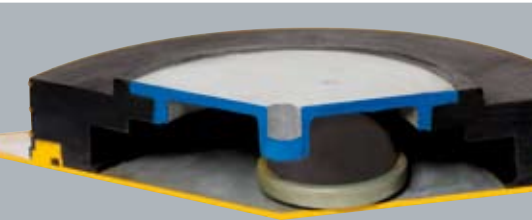


EFFBE



LEVELMOUNT MACHINE SUPPORTS

Advantages of EFFBE machine supports

Objectives

Modern machine designs, with increased performance, are often at odds with optimal manufacturing processes and greater environmental awareness of noise and vibration. This leads to increasing demands on elastic supports when the machines are installed. Our mission is to meet these requirements while keeping your efficient and reliable production free of organisational and environmental constraints.

Quality

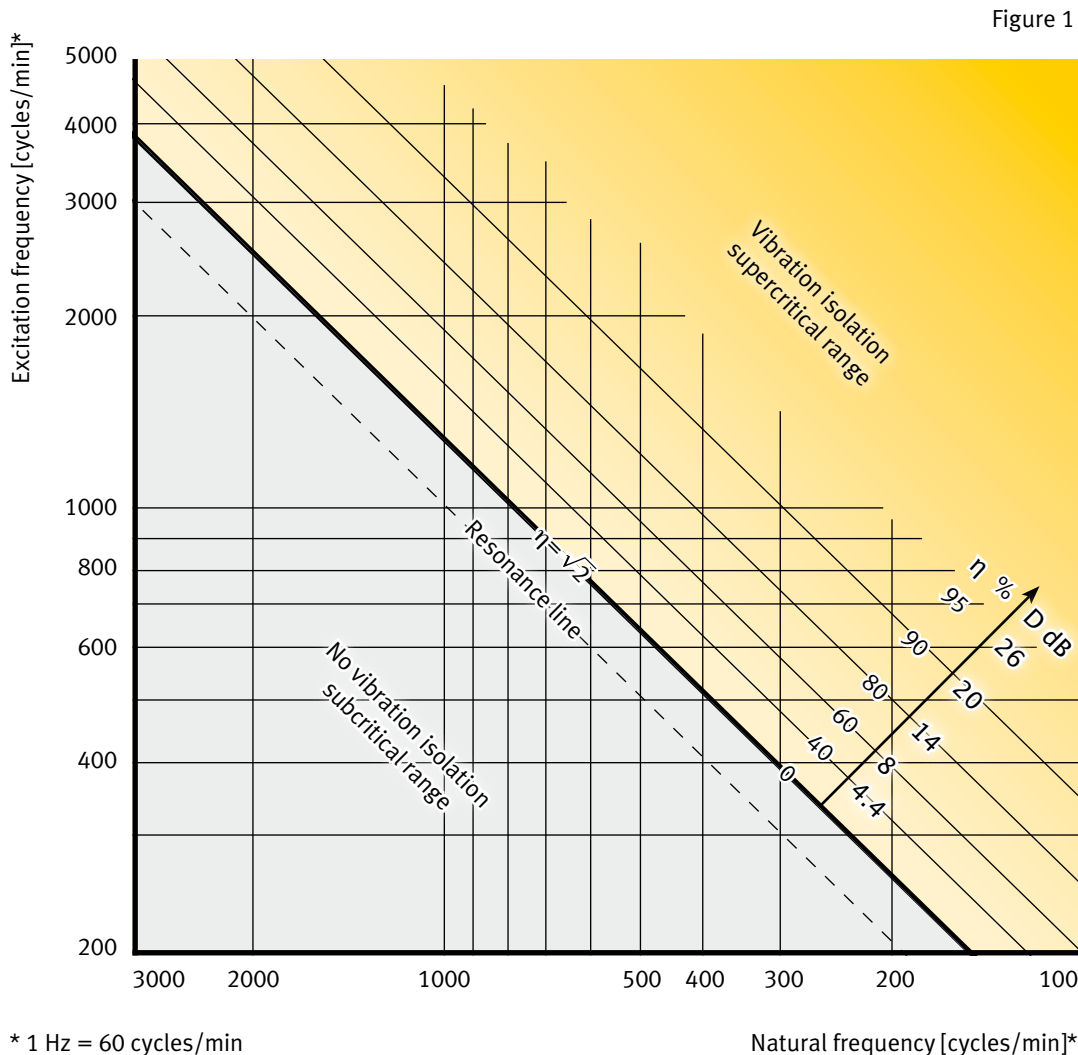
Quality is not only the foundation of our products, but also defines our technological aspirations. Quality assurance according to DIN ISO standards, in conjunction with state-of-the-art manufacturing processes and elastomer developments by our in-house laboratory, ensure products of a consistently high quality standard. We are committed to our customers on this principle for now and for the future.

Consulting

Informative technical product documentation and experienced application engineers in office and field will help you make optimal use of our LEVELMOUNT elements. Vibration analysis with the most advanced measuring equipment form the basis of safe and secure machine installation according to current regulations, even in critical applications. The EFFBE sales organisation ensures that a competent partner is always available in your area. Take advantage of more than 60 years of practical experience.

Delivery

Sophisticated logistics, with appropriate warehousing, guarantees our customers delivery of goods in time for machine installation.



Contents

Products

In terms of form and characteristics, all components are purposely designed and manufactured for their respective roles in vibration technology.

EFFBE LEVELMOUNT elements are designed for high static and dynamic fatigue strength with sufficient safety margins. In particular, the material and shape of the elastomer bodies determine the dynamic properties of the support element. Therefore, we use no semi-finished components in manufacturing our elastomer bodies.

Durability

The elastomers used for EFFBE LEVELMOUNT support elements are characterised by a high resistance to fluids they might come in contact with (e.g. coolants, oils, drilling emulsions, detergents).

Long-term behaviour

EFFBE LEVELMOUNT elements are mostly maintenance-free. The compression set is low, compared to other elastomers or composite materials, and ensures excellent longterm stability with outstanding level consistency.



Figure 2

2–3	Advantages of EFFBE machine supports
4	General Information on Vibration Technology
5–7	LM Series
8–9	SLM Series
10–11	SLM Series with damping
12–13	Pneumatic spring accessories
14–15	ADS / SLM-ISR System
16–17	ISR System
18–19	LMP Series
20–21	LE Series / LE Cermalan® Series
22–23	KE Series / KE Cermalan® Series
24–25	CP Series
26	HPRSF / HPRSF-G with Levelling Spindle
27	EPA / EP Isolating Plates
28	RPV / HPS Isolating Plates
29	Calculation Programme
30	Application Examples
32	Contact

The information in this brochure is the result of extensive product and application experience. Descriptions and characteristics given do not guarantee particular properties or performance. Subject to technical modifications due to further product development.

General information on vibration technology

The following section explains some of the basics of vibration technology. It aims to help understanding the information in this technical brochure, and our solutions to your vibration problems.

Problem

Vibrations and shocks have a negative impact in many areas. Poor quality when working with measuring and precision equipment, reduced employee efficiency, or structural damage, are just a few examples. To assess the impact on people and structures, DIN standards and VDI guidelines were developed.

Procedure

Information on the machine and installation site is the basis for an assessment. This information will help to decide on measures for isolating vibration. Standards provide reference values that differ according to building type, excitation condition and exposure period. On page 30 of this brochure, the procedure is demonstrated with the help of a case study.

Vibration isolation

In principle, there are two different types of vibration isolation:

- source isolation (active)
- receiver isolation (passive)

The isolation can be divided into two types:

- isolation of periodic vibrations
- shock absorption

Periodic vibrations result from imbalances of rotating machinery parts or mass moments of stroke movements. The isolation rate is dependent on the ratio of the excitation frequency (for example, engine speed) to the natural frequency of the vibration isolator (tuning ratio $[\eta]$).

As shown in figure 1 (page 2), an isolating effect takes place only from a tuning ratio of $\eta = \sqrt{2}$; below this value an increased disturbance force must be expected.

Damping $[D]$ reduces the increase in disturbance forces. However, below $\eta = \sqrt{2}$ damping degrades the isolation effect (see page 31, Dynamic Properties). This means in practical applications

that vibration isolating is a compromise between tuning ratio and damping.

Shocks are characterised by their strength, duration and behaviour. They result, for example, from releasing work in a press.

The characteristic short, high-peak force is spread over a more protracted course with low residual forces. The cushioned system vibrates with the natural frequency of the vibration isolator.

The lower the natural frequency of the vibration isolator, the lower the transferred residual force becomes.

Passive isolating means to isolate machines (e.g. measuring equipment) and machine parts against external disturbance forces.

Theoretical analysis does not distinguish between active and passive isolation. Therefore, the degree of isolation can be determined analogous to the active isolation.

In practical applications, passive isolation elements with low natural frequency are used. The excitation frequencies are usually natural frequencies of the floor in the case of floor-mounted installations or low-frequency shock excitations. The best isolation values are achieved with LEVELMOUNT pneumatic spring elements.

Structure-borne sound insulation

Structure-borne sound insulation represents a special type of vibration isolation. Structure-borne vibrations spread wave-like within a machine or machinery and excite components to vibrate. These vibrations are then audible as sound waves (secondary airborne noise). Structure-borne sound waves are reflected by boundaries between different materials.

The degree of reflection, and thus the effectiveness of the structure-borne sound insulation are dependent on the magnitude of the impedance discontinuity. Impedance discontinuity is the difference between the elasticity and density of the different materials.

Please visit us at www.effb.de

LM Series

Construction

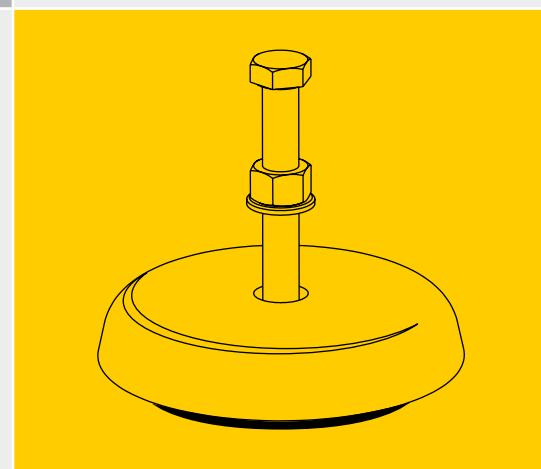
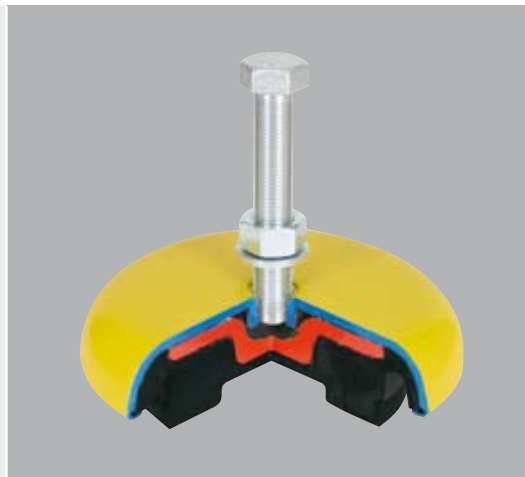
Elastomer-metal combination, compact design, integrated levelling system, 7 sizes in 3 Shore hardnesses

Properties

- Active and passive supports
- Vibration isolation
- Shock absorption
- Structure-borne sound insulation
- Anchor-free installation
- Load range
0.1 kN – 110 kN
- Natural frequency (stat.) 6 Hz – 20 Hz
- Fine-pitch thread

Materials

- Elastomer body in CR grade with high elasticity, oil-resistant and non-ageing
- Outer cap made of steel St W 23, or grey cast iron, Metal surface powder-coated, yellow
- Forged pressure plate
- Screw ISO 8676 (DIN 961), M5/M10/M12 ISO 4017 (DIN 933), grade 8.8, galvanised



Levelling

Levelling range max. 5 – 30 mm

Remarks

- Options:
- metal parts made of stainless steel
 - elements with square head bolts

Delivery contents

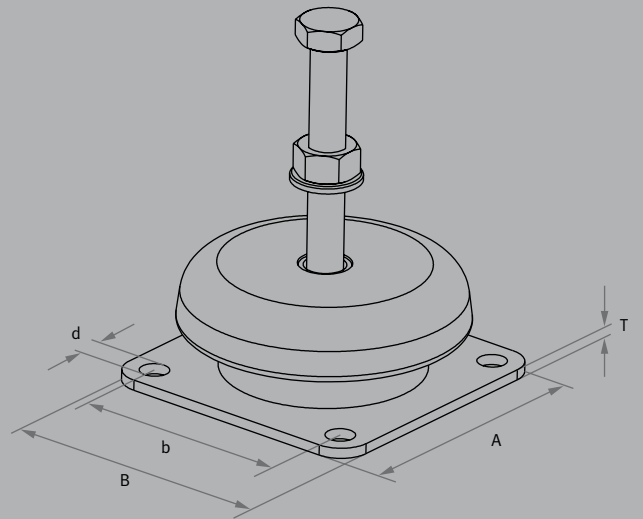
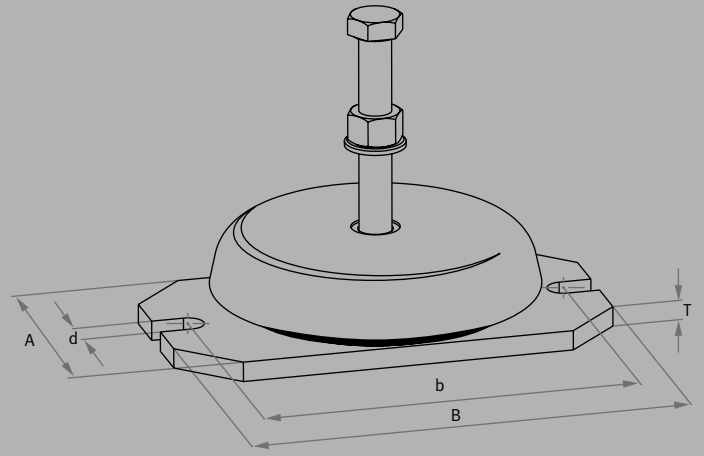
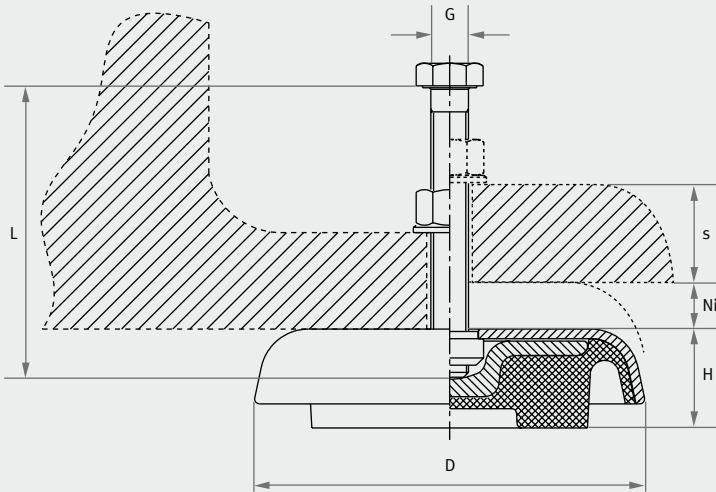
Standard with mounting screw, washer and nut, BA type without anchor bolt

Variants

Standard: LM 5-42

LM Series	0-4	1-4	1-6	1-11	3-11	3-25	3-33	5-27	5-42	5-55	6-60	6-80	6-66	7-100	7-77	8-250	8-251
Load per element in kN																	
Presses in general Strokes up to 110/min. (max.)		2.0	3.2	4.5	5.0	7.0	10.0	9.0	13.0	20.0	18.0	30.0	35.0	50.0	65.0	100.0	90.0
Eccentric presses and automatic cutting presses strokes up to 300/min. (max.)		1.3	2.4		4.0	6.0		7.0	9.5		13.0	23.0		40.0		70.0	60.0
For higher stroke rates, please contact us																	
Turning machines				2.2		3.0	4.2		5.0	10.0	7.0	12.0	20.0	17.0	30.0	25.0	
Milling machines				3.0	2.5	4.0	6.0	4.0	7.0	15.0	10.0	20.0	28.0	23.0	36.0	35.0	
Surface grinders				2.2		3.0	4.2		5.0	10.0	7.0	12.0	20.0	17.0	30.0	25.0	
Machines in general	0.8	2.2	3.8	4.8	6.5	9.0	12.0	11.0	16.0	30.0	25.0	35.0	40.0	64.0	72.0	100.0	100.0
Static maximum load	1.0	2.6	4.3	6.0	8.8	12.0	20.0	14.0	22.0	40.0	32.0	50.0	55.0	70.0	80.0	110.0	110.0

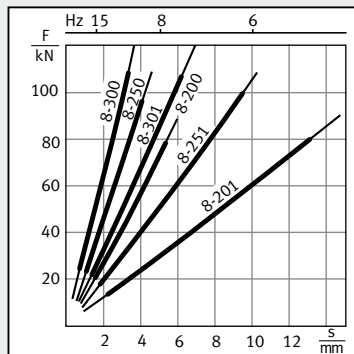
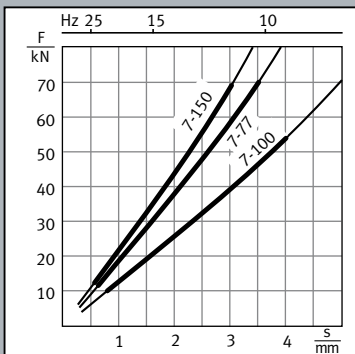
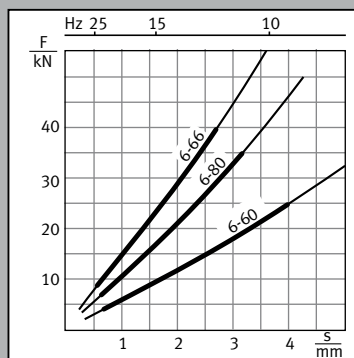
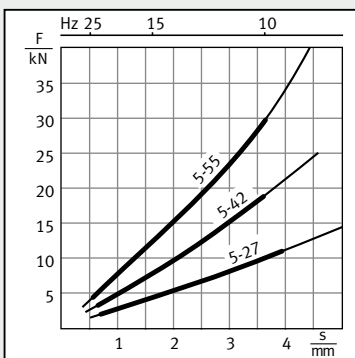
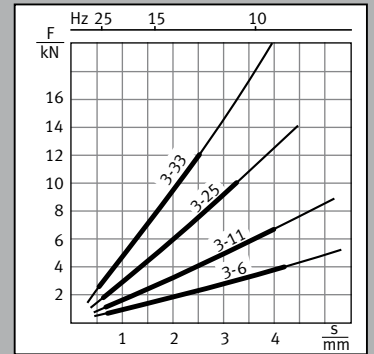
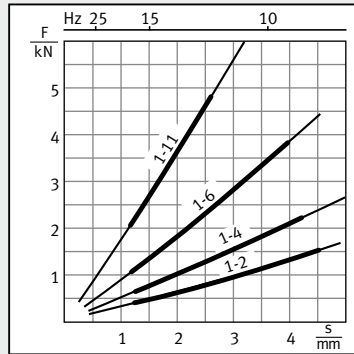
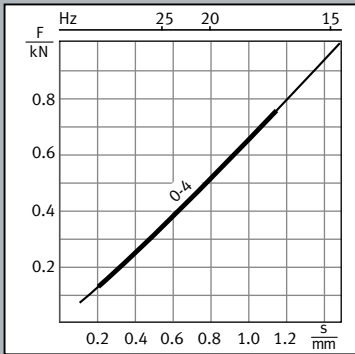
The load values listed in this table represent reference values that were determined on the basis of good stability and anchor-free installation of machines. The load areas not highlighted in colour in the table are used in individual vibrational machine supports that were designed according to diagram. For elements not listed in the table, refer to page 7.



LM Series Dimension table Dimensions in mm		0-4	1-2 1-4 1-6	1-11	3-6 3-11 3-25	3-33	5-27 5-42	5-55	6-60 6-80	6-66	7-100 7-150	7-77	8-200 8-250 8-300	8-201 8-251 8-301
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Standard version														
Diameter	D	40	80		120		160		185		241		315	
Height	H	15	30	25	37	32	41	35	45	39	60	54	70	100
Thread size	G	M5	M10		M12		M16 x 1.5		M20 x 1.5		M24 x 1.5		M30 x 2	
Screw length	L	30	80		90		100		120		140		160	
Max. machine base gauge	s	11	43		44		44		58		70		80	
Levelling height	Ni	5	15		20		20		20		20		30	
Weight / element	kg	0.05	0.4		1.1		2.2		4		8.5	8	18	20.8

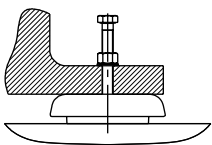
BA base plate														
Length	B		□ 83		158		220		245		300		395	395
Width	A		□ 83		90		114		150		197		270	270
Gauge	T		3.5		10		10		10		15		15	15
Hole spacing	b		65		140		190		215		265		357	357
Hole	d		8		13		16		20		20		25	25
Weight BA version	kg		0.6		2		3.1		6.6		15		30	32.5



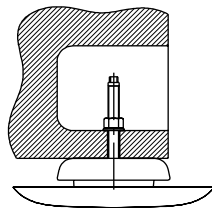
Accented characteristic curve = preferred load region, taking figures from an operational installation.

Mounting options

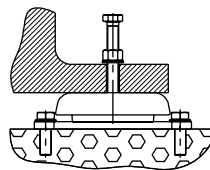
Typ LM



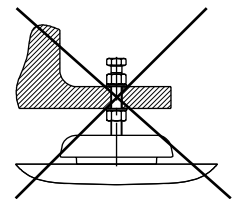
Type LM with square head bolt



Type LM bolted to the floor



Installation not permissible



SLM Series

Construction

Elastomer-metal combination with screwed-on base plate, air chamber made of elastomer reinforced with steel rings, air control with car tyre valve, 10 sizes

Properties

- Low frequency active or passive support
- Vertical and horizontal stiffness approx. 1:1
- Vibration isolation
- Shock absorption
- Structure-borne sound insulation
- Anchor-free installation
- Can function unpressurised
- Load region: 0.2 kN – 100 kN
- Natural frequency (stat.) 3 Hz – 5 Hz
- Natural frequency (stat.) unpressurised 8 Hz

Area of application

Measuring machines, plane tables, foundations, presses, automatic cutting presses, nibbling machines, compressors, fans, air conditioners

Materials

- Elastomer body in CR grade with high elasticity, oil-resistant and non-ageing
- Carrier and base plate: SLM 1 – 12 aluminium, SLM 24 – 192 galvanised steel
- Screw grade 8.8, galvanised

SLM A



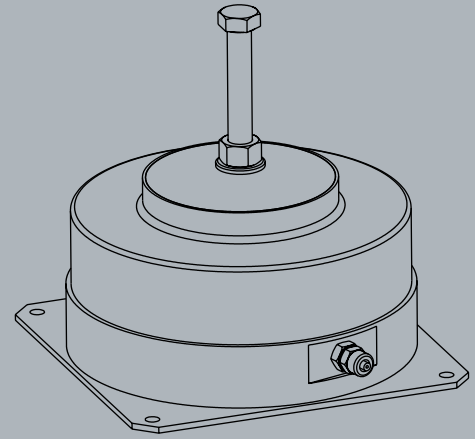
Levelling

Levelling range +/- 5 mm or +/- 6 mm, air-pressure controlled

Accessories

- Automatic levelling control:
- Mechanical-pneumatic version
 - Electro-pneumatic version (Reset time and accuracy programmable)

SLM B



Reduced maintenance due to automatic pressure monitoring

Delivery contents

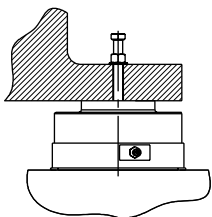
Pneumatic spring element with hexagon head screw

Accessory

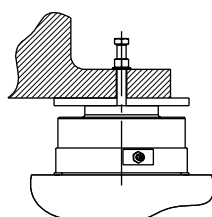
Mounting plate to distribute planar load over full area of element in cases where machine footprint is undersize

Mounting options

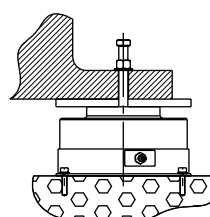
SLM pneumatic spring type



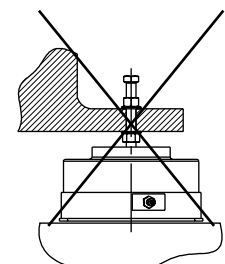
SLM pneumatic spring type with mounting plate for undersize machine foot

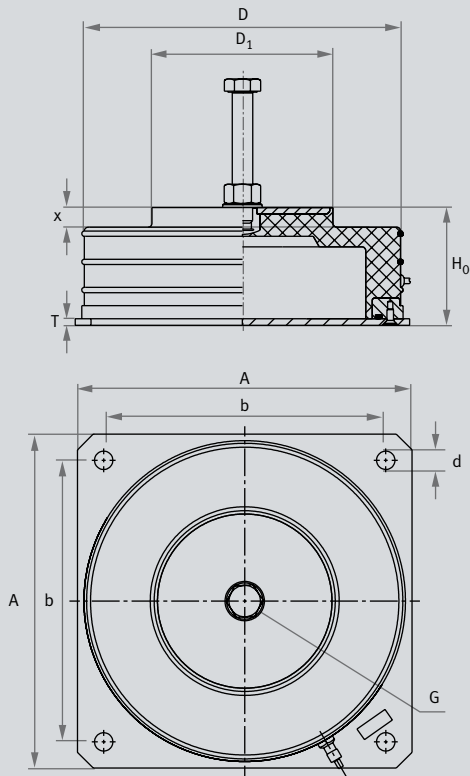


SLM pneumatic spring type with mounting plate, bolted to the floor



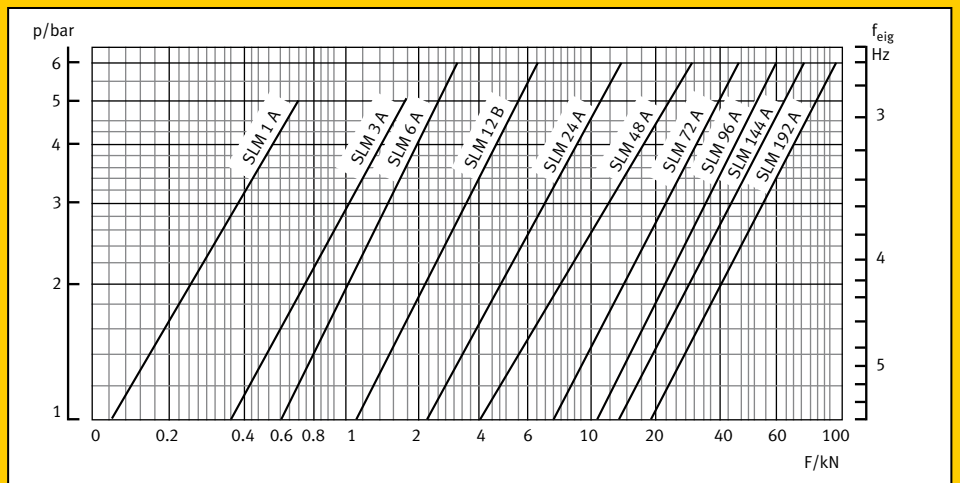
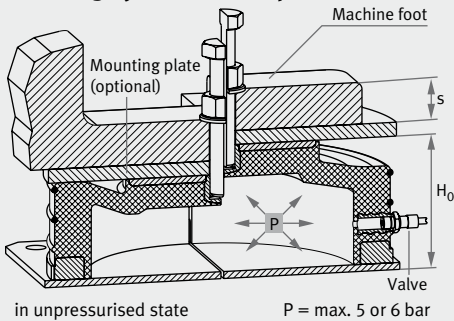
Installation not permissible





Standard version: hexagon head screw

Leveling by means of air pressure



SLM Series Dimension table Dimensions in mm	D	H ₀	D1	G	L	S Machine base thick- ness (max.)	Ni	X	A	b	d	T	Weight kg	Load (max.) kN
SLM 1 A	73	65	28	M10	80	50	+/- 5	12	75	60	7	3	0.3	0.65
SLM 3 A	105	65	52	M12	90	65	+/- 5	12	105	89	7	3	0.5	1.8
SLM 6 A	127	90	60	M12	90	65	+/- 6	15	130	108	7	3	1.0	2.8
SLM 12 B	172	90	96	M12	90	65	+/- 6	15	175	153	7	3	2.2	6.0
SLM 24 A	245	90	138	M16	100	75	+/- 6	15	255	215	14	5	7.2	13.0
SLM 48 A	338	90	205	M16	100	75	+/- 6	15	343	305	14	5	14.7	26.0
SLM 72 A	380	91	255	M24 x 1.5	140	75	+/- 6	17	385	310	20	6	22.5	38.0
SLM 96 A	468	90	300	M24	130	75	+/- 6	15	470	406	20	6	29.3	55.0
SLM 144 A	550	91	360	M24 x 1.5	140	75	+/- 6	17	555	480	20	6	46.5	76.0
SLM 192 A	610	90	430	M24	130	75	+/- 6	15	610	508	20	6	52.5	100.0

L = Screw length

SLM Series with Damping

Construction

SLM standard pneumatic spring series with integrated viscose damper, 6 sizes

Properties

- Up to 70 % reduction in increased resonance through vertical source isolation
- Use in resonance region permitted
- Load range 3.0 kN – 100 kN
- Natural frequency (stat.) 4 Hz – 7 Hz (see diagrams on the right)

Area of application

Presses, automatic cutting presses, nibbling machines, compressors, packaging systems

Materials

- As standard series SLM
- Damper in elastomer-metal combination with viscose filling

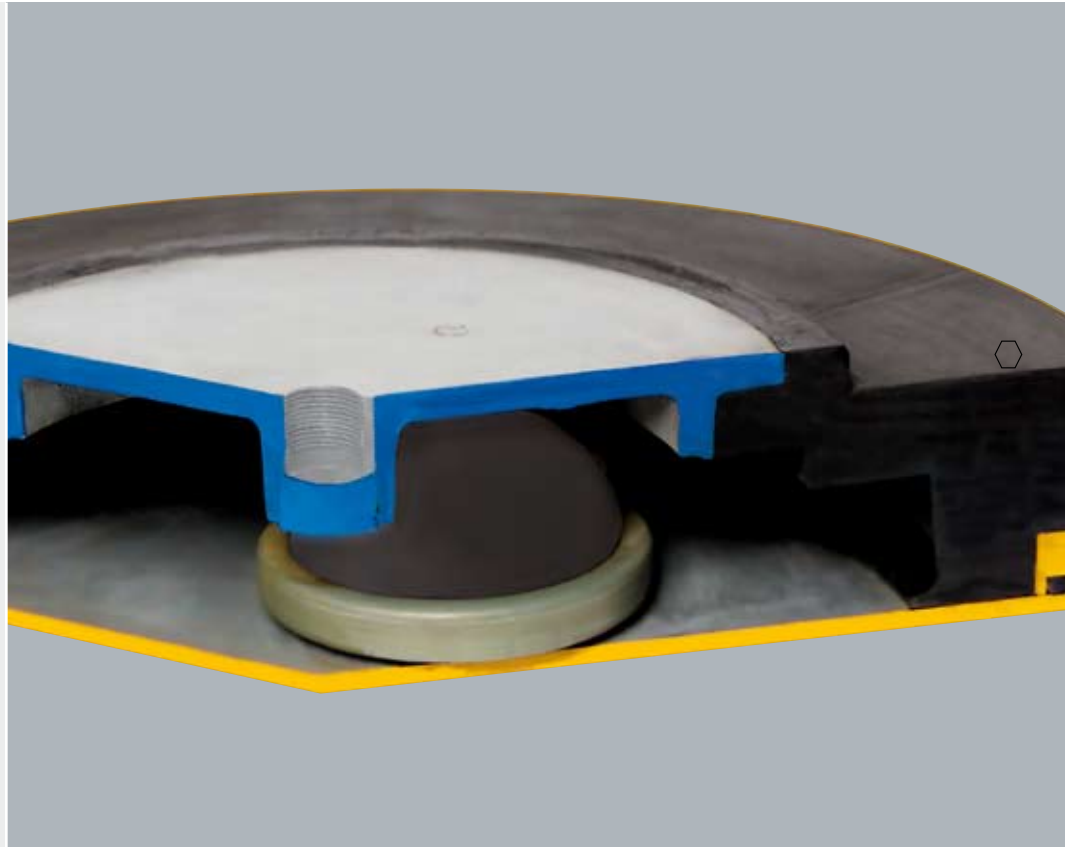
Levelling

Levelling range ± 6 mm, air-pressure controlled

Accessories

Automatic levelling control:

- Mechanical-pneumatic version
- Electro-pneumatic version (Reset time and accuracy programmable)



Reduced maintenance due to automatic pressure monitoring

Delivery contents

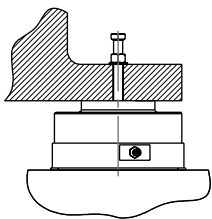
Pneumatic spring element with hexagon head screw

Accessory

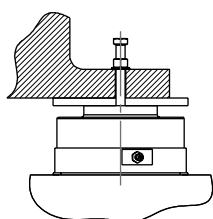
Mounting plate to distribute planar load over full area of element, in cases where machine footprint is undersize (see page 13)

Mounting options

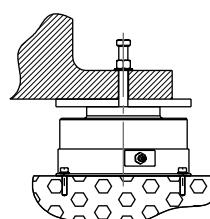
SLM pneumatic spring type



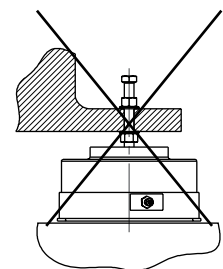
SLM pneumatic spring type with mounting plate for undersize machine foot

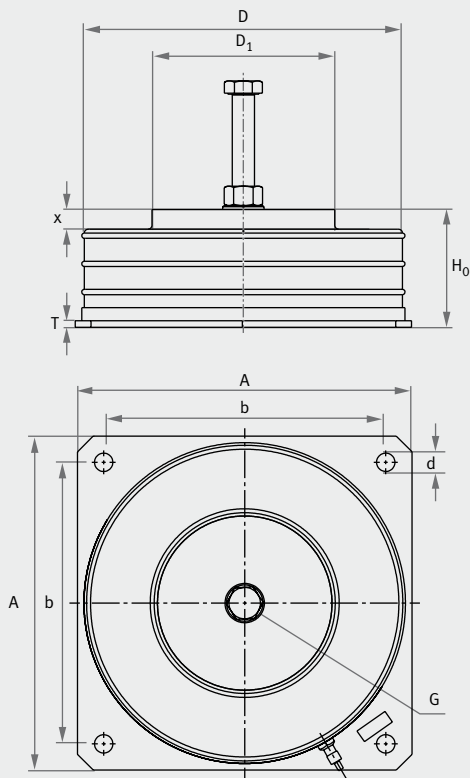


SLM pneumatic spring type with mounting plate, bolted to the floor



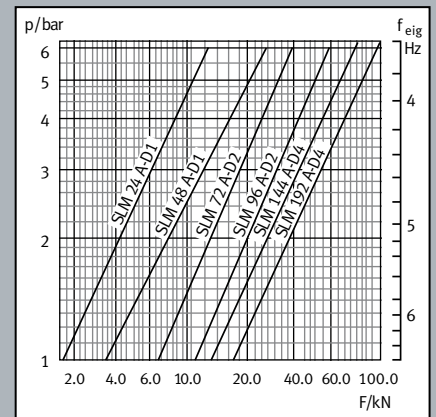
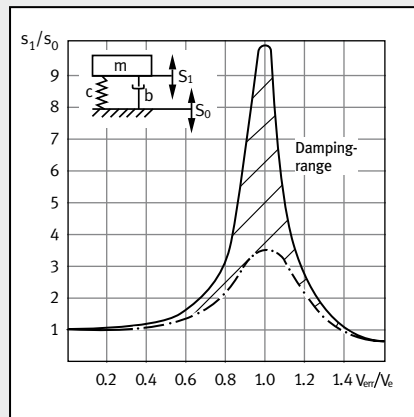
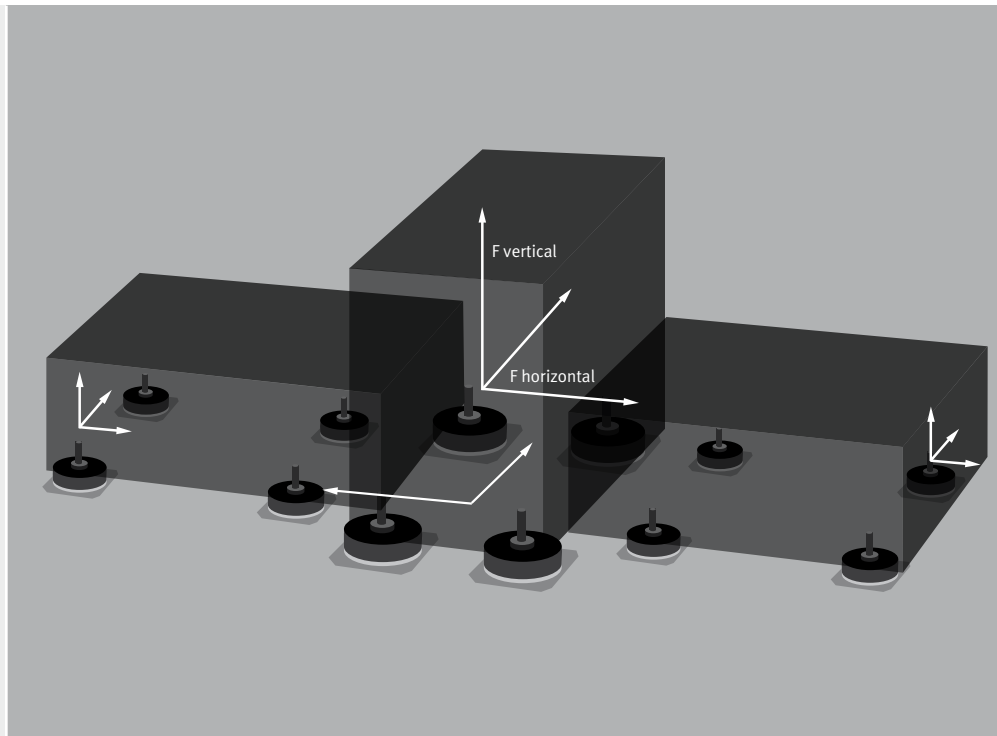
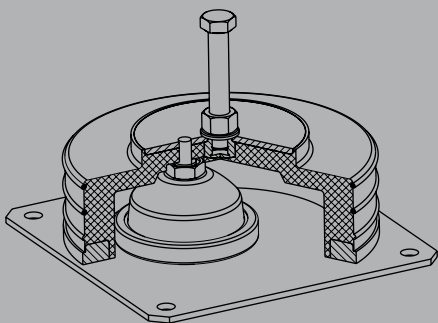
Installation not permissible





Standard version: hexagon head screw

Leveling by means of air pressure



SLM Series Dimension table Dimensions in mm	D	H ₀	D1	G	L	Machine base thick- ness (max.)	Ni	X	A	b	d	T	Weight kg	Load (max.) kN
SLM 24 A – D1	245	90	138	M16	100	75	± 6	15	225	215	14	5	8.2	13.0
SLM 48 A – D1	338	90	205	M16	100	75	± 6	15	343	305	14	5	16.1	26.0
SLM 72 A – D2	380	91	255	M24x1.5	140	75	± 6	17	385	310	20	6	23.9	38.0
SLM 96 A – D2	468	90	300	M24	130	75	± 6	15	470	406	20	6	32	55.0
SLM 144 A – D4	550	91	360	M24x1.5	140	75	± 6	17	555	480	20	6	47.9	76.0
SLM 192 A – D4	610	90	430	M24	130	75	± 6	15	610	508	20	6	57.9	100.0

Pneumatic spring accessory

Pressure regulators PR-A3 / PR-A4

Construction

Three or four pressure regulators with gauges are used to adjust the pressure in each regulator circuit. An additional pressure gauge indicates the available network pressure.

Area of application

The pressure regulators PR-A3 / PR-A4 are used in combination with pneumatic springs (e.g. SLM type) for setting the required pressure in each regulator circuit. Pressure losses through leakages are automatically compensated.

For use at constant load distribution.

Mode of operation

By using the pressure regulators, the network pressure is reduced to such an extent that the connected pneumatic spring elements carry the applied load. Please observe the assembly instructions of pneumatic spring elements!

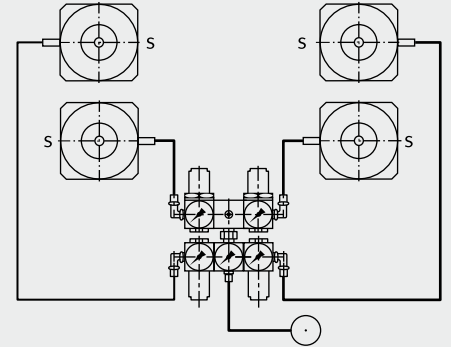
Delivery contents



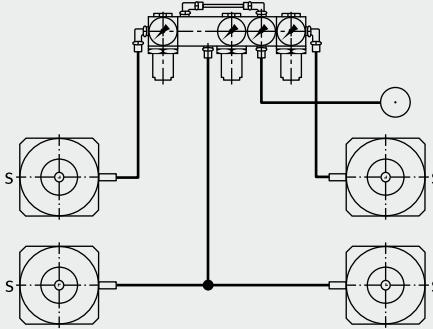
Order reference

Pressure regulator **PR-A3**
Part no.: FB61021586

Circuit diagram (PR-A4)



Circuit diagram (PR-A3)



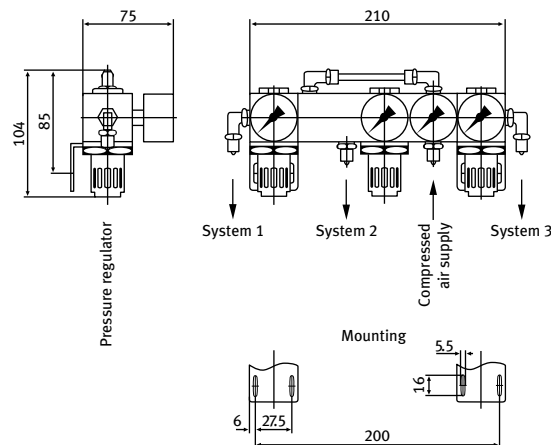
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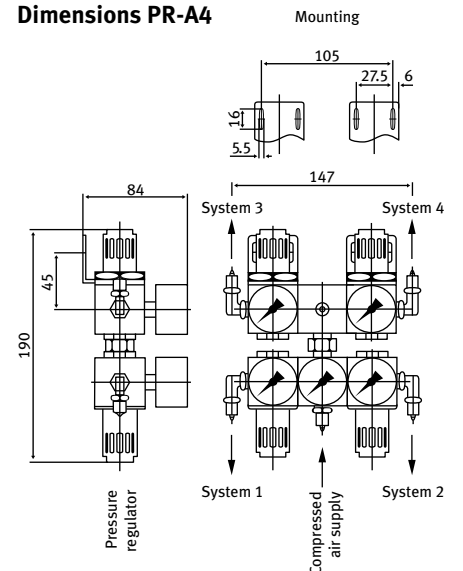
Order reference

Pressure regulator **PR-A4**
Part no.: FB61022937

Dimensions PR-A3



Dimensions PR-A4



Maintenance and control unit SU-A

Construction

Filter-regulator with pressure gauge for displaying the system pressure (inlet pressure) and a cut-off cock. Pressure gauges for displaying network pressure and pressure in each regulator circuit.

Area of application

The maintenance and control unit is used in conjunction with suitable levelling control valves for semi-active control of pneumatic springs (e.g. type SLM). Particularly for situations with varying load distribution.

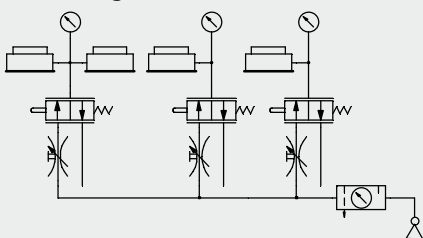
Mode of operation

The network pressure is set to the required inlet pressure by using the filter-regulator. The inlet pressure must be set to a value at which the connected pneumatic spring elements carry the applied load safely.

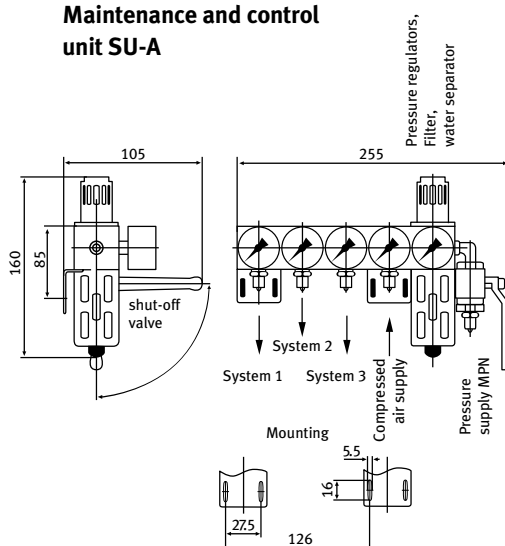
Delivery contents

Maintenance and control unit **SU-A**
Part no.: FB61020860

Circuit diagram (SU-A)



Maintenance and control unit SU-A



MPN (mechanical-pneumatic levelling regulation) for standard pneumatic springs

Construction

- Mechanical-pneumatic proportional valve
- Metal parts made of light alloy
- Swivel connectors for hose with 6 mm outer diameter
- Inflow rate controlled with throttle valve at entry
- Base plate with screw mount (Ø 8 mm)

Area of application

Pneumatic suspension systems with level control by EFFBE, e.g. for optical and mechanical measuring equipment, measuring tables, mounting plates, test benches, scales, etc.

To be used in conjunction with maintenance and control unit SU-A for varying load distribution.

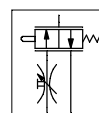
Mode of operation

Target level is set with adjusting screw on the lever. According to the lever position, any load change leads to supply or discharge of compressed air.

Order reference

Levelling control valve **MPN 01/H**
Part no.: FB61020991
Levelling control valve **MPN 03/H MV**
Part no.: FB61021518

Circuit diagram (MPN)



Dimensions upon request



Example: MPN 03H

Mounting plate

Construction

- Steel plate
- Silver powder-coated finish similar to RAL 9006

Area of application

Using the mounting plate ensures that the load footprint covers the entire (projected) surface of the EFFBE LEVELMOUNT SLM element, and is thus centred. This avoids any undesirable internal forces on the pneumatic springs, allowing the design load to be supported in complete safety.

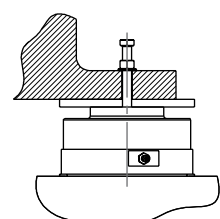
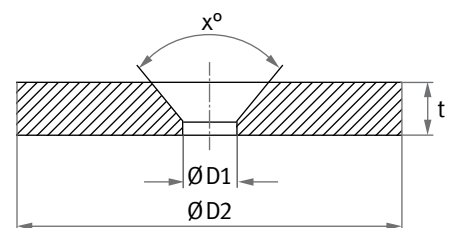
Materials

Steel St 37

Delivery contents

Mounting plate version S (standard)

Mounting plate Type	Part no.	Ø D2	Ø D1	t	kg
MPL 1 S	FB66026616S	75	11	6	0.2
MPL 3 S	FB66026617S	105	13	8	0.5
MPL 6 S	FB66026618S	130	13	8	0.8
MPL 12 S	FB66026619S	175	13	10	1.9
MPL 24 S	FB66026620S	250	17	10	3.8
MPL 48 S	FB66026621S	340	17	10	7.1
MPL 72 S	FB66026622S	380	26	15	13.2
MPL 96 S	FB66026623S	470	26	15	20.2
MPL 144 S	FB66026624S	550	26	15	27.7
MPL 192 S	FB66026625S	610	26	15	34.1



ADS/SLM ISR-System

ADS-ISR construction

Membrane-based pneumatic spring element with housing, carrier and base plate made of aluminium

Natural frequencies

1.5 Hz–3 Hz

SLM-ISR construction

Elastomer-metal combination with screwed on base plate

Natural frequencies

3 Hz–5 Hz

Delivery contents of standard ISR pneumatic spring system

- 4 supporting points
 - 3 pneumatic springs ADS/SLM type Master with sensors and control valves
 - 1 pneumatic spring ADS/SLM type Slave without sensors and valves
- 1 control unit as 3-channel circuit board with RS-232 PC interface
- Control cable for master elements
- Hose NW 4 with cross piece or T-pieces
- Power adapter

(see page 16/17)

ADS-ISR



Options

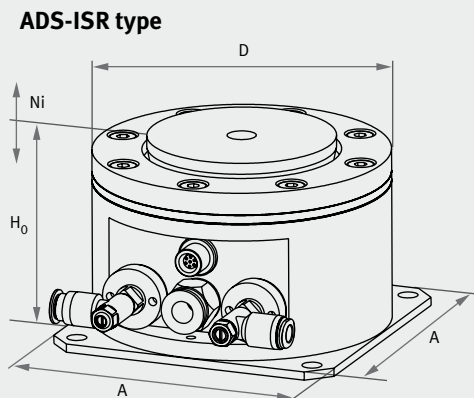
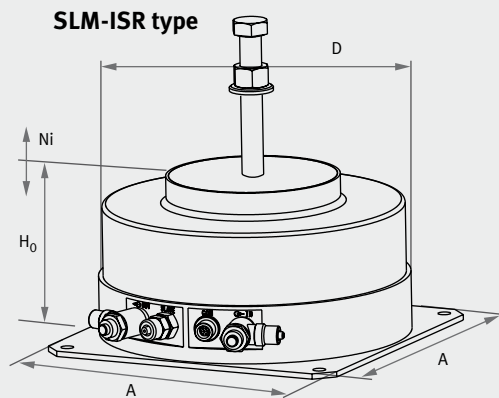
- Control unit: circuit board in synthetic enclosure
- Connectors for control cable
- Filter-regulator unit consisting of pressure regulator, pressure gauge, filter, water separator
- Control cable: length of 3 control cables to customer specifications
- "Air Level Control" software for PC (Windows)
- Serial cable RS-232
- Additional hose sections and connectors according to number of pneumatic springs

Supply conditions

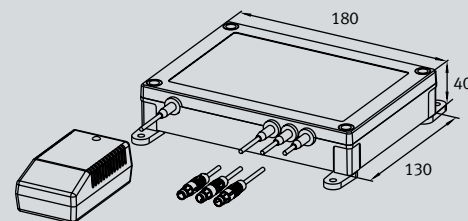
- Compressed air: operating pressure 1 – 6 bar, dry, dust and oil free; alternative filter-regulator (FRK)
- Control unit: Circuit board approx. 160 x 100 x 15 mm; alternative circuit board in synthetic housing approx. 225 x 200 x 40 mm
- Power supply: 24 V – 1A; alternative power adapter, input 230 V, 50 Hz, 130 Watt, output 24 V, 1A, DC
- PC interface: serial connection
- RS-232; for programming EFFBE Software "Air Level Control" is required
- Commissioning and adjusting of pneumatic spring system as well as operator training by EFFBE staff upon request

SLM-ISR





ISR Control Unit



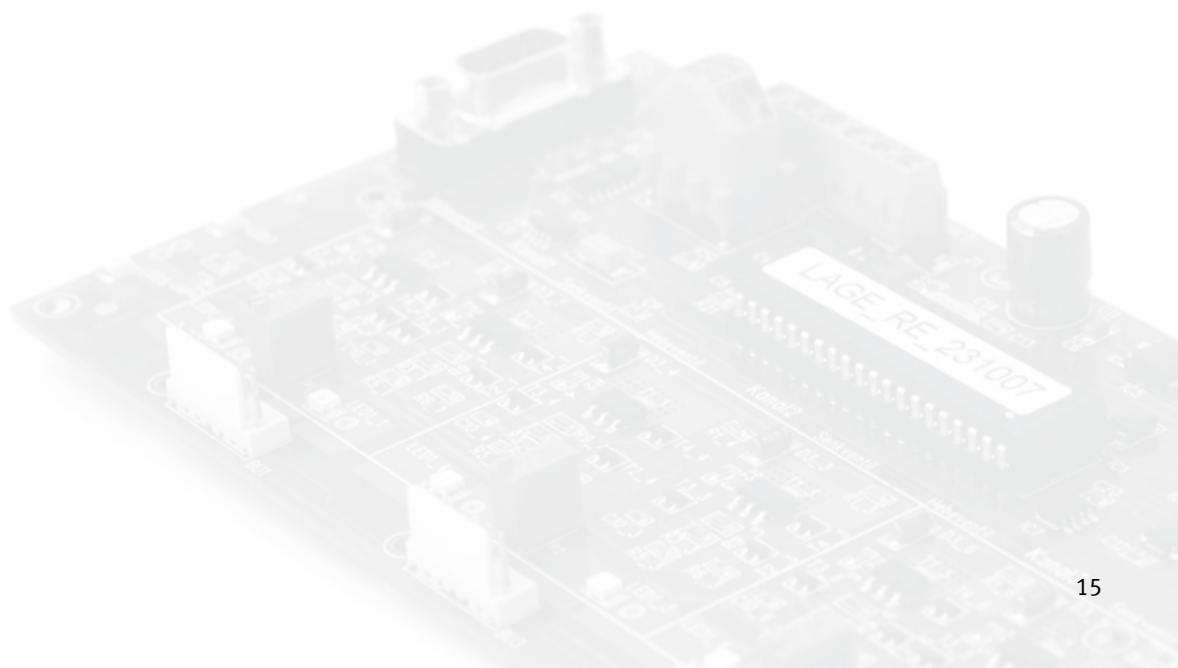
ISR system

The basic version of the ISR pneumatic spring system is factory-programmed. However, the software allows varying the following parameters: reset accuracy, permissible deflection, response time, average level. These parameters can be viewed, freely chosen within wide limits, and permanently stored in the control unit. The values are retained even after a power failure. The factory default settings are documented in a datasheet.

Overview of programmable parameters

- Reset accuracy: rough (+/- 0.5 mm, fine (+/- 0.1 mm), user-defined (+/- 0.01 mm ... 1 mm)
- Permissible deflection: wide (+/- 1.0 mm), narrow (+/- 0.5 mm), user-defined (+/- 0.01 mm ... 1.5 mm)
- Response time: fast (10 ms), slow (125 ms), user-defined (5 ms ... 125 ms)
- Level: Middle position (+/- 5 mm), fine adjustment with potentiometer and / or software

ADS-/SLM-ISR Series Dimension table Dimensions in mm	D	Ho	Ni	A	Load (max.) kN
ADS 3	105	65	+/- 5	106	1.8
ADS 6	127	90	+/- 6	130	2.8
ADS 12 / SLM 12 B ISR	175 / 170	90	+/- 6	175	6.0
ADS 24	245	90	+/- 6	255	13.0
ADS 48	338	90	+/- 6	343	26.0
ADS 96	468	90	+/- 6	470	55.0
ADS 192	610	90	+/- 6	610	100.0



ISR System

Construction

The ISR pneumatic spring control system combines the proven pneumatic springs with a new contactless electro-pneumatic controller, where sensor and control valves are combined into one compact assembly, and integrated into the pneumatic spring.

A controller with manual operation or PC connection allows the selection of the following settings:

- Levelling of the system (horizontal installation)
- Tracking the position of each support (operating height)
- Tolerance choice of height and reset accuracy
- Delayed or suppressed reaction with dynamic action
- Monitoring and documenting

The design implements a compact design with low cost modules.

A sensor for non-contact level detection is integrated in the pneumatic element. As a result, separate sensing of the machine height is unnecessary. In addition, valves for filling or emptying the interior chamber are arranged as lifting and lowering valves within the pneumatic spring.

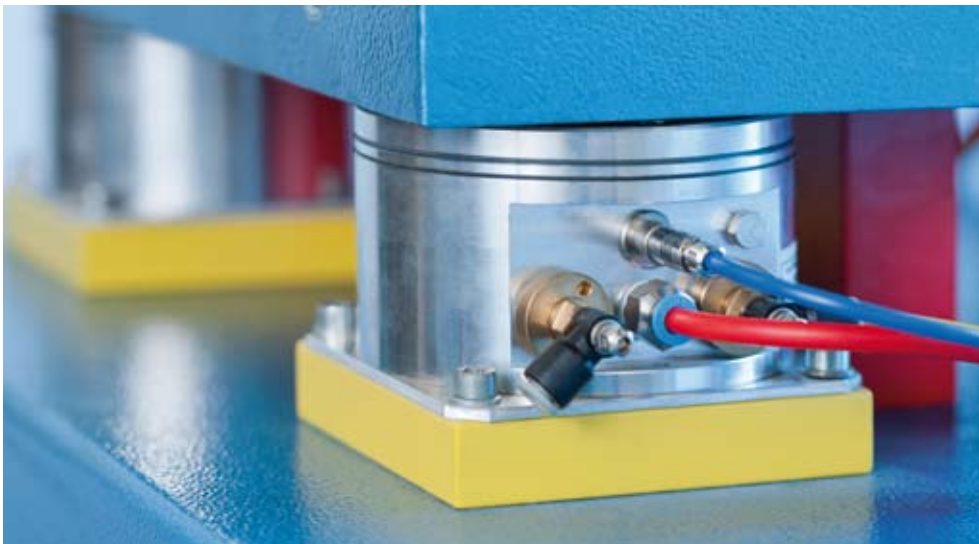


The outlet air can be discharged feely or guided (e.g. for clean room requirements).

The system comprises three controlled pneumatic supports (masters) and further pneumatic supports (slaves) without control that may be engaged for load distribution. The system includes a controller that records data from sensors on the operating height or level of each support, and compares this information with adjustable set-point values.

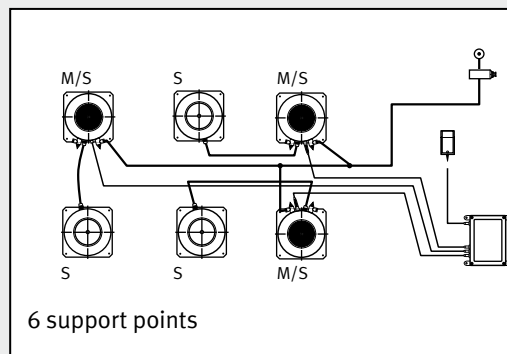
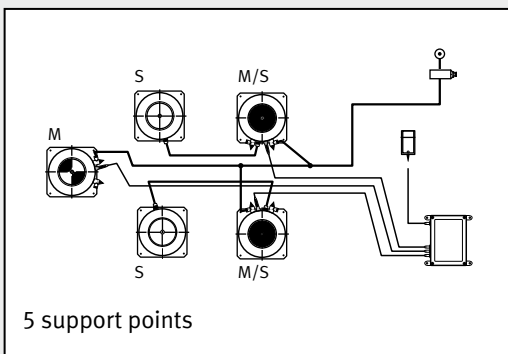
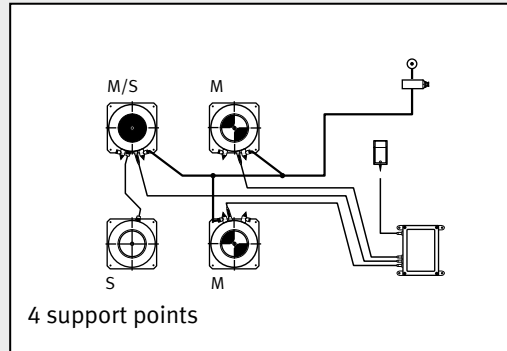
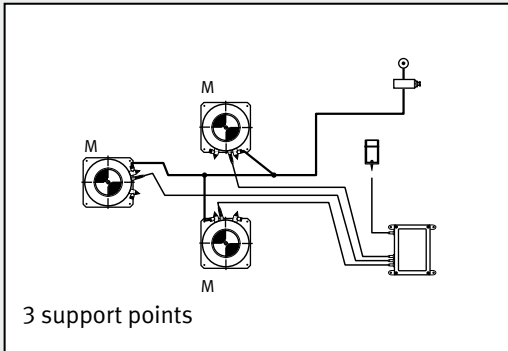
A user-specific tolerance can be pre-set for avoiding overreactions. The individual zero positions of the three controlled supports are adjusted with a potentiometer; the system is levelled at the same time.

Menu-driven software allows the selection of resetting accuracy, height tolerance, switching and response times as well as monitoring.



Circuit diagram

Examples for 3, 4, 5 and 6 support points. Other versions upon request.

**Working method**

Software "Air Level Control"

- Display and documentation of set-point and actual values
- Settings of programmable parameters
- Function check of valves



LMP Series

Construction

Specially moulded elastomer body combined with steel pressure plate and outer plate, integrated levelling system, 4 sizes

Properties

- Vibration isolation
- Structure-borne sound insulation
- Shock absorption (even at high horizontal forces)
- Anchor-free installation
- Load range 30 kN – 100 kN
- Natural frequency vertical (stat.) 12 Hz – 20 Hz

Application

Horizontally operating equipment, such as injection moulding machines / presses (installed above ground-floor level)

Materials

- Elastomer body made from nitrile rubber NBR (90 SH A) with high elasticity, oil-resistant and non-ageing
- Outer plate made of ductile cast iron or steel, powder coated yellow
- Steel pressure plate
- Screw ISO 8676 (DIN 961), galvanised

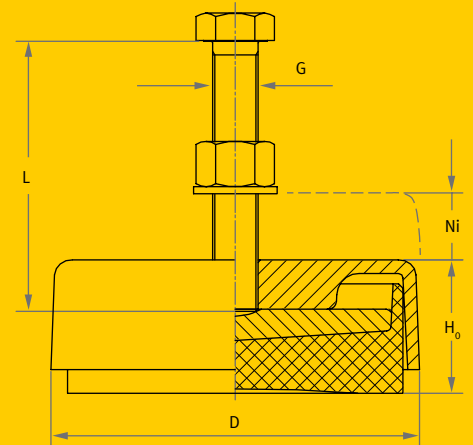


Levelling

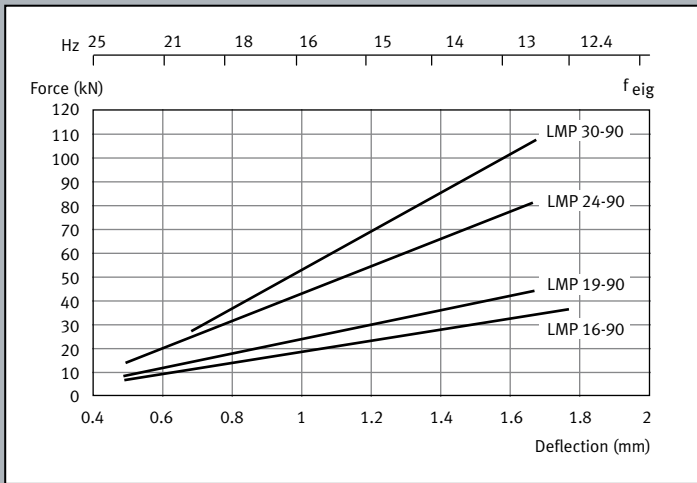
Levelling with fine thread screw, levelling range max. 30 mm

Delivery contents

Support element with levelling screw

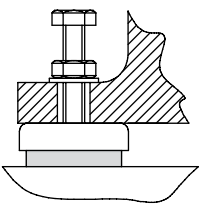


LMP Series Dimension table Dimensions in mm	D	H ₀	G	L	Machine base thickness (max.)	Ni	Element Weight kg	Load (max.) kN
LMP 16-90	165	59	M20x1.5	120	40	28	4.7	30.0
LMP 19-90	190	62	M20x1.5	120	40	30	5.9	50.0
LMP 24-90	240	64	M30x2	120	30	30	9.3	75.0
LMP 30-90	300	74	M30x2	120	30	30	18.8	100.0

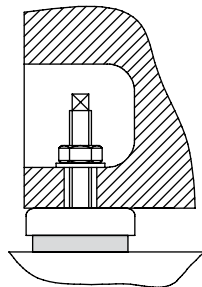


Mounting options

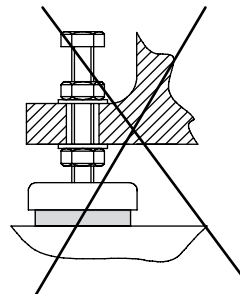
LMP type



LMP type with square head bolt



Installation not permissible



LE Series

Construction

Specially moulded elastomer body combined with cast pressure plate and galvanised steel outer plate; 3 sizes, integrated levelling system

Properties

Non-slip, structure-borne sound insulating, vibration isolating, shock-absorbing, anchor-free setup also with horizontal load

Area of application

Anchor-free installation of injection moulding machines for example

Materials

- Elastomer body made of nitrile rubber NBR (80 SH A) with high elasticity, oil-resistant and non-ageing,
- Pressure plate made of cast iron
- Outer plate made of steel, galvanised

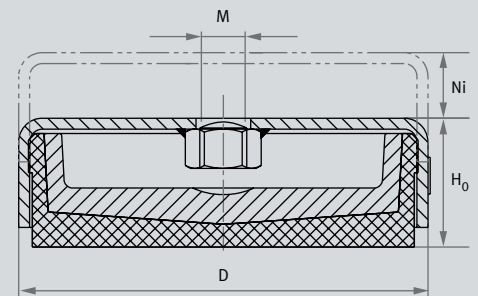
Levelling

Levelling with button head screw according to DIN EN ISO 4753 (not included!)



Delivery contents

Element
Optional levelling screw available in different lengths



LE Series Dimension table Dimensions in mm	D	H	M	Ni	Dimension x*	Weight	Recommended load range kN	Load (max.) kN
LE 120 M12	124	47	M12	24	90	1.5	20.0	30.0
LE 120 M16x1.5	124	47	M16x1.5	24	95	1.5	20.0	30.0
LE 160 M16	166	59	M16	30	85	3.4	36.0	55.0
LE 160 M16x1.5	166	59	M16x1.5	30	85	3.4	36.0	55.0
LE 160 M20x1.5	166	59	M20x1.5	30	90	3.4	36.0	55.0
LE 190 M20x1.5	193	62	M20x1.5	30	90	5.0	50.0	80.0
LE 190 M24x1.5	193	62	M24x1.5	30	95	5.0	50.0	80.0

*required screw length = machine base gauge + dimension x

LE Cermalan® Series

Construction

Specially moulded elastomer body combined with cast pressure plate and outer plate made of Cermalan®, 3 sizes, integrated levelling system

Properties

Reduced weight by using Cermalan®, non-slip, structure-borne sound insulating, vibration isolating, shock-absorbing, anchor-free setup also with horizontal load

Area of application

Anchor-free installation of injection moulding machines for example

Materials

- Elastomer body made of nitrile rubber NBR (80 SH A) with high elasticity, hardness, oil-resistant and non-ageing
- Cast pressure plate
- Outer plate made of Cermalan® (long fibre reinforced composite material) with threaded insert made of steel, Colour similar to RAL 1012 (lemon yellow) or similar to RAL 7035 (light grey)

Levelling

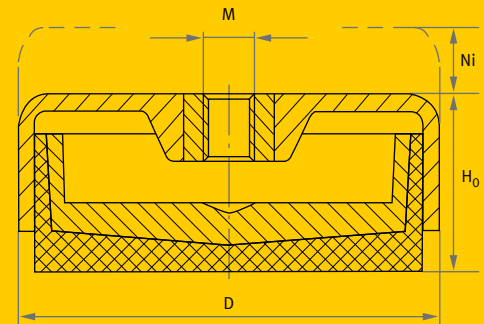
Levelling with button head screw according to DIN EN ISO 4753 (not included!)

LE-C element, outer plate made of Cermalan®



Delivery contents

Element
Optional levelling screw available in different lengths



LE Series Dimension table Dimensions in mm	D	H	M	Ni	Dimension x*	Weight	Recommended load range kN	Load (max.) kN
LE 120 M12	124	47	M12	24	90	1.2	20.0	30.0
LE 120 M16x1.5	124	47	M16x1.5	24	95	1.2	20.0	30.0
LE 160 M16	166	59	M16	30	85	2.8	36.0	55.0
LE 160 M16x1.5	166	59	M16x1.5	30	85	2.8	36.0	55.0
LE 160 M20x1.5	166	59	M20x1.5	30	90	2.8	36.0	55.0
LE 190 M20x1.5	193	62	M20x1.5	30	90	4.2	50.0	80.0
LE 190 M24x1.5	193	62	M24x1.5	30	95	4.2	50.0	80.0

*required screw length = machine base gauge + dimension x

KE Series / KE Cermalan® Series

Construction

Wedge shoe,
lateral set screw with fine thread,
anti-slip or damping coating,
6 sizes

Properties

- Anchor-free installation
- Positioning / level fixing with damping coating for active / passive isolation
- Load range max. 15 – 150 kN
- Natural frequency (stat.) > 15 Hz according to damping coating

Area of application

Machines with or without mounting option and requiring a particularly rigid installation

Materials

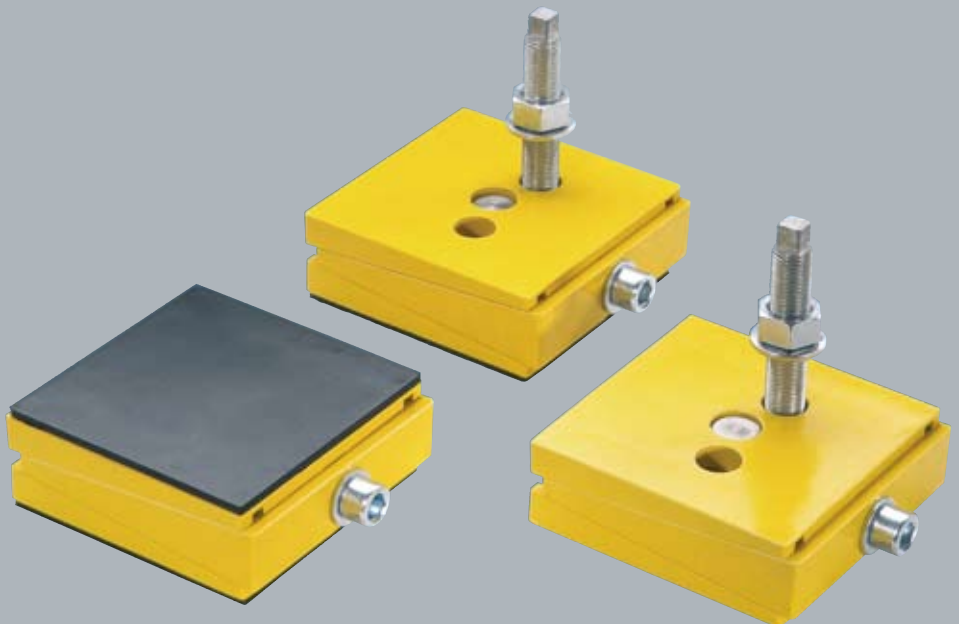
- Element bodies made of cast iron or Cermalan®, Metal surface painted yellow
- Coating made of elastomer with high elasticity, oil-resistant, non-ageing
- Levelling screw grade 8.8, galvanised

Levelling

Levelling range max. 7 – 20 mm

Remarks

Elements with one-sided coating can be bolted on; elements without coating can be bolted through



Delivery contents

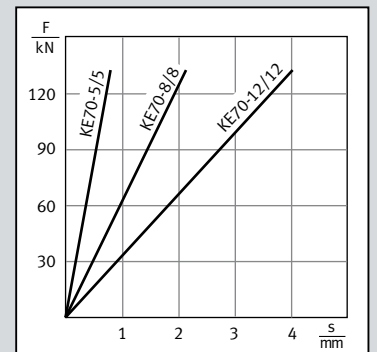
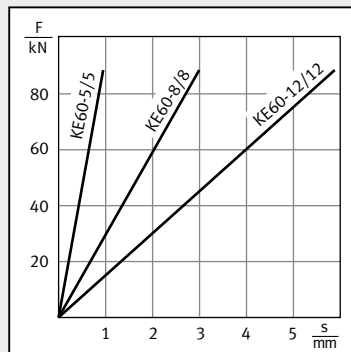
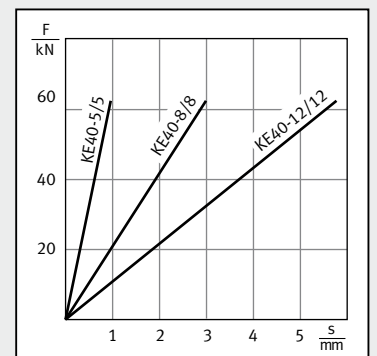
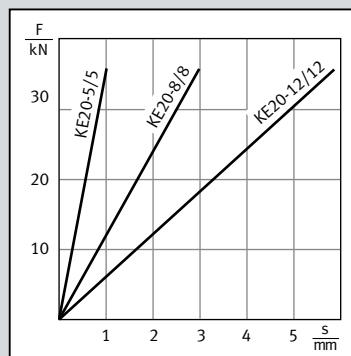
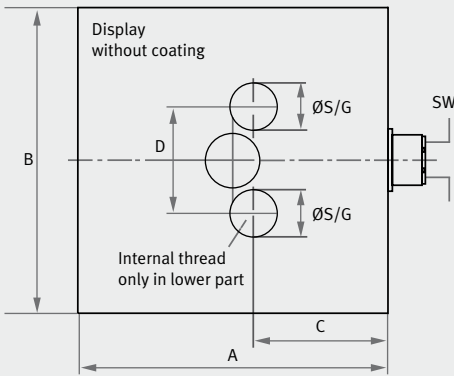
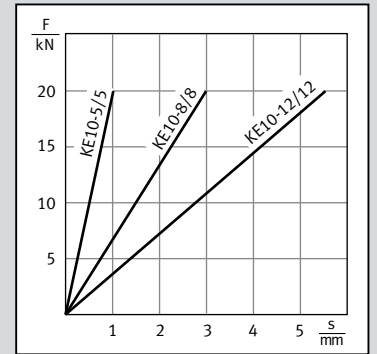
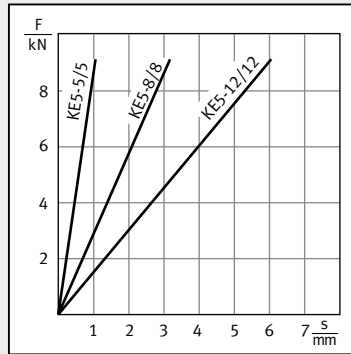
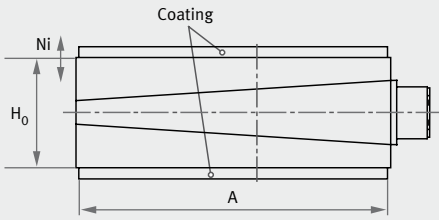
Support elements without fastening screw

Damping coating

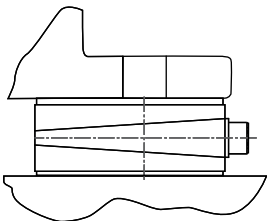
5/5 anti-slip coating on both sides 5 mm
8/8 damping coating on both sides 8 mm
12/12 damping coating on both sides 12 mm

Special versions

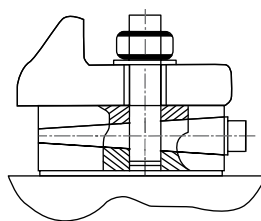
to customer specifications



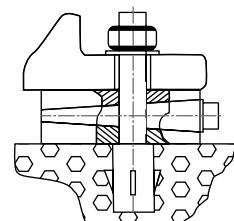
Without mounting



Bolted on



Bolted through



KE Series	Dimension table, mm	A	B	H ₀	Ni	C	D	SØ	G	SW	Weight kg	Load (max.) with coating kN	Load (max.) without coating kN
KE 5		105	55	36	-4/+3	-	-	-	-	17/8	1.2	9.0	15.0
KE 10C		115	115	40	-4/+4	50	24	17	M16x1.5	10	0.9	28.0	50.0
KE 20		150	150	47	-5/+4	60	23	18	M16	22/12	5.4	36.0	40.0
KE 40C		200	200	46	-4/+4	75	27.5	22	M20x1.5	14	3.3	100.0	200.0
KE 60		220	250	74	-9/+11	125	62	24	M20	27/14	21.2	90.0	100.0
KE 70		300	400	74	-11/+8	125	70	28	M20	27/18	43.4	135.0	150.0

CP Series

Construction

Elastomer-metal combination with mounting flange, in 4 sizes and 4 or 5 Shore hardnesses

Properties

- Protection against shearing
- Active and passive support
- Vibration isolation
- Shock absorption
- Structure-borne sound insulation
- Resistant to compression, traction and thrust at identical spring rigidity
- load range: 0.1 kN – 20 kN
- Natural frequency (stat.)
10 Hz – 25 Hz (in series < 9 Hz)

Area of application

Machines, devices and plant, in stationary and mobile use



Materials

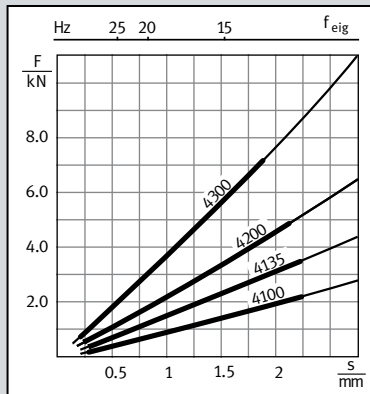
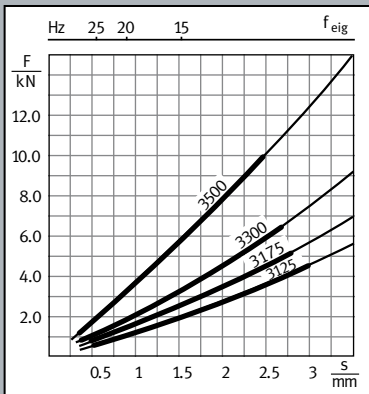
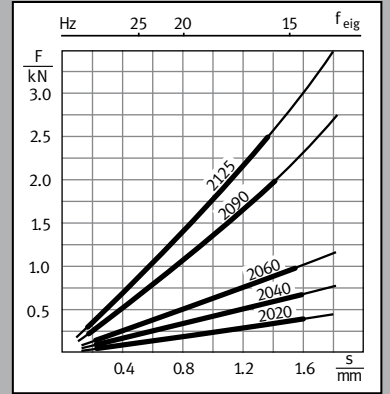
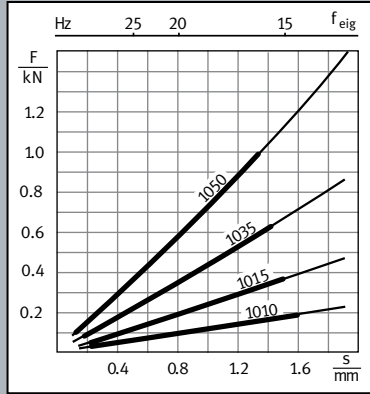
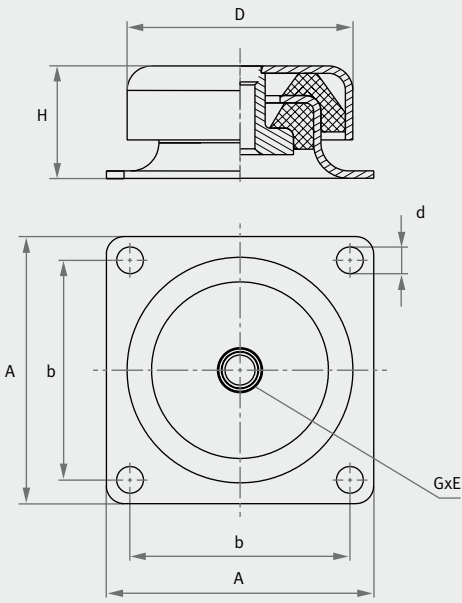
- Elastomer body in CR grade with high elasticity, oil-resistant and non-ageing
- Metal parts made of steel, galvanised

Option: elastomer body made of high damping silicone. Metal parts made of stainless steel

Delivery contents

Support element without fastening screws





Accented characteristic curve = preferred load region, taking figures from an operational installation.

CP Series Dimension table Dimensions in mm	D	H	A	b	d	G	E	Weight kg	Load (max.) kN
C 1000	58	28	60	49.5	5.2	M6 / M8	20	0.2	1.5
C 2000	76	38	76	63.5	6.4	M10 / M12	30	0.45	3.5
C 4000	124	63	133	108	11.9	M16	19	1.8	15.0
C 3000	168	90	175	143	13.5	M16	65	4.5	20.0

HPRSF / HPRSF-G Levelling Series

Construction

Elastomer-metal combination,
Cover plate with screw fixing,
type HPRSF-G with movable mounting
and levelling spindle,
3 sizes

Properties

- Anti-slip
- Structure-borne sound insulation
- Vibration isolation
- Load range: 8.5 kN – 30 kN
- Natural frequency (stat.) > 15 Hz

Area of application

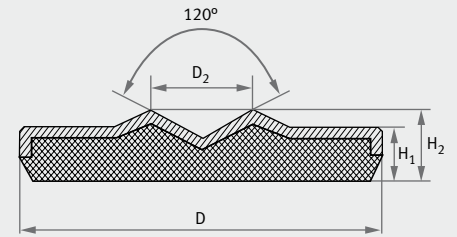
Anchor-free, anti-slip installation of
machines and plant

Materials

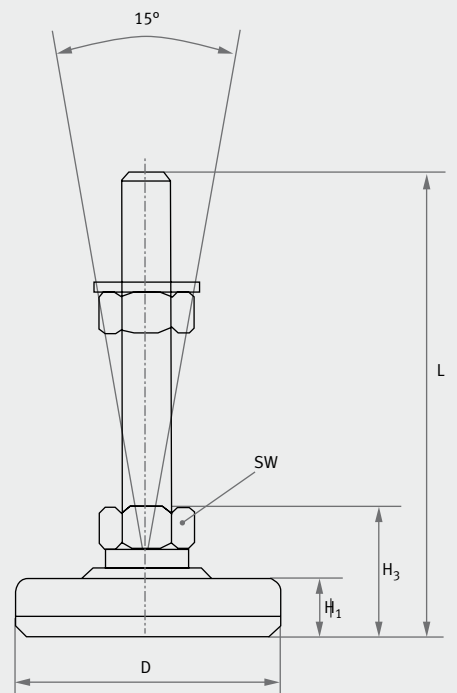
- Elastomer body made of nitrile rubber
NBR with high elasticity,
oil-resistant and non-ageing
- Metal parts made of steel,
chrome plated

Levelling

Levelling with external screw,
e.g. jacking screw or levelling spindle



Type HPRSF



Type HPRSF-G

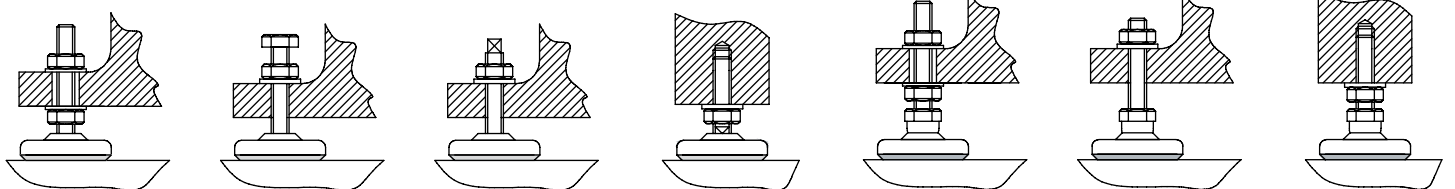
Remarks

Versions HPRSF/ HPRSF-G for floors with
stronger inclination up to 12 %
screw with spherical cap,
type HPRSF-G with modified threaded bolts.
Option: metal parts made of stainless steel
HPRSFE
HPRSFE-G

Delivery contents

HPRSF = support element without
mounting screw
HPRSF-G = with movable spindle

Mounting options

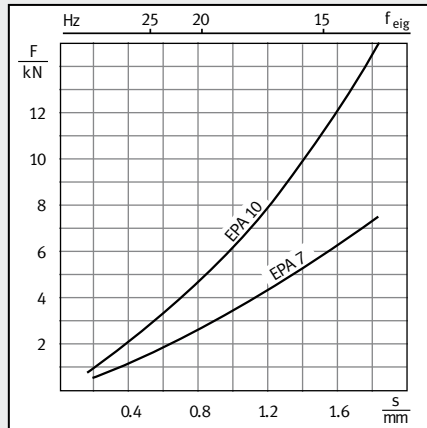
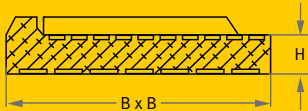


HPRSF Series Dimension table Dimensions in mm	D	D ₂	H ₁	H ₂	H ₃	L	Spindle	SW	Element weight kg	Load (max.) kN
HPRSF 80	80	25	17	22	–	–	–	–	0.3	8.5
HPRSF 100	100	30	19	25	–	–	–	–	0.4	20.0
HPRSF 125	125	35	19	25	–	–	–	–	0.6	30.0
HPRSF-G 80	80	–	17	–	45	145	M20 x 100	30	0.6	8.5
HPRSF-G 100	100	–	19	–	47	147	M20 x 100	20	0.8	20.0
HPRSF-G 125	125	–	19	–	47	147	M20 x 100	30	1.0	30.0

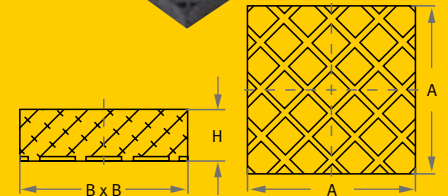
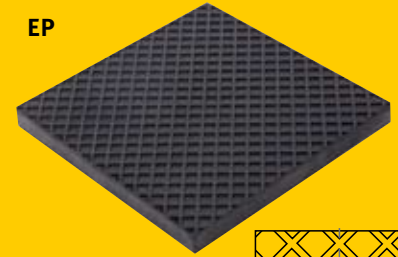
Please note: other threaded spindles upon request

EPA-/EP Isolating Plates

EPA



EP



EPA isolating plates

Construction

Elastomer mould plate,
2 sizes

Properties

- Anti-slip
- Structure-borne sound insulation
- Load range 0.5 kN – 15 kN
- Natural frequency (stat.) > 15 Hz
- Positioning with stop ridge

Area of application

Anchor-free, anti-slip installation of machines and devices without mounting option

Materials

Elastomer body in NBR grade with high elasticity, oil-resistant and non-ageing

EP isolating plates

Construction

Elastomer plate, mould-vulcanised,
1 basic size

Properties

- Vibration isolation
- Shock absorption
- Structure-borne sound insulation
- Load range max. 120 kN
- Natural frequency (stat.) > 15 Hz

Area of application

Anchor-free, anti-slip installation of machines and devices without mounting option, foundation supports

Materials

Elastomer body in CR grade with high elasticity, oil-resistant and non-ageing

Remarks

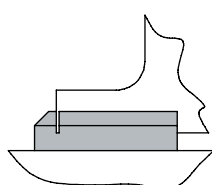
For central position, on stop web may be cut off

Variants

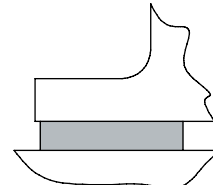
Standard: EPA 10

Mounting options

EPA



EP



Remarks

Other formats with smooth surface available, customising max. 1000 x 1000 mm, gauges up to 70 mm

Variants

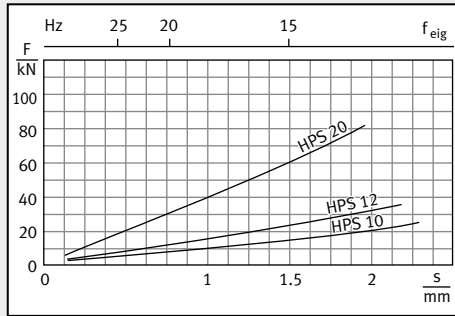
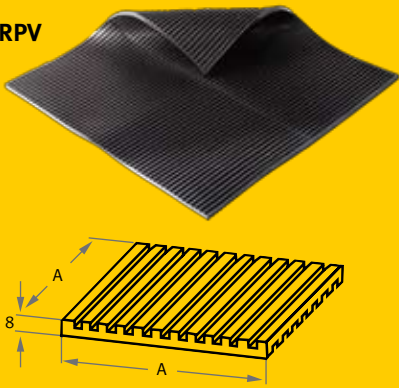
Standard: EP 25

EPA Series Dimension table Dimensions in mm	A	H	Element weight kg	Load (max.) kN
EPA 7	70 x 70	13	0.1	7.5
EPA 10	100 x 100	13	0.2	15.0

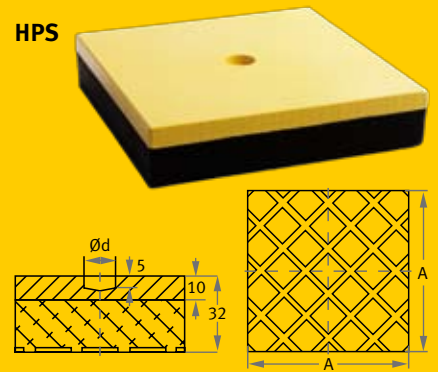
EP Series Dimension table Dimensions in mm	A	B	H	Element weight kg	Load (max.) kN
EP 25	250	250	25	2.1	120.0

RPV / HPS Isolating Plates

RPV



HPS



RPV isolating plates

Construction

Elastomer plate, mould-vulcanised, 1 basic size

Properties

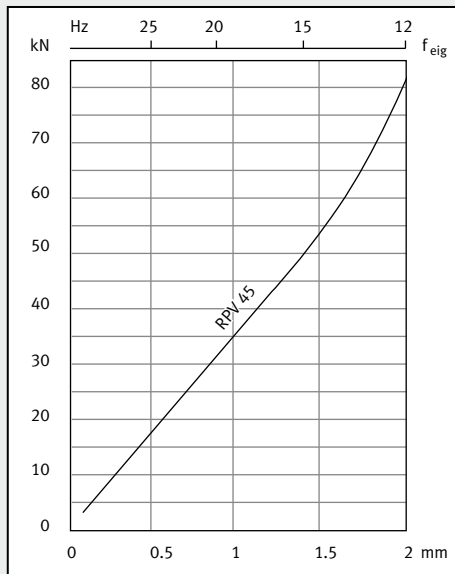
- Anti-slip
- Vibration isolation
- Structure-borne sound insulation
- Load range max. 0.6 N/mm²
- Natural frequency (stat.) ≥ 12 Hz

Area of application

Anti-slip installation of machines and devices without mounting option

Materials

Elastomer body in CR grade, 45 SH. A oil-resistant and non-ageing



HPS

Construction

Elastomer-metal combination, metal plate with screw fixing, 3 sizes

Properties

- Anti-slip
- Structure-borne sound insulation
- Vibration isolation
- Load range 1 kN – 80 kN
- Natural frequency (stat.) > 18 Hz

Area of application

Anchor-free, anti-slip installation of machines and plant

Materials

- Elastomer body in CR grade with high elasticity, oil-resistant and non-ageing
- Metal plate made of steel, Metal surface painted yellow

Remarks

Arrangement on larger areas possible, low natural frequency due to layering, any format by cutting to size

Variants

Standard: RPV 45

Remarks

Metal plate with screw hole

Variants

Standard: HPS 10

RPV Series Dimension table Dimensions in mm	A	B	H	Area cm ²	Weight kg	Load (max.) with coa- ting kN
RPV 45	450	450	8	2025	1.8	80.0

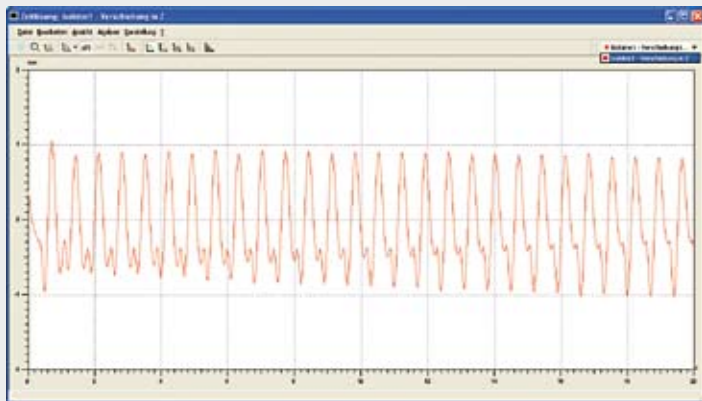
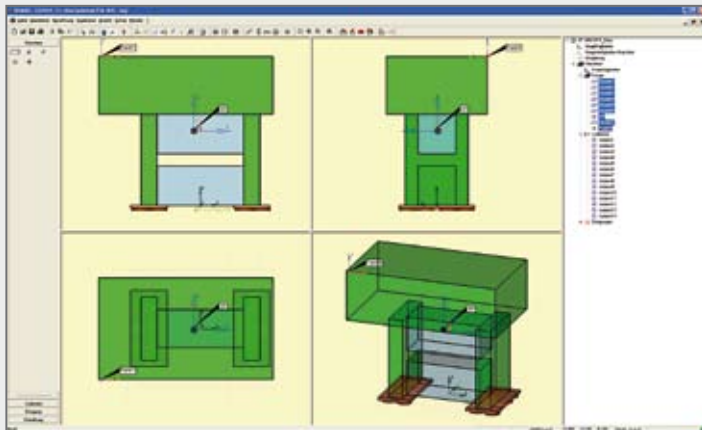
HPS Series Dimension table Dimensions in mm	A	B	H	h	d	T	Weight kg	Recommended load range kN	Load (max.) with coa- ting kN
HPS 10	100	100	32	10	17	5	1	6–15	20.0
HPS 12	120	120	32	10	17	5	1.4	13–20	30.0
HPS 20	200	200	32	10	21	5	4.6	30–60	80.0

*When using with levelling screw, please select lower load values

Calculation program for dynamic analysis of machines and foundations

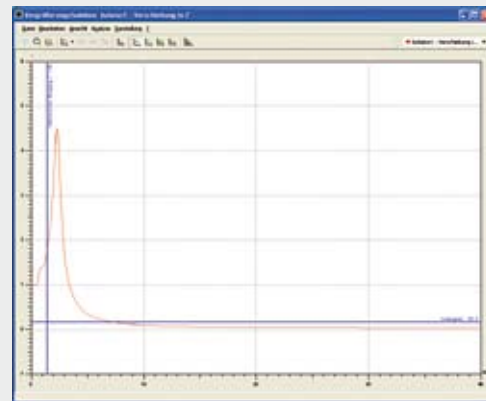
Using the simulation program, static and dynamic calculations can be carried out for machines that require elastic support. For this calculation, only the machine dimensions, centre of gravity location, the location of the support points and the excitation forces are required.

The software allows the determination of machine movements, foundation loads, natural frequencies and support forces from these data.

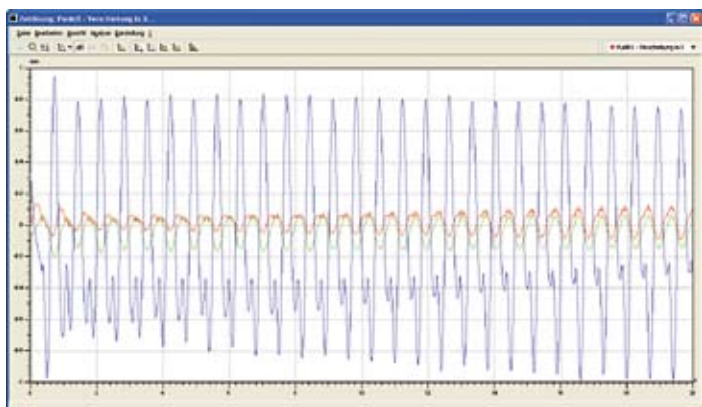


Excitation

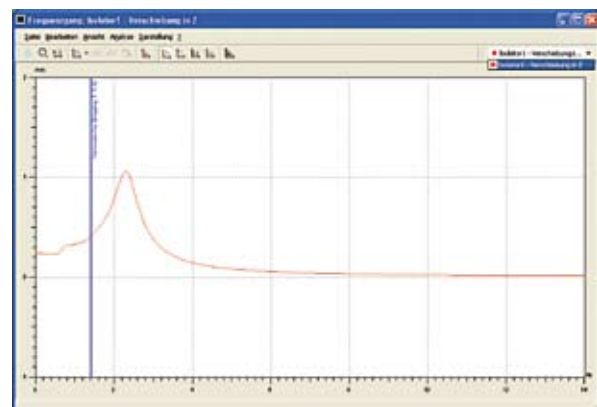
Project	D 11251 – variant 2, elements moved to y	AT 100_10
Machine:	D 1251	
Mass:	1500 kg	
Mass coil:	4000 kg	
Element:	EFFBE LEVELMOUNT LM 7-100	
Number:	8 pieces	
Excitation:	1000 min-1, 730 kg mm	



Transmissibility



Vibration displacement



Frequency response function

Application Examples

Example 1:

In this example, the stability of an injection moulding machine was demonstrated. In such machines, opening and closing the mould plate causes inertial mass forces that could lead to the machine slipping. The static load is intensified and lightened alternately by the dynamic force. By calculating the resulting residual forces, and given the coefficient of friction, the stability of the machine can be derived. The dynamic movements, resulting from an elastic support, can be calculated for every point in the room. This is very important for dimensioning feeding systems etc. As a result, it was possible to optimise isolating elements and their arrangement, already during the design phase. The practical result of this was subsequently verified with vibration measurements on the actual machine (see figure 3).

Example 2:

The second example shows how a difficult vibration problem was solved by selecting the correct element and exact tuning.

The problem:

An eccentric press was located on the third storey on top of a wooden floor. So far, the firmly mounted machine could be operated only with uneconomic 100 strokes / min. Using higher stroke rates, the weak wooden floor was exposed to unacceptably high vibration.

The solution:

The SLM pneumatic spring element was used as support. A subsequent re-measurement resulted in very good isolation results; however, rates above 180 strokes / min. caused unacceptably high machine movements.

To reduce machine movements, SLM elements with viscose damping were used. After damper optimization, re-measurement demonstrated that all values for machine, operating personnel and building, had fallen to below – in some cases significantly below – their guidance levels. This was achieved although the machine output was more than doubled by increasing the rate to 240 strokes / min. (see figure 4).

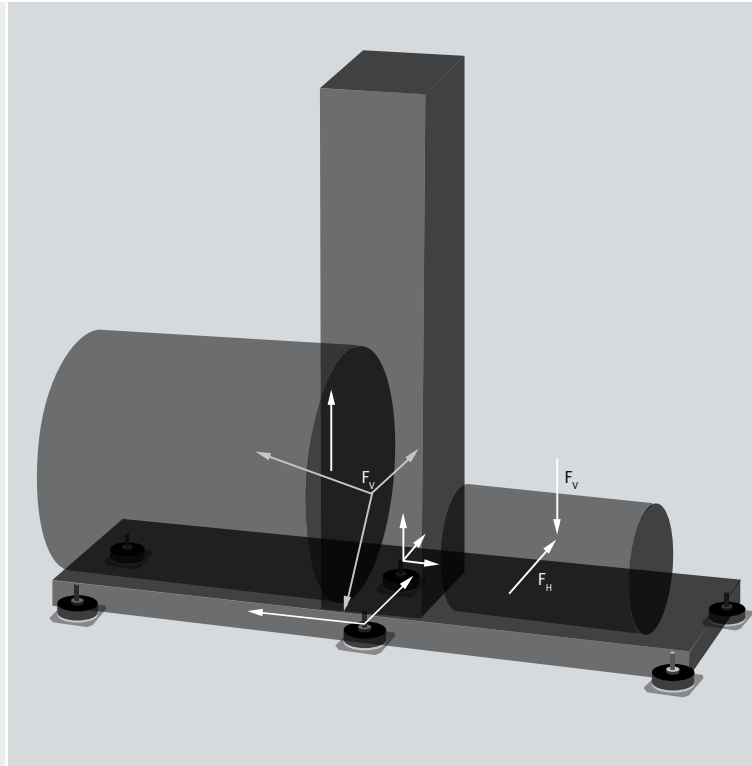
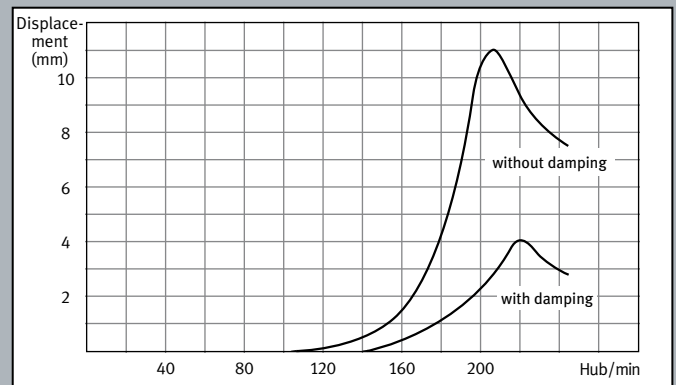


Figure 4



Analysis of vibration measurements

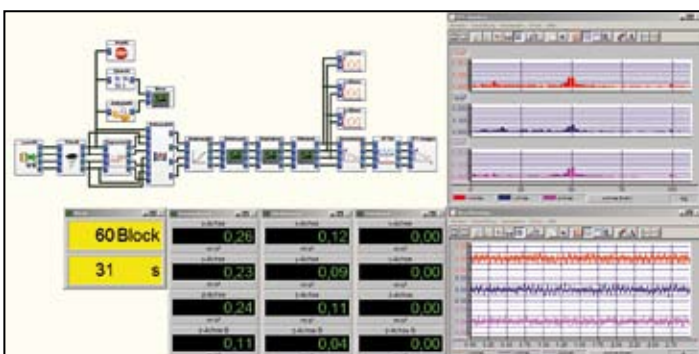


Figure 3

Dynamic properties

In general

- In static equilibrium, the static load is balanced by the sum of all reaction forces.
- In dynamic equilibrium, the accelerated mass results in an additional frequency-dependent force, called inertia.

The effect of inertial forces on the vibration system is determined by the tuning ratio. If the tuning ratio $\eta < \sqrt{2}$, excitation and inertial forces add up. If the tuning ratio $\eta > \sqrt{2}$, the inertial forces are phase-inverted to the exciting force. From a tuning ratio of $\sqrt{2}$, the resulting force will be smaller than the exciting force (see figure 5).

Effects

Natural frequency and damping determine the dynamic properties of a vibration element.

- The natural frequency is a function of deflection (s). In the linear region of the spring characteristic curve, the following applies by approximation $f_e \text{ (Hz)} = 5 / \sqrt{s \text{ (cm)}}$. The wide area of linearity achieved by EFFBE LEVELMOUNT supports is due to the special design of the elastomer body.
- Damping describes the energy loss that the vibratory system undergoes by internal friction. This produces damping forces that reduce the vibration amplitudes at a tuning ratio of up to $\eta = \sqrt{2}$.

If the tuning ratio is higher, the vibration amplitudes are influenced only marginally by damping. Damping is effective only up to $\eta = \sqrt{2}$, and so depends on the excitation frequency. Frequency-dependent damping is achieved with the patented pneumatic spring SLM-D. During shock absorption, damping reduces the amplitude with a tendency to poorer shock absorption at increased damping.

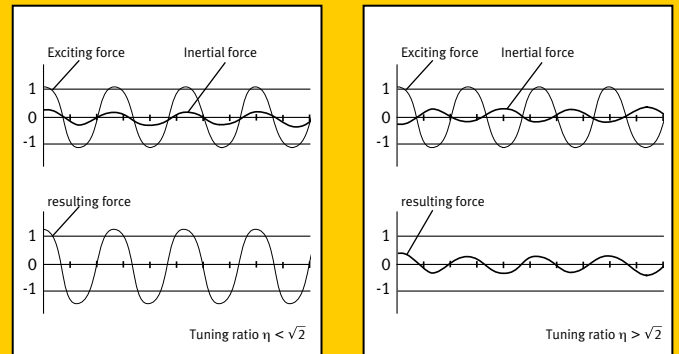


Figure 5

Long-term effects

A pre-condition for a consistent isolating effect is the long-term elasticity of the elastomer material. Composite or reclaimed materials are pressed together by static and dynamic loading and lose their elasticity. Environmental influences may cause elasticity loss. In this respect, above all, a high ozone resistance is required.

EFFBE elastomer materials are characterised by a low compression set according to DIN ISO 815 and a high ozone resistance. This ensures the necessary long-term durability.

Literature

DIN EN 1299 Mechanical Vibration and Shock
Vibration Isolation of Machines
Information for the application of source isolation

VDI 2062 Vibration Isolation
Part 1 Terms, definitions and methods
Part 2 Isolation elements

VDI 3833 Dynamic damper and dynamic vibration absorber
Part 1 Dynamic damper
Terms, characteristics, implementation, application
Part 2 Dynamic vibration absorber
Terms, characteristics, implementation, application



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Effbe GmbH

Hanauer Landstraße 16
 63628 Bad Soden-Salmünster
 Germany
 Phone: +49 (0) 6056 78 74 00
 Fax: +49 (0) 6056 78 79 66
 E-mail: info@effbe.de
 Internet: www.effbe.de

Sales office Germany

Planiestraße 11
 71063 Sindelfingen
 Germany
 Phone: +49 (0) 7031 81 50 60
 Fax: +49 (0) 7031 87 56 99
 E-mail: info@effbe.de
 Internet: www.effbe.de

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