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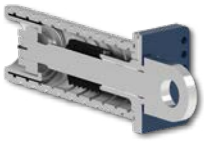
# Damping Technology



Friction Springs









Industrial Buffers

EN 10.2022

## Product Paper & Tech Paper



100 YEARS EMPOWERING TOMORROW SINCE 1922



Machine Building



Aviation & Aerospace



Process Technology

# Welcome

## Your System Partner for 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.



Movement



Energy



Extraction

RINGFEDER POWER TRANSMISSION is the international market leader in niche markets for drive and damping technology. We develop, manufacture and supply superior Shaft-Hub Connections, Damping Components, Couplings, Brake Systems and Bearing Housings for highest functionality and durability requirements in a wide range of technology sectors worldwide. Not only do we always provide our ambitious customers with competent advice based on over 100 years of experience and expertise, but also realize need-based, application-oriented solutions together with them that guarantee safe, failure-free and economic machine and plant operation – with our aspiration to be **Partner for Performance**.

## Our customer promise for your specific use case:

- Excellent know-how for maximum performance and reliability
- Best cost-benefit ratio
- Short reaction times and high product availability




## Quality & Expertise

One century of competence and experience

As pioneer and market leader for premium systems and components of drive and damping technology, we stand for outstanding professional competence, superior product and service quality as well as excellent customer focus. For your advantage, we consistently combine highest quality standards, continuous optimization and profound consulting – no matter how, where and when forces must be transmitted or damped.

## Reliability & Trust

From the requirement to the optimum result

Whether customized special design or proven standard type, highly specific individual or holistic system solution: As a competent, professional and service-oriented partner, we support and accompany you from the initial clarification of your requirements to the successful completion of your purpose – and, of course, also beyond.



# Your Projects, Our Drive

## Anytime & Anywhere

Locally on-site for you worldwide

Thanks to national and international development, manufacturing and sales 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, brochures and data sheets, use our calculation and selection program for shaft-hub connections, arrange a video consultation appointment with one of our specialists and much more – quickly, easily, with no obligation and at any time. Convince yourself on our website at www.ringfeder.com.

# RINGFEDER®
# Damping Technology

## Protecting People, Securing Structures

Slowing down moving masses in a quick, safe and precise manner: **RINGFEDER® Friction Springs and Industrial Buffers** are indispensable, maintenance-free safety components in all technology and industry sectors where suddenly occurring forces have to be taken up and kinetic energies must be absorbed, or when damping systems are required for enormous forces at relatively small dimensions – whether as customized special design or proven, readily available standard version.

As the pioneer of Friction Spring technology, RINGFEDER POWER TRANSMISSION has been the expert for more than 100 years for highly reliable premium products of damping technology, which – depending on requirement and application – absorb energies, act as overload protection and compensate for movements.

### Friction Springs

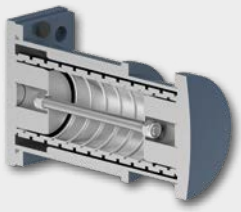
Complete spring columns consisting of precisely machined inner and outer rings



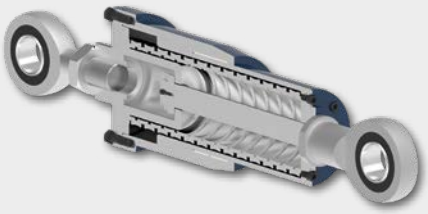
### Industrial Buffers

Friction Springs as application-specific buffer versions

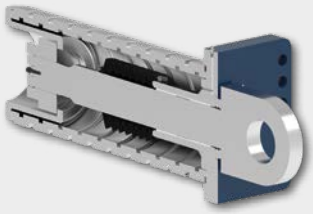
**Buffer**



**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

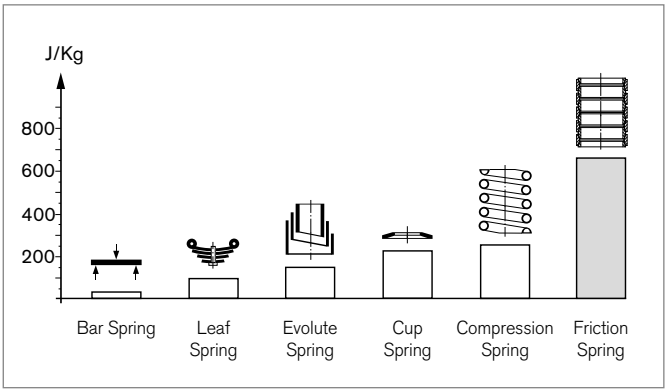
## One Technology, Numerous Advantages

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

- High spring work at low weight and volume
- High damping capability
- 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 RINGFEDER® Friction Springs make full use of the spring material, dimensions and weight are reduced to a minimum. The decisive factor here is the spring work.



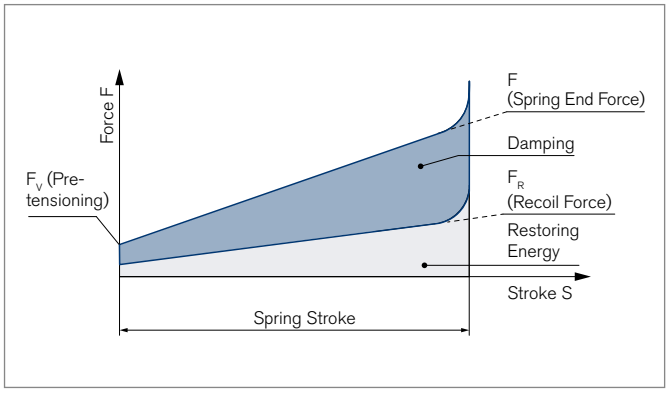

Weight utilization $\eta$ of various springs

**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 carry out modifications at any time in the interests of technical progress.

### High damping capability

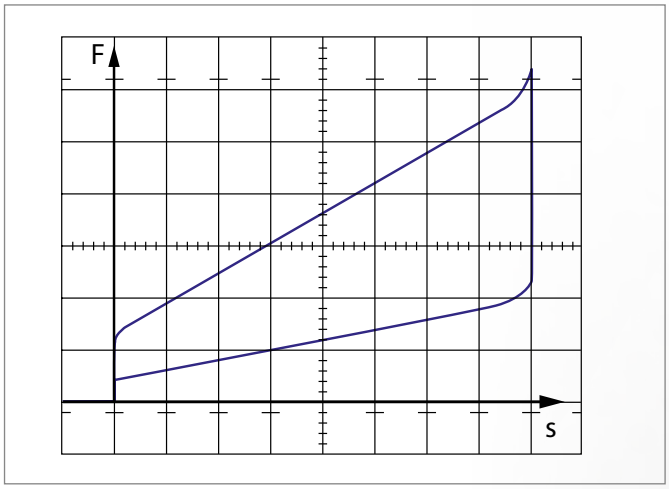
The damping of the RINGFEDER® Friction Springs is 66% as standard, which means that the energy introduced is quickly absorbed and resonance effects are completely suppressed. Variations in damping between 33% and 66% are possible by using other lubricants specific to the customer and application.




Damping and spring work

### Spring work and damping effect independent from load speed

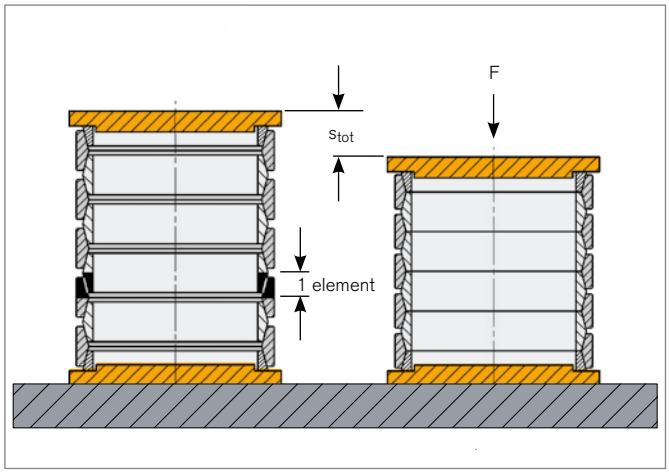
The force-stroke diagram of the RINGFEDER® Friction Spring applies for all operating conditions. In contrast to other damping systems, RINGFEDER® Friction Springs provide full spring work and damping effects even, when the load is applied extremely slowly or quickly.




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

## Overload-safe in block position

RINGFEDER® Friction Springs are generally designed to “block”, so it is therefore ensured that the admissible stresses cannot be exceeded and the RINGFEDER® Friction Springs will not be damaged.




Overload protection

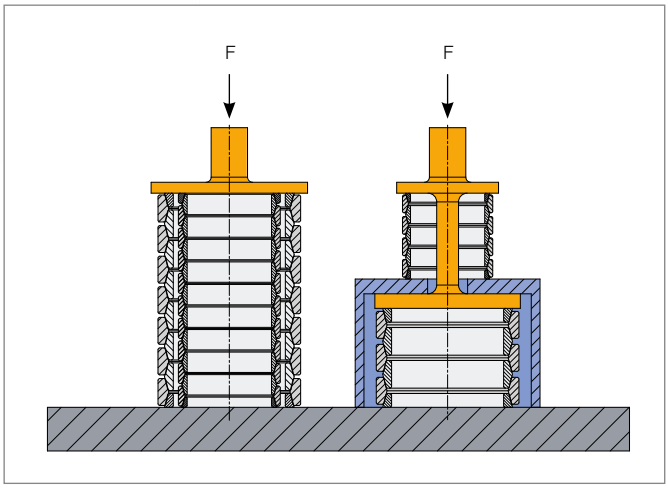
## Maintenance-free and temperature-independent

With hydraulic dampers and springs made of synthetic material, the force-stroke diagram will be influenced by temperature fluctuations and inherent temperature rises. The characteristic curve of the RINGFEDER® Friction Spring, however remain independent of these factors and can be used in the temperature range of -20 °C to +60 °C without the curve changing appreciably, as the inherent temperature rises of the spring due to the dampening effect have been taken into account. Please contact us for applications outside the named temperature range because changes will need to be made to the lubricants (-73 °C to +200 °C possible).

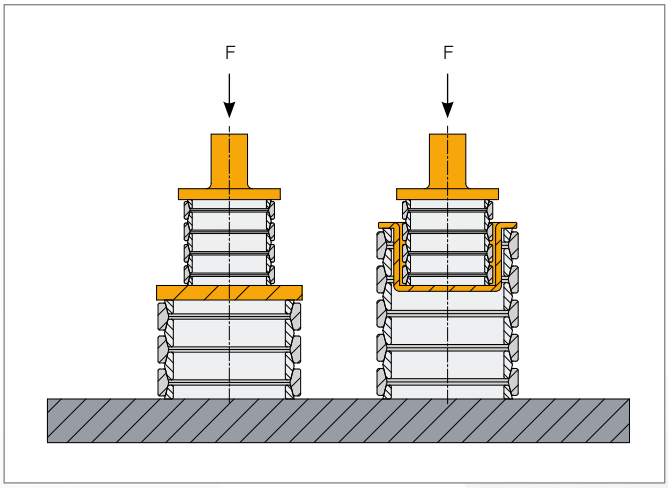
Basically, relubrication of the operating Friction Spring is **not required**. Use of other lubricants may even lead to spring failure.

## Parallel and serial arrangement of springs

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




Parallel arrangement for higher forces

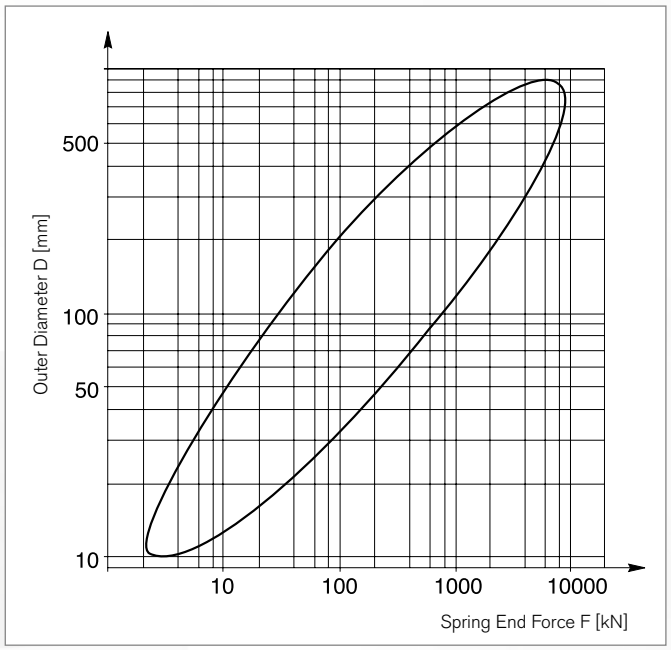



Serial arrangement for more spring travel

# Structure of a Friction Spring

## Individual designs for specific use cases

On top of the RINGFEDER® Friction Spring standard range (see table on page 13), we can offer customized solutions based on your specific requirements. The graph below shows the ratio of outer diameter to spring end force, which can be used to quickly see if an application is possible even though a standard spring is not available. The geometry of the RINGFEDER® Friction Spring allows an optimum utilisation of the available mounting space due to a nested construction, using parallel or serial spring arrangements.




Ratio of outer diameter to spring end force

A RINGFEDER® Friction Spring comprising **e** elements generally concludes with semi-rings. Its unclamped length $L_0$ is then (the values $h_e$, $s_e$, $W_e$ that are necessary for the calculation can be found in the table on page 13):

$$L_o = e \cdot h_e$$

The total spring stroke can be calculated according to the equal:

$$s = e \cdot s_e$$

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

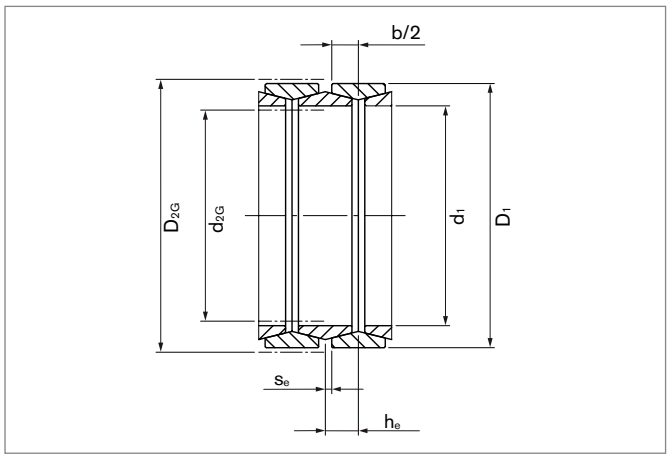
$$W = e \cdot W_e$$



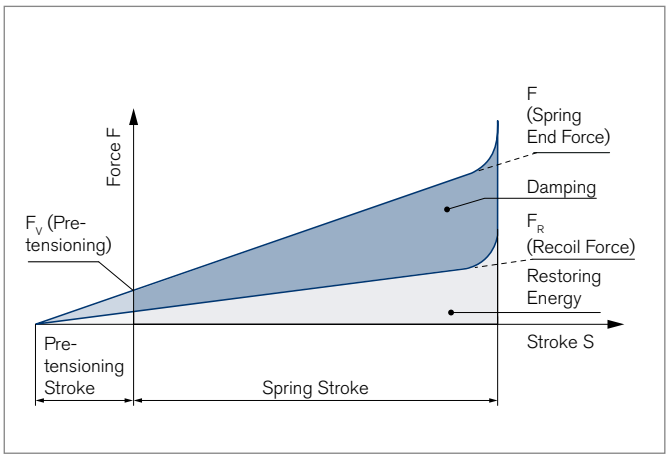
Thanks to their extremely low weight, highly compact design and resistance to very high and very low temperatures, RINGFEDER® Friction Springs are ideally suited for use in the aviation and aerospace industry. For example, they are applied in emergency exit doors of passenger aircrafts in the form of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



# Selection and Installation Notes




Dimensions RINGFEDER® Friction Springs




Force-stroke diagram for one element

## Pretensioning

RINGFEDER® Friction Springs have to be pretensioned with a minimum of 5%, preferably 10% of the total spring stroke. In order not to impair the lubricant film, the pretensioning force should not exceed 50%. Exceptions are possible after consultation.

## Guiding

For RINGFEDER® Friction Springs, some form of guiding guide must be provided, either on the inner diameter ($d_{2G}$) or on the outer diameter ($D_{2G}$). Exceptions apply for short springs with a length ≤ 1,5 $D_1$, in this case they need to be loaded between parallel thrust plates.



## Lubrication

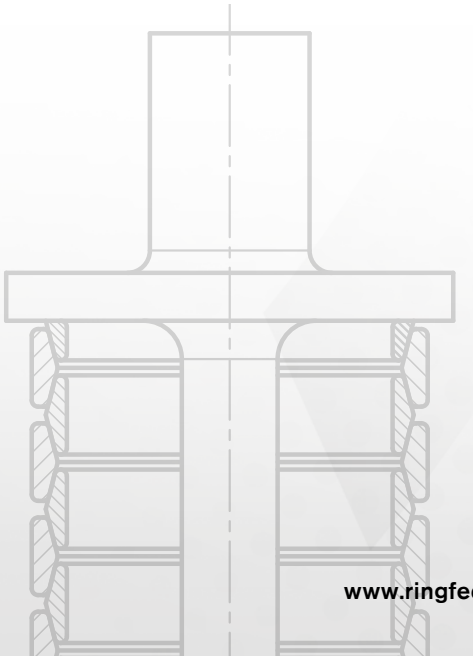
**Only** the special greases recommended by RINGFEDER® must be used for lubrication purposes, this is because the cone surfaces are under a high contact pressure. Generally, the grease provided with the spring is sufficient. Re-greasing is not required.

## Observe the diagram

With Friction Springs the available spring work in J, i.e. the area under the loading-curve (upper 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-reducing lubricant. For this, please let us have your specifications.

## Sealing

RINGFEDER® Friction Springs must be installed protected from dirt and moisture in order not to compromise the lubricant film. Simple plain bearing guides are sufficient. Folding bellows are recommended in cases of heavy soiling and/or dampness development.



## Force-stroke diagram

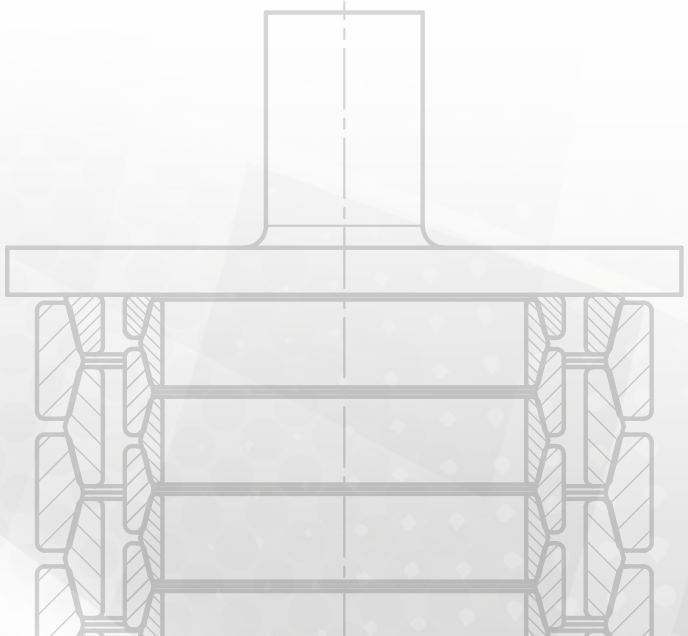
During the operation of the Friction Spring, two thirds of the input energy is dissipated as frictional heat. The recoil force $F_R$ at any point on the diagram is approximately equal to one third of the relative compressive force F. The capacity of the spring is represented by the total area shown below 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

**Explanations to table**

- **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 RINGFEDER® 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 13400 Joule. The requirement is to absorb a maximum energy of 6000 Joule.

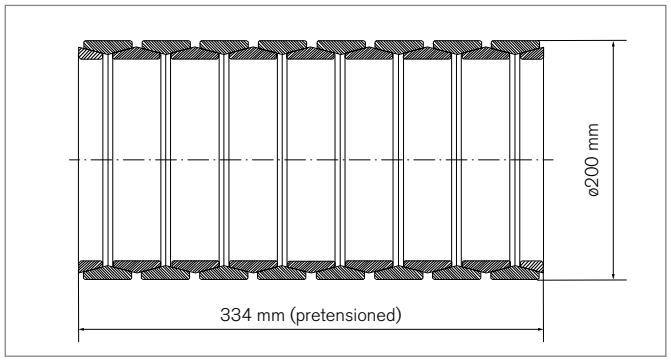



Figure 1

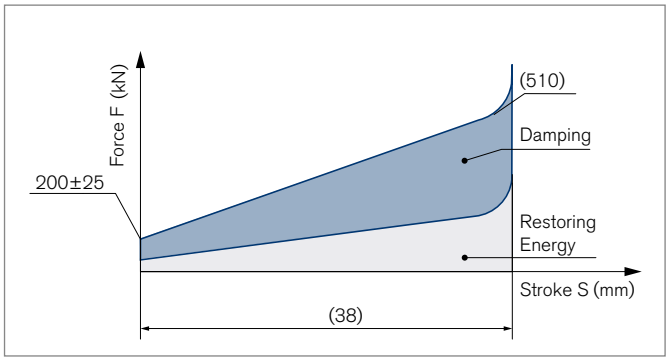



Figure 2

**Diagram 1:** When the RINGFEDER® Friction Spring receives an impact force, it compresses by 21 mm and absorbs 6000 Joule (=66%) from which 4000 Joule are converted to heat. After the compression, the RINGFEDER® Friction Spring discharges back by the same 21 mm due to a reaction force and there are 2000 Joule which has to be absorbed.

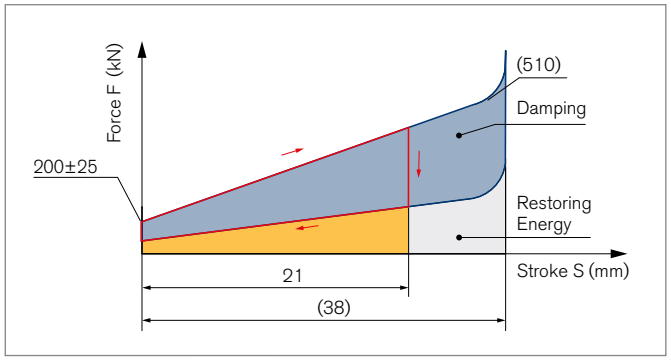



Diagram 1

**Diagram 2:** The impacting body strikes again on the RINGFEDER® Friction Spring with the remaining 2000 Joule and compress it by 8,5 mm. After the compression, the buffer springs back by the same 8,5 mm due to the reaction 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 6000 Joule are now absorbed and the system comes to rest.

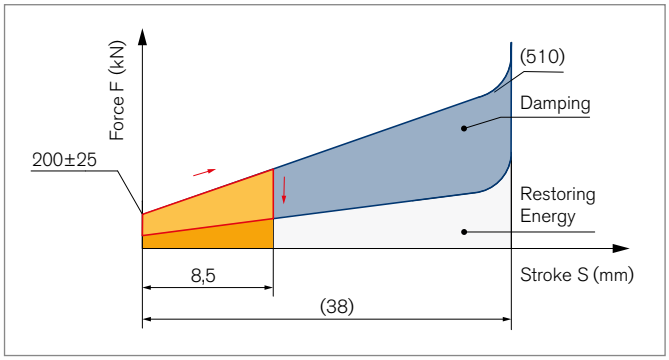
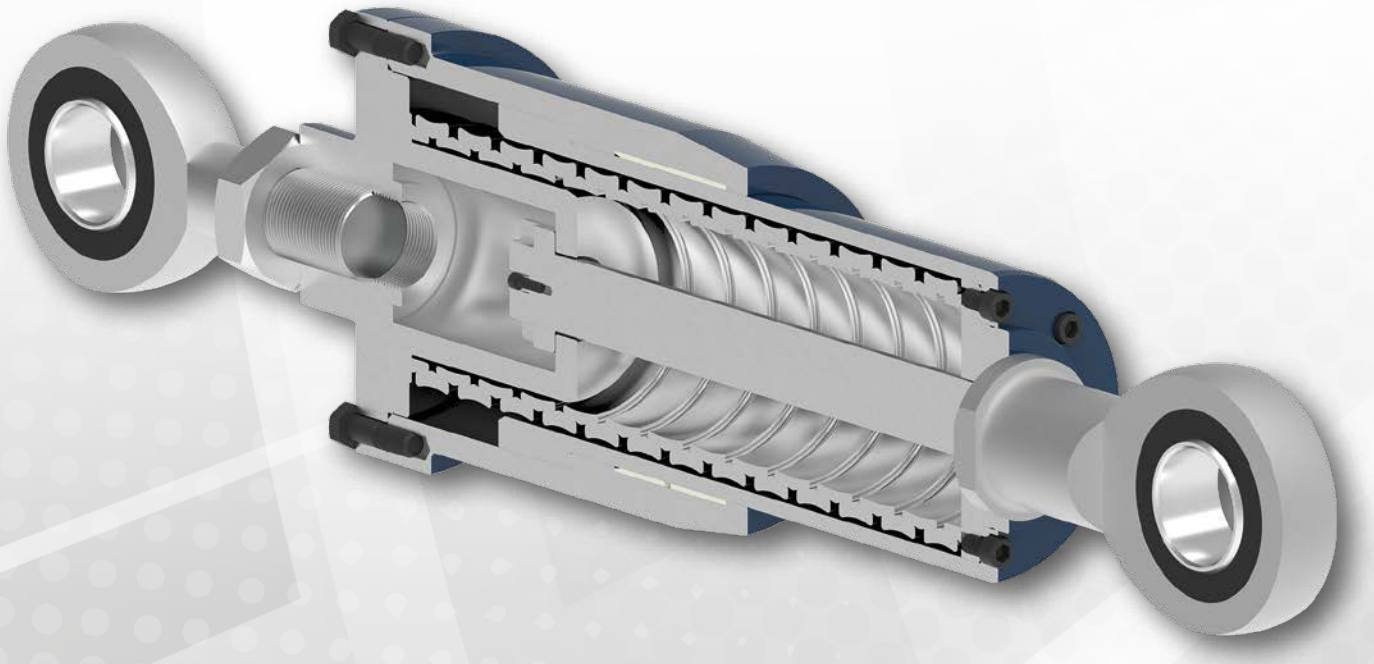


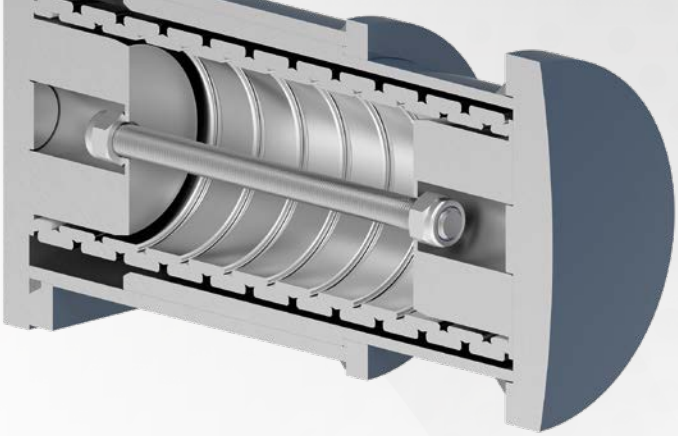

Diagram 2



Tall, slender structures in exposed locations, e.g. the television and radio antenna system on the Brocken mountain in Saxony-Anhalt, Germany, are subject to strong lateral oscillations induced by prevailing winds, threatening the existence of the entire building. RINGFEDER® Friction Springs in the form of special push-pull units effectively compensate movements of this kind and thus act as powerful vibration dampers or absorbers, providing highly reliable protection for chimneys, skyscrapers, antennas, etc.

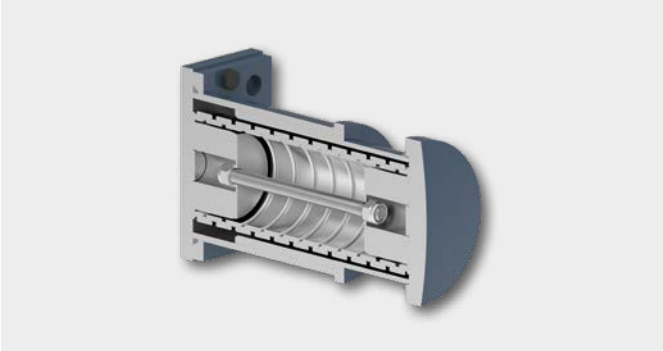


# RINGFEDER®
# Industrial Buffers

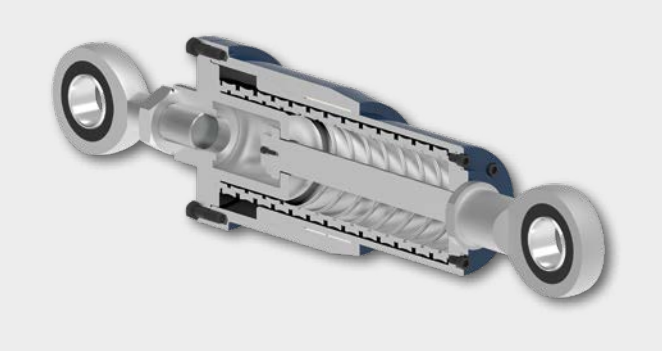


In addition to sole spring columns, RINGFEDER® Friction Springs are also available as complete, application- and customer-specific buffer versions in various shapes and sizes for diverse use cases, e.g. in mechanical engineering, in raw material extraction and processing, or in the aviation and aerospace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

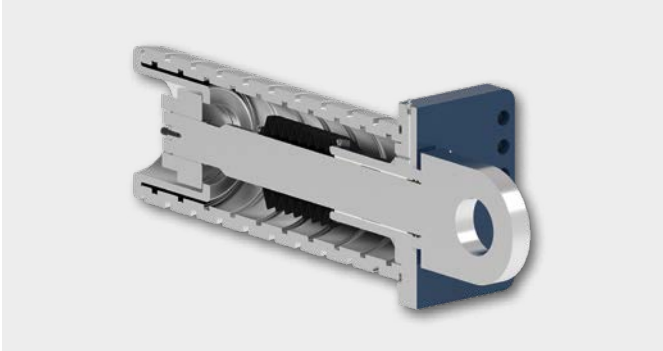
Common designs include push-pull units as highly effective vibration dampers or absorbers, and slipping clutches for reliable protection against overloads.



Buffer



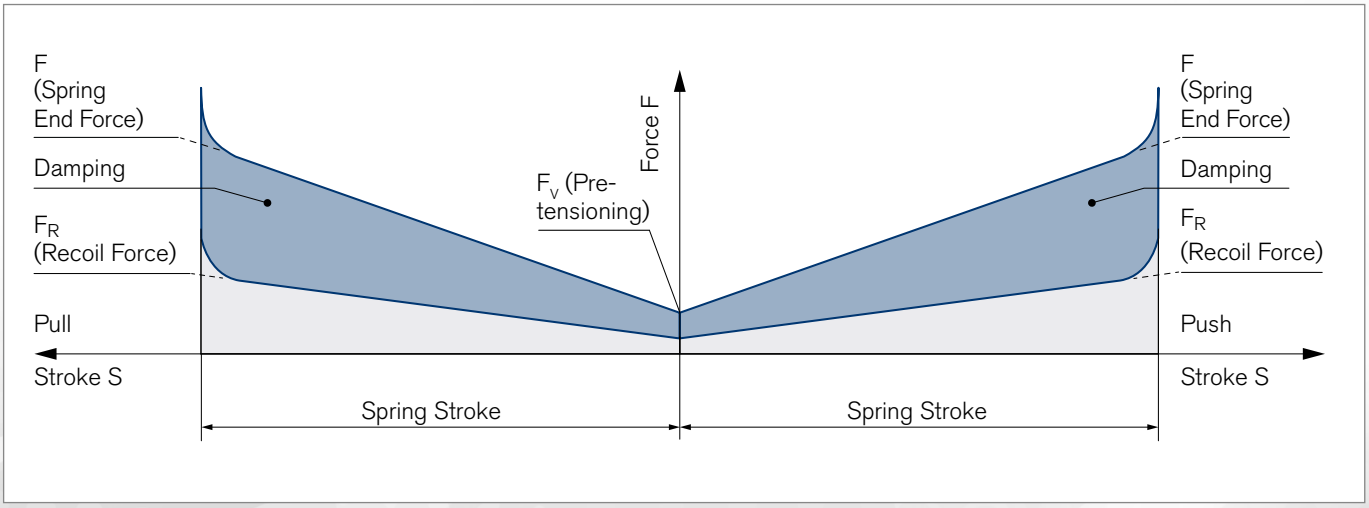
Push-Pull Unit



Draw Gear



Overload Clutch

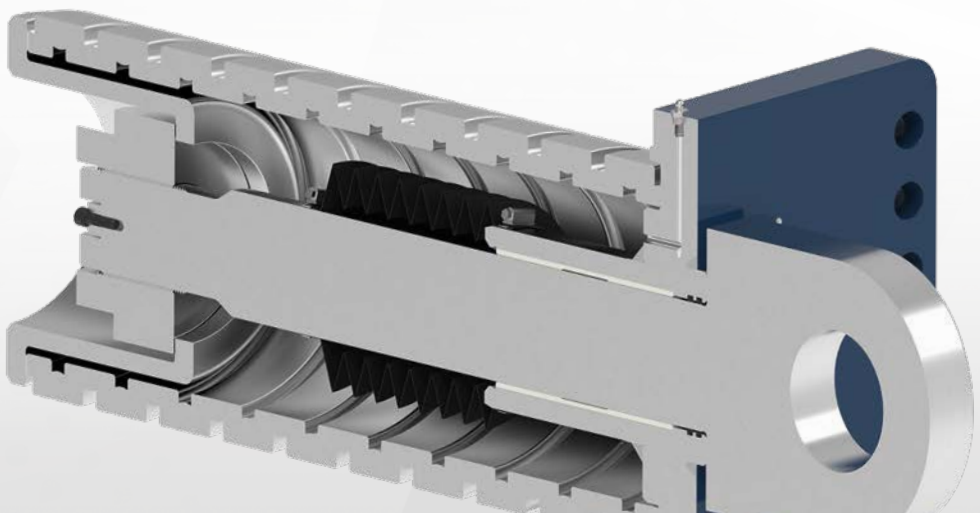



Force-stroke diagram for a push-pull unit

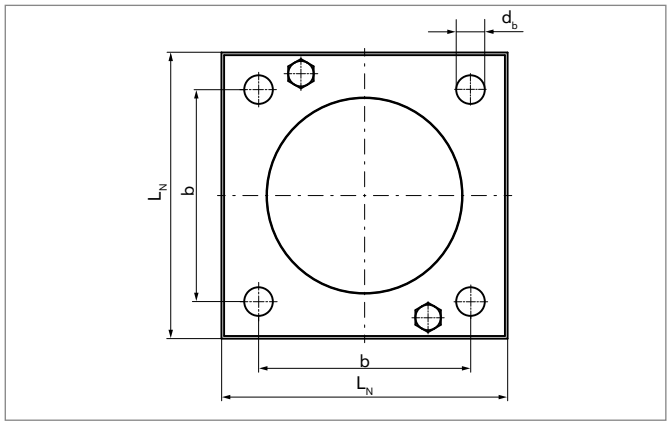
| Size | Type | Diagram | | | | Buffer Dimensions | | | | | | | | | Fitting | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $F_v$ | F | s | W | L | $l_S$ | D | $D_B$ | $D_C$ | $D_P$ | $F_K$ | $L_N$ | Gw | b | $d_b$ | $D_E$ | t |
| | | kN | | mm | J | mm | | | | | | | | 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 | - | - |

**Explanations to table**

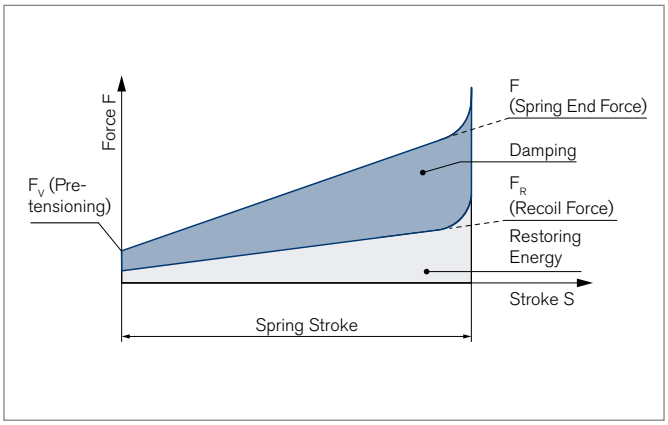
- $F_v$ = Pretensioning force
- F = Spring end force
- s = Spring stroke
- W = Spring work
- L = Total length
- $l_S$ = Submerged length
- D = Outer diameter
- $D_B$ = Flapper diameter
- $D_C$ = Case diameter
- $D_P$ = Plunger diameter
- $F_K$ = Flange thickness
- $L_N$ = Flange width
- Gw = Weight
-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



# Buffers with RINGFEDER® Friction Springs

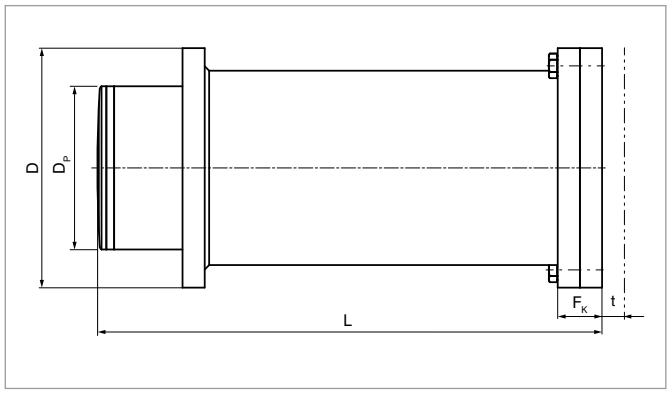



Typical hole pattern

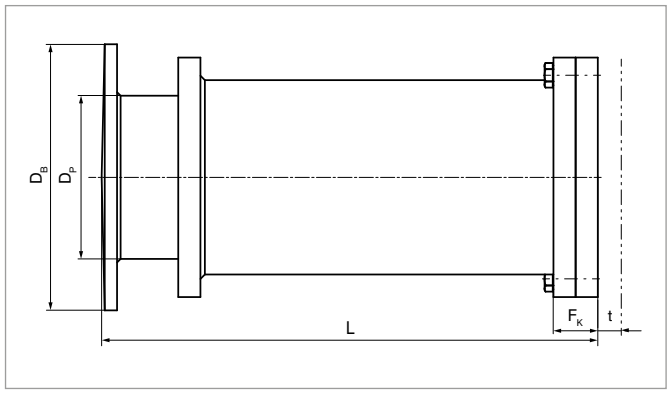



Typical friction spring diagram

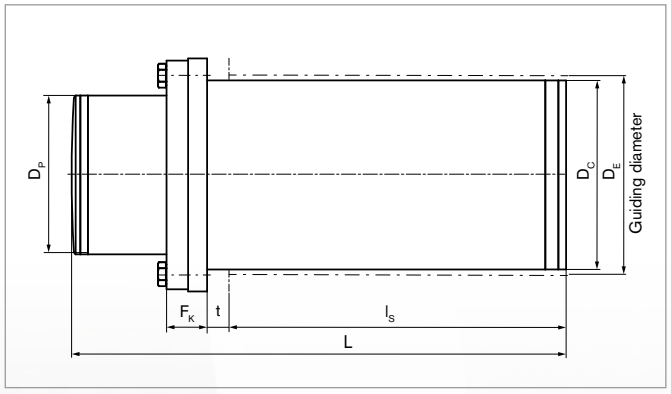
The buffer types shown in extracts on the previous page are standard delivered in one of the following 4 designs. These buffers are suitable for operation temperatures from -20 °C to +60 °C. Above that, modifications allow an extended temperature range from -73 °C to +200 °C. Customized requirements with respect to geometrical and technical special solutions on request.



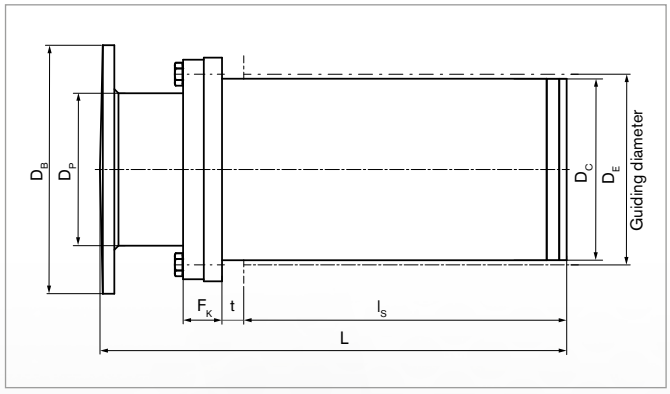

Buffer without flapper and with end flange



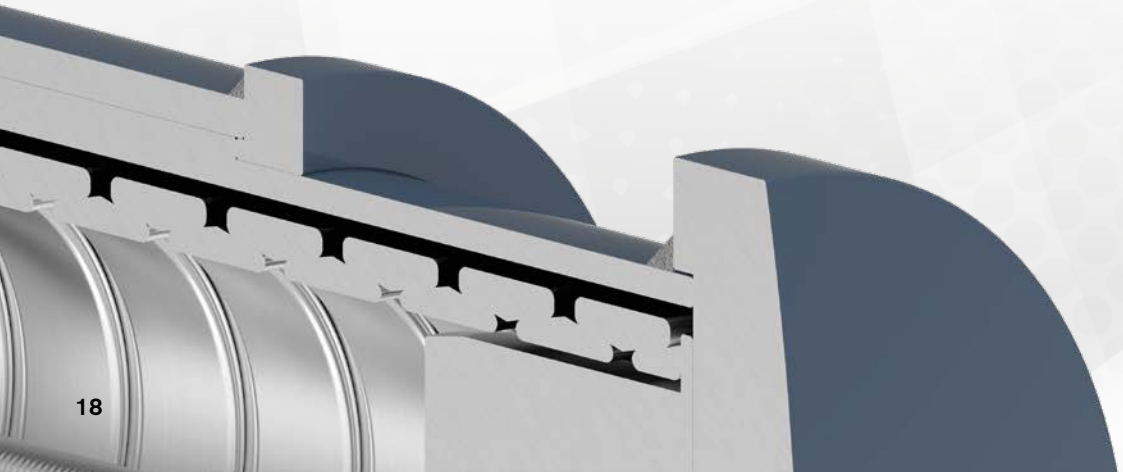

Buffer with flapper and end flange




Buffer without flapper and with central flange




Buffer with flapper and central flange



Friction Spring technology is also predestined for use in case of large masses and low load speeds: In gasometers, used for storing and stockpiling high volumes of all kinds of gases, maintenance-free industrial buffers with RINGFEDER® Friction Springs reliably equalize movements of the outer casing caused by pressure variations and thus prevent damages, e.g. due to cracks, with potentially catastrophic consequences.



# RINGFEDER®
# Earthquake Protection

Friction Springs will increasingly be a part of future constructions for the protection of residential buildings as well as installations for electricity transmission, e.g. high voltage switches or so called Wall Bushings. Not all damage that a significant earthquake will cause can be avoided, but with RINGFEDER® Friction Springs there is a high probability that a building will sustain an earthquake, such as those that occurred in Christchurch in 2010 and 2011, and still be habitable. There are already buildings in New Zealand equipped with RINGFEDER® Friction Springs that have been tested in practice. For example, the Te Puni Village student residence was already completed when an earthquake occurred on July 21, 2013 with an intensity of 6.5 on the Moment Magnitude Scale and aftershocks with a magnitude of 5.8. The building withstood the quakes without major damage.

## Advantages

1. **Longevity** – RINGFEDER® Friction Springs are designed to last through many cycles and remain reusable. If one of the rings in a RINGFEDER® Friction Spring breaks, it will lose some spring travel and the stiffness will increase slightly, but it will continue to work. The end force and damping capability are unaffected. For comparison, if a coil spring or a disc spring breaks, this means a total loss of function and there is no longer any protection.

2. **Damping** – With our RINGFEDER® Standard Grease F-S1, 2/3 of the induced energy is consumed. If less damping is required, a customized solution can be used to achieve reduced damping of up to approx. 1/3 of the injected energy. This is a simple solution to purposefully modify the characteristics of the Friction Spring. In certain seismic applications, a higher force is required to release the spring in order to move the structure back to its vertical position.

3. **Fire and High Temperature** – Friction Springs are made of special spring steel and are covered with grease. In the event of a fire, rubber products will be destroyed, but Friction Springs will withstand the fire and the accompanying temperatures. They only need to be re-greased.

4. **Recoil Force** – Thanks to the always application-specific design of the Friction Spring, the optimum recoil force is achieved for a particular use case. This can be realized, for example, by using a different grease, increasing the outer diameter or changing the taper angle. With conventional springs, this possibility does not exist.

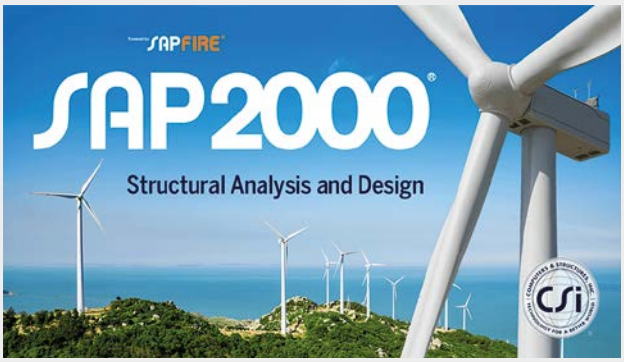
5. **Reusability** – Friction Springs can be reused after a seismic event. They are designed to withstand many load cycles while maintaining their beneficial functionality and performance. Friction Springs are wear- and maintenance-free.

6. **Speed** – Friction Springs react faster to applied forces than all other spring types.

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.



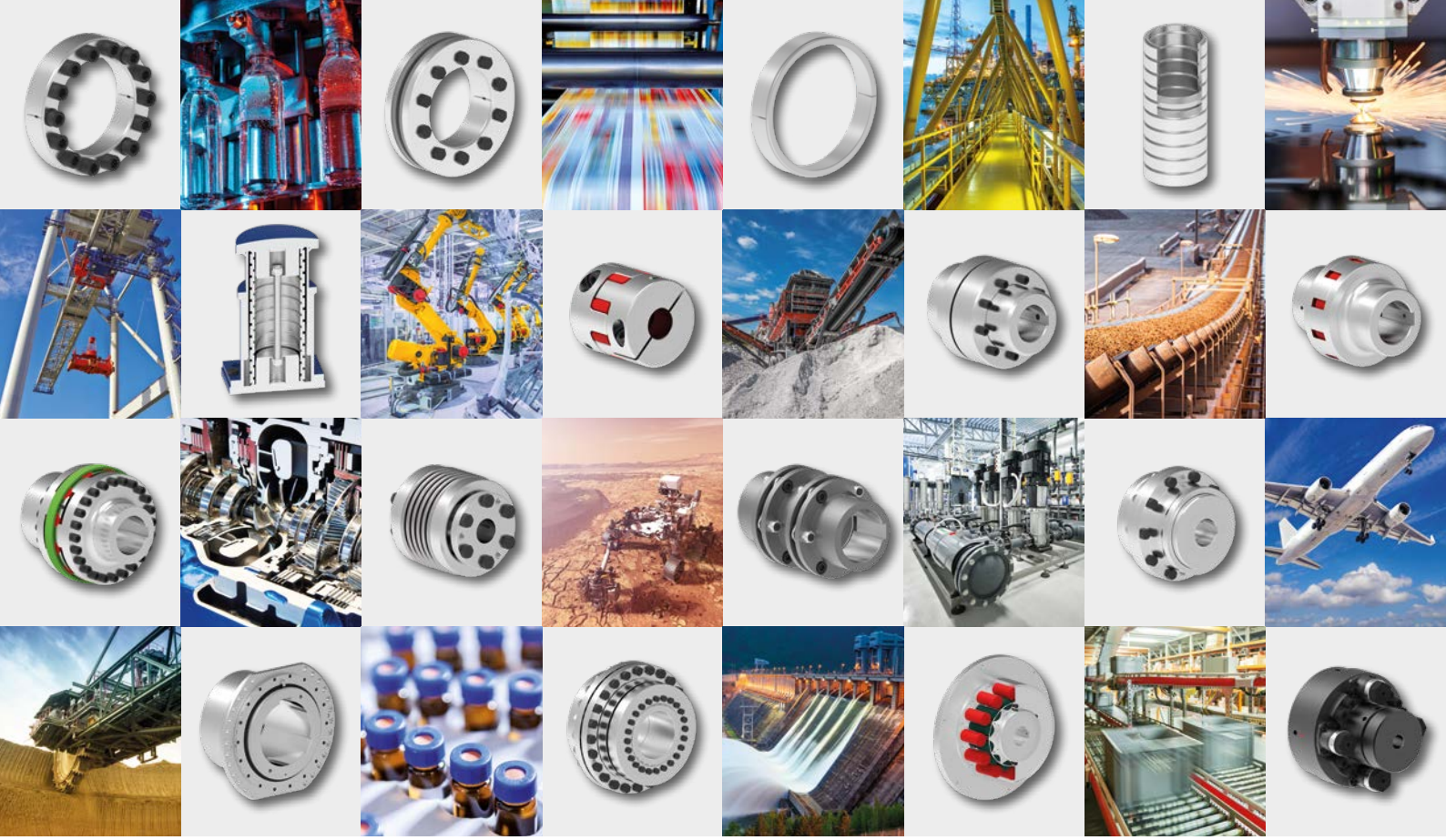
For safe protection against earthquake damages, the steel support frame of the Te Puni Village student residence in New Zealand's capital Wellington is equipped with RINGFEDER® Friction Springs. These operate in conjunction with special sliding hinge joints, which are located between the supports and 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.





Whether as cross bracing to maximize ultimate loads, as base isolation for decoupling from the foundation, or for shear walls, RINGFEDER® Friction Springs serve as a highly effective, maintenance- and wear-free protection system against earthquake damage in buildings and other critical infrastructure. In the event of an earthquake, they absorb the occurring energy and, through their restoring force, ensure a safe so-called “Re-Centering” of the structure back to its original position.






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