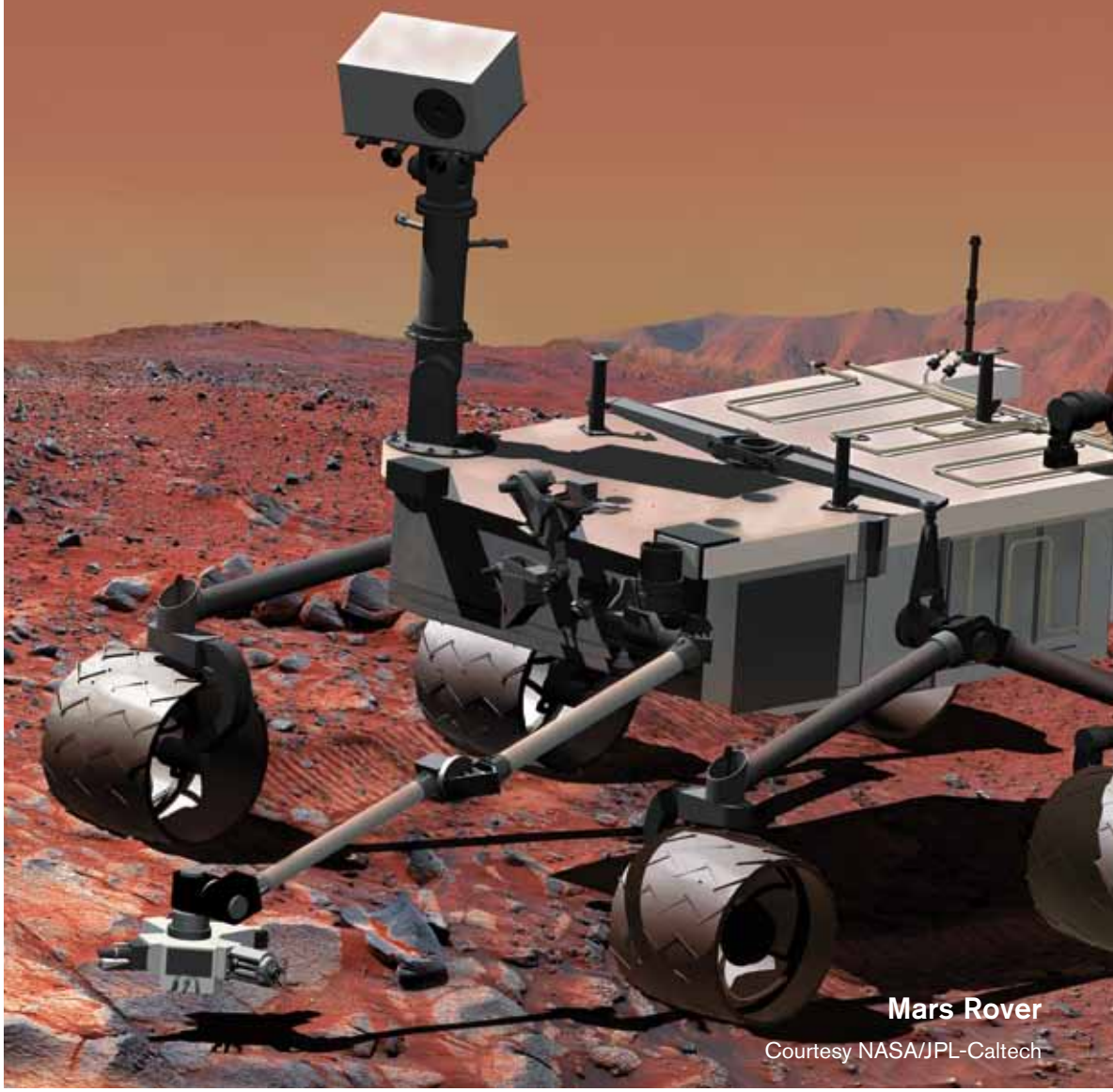
US
05|2010

Damping Technology



Mars Rover
Courtesy NASA/JPL-Caltech

Partner for Performance
www.ringfeder.com

RINGFEDER

A Global Presence For You

The RINGFEDER POWER TRANSMISSION GMBH was founded in 1922 in Krefeld, Germany to fabricate and promote Friction Spring technology. Today we have expanded our offerings to top power transmission and damping products. Innovative thinking sets us apart and allows us to develop progressive and economical solutions to support our customers.

Special applications require special solutions

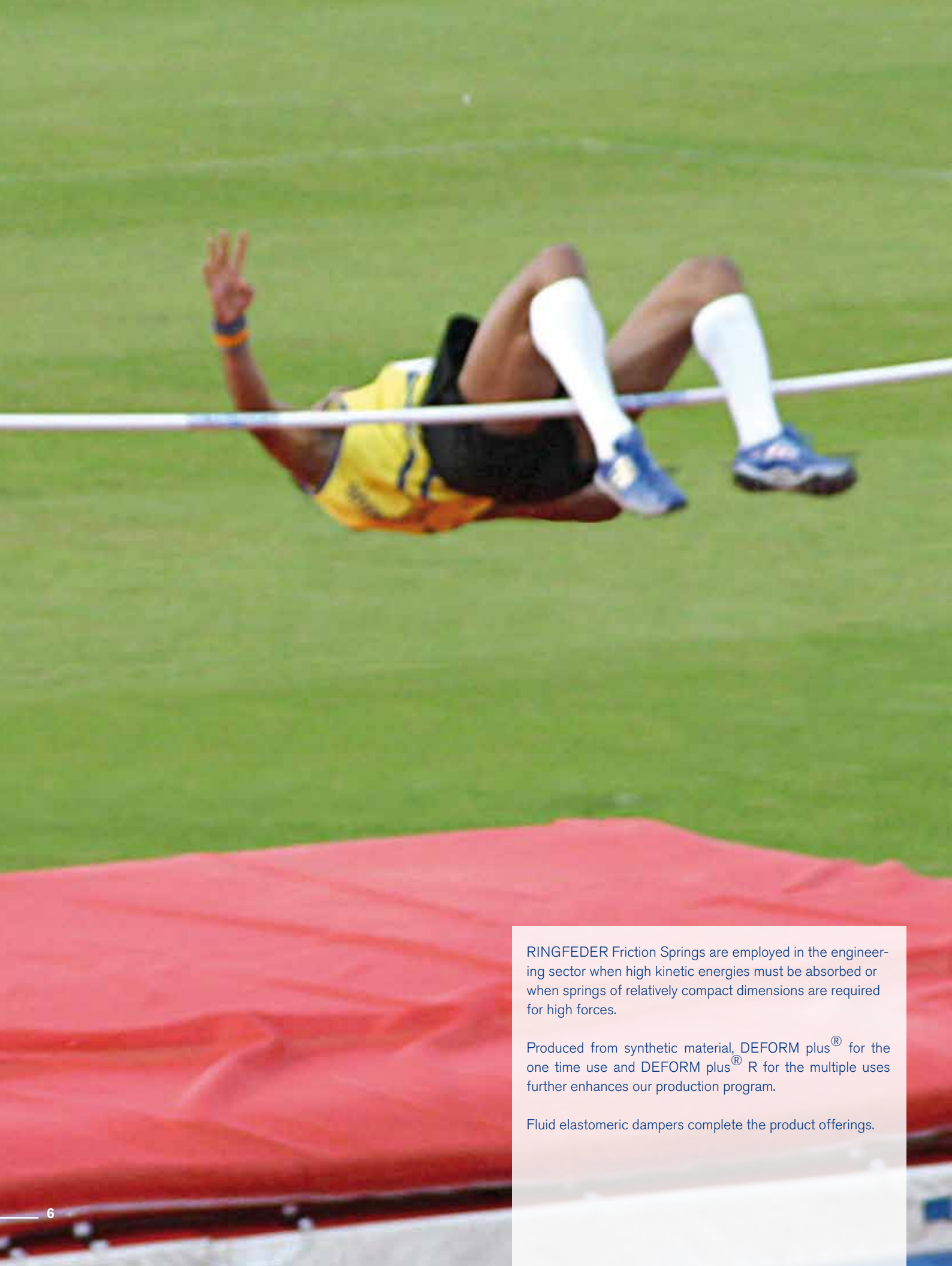
Our extensive range of RINGFEDER POWER TRANSMISSION products can be applied to solve most applications. We don´t just sell, but by understanding the individual requirements of our customers (e.g. loads on the components, easy installation/removal capability and reduction of production costs) assist you in every step with innovative engineering to plan efficient and technically mature solutions.

Experts for Damping Technology

Experts for Damping Technology

Protecting people and keeping equipment running - modern damping technology products are essential safety devices in all applications where suddenly appearing kinetic energies must be absorbed. In crash protection of the automotive and elevator industries, in machine tools or industrial machinery, shock absorbing devices convert the energy of an undesirable shock load impact into a measurable and predictable deformation thus saving expensive technology from destruction; in other words, increase the service life of the equipment.

For almost 100 years, we have been the experts in braking moving masses quickly, safely and precisely. We develop, manufacture and deliver top shock absorbing solutions on a global scale - either as standard products or as special solution as driven by customer's demands.



RINGFEDER Friction Springs are employed in the engineering sector when high kinetic energies must be absorbed or when springs of relatively compact dimensions are required for high forces.

Produced from synthetic material, DEFORM plus® for the one time use and DEFORM plus® R for the multiple uses further enhances our production program.

Fluid elastomeric dampers complete the product offerings.

Content

Friction Spring RINGFEDER®

DEFORM plus®

DEFORM plus® R

Fluid Elastomeric Damper

RINGFEDER® Friction Spring

Features of RING – springs®

Compared to other damping systems, Friction springs RINGFEDER®
have multiple features:

- **High spring work combined with low weight and volume**
- **High Damping Potential**
- **Overload-safe in blocked position**
- **Independent of loading rate**
- **Diagram independent of temperature**
- **Maintenance free**
- **RINGFEDER® Friction Spring Design**
- **Versatility in design**
- **Parallel and series arrangement**

The versatility of the RING-spring® design due to the stacking nature of the rings is infinite. A buffer design can be configured so as to have limited or extreme strokes, soft absorption of loads or stiff absorption or very long designs vs very short designs.

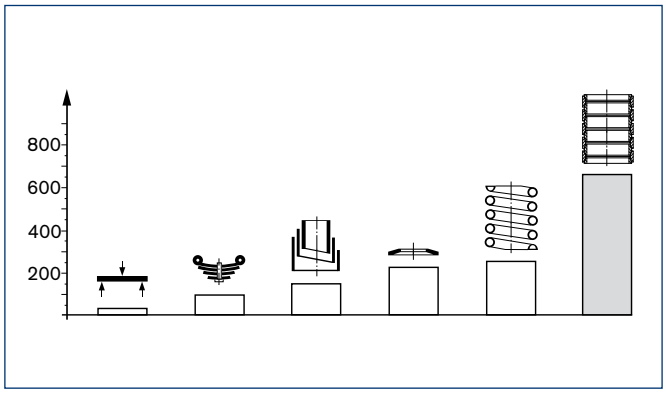
Friction springs can operate in extreme environments for many years without maintenance if properly designed and protected, unlike other shock absorbing system on the market today.

Features

Friction springs RINGFEDER® have a multitude of features in comparison to other damping systems:

High spring work combined with low weight and volume

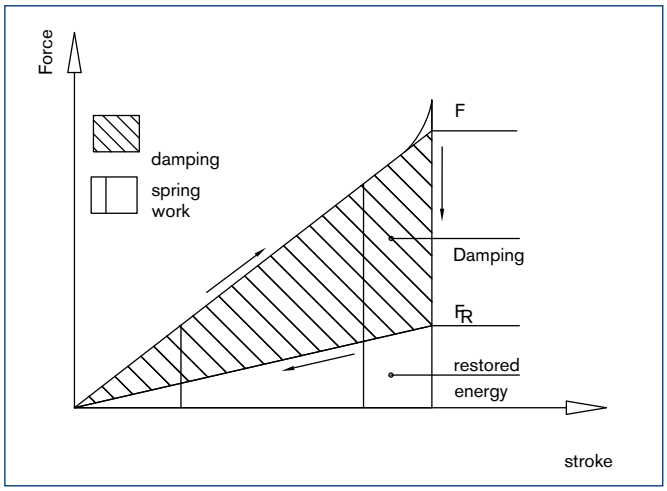
As precise as possible calculation of the spring work needed for the application will insure that the spring is neither undersized or oversized. This last point is important to the life of the spring.
In general application RING-springs® are capable of operating for many years. If the spring work needed for the application is correctly matched to the required spring, the spring will indeed function for years. Please see the data input sheet on page 43 for the necessary information.



Utilization h *of various springs*

High Damping Potential

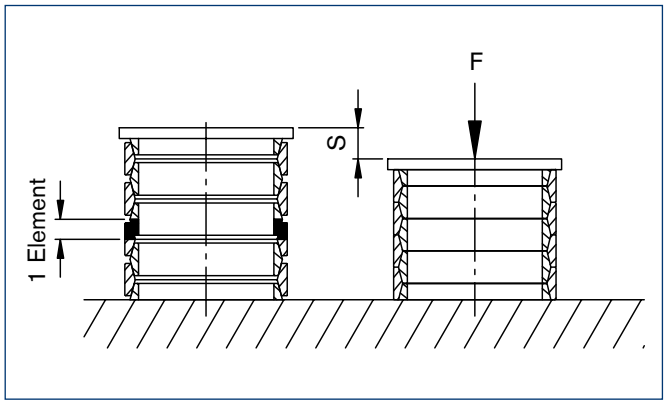
Although most of the applications in use today use our standard grease, our engineers have decades of experience in selecting the right lubricant for special applications. Not only that, special ring sizes and configurations are also employed worldwide for a variety of solutions not suitable from our standard ring selection.



Damping and spring work

Overload-safe in blocked position

This overload protection feature is accomplished due to the basic design principles of the rings and element stack height. During an overload and when blocked, the springs take on the form of a column in compression which is extremely immune to damage.



Overload protection

Drilling equipment

In applications for drilling equipment the loads dampers are expected to absorb are exceptionally high; however, this presents no problem for Friction Springs RINGFEDER®. The increased loads of compressed-air systems and the high damping action required are ideal for such applications. Besides, the higher reliability of Friction Springs RINGFEDER®, compared to springs made of synthetic materials, is a significant advantage.

Construction and table

Independent of loading rate

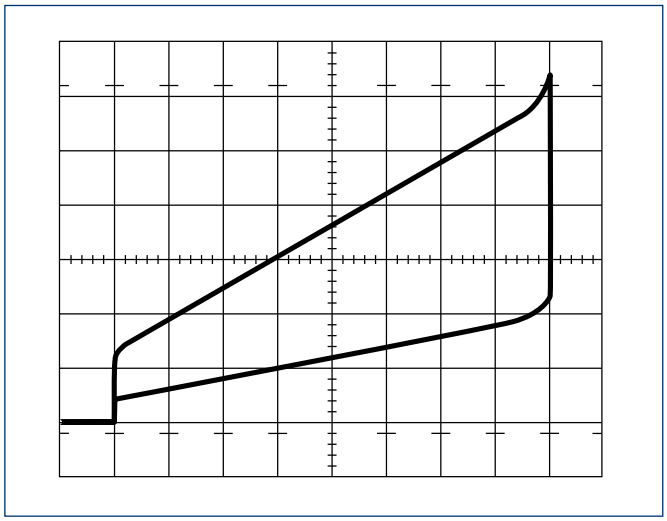
The force-travel-diagram of the Friction Spring RINGFEDER® is independent of the load frequency under all operating conditions. In contrast to other damping systems, Friction Springs RINGFEDER® also provide full spring work and damping effects even; when the load is applied extremely slowly or quickly.

Diagram independent of temperature

With hydraulic dampers and springs made of synthetic material, the force-travel diagram will be influenced by temperature fluctuations and inherent temperature rises. The characteristic curve of a friction spring, however, remains independent of these factors within certain limits. RINGFEDER® RING-springs® can be employed in the temperature range of -40 ° to +80 °C without the curve changing appreciably. Here, allowances are made for the inherent temperature rises of the spring due to the dampening effect. For extreme applications going beyond the indicated temperature range please consult with us.

Maintenance free

Normally; during operation, no regreasing of the spring is necessary; such procedures could even result in a failure of the spring if lubricants are used other than those specified by us.



Dynamic force-travel diagram of a pretensioned Friction Spring RINGFEDER®

RINGFEDER® Friction Spring Design

If a RINGFEDER® Friction Spring consisting of "e" elements terminates with half rings its untensioned length will be:

$$L_o = e \cdot h_e$$

The total spring travel can be calculated according to the equation:

$$s = e \cdot s_e$$

When eliminating the pretensioning force the spring work is given by:

$$W = e \cdot W_e$$

The end force does not change with the number of elements.

Aviation and astronautics

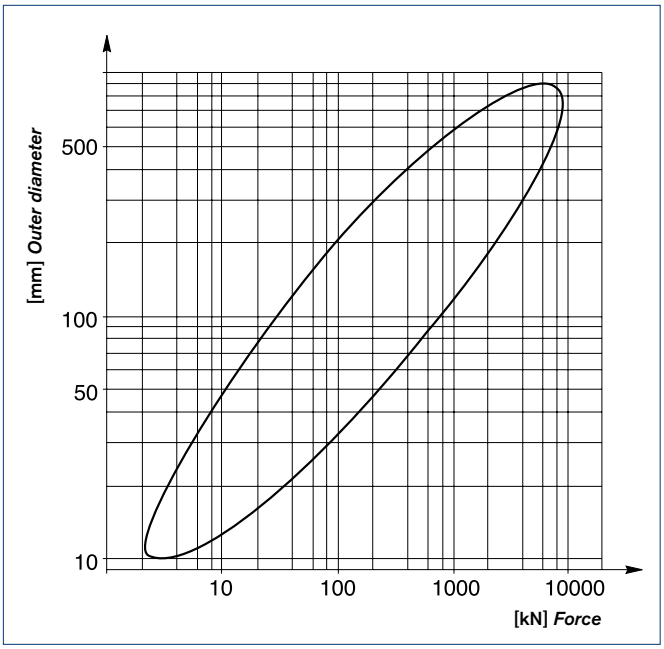
In the aerospace industry, the use of Friction Springs RINGFEDER® is ideal. These springs can be utilized in airbrakes or emergency exit doors.

A low weight and a compact construction, capable of withstanding temperature variations are required for such applications.

Construction and table

Versatility in design

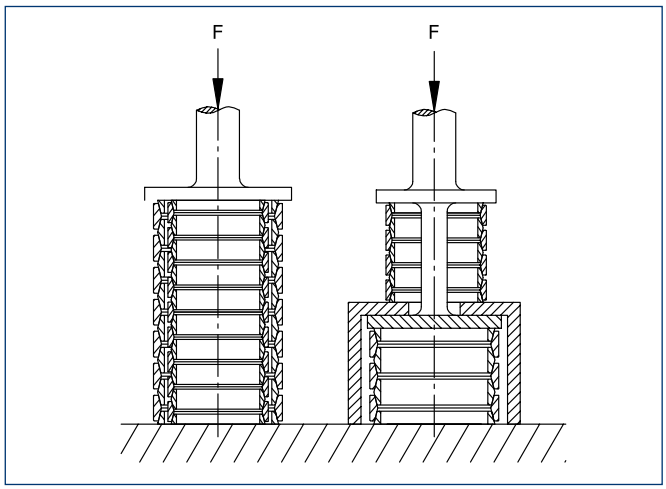
Apart from the standard RINGFEDER® friction springs (see table on page 16) we offer special solutions depending on your specific applications. The ratio of outer diameter to spring end force is shown in diagram to the right. It can thus easily be seen if there is a solution for an application even though according to the table no standard spring seems to be available.



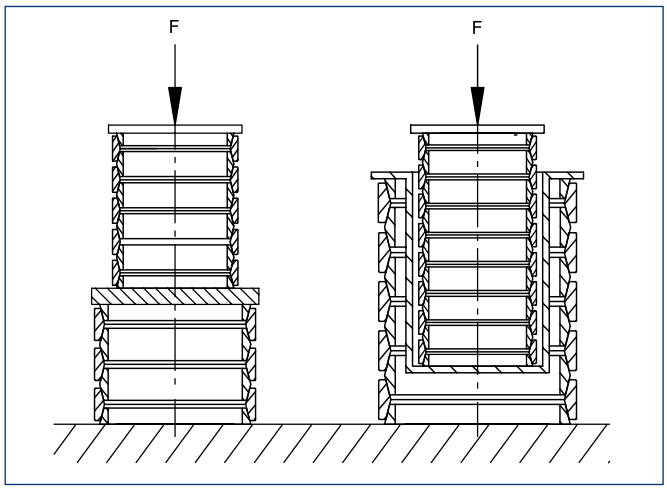
Ratio of outer diameter to spring end force

Parallel and series arrangement of springs

The geometry of the RINGFEDER® Friction Spring allows an optimum utilization of the available mounting space due to a nested spring construction, using parallel and series spring arrangements.

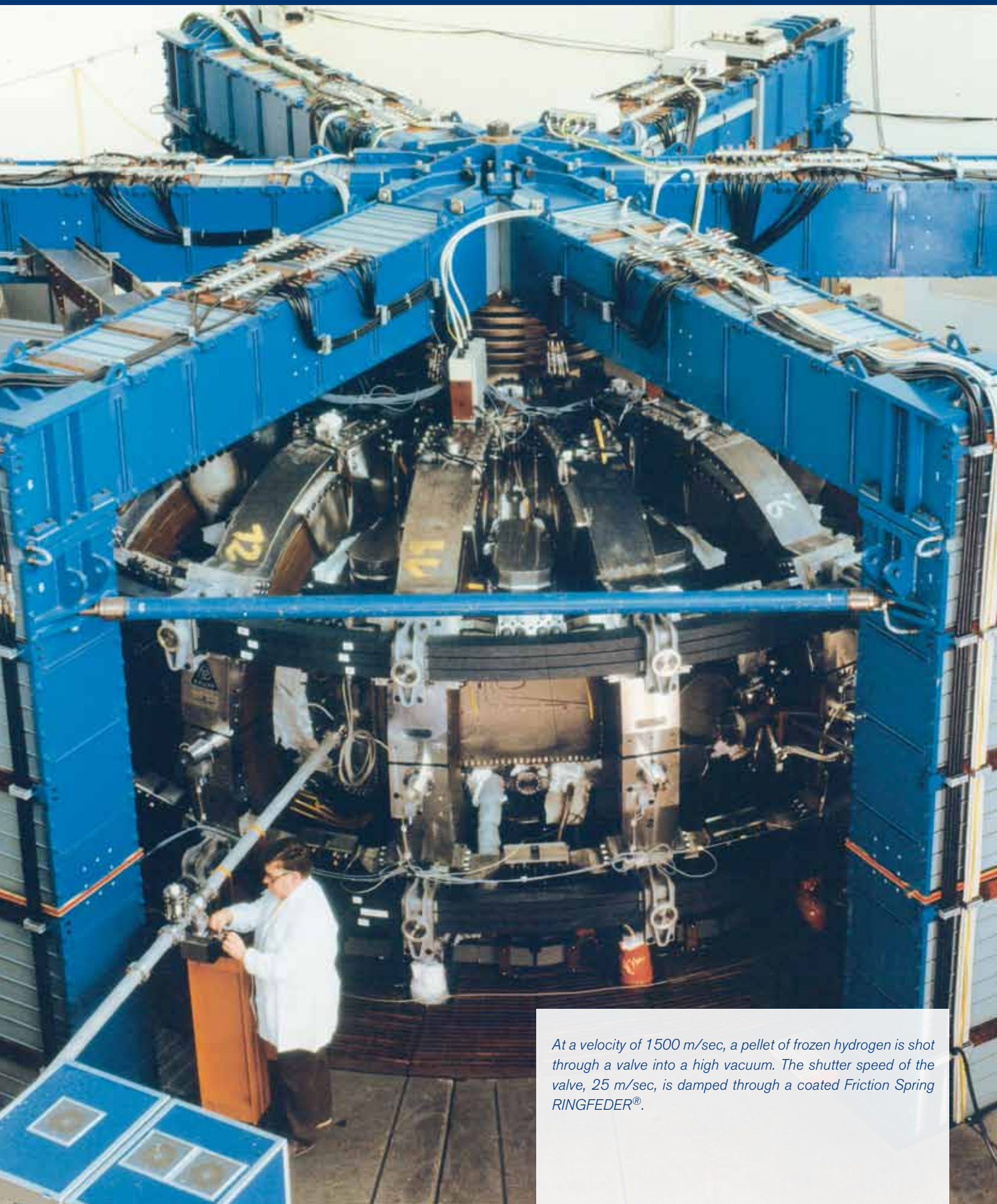


Parallel arrangement



Serial arrangement

Valve



At a velocity of 1500 m/sec, a pellet of frozen hydrogen is shot through a valve into a high vacuum. The shutter speed of the valve, 25 m/sec, is damped through a coated Friction Spring RINGFEDER®.

Table of standard Ringfeder® Friction Springs

Force-travel Diagram

This amounts to two thirds of the input energy and is dissipated as frictional heat. The recoil force F_R at any point on the diagram is approximately equal to one third of the relative compressive force F. The capacity of the spring is represented by the total area shown below the load curve. The total energy absorption can be calculated by W_e multiplied by the number of elements.

Explanations to table

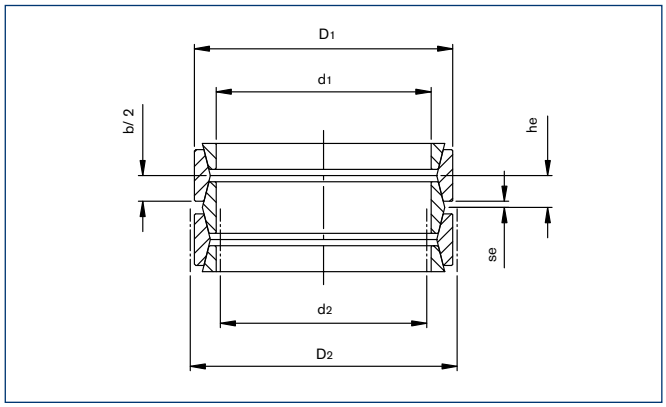
F = spring end force
s_e = spring travel for one element
W_e = energy absorption (work of one element)
he = element height
D_1 , d_1 = outer and inner diameter of rings
b/2 = half width of the ring
D_2 , d_2 = outer and inner diameter of guide components
G_e = element weight

Type	old Type	Solid Rings Diagramm F	Se	We	Dimensions he	D1	d1	b/2	Other Greases Fm	Fo	Guide D_2	d_2	Weight G_e
		kN lb	mm in	Joules lb-ft	mm in	mm in	mm in	mm in	kN lb	kN lb	mm	mm	kg
01800	1201	5 *1.125*	0.4 *0.0157*	1.0 *0.738*	2.2 *0.0866*	18.1 *0.7126*	14.4 *0.5669*	1.8 *0.0709*	4.4 *990*	4.7 *1058*	18.7	13.9	0.002
02500	1202	9 *2.025*	0.6 *0.0236*	2.7 *1.991*	3.1 *0.1220*	25.0 *0.9843*	20.8 *0.8189*	2.5 *0.0984*	7.5 *1688*	8.2 *1845*	25.9	20.1	0.004
03200	1203	14 *3.150*	0.8 *0.0315*	5.6 *4.130*	0.4 *0.1575*	32.0 *1.2598*	27.0 *1.0630*	3.2 *0.1260*	12 *2700*	12.8 *2880*	33.1	26.1	0.007
03800	1204	20 *4.500*	0.9 *0.0354*	9.0 *6.638*	4.7 *0.1850*	38.0 *1.4961*	31.7 *1.2480*	3.8 *0.1496*	17 *3825*	18 *4050*	39.3	30.6	0.012
04200	1205	26 *5.850*	1 *0.0394*	13.0 *9.588*	5.2 *0.2047*	42.2 *1.6614*	34.6 *1.3622*	4.2 *0.1654*	23 *5175*	24 *5400*	43.6	33.4	0.018
04800	1206	34 *7.650*	1.1 *0.0433*	18.7 *13.792*	5.9 *0.2323*	48.2 *1.8976*	39.4 *1.5512*	4.8 *0.1890*	29 *6525*	31 *6975*	49.8	38.1	0.026
05500	1207	40 *9.000*	1.3 *0.0512*	26.0 *19.177*	6.8 *0.2677*	55.0 *2.1654*	46.0 *1.8110*	5.5 *0.2165*	34 *7650*	36 *8100*	56.7	44.5	0.035
06300	1208	54 *12.150*	1.4 *0.0551*	37.8 *27.880*	7.7 *0.3031*	63.0 *2.4803*	51.9 *2.0433*	6.3 *0.2480*	46 *10350*	49 *11025*	64.9	50.3	0.056
07000	1209	65 *14.625*	1.6 *0.0630*	52.0 *38.353*	8.6 *0.3386*	70.0 *2.7559*	58.2 *2.2913*	7.0 *0.2756*	55 *12375*	59 *13275*	72.1	56.4	0.074
08000	1310	83 *18.675*	1.8 *0.0709*	75.0 *55.317*	9.8 *0.3858*	80.0 *3.1496*	67.0 *2.6378*	8.0 *0.3150*	69 *15525*	74 *16650*	83	64	0.105
09000	1311	100 *22.500*	2 *0.0787*	100.0 *73.756*	11 *0.4331*	90.0 *3.5433*	75.5 *2.9724*	9.0 *0.3543*	83 *18675*	89 *20025*	93	73	0.145
10000	1312	125 *28.125*	2.2 *0.0866*	138.0 *101.783*	12.2 *0.4803*	100.0 *3.9370*	84.0 *3.3071*	10.0 *0.3937*	105 *23625*	111 *24975*	103	81	0.203
13000	1313	160 *36.000*	2.6 *0.1024*	208.0 *153.412*	15 *0.5906*	130.0 *5.1181*	111.5 *4.3898*	12.4 *0.4882*	135 *30375*	142 *31950*	134	108	0.376
12400	1314	200 *45.000*	2.6 *0.1024*	260.0 *191.766*	15 *0.5906*	124.0 *4.8819*	102.0 *4.0157*	12.4 *0.4882*	165 *37125*	177 *39825*	128	98	0.408
14000	1315	250 *56.250*	3 *0.1181*	375.0 *276.585*	17 *0.6693*	140.0 *5.5118*	116.0 *4.5669*	14.0 *0.5512*	210 *47250*	221 *49725*	144	112	0.568
16600	1316	350 *78.750*	3.7 *0.1457*	648.0 *477.939*	20 *0.7874*	166.0 *6.5354*	134.0 *5.2756*	16.0 *0.6299*	290 *65250*	310 *69750*	170	130	0.869
	1356	400 *90000*	3.8 *0.1496*	760.0 *560.546*	19.8 *0.7795*	166.0 *6.5354*	140.0 *5.5118*	16.0 *0.6299*	335 *75375*	355 *79875*	170	136	0.84
20000	1317	510 *114.750*	3.9 *0.1535*	995.0 *733.872*	22.4 *0.8819*	198.0 *7.7953*	162.0 *6.3780*	18.5 *0.7283*	425 *95625*	450 *101250*	203	157	1.57
19600	1318	600 *135.000*	4.4 *0.1732*	1320.0 *973.579*	23.4 *0.9213*	194.0 *7.6378*	155.0 *6.1024*	19.0 *0.7480*	500 *112500*	530 *119250*	199	150	1.676
22000	1319	720 *162.000*	4.4 *0.1732*	1584.0 *1.168.295*	26.4 *1.0394*	220.0 *8.6614*	174.0 *6.8504*	22.0 *0.8661*	600 *135000*	640 *144000*	225	169	2.573
26200	1320	860 *193.500*	4.8 *0.1890*	2064 *1.522.324*	25.8 *1.0157*	262.0 *10.3150*	208.0 *8.1890*	21.0 *0.8268*	720 *162000*	770 *173250*	268	202	3.415
30000	1221	1000 *225.000*	5.8 *0.2283*	2900.0 *2.138.924*	35.8 *1.4094*	300.0 *11.8110*	250.0 *9.8425*	30.0 *1.1811*	850 *191250*	910 *204750*	306	245	5.51
32000	1222	1200 *270.000*	6.2 *0.2441*	3720.0 *2.743.723*	38.2 *1.5039*	320.0 *12.5984*	263.0 *10.3543*	32.0 *1.2598*	1040 *234000*	1100 *247500*	326	258	7.06
35000	1223	1400 *315.000*	6.6 *0.2598*	4620.0 *3.407.527*	41.6 *1.6378*	350.0 *13.7795*	288.0 *11.3386*	35.0 *1.3780*	1200 *270000*	1280 *288000*	356	283	9.18
40000	1224	1800 *405.000*	7.6 *0.2992*	6840.0 *5.044.910*	47.6 *1.8740*	400.0 *15.7480*	330.0 *12.9921*	40.0 *1.5748*	1560 *351000*	1670 *375750*	407	324	13,56

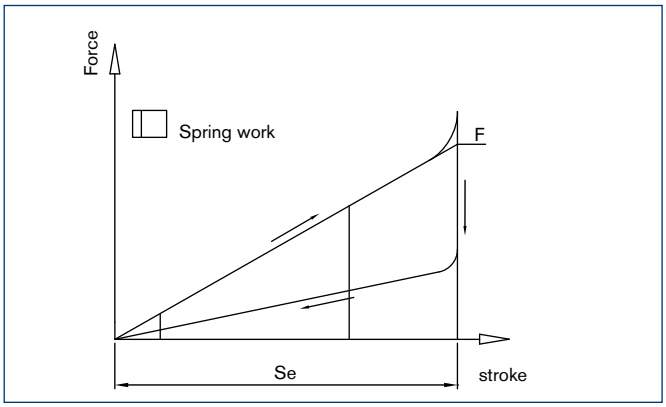
Substation

For high-voltage switches where quick changeover actions are necessary as well as for electric power substations which need to be protected during earthquakes, friction springs of “RINGFEDER can be a perfect product for your application.

Design notes



Dimensions RINGFEDER® Friction Spring



Force - travel diagram for one element

Recommendations for the selection and mounting of Friction Springs RINGFEDER®

Pretensioning

Friction Springs RINGFEDER® must be pretensioned a min. of 5% and preferably 10% of the total spring travel. In order not to impair the effectiveness of the lubrication, the pretensioning force should not exceed 50%. Exceptions are possible after consulting with us.

Guiding

For Friction Springs RINGFEDER® a guide device (exterior tube or internal shaft) is necessary (D_2 and d_2 in the preceding table). Exceptions apply for short springs with a length of ≤ 1.5 D_1, if they are loaded between parallel thrust plates.

Lubrication

ONLY the special greases we recommended should be used for lubrication purposes, because the tapered surfaces are under a high contact pressure. Generally, the grease provided with the spring is sufficient. Re-greasing is not required.

Observe the diagram

With buffer springs the available spring work in J, i.e. the area under the loading-curve (above curve), is of interest. If the spring is to be used as a tension device, the recoil curve has to be taken into account (lower curve). Of course, the lower curve can be increased by using a friction reduction lubricant. For this, please let us have your specifications.

Sealing

Friction Springs RINGFEDER® must be installed with protection against dust and moisture, in order not to impair the function of the lubricant. Simple sliding guides are sufficient. Under strong dust and moisture applications, we recommend using rubber boots.

Rolling mill

In this rolling mill, the material being rolled has to be stopped. Due to the relatively high velocities and masses, pre-dampers with high energy absorption are required. Under these tough operation, buffers with Friction Springs RINGFEDER® proved to be of the highest reliability.

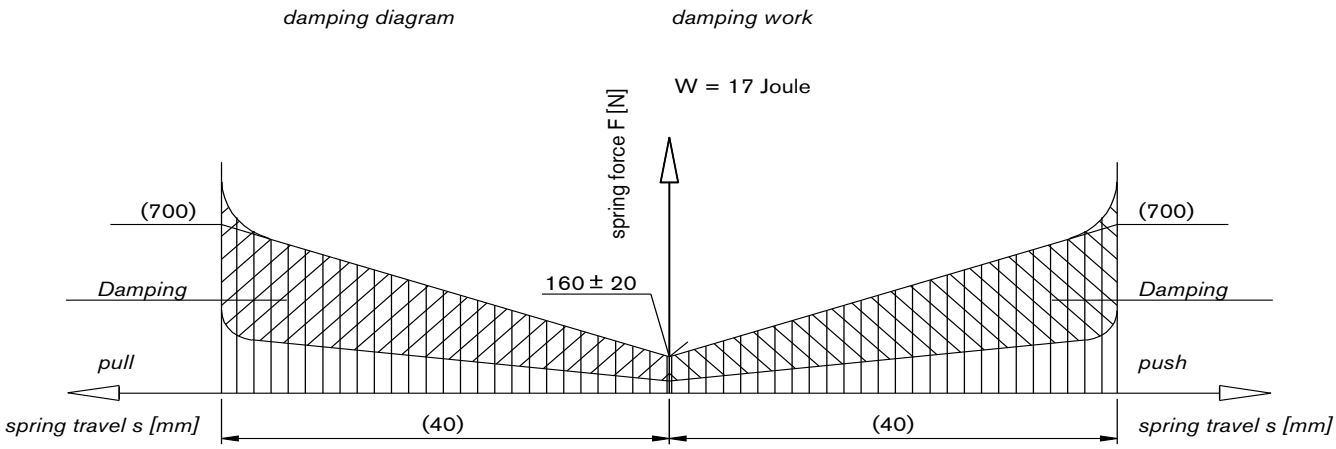
Industrial buffer

Friction Spring RINGFEDER® can also be supplied as complete industrial buffers. A range of approved smaller buffer types are shown in the table at page 22. Customized versions as well variation of the flange and plunger and also water-cooled versions are possible. Units in push-pull design are feasible.

Cross section of industrial buffer

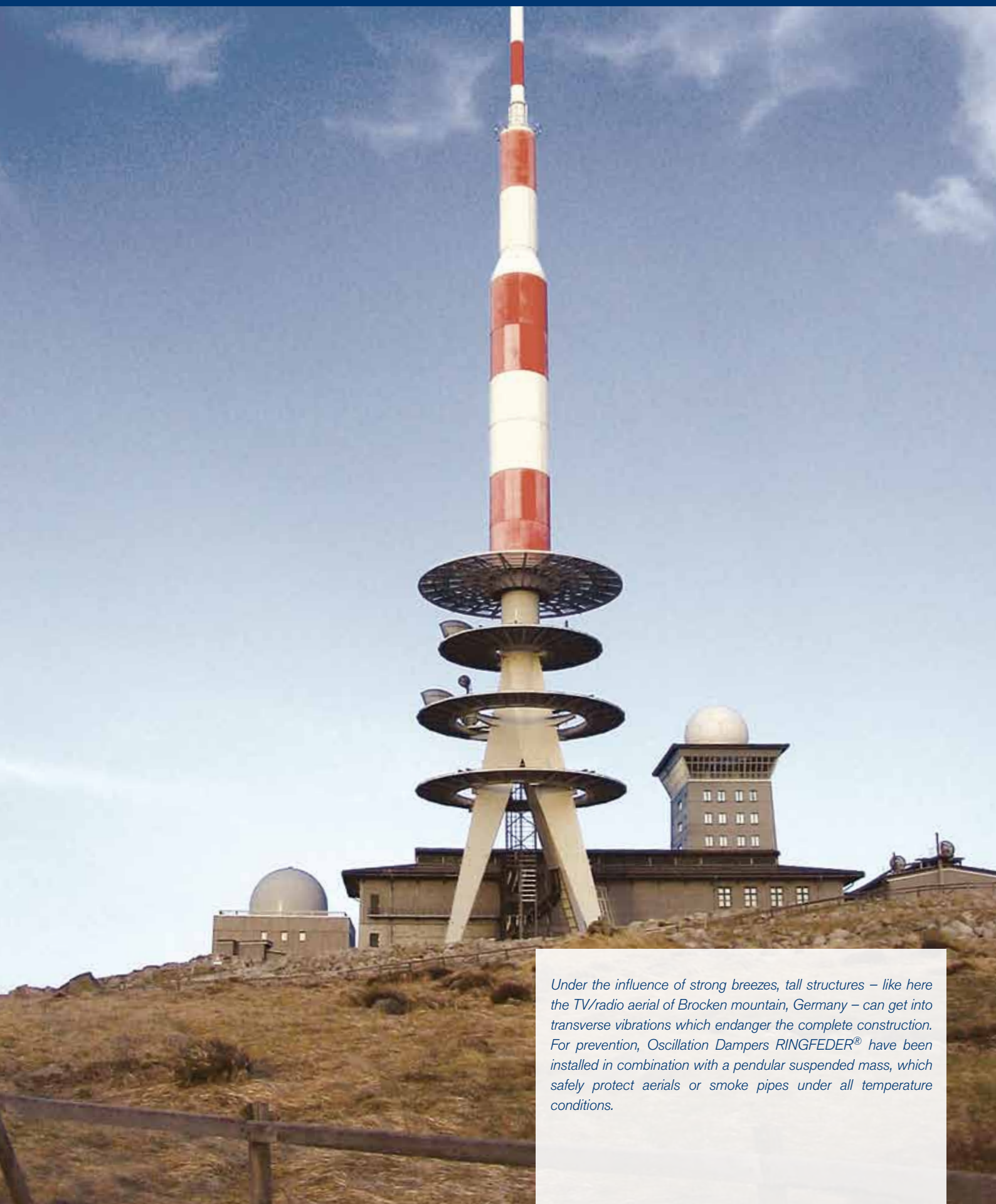
Overload clutch

Oscillation damper



Force - Stroke - diagram from a Oscillation damper

Aerial mast



Under the influence of strong breezes, tall structures – like here the TV/radio aerial of Brocken mountain, Germany – can get into transverse vibrations which endanger the complete construction. For prevention, Oscillation Dampers RINGFEDER® have been installed in combination with a pendular suspended mass, which safely protect aerials or smoke pipes under all temperature conditions.

Industrial buffer

Size	Type	Diagram				Buffer Dimensions								Weight	Fitting			
		F_v	F	s	W	L	l	D	d	C	T	K	a		b	d_1	D_1	t
		kN	kN	mm	Joule	mm	mm	mm	mm	mm	mm	mm	mm	kg	mm	mm	mm	mm
1				27	820	202	107							10				
2				37	1.100	262	156							12				
3	06300	6	54	55	1.640	374	225	102	80	112	150	27	145	17	100	18	104	15
4				64	1.900	434	293							19				
5				74	2.200	494	293							20				
6				33	1.500	230	125							13				
7				46	2.050	306	170							16				
8	08000	7	83	66	2.950	428	258	114	96	122	200	27	160	23	110	18	117	15
9				79	3.550	505	355							26				
10				92	4.150	582	360							28				
11				45	3.000	300	165							22				
12				61	4.100	397	230							26				
13	10000	10	125	89	6.000	571	350	133	114	142	250	31	185	37	130	23	135	20
14				105	7.050	667	470							42				
15				121	8.150	763	470							45				
16				51	5.600	366	216							39				
17				65	7.150	454	275							45				
18	12400	20	200	102	11.200	696	456	165	142	178	250	34	215	64	155	23	167	20
19				116	12.800	784	574							75				
20				130	14.300	872	550							78				
21				**75**	**13.900**	**500**	**328**							**85**				
22				**95**	**17.500**	**630**	**450**							**105**				
23	**16600**	**10**	**350**	**140**	**25.900**	**880**	**657**	**219**	**184**	**235**	370	**46**	**270**	**145**	**200**	**27**	**222**	**25**
24				**165**	**30.500**	1.040	**690**							**160**				
25				190	35.000	1.200	850							165				

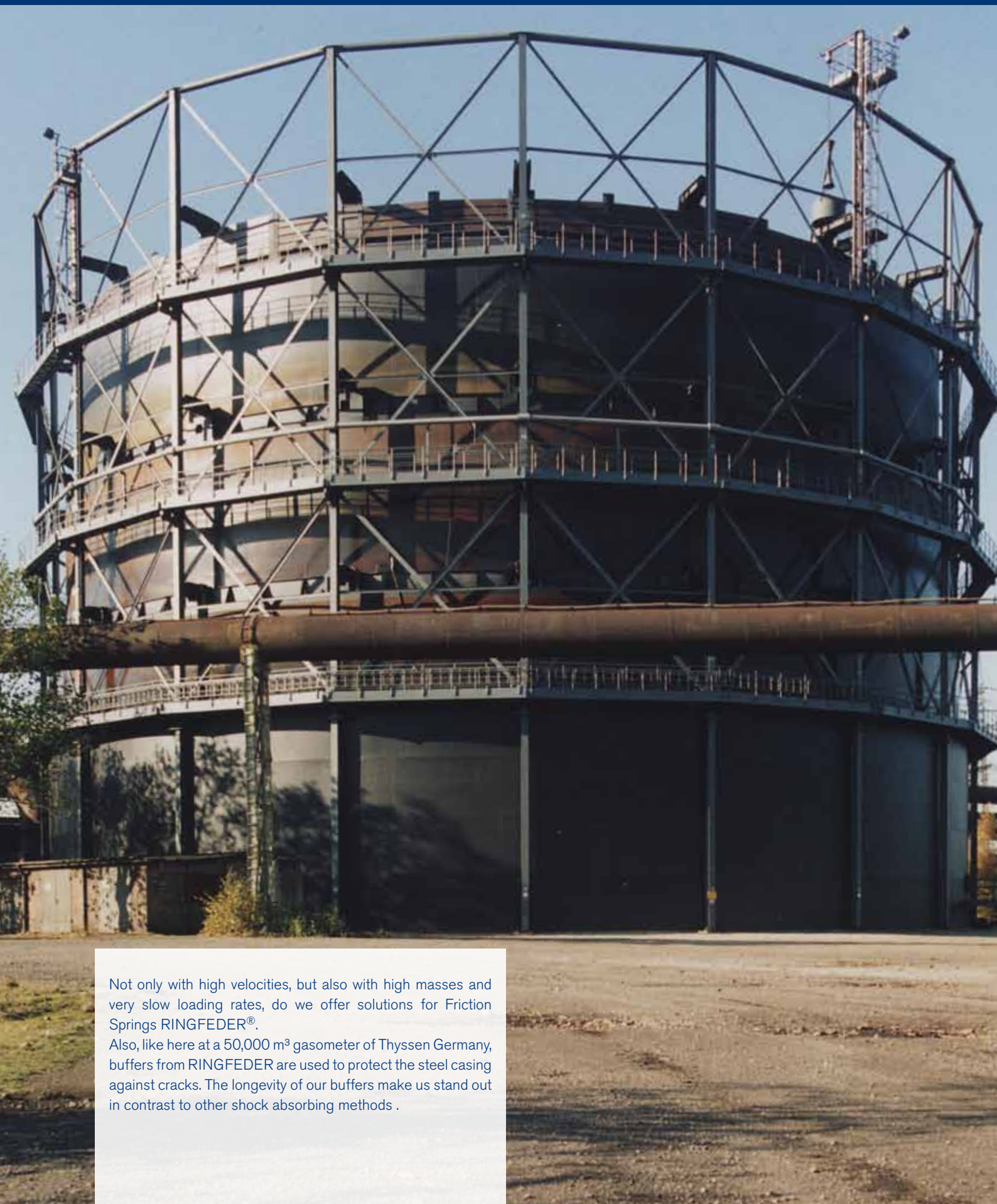
Extract of proven buffer types, further design after request

Explanations to table

F_v = *pretensioning force*
F = *spring force*
s = *spring travel*
W = *spring work*
L = *total length*
l = *dimple length*
D = *Outer diameter*
d = *plunger diameter*
C = *case diameter*
T = *baffle diameter*
K = *flange thickness*
a = *flange dimension*
b = *hole size*
d_1 = *flange bore*
D_1 = *installation diameter*
t = *wall thickness*

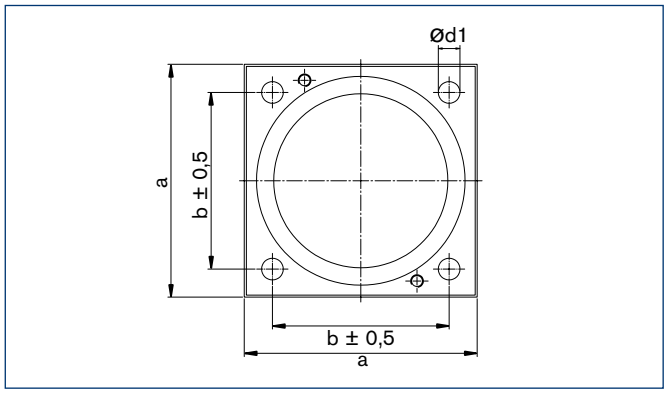
Buffer for Gas tank

Gas tank

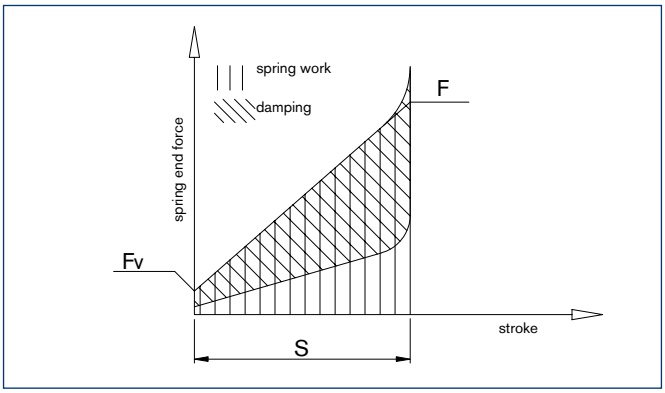


Not only with high velocities, but also with high masses and very slow loading rates, do we offer solutions for Friction Springs RINGFEDER®.
Also, like here at a 50,000 m³ gasometer of Thyssen Germany, buffers from RINGFEDER are used to protect the steel casing against cracks. The longevity of our buffers make us stand out in contrast to other shock absorbing methods .

Industrial buffer



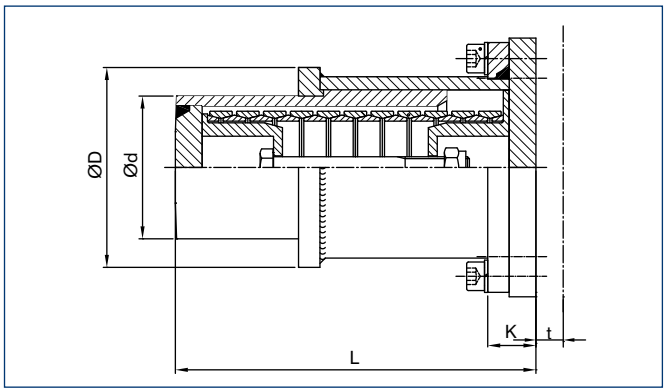
Fitting dimensions



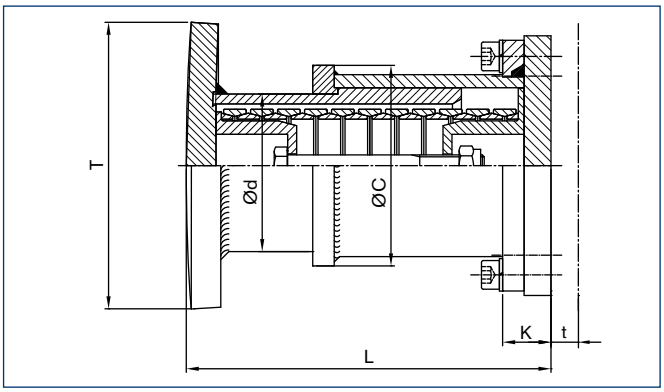
Typical Friction spring diagram

Buffer with Friction Springs RINGFEDER®

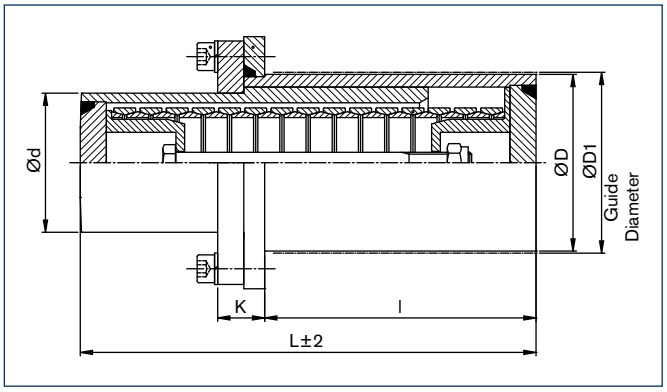
The buffer types shown in extracts on the previous page are standard in one of the following 4 designs. These buffers are suitable for operation temperatures from -40°C to +80°C. Above that, modifications allow an extended temperature range from -73°C to +200°C. Customized requirements with respect to geometrical and technical special solutions on request.



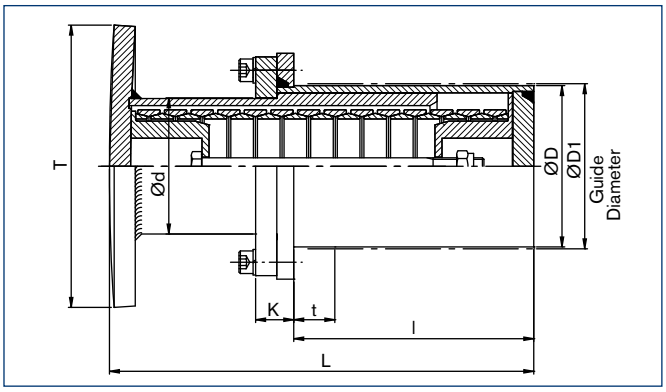
design 1



design 2



design 3



design 4

Oven

At this oven large scrap metal parts fall down from above. By means of a multitude of draw gears up to 80.000 Joule/ unit, these parts are caught above the caster. High thermal stresses must be constantly endured.

Assembly and disassembly instructions for Friction Springs RINGFEDER®

Lubrication

An essential factor for long service life is sufficient and proper lubrication of the springs. All Friction Springs are supplied in greased condition - ready to be installed. Loose rings are oiled. They must be cleaned and then greased with RINGFEDER special grease on all surfaces prior to installing. It is necessary for all springs that any excess grease be allowed to escape (i.e. through a groove in the thrust piece).

Assembly

If the Friction Spring RINGFEDER® is not designed into a spring cartridge, the spring is best mounted in the vertical position. Mounting of particularly long springs is facilitated by guiding on a bolt or tube during aligning and pretensioning. When we supply already tested springs, the spring column must not be disassembled, nor the ring order be changed, so that the integrity of the test diagram remains intact.

Maintenance

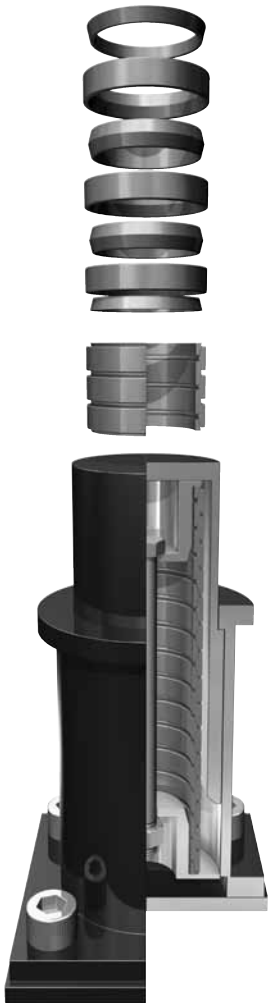
Normally during operation, regreasing of the springs is not necessary. Regreasing the spring could even result in a failure of the spring when using lubricants other than specified by Ringfeder.
If by design it is impossible to avoid impurities contaminating the lubricant, appropriate maintenance intervals must be provided. During these maintenance intervals the rings should be inspected and damaged rings should be exchanged.

Disassembly

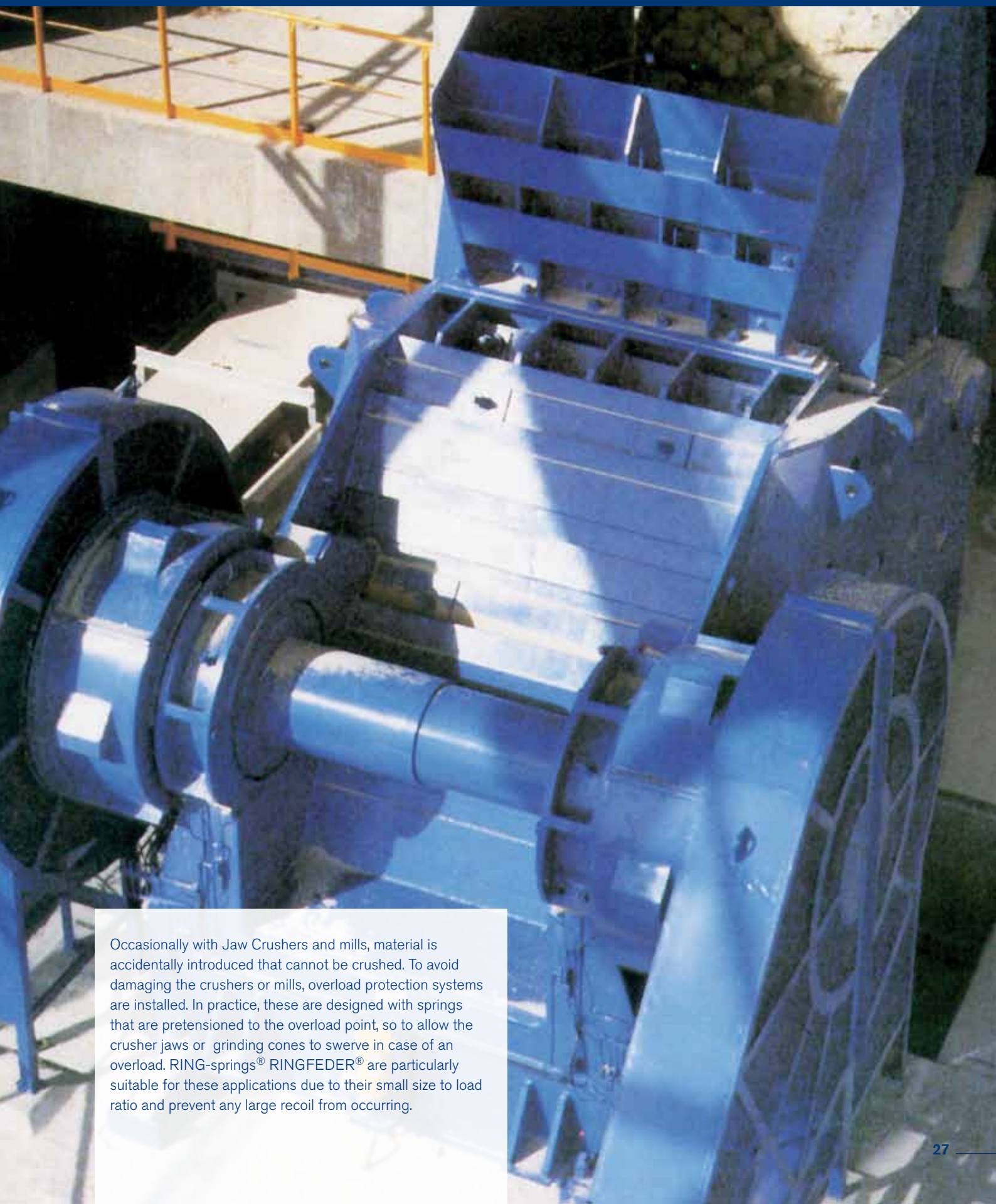
To prevent accidents during disassembly, care must be taken that all rings expand evenly. Rings in spring cartridges without pretension components must only be transported and stored when protected in a casing. To prevent jammed rings from being forced apart explosively by the stored energy (CAUTION, DANGER!), they can only be released within a safety enclosure by hitting the rings with a hammer stroke, after the rings have been carefully tied up with a strong rope.
Jammed rings in spring cartridges with pretension components in position must also be released using a hammer within a safety enclosure before disassembly can be started.

Cleaning of the Rings

All residue of dirt and grease must be removed from the rings. Actual cleaning may be carried out in any grease solvent clear of impurities. Optimum spring life can only be obtained with rings showing a bright metallic surface. Rusty rings or rings with a black coating can only be cleaned by sandblasting. Any rings showing axial scoring marks must be scrapped and replaced by new rings!
Cleaning and checking can, of course, also be carried out by RINGFEDER technical staff. Cleaned rings must subsequently be regreased with RINGFEDER SPECIAL GREASE.



Jaw crusher



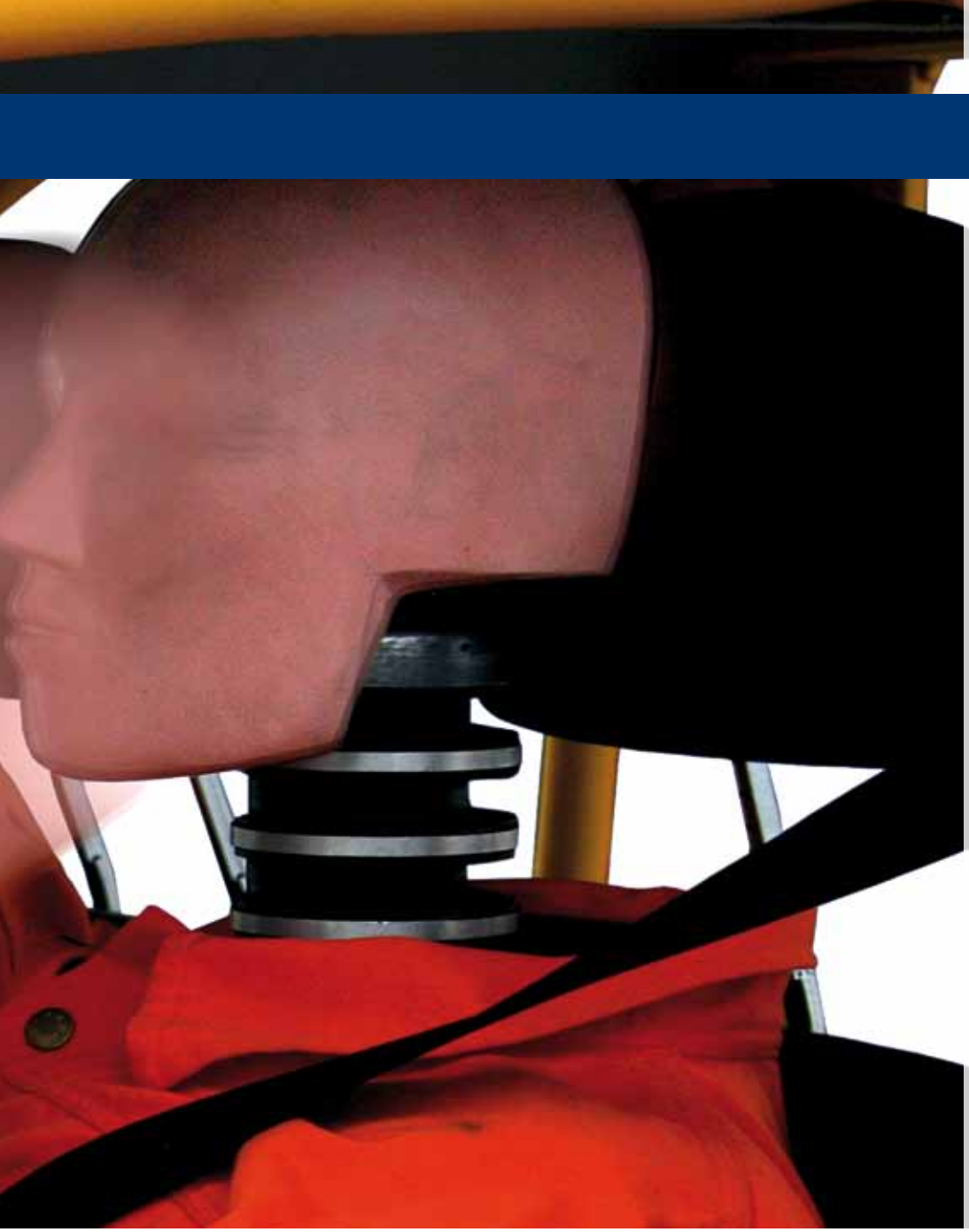
Occasionally with Jaw Crushers and mills, material is accidentally introduced that cannot be crushed. To avoid damaging the crushers or mills, overload protection systems are installed. In practice, these are designed with springs that are pretensioned to the overload point, so to allow the crusher jaws or grinding cones to swerve in case of an overload. RING-springs® RINGFEDER® are particularly suitable for these applications due to their small size to load ratio and prevent any large recoil from occurring.

Shock Absorbing Units

SHOCK ABSORBING UNITS / DEFORM plus®

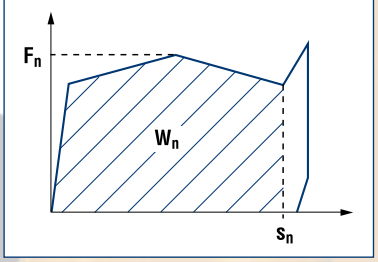
DEFORM plus® Shock Absorbing Elements are one-time use damping elements for high energy absorption. Similar to the purpose of an airbag in a vehicle they transform kinetic energy caused by an impact into deformation energy. DEFORM plus® units have the following characteristics:

- **high damping properties (up to 95%)**
- **low costs**
- **small installation space**
- **low weight**
- **easy replacement of used elements**
- **maintenance-free**
- **no corrosion**
- **rectangular force-travel diagram**
- **versatility in design**



Shock absorbing element

Static DEFORM plus® - diagram



A damping element consists of a thick-walled, cylindrical high quality thermoplastic resin. On impact, it folds/shrinks to a discus-shaped structure.

DEFORM plus® Features

DF 1-009-016-E

DF 1-014-016-A/
DF 1-024-024-A/
DF 1-018-012 P

DF 1-042-082-E/
DF 1-031-046 E/
DF 1-032-052 E

DF 2-020-033-A/
DF 2-021-035 A

DF 2-020-55 E /
DF 2-020-055 A

DF 2-046-030-A/
DF 2-047-030-A

DF 3-070-030 A/
DF 3-072-033 A

Operating conditions

- -25 up to + 50 °C
- resistant to lubricants
- resistant to hydrolysis
- almost equal properties under dynamic and quasi-static loads, force F_n raised factor at dynamic load
  $f_F \approx 1 + 0{,}075 * v\ (m/s)$
- For outdoor applications we recommend the units to be coated or suitably protected against UV-rays

Applications of the patented DEFORM plus® units include

- machine tools
- wind driven turbines
- automobile industry
- construction of vehicles
- mechanical engineering

DF 3-085-150-A

Machining centre

In the event of a crash, DEFORM plus® Damping Elements or Friction Springs RINGFEDER® – in their function as overload protection – precisely absorb the full kinetic energy and thus avoid enormous costs for external service technicians and downtimes. No other damping systems can absorb such energies within these extremely limited mounting spaces.

DEFORM plus® Table

Extract of standard DEFORM plus®-units

Standard DEFORM plus Units

Type		Nom. values of stat. diagram			Dimensions					Weight
		F_n	s_n	W_n	D'	D	L	thread	L_s	
		kN	mm	Nm	mm	mm	mm	***	mm	kg
DF	1-009-016-E	4,3	11	32	16	16	32,5	M12	15	0,007
DF	1-014-016-A	20,0	10	100	20	20	27,5	M12	15	0,007
DF	1-018-012-P	42,0	12	**) 350	28	28	40,5	M16	18	0,030
DF	1-024-024-A	65,0	18	700	32	32	*) 48,0	M16	20	0,040
DF	1-031-046-E	40,0	46	1500	48	48	*) 103,0	M30	60	0,120
DF	1-032-052-E	52,0	52	1900	50	50	*) 116,2	M30	60	0,120
DF	1-042-082-E	85,0	80	5250	63	63	172,0	M36	95	0,320
DF	2-020-055-E	13,5	50	525	30	30	118,5	M24	57	0,400
DF	2-020-033-A	27,0	33	660	34.5	34.5	106,0	M12	20	0,340
DF	2-021-035-A	31,0	35	840	34.5	34.5	113,6	M12	21	0,360
DF	2-020-055-A	27,0	50	1100	30	30	118,4	M24	57	0,400
DF	2-046-030-A	115,0	30	2500	50	50	87,0	M12	18	0,590
DF	2-047-030-A	140,0	30	3250	50	50	87,0	M12	18	0,600
DF	3-070-030-A	270,0	30	6000	90	90	121,5	M24	41	1,260
DF	3-072-033-A	300,0	33	7500	90	90	126,7	M24	36	1,270
DF	3-085-150-A	700,0	150	75000	141	141	485,0	M24	50	10,600

* *stainless steel spring pin*

** V_{zul} = 1,4 m/sec*

*** Units with plastic thread are hand-screwed, units with metal screws are preloaded with half a screw turn.*

Explanations to table

F_n = *Nominal Force*

s_n = *Nominal stroke*

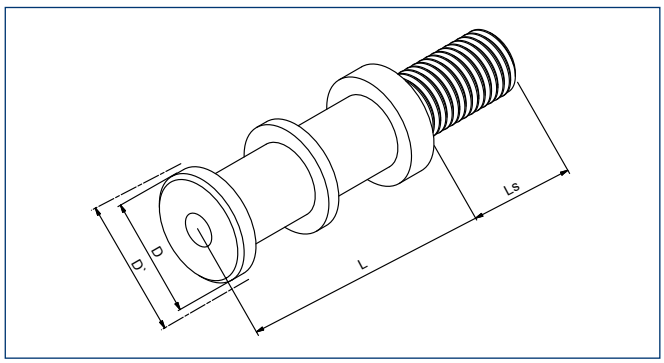
W_n = *Nominal capacity*

D' = *Installation diameter*

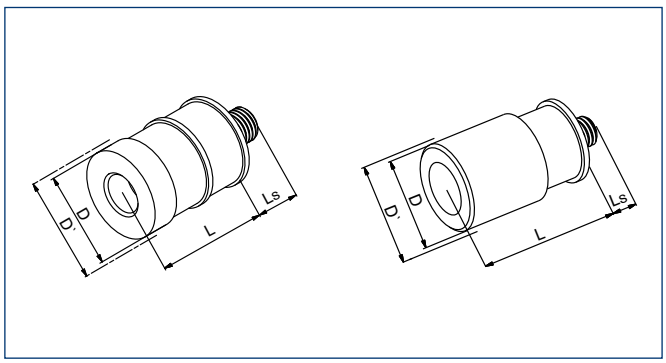
D = *Nominal diameter*

L = *Effective length*

L_s = *Thread length*



Type 1



Type 2/3

Streetcar

RINGFEDER POWER TRANSMISSION Damping Technology products not only ensure safety in machines, but also vehicles. Like here at a streetcar of the Rheinbahn Duesseldorf, a local public transport provider, DEFORM plus® Damping Elements are installed to protect man and machine. The DEFORM plus® Damping Elements, ready for operation at any time, minimize forces and decelerations in case of a crash.

DEFORM plus® R/RMP Features

Shock Absorbing Elements DEFORM plus® R/RMP

Reversible buffer for absorption of kinetic energies without additional spring.

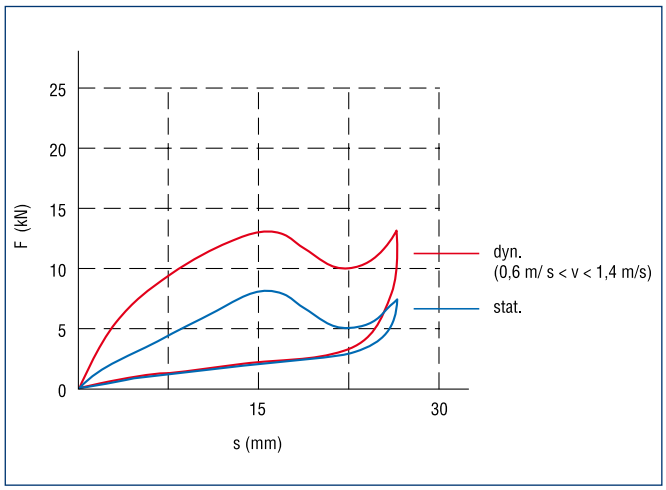
The casing combines the function of a spring and a damper. It can be reused after a dynamic load. Dependent on the velocity, the maximum supporting load automatically adapts to the impact energy, which means that i.e. equal masses are retarded more softly at lower velocities. Working temperature: -10°C up to +50°C.

Ambient conditions:

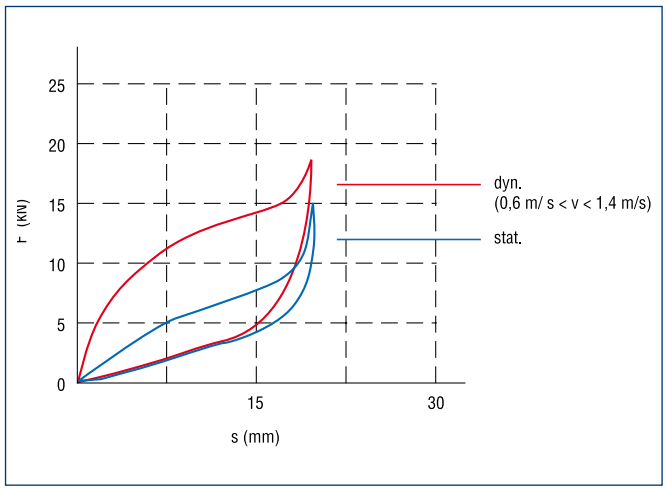
The material is resistant to

- ***bleach liquor 3%***
- ***sugar solution 30%***
- ***hydrogen peroxide 10%***
- ***ammonia 5%***
- ***acetic acid 2%***
- ***formic acid 2%***
- ***linseed fatty acid***
- ***tannic acid solution 20%***
- ***lubrication grease and oil***

A continuous contact with water should be avoided. In accordance with DIN 4012, building material class 2, the material is classified as non-combustible, dripping (off).



DEFORM plus® R45
Spring diagram at appr. 20°C



DEFORM plus® R45MP
Spring diagram at appr. 20°C

Coil scale

Even with smallest setting velocities, impacts are created which can, on sensitive machine parts like this precision scale, lead to damages.

DEFORM *plus*® R/RMP *Table*

Standard DEFORM *plus*® Units

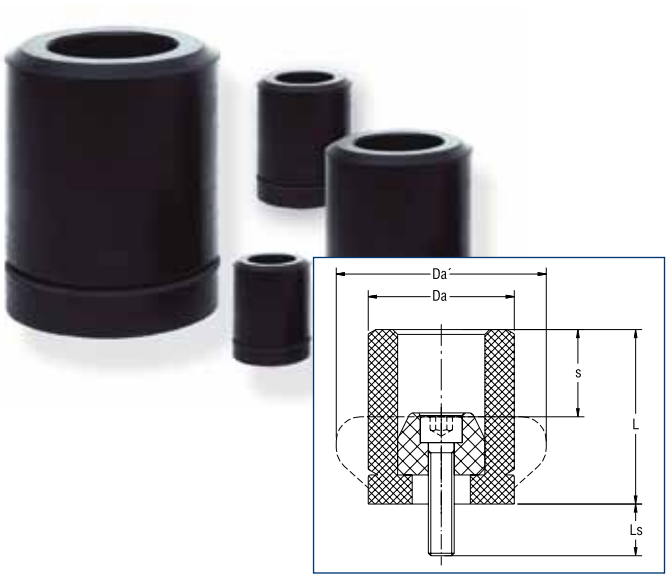
Type	Wmax / 16h	Wmax / 1h	Wstat / load	Fdyn (≈ 2 x Fstat)	max. driving force	$s_{max.}$	Da'	D_a / D_p	L	Thread	L_s	weight
	Werte bei ≈20°C *Value at ≈ 20°C*			bei ≈ 20°C *at ≈ 20°C*			mm	mm	mm		[mm]	[g]
R30	76 Nm		38 Nm	7 kN (1,1 m/s)	1,5 kN	18 mm	45	30 / -	36	M6	14	47
R45	240 Nm		120 Nm	16 kN (1,4 m/s)	2,5 kN	27 mm	68	45 / -	54	M8	17	85
R60	560 Nm		280 Nm	33 kN (2,0 m/s)	4,5 kN	36 mm	91	60 / -	72	M12	17	240
R90	1800 Nm		900 Nm	66 kN (3,2 m/s)	9,0 kN	54 mm	137	90 / -	108	M16	24	750
R30MP		57 Nm	30 Nm	8 kN (1,1 m/s)	5 kN	13 mm	45	30 / 37	42	M8	16	70
R45MP		180 Nm	115 Nm	18 kN (1,4 m/s)	10 kN	19 mm	65	45 / 57	63	M12	25	160
R60MP		420 Nm	200 Nm	36 kN (2,0 m/s)	15 kN	25 mm	90	60 / 71	85	M16	22	360
R90MP		1350 Nm	750 Nm	83 kN (3,2 m/s)	20 kN	37 mm	130	90 / 112	127	M24	28	1300

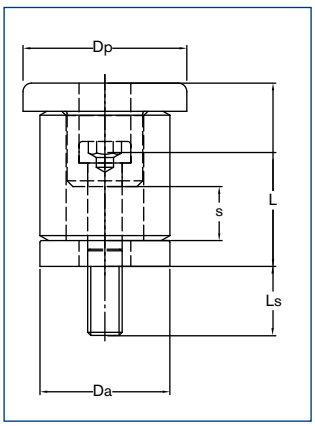
The Damping Elements are impervious to dirt and are supplied ready-to-install including the locking bolt.

Mounting of the buffers is most simple: The screw, with a coating of Loctite, is tightened to the component part to be protected, until the buffer can no longer rotate; then, the buffer is pretensioned by half a screw turn.

Due to its guidance by the fastening screw, the buffer (see figure below) is relatively insensitive to the influence of lateral forces. In case of a design "impact buffer vs. buffer", at least one damper must be equipped with a baffle plate.

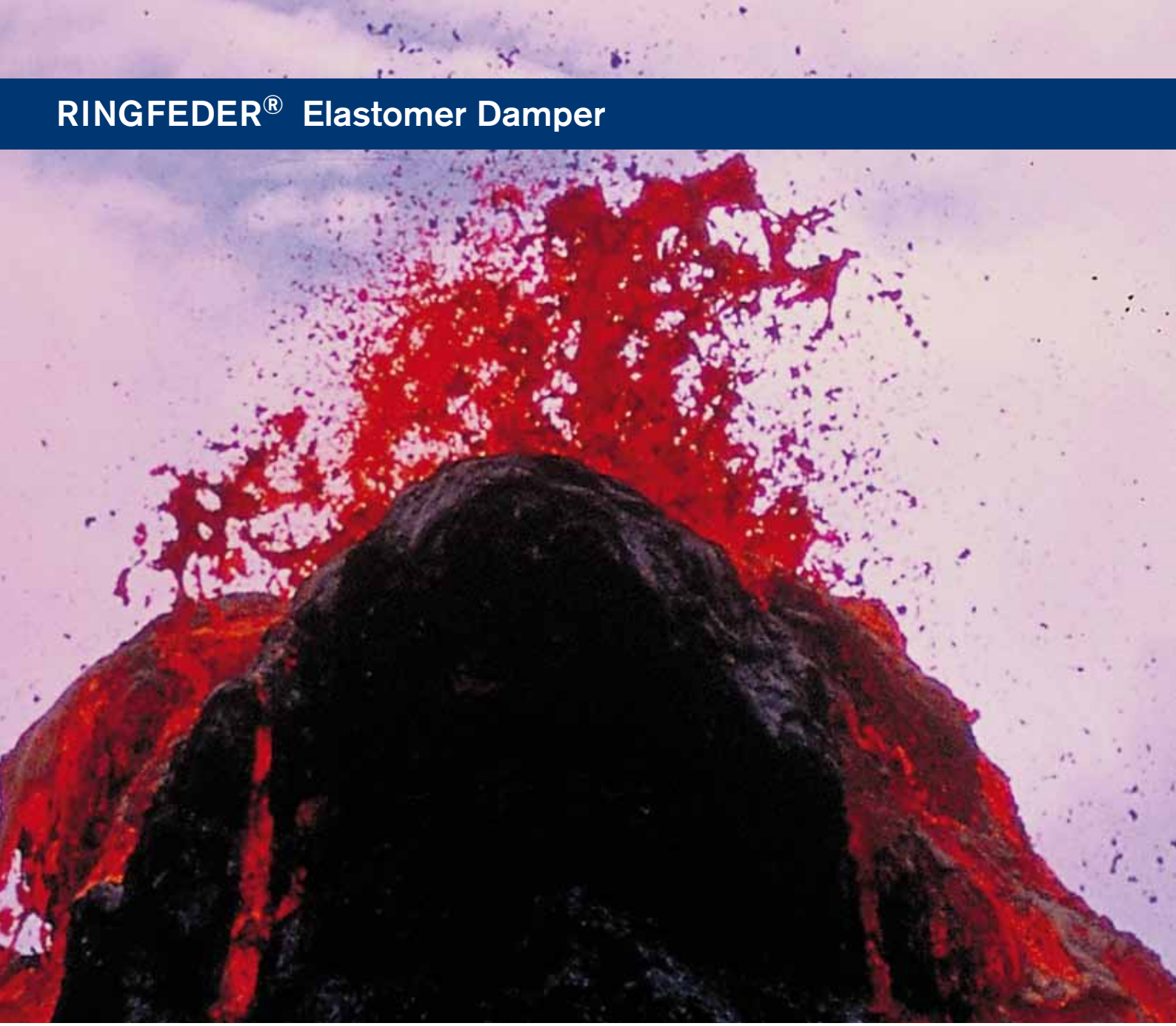
A low-cost version designed for infrequently occurring stresses, the DEFORM plus® R damper without baffle plate (see figure below). This type provides max. protection by avoiding the progressive force rise.





Mountain railway

Mountain railways have high safety requirements at the valley station. DEFORM plus® R fulfils these requirements for passenger security by keeping the deceleration , in case the cabin drives against the buffer stock, as low as possible. Hydraulic unit's initial breakaway torque is too high and could thus create high braking forces.

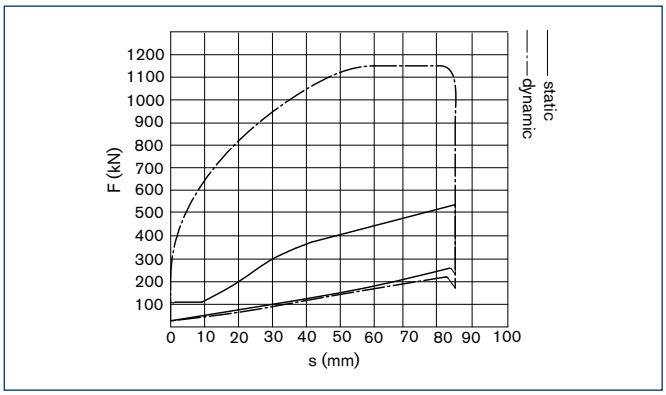


Fluid Elastomer Damper

Hydro elastic dampers are high performance dampers which complete our range of products with relatively small mounting space. The function of these units is based on the use of the worldwide unique fluid elastomer, which is used under high pressure in heavy-walled housings. The application of this technique ensures excellent and everlasting operating parameters of the products and allows its reliable, long lasting use within a large temperature range.

- High capacity
- Big Damping potential
- Non flammable
- Environment-friendly
- Recyclable
- Bigger temperature frame
- Maintenance free

Characteristics



Buffer Characteristic

Field of Application

- ***Steel mills***
- ***Rolling mills***
- ***Overhead Cranes***
- ***Heavy Duty Engineering***
- ***Materials Handling Equipment***

RINGFEDER® Elastomer technology

Fluid Elastomer Technology

The Fluid Elastomer Technology, which is applied in buffers and shock absorbers, is based on the characteristics of the pourable elastomer, whose composite is patented. The design layout of the units is done in a way, that no additional gas spring or helical spring is required. This elastomer is a high-viscosity substance, which reacts under constant conditions like a ductile substance, in contrast to dynamic loads, where it is characterized through a high resilience.The pourable elastomer has an excellent capacity for the absorption and distribution of mechanical energies, the damping of vibrations, impacts and other mechanical loads. Thanks to its consistency and chemical composition it is nonpolluting and, therefore, no hazard for the environment. The production of the elastomer is absolutely residue-free.

Depending on the operating requirements, there is the additional possibility of a modification of the parameters of the hydro elastic damper to achieve optimum operating requirements. That way it is also possible to modify the absorbability according to the requirements, so the units can also be designed as force limiting device, i.e. virtually as spring with low damping features.

Heavy duty crane

For the end stop position, we offer buffers of all categories. Regardless of when and under which operating conditions safety is required, the products of RINGFEDER POWER TRANSMISSION are available for your application.

Fax Inquiry

RINGFEDER POWER TRANSMISSION USA CORPORATION, NJ 07675, USA

Fax +1 201 664 6053

Adresser

Company

attn. Dept.

Address

Phone Fax

E-mail

We ask for a consulting discussion. Please call us under back

Please let us have your design proposal for a RINGFEDER® Friction Spring suitable for the following application

Spring Diagram:

energy absorption (spring work) W_B = (J) ±

admissible operating force F_B = (kN) ±

desired working spring travel S_B = (mm)±

pretensioning force F_V = (kN)±

spring stiffness c = (kN/mm)

intensity ±

Installation Space:

max. outer diameter D_2 = (mm) ±

max. inner diameter d_2 = (mm) ±

dampening D = (%)

max. installation length L_V = (mm) ±

Loadings:

load frequency n = (1/sec) ±

life expectancy N = ±

External Operating Conditions

ambient temperature t = (°c) ±

Influence of dust or moisture

Description of the load collective concerning and frequency:

Special Properties and Conditions

grease specification

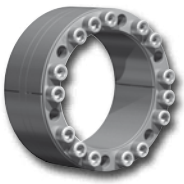
oil

*****If possible, please supply an assembly drawing or sketch.*****

Delivery Program

RINGFEDER

Locking Devices


Locking Assemblies


Locking Elements


Shrink Discs®


Smart-Lock

Damping Technology


Friction Springs


DEFORM plus®
DEFORM plus® R


Fluid Elastomeric Damper

Special Solutions


Shaft Couplings


Locking Assemblies


Flange Couplings

GERWAH®

Couplings


Magnetic Couplings


Metal Bellows Couplings


Servo-Insert Couplings


RING-flex® – torsionally rigid Disc Couplings


Safety Couplings


Line Shafts

Weitere technische Hinweise befinden sich im jeweiligen Katalog.

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Check out the respective catalogue for further technical details

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RINGFEDER POWER TRANSMISSION GMBH

- Oberschlesienstr. 15, D-47807 Krefeld, Germany
- Lützeltaler Str. 5a, D-63868 Großwallstadt, Germany · Phone: +49 (0) 6022 2204-0 · Fax: +49 (0) 6022 2204-11
  E-mail: sales.international@ringfeder.com · E-mail: sales.international@gerwah.com

RINGFEDER POWER TRANSMISSION USA CORPORATION

165 Carver Avenue, P.O. Box 691 Westwood, NJ 07675, USA · Toll Free: +1 888 746-4333 · Phone: +1 201 666 3320
Fax: +1 201 664 6053 · E-mail: sales.usa@ringfeder.com · E-mail: sales.usa@gerwah.com

RINGFEDER POWER TRANSMISSION INDIA PRIVATE LIMITED

Plot No. 4, Door No. 220, Mount - Poonamallee Road, Kattupakkam, Chennai – 600 056, India
Phone: +91 (0) 44-2679-1411 · Fax: +91 (0) 44-2679-1422 · E-mail: sales.india@ringfeder.com · E-mail: sales.india@gerwah.com

KUNSHAN RINGFEDER POWER TRANSMISSION COMPANY LIMITED

German Industry Park, No. 508 Hengguanjing Road, Zhangpu Town 215321, Kunshan City, P.R. China
Phone: +86 (0) 512-5745-3960 · Fax: +86 (0) 512-5745-3961 · E-mail sales.china@ringfeder.com