, the area required for a design with load washers cannot be ignored.

As a highly progressive load increase occurs at the end of the spring deflection when the washer is flattened, the load has been indicated as double the calculated value in the following table. Tests have shown that these values are comparable with the measured values.

For the security of the bolted connection, only the force is available which is still present after a full compression of the load washer and the related setting. Therefore, the table indicates the minimum height after the loading test. This limits the height loss caused by setting.

The load washers contained in the table conform to DIN 6796, Edition October 1987 "Conical spring washers for bolted connections." The test specifications are laid down in DIN 267 Part 26 "Fasteners; technical specifications for elements made of spring steel for bolted connections."

Original SCHNORR® Safety Washers type "S"



Original SCHNORR® Safety Washers type "S"

The "S" series is suitable for normal duty and available for screws of size M1.6 to M36.

Available materials:

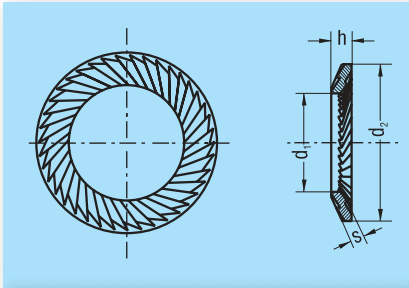
Carbon steel SAE 1060
Stainless steel
Phosphor bronze

Available finishes:

phosphated (Standard) – in stock
zinc-plated clear (ZC) – in stock
zinc-plated yellow (ZY) – in stock
stainless steel – in stock

Order Reference	Bolt Size		d ₁ mm	d ₂ mm	s mm	h		d ₁ inch	d ₂ inch	s inch	h		Packaging [pieces per box]
	metric mm	imperial inch				max. mm	min. mm				max. inch	min. inch	
S 1.6	1,6		1,7	3,2	0,35	0,6	0,38	.067	.126	.014	.024	.015	2000
S 2	2		2,2	4	0,35	0,6	0,39	.087	.157	.014	.024	.015	2000
S 2.5	2,5		2,7	4,8	0,45	0,9	0,49	.106	.189	.018	.035	.019	2000
S 3	3	1/8"	3,2	5,5	0,45	0,9	0,51	.126	.217	.018	.035	.020	2000
S 3.5	3,5		3,7	6	0,45	0,9	0,52	.146	.236	.018	.035	.020	2000
S 4	4	5/32"	4,3	7	0,5	1	0,59	.169	.276	.020	.039	.023	1000
S 5	5	3/16"	5,3	9	0,6	1,1	0,73	.209	.354	.024	.043	.029	1000
S 6	6		6,4	10	0,7	1,2	0,82	.252	.394	.028	.047	.032	1000
S 6.35	6,35	1/4"	6,7	9,5	0,7	1,2	0,79	.264	.374	.028	.047	.031	1000
S 7	7		7,4	12	0,7	1,3	0,89	.291	.472	.028	.051	.035	1000
S 8	8	5/16"	8,4	13	0,8	1,4	0,98	.331	.512	.031	.055	.039	1000
S 10	10	3/8"	10,5	16	1	1,6	1,21	.413	.630	.039	.063	.048	1000
S 11.1	11,1	7/16"	11,6	15,9	1	1,6	1,18	.457	.626	.039	.063	.046	500
S 12	12		13	18	1,1	1,7	1,31	.512	.709	.043	.067	.052	500
S 12.7	12,7	1/2"	13,7	19	1,1	1,8	1,33	.539	.748	.043	.071	.052	500
S 14	14	9/16"	15	22	1,2	2	1,52	.591	.866	.047	.079	.060	500
S 16	16	5/8"	17	24	1,3	2,1	1,63	.669	.945	.051	.083	.064	500
S 18	18		19	27	1,5	2,3	1,85	.748	1.063	.059	.091	.073	250
S 19	19	3/4"	20	30	1,5	2,5	1,98	.787	1.181	.059	.098	.078	250
S 20	20		21	30	1,5	2,5	1,94	.827	1.181	.059	.098	.076	250
S 22	22	7/8"	23	33	1,5	2,7	2,08	.906	1.299	.059	.106	.082	100
S 24	24		25,6	36	1,8	2,9	2,32	1.008	1.417	.071	.114	.091	100
S 25.4	25,4	1"	27	38	2	3,1	2,52	1.063	1.299	.079	.122	.099	100
S 27	27		28,6	39	2	3,1	2,52	1.126	1.535	.079	.122	.099	100
S 30	30	1 1/8"	31,6	45	2	3,6	2,78	1.244	1.772	.079	.142	.109	100
S 33	33	1 1/4"	34,6	50	2,5	4,0	3,26	1.362	1.969	.098	.157	.128	100
S 36	36	1 3/8"	38	54	2,5	4,2	3,38	1.496	2.126	.098	.165	.133	50

Original SCHNORR® Safety Washers "VS"



Original SCHNORR® Safety Washers type "VS"

The reinforced safety washer of the "VS" series is thicker, and therefore achieves higher pretensioning loads. The inner and outer diameters are the same as for the "S" series. These washers are available for screws M 5 to M 36.

Available materials:

- Carbon steel SAE 1060
- Stainless steel
- Phosphor bronze

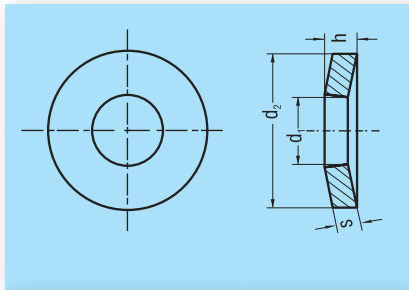
Available finishes:

- phosphated (Standard) – in stock
- zinc-plated clear (ZC) – in stock
- zinc-plated yellow (ZY) – in stock
- stainless steel – in stock

Order Reference	Bolt Size		d ₁ mm	d ₂ mm	s mm	h		d ₁ inch	d ₂ inch	s inch	h		Packaging [pieces per box]
	metric mm	imperial inch				max. mm	min. mm				max. inch	min. inch	
VS 5	5	3/16"	5,3	9	1	1,3	1,07	.209	.354	.039	.051	.042	1000
VS 6	6		6,4	10	1	1,4	1,08	.252	.394	.039	.055	.043	1000
VS 8	8	5/16"	8,4	13	1,2	1,7	1,32	.331	.512	.047	.067	.052	1000
VS 10	10	3/8"	10,5	16	1,5	2	1,64	.413	.630	.059	.079	.065	1000
VS 12	12		13	18	1,5	2,1	1,65	.512	.709	.059	.083	.065	500
VS 14	14	9/16"	15	22	1,5	2,2	1,76	.591	.866	.059	.087	.069	500
VS 16	16	5/8"	17	24	2	2,6	2,21	.669	.945	.079	.102	.087	250
VS 18	18		19	27	2	2,7	2,27	.748	1.063	.079	.106	.089	250
VS 20	20		21	30	2	2,8	2,34	.827	1.181	.079	.110	.092	250
VS 22	22	7/8"	23	33	2	3,0	2,42	.906	1.299	.079	.118	.095	100
VS 24	24		25,6	36	2,5	3,4	2,87	1.008	1.417	.098	.134	.113	100
VS 25.4	25,4	1"	27	38	2,5	3,4	2,95	1.063	1.496	.098	.134	.116	100
VS 27	27		28,6	39	2,5	3,5	2,91	1.126	1.535	.098	.138	.115	100
VS 30	30	1 1/8"	31,6	45	2,5	3,8	3,12	1.244	1.772	.098	.150	.123	100
VS 33	33	1 1/4"	34,6	50	3,0	4,5	3,65	1.362	1.969	.098	.157	.128	100
VS 36	36	1 3/8"	38	54	3,0	4,5	3,72	1.496	2.126	.098	.157	.146	50



SCHNORR® HDS Load Washers as per DIN 6796



HDS Load Washer

These load washers have been specifically developed for high-strength bolts in the strength classes 8.8–10.9 as per DIN ISO 898 Part 1 (SAE Grade 5). The loads of the washers have been matched to these bolts and are 70 to 90% of the bolt load in the flat state.

Available materials:

Carbon steel SAE 1060

Stainless steel 17-7 PH

Available finishes:

phosphated (Standard)

zinc-plated clear (ZC)

zinc-plated yellow (ZY)

– in stock

– in stock

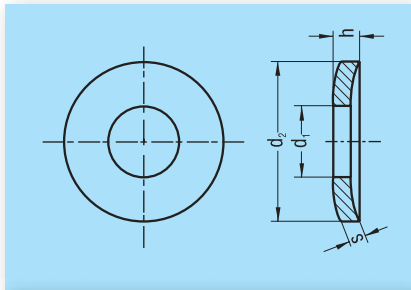
– in stock

Order Reference	Bolt Size		d ₁ mm	d ₂ mm	s mm	h		d ₁ inch	d ₂ inch	s inch	h		Steel Flat Load lbs
	metric mm	imperial inch				max. mm	min. mm				max. inch	min. inch	
HDS 2	2		2,2	5	0,4	0,6	0,5	.087	.197	.016	.024	.020	141
HDS 2.5	2,5		2,7	6	0,5	0,72	0,61	.106	.236	.020	.028	.024	213
HDS 3	3	1/8"	3,2	7	0,6	0,85	0,72	.126	.276	.024	.033	.028	297
HDS 3.5	3,5		3,7	8	0,8	1,06	0,92	.146	.315	.031	.042	.036	542
HDS 4	4	5/32"	4,3	9	1	1,3	1,12	.169	.354	.039	.051	.044	848
HDS 5	5	3/16"	5,3	11	1,2	1,55	1,35	.209	.433	.047	.061	.053	1232
HDS 6	6	1/4"	6,4	14	1,5	2	1,7	.252	.551	.059	.079	.067	1931
HDS 7	7		7,4	17	1,75	2,3	2	.291	.669	.069	.091	.079	2540
HDS 8	8	5/16"	8,4	18	2	2,6	2,24	.331	.709	.079	.102	.088	3350
HDS 10	10	3/8"	10,5	23	2,5	3,2	2,8	.413	.906	.098	.126	.110	4968
HDS 12	12	1/2"	13	29	3	3,95	3,43	.512	1.142	.118	.156	.135	7666
HDS 14	14	9/16"	15	35	3,5	4,65	4,04	.591	.378	.138	.183	.159	10341
HDS 16	16	5/8"	17	39	4	5,25	4,58	.669	1.535	.157	.207	.180	13421
HDS 18	18		19	42	4,5	5,8	5,08	.748	1.654	.177	.228	.200	16726
HDS 20	20	3/4"	21	45	5	6,4	5,6	.827	1.772	.197	.252	.220	20952
HDS 22	22	7/8"	23	49	5,5	7,05	6,15	.906	1.929	.217	.278	.242	25561
HDS 24	24		25	56	6	7,75	6,77	.984	2.205	.236	.305	.267	29450
HDS 27	27	1"	28	60	6,5	8,35	7,3	1.102	2.362	.256	.329	.287	34621
HDS 30	30	1 1/8"	31	70	7	9,2	8	1.220	2.756	.276	.362	.315	38667

Technical notes and explanations

- h max is spring height as received
- h min is spring height after compression
- load information for design reference only
- figures based on spring steel, values will be different for other materials
- to be used for static applications only not stack in series or parallel
- S and VS are designed for use in light and medium duty applications

SCHNORR® High Load Safety Washers "HS"



Original SCHNORR® High Load Safety Washer "HS"

This safety washer is in principle a load washer with a smaller outer diameter than those in DIN 6796.

A notable feature of these washers is the slightly curved form, which provides a progressively increasing characteristic curve. Despite the smaller outside

dimensions, this makes it possible to achieve the same load as the load washers as per DIN 6796.

These washers are primarily used when the space available is insufficient for standardized load washers.

Available materials:

Spring steel
as per DIN 17221 or 17222

Available finishes:

phosphated and oiled

Order Reference	Bolt Size		d ₁ mm	d ₂ mm	s mm	h		d ₁ inch	d ₂ inch	s inch	h		Steel Flat Load lbs
	metric mm	imperial inch				max. mm	min. mm				max. inch	min. inch	
HS 6	6	1/4"	6,4	12	1,5	1,9	1,64	.252	.472	.059	.075	.065	2005
HS 8	8	5/16"	8,4	17	2	2,55	2,21	.331	.669	.079	.100	.087	3395
HS 10	10	3/8"	10,5	21	2,5	3,15	2,75	.413	.827	.098	.124	.108	5216
HS 12	12	1/2"	13	24	3	3,75	3,27	.512	.945	.118	.148	.129	7823
HS 14	14	9/16"	15	28	3,5	4,35	3,8	.591	1.102	.138	.171	.150	10071
HS 16	16	5/8"	17	30	4	4,95	4,31	.669	1.181	.157	.195	.170	14118
HS 18	18		19	33	4,5	5,5	4,8	.748	1.299	.177	.217	.189	16321
HS 20	20	3/4"	21	36	5	5,95	5,3	.827	1.417	.197	.234	.209	20727
HS 22	22	7/8"	23	40	5,5	6,7	5,9	.906	1.575	.217	.264	.232	26977
HS 24	24		25	45	6	7,3	6,45	.984	1.772	.236	.287	.254	30349
HS 27	27	1"	28	50	6,5	8	7	1.102	1.969	.256	.315	.276	34845
HS 30	30	1 1/8"	31	58	7	8,9	7,65	1.220	2.283	.276	.350	.301	40466

Standards

DIN EN 10048	Hot-rolled narrow steel strip – Tolerances on dimensions and shape
DIN EN 10140	Colled rolled steel
DIN 2092	Disc springs; calculation
DIN 2093	Disc springs; dimensions and quality specifications
DIN 7521	Steel forgings; technical terms of delivery
DIN 17221	Hot rolled steels for quenched and tempered springs
DIN EN 10132-4	Cold-rolled narrow steel strip for heat-treatment Part 4: Spring steels and other applications
DIN EN 10151	Wire and strip of stainless steels for springs
DIN EN 10269	Steel and nickel alloys for fasteners with specified elevated and / or low temperature properties

DIN EN 1652	Copper and copper alloys – Plate, sheet, strip and circles for general purposes
DIN EN 1654	Copper and copper alloys – Strip for springs and connectors
DIN 50938	Alkaline blackening (black finishing) of iron materials
DIN 50942	Phosphating of metals
DIN 50960	Electroplated and chemical coatings; designation and specification in technical documents
DIN EN 10258	Cold-rolled stainless steel narrow strip and cut lengths – Tolerances on dimensions and shape
DIN EN 10029	Hot rolled steel plates 3 mm thick or above; Tolerances on dimensions, shape and mass
DIN EN 10088-2	Stainless steels



SPECIALIST MANUFACTURER OF DISC SPRINGS
ISO/TS 16949: 2002 certified

For further information contact

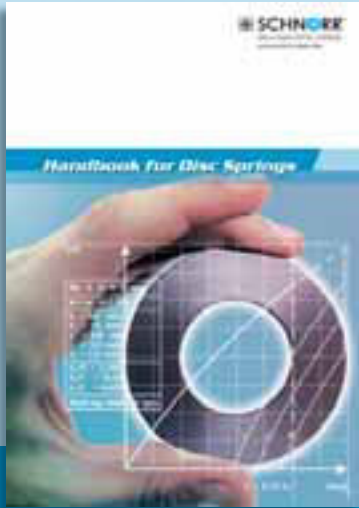
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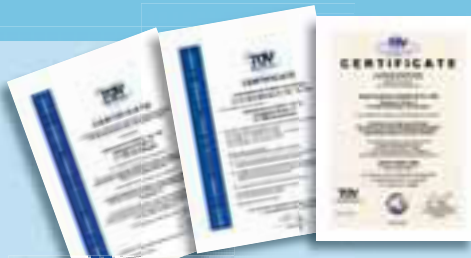
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Internet www.schnorr.com



Handbook for Disc Springs
150 page engineering handbook
available upon request.



Additional information
and current quality certifications
on our website



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