Partner for Performance

RINGFEDER

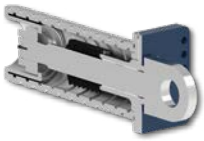
Damping Components



Friction Springs









Industrial Dampers

EN 10.2026

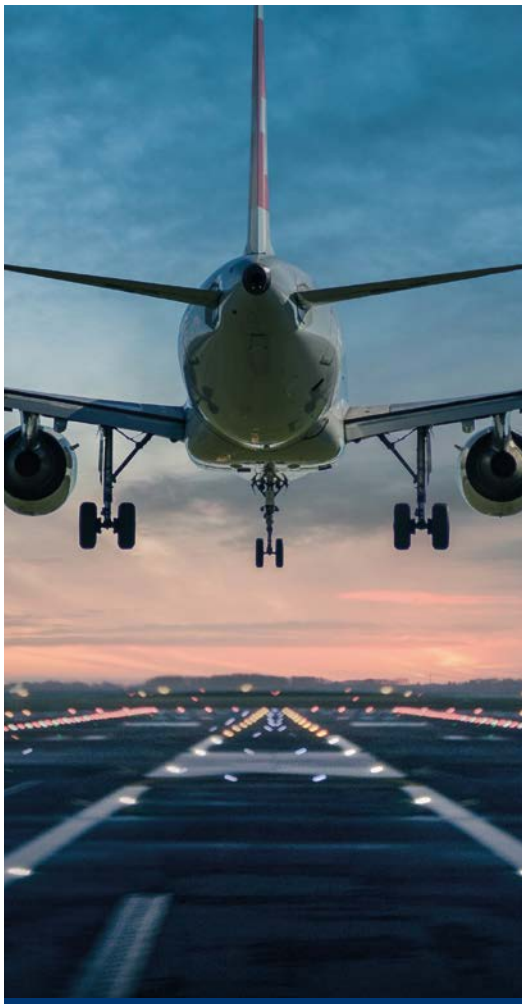
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Process Technology

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Your Partner for High-Quality Components of Drive and Damping Technology

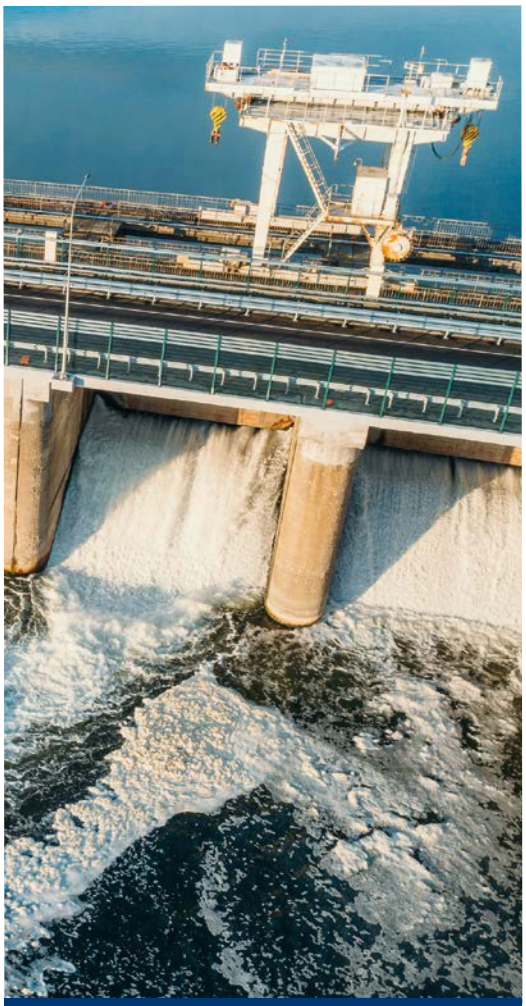
We say what we mean and mean what we say.

We see things from our customers' perspective.

We are considerate of our employees and their families as well as of our environment and society.



Drive Systems



Power Generation



Raw Material Extraction

RINGFEDER POWER TRANSMISSION is the international market leader in niche markets of drive and damping technology. We develop, manufacture and supply superior Shaft-Hub Connections, Damping Components, Couplings, Brake Systems and Bearing Housings for highest requirements on functionality and reliability in the most diverse technology sectors worldwide. With over 100 years of experience and profound expertise, we stand by our customers as a competent, dependable and dedicated partner. Together with them, we realize need-based, application-oriented solutions that are indispensable for safe, failure-free and economical operation of machines, plants, vehicles and constructions – fully in line with our commitment as your **Partner for Performance**.

Our promise for your specific use case:

- Excellent know-how
- Optimal cost-benefit ratio
- Fast reaction times
- High availability



Quality & Expertise

Over one century of knowledge and experience

As a pioneer and specialist in high-performance, highly reliable components of drive and damping technology, we excel through exceptional professional competence, first-class product and service quality as well as consistent customer focus. For your success, we set technical standards, create future-proof innovations and provide groundbreaking inspiration – no matter how, where and when forces must be transmitted or damped.

Reliability & Trust

From the requirement to the optimal result

Whether a customized special design or proven standard model, whether a highly specific individual or holistic system solution: As a proficient, professional and trustworthy partner on equal terms, we support and accompany you from the initial clarification of requirements to the successful completion of your objective – and, of course, also beyond.



Your Projects, Our Solutions

Anytime & Anywhere

Locally on-site for you worldwide

Thanks to national and international development, manufacturing and distribution locations as well as a worldwide service and partner network, we are at your side around the globe directly and locally with qualified technical support and fast product availability – around the clock, seven days a week, of course also and particularly in urgent maintenance and repair cases.

Digital & Online

Always find the right information instantly

Discover the latest company and product information, download CAD models, manuals, brochures and data sheets, use our calculation and selection program for shaft-hub connections, arrange a video consultation appointment with one of our experts and much more – quickly, easily, at any time and without any obligation. Convince yourself on our website at www.ringfeder.com.

RINGFEDER®
Damping Components

Securing Structures, Protecting People

Slowing down moving masses in a quick, secure and precise manner, in machines, vehicles, buildings and other structures: **RINGFEDER® Damping Components** are indispensable, maintenance-free safety elements in all technology sectors where suddenly occurring kinetic energies must be absorbed or highly effective damping solutions are required for enormous forces at relatively small dimensions – whether as application-specific custom design or readily available standard version.

As the pioneer and inventor of Friction Spring technology, RINGFEDER POWER TRANSMISSION has been a leading expert for more than 100 years in highly-reliable, precisely fitting damping components, that – depending on the specific requirements of the application – absorb forces, provide overload protection and compensate for movement.

RINGFEDER® Friction Springs

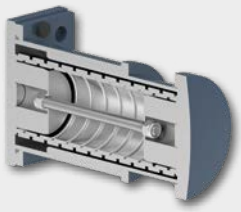
Complete spring columns consisting of precisely machined inner and outer rings.



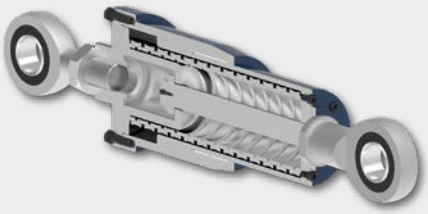
RINGFEDER® Industrial Dampers

Friction Springs as application-specific damper versions.

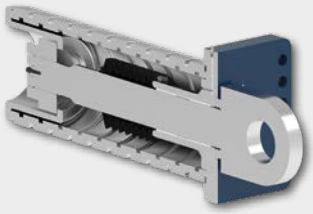
Buffer



Push-Pull Unit



Draw Gear



Overload Clutch



From a height of up to ten meters, very large, heavy pieces of steel scrap fall into this melting furnace in a steel plant. Thanks to the use of numerous draw gears based on RINGFEDER® Friction Springs, each with an absorption capacity of tens of thousands of joules, the resulting drop energy is effectively absorbed and the overall structure is thus safely protected against damage – and this without wear and maintenance during continuous furnace operation at temperatures of several thousand degrees Celsius.



RINGFEDER®
Friction Springs

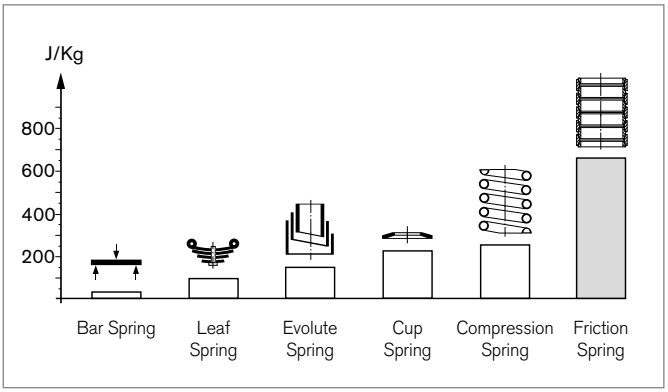
One Technology, Numerous Advantages

Compared to conventional damping alternatives, RINGFEDER® Friction Springs have a variety of superior advantages:

- High spring work at low weight and volume
- High damping effect
- Spring work and damping effect independent from load speed
- Overload-safe in block position
- Maintenance-free and temperature-independent
- Parallel and serial arrangement of springs
- Individual designs for specific use cases

High spring work at low weight and volume

Since Friction Springs make full use of the spring material of which they are made, dimensions and weight are reduced to a minimum. The decisive parameter is therefore the spring work.



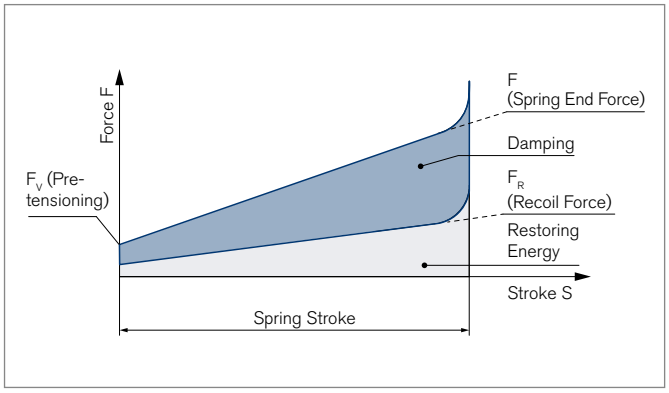
Weight utilization η of various springs

Disclaimer of liability

All technical details and notes are non-binding and cannot be used as a basis for legal claims. The user is obligated to determine whether the represented products meet his requirements. We reserve the right to carry out modifications at any time in the interests of technical progress.

High damping effect

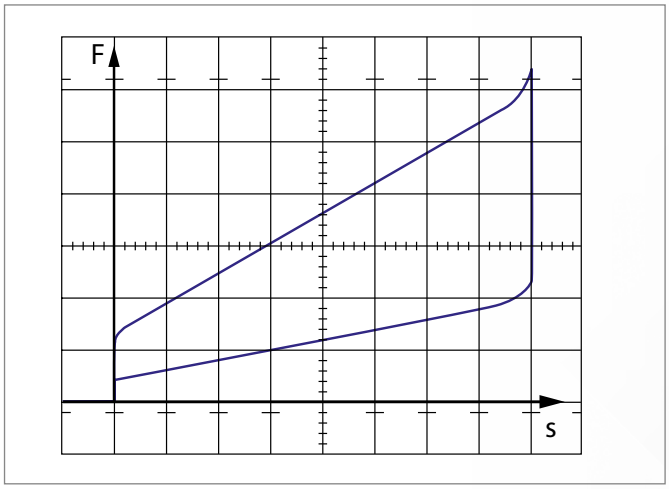
The damping effect of Friction Springs is 66 % as standard, which means that the energy induced is quickly absorbed and resonance effects are completely suppressed. Variation of the damping effect between 33 % and 66 % is realized by using other lubricants specific to the customer and the application.



Damping effect and spring work of RINGFEDER® Friction Springs

Spring work and damping effect independent from load speed

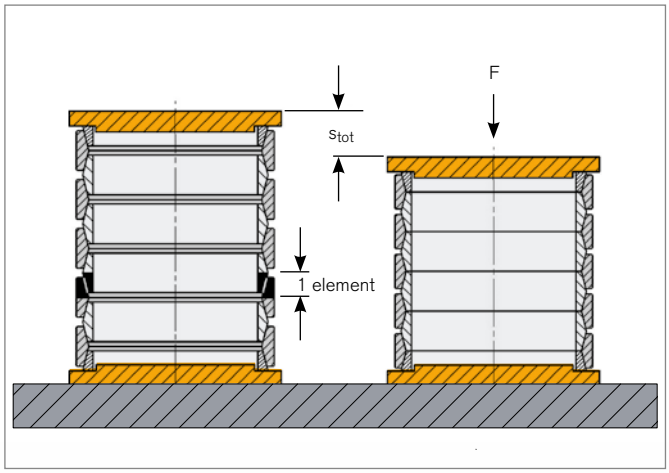
The force-stroke diagram of the Friction Springs applies for all operating conditions. In contrast to other damping alternatives, Friction Springs provide full spring work and damping effect even when the load is applied extremely slowly or quickly.



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

Overload-safe in block position

Generally, Friction Springs are designed to „block“: When the maximum spring stroke is reached, the front surfaces of the inner rings make contact with each other, and the Friction Spring thus forms a rigid column. This ensures that admissible stresses cannot be exceeded and the Friction Spring will not be damaged.



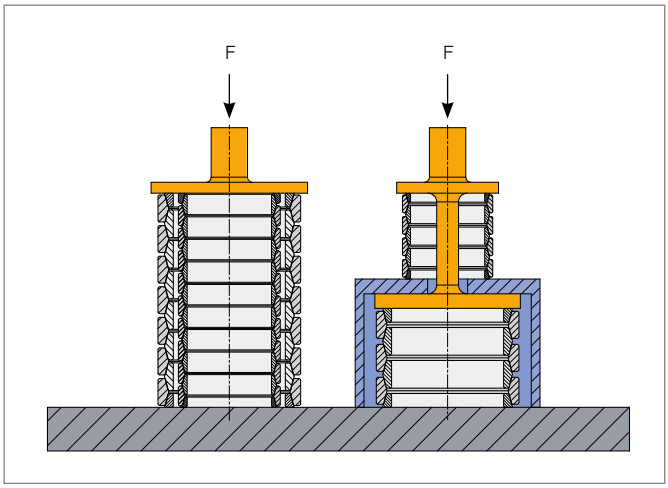
Overload protection of RINGFEDER® Friction Springs

Maintenance-free and temperature-independent

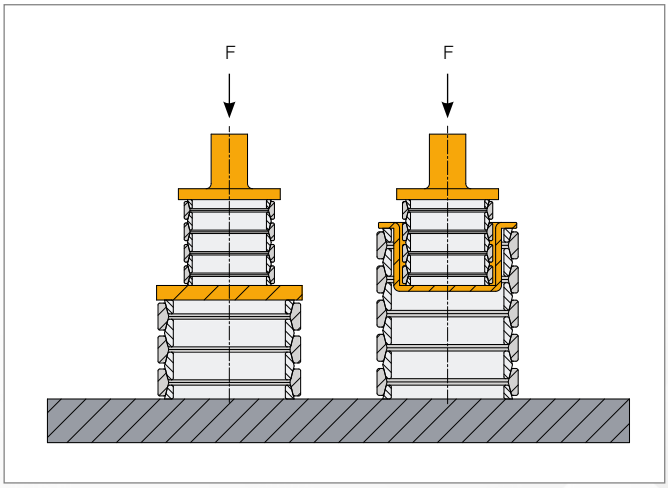
For hydraulic dampers or springs made of synthetic material, the force-stroke diagram is influenced by temperature fluctuations and inherent heating. The characteristic curve of Friction Springs is independent from these factors. Friction Springs can therefore be applied in a temperature range from -20 °C to +60 °C without the curve changing considerably. However, inherent heating of the spring resulting from the damping effect must be taken into account. Friction Spring applications beyond this temperature range can be realized by using other lubricants. Generally, relubrication of an installed Friction Spring is not required.

Parallel and serial arrangement of springs

The geometry of Friction Springs allows for an even more efficient utilization of the available installation space using a nested construction with parallel or serial spring arrangements.



Parallel arrangement of RINGFEDER® Friction Springs for higher forces

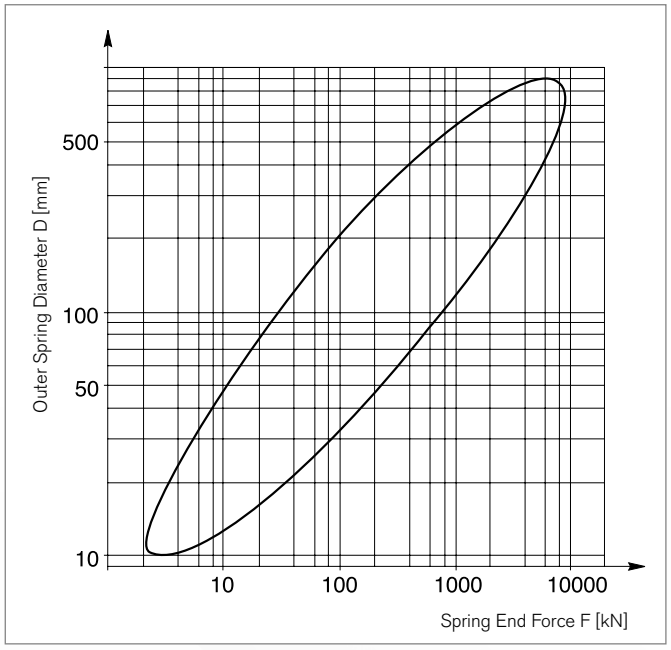


Serial arrangement of RINGFEDER® Friction Springs for more spring stroke

Structure of a Friction Spring

Individual designs for specific use cases

In addition to the standard range of Friction Springs (see table on page 13), customized solutions for specific customer and application requirements can of course be provided. The graph below shows the ratio of outer spring diameter to spring end force, illustrating whether the use of Friction Springs is possible even though a standard spring is not available.



Ratio of outer diameter to spring end force

Generally, a Friction Spring comprising of e elements concludes with half rings. Its unstressed length is then given by:

$$L_o = e \cdot h_e$$

Total spring stroke can be calculated using:

$$s = e \cdot s_e$$

Without considering pretensioning force, spring work is:

$$W = e \cdot W_e$$

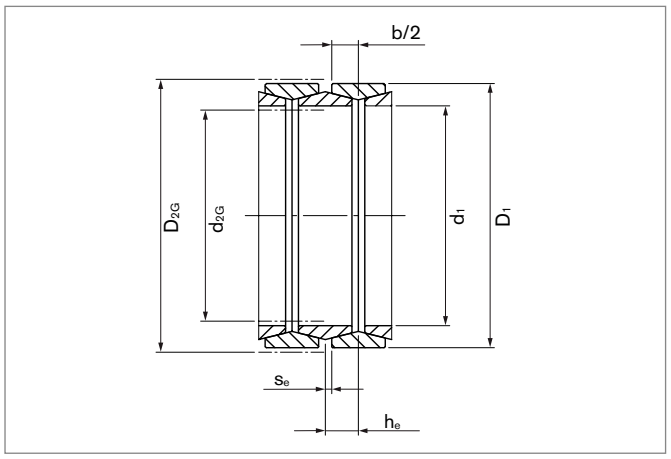
Values h_e, s_e and W_e that are necessary for the calculation can be found in the table on page 13.



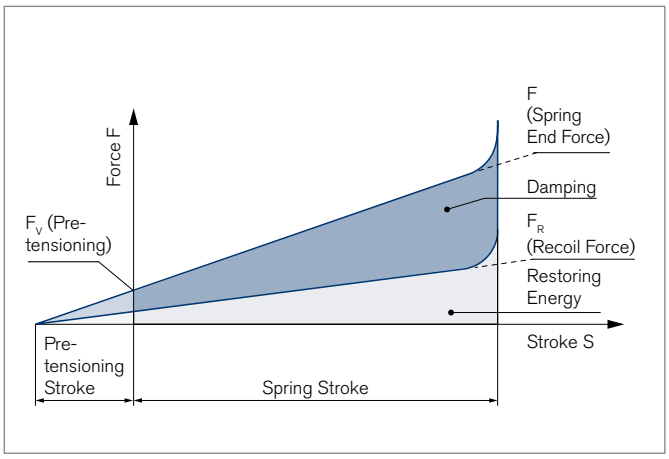
Thanks to their extremely low weight, highly compact design and resistance to very high and very low temperatures, RINGFEDER® Friction Springs are ideally suited for use in the aviation and aerospace industry. For example, they are applied in emergency exit doors of a passenger aircraft in the form of specially developed overload clutches with minimal dimensions, which ensure fast and safe opening of the exit doors in case of an emergency.



Selection & Installation Notes



Dimensions of RINGFEDER® Friction Springs



Force-stroke diagram for one RINGFEDER® Friction Spring element

Pretensioning

Friction Springs must be pretensioned to at least 5 %, preferably 10 %, of the total spring stroke. However, pretensioning force should not exceed 50 % of spring end force in order not to impair the lubrication film.

Guiding

For Friction Springs, a guiding must be provided either on the inner diameter (d_{2G}) or the outer diameter (D_{2G}). Exceptions apply for short springs whose length is ≤ 1.5 D_1, provided they are loaded between parallel guided thrust plates.

Lubrication

Only the recommended special greases must be used for lubrication, as the conical surfaces are under enormous contact pressure. In general, the quantity of grease provided with the spring is sufficient. Relubrication is not required.

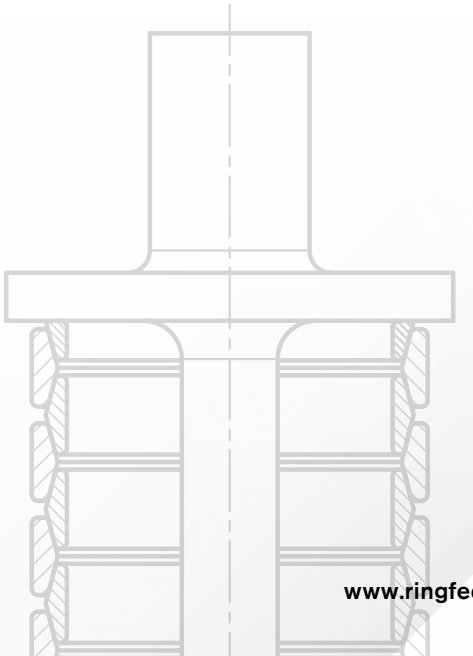
Refer to the diagram

For Friction Springs used as damping springs, the available spring work in Joule, i.e. the area below the upper loading curve, is of interest. For Friction Springs used as tensioning devices, the lower recoil curve applies. The latter can be raised by using friction-minimizing lubricants.

Sealing

Friction Springs must be installed protected against dirt and moisture in order to prevent the lubrication film from being compromised. Simple sliding guides are sufficient. In environments with high levels of dirt and/or moisture, folding bellows are recommended.





Force-stroke diagram

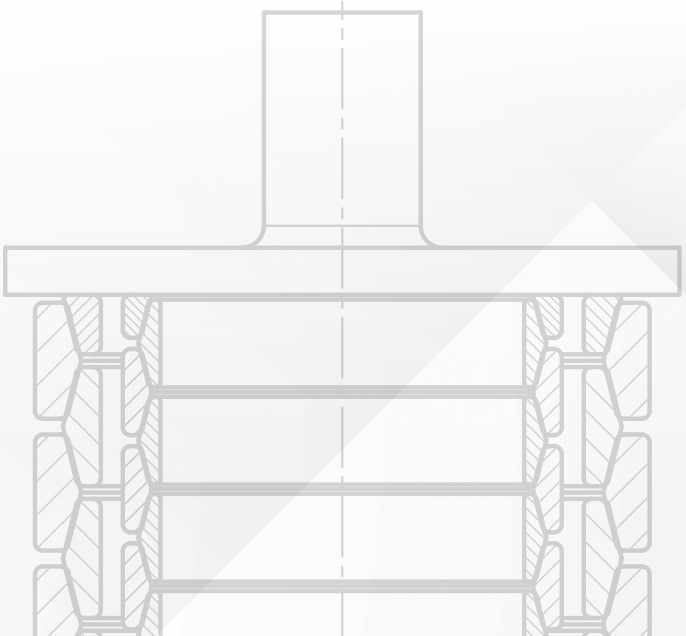
During the operation of the Friction Spring, two thirds of the input energy is dissipated as frictional heat. The recoil force F_R at any point on the diagram is approximately equal to one third of the relative compressive force F. The capacity of the spring is represented by the total area shown below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

Type	Type old	Diagram				Dimensions			Guiding		
		F	s_e	W_e	h_e	D_1	d_1	b/2	D_{2G}	d_{2G}	Gw_e
		kN	mm	Joule	mm	mm	mm	mm	mm	mm	kg
01800	1201	5	0,4	1,0	2,2	18,1	14,4	1,8	18,7	13,9	0,002
02500	1202	9	0,6	2,7	3,1	25,0	20,8	2,5	25,9	20,1	0,004
03200	1203	14	0,8	5,6	4,0	32,0	27,0	3,2	33,1	26,1	0,007
03800	1204	20	0,9	9,0	4,7	38,0	31,7	3,8	39,3	30,6	0,012
04200	1205	26	1,0	13,0	5,2	42,2	34,6	4,2	43,6	33,4	0,018
04800	1206	34	1,1	18,7	5,9	48,2	39,4	4,8	49,8	38,1	0,026
05500	1207	40	1,3	26,0	6,8	55,0	46,0	5,5	56,7	44,5	0,035
06300	1208	54	1,4	37,8	7,7	63,0	51,9	6,3	64,9	50,3	0,056
07000	1209	65	1,6	52,0	8,6	70,0	58,2	7,0	72,1	56,4	0,074
08000	1310	83	1,8	75,0	9,8	80,0	67,0	8,0	83,0	64,0	0,105
09000	1311	100	2,0	100,0	11,0	90,0	75,5	9,0	93,0	73,0	0,145
10000	1312	125	2,2	138,0	12,2	100,0	84,0	10,0	103,0	81,0	0,203
12400	1314	200	2,6	260,0	15,0	124,0	102,0	12,4	128,0	98,0	0,408
13000	1313	160	2,6	208,0	15,0	130,0	111,5	12,4	134,0	108,0	0,376
14000	1315	250	3,0	375,0	17,0	140,0	116,0	14,0	144,0	112,0	0,568
16600 *	1316	350	3,7	648,0	20,0	166,0	134,0	16,0	170,0	130,0	0,869
19600	1318	600	4,4	1320,0	23,4	194,0	155,0	19,0	199,0	150,0	1,676
20000	1317	510	3,9	995,0	22,4	198,0	162,0	18,5	203,0	157,0	1,570
22000	1319	720	4,4	1584,0	26,4	220,0	174,0	22,0	225,0	169,0	2,573
26200	1320	860	4,8	2064,0	25,8	262,0	208,0	21,0	268,0	202,0	3,415
30000	1221	1000	5,8	2900,0	35,8	300,0	250,0	30,0	306,0	245,0	5,510
32000	1222	1200	6,2	3720,0	38,2	320,0	263,0	32,0	326,0	258,0	7,060
35000	1223	1400	6,6	4620,0	41,6	350,0	288,0	35,0	356,0	283,0	9,180
40000	1224	1800	7,6	6840,0	47,6	400,0	330,0	40,0	407,0	324,0	13,560

* For type 1316 a separate stroke limitation has to be provided

Table explanations

- **F** = Spring end force
- **s_e** = Spring stroke for one element
- **W_e** = Energy absorption of one element
- **h_e** = Length of one element
- **D_1, d_1** = Outer and inner diameter
- **b/2** = Half length of the ring
- **D_{2G}** = Outer guiding diameter
- **d_{2G}** = Inner guiding diameter
- **Gw_e** = Weight of one element



Application Example

Figures 1 and 2 show a Friction Spring of type 20000, which consists of 8 outer rings, 7 inner rings and 2 half inner rings. It is pretensioned with 200 kN to a length of 334 mm. With these values, it has a maximum stroke of 38 mm and a capacity of 13,400 Joule. The requirement is to absorb a maximum energy of 6,000 Joule.

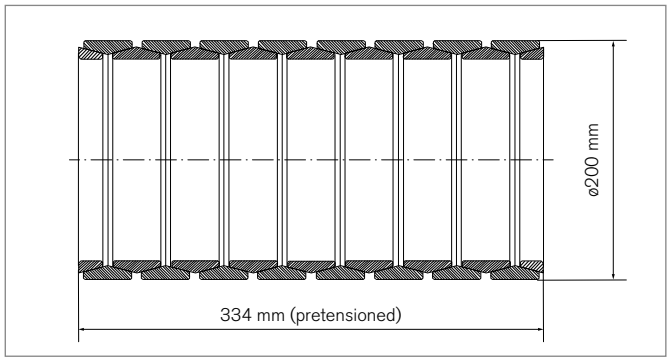


Figure 1

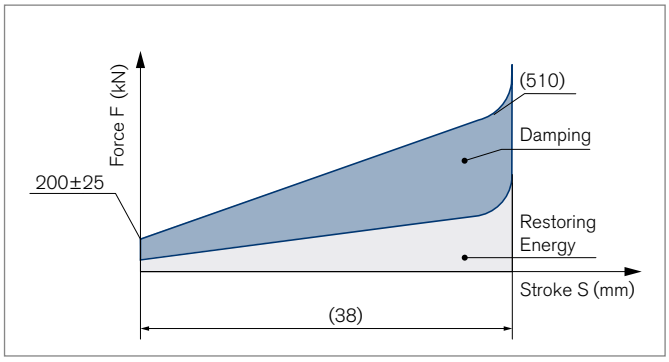


Figure 2

Diagram 1: When the Friction Spring receives an impact force, it compresses by 21 mm and absorbs 6,000 Joule (= 66 %) from which 4,000 Joule are converted to heat. After the compression, the Friction Spring discharges back by the same 21 mm due to a recoil force and there are 2,000 Joule that have to be absorbed.

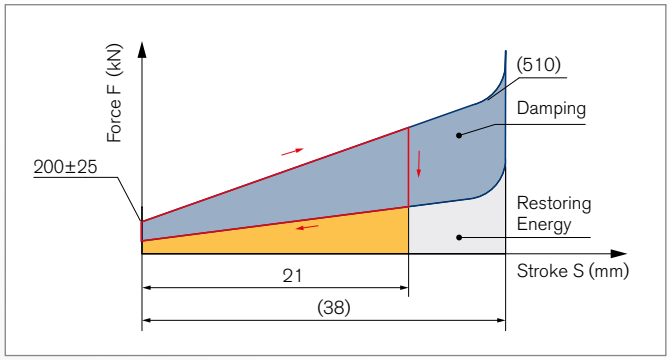


Diagram 1

Diagram 2: The impacting body strikes again on the Friction Spring with the remaining 2,000 Joule and compresses it by 8.5 mm. After the compression, the damper springs back by the same 8.5 mm due to the recoil force. Based on the fact that the friction not only occurs between the rings of the friction spring but in the whole system, the complete 6,000 Joule are now absorbed and the system comes to rest.

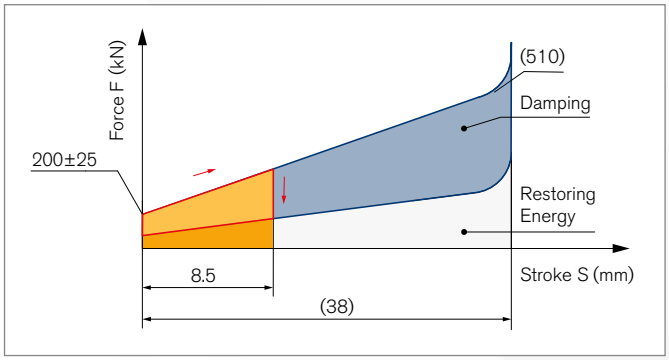
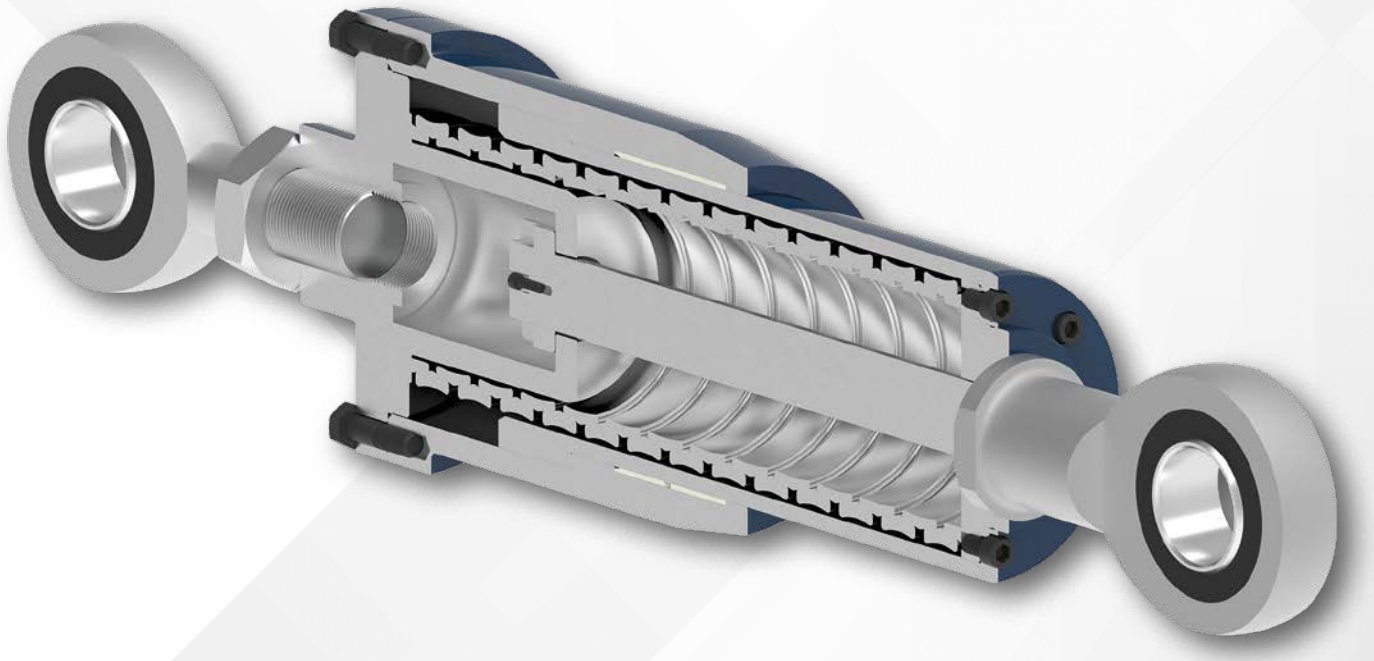


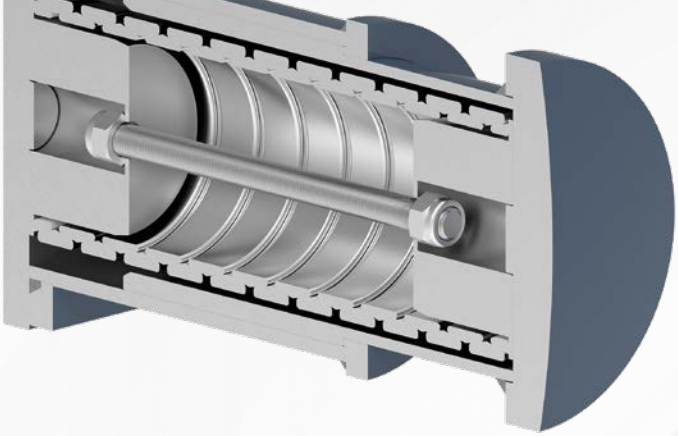
Diagram 2



In medium-caliber weapon systems, such as automatic grenade machine guns, recoil damping plays a decisive role in achieving high firing accuracy and operational stability. RINGFEDER® Friction Springs provide efficient and reliable recoil damping, significantly reducing system vibrations and improving shooting precision. At the same time, they protect both the weapon system and adjacent equipment, including sensitive sensor technology. Their durable, high-performance design ensures consistent functionality even under demanding operating conditions.

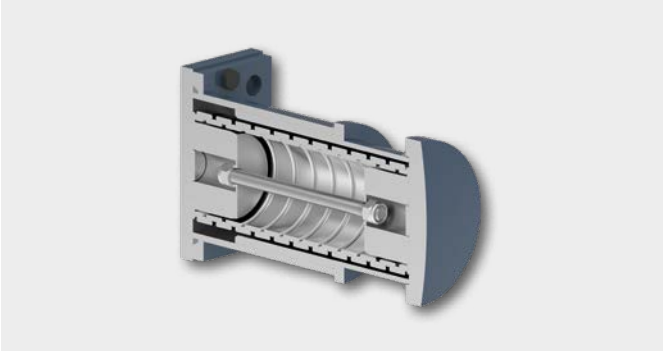


RINGFEDER®
Industrial Dampers

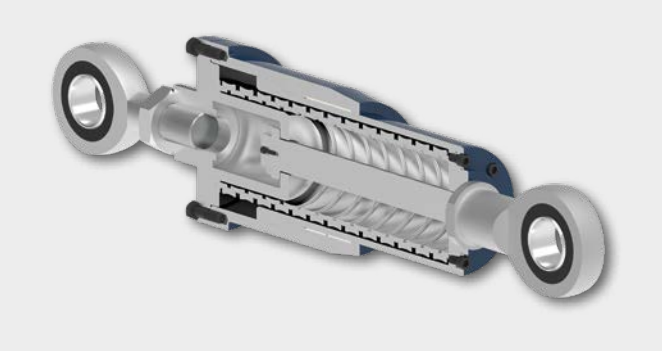


In addition to sole spring columns, RINGFEDER® Friction Springs are also available as complete, application- and customer-specific damper versions in various shapes and sizes for diverse use cases, e.g. in mechanical engineering, in raw material extraction and processing or in the aviation and aerospace industry. A selection of typical damper types can be obtained from the table on page 17.

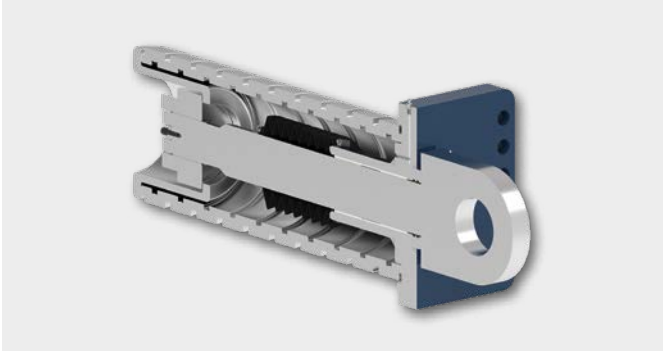
Common designs include push-pull units as highly effective vibration absorbers and slipping clutches for reliable protection against overloads.



Buffer



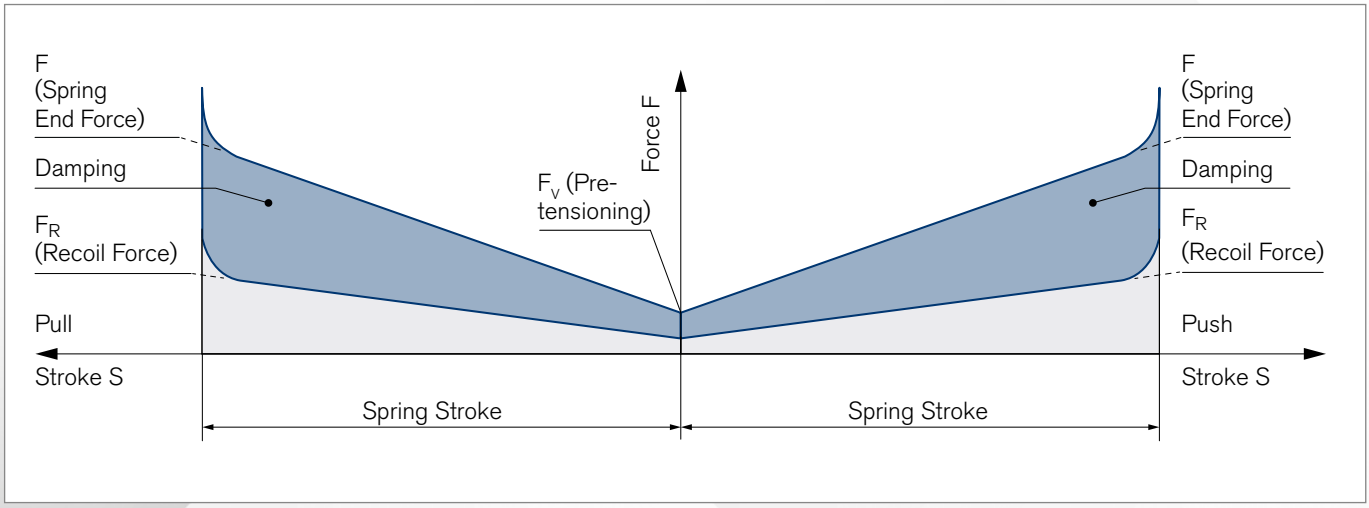
Push-Pull Unit



Draw Gear



Overload Clutch

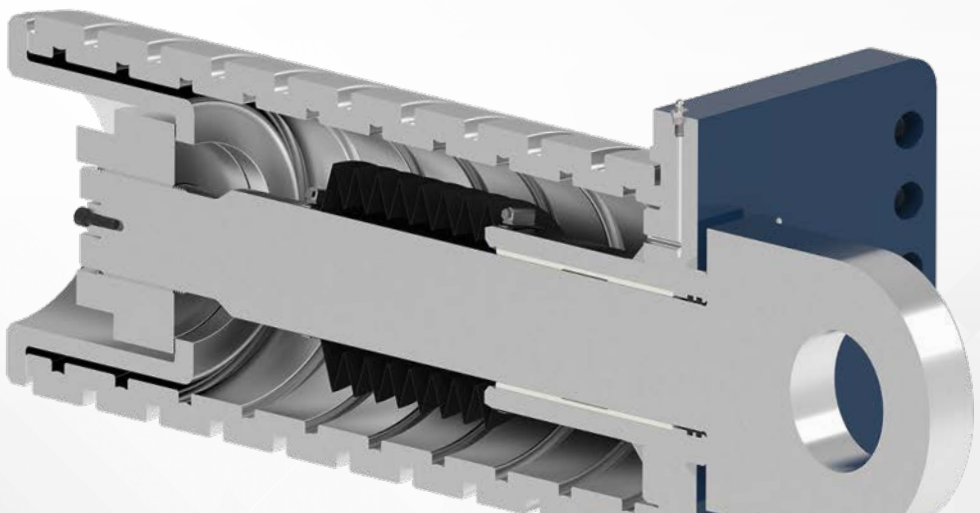


Force-stroke diagram for a push-pull unit

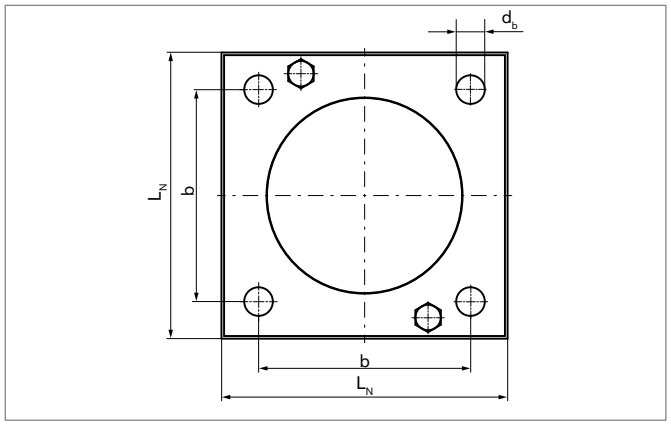
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		F_v	F	s	W	L	l_S	D	D_B	D_C	D_P	F_K	L_N	Gw	b	d_b	D_E	t
		kN		mm	J	mm								kg	mm			
1				27	820	202	107							10				
2				37	1100	262	156							12				
3	06300	6	54	55	1640	374	225	112	150	102	80	27	145	17	100	18	104	15
4				64	1900	434	293							19				
5				74	2200	494	293							20				
6				33	1500	230	125							13				
7				46	2050	306	170							16				
8	08000	7	83	66	2950	428	258	122	200	114	96	27	160	23	110	18	117	15
9				79	3550	505	355							26				
10				92	4150	582	360							28				
11				45	3000	300	165							22				
12				61	4100	397	230							26				
13	10000	10	125	89	6000	571	350	142	250	133	114	31	185	37	130	23	135	20
14				105	7050	667	470							42				
15				121	8150	763	470							45				
16				51	5600	366	216							39				
17				65	7150	454	275							45				
18	12400	20	200	102	11200	696	456	178	250	165	142	34	215	64	155	23	167	20
19				116	12800	784	574							75				
20				130	14300	872	550							78				
21				75	13900	500	328							85				
22				95	17500	630	450							105				
23	16600	10	350	140	25900	880	657	235	370	219	184	46	270	145	200	27	222	25
24				165	30500	1040	690							160				
25				190	35000	1200	850							165				
27	19600	20	600	105	32000	620	-	-		-	-	-	-	153	-	26	-	-

Table explanations

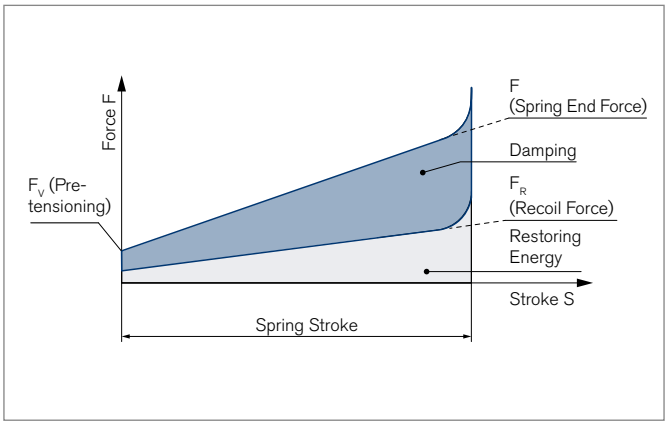
- F_v = Pretensioning force
- F = Spring end force
- s = Spring stroke
- W = Spring work
- L = Total length
- l_S = Submerged length
- D = Outer diameter
- D_B = Flapper diameter
- D_C = Case diameter
- D_P = Plunger diameter
- F_K = Flange thickness
- L_N = Flange width
- Gw = Weight
- b = Distance between flange bore
- d_b = Diameter of through holes
- D_E = Guiding diameter
- t = Wall thickness



Buffers with RINGFEDER® Friction Springs

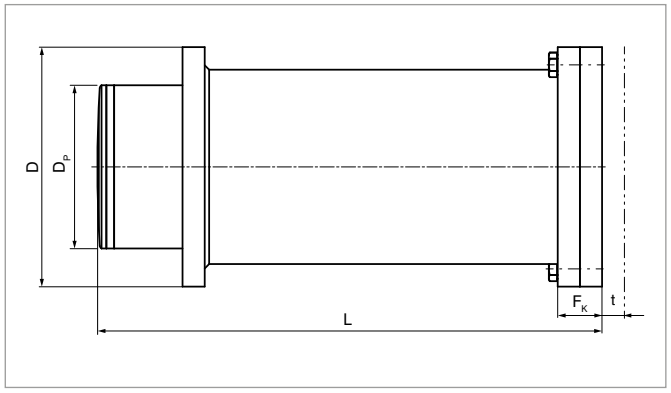


Typical hole pattern

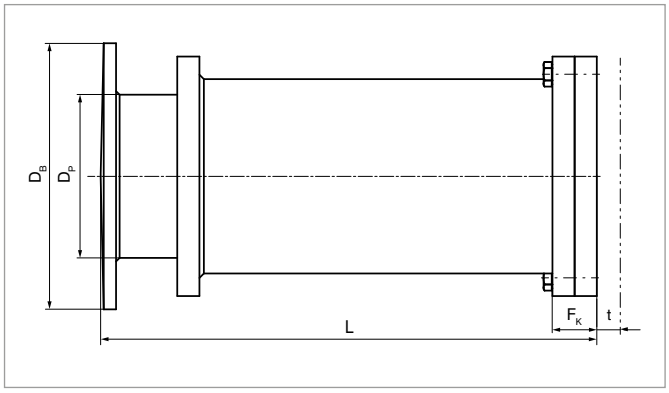


Typical force-stroke diagram of a Friction Spring

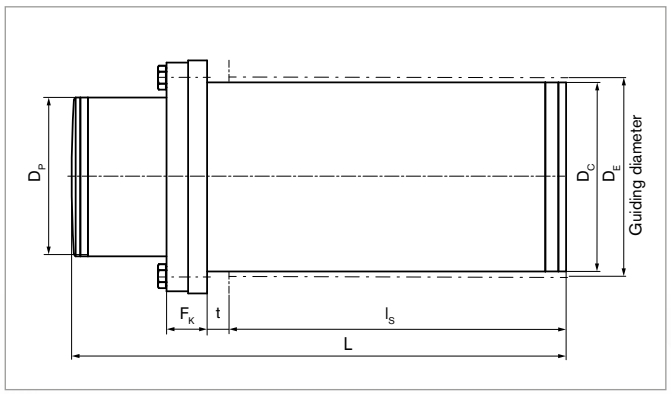
Buffers with Friction Springs are supplied in one of the four following designs. These dampers are suitable for operating temperatures from -20 °C to +60 °C. Specific modifications allow for an extended temperature range from -70 °C to +200 °C.



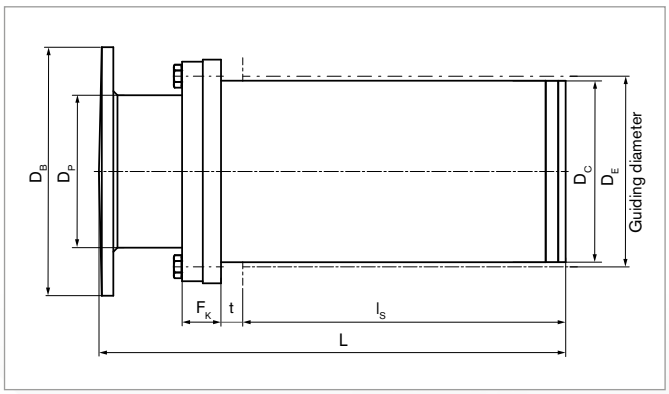
Buffer without flapper and with end flange



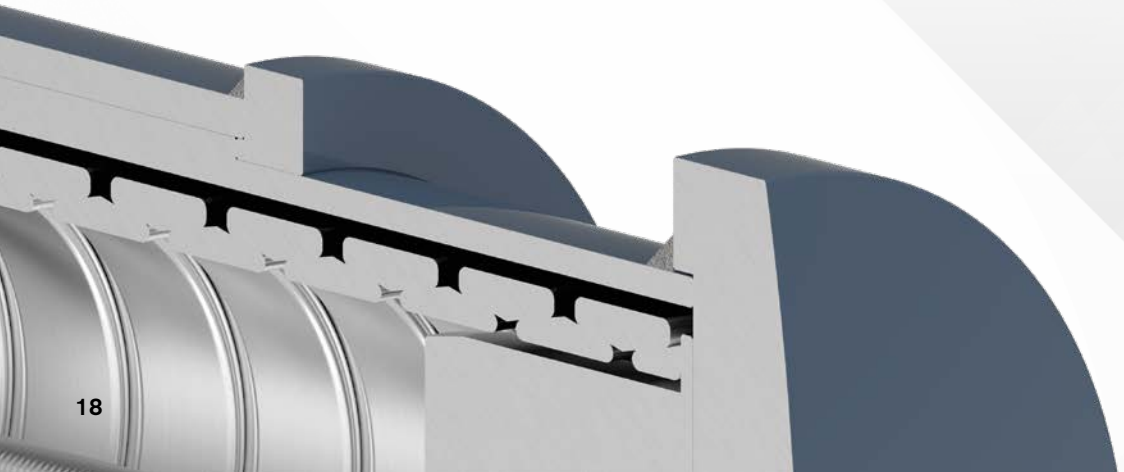
Buffer with flapper and end flange



Buffer without flapper and with central flange



Buffer with flapper and central flange



In marine applications, ammunition and missile systems are exposed to severe dynamic loads, such as strong wave motion, shock forces and potential underwater detonations. These conditions can pose a significant risk to structural integrity and sensitive guidance systems. RINGFEDER® Friction Springs provide highly effective protection by absorbing large amounts of energy within a compact design space. Integrated into storage and mounting systems, they reliably reduce vibrations and shock loads, ensuring the safe storage and operational readiness of missiles and other sensitive equipment even under extreme conditions at sea.



RINGFEDER® Friction Springs for Earthquake Protection

Friction Springs will increasingly become an integral part of future constructions for the seismic protection of residential buildings as well as electrical transmission installations, such as high-voltage switches and so-called wall bushings. While not all damage caused by a major earthquake can be prevented, the application of Friction Springs significantly increases the likelihood that a building will withstand such events – like those that occurred in Christchurch, New Zealand, in 2010 and 2011 – and remain habitable. Buildings in New Zealand equipped with Friction Springs have already demonstrated their effectiveness under real conditions. For example, the Te Puni Village student residence had already been completed when an earthquake struck on July 21, 2013, with a magnitude of 6.5 on the Moment Magnitude Scale, followed by aftershocks reaching 5.8. The building withstood these quakes without any major damage.

Advantages

1. **Longevity** – Friction Springs are designed for long service life and can withstand a large number of load cycles while remaining reusable. If one of the rings within a Friction Spring fails, the spring will lose part of its stroke and its stiffness will increase slightly. However, it will remain functional. The maximum end force and damping capability are not affected. In contrast, the failure of a coil spring or a disc spring results in a complete loss of function, leaving no protective capability.

2. **Damping** – When using our RINGFEDER® standard grease F-S1, approximately 66 % of the induced force is dissipated. If a lower level of damping is required, a customized solution can be applied to achieve reduced damping of up to approximately 33 % of the injected energy. This provides a simple and effective way to deliberately adjust the characteristics of the friction spring. In certain seismic applications, a higher release force is required to return the structure to its original vertical position.

3. **Fire & High Temperature** – Friction Springs are manufactured from high-quality spring steel and are lubricated with grease. In the event of a fire, rubber-based components and viscous dampers may be destroyed, whereas Friction Springs will remain intact. They typically only require regreasing and can then continue to be used.

4. **Self-Centering** – Thanks to the application-specific design of Friction Springs, the optimal restoring force can be achieved for each particular use case. This can be realized, for example, by using different types of grease, increasing the outer diameter or adjusting the taper angle. Such flexibility is not available with conventional spring types.

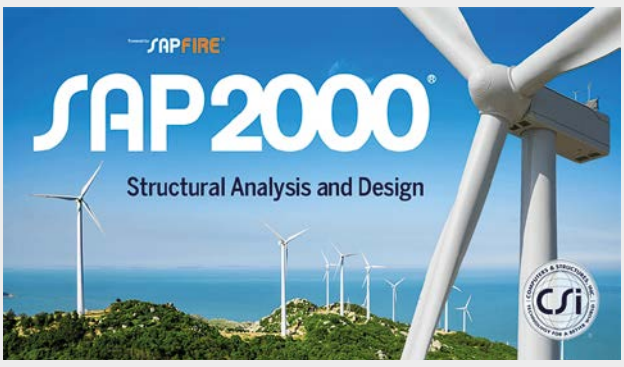
5. **Reusability** – Friction Springs can be reused after a seismic event. They are designed to withstand numerous load cycles while maintaining their functionality and performance. Friction Springs are essentially wear- and maintenance-free.

6. **Speed** – Compared to all other types of springs, Friction Springs respond most rapidly to applied forces. Moreover, they work independently of loading rates and, unlike hydraulic dampers, provide full spring work and damping effect even in case of very slow and extremely fast load occurrences.

7. **Installation Space** – For a given diameter, Friction Springs provide the largest spring forces in comparison to other spring types.

Software Integration of RINGFEDER® Friction Springs

Friction Springs are an integral part of the SAP2000® Software for Structural Analysis and Design of buildings, developed and distributed by Computers and Structures, Inc. Founded in 1975, the California-based company develops software for structural analysis of buildings of various shapes, sizes and functions. The ETABS® software was used, for example, for the mathematical modeling of the currently tallest building in the world, the Burj Khalifa in Dubai, in order to simulate and analyze influencing factors such as gravity, wind and earthquake events.



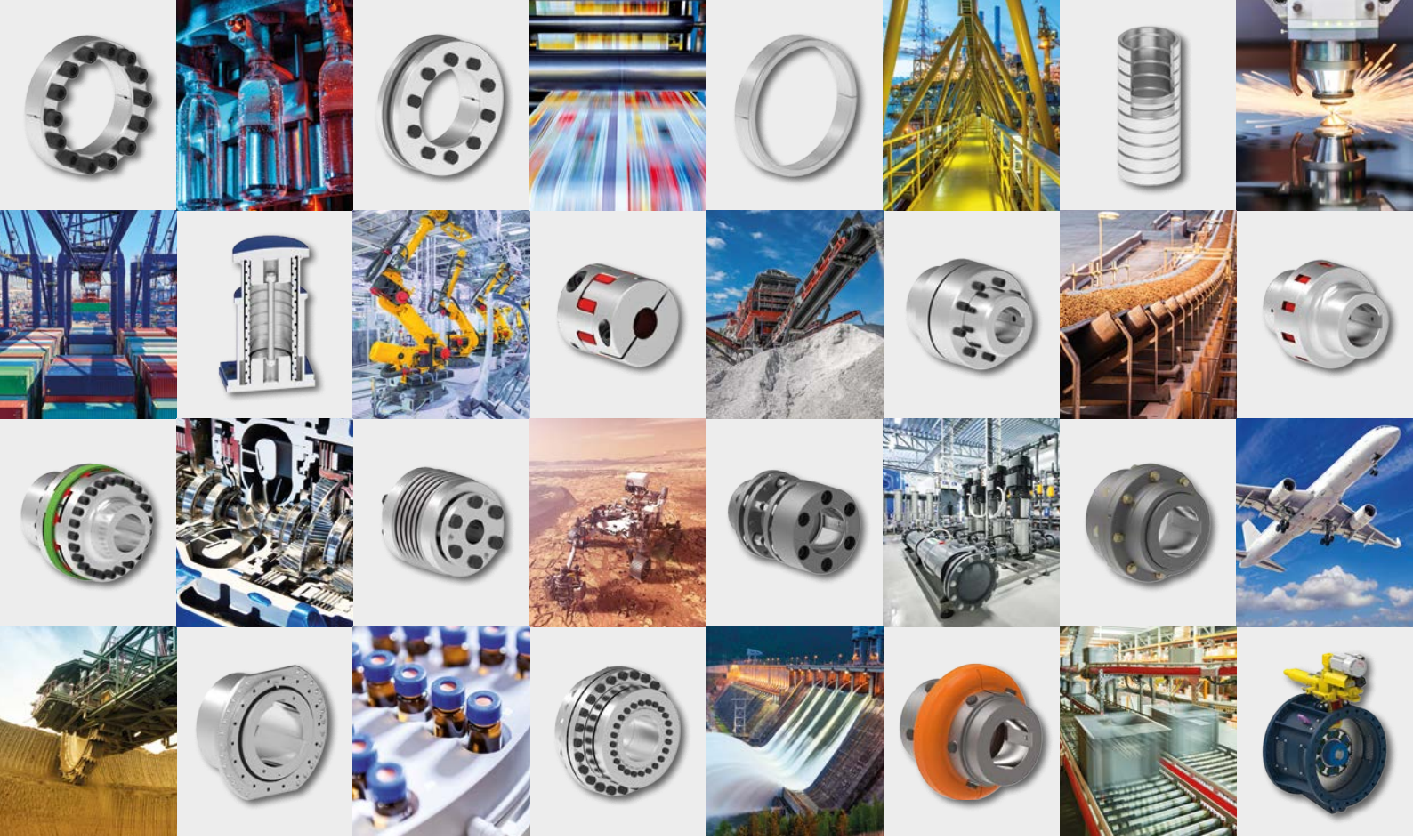
For safe protection against earthquake damages, the steel support frame of the Te Puni Village student residence in New Zealand's capital Wellington is equipped with RINGFEDER® Friction Springs. These operate in conjunction with special sliding hinge joints, which are located between the supports and traverses of the frame. By applying the Friction Spring technology, a self-centering sliding hinge joint is created that gives the building flexibility and reliably balances ground accelerations occurring in the event of an earthquake. The energy induced is absorbed and the building is also moved back to its initial position.





Firing a fighter aircraft's onboard cannon during flight generates extremely high recoil forces that must be effectively absorbed to protect the aircraft structure and ensure pilot safety. RINGFEDER® Friction Springs are ideally suited for this demanding task. They operate reliably across a wide temperature range, are independent of firing frequency and can be easily integrated into compact system designs. Thanks to their high energy absorption capacity, low weight and robust performance, they are already used in a variety of aerospace applications requiring maximum reliability under extreme conditions.





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