ZH|EN
08|2015

RINGFEDER

减震技术
Damping Technology

火星车Mars Rover
Courtesy NASA/JPL-Caltech
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你的执行伙伴
Partner for Performance

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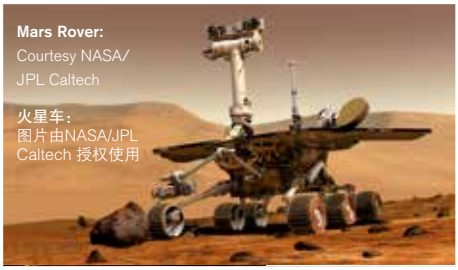
RINGFEDER
POWER TRANSMISSION
灵 飞 达 传 动



Mars Rover:
Courtesy NASA/
JPL Caltech

火星车：
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欢迎来到灵飞达传动
—为每项传动需求提供系统方案

灵飞达传动(德国)有限公司(RINGFEDER POWER TRANSMISSION GMBH)，作为摩擦弹簧的专利创立者，于1922年在科雷菲尔德成立。今天，我们已成长为顶级传动产品和减震产品的全球供应商。

灵飞达传动(RINGFEDER POWER TRANSMISSION)在诸多细分领域均是市场领先者。凭借可持续的有机增长和指向明确的并购活动，通过与客户的紧密合作，我们不断补充和完善现有产品线，提供面向未来的服务。灵飞达传动(RINGFEDER POWER TRANSMISSION)也由此成为我们敏锐客户的传动技术首选之一。

我们拥有世界知名的品牌“RINGFEDER(灵飞达)”、“TSCHAN(传安)”、“GERWAH(固威)”，他们以“客户导向”型解决方案满足最高要求并为系统运行提供可靠保证。在“ECOLOC(易扣)”品牌下，我们提供可靠的标准化产品。

“RINGFEDER(灵飞达)”是世界级的胀紧联接产品和减震产品。“GERWAH(固威)”品牌为您提供低扭矩范围内的扭转刚性联轴器和弹性联轴器，以及安全联轴器产品。“TSCHAN(传安)”品牌代表高扭矩范围内的非转接式弹性和高弹性联轴器，以及扭转刚性联轴器。“ECOLOC(易扣)”品牌则覆盖了标准应用的高性价比传动产品。

我们的高质量产品涉及到传动领域各个方面，带来最优的成本 – 效益比。

Welcome to your system supplier for every aspect of power transmission

Today's RINGFEDER POWER TRANSMISSION GMBH was founded in 1922 in Krefeld, Germany as patent exploitation company for Friction Springs. Today we are a global supplier of top-quality products for the power transmission- and damping technology.

RINGFEDER POWER TRANSMISSION are one of the leading companies in selected market niches. Through our sustainable, organic growth, targeted acquisitions and attentive proximity to our customers, we are constantly supplementing and developing our range of products in cooperation with our customers and deliver service for the future. Beyond that, RINGFEDER POWER TRANSMISSION are one of the prime addresses in regard to technical know-how for our discerning customers.

Our world-renowned German brands RINGFEDER, TSCHAN and GERWAH stand for customer-oriented solutions that fulfil the highest requirements and guarantee our customers a trouble-free system operation. Under the brand name ECOLOC we offer reliable products off the shelf.

The brand RINGFEDER is world's leading in the sector of locking devices and damping technology. The GERWAH brand stands for torsionally rigid, elastic couplings as well as safety couplings in the lower torque range, whereas TSCHAN stands for non-shiftable elastic, highly-elastic and torsionally rigid shaft couplings in the higher torque range. The ECOLOC brand includes cost-efficient alternatives from the premium range available for standard use.

Hence, the product portfolio comprises high-quality products with the best cost-benefit ratio, covering all aspects of power transmission.

减震技术专家

我们是减震技术专家

保护人群和机器设备 — 现代减震产品是所有需要吸收突发动能的科技装备中不可或缺的安全部件。在冲击吸收方面，无论是机床或是生产设施，冲击吸能部件均能使破坏性冲击转化为设定的变形能量，以此拯救生命，保护贵重技术装备免受损坏并延长其使用寿命。我们超过100年的专业努力，就是对移动物体进行快速、安全和准确的缓冲。我们开发，生产并提供最顶级的减震科技产品，包括标准件、专用件和客户定制产品。

Experts for Damping Technology

Experts for Damping Technology

Protecting people, conserving machines – modern damping-products are indispensable safety parts inside all technologies when sudden occurring kinetic energy has to be absorbed. In the crash absorption, with machine tools or production plants, impact damping units dissipate the energy of an unwanted collision into targeted deformation energy and can so save lives or prevent precious technology from destruction and respectively extend their durability. For almost 100 years we are experts, when moved masses have to be slowed down fast, safe and precise. We develop, manufacture and supply top products for damping technology – as standard products or precision work or customized.

灵飞达®摩擦弹簧应用于需要吸收突发动能的工程领域，也可用于对安装空间要求较为苛刻而普通弹簧无法胜任的接收高冲击力的场合。

顶福加®(DEFORM plus®) 缓冲器由合成材料制成，一次性使用；顶福加®(DEFORM plus®) R型缓冲器可反复多次使用，进一步丰富了我们的产品线。

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.

DEFORM plus® produced from synthetic material, for single use and DEFORM plus® R for multiple uses further enhances our production program.

目录 · *Content*

灵飞达® 摩擦弹簧
RINGFEDER® Friction Spring

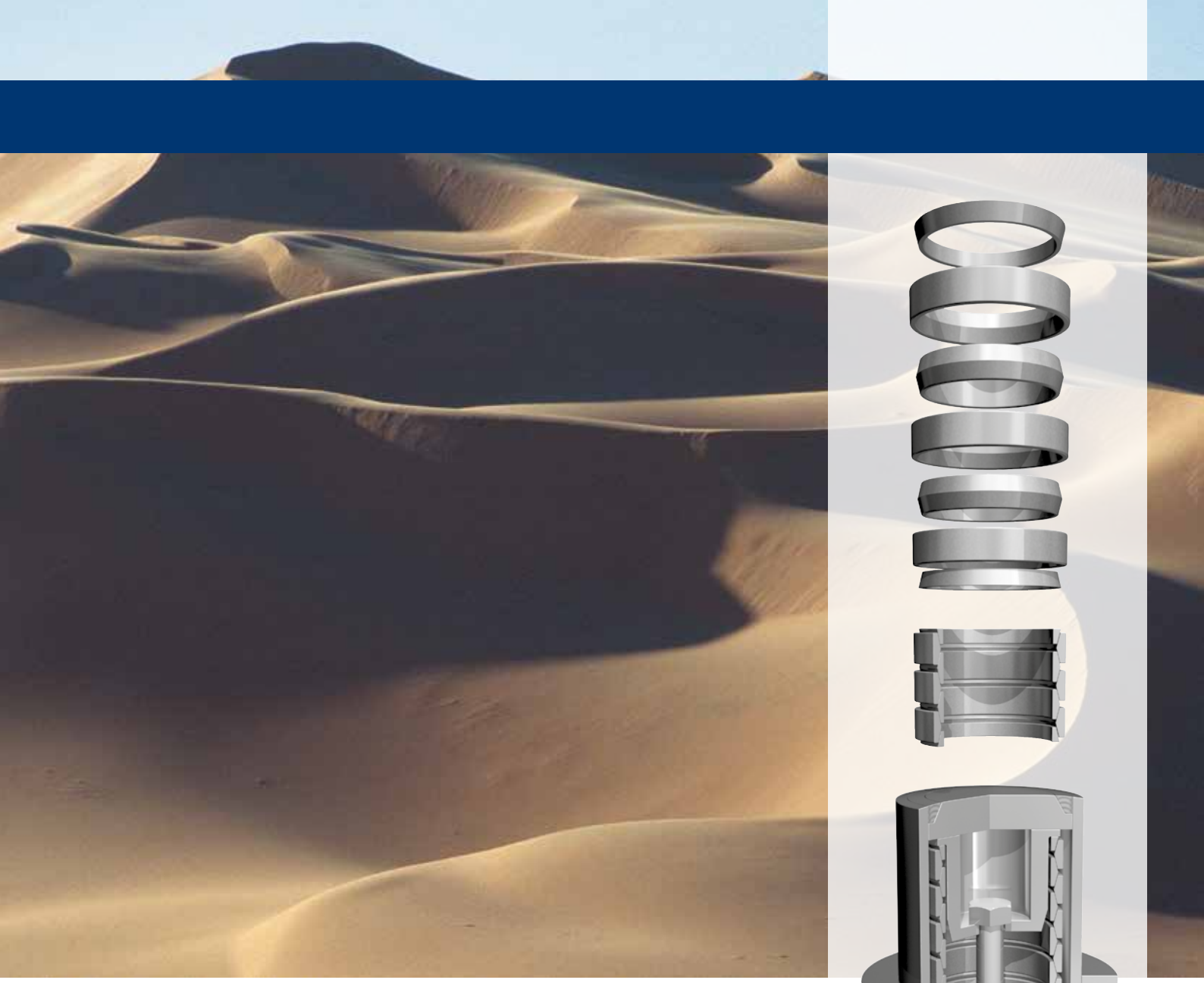
顶福加® 一次缓冲器
DEFORM *plus*®

顶福加® R型多次缓冲器
DEFORM *plus*® R

灵飞达® 摩擦弹簧的特点

与其他减震系统相比，灵飞达® 摩擦弹簧具有众多特点：

- 轻量化、小体积与高弹簧功的结合
- 高减震势能
- 阻停位置保证过载安全
- （减震性能）不受荷载率影响
- （减震性能）不受温度影响
- 免维护
- 灵飞达®摩擦弹簧特有设计
- 设计多样性
- 平行和串联布置均可



Features of RINGFEDER® Friction Springs

RINGFEDER® Friction Springs have multitude features in opposite to other damping systems:

- ***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***

产品特点 · *Features*

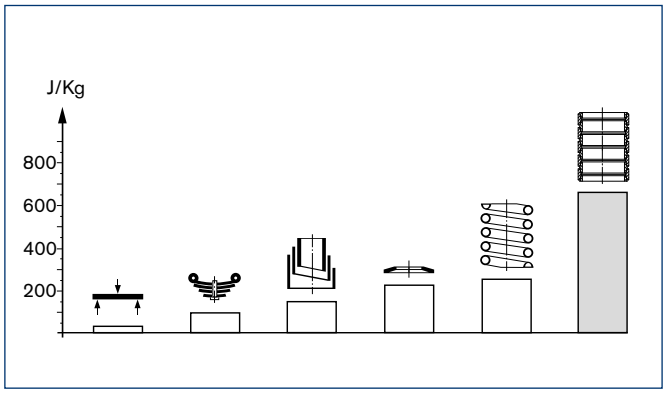
与其他减震系统相比，灵飞达® 摩擦弹簧具有众多特点：

RINGFEDER® Friction Springs have multitude features in opposite to other damping systems:

轻量化、小体积与高弹簧功的结合
High spring work combined with low weight and volume

灵飞达®摩擦弹簧工作完全依赖于其材料，这些材料按最小尺寸和重量需要来制成，而决定因素在于所需要的弹簧做功的大小。

As RINGFEDER® Friction Spring completely utilise the material of which they are made only a minimum of dimensions and weight are required. The decisive parameter here is therefore the spring work.

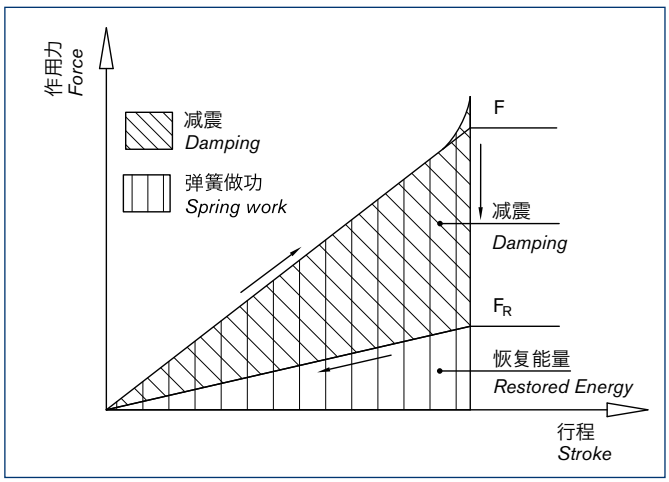


不同弹簧的重量利用对比 / ***Weight utilization η of various springs***

高减震能力 / *High damping potential*

灵飞达®摩擦弹簧的标准减震效能是在瞬间吸收66%的能量，同时完全消除共振。通过使用不同的油脂可实现不同效果。

The damping of RINGFEDER® Friction Springs is standard with 66 % wherewith the energy will be soon absorbed and resonances complete disabled. Variations are possible with different greases.

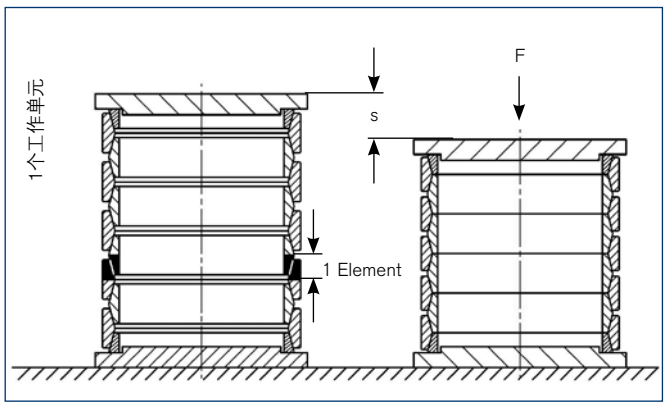


减震与弹簧做功 / ***Damping and spring work***

阻停位置保证过载安全
Overload-safe in blocked position

灵飞达®摩擦弹簧通常被设计用来“阻停”，以保证不超过设计许可的压力，而灵飞达®摩擦弹簧本身是绝对不会损坏的。

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.



过载保护 / ***Overload protection***

钻探设备 · *Drilling equipment*

在卓越钻探设备公司，减震器承受的负荷极高，但对于灵飞达®摩擦弹簧来说并不是问题。对压缩空气的及高强度减震工作来说，这是最理想的应用。同时，灵飞达®摩擦弹簧相比于其他减震系统更优的可靠性，也是其重要的优势。

At superior drilling equipment the loads on the dampers are exceptionally high, however, this is not a problem for RINGFEDER® Friction Springs. The increased requirements from compressed-air and the high damping action are ideal for such applications. Also, the better reliability of RINGFEDER® Friction Springs, compared to other damping systems, is a significant advantage.

（减震性能）不受荷载速度影响
Independent of loading rate

灵飞达®摩擦弹簧动态压力–行程关系适用于所有运行条件。相对于其他减震系统，灵飞达®摩擦弹簧都能表现出完全的弹簧功和减震效果，即使负荷施加过程极慢或极快。

The force-travel-diagram of the RINGFEDER® Friction Springs 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.

（减震性能）不受温度影响
Diagram independent of temperature

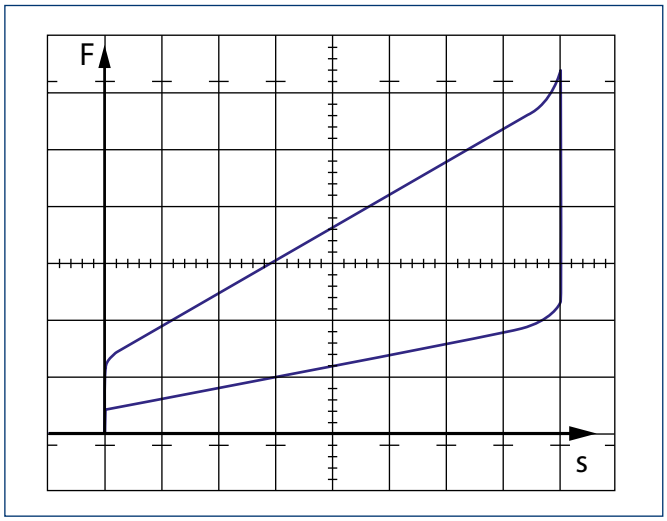
液压式减震器和合成材料制成的弹簧，其压力–行程特性会受到环境温度变化和自身温度升高的影响。灵飞达®摩擦弹簧的特征曲线则不受这些因素变化影响，其正常使用的环境温度可达–40℃至+80℃，此工作温度范围已经考虑了减震动作导致的弹簧自身的温度升高因素。如有超出以上温度范围的特殊应用，请咨询我们的技术部门以获取帮助。

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 the Friction Springs RINGFEDER® Friction Springs, however remain independent of these factors and can be used in the temperature range of -40 ° to +80 °C without the curve changing appreciably, as the inherent temperature rises of the spring due to the dampening effect have been taken into account. For extreme applications going beyond the indicated temperature range please consult our technical department.

免维护 / *Maintenance-free*

正常情况下，**在工作期间弹簧无需进行润滑**。如果在特定情况下需要对弹簧进行再次润滑，请特别注意只有灵飞达®指定润滑油脂才能保证摩擦弹簧发挥正确的功能！

Normally, during operation there is ***no relubrication needed.***
The use of other lubricants can cause technical defaults or even breakdowns.



预张灵飞达® 摩擦弹簧动态压力–行程图示
Dynamic force-travel diagram of a pretensioned RINGFEDER® Friction Spring

灵飞达® 摩擦弹簧特有设计
RINGFEDER® Friction Spring design

如果一套包含有‘**e**’工作单元的灵飞达®摩擦弹簧以半环作为结束端，则其无预张状态下的长度计算应为：
If a RINGFEDER® Friction Spring consisting of "e" elements terminates with half rings its untensioned length will be:

$$L_o = e \cdot h_e$$

此时的弹簧总行程计算公式为：
The total spring travel can be calculated according to the equal:

$$s = e \cdot s_e$$

排除预张力后弹簧的做功计算为：
When eliminating the pretensioning force the spring work is given by:

$$W = e \cdot W_e$$

弹簧端面压力不受工作单元数量变化的影响。
The end force does ***not*** *change with the number of elements.*

航空和航天应用 · *Aviation and astronautics*

航空工业中，灵飞达®摩擦弹簧的应用堪称完美。这些摩擦弹簧被应用在诸如空气刹车、紧急逃生舱门等位置。

以上这些应用都要求低重量，结构紧凑，及对温度变化的高耐受力。

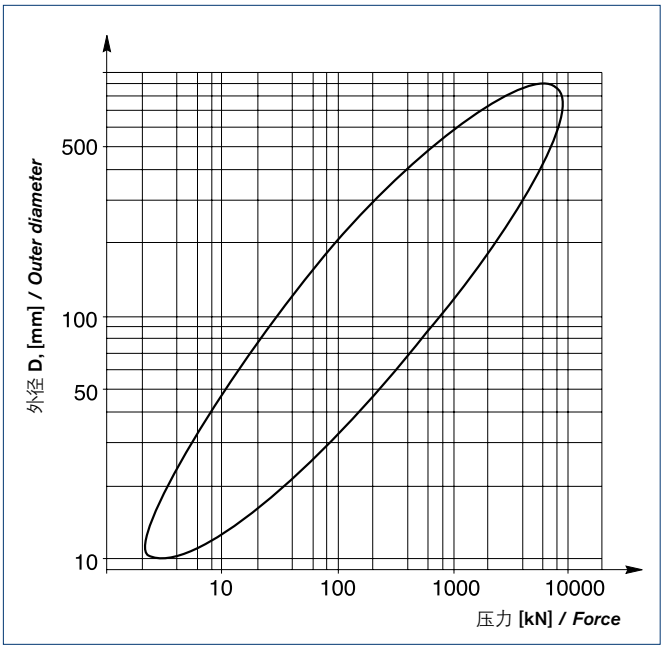
In aerospace industry, the use of RINGFEDER® Friction Springs is perfect. These springs are used in applications such as airbrakes or emergency exit doors.

The low weight, compact construction, and the capability of withstanding temperature variations are required for such applications.

设计多样性
Versatility in design

除标准的灵飞达®摩擦弹簧系列（请参见第16页规格参数表）以外，我们还可以基于你的特定应用提供特殊解决方案。右边的图示展示了弹簧外径与端面压力的比例关系，从图中也可以快速判断出在标准产品无法满足使用要求时其他方案是否可行。灵飞达®摩擦弹簧采用套叠式组合，并可采用平行或串联布置，极大的优化利用有限的安装空间。

As well as the standard RINGFEDER® Friction Spring range (see table on page 16) we can offer special solutions based on your specific application. The graph (to the right) shows the ratio of outer diameter to spring end force, this 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 series spring arrangements.

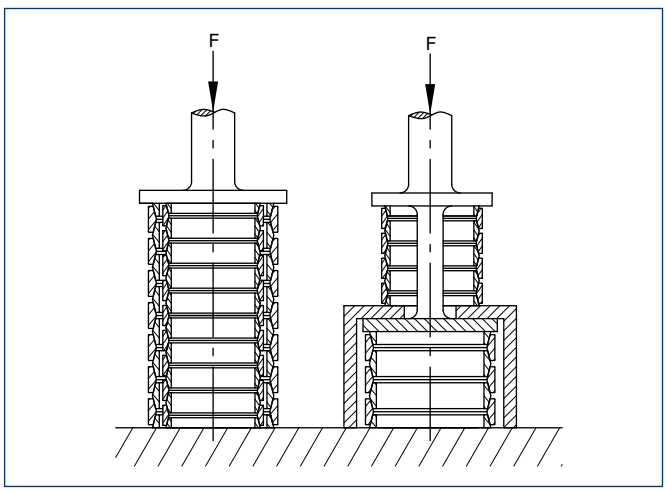


外径与弹簧端面压力的比例关系 / ***Ratio of outer diameter to spring end force***

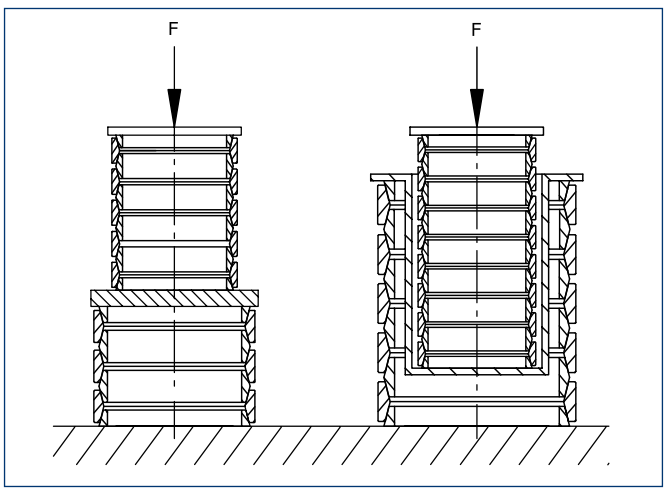
弹簧的平行布置和串联布置
Parallel and series arrangement of springs

灵飞达®摩擦弹簧采用套叠式组合，并可使用平行或串联布置，极大的优化利用有限的安装空间。

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.

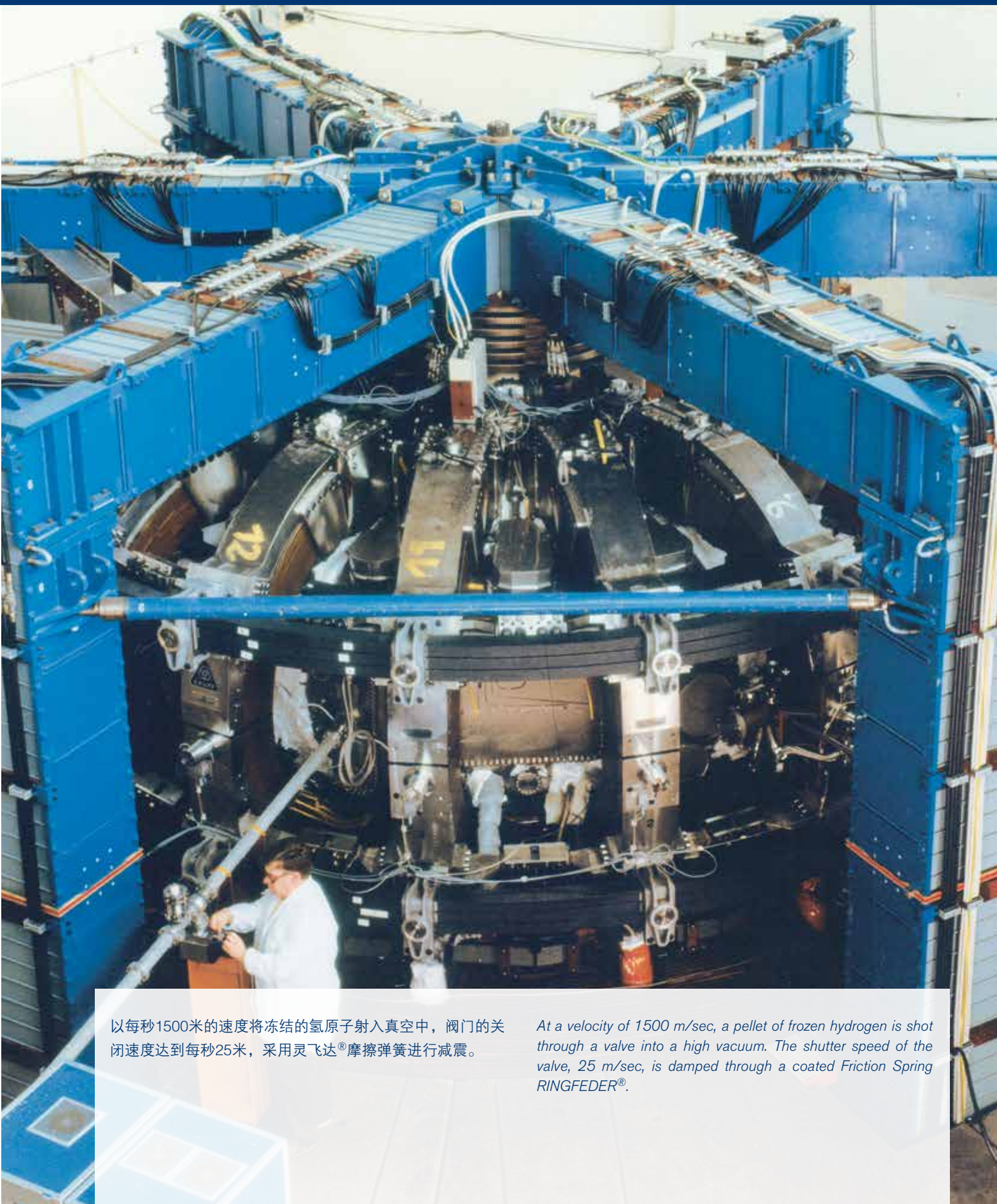


平行布置 / ***Parallel arrangement***



串联布置 / ***Serial arrangement***

阀门应用 · *Valve*



以每秒1500米的速度将冻结的氢原子射入真空中，阀门的关闭速度达到每秒25米，采用灵飞达®摩擦弹簧进行减震。

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®.

压力–行程关系图

摩擦弹簧工作时约三分之二的冲击能量被消除并转化为摩擦热能。在图中曲线上任意一点的反冲力约等于相对压缩力的三分之一。弹簧的减震能力以所有荷 载曲线以下的区域表示。摩擦弹簧的总吸收能量可用We乘以工作单元数量得到。

Force-travel 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.

产品规格 *Type*	旧规格代号 *Type old*	性能参数 *Diagram*				产品尺寸 *Dimensions*			导引套尺寸 *Guide*		重量
		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	5,573
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

*1316型号单独提供行程限值
For type 1316 a separate stroke limitation has to be provided

图示说明

- **F** = 弹簧端面压力
- **s_e** = 一个工作单元的弹簧行程
- **W_e** = 吸收能量（一个工作单元做功量）
- **h_e** = 工作单元高度
- **D_1, d_1** = 工作环的外径和内径
- **b/2** = 工作环的一半宽度
- **D_{2G}** = 导引套外径
- **d_{2G}** = 导引套内径
- **Gw_e** = 一个工作单元重量

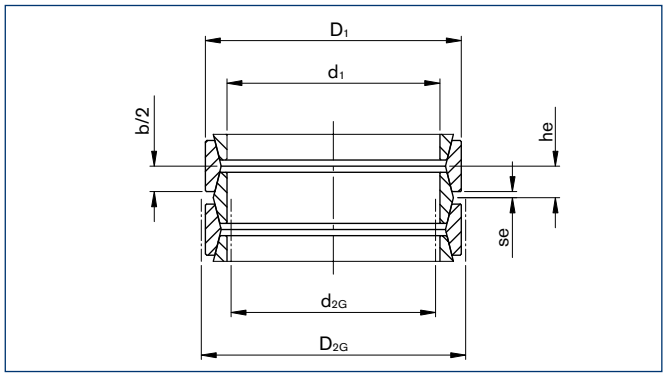
Explanations to table

- ***F*** = *Spring end force*
- ***s_e*** = *Spring travel for one element*
- ***W_e*** = *Energy absorption (work of one element)*
- ***he*** = *Length of one element*
- ***D_1 , d_1*** = *Outer and inner diameter of rings*
- ***b/2*** = *Half width of the ring*
- ***D_{2G}*** = *Guiding diameter outside*
- ***d_{2G}*** = *Inner guiding diameter*
- ***Gw_e*** = *Weight of one element*

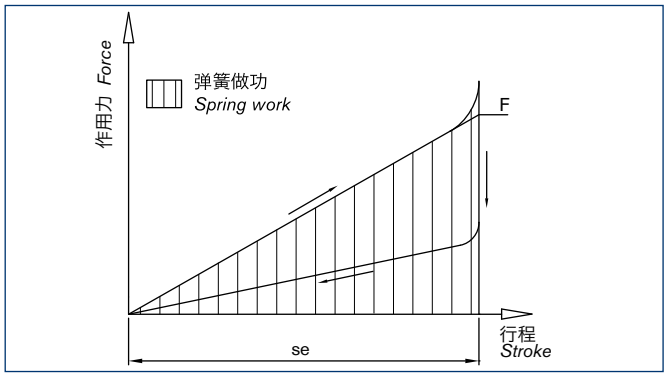
融炼炉应用 · *Oven*

图中所示的融炼炉需要从高处投入大量的废旧金属，大型铸缸所用的拖钩每只需要承受高达8万焦的能量冲击。这种应用同样要求摩擦必须持续经受很高的温度及应力变化。

At this furnace large scrap metal parts are dropped from a high level. By using a several draw gears up to 80.000 Joule/unit, these parts are caught above the cast. This application also requires that the friction springs are constantly subjected to high thermal stresses.



灵飞达®摩擦弹簧尺寸图示 / ***Dimensions RINGFEDER® Friction Spring***



一个工作单元的作用力 — 行程关系图 / ***Force-travel diagram for one element***

关于灵飞达®摩擦弹簧的选择和配合的推荐建议
Recommendations for the selection and fitting of Friction Springs RINGFEDER®

弹簧的预压紧

灵飞达®摩擦弹簧必须进行最小（弹簧总行程的）5%的预压紧，推荐量为10%。为了避免损坏润滑油膜层，最大预压紧量不得超过50%。例外情况也有可能出现，但须先经过咨询。

弹簧的导引

灵飞达®摩擦弹簧也必须进行一定形式的导引（请参考产品规格和参数表中的D_{2G}和d_{2G}值）。也有例外情况，即当使用长度小于等于1.5（D1）的短弹簧时，摩擦弹簧只需要置于两个平行压板之间即可。

弹簧的润滑

由于弹簧环的锥面上所受压力很大，必须使用润滑油，但只有灵飞达®所推荐的润滑油才能使用。通常情况下，出厂自带的润滑油足以满足需要，无需再次润滑。

弹簧图示的观察

对于减震弹簧来说，有效弹簧做功，即（上行线）荷载曲线以下的部分是有用的因素。如弹簧同时被用作一个反向压紧装置，则（下行线）的反冲力曲线应作为设计考虑因素。当然，工作曲线也可以通过采用减小摩擦的专门润滑油脂来提高。如要采用此方式，请向我们提供你的相关规范。

弹簧的密封

灵飞达®摩擦弹簧必须安装在保护套中以防灰尘与湿气损害到润滑油膜。简易的导引套足以满足使用要求，但在高密度灰尘和潮湿环境下，我们推荐使用密封套

Pretensioning

RINGFEDER® Friction Springs have to be pretensioned with min. of 5%, preferably 10% of the total spring travel. 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 is necessary (D_{2G} and d_{2G} in the preceding table). 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 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

RINGFEDER® Friction Springs have to be assembled with protection against dust and moisture, in order not to impair the lubricating film. Simple sliding guides are sufficient. Under strong dust and moisture, we recommend to use gaiters.

轧机应用 · *Rolling mill*

在图中的轧机运行线上，待处理的材料必须被停下来。由于材料本身的质量很大，运行速度很快，因此需要配置具有高能吸收能力的预置减震器。在此类接触式减震器中，灵飞达® 摩擦弹簧已证明自己具备最高的可靠性。

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 RINGFEDER® Friction Springs proved to be of the highest reliability.

工业缓冲器 / *Industrial buffer*

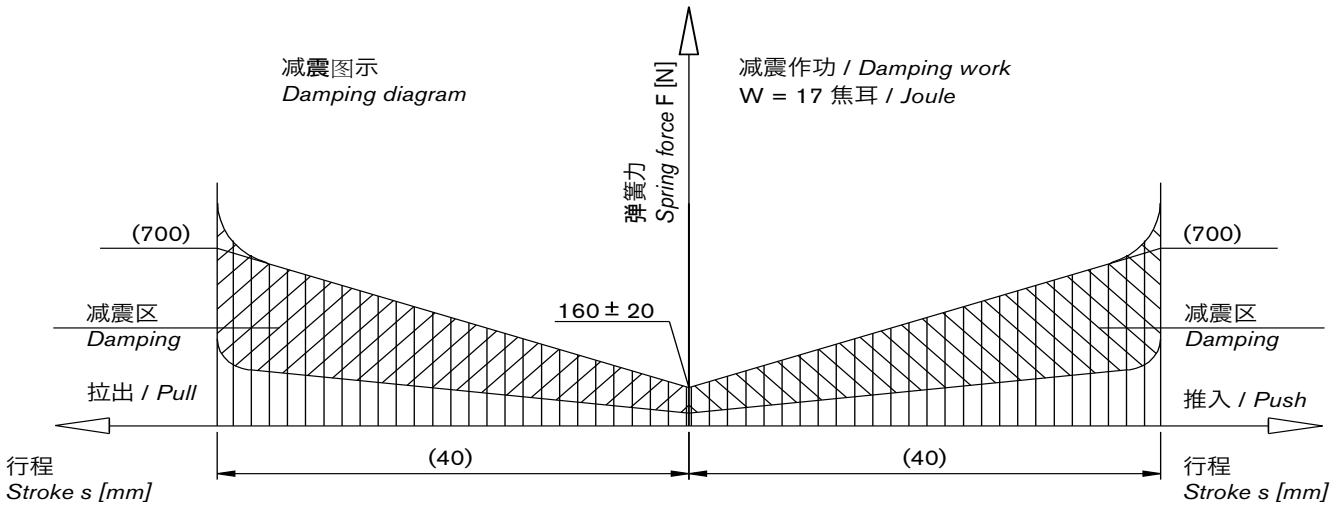
灵飞达®摩擦弹簧可以成套工业缓冲器形式供货，经批准的减震器型号如第22页规格参数表所示。客户定制形式和水冷式版本同样可以提供，包括推入式和拉出式设计。

RINGFEDER® Friction Springs can be supplied as complete industrial buffers. A range of approved buffer types are shown in the table at page 22. Customized and watercooled versions are also possible, including units with a push pull design.

工业缓冲器剖视图 / ***Cross section of industrial buffer***

过载离合器 / ***Overload clutch***

振荡消除器 / ***Oscillation damper***



振荡消除器作用力 — 行程曲线图示 / ***Force-travel diagram from an oscillation damper***

天线杆应用 · *Aerial mast*

在强风的影响下，高度结构如图中位于德国布罗肯山上的电视/广播天线，会产生横向摆动，进而威胁到建筑结构整体的稳定和安全。为预防这种情况的发生，灵飞达®振荡消除器与一副钟摆式配重配合安装在一起，全天候保护诸如天线、烟筒等建筑。

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, RINGFEDER® Oscillation Dampers have been installed in combination with a pendular suspended mass, which safely protect aerials or smoke pipes under all temperature conditions.

工业缓冲器 / *Industrial buffer*

尺寸 *Size*	型号 *Type*	性能参数 *Diagram*				减震器尺寸 *Buffer Dimensions*									外形尺寸 *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								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								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	-	-

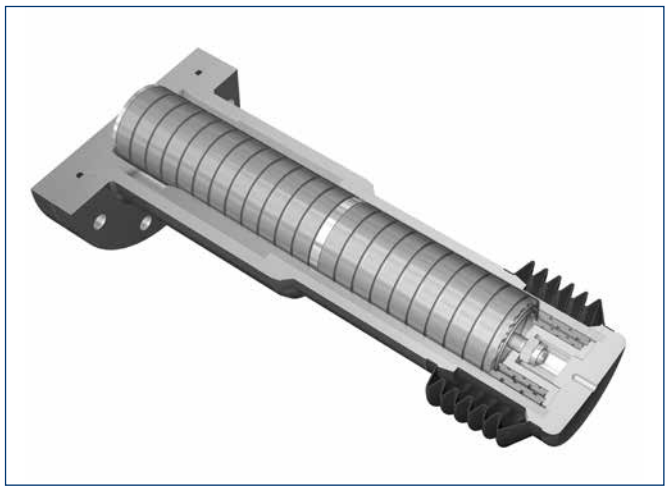
以上为现有批准的减震器型号，客户要求时可另行设计 / ***Extract of proved buffer types, further design after request***

图例说明

- F_v = 预压紧力
- F = 弹簧压力
- s = 弹簧行程
- W = 弹簧做功量
- L = 总长
- l_S = 潜藏深度
- D = 外径
- D_P = 柱塞直径
- D_C = 衬套直径
- D_B = 隔离层直径
- F_K = 法兰厚度
- L_N = 法兰尺寸
- Gw = 重量
- b = 法兰孔距
- d_b = 通孔直径
- D_E = 安装直径
- t = 壁厚

Explanations to table

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



大型储气罐用缓冲器
Buffer for gas tank

工业储气罐应用 · *Gas tank*

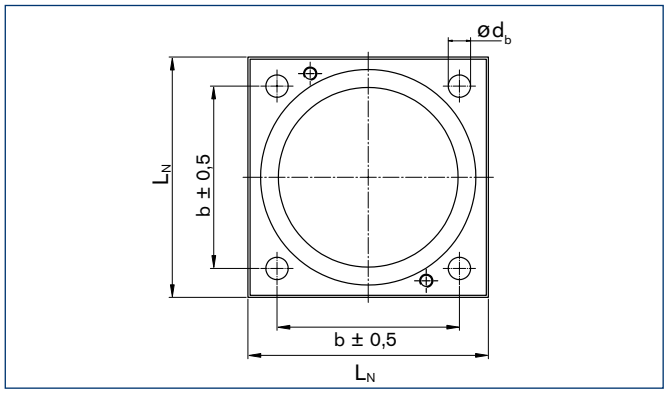
灵飞达®摩擦弹簧不仅能够适应高速冲击，也能够适用于大质量，以及非常缓慢的冲击速率。

由德国蒂森公司制造的5万立方米工业储气罐，使用了来自灵飞达传动®的缓冲器支撑整个钢制壳体以适应其膨胀与收缩变形。我们的缓冲器以超长使用寿命著称。

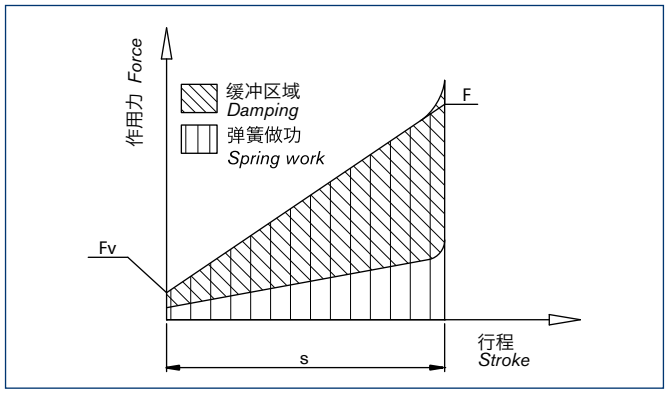
Not just for high velocities, but also with high masses and very slow loading rates, RINGFEDER® Friction Springs can provide solutions.

This 50.000 m³ gasometer by Thyssen Germany, uses buffers from RINGFEDER® to support the steel envelope but still allows expansion and contraction. Our buffers are characterised by very long operating lives.

工业缓冲器 / *Industrial buffer*



典型安装孔形式 / *Typical hole pattern*



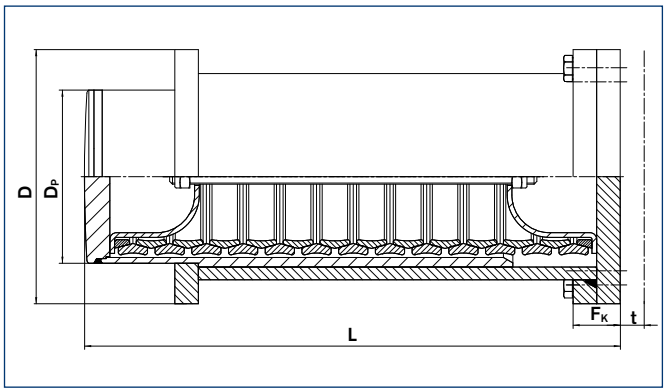
典型摩擦弹簧工作曲线 / *Typical friction spring diagram*

配备灵飞达®摩擦弹簧的缓冲器

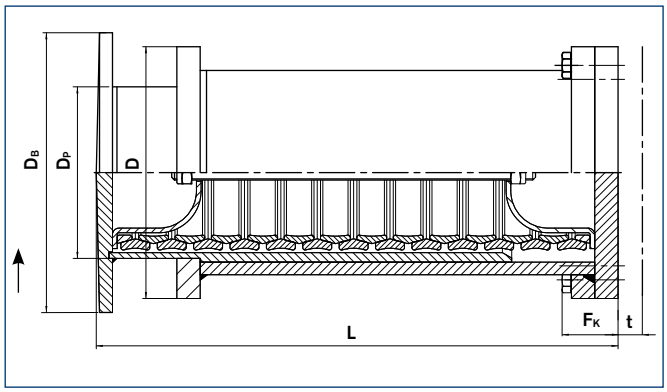
在前页中所列出的标准缓冲器可以下列4种设计方案供货。这类缓冲器的工作温度范围为–40℃至80℃，经过改造的缓冲器工作温度范围可达–73℃至+200℃。根据客户要求，对几何形状和其他特殊技术条件均可进行定制。

Buffer with RINGFEDER® Friction Springs

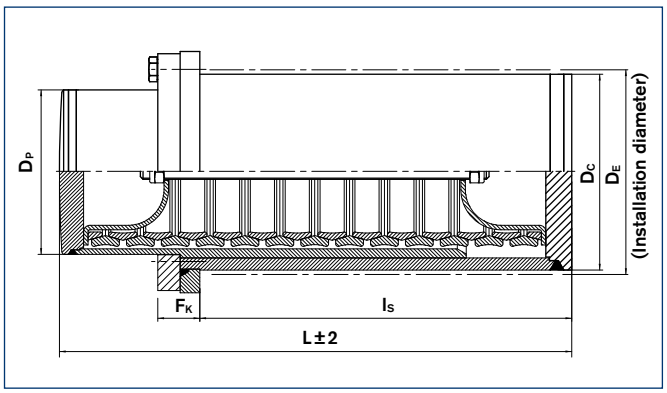
The buffer types shown in extracts on the previous page are standard delivered in one of the following 4 designs. These buffers are suitable for operation temperatures from -40°C to +80°C. Above that, modifications allow an extended temperature range from -73°C to +200°C. Customized requirements with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



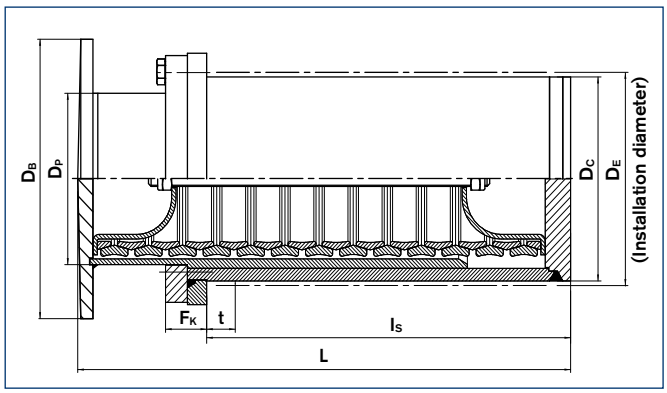
设计方案1 / *Design 1*



设计方案2 / *Design 2*



设计方案3 / *Design 3*



设计方案4 / *Design 4*

颚式破碎机应用 · *Jaw crusher*

破碎机和粉碎机偶而会被投入无法粉碎的原料，在这种情况下设备会被损坏，通常应配备过载保护装置以避免此类事故。过载保护基本上都包括一组预紧支撑弹簧，在过载时可将破碎/粉碎头顶向一侧。

由于所需安装空间小，并可作为震动受体，灵飞达®摩擦弹簧特别适用于此类应用场合。

Crushers and mills, occasionally are fed with product that cannot be processed. In such cases the crushers or mills can stall and be damaged, therefore overload protection is required. RINGFEDER® Friction Springs are used with springs pretensioned holding the crushing/grinding faces in position to allow regular loads, but in the event of an overload the crushing/grinding faces are allowed to move apart.

安装 / 拆卸

放置在弹簧套筒中并配有预紧部件的卡阻环，在拆卸之前，也必须在保护装置中用锤击散。

卡阻在一起的工作环可能仍然储集有能量，为防止其突然爆散（**警告，危险**！），必须事先用足够粗壮的绳索小心绑扎，然后在保护装置中用锤将其击散。

润滑

适当的润滑是保持弹簧长寿命的基本条件。所有摩擦弹簧供货时均已经过润滑并可立即安装。散装环涂有防锈油，在安装前必须清除干净并全表面重新涂抹灵飞达®专用油脂。

安装后必须保证多余油脂可自行流出（如经过压环间的沟槽）

安装

如灵飞达®摩擦弹簧采用的是无套筒式设计，则弹簧应以垂直方式进行装配。对于特别长的摩擦弹簧的装配，可利用长螺栓或圆管协助，进行对准排列和预紧。

以完成测试状态交货的弹簧，为保证其测试性能，不得擅自进行拆卸或工作环的替换。

维护

正常情况下，在工作期间不需要进行重新润滑。而如果使用非灵飞达®传动专用润滑油脂进行重新润滑，可能导致弹簧失效。如通过结构设计措施无法避免使用过程中润滑油脂被污染，则需要定期进行适当维护。重新清理检查时，损坏的工作环必须进行更换。

拆卸

为避免拆卸时发生意外，必须仔细观察并确保所有工作环已均匀舒展开。

未在弹簧套筒中装配预紧的工作环必须进行保护性包装后才能运输和放置。

工作环的清洁

工作环上所有残余污渍和油脂必须清除。清除过程中可使用清洁无杂质的油脂溶剂。带有表面金属光泽的工作环可以更好的保证弹簧寿命。生锈的或表面发黑的工作环必须进行喷砂处理。任何带有轴向划痕的工作环都必须报废并用新环代替！

清洁和检查工作也可由灵飞达传动有限公司执行，清洁后的工作环必须用灵飞达®专用油脂进行润滑。

Installation and removal instructions for RINGFEDER® Friction Springs

Lubrication

An essential factor for long service life is a sufficient lubrication of the springs. All friction springs are supplied in greased condition - ready to be installed. Loose rings are oiled for the protection against corrosion. They must be cleaned and then greased with RINGFEDER SPECIAL GREASE on all surfaces prior to installing.
It has to be ensured for all springs that an excess of grease may escape (e.g. through a groove in the thrust piece).

Installation

If the RINGFEDER® Friction Spring is not designed into a spring cartridge, the spring which the consists of piled up loose rings is assembled best in its vertical position. Designing of particularly long springs is facilitated by guiding on a bolt or tube during aligning and pretensioning.
At deliveries of already tested springs, the spring column must not be disassembled, nor the rings be exchanged, in order to maintain the values of the test diagram.

Maintenance

Normally, during operation, no regreasing of the springs is necessary. Regreasing could even result in a failure of the spring when using other lubricants than specified by RINGFEDER POWER TRANSMISSION. If by constructional measures impurities of the lubricant cannot be avoided, appropriate maintenance intervals have to be provided. For refurbishing, a damaged friction spring has to be dismantled.

Removal

To prevent accidents during removal, it must be observed, that all rings expand evenly.

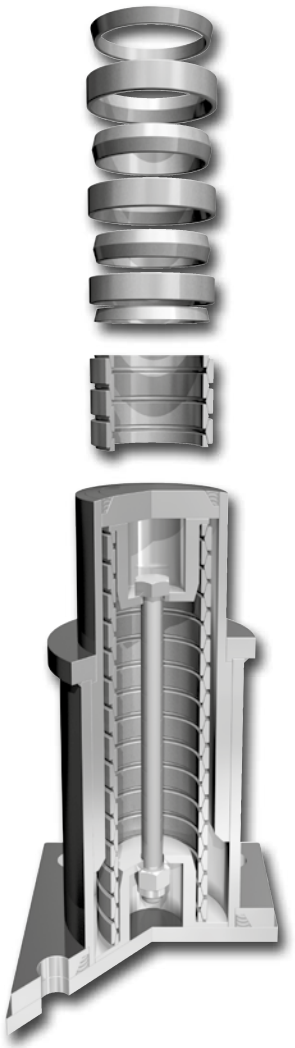
Rings which are not braced into a spring cartridge by the help of pretension components must only be transported and put down when protected in a casing.

To prevent jammed rings from being forced apart explosively by the stored energy (CAUTION, DANGER!), they have to be released within a safety-device by 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 by a hammer stroke within a safety-device, before disassembly can be started.

Cleaning of the rings

All residues of dirt and grease must be removed from the rings. Actual cleaning may be carried out in any grease solvent containing no 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 blasting. Any rings showing axial scoring marks have to be scrapped and replaced by new rings!
Cleaning and checking can, of course, also be carried out by RINGFEDER POWER TRANSMISSION GMBH. Cleaned rings must subsequently be regreased with RINGFEDER SPECIAL GREASE.



减震元件 · *Shock Absorbing Units*

顶福加®减震元件

顶福加®缓冲元件是一次性使用的高能吸收型减震产品，能够将动能转化为变形能量。

该减震元件为厚壁圆筒形设计，由热塑树脂材料制成，经一次冲击后弯折/收缩变形为碟形结构。

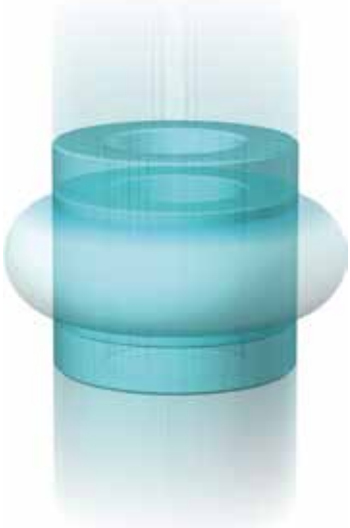
专利设计的顶福加®减震元件的应用领域

- 机床制造
- 风机
- 汽车装配
- 机械工程

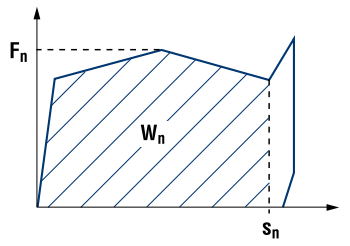
顶福加®缓冲元件具有以下特点：

- **高减震性（可达95%）**
- **低成本**
- **小安装空间**
- **低重量**
- **易于更换**
- **免维护**
- **无污染**
- **矩形压力–行程曲线**
- **设计多样化**
- **对各类溶剂，油脂，碱等具有良好的抗腐蚀性**

缓冲元件
Shock absorbing unit



顶福加®缓冲元件 — 静态曲线
Static DEFORM plus® - diagram



Shock Absorbing Units DEFORM plus®

Shock Absorbing Units DEFORM plus® are one-time use damping elements for high energy absorption. They transform kinetic energy caused by an impact into deformation energy.
A damping element consists of a thickwalled, cylinder of high quality thermoplastic resin. On impact, it folds/shrinks to a discus-shaped structure.

Applications of the patented **DEFORM *plus®* *units***

- ***Tool manufacturing***
- ***Wind driven turbines***
- ***Construction of vehicles***
- ***Mechanical engineering***

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-stroke diagram***
- ***Versatility in design***
- ***A good resistance to a variety of solvents, oil, grease and alkalis***

顶福加® · 特点 DEFORM *plus*® · *Features*

规定的可吸收冲击能量W_n适用于工作温度范围为–25℃至+50℃的场合。工作温度低于20℃时，可吸收能量会增加，在工作温度为20℃时元件可达到最大变形量。冲击速度越大，吸收的能量也相应增加。

如工作温度保持在50℃以下，元件可吸收更多的冲击能量。对于工作温度在50℃以上的场合，我们推荐不锈钢版本。

如有需要，我们可以根据客户要求来设计顶福加®元件并在我们的测试设备上进行验证，目前最大吸收能量可达到5600焦耳。

对于室外应用，应进行油漆或涂层保护以防紫外辐射。元件本身自带普通螺纹，安装时请置于安装面上对应的螺纹孔。请勿在元件上自行钻孔，再用外部螺钉安装。

元件的变色并不影响使用功能。

The nominal energy absorption W_n applies for the temperature range from -25℃ until +50℃. Temperatures < 20℃ increase the force. About 20℃ the max. possible deformation stroke can be achieved. The forces increase with higher impact velocity.

If the temperature is always below 50℃, higher energies may well be absorbed. For applications above +50℃, we offer solutions in stainless steel.

If required, we can design the DEFORM plus units according to your requirements and can test up to an energy introduction of 5600 J on our test facility.

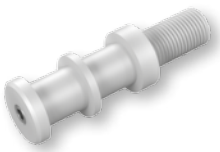
Outdoor use will be needed paint or cover for protection from UV radiation. The units should be screwed into one of the contact surface subsequent thread and not, plugged through a hole, fixed by a nut.

Color variations do not affect the function.

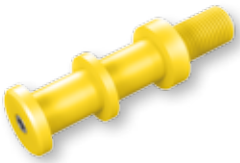
DF 1-009-016-E

DF 1-010-014-A
DF 1-014-016-A
DF 1-018-012-P
DF 1-024-024-A

DF 2-028-014-A

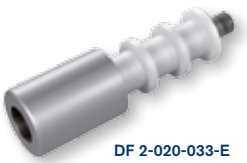


DF 1-022-035-A

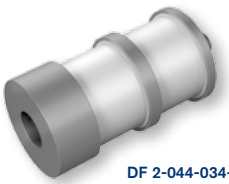


DF 1-024-040-C

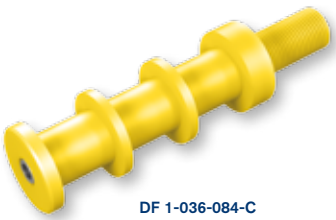
DF 2-024-030-A



DF 2-020-033-E
DF 2-020-022-A
DF 2-020-033-A
DF 2-021-035-A



DF 2-044-034-A
DF 2-047-030-A

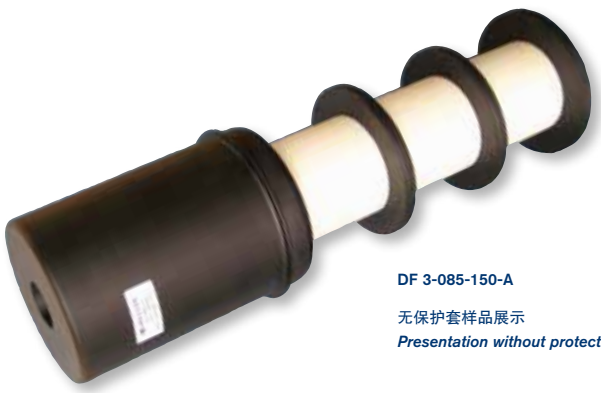


DF 1-036-084-C

DF 1-042-082-E

DF 3-085-150-A

带发黑处理的运输保护套
Delivery against illustration with black painted tube



DF 3-085-150-A

无保护套样品展示
Presentation without protection tube

加工中心应用 · *Machining centre*

在破坏性运行过度导致冲击的情况下，顶福加®缓冲元件或灵飞达®摩擦弹簧都可用作过载保护装置。他们均能够精、完全的吸收冲击动能以防止设备损坏，并能节省外修技术服务和设备停转产生的费用。在如此极端有限的空间内，没有任何其他减震系统能够发挥同样效能。

In cases of crash over run, DEFORM plus® Damping Elements or RINGFEDER® Friction Springs – are used as overload protection – They will precisely absorb the full kinetic energy and thus prevent damage and the costs for external service technicians and downtimes. No other damping systems can absorb such energies within these extremely limited mounting spaces.

顶福加® · 规格参数表 DEFORM *plus*® · *Table*

顶福加®标准元件 / *Standard DEFORM plus® Units*

型号 *Type*	规定的静态参数 *Nom. values of stat. diagram* F_n	s_n	W_n	产品尺寸 *Dimensions* D'	D_1	D_G	L_c	L_M	T_E	重量 Gw
	kN	mm	Joule	mm	mm	mm	mm	mm	mm	kg
DF 1-009-016-E	4	10	30	15	16,2	M12	44,5	33,0	12	0,007
DF 1-010-014-A	10	6	45	16	16,0	M12	36,0	24,0	12	0,007
DF 1-014-016-A	20	8	100	21	20,0	M12	39,5	28,0	12	0,010
DF 1-018-012-P	40	12	350	31	28,0	M16	56,5	41,0	16	0,030
DF 1-024-024-A	60	16	710	40	32,0	M16	63,0	48,0	21	0,040
DF 1-022-035-A	45	30	950	37	32,0	M20	106,0	69,0	41	0,071
DF 1-024-040-C	33	40	1000	44	34,0	M20	120,0	85,0	50	0,071
DF 1-036-084-C	70	81	4700	65	58,0	M30	230,0	170,0	101	0,470
DF 1-042-082-E	81	81	5200	71	63,0	M36	262,0	172,0	98	0,620
DF 2-020-033-E	13	30	310	30	34,5	M12	---	106,5	20	0,340
DF 2-020-022-A	26	20	425	30	34,5	M12	---	90,5	15	0,320
DF 2-020-033-A	26	30	620	30	34,5	M12	---	106,5	20	0,340
DF 2-028-014-A	70	14	700	42	34,5	M12	---	54,5	13	0,22
DF 2-021-035-A*	30	33	800	33	34,5	M12	---	113,7	21	0,360
DF 2-024-030-A	46	30	1000	40	34,5	M12	---	103,5	22	0,370
DF 2-044-034-A	110	33	3000	61	50,0	M12	---	89,5	18	0,583
DF 2-047-030-A	140	30	3250	63	50,0	M12	---	87,5	18	0,583
DF 3-085-150-A	680	144	70000	134	141,0	M24	---	486,0	50	10,600

1型至1500焦耳规格均使用不锈钢压紧销
Type 1 up to 1500 J with stainless steel clamping pin

*规格号1–018–012–P只适用于1,4m/s或以下冲击速度
**Type 1-018-012-P only suitable up to 1,4 m/s.*

安装/ Mounting:

1型/Type 1 : 手动安装 / *Tighten units by hand*

2型/Type 2 : 旋紧至无空回状态后再紧固四分之一圈
Tighten screws after backlash-free mounting by ¼ turn.

3型/Type 3 : 旋紧至无空回状态后再紧固四分之一圈
Tighten screws after backlash-free mounting by ¼ turn.

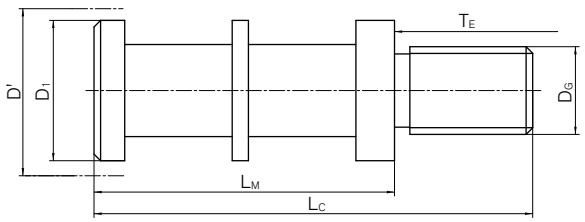
安装：

F_n = 规定作用力
s_n = 规定变形行程
W_n = 规定能量
D' = 规定荷载下最大直径
D_1 = 外径
D_G = 螺纹规格
L_c = 零件总长度
L_M = 工作部分长度
T_E = 安装部分长度
Gw = 重量

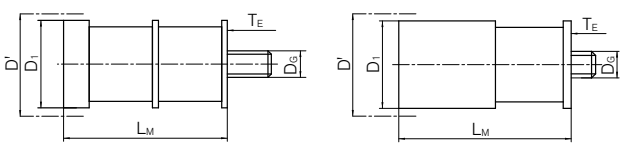
Explanations to table

F_n = *Nominal force*
s_n = *Nominal deformation stroke*
W_n = *Nominal capacity*
D' = *Max. diameter during nominal loading*
D_1 = *Outer diameter*
D_G = *Thread*
L_c = *Unit length complete*
L_M = *Protruding module length*
T_E = *Kept available mounting depth*
Gw = *Weight*

1型
Type 1



2/3型
Type 2/3



有轨电车应用 · *Tramway*

灵飞达传动的减震技术产品不仅能够保护设备，也同样能够保护车辆安全。例如图中所示的德国杜塞尔多夫莱茵巴恩市政客运有轨电车，顶福加®缓冲元件被安装在车头位置以保护乘员和设备。顶福加®缓冲元件随时准备，在发生碰撞时使冲击力最小化并使车辆减速。

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® Shock Absorbing Units are installed to protect man and machine. The DEFORM plus® units, ready for operation at any time, minimize forces and decelerations in case of a crash.

顶福加®R/RMP冲击吸能元件

无需增加弹簧即可实现反复使用的动能吸收减震阻尼

环形结构集成了弹簧和减震器的功能，在动态载荷下能够反复使用。依据不同冲击速度，最大支持载荷可自动匹配相应的冲击能量，这就意味着相同质量的冲击均能以更低速度被缓冲。工作温度范围为–10℃至+50℃。

工作环境条件：

本产品材料可适应以下化学环境

- 3%漂白剂
- 30%含粮溶液
- 10%过氧化氢
- 5%氨水
- 2%乙酸
- 2%甲酸
- 亚麻仁脂肪酸
- 20%丹宁酸溶液
- 润滑油脂和机油

应避免产品持续接触水。依据DIN4012标准中建筑材料分类2，本产品归类为阻燃材料和非滴洒材料。

Shock Absorbing Units DEFORM plus® R/RMP

Re-usable buffer for absorption of kinetic energies without additional spring

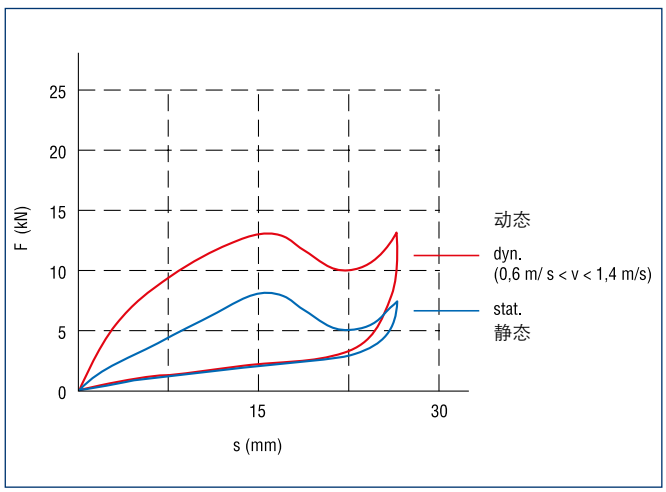
The casing combines the function of a spring and a damper. It can be re-used after a dynamic load. Dependent on the velocity, the maximum supporting load automatically adapts to the impact energy, which means that i.e. equal masses are retarded more softly at lower velocities. Working temperature: -10°C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

Ambient conditions:

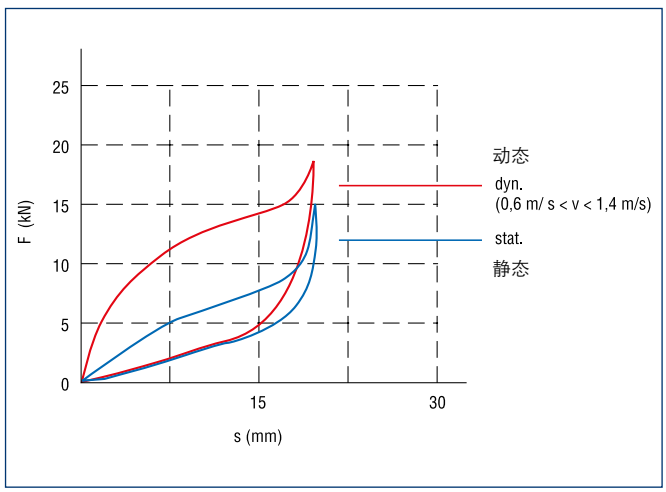
The material is resistant to

- ***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).



顶福加®R45型号 **DEFORM *plus*® R45**
在20℃下的工作曲线 / ***Spring diagram at appr. 20°C***



顶福加®R45MP型号 **DEFORM *plus*® RMP45**
在20℃下的工作曲线 / ***Spring diagram at appr. 20°C***

钢卷秤应用 · *Coil scale*

敏感型的设备，例如图中所示的称量传感器，即使是最慢速度的冲击都有可能造成损坏。

Even at the lowest of speeds impacts are created, which can – for sensitive machine parts like here a weighing cell – lead to damage.

免维护的顶福加®减震元件被集成到此项应用场合。

16 DEFORM plus® Shock Absorbing Units are integrated here in a maintenance-free application.

顶福加® R/RMP · 规格参数表　DEFORM *plus*® R/RMP · *Table*

顶福加® R标准元件 / *Standard DEFORM plus® R units*

Typ	$W_{max(20°C)}$/6h	$W_{max(20°C)}$/1h	$W_{stat(20°C)}$	$F_{dyn(20°C)}$ ~ 2x$F_{stat(20°C)}$	F_{Mmax}	s_{max}	D'	D_1/D_B	L	D_G	T_E	Gw
	Joule	Joule	Joule	kN	kN	mm	mm	mm	mm	mm	mm	kg
R30	76	---	38	7,5 (at 1,1 m/s)	1,5	18	45	30 / ---	36	M6	14	0,047
R45	240	---	120	15 (at 1,4 m/s)	2,5	27	68	45 / ---	54	M8	17	0,085
R60	560	---	280	30 (at 2,0 m/s)	4,5	36	91	90 / ---	72	M12	17	0,240
R90	1800	---	900	65 (at 3,2 m/s)	9,0	54	137	90 / ---	108	M16	24	0,750
R30MP	---	57	30	8 (at 1,1 m/s)	5,0	13	45	30 / 37	42	M8	16	0,700
R45MP	---	180	115	20 (at 1,4 m/s)	10,0	19	65	45 / 57	63	M12	25	0,160
R60MP	---	420	200	40 (at 2,0 m/s)	15,0	25	90	60 / 71	85	M16	22	0,360
R90MP	---	1350	750	80 (bei 3,2 m/s)	20,0	37	130	90 / 112	127	M24	28	1,300

Wmax(20°C)/6h =
6小时内规定环境温度下的最大可吸收能量

Wmax(20°C)/1h =
1小时内规定环境温度下的最大可吸收能量

Wstat(20°C) =
20℃环境温度下且慢速状态时可保证的吸收能量

Fdyn(20°C) ~ 2xFstat(20°C) =
规定环境温度下的即时作用力

F_{Mmax} = 最大允许驱动力
s_{max} = 最大行程
D' = 规定载荷下的最大外径
D_1 = 外径
D_B = 挡板直径
L = 总长
D_G = 螺纹规格
T_E = 预留有效安装深度
Gw = 重量

Wmax(20°C)/6h =
Permissible energy absorption at ambient temperature within 6 hours.

Wmax(20°C)/1h =
Permissible energy absorbtion at ambient temperature within 1 hour.

Wstat(20°C) =
Guaranteed energy absorbtion at a slow load and 20°C ambient temperature.

Fdyn(20°C) ~ 2xFstat(20°C) =
Occurring force based on specified speed at ambient temperature

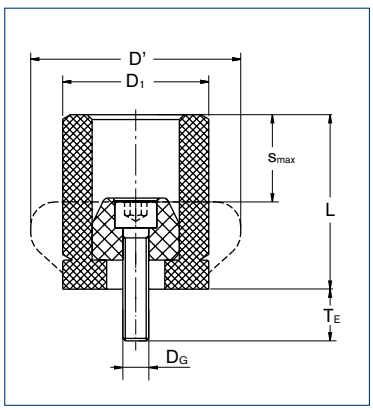
F_{Mmax} = *Max. admissible driving force*
s_{max} = *Max. spring stroke*
D' = *Max. diameter during nominal loading*
D_1 = *Outer diameter*
D_B = *Baffle diameter*
L = *Overall length*
D_G = *Thread*
T_E = *Kept available mounting depth*
Gw = *Weight*

这类缓冲元件对工作环境清洁度不敏感，并以“预备安装”状态供货，自带锁紧螺栓。

缓冲器的安装是最简便的：只需将涂抹好乐泰胶水的螺栓直接拧固到需要保护的器件上，直至螺栓不能再旋进为止，此时的缓冲器已经自行预紧半圈螺纹。

由于有紧固螺栓的引导固定，本缓冲器（如下右图所示）基本上不考虑侧向力的影响。在“主动缓冲器–对–被动缓冲器”的专门设计中，应至少有一个缓冲器配备顶部挡板。

作为不常接受冲击情况下使用的低成本版本产品，顶福加R型缓冲器无需设置挡板（如下左图所示）。针对持续增强性冲击力，本产品可提供最大程度的保护。

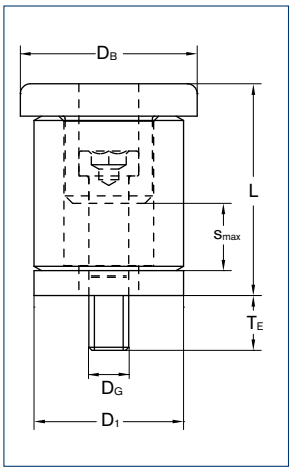


The damping elements are not sensitive to dirt and are supplied ready-to-install including the locking bolt.

Mounting of the buffers is most simple: *The screw, provided with some 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 right) is relatively insensitive to the influence of lateral forces. In case of a design “impact buffer vs. buffer”, at least one damper has to be equipped with a baffle plate.

As reasonably priced alternative for infrequent stresses we offer the DEFORM *plus*® R *without baffle plate (see picture bottom left). This type provides max. protection by avoiding progressive increase in force.*



山地火车应用 · *Mountain railway*

山地火车在峡谷车站进出时通常有很高的安全规定和要求。顶福加®完全满足应用要求，它能够通过尽量减低速度（当机车车体与止停阻尼发生碰撞时），保护乘员安全。由于自身起步阻力巨大，液压式减震器并不适合此类应用。

Mountain railways have high safety requirements at the valley station. DEFORM plus® fulfils these requirements for passenger security by keeping the deceleration (in case of collision with the buffer stock) as low as possible. Hydraulic units are not suitable as they have a too high an initial breakaway force.

灵飞达® · 地震防护 RINGFEDER® · *Earthquake protection*

保护您的建筑！ Save your constructions!

灵飞达®地震防护 Earthquake protection by RINGFEDER®

在未来民用建筑和高压电气断路开关的保护设计中，摩擦弹簧将越来越多的得到应用。虽然大地震造成的破坏不能完全被避免，但灵飞达®摩擦弹簧将使你的建筑物有更大的机会在地震中得以幸存，正如新西兰基督城的建筑物在经历了2010年11月发生的地震后仍可正常居住一样。在新西兰已经有一些建筑装配了灵飞达®摩擦弹簧并经过了实践检验。例如下图所示的Te Puni Village学生公寓，经受住了2013年7月21日发生的6.5级（力矩震级）地震以及随后发生的5.8级（力矩震级）余震考验，建筑物未出现明显损坏。

Friction Springs will be more and more part of the future design systems for both, protection of residential buildings and high-voltage circuit breakers for electrical power transmission. Not all of the damage can been avoided that a big earthquake will cause, but with RINGFEDER® Friction Springs you have a great possibility that your building survives an earthquake like the ones in Christchurch 2010/11 and is still habitable. There already are buildings in New Zealand which are equipped with RINGFEDER® Friction Springs and are tested in reality. For example Te Puni Village Student Accommodation was already completed when the earthquake on July 21st 2013 occurred, measuring 6.5 on the Moment Magnitude Scale and the following aftershock measuring 5.8 on the MMS. The building withstood the earthquake without nameable damage.

Te Puni Village学生公寓 · *Te Puni Village Student Accommodation*

产品优势

1. 长寿命 — 灵飞达®摩擦弹簧可反复多次接受冲击并可回收利用。如一组灵飞达®摩擦弹簧中的某个环发生损坏，弹簧仍可以继续工作，但行程会缩短并略微变硬。相比较之下，如螺旋弹簧或贝勒维尔弹簧垫圈（碟形弹簧）发生部分损坏时将整体失效从而失去保护作用。

2. 减震作用 — 采用我们标准的灵飞达®F–S1油脂，摩擦弹簧可吸收三分之二的冲击能量。如你只需要较小的减震作用，我们可按照你的使用要求进行定制设计，最低可达到约三分之一的冲击能量。这是一种改变弹簧性能的简便解决方案。在特定的地震防护设计中，由于需要弹簧进行支撑以帮助建筑物回复正常垂直位置，客户可能要求摩擦弹簧具备更高的功效。

3. 防火及耐高温 — 摩擦弹簧由特种弹簧钢制成并涂抹专用油脂。在火灾情况下，橡胶产品会受到损坏而摩擦弹簧则可以经受大火。事后可需要重新涂抹专用油脂即可。

4. 回弹力 — 你可以就具体应用要求向我们进行咨询以确定最适合的回弹力。对于传统弹簧来说，这一点是无法实现的。通过变换专用油脂型号、增加外径，或改变锥面角度等手段，可以达到你的需求。

5. 重复使用 — 接受冲击后的摩擦弹簧可以再次使用。弹簧本身能够接受很多次冲击变形并保证其性能稳定。摩擦弹簧也是免维护的。

6. 反应速度 — 摩擦弹簧的冲击反应速度快于任何其他形式的弹簧。

7. 安装空间 — 在给定的尺寸下摩擦弹簧可吸收最大的冲击能量。

Advantages

1. *Long Life – RINGFEDER® Friction Springs are designed to last through many cycles and are reusable. If one of the rings in a RINGFEDER® Friction Spring assembly breaks, the spring will still work but lose a little stroke and become slightly stiffer. The end force and the dampening remain unaffected. As a comparison, if a coil spring or a Belleville washer breaks, there will be a total failure and you have no protection any more.*

2. *Dampening – Using our standard RINGFEDER® F-S1 grease, our Friction Springs will dampen 2/3 of the introduced energy. If you need less damping, we can easily design a customized solution that is tailored to your needs to achieve a reduced damping of about 1/3 of the introduced energy. This is a simple solution that can change the properties of the Friction Spring. In certain seismic designs you may require the Friction Spring to have a higher force as the spring is unloaded to help push the building structure back to its vertical position.*

3. *Fire and High Temperature – Friction Springs are made out of special spring-steel and coated with grease. In case of a fire, rubber products will be destroyed but our Friction Springs will endure the fire. You would just need to re-apply grease to the springs.*

4. *Return Force – You can discuss your application with us to determine the best return force of the spring for your specific design. This is not possible with other, e.g. conventional spring types. We can change the grease, increase the outside diameter or change the taper angle to achieve the results you need.*

5. *Re-Usabilty – Friction Springs can be re-used after a seismic event. They are designed to withstand many cycles and remain stable. Friction Springs are maintenance free.*

6. *Speed – Friction Springs react faster to applied forces than any other spring type.*

7. *Space – Friction Springs give you the highest forces at a given diameter.*

工作图示 · *Diagrams*

灵飞达®摩擦弹簧的工作原理

图示1为20000型摩擦弹簧性能曲线，该型弹簧包含8个外环，7个内环，以及两个半环。弹簧以200kN的压力被预紧到总长为334mm。在此状态下，摩擦弹簧最大工作行程为38mm，并具备13400焦耳的弹簧功。工作要求是能够吸收最大为6000焦耳的能量。

图示2：当摩擦弹簧接受冲击时，弹簧收缩21mm并吸收6000焦耳能量（约占总冲击能量的66%），其中的4000焦耳冲击能被转化为热能。冲击变形后，弹簧在反作用力下回弹21mm，由此产生的2000焦耳能量也需要被吸收。

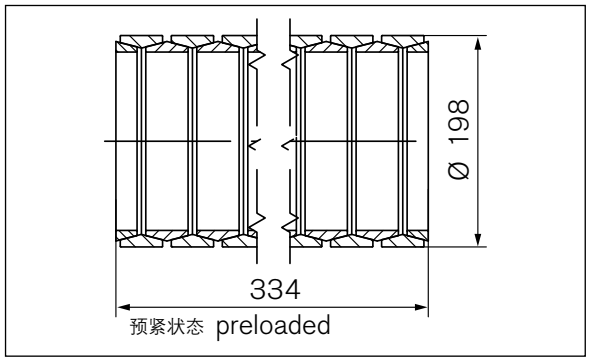
图示3：冲击体以2000焦耳的能量再次作用于弹簧，冲击行程为8.5mm。冲击完成后，弹簧在反作用力下再次回弹8.5mm。通过摩擦弹簧各个组环以及整个系统的共同作用，6000焦耳能量至此全部被吸收，系统重新回到准备状态。

How a RINGFEDER® Friction Spring works

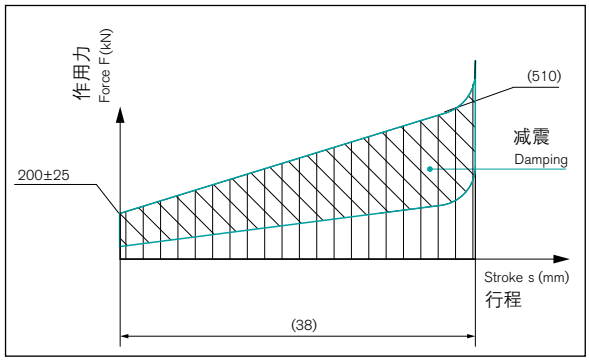
Diagram 1 represents the shown friction spring type 20000, which consists of 8 outer rings, 7 inner rings and 2 half inner rings. It is preloaded with 200 kN to a length of 334 mm. With these values it has a maximum stroke of 38 mm and a capacity of 13400 Joule. The requirement is to absorb a maximum energy of 6000 Joule.

Diagram 2: When the 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 friction spring discharges back by the same 21 mm due to a reaction force and there are 2000 Joule which has to be absorbed.

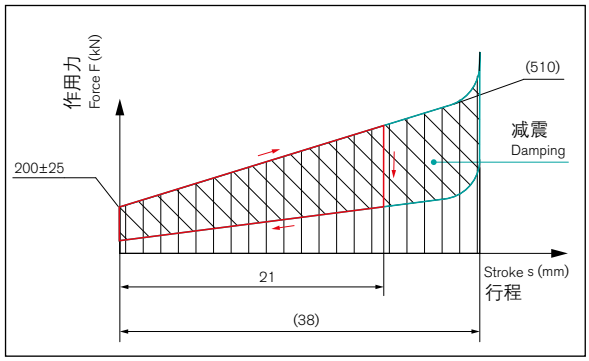
Diagram 3: The impacting body strikes again on the friction spring with the remaining 2000 Joule and compress it by 8,5 mm. After the compression, the buffer springs back by the same 8,5 mm due to the reaction force. Based on the fact that the friction not only occurs between the rings of the friction spring but in the whole system, the complete 6000 Joule are now absorbed and the system comes to rest.



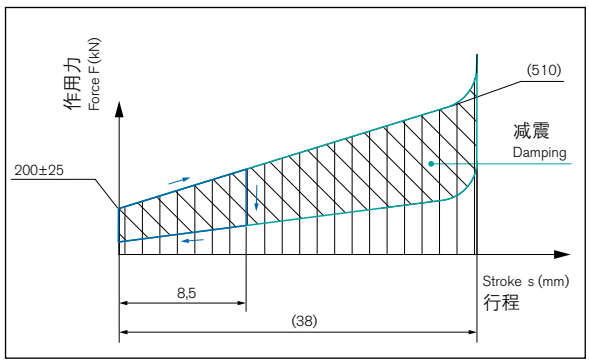
适用于垂直方向的应用
Valid for vertical application



图示1 / ***Diagram 1***

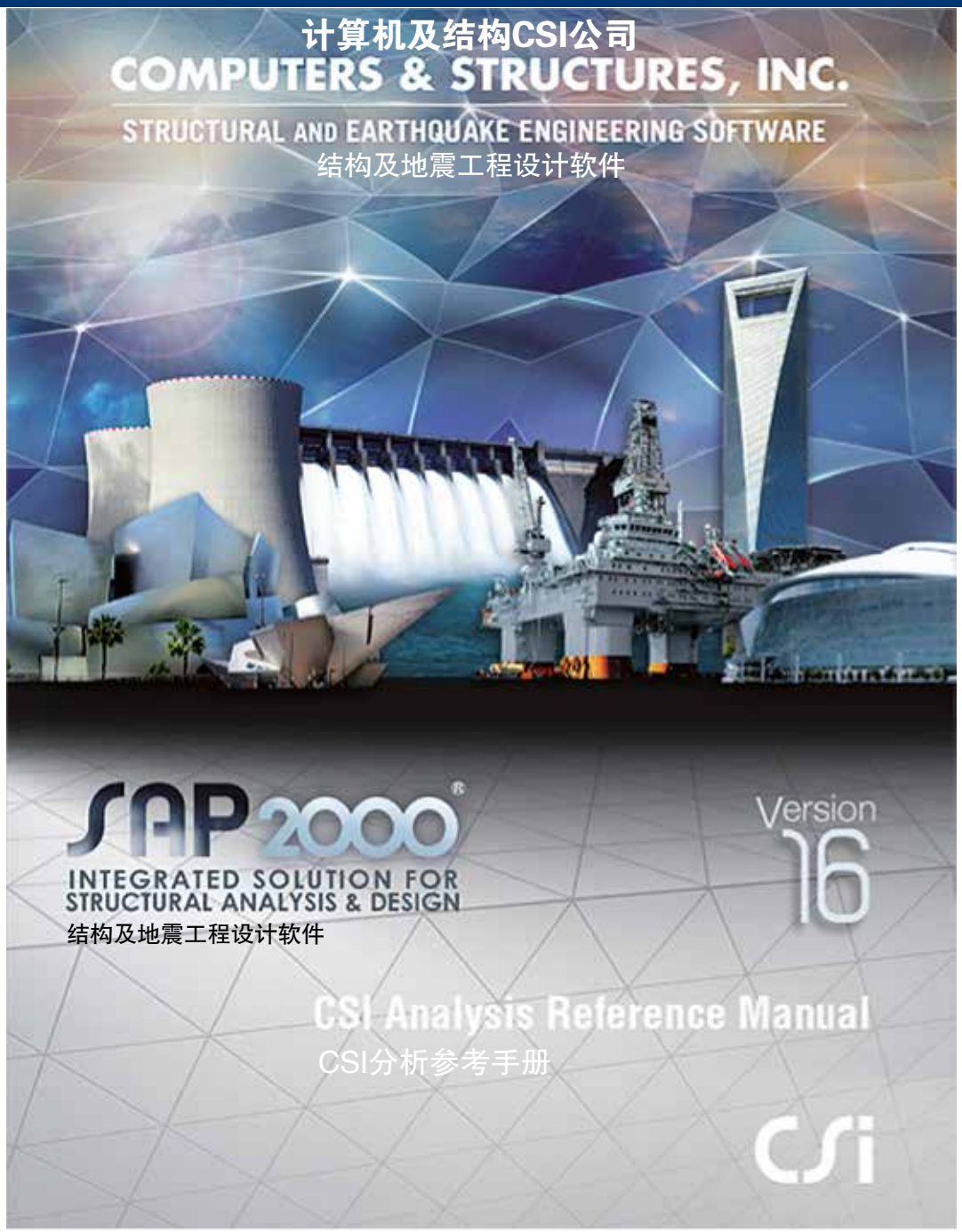


图示2 / ***Diagram 2***



图示3 / ***Diagram 3***

灵飞达®摩擦弹簧应用软件Software Integration of RINGFEDER® Friction Springs



在计算机及结构（CSI）公司开发的 SAP2000® 软件中，摩擦弹簧成为其建筑设计和结构分析组件之一。

位于美国加州的 CSI 公司，成立于 1975 年，已经开发了众多结构分析软件包，包括 SAP2000® 和 ETABS® 等。ETABS® 软件更是被用于世界最高建筑哈利法塔（迪拜塔）的数字建模工作（包括重力，风力及地震响应计算）。

The Friction Spring is part of the SAP2000® software for the structural analysis and design of buildings, created by „Computers and Structures, Inc. (CSI)“.

CSI, based in California, USA, was founded in 1975 and has created many software packages for structural analysis including SAP2000® and ETABS®. ETABS® was used to create the mathematical model of the Burj Khalifa, currently the world's tallest building (gravity, wind and seismic response were all characterized using ETABS®).

技术咨询表

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RINGFEDER POWER TRANSMISSION GMBH 地 址：64823 Groß-Umstadt, Germany
传真号码 +49 (0) 60 78 / 93 85 - 22 100

客户联系信息

公司

联系人 部门

地址

电话 传真

邮件

如需我们参与技术讨论, 请拨打我们的电话号码

为了更好适应对灵飞达® 摩擦弹簧的应用要求，请告知我们您的设计方案：

性能参数：

能量吸收(弹簧做功) W_B = (J) ±

允许运行压力 F_B = (kN) ±

期望的弹簧工作行程 S_B = (mm)±

预紧力 F_V = (kN)±

弹簧刚度 c = (kN/mm)
±

安装空间：

最大外径 D_2 = (mm) ±

最大内径 d_2 = (mm) ±

最大安装长度 L_V = (mm) ±

载荷：

载荷频率 n = (1/sec) ±

预期寿命 N = ±

外部工况：

环境温度 t = (°c) ±

灰尘或潮湿影响?

对荷载强度和频率集中情况的描述

特殊性能和工作条件:

减震性能 D = (%)

润滑油脂规范

其他油

如有可能，请提供装配图或草图。

Fax Inquiry

RINGFEDER POWER TRANSMISSION GMBH, 64823 Groß-Umstadt, Germany

Fax +49 (0) 60 78 / 93 85 - 22 100

Addresser

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 stroke S_B = (mm)±

Pretensioning force F_V = (kN)±

Spring stiffness c = (kN/mm) ±

Installation space:

Max. outer diameter D_{2G} = (mm) ±

Min. inner diameter d_{2G} = (mm) ±

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 intensity and frequency:

Special properties and conditions

Damping D = (%)

Grease specification

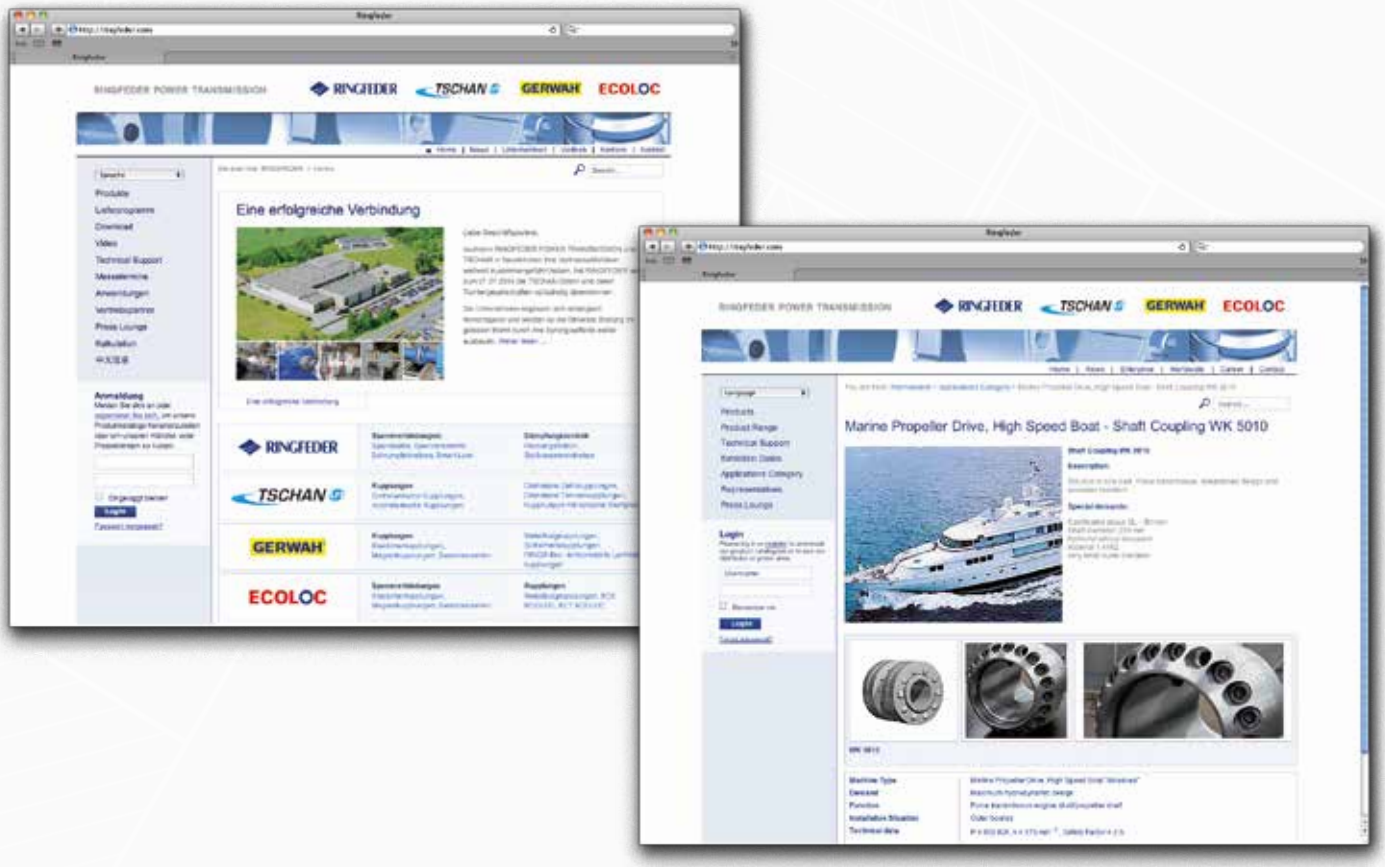
Oil

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

变电站应用 · *Substation*

变电站中的高压断电开关是快速重复转换设备，需要重点抗震保护，灵飞达®摩擦弹簧无疑是最佳解决方案！

For high-voltage circuit breakers when quick change-over processes have to be performed and for substations that have to be protected against earthquake shocks. RINGFEDER® Friction Springs are the best solution.



我们的网站

便捷可查的信息

灵飞达传动RINGFEDER POWER TRANSMISSION — 是机械传动和减震技术领域最顶尖的网址之一。你可以在我们的网站找到第一手的服务和技术信息。这些信息包括我们完整的产品门类，以及可供下载的海量文件，如产品样本，技术参数表，安装与拆卸指导等等。一切更新尽请访问 **www.ringfeder.com**.

Our Website

Easily accessible information.

*RINGFEDER POWER TRANSMISSION – one of the top addresses for drive and damping technology in mechanical engineering. You can find first-hand service details and information on our website. It contains both details on our entire range of products and numerous documents such as product catalogues, data sheets and assembly instruction for you to download. Visit **www.ringfeder.com** to get right up to date.*

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Available Instructions for Installation, Removal and Maintaining

RINGFEDER
灵飞达

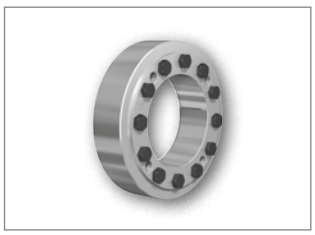
胀紧联接装置
Locking Devices

胀套
Locking Assemblies

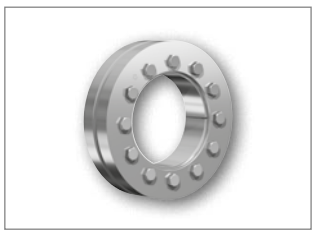
适应弯矩载荷的胀套
Locking Assemblies for bending loads

胀套 – 不锈钢
Locking Assemblies – Stainless steel

胀紧环
Locking Elements



锁紧盘
Shrink Discs



锁紧盘 – 不锈钢
Shrink Discs – Stainless steel

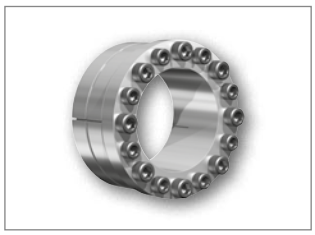
减震技术
Damping Technology

摩擦弹簧
Friction Springs

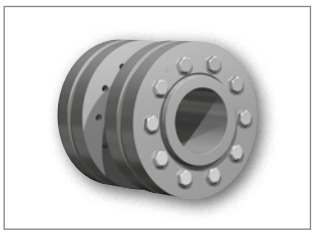
顶福加®单次缓冲器
DEFORM *plus*®

顶福加®多次缓冲器
DEFORM *plus*® R

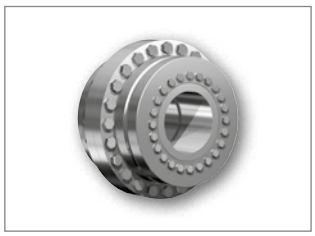
特规产品
Special Solutions



胀套
Locking Assemblies



锁紧连接器
Shaft Couplings



法兰式锁紧联轴器
Flange Couplings

TSCHAN 传 安

联轴器 *Couplings*

扭转弹性联轴器
Torsionally Flexible Couplings

扭转弹性联轴器
Torsionally Flexible Couplings

扭转弹性联轴器
Torsionally Flexible Couplings

扭转刚性齿轮联轴器
Torsionally Rigid Gear Couplings

扭转刚性鼓形齿联轴器
Torsionally Rigid Barrel Coupling

刚性可调式联轴器
Couplings with variable Stiffness

GERWAH® 固 威®

联轴器 *Couplings*

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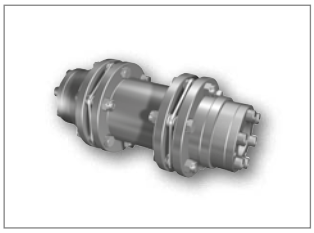
Metal Bellows Couplings

梅花形联轴器
Servo-Insert Couplings

安全联轴器
Safety Couplings

线型联轴器
Line Shafts



扭转刚性膜片式联轴器
Torsionally Rigid Disc Couplings

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