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VIBRATION CONTROL

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Industrial Gas Springs (push type), Industrial Gas Springs (pull type), Hydraulic Dampers, Hydraulic Feed Controls, Door Dampers, Rotary Dampers



Rubber-Metal Isolators, Vibration-Isolating Pads, Low Frequency Pneumatic Levelling Mounts



Safety Shock Absorbers, Safety Dampers, Clamping Elements, Viscoelastic Shock Absorbers

We are your specialists for industrial damping technology

ACE is the internationally recognised expert in the field of industrial damping technology – with representative offices in 45 countries on all continents. ACE has also been active in Germany since 1978.

ACE customers profit from well-conceived solutions, valuable innovations and model service for all damping technology issues. Thanks to its close cooperation with leading mechanical engineering companies, the German ACE branch office has recently established itself as a pioneer of technical progress in damping technology.

This catalogue is a decisive step – a much expressed desire of our customers: the realisation of offering everything from one source for damping technology and vibration isolation.

ACE develops, produces and distributes a broad spectrum of damping products. The wide range of products extends from damping solutions in automation technology, motion control and vibration isolation to safety elements.

The products are particularly successful with forward-looking companies, because there are no better solutions available for braking moving masses rapidly, gently and precisely or for isolating harmful vibrations.

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01

Rubber-Metal Isolators



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03

Low-Frequency Air Spring Elements



PLM	Pneumatic Air Spring Elements	56
PAL	Air Spring Elements with Automatic Level Controls	58

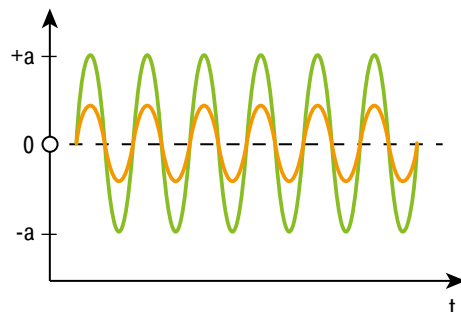
Vibration Isolation

Noise reduction and vibration isolation are becoming more and more important in our daily lives. This applies in particular to the workplace and the environments around production companies.

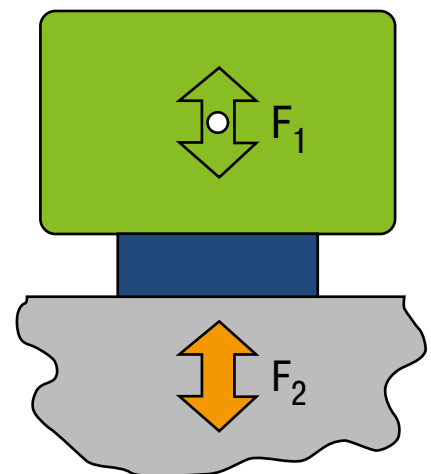
Preventing noise emissions or harmful vibrations is therefore not only a necessity required by noise protection and occupational health and safety legislation; their sources must also be localised by means of targeted analyses in order to develop suitable improvement measures for achieving, for example, increased production quality. A second by-product of vibrations are their effects on the surrounding production environment and any measuring and testing facilities that may be in use.

Preventive vibration isolation leads to

- improved working conditions for people and the environment
- more accurate production tolerances and thereby increased product quality
- competitive and cost advantages thanks to lower reject rate in production
- increased production speed thanks to increased maximum machine dynamics
- longer tool and machine life thanks to lower stress
- faster and more accurate measuring results



Measurement of degree of isolation



Types and mode of action of vibration isolation

Vibration isolation is generally subdivided into source isolation and receiver isolation. In source isolation (emission protection), for example, a press or a machine is isolated from its foundation so that the vibrations are damped to a desired extent.

In the case of receiver isolation, however, the object to be protected, e.g. a measuring table, is isolated from the foundation. If the machinery or equipment is rigidly connected with the foundation, one can assume an almost 100% transmission of vibrations or shocks.

The task of vibration isolation for machinery and equipment is to reduce the transmission of mechanical vibrations and reciprocal forces by installing elastic, damping components.

However, it is not always possible in practice to provide a desirably elastic (soft) support for all machines, foundations, measurement facilities and building parts. Users are forced therefore to aim for a viable state between system stability and degree of isolation.

Our technicians and engineers are happy to assist you in selecting products and solutions.



A measuring machine as an example of receiver isolation



A machine connection as an example for source isolation

Effectiveness and vibration calibration

In order to assess the effectiveness of isolation elements for harmonic vibrations, one relates the excitation frequency f_e (machine speed in 1/s) of the isolator to the natural frequency f_0 . It may generally be assumed that the effectiveness of an isolation increases with the decreasing natural frequency of the system. If the ratio η of the excitation frequency to the natural frequency of the system is larger than $\sqrt{2}$, one may refer to an isolation effect. Furthermore, the degree of effectiveness (isolation) increases in proportion to the ratio ($\eta = f_e / f_n$).

If the ratio is lower than $\sqrt{2}$, the vibrations become amplified. This is particularly the case in the resonance range if the disturbance frequency is equal to the natural frequency of the isolator ($\eta = f_e / f_n = 1$).

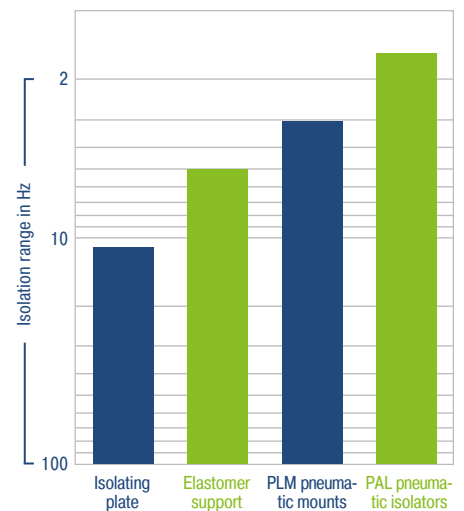
Damping (D) plays an additional, not unimportant role in vibration isolation. When ramping up machines to their operating speed or when ramping down, the natural frequencies of the vibration isolation are generally passed through. In order not to exceed the amplitudes or limit values when passing through the resonances, sufficient damping must be in place.

Quick selection

Different materials can be used to isolate machinery and equipment. These differ in material, form and mode of action. The following quick selection will allow an initial rough estimation by showing you the effectiveness of the different damping products.

Unlike uniform vibrations, shocks induced by machinery, equipment or production processes differ in their time profile and intensity. Our application engineers are happy to assist you in selecting the right shock absorber. In addition, selection ranges which suit your needs are available on our homepage.

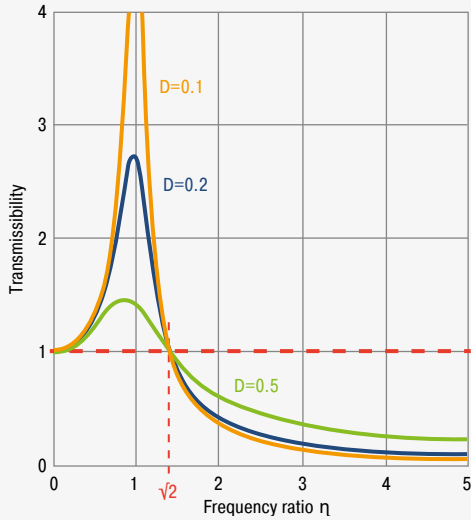
Application ranges of isolators



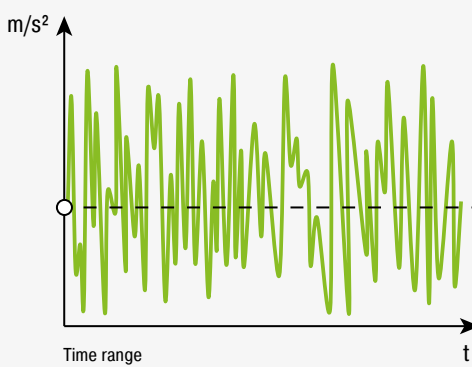
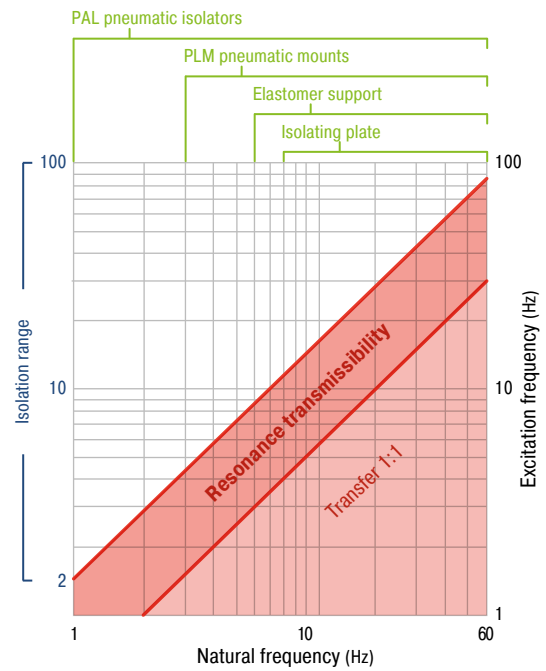
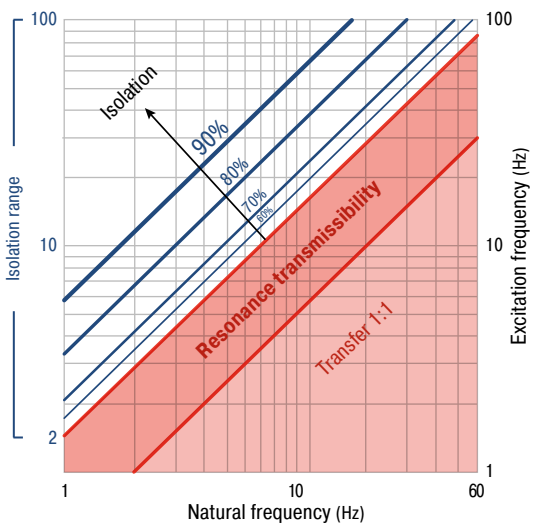
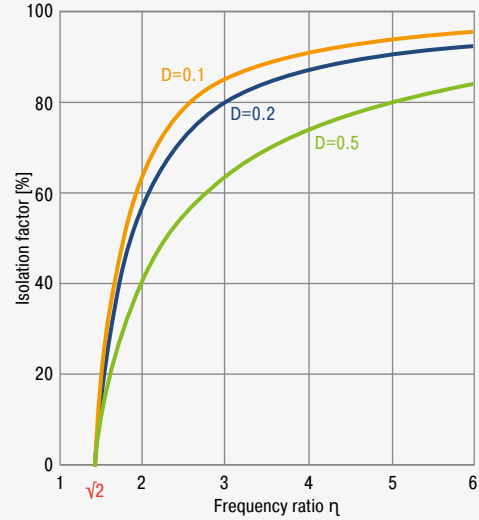
More complex vibration states

In case of more complex vibration states, a prior vibration analysis is recommended. In this process, the measured time signal is transformed into the frequency range. This allows for an evaluation of the frequencies for which an isolation is required. The selection of isolation material is then made for the lowest excitation frequency to be isolated.

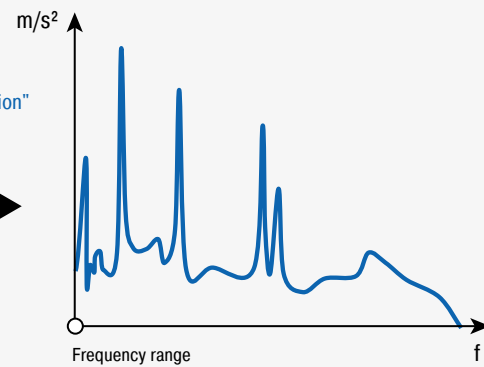
Transmissibility depending on frequency ratio and damping degree











Isolation factor depending on frequency ratio and damping degree



Signal conversion via "Fast Fourier Transformation" or "FFT".






Frequency and weight ranges



	Type	Effective Direction		Load Range kg	Natural Frequency Range Hz	
Rubber-Metal Isolators						
	LEV	↓		45 - 5900	8 - 24	
	CM	↕		3 - 750	12 - 35	
	COM	↓		6.5 - 1814	4.5 - 16	
	AAM	↕		0.5 - 22.7	16 - 46	
	SFM	↕		20 - 1000	8 - 13	
	BM	↓		0.7 - 8.2	8 - 16	
	UMO	↕	For plate thickness G1*: For plate thickness G2*:	axial 8 - 545 24 - 2065	radial 4 - 300 10 - 640	15 - 24 10 - 19
	FL	↕		2 - 28 0.4 - 5	not specified	

* See page 41.

Application overview

Type	Machines	Transfer systems	Construction Transport	Blower Fan	Foundations	Control units Electrical systems	Off-road vehicles
Rubber-Metal Isolators							
LEV	■	■		■			
CM	■		■	■			■
COM	■	■		■		■	
AAM		■	■			■	■
SFM			■				■
BM				■		■	
UMO	■	■	■			■	■
FL	■		■			■	
Vibration-Isolating Plates							
SLAB	■	■	■	■	■		
CEL	■	■	■	■	■		
PAD	■		■		■		■
Air Spring Elements							
PLM	■						
PAL					■		

Type	Load Range N/mm ²	Natural Frequency Range Hz
Vibration-Isolating Plates		
 SLAB	0.002 - 0.055	12 - 50
 CEL	0.35 - 2.1	11 - 60
 PAD	0 - 13.8	for shock absorption only

Typ	Load Range kg	Natural Frequency Range Hz
Low-Frequency Air Spring Elements		
 PLM	20 - 8800	3 - 10
 PAL	36 - 42 000	1.3 - 2.7

Engines Generators	Compressors	Oil and gas industry	Aerospace engineering	Presses	Medicine	Measuring tables	Test benches	Type
Rubber-Metal Isolators								
				■				LEV
■	■	■	■					CM
■	■			■				COM
■			■		■			AAM
■	■							SFM
					■			BM
■	■	■	■					UMO
■	■							FL
Vibration-Isolating Plates								
		■		■	■	■		SLAB
		■		■	■	■	■	CEL
		■		■				PAD
Air Spring Elements								
				■	■	■	■	PLM
			■			■	■	PAL

Quick selection of suitable isolation products made easy!

The majority of isolation solutions can be found with the relatively easy use of diagrams. They allow a simple relation to be made between natural frequency, the predominant excitation frequency and the degree of isolation to be expected.

As marked in the diagrams, we recommend the use of products with a theoretical degree of isolation of 50% or higher. Another rough guide value for an efficient and cost-effective vibration isolation is a ratio of roughly 3 between the excitation frequency of the isolator and the predominant natural frequency.

The quick selection guide is based on the physics of a single degree of freedom system. With more complex and non-rigid systems and superstructures, it is always recommended to contact a technical consultant or application engineer.

The selection tables were prepared according to our best knowledge; their use excludes entitlement to legal and warranty claims. On request, ACE offers consultation and measurement services separately to this approximate preselection.

- 1 **Natural frequencies of products**
in relation to the load in kg per element (rubber-metal isolators) or N/mm² as surface pressure (damping plates).
- 2 **Spring characteristic**
according to load or surface pressure.
- 3 **Relationship diagram**
with relation between excitation frequency and the required natural frequency of an isolator in relation to the desired isolation result.

Using the diagram

Example

A user has a 1,000 kg machine with 1,800 1/min, which corresponds to an excitation frequency of $1,800 / 60 = 30$ Hz. Furthermore, the user would like to achieve a good isolation from the floor by using 4 CM cup mounts (250 kg per isolator).

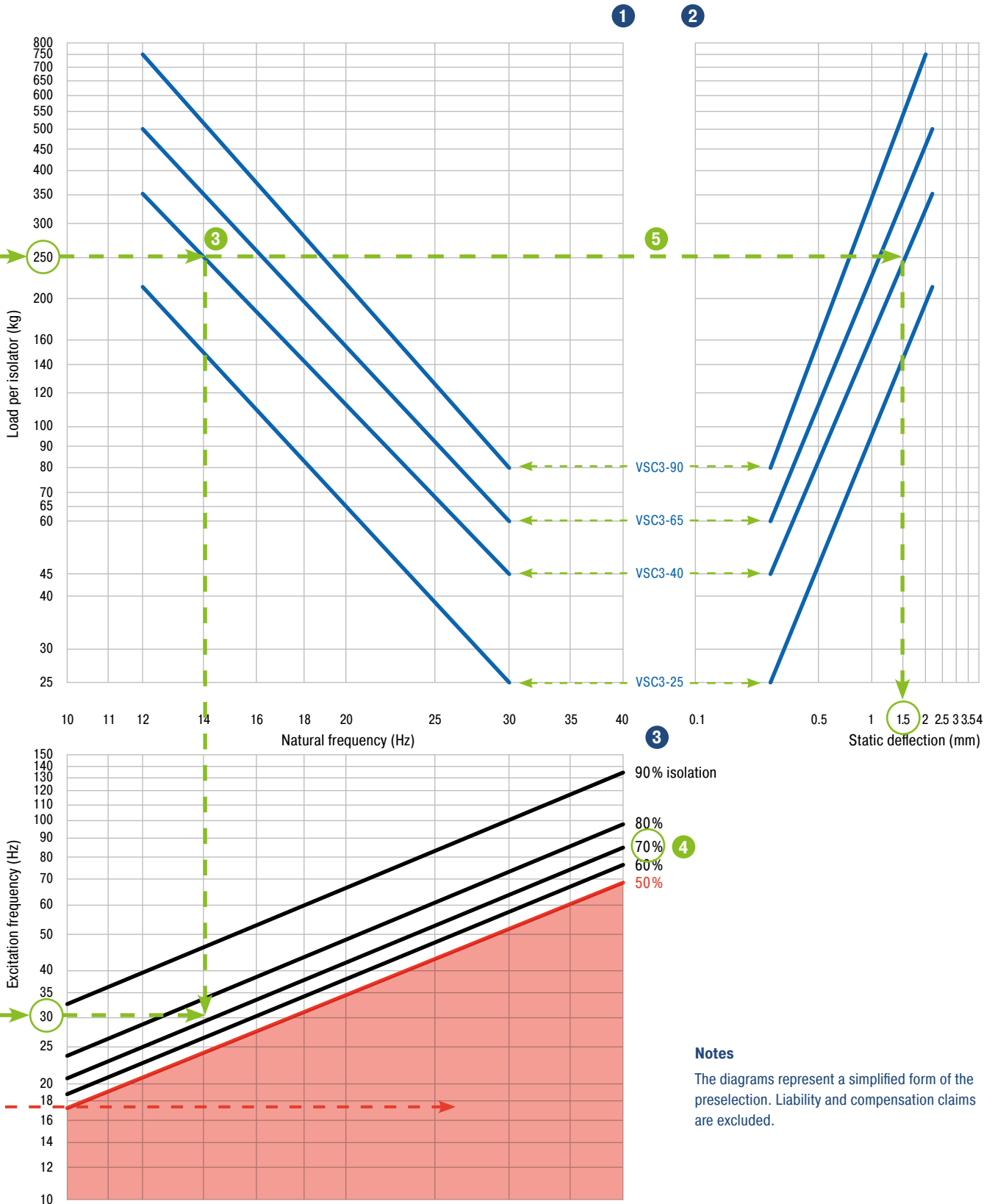
The selection is as follows:

- 1 Draw horizontal line in diagram 1 at 250 kg Load per isolator. The line intersects 3 products as solutions, with the most cost-effective being the CM-VSC3-40 in this case.
- 2 Draw horizontal line in diagram 3 at 30 Hz excitation frequency.
- 3 Draw a vertical line from the intersection point in diagram 1 downwards until the horizontal line previously drawn in diagram 3 is met.
- 4 Now you can simply read the isolation to be anticipated: in this case it is 70%, which represents a good isolation value.
- 5 Continue to draw the horizontal line from diagram 1 until it intersects the product line CM-VSC3-40 in diagram 2. Here the value for the static deflection can be read on the x-axis below. In this example, the reference value is 1.5 mm.

Critical performance area

In the area shown here in red, there is either no improvement or only a very minor improvement in the starting vibration situation. This critical performance area also corresponds to the area of resonance.

Example Diagram



01

Rubber-Metal Isolators



LEV

Levelling Mounts (height-adjustable machine feet)

Secure, adjustable stabilisation for all types of machines, transfer systems, assembly stations, etc.



CM

Cup Mounts (Highly resilient vibration isolators)

For isolating machinery and equipment. Fail-safe isolators for all axes in any installation position. Application examples: compressors, off-road vehicles, engines, fans, etc.



COM

Compression Mounts (high-performance bearing surface)

Vertically acting isolators for machinery and equipment. Applications include: blowers, compressors, motors, generators, presses, etc.



AAM

All Attitude Mounts (vibration-isolating fasteners)

Maintenance free isolators for decoupling parts and components in electronics, aerospace, the military, medicine transfer systems, etc.



SFM

Stable Flex Mounts (stable machine feet)

Extremely rugged and maintenance-free isolators, e.g. for marine applications, for diesel generators, in power generation or in off-road vehicles.



BM

Bubble Mounts (low-frequency vibration isolators)

For protecting small devices and electronic components, e.g. in medical technology, aerospace, electronic systems or computers.



UMO

Universal Mounts (universal connection isolators)

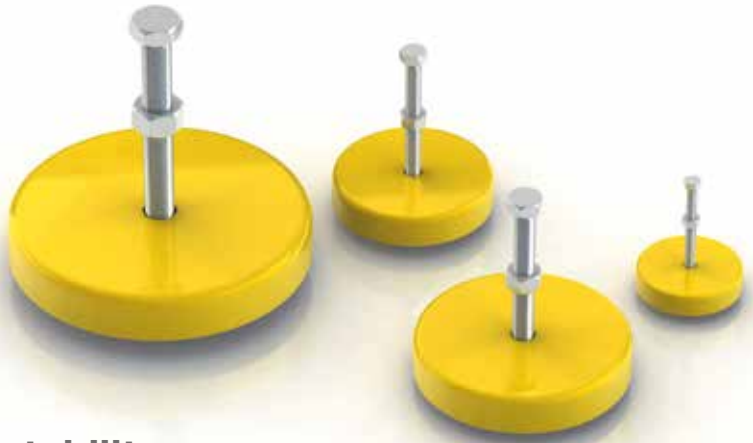
Maintenance-free connection isolators which can be implemented both radially and axially. Application examples: conveying systems, machinery and equipment, off-road, oil and gas industry, control systems, etc.



FL

Flex Locs (quick fastening elements)

Simple, efficient components with versatile applications as isolating fasteners for decoupling structure-borne sound in enclosures, housings, equipment and machinery. For application in mechanical engineering, in buildings, vehicles, or navigation.



LEV

Balancing elements for stability

Height-Adjustable Machine Feet

Natural frequency 8 Hz to 24 Hz

Load range 45 kg to 5,900 kg

Height-adjustable machine feet from the LEV product group are maintenance-free and ready-for-installation.

The precise, adjustable LEV machine feet are used whenever machines require an adjustable, stable positioning.

Their function ensures the secure positioning of machinery and equipment, protecting them against damaging shocks and vibrations. LEV machine feet can be supplied in different sizes, from M10 to M24 threads, and can secure and bear loads in these sizes from 45 to 5,900 kg.

The selection of suitable machine feet is simply made via the given mass of the machine or plant distributed among the desired support points. A weight distribution within the system must be considered in such a way that the feet are also measured with the associated load component. If additional dynamic loads are exerted by the machine or plant, the next largest type must be chosen in a borderline static load case.

The mounts meet OSHA requirements for anchoring machines.

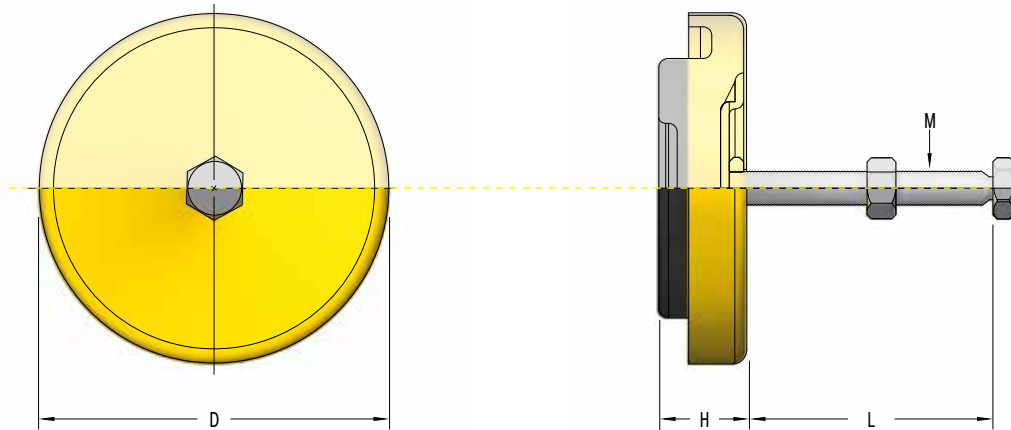
Properties

- Easy to level
- Vibration-reducing
- Noise-reducing
- Improved product quality
- Maintenance-free
- Compensates for floor unevenness
- Special models available on request
- Special vibration-isolating feet according to design and custom-made product
- All metal parts galvanised (ROHS compliant)
- Rubber part made of neoprene (chloroprene rubber)
- Operating temperature range -30 °C to +80 °C

Areas of application

- Injection moulding machines
- Conveyors
- Production and processing centres
- Assembly stations
- Small presses, etc.

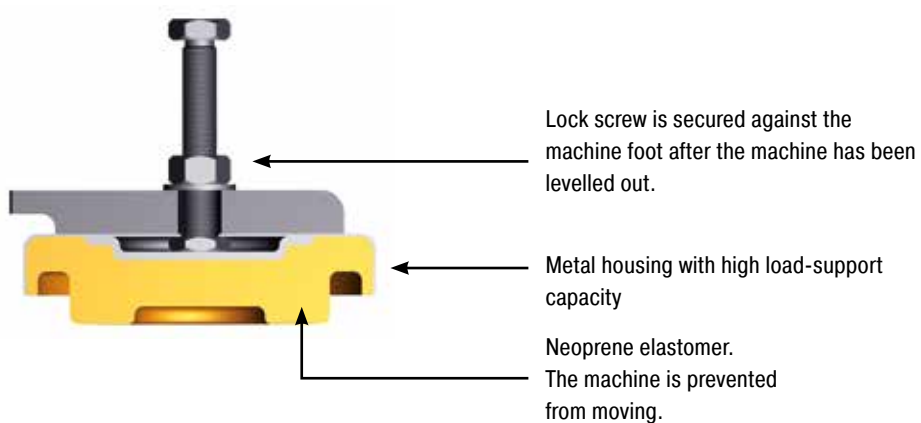
LEV M10 to M24



Type	Min. Load kg	Max. Load kg	Natural Frequency Range Hz	M	L mm	D mm	H mm
LEV-52221-M10	45	230	8 - 24	M10x1.5	80	80	38
LEV-52224-M12	135	450	8 - 24	M12x1.75	130	120	38
LEV-52226-M20	230	2040	8 - 24	M20x2.5	130	160	41
LEV-52229-M24	1815	5900	8 - 24	M24x3.0	180	230	57

Standard delivery with hexagon nut

Installation sketch





CM

Ideal für alle Umgebungen und Raumachsen

Highly resilient vibration isolators

Natural frequency 12 Hz to 35 Hz

Load range 3 kg to 750 kg

The CM cup mounts protect machinery, vehicles and equipment against damaging vibrations and shocks. They are maintenance-free machine elements.

The correct function of the mounts is guaranteed even in an arduous environment due to the fail-safe design of the machine elements. The low-profile CMs are able to isolate machine parts from each other in an effective way. The CMs can be installed in the applications freely in space (X, Y and Z) and at any inclination. Standard CMs are manufactured and delivered with neoprene as damping material.

For applications in the areas of heavy shocks (off-road) and extreme temperatures, we recommend the use of the CMs with high-damping silicone as damping material. Under normal loading conditions, the CMs have a natural frequency of up to 12 Hz (please refer to the selection diagram for more exact values).

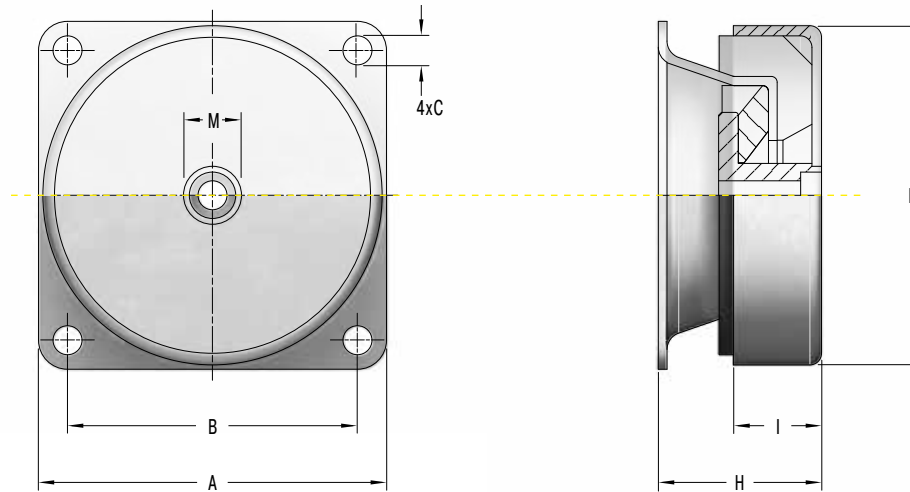
Properties

- Fail-safe
- Can be installed in all spatial axes
Can be used for shear, compressive and tensile loads
- Available with centric thread or through-hole
- All metal parts galvanised, aluminium or stainless steel available on request
- Operating temperature range -30 °C to +80 °C for neoprene
- Operating temperature range -60 °C to +150 °C for high-damping silicone

Areas of application

- Compressors and other vibrating machines
- Electronic control units and systems
- Crusher plants
- Fans and blowers in construction machinery and in buildings
- Off-road vehicles
- Shipbuilding
- Aircraft construction

CM-VSC1 / CM-VSC2 / CM-VSC3



Type	Min. Load kg	Max. Load kg	M	Screw-in Depth mm	A mm	B mm	D mm	C mm	H mm	I mm	Weight kg
CM-VSC1-2	3	16	M6 or M8	20	60	49.5	58	5.5	28	18	0.2
CM-VSC1-4	7	35	M6 or M8	20	60	49.5	58	5.5	28	18	0.2
CM-VSC1-7	14	60	M6 or M8	20	60	49.5	58	5.5	28	18	0.2
CM-VSC1-10	25	100	M6 or M8	20	60	49.5	58	5.5	28	18	0.2
CM-VSC2-5	9	35	M10 or M12	30	76	63.5	76	6.4	38	25	0.45
CM-VSC2-10	14	60	M10 or M12	30	76	63.5	76	6.4	38	25	0.45
CM-VSC2-15	25	90	M10 or M12	30	76	63.5	76	6.4	38	25	0.45
CM-VSC2-25	50	200	M10 or M12	30	76	63.5	76	6.4	38	25	0.45
CM-VSC2-40	35	250	M10 or M12	30	76	63.5	76	6.4	38	25	0.45
CM-VSC3-25	25	210	M16	19	133	108	124	11.9	63	38	1.8
CM-VSC3-40	45	350	M16	19	133	108	124	11.9	63	38	1.8
CM-VSC3-65	60	500	M16	19	133	108	124	11.9	63	38	1.8
CM-VSC3-90	80	750	M16	19	133	108	124	11.9	63	38	1.8

Difference between stationary and mobile application in the selection diagrams

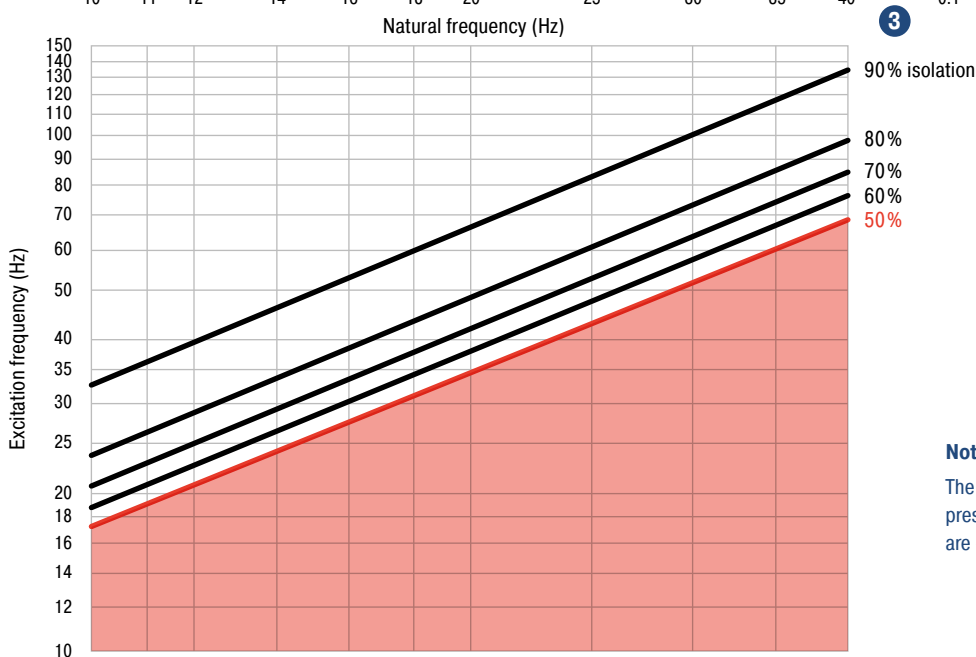
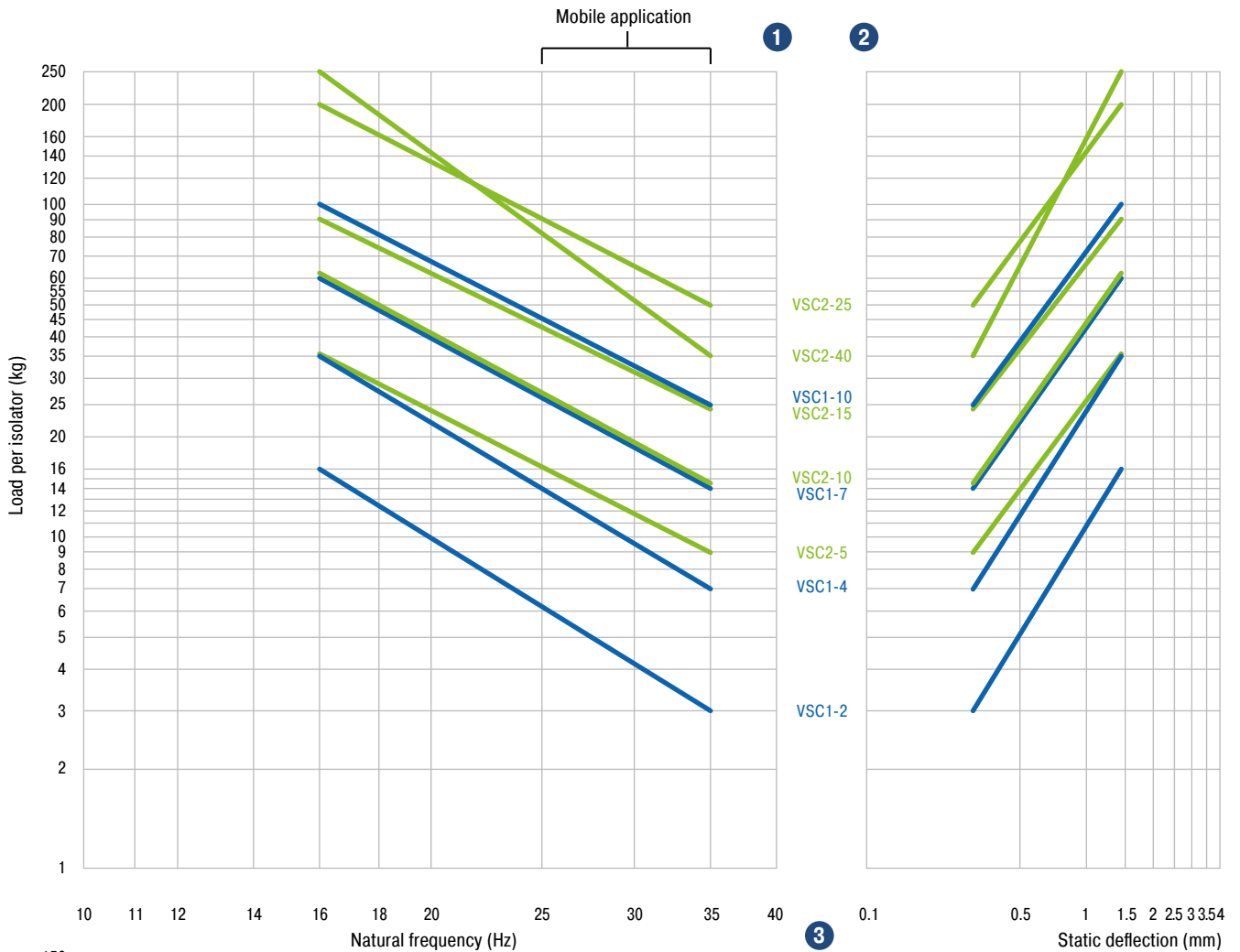
Stationary applications are those in which the cup mounts isolate stationary machines, plants, etc.

Mobile applications, however, refer to applications in which the cup mounts isolate engines, rotors or other parts on moving vehicles. Their range of application is reduced because, in addition to static load, there are additional dynamic loads exerted by the movement which must be considered.

CM – Cup Mounts



CM-VSC1 / CM-VSC2

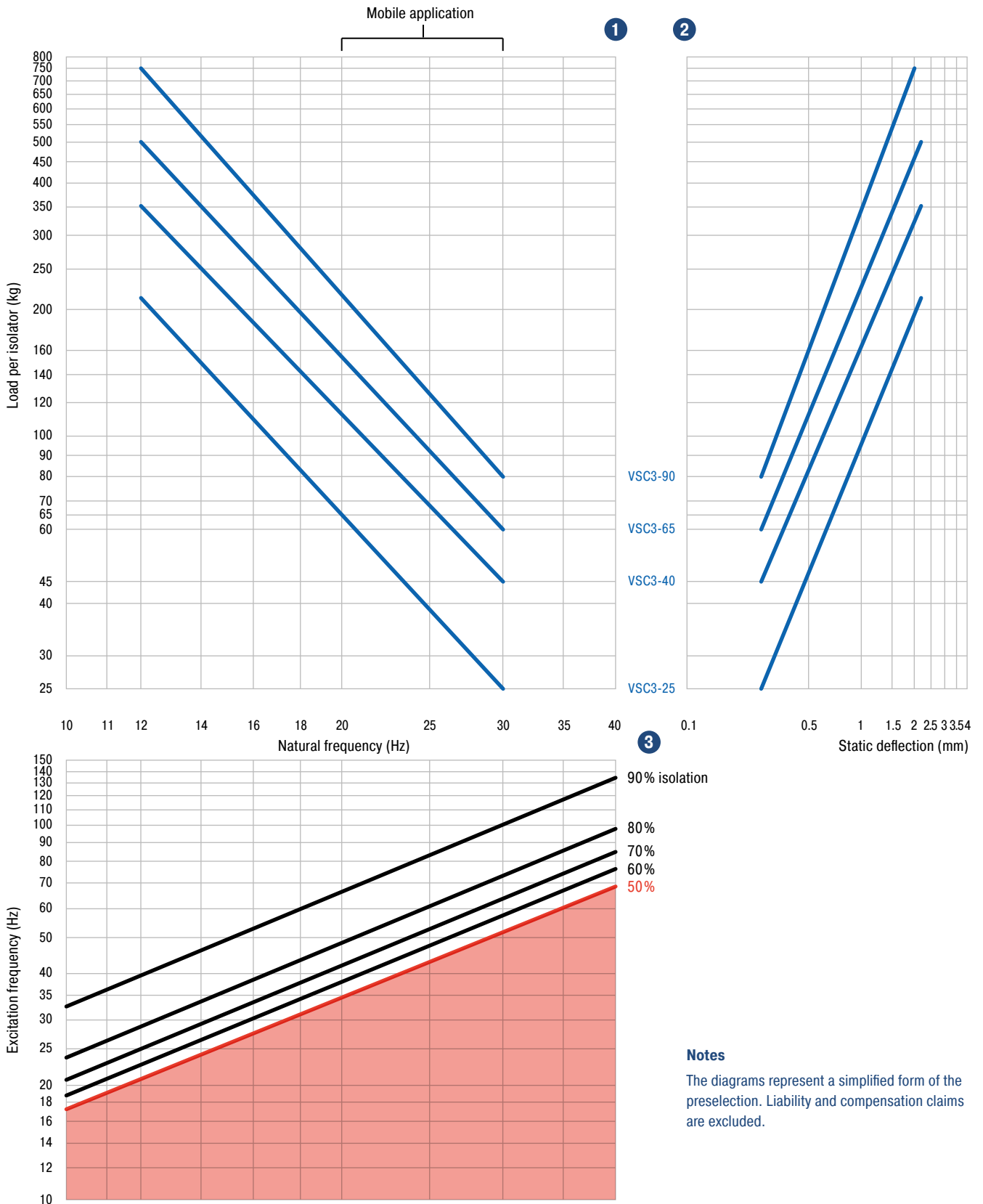


Notes

The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.



CM-VSC3





COM

Ideal for preventing unbalanced masses from vibrating

High-Performance Bearing Surface

Natural frequency 4.5 Hz to 16 Hz

Load range 6.3 kg to 1,814.4 kg

The COM compression mounts are high-performance bearing surface elements for isolating machines and plants. These extremely rugged elastomer bearing surfaces are primarily used in heavy-duty applications, such as in pumps and compressors.

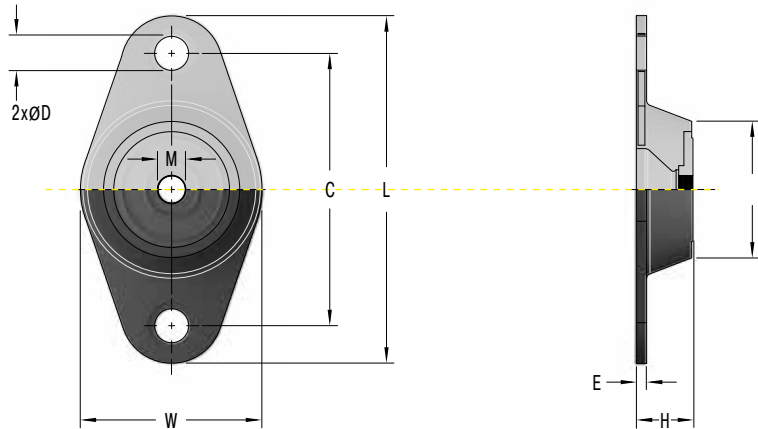
In their operating range, the COMs exhibit a low natural frequency of approx. 8 to 15 Hz and can when necessary be coupled for certain applications, whereby the natural system frequency can be further reduced to approx. 6 to 10 Hz (please refer to the selection diagram for more exact data). They are often used in situations in which unbalanced machine parts cause shocks and vibrations which can have a negative impact on the surrounding area. Disturbance frequencies from 900 min⁻¹ (15 Hz) are effectively isolated. Through the use of the high-performance bearing surfaces, structure-borne noise paths become interrupted, preventing the generation of resonant sound.

Properties

- enhance efficiency
- Isolates structure-borne noise
- Low-frequency application range from about 15 Hz
- Rugged
- Maintenance-free
- All metal parts galvanised (ROHS compliant)
- Rubber part made of neoprene (chloroprene rubber)
- Operating temperature range -30 °C to +80 °C

Areas of application

- Centrifuges
- Blowers
- Vibrators and crusher plants
- Compressors and ventilation systems
- Injection moulding systems
- Switch cabinets
- Military and off-road vehicles



COM-5250x / COM-5252x / COM-5254x



Type	Colour Code*	Min. Load kg	Max. Load kg	M	L mm	W mm	H mm	A mm	C mm	D mm	E mm
COM-52501	blue	6.3	15.9	M8x1.25	79.4	44.5	25.4	31.8	60.3	8.7	4.8
COM-52502	black	8.2	20.4	M8x1.25	79.4	44.5	25.4	31.8	60.3	8.7	4.8
COM-52503	red	12.7	31.8	M8x1.25	79.4	44.5	25.4	31.8	60.3	8.7	4.8
COM-52504	green	21.8	54.4	M8x1.25	79.4	44.5	25.4	31.8	60.3	8.7	4.8
COM-52521	blue	24.5	61.2	M10x1.5	98.4	60.3	31.8	44.5	76.2	8.7	5.6
COM-52522	black	30.8	77.1	M10x1.5	98.4	60.3	31.8	44.5	76.2	8.7	5.6
COM-52523	red	43.6	108.9	M10x1.5	98.4	60.3	31.8	44.5	76.2	8.7	5.6
COM-52524	green	69.0	172.4	M10x1.5	98.4	60.3	31.8	44.5	76.2	8.7	5.6
COM-52525	grey	99.8	249.5	M10x1.5	98.4	60.3	31.8	44.5	76.2	8.7	5.6
COM-52541	black	45.4	113.4	M12x1.75	139.7	85.7	44.5	63.5	104.8	14.3	6.4
COM-52542	red	95.2	238.1	M12x1.75	139.7	85.7	44.5	63.5	104.8	14.3	6.4
COM-52543	green	136.1	340.2	M12x1.75	139.7	85.7	44.5	63.5	104.8	14.3	6.4
COM-52544	grey	199.6	499.0	M12x1.75	139.7	85.7	44.5	63.5	104.8	14.3	6.4

* The colour code is for identifying the loading capacity. The products are marked in colour accordingly.

COM-5251x / COM-5253x / COM-5255x

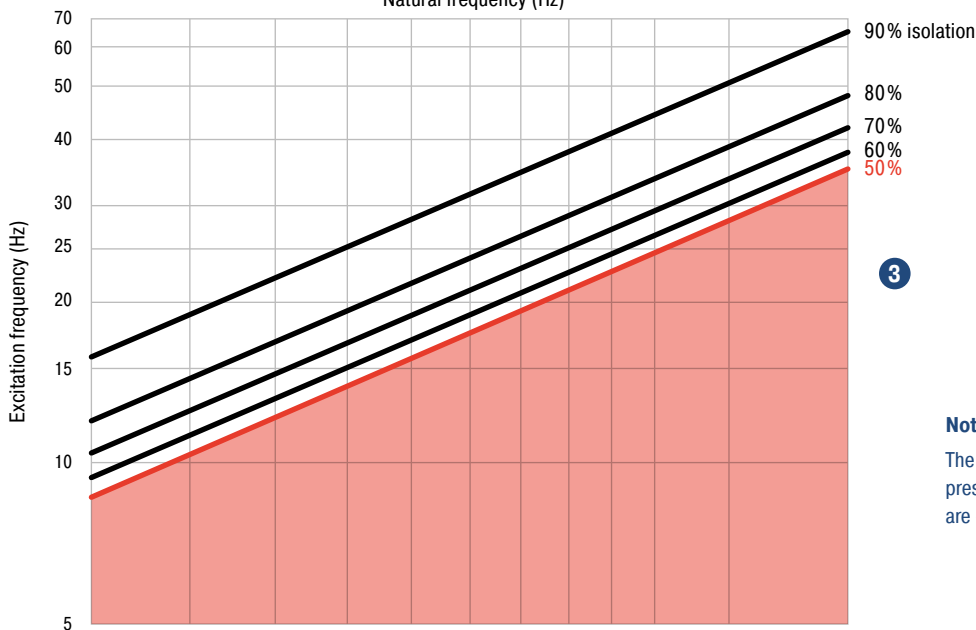
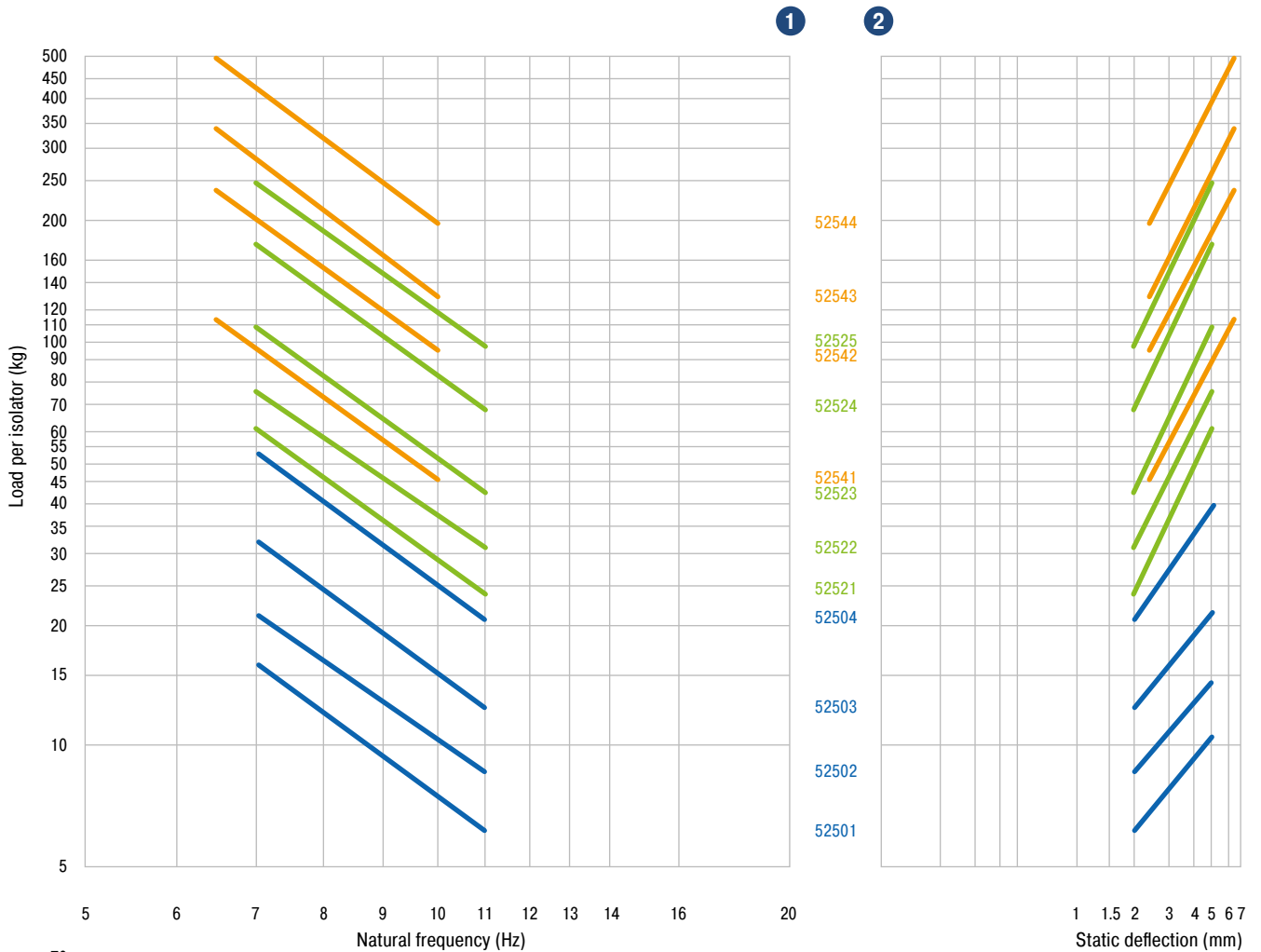


Type	Colour Code*	Min. Load kg	Max. Load kg	M	L mm	W mm	H mm	A mm	C mm	D mm	E mm
COM-52511	blue	6.3	15.9	M8x1.25	79.4	44.5	31.8	31.8	60.3	8.7	4.8
COM-52512	black	8.2	20.4	M8x1.25	79.4	44.5	31.8	31.8	60.3	8.7	4.8
COM-52513	red	12.7	31.8	M8x1.25	79.4	44.5	31.8	31.8	60.3	8.7	4.8
COM-52514	green	21.8	54.4	M8x1.25	79.4	44.5	31.8	31.8	60.3	8.7	4.8
COM-52531	blue	24.5	61.2	M10x1.5	98.4	60.3	44.5	44.5	76.2	8.7	5.6
COM-52532	black	30.8	77.1	M10x1.5	98.4	60.3	44.5	44.5	76.2	8.7	5.6
COM-52533	red	43.6	108.9	M10x1.5	98.4	60.3	44.5	44.5	76.2	8.7	5.6
COM-52534	green	69.0	172.4	M10x1.5	98.4	60.3	44.5	44.5	76.2	8.7	5.6
COM-52535	grey	99.8	249.5	M10x1.5	98.4	60.3	44.5	44.5	76.2	8.7	5.6
COM-52551	black	45.4	113.4	M12x1.75	139.7	85.7	73	63.5	104.8	14.3	6.4
COM-52552	red	95.2	238.1	M12x1.75	139.7	85.7	73	63.5	104.8	14.3	6.4
COM-52553	green	136.1	340.2	M12x1.75	139.7	85.7	73	63.5	104.8	14.3	6.4
COM-52554	grey	199.6	499.0	M12x1.75	139.7	85.7	73	63.5	104.8	14.3	6.4

* The colour code is for identifying the loading capacity. The products are marked in colour accordingly.



COM-5250x / COM-5252x / COM-5254x



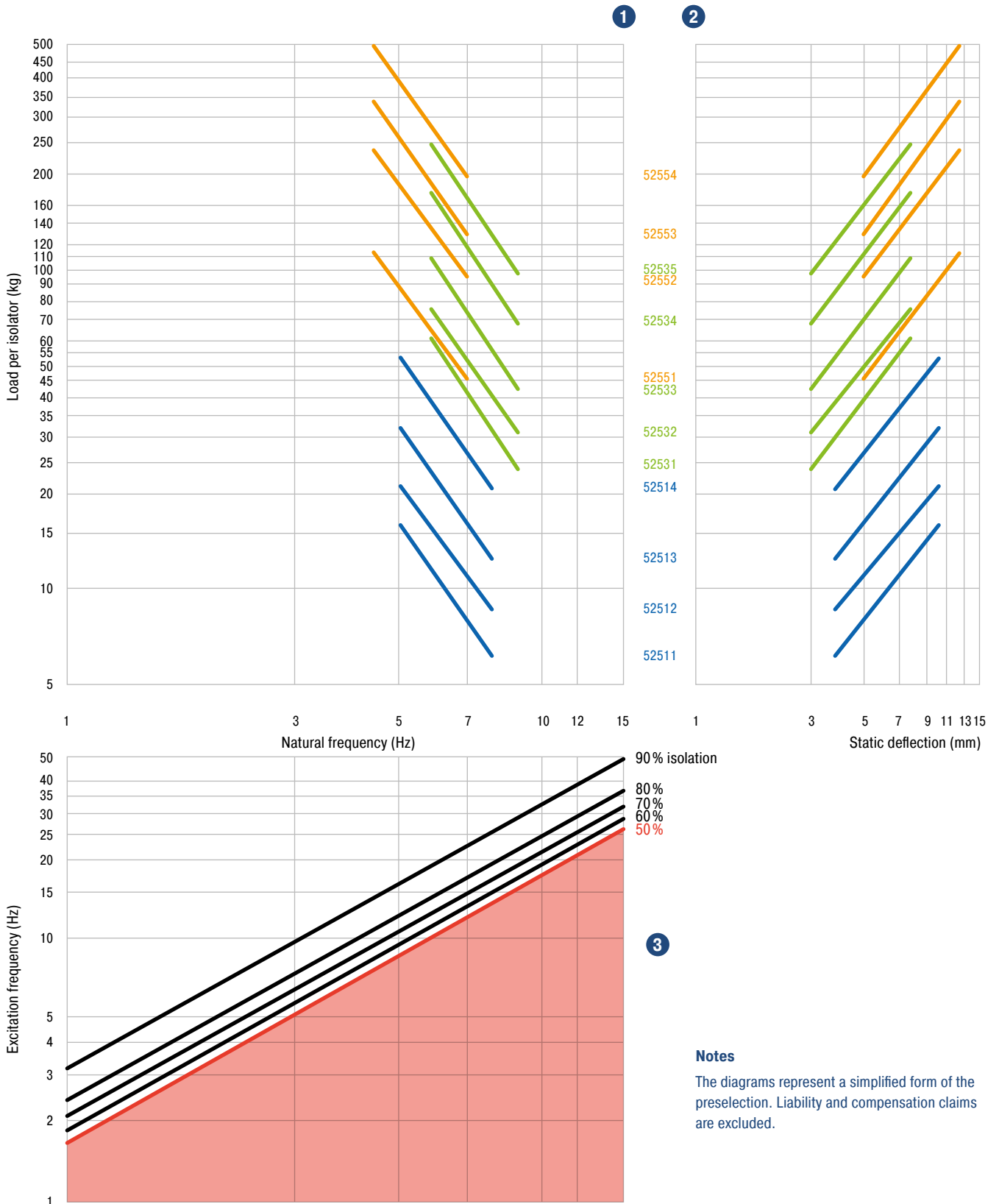
3

Notes

The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.



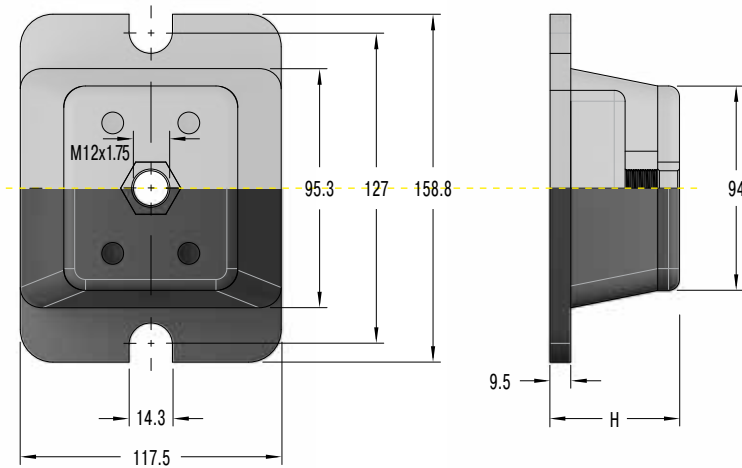
COM-5251x / COM-5253x / COM-5255x



Notes

The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.

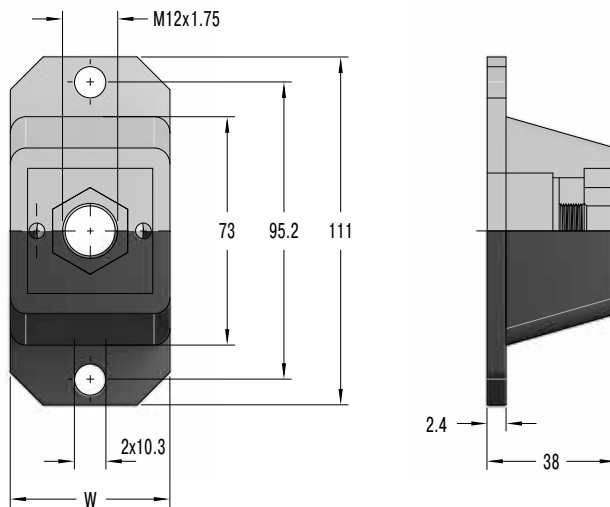
COM-5256x / COM-5257x



Type	Colour Code*	Min. Load kg	Max. Load kg	H mm
COM-52561	black	272.2	680.4	41.3
COM-52562	red	408.2	1020.6	41.3
COM-52563	green	544.3	1360.8	41.3
COM-52564	grey	725.8	1814.4	41.3
COM-52571	black	272.2	680.4	69.9
COM-52572	red	408.2	1020.6	69.9
COM-52573	green	544.3	1360.8	69.9
COM-52574	grey	725.8	1814.4	69.9

* The colour code is for identifying the loading capacity. The products are marked in colour accordingly.

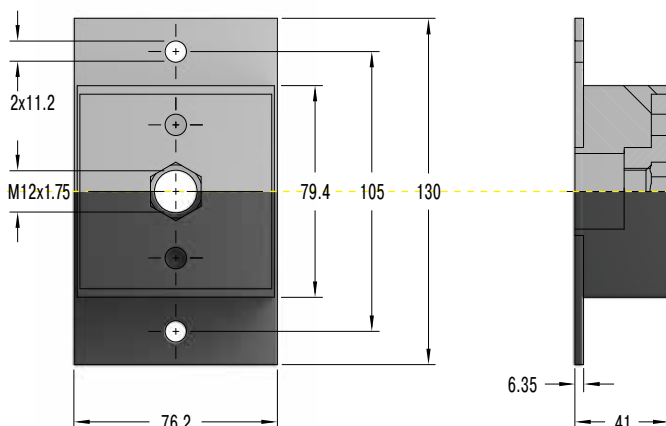
COM-5216x



Type	Colour Code*	Min. Load kg	Max. Load kg	W mm
COM-52160	yellow	10.9	27.2	50.8
COM-52161	red	18.2	45.4	50.8
COM-52162	green	27.2	68.0	50.8
COM-52163	blue	36.3	90.7	50.8
COM-52164	red	36.3	90.7	101.6
COM-52165	green	50.8	127.0	101.6
COM-52166	blue	90.7	226.8	101.6
COM-52167	white	127.0	317.5	101.6

* The colour code is for identifying the loading capacity. The products are marked in colour accordingly.

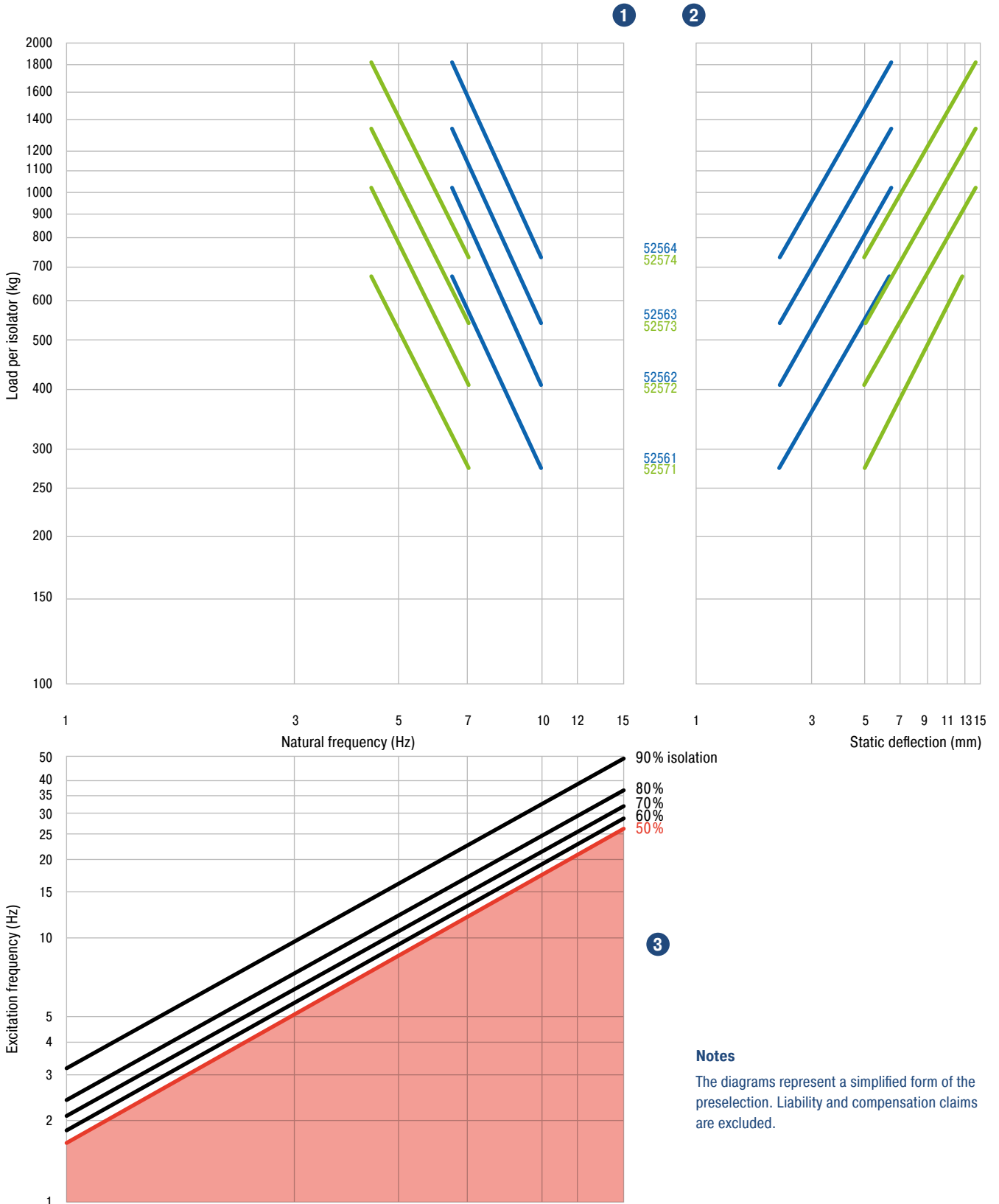
COM-5217x



Type	Colour Code*	Min. Load kg	Max. Load kg
COM-52171	red	127.0	317.5
COM-52172	green	181.4	453.6
COM-52173	blue	272.2	680.4
COM-52174	white	453.6	1134.0

* The colour code is for identifying the loading capacity. The products are marked in colour accordingly.

COM-5256x / 5257x



Notes

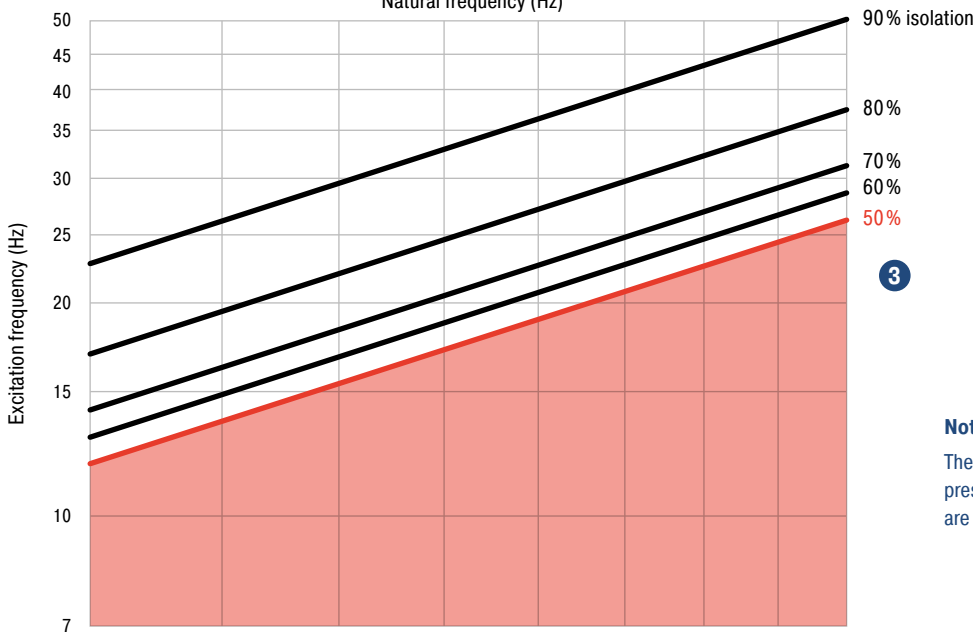
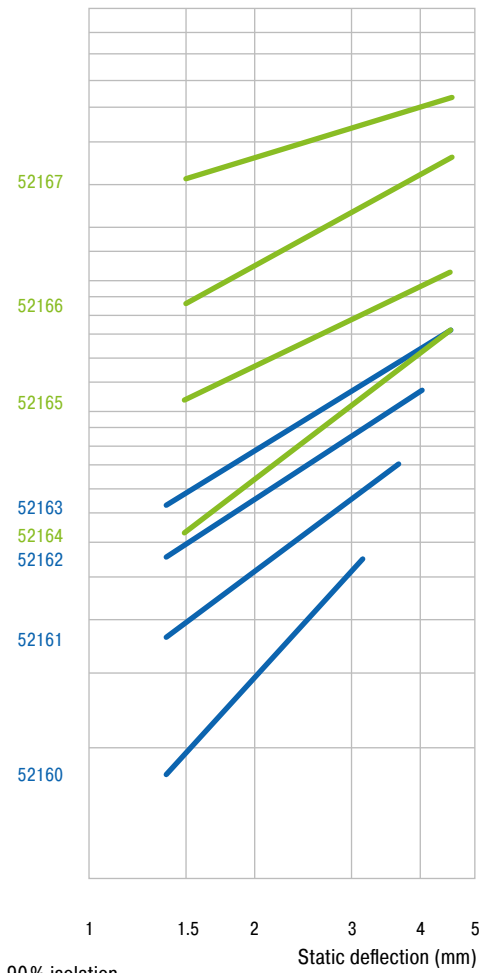
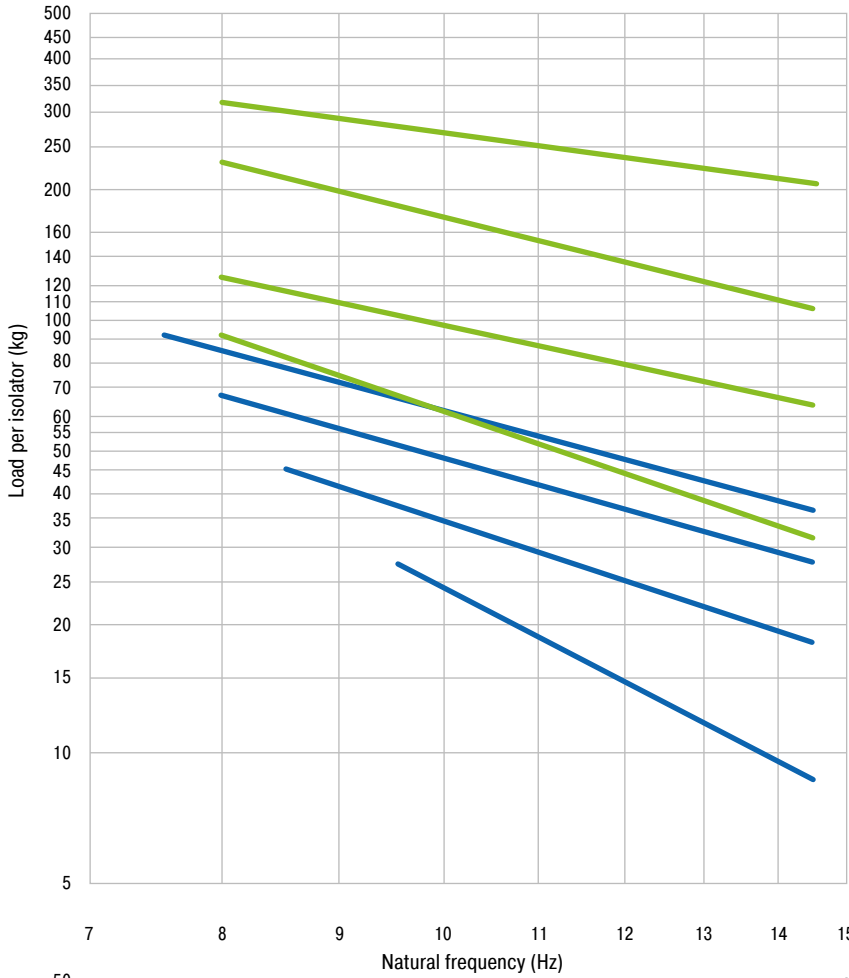
The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.



COM-5216x

1

2



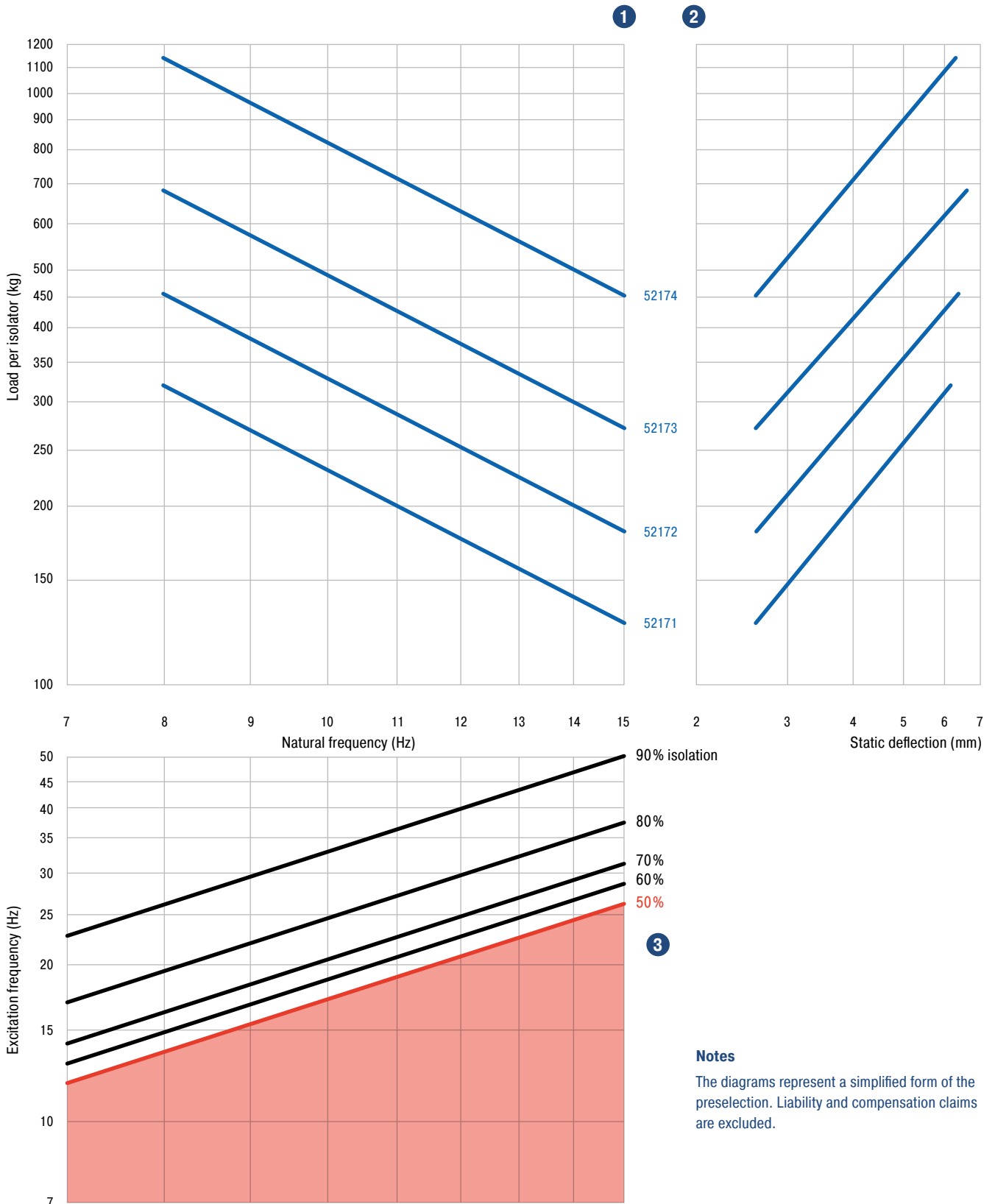
3

Notes

The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.



COM-5217x



Notes

The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.



AAM

Vibration-isolating fasteners

Vibration-Isolating Mounts

Natural frequency 16 Hz to 46 Hz

Load range 0.5 kg to 22.7 kg

The vibration-isolating fasteners (all-attitude mounts) of the AAM product group are maintenance-free and ready-to-install isolators that can reduce vibrations and shocks in all directions. The isolation effect is achieved by a special neoprene- or silicone-elastomer.

For applications in which shock absorption is particularly important, the AAMs can also be manufactured with high-damping silicone. The elements can be installed in all spatial axes. The AAM range is used mainly for isolating lighter electronic equipment and components.

Properties

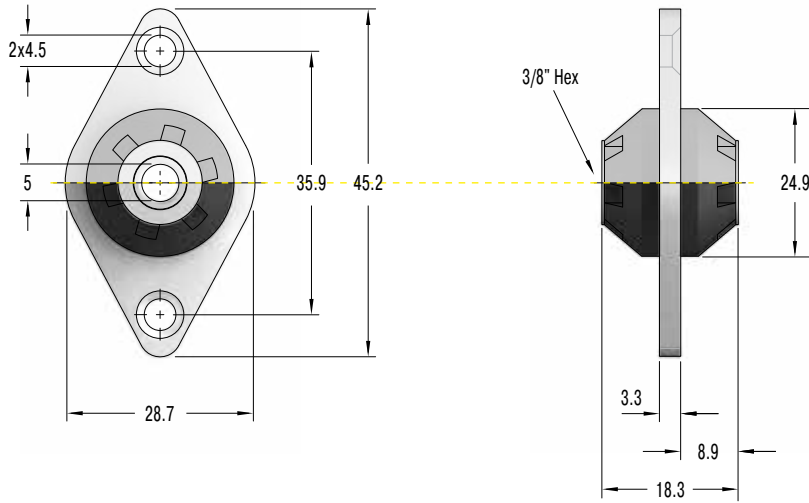
- Can be installed in all spatial axes
Can be used for shear, compressive and tensile loads
- Special applications with high-damping silicone possible
- Shock absorption possible
- All metal parts galvanised (ROHS compliant)
- Rubber part made of neoprene (chloroprene rubber) or silicone, depending on the type
- Operating temperature range -30 °C to +80 °C

Areas of application

- Electronic equipment and control units
- Off-road vehicles
- Military



AAM-5642x

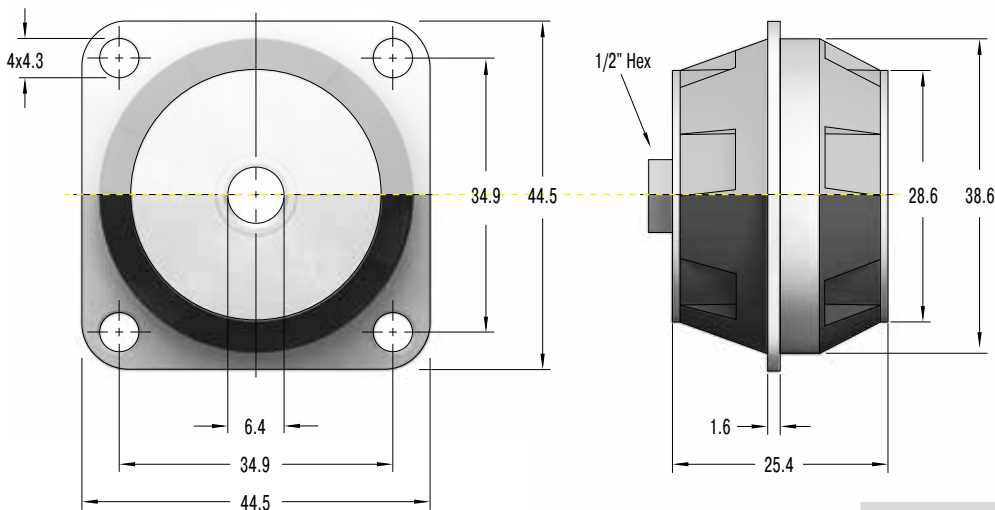


Type	Colour Code*	Min. Load kg	Max. Load kg
AAM-56423	grey	0.5	1.4
AAM-56424	red	0.8	2.0
AAM-56425	yellow	1.3	3.2
AAM-56426	green	1.8	4.5

* The colour code is for identifying the loading capacity.
The products are marked in colour accordingly.

Standard material: Silicone

AAM-5220x



Type	Colour Code*	Min. Load kg	Max. Load kg
AAM-52205	red	1.3	6.8
AAM-52206	green	1.8	11.3
AAM-52207	yellow	2.7	15.9
AAM-52208	blue	4.1	22.7

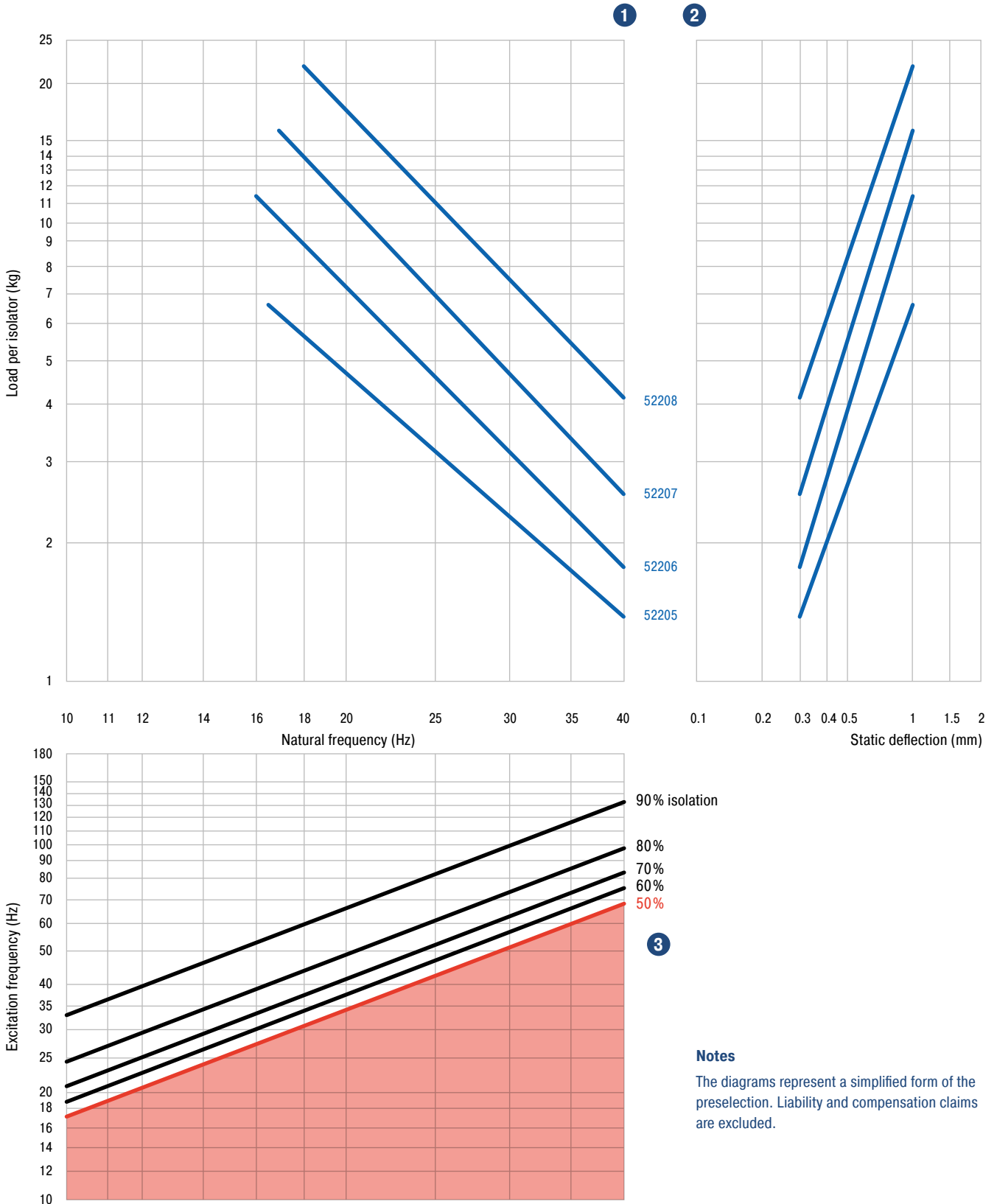
* The colour code is for identifying the loading capacity.
The products are marked in colour accordingly.

Standard material: Neoprene, silicone alternatively available

AAM – All Attitude Mounts



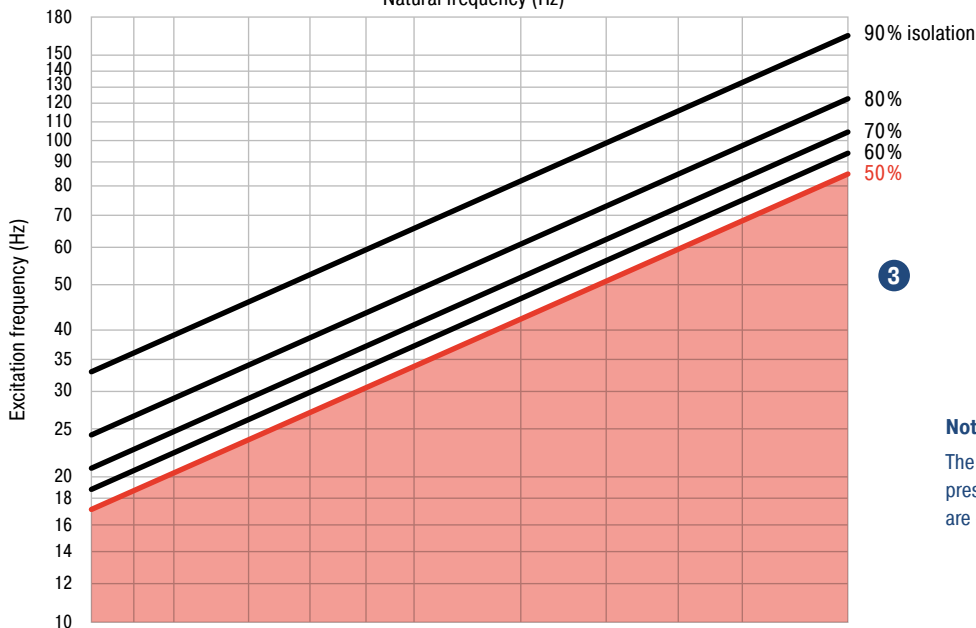
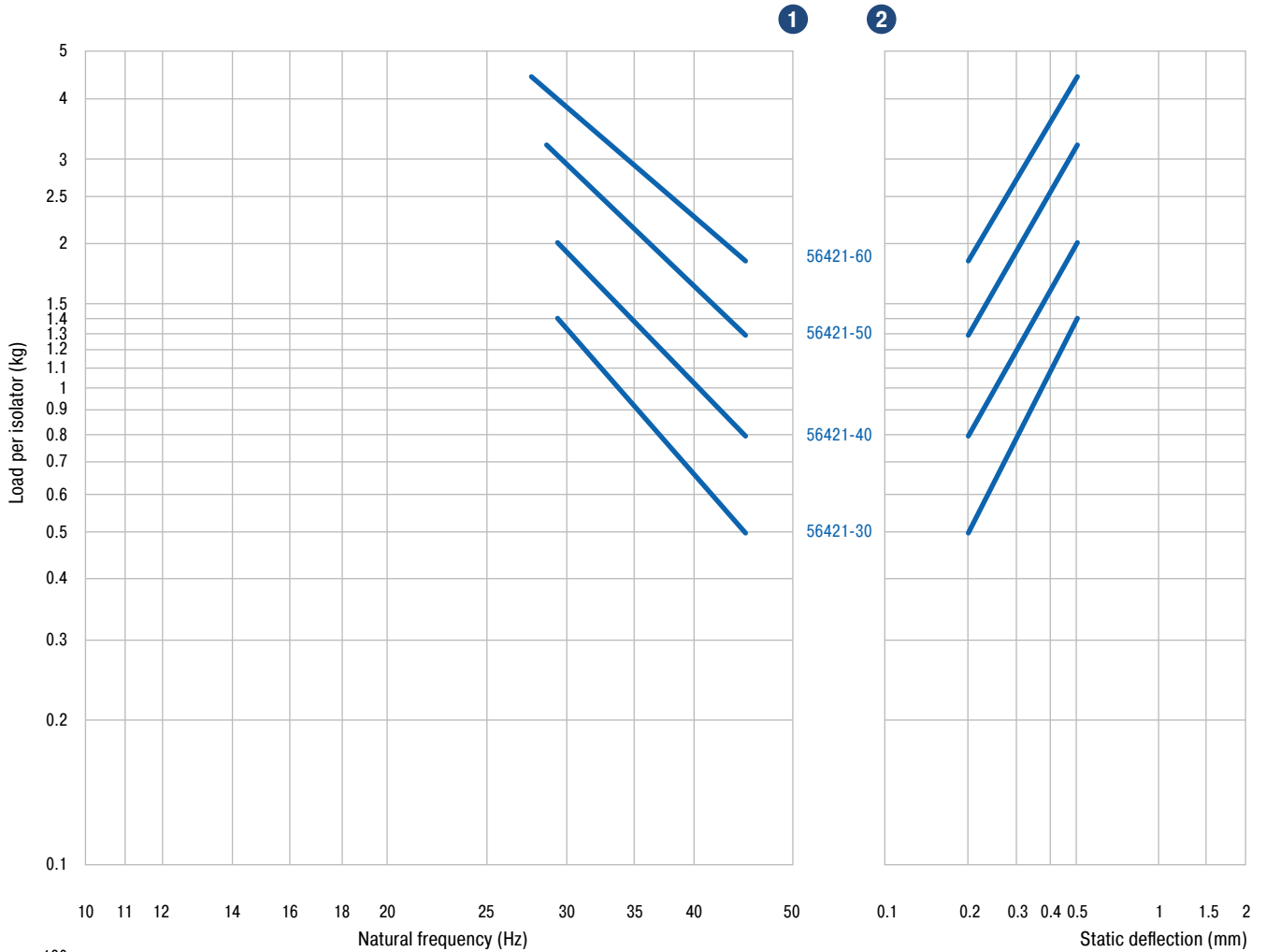
AAM-5220x



Notes
 The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.



AAM-5642x



Notes

The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.



SFM

Stability even in the toughest applications

Ideal for mobile applications

Natural frequency 6.3 Hz to 13 Hz

Load range 20 kg to 997.9 kg

These rugged, fail-safe isolators of the SFM product group are maintenance-free, ready-to-install machine elements. Neoprene is used as the standard damping material for these extremely effective fasteners.

The isolators are used in marine applications and for diesel generators. The SFMs are available in three sizes for applications from 20 kg to 1,000 kg. Their longitudinal rigidity is by a factor of 2.5 higher than their vertical rigidity. The transversal rigidity is by a factor of 0.75 lower than the vertical rigidity. Under maximum load, the SFMs have a natural frequency of only 8 Hz.

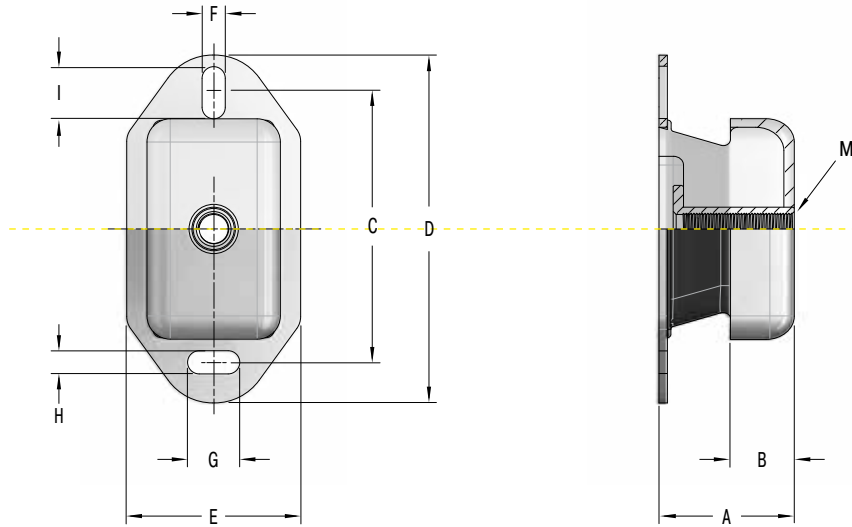
Properties

- Fail-safe
- Low natural frequency
- Rugged
- Versatile
- Maintenance-free
- All metal parts galvanised (ROHS compliant)
- Rubber part made of neoprene (chloroprene rubber)
- Operating temperature range -30 °C to +80 °C

Areas of application

- Power generation
- Off-road vehicles
- Diesel and marine applications

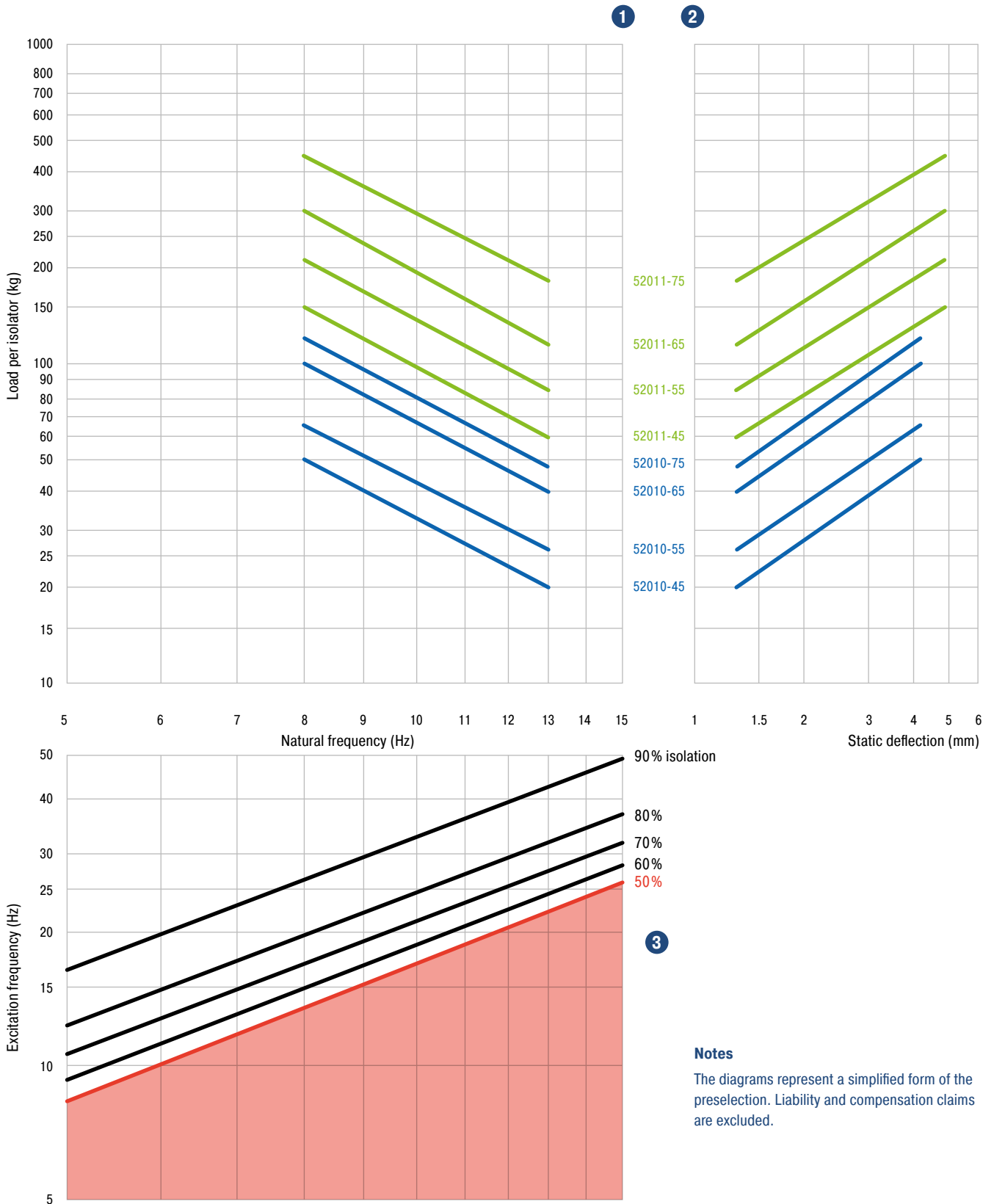
SFM-52010-xx / SFM-52011-xx / SFM-52012-xx



Type	Min. Load kg	Max. Load kg	M	A mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	I mm
SFM-52010-45	20.0	49.9	M12	38.6	20.1	100.1	119.9	59.9	14.2	14.0	10.9	14.0
SFM-52010-55	26.3	65.8	M12	38.6	20.1	100.1	119.9	59.9	14.2	14.0	10.9	14.0
SFM-52010-65	39.9	99.8	M12	38.6	20.1	100.1	119.9	59.9	14.2	14.0	10.9	14.0
SFM-52010-75	48.1	120.2	M12	38.6	20.1	100.1	119.9	59.9	14.2	14.0	10.9	14.0
SFM-52011-45	59.9	149.7	M16	50.0	27.9	140.0	182.9	74.9	13.0	30.0	13.0	20.3
SFM-52011-55	84.4	210.9	M16	50.0	27.9	140.0	182.9	74.9	13.0	30.0	13.0	20.3
SFM-52011-65	119.8	299.4	M16	50.0	27.9	140.0	182.9	74.9	13.0	30.0	13.0	20.3
SFM-52011-75	179.6	449.1	M16	50.0	27.9	140.0	182.9	74.9	13.0	30.0	13.0	20.3
SFM-52012-45	139.7	349.3	M20	72.6	41.9	182.1	228.1	112.0	18.0	34.0	18.0	26.7
SFM-52012-55	207.8	519.4	M20	72.6	41.9	182.1	228.1	112.0	18.0	34.0	18.0	26.7
SFM-52012-65	281.2	703.1	M20	72.6	41.9	182.1	228.1	112.0	18.0	34.0	18.0	26.7
SFM-52012-75	399.2	997.9	M20	72.6	41.9	182.1	228.1	112.0	18.0	34.0	18.0	26.7

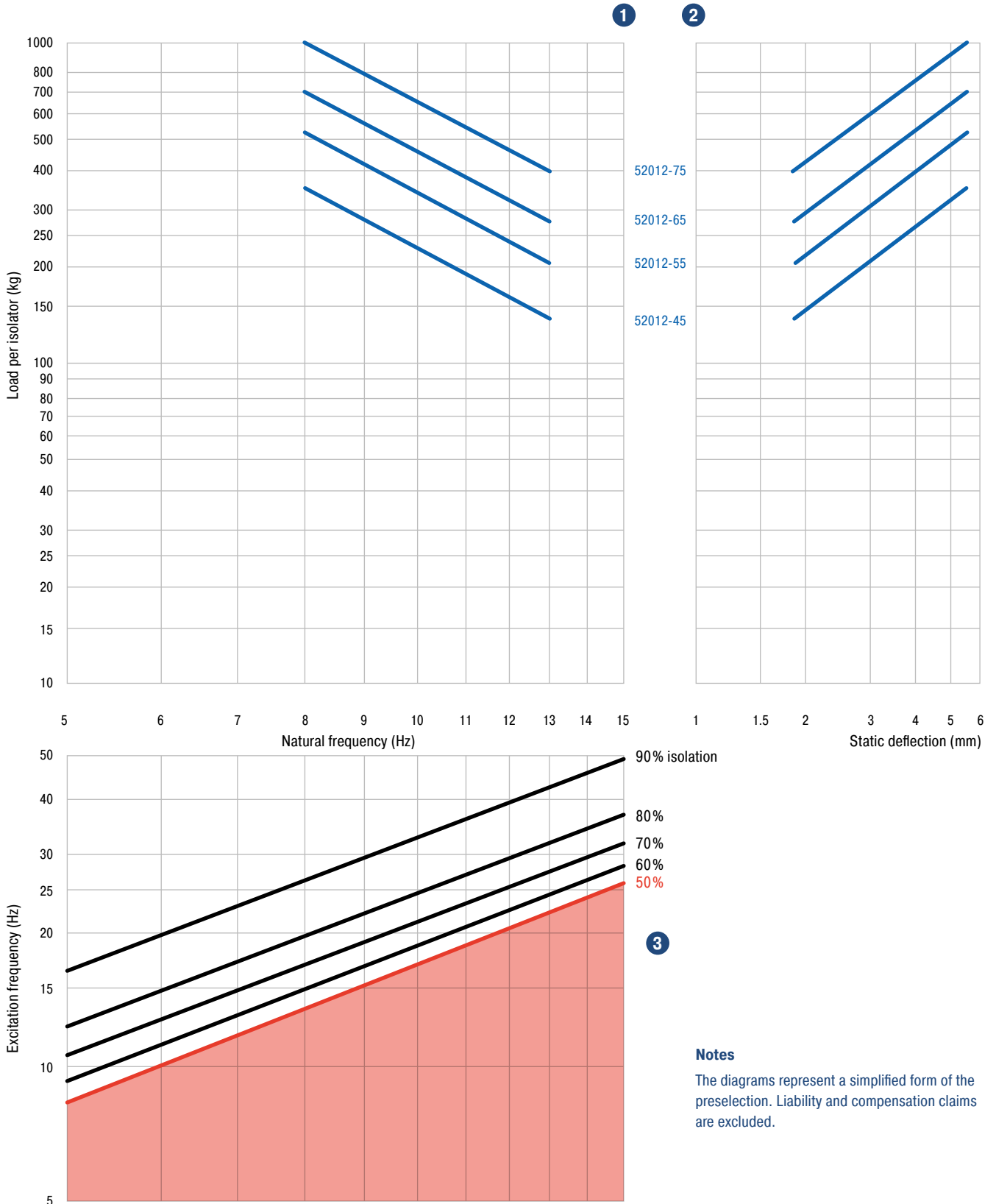


SFM-52010 / SFM-52011





SFM-52012



Notes

The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.



BM

Excellent isolation of light loads

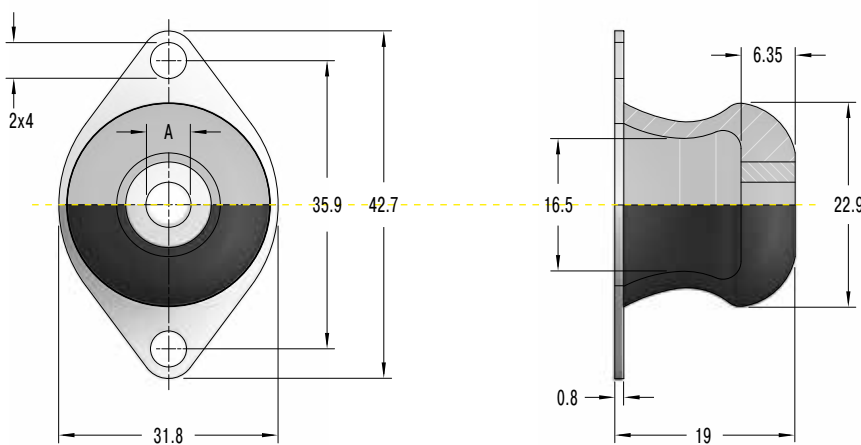
Low-Frequency Vibration Isolators

Natural frequency 8 Hz to 16 Hz

Load range 0.7 kg to 8.2 kg

The BM low-frequency vibration dampers are used to isolate small devices, electronic components and control units.

BMs are mainly used in vertical compressive stresses under load. They efficiently protect electronic or medical equipment against damaging vibrations and shocks.



BM-5064x BM-5068x

Properties

- Good shock absorption
- Low natural frequency
- Small, light design
- All metal parts galvanised (ROHS compliant)
- Rubber part made of neoprene (chloroprene rubber), silicone available on request
- Operating temperature range -30 °C to +80 °C

Areas of application

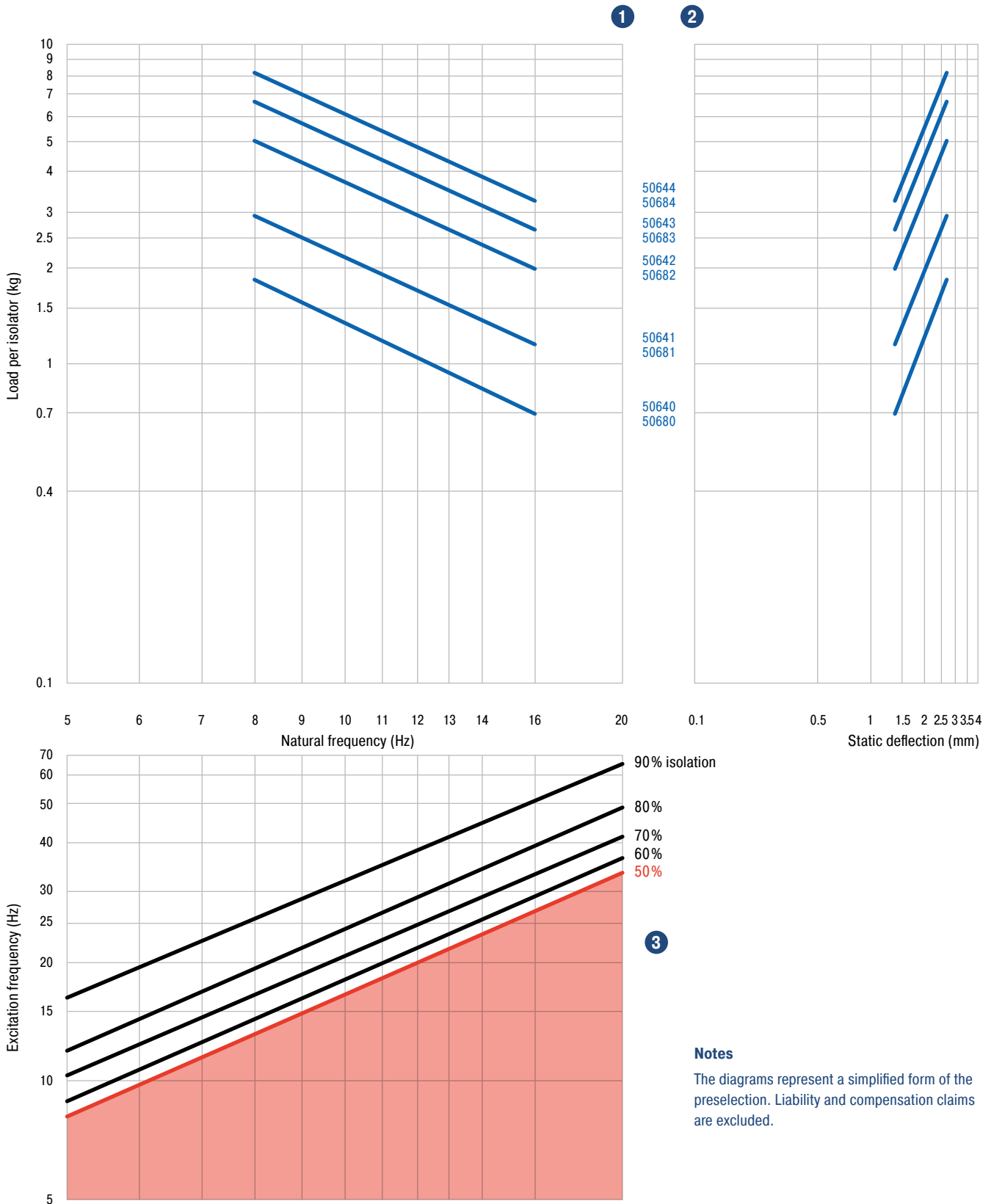
- Medical technology
- Computers
- Electronic equipment
- Aerospace

Type	Colour Code*	Min. Load kg	Max. Load kg	A mm
BM-50640	yellow	0.7	1.8	4.3
BM-50641	red	1.2	2.9	4.3
BM-50642	green	2.2	5.0	4.3
BM-50643	blue	2.7	6.8	4.3
BM-50644	white	3.3	8.2	4.3
BM-50680	yellow	0.7	1.8	6.5
BM-50681	red	1.2	2.9	6.5
BM-50682	green	2.2	5.0	6.5
BM-50683	blue	2.7	6.8	6.5
BM-50684	white	3.3	8.2	6.5

* The colour code is for identifying the loading capacity. The products are marked in colour accordingly.



BM-5064x / BM-5068x





UMO

Elastically mounted
under dynamic loads

Universal Connection Isolators
Natural frequency 10 Hz to 24 Hz
Load range 4 kg to 2,065 kg

UMOs (universal mounts) are two-part isolators for connecting machines or plants with bordering components, such as cabins or housings.

The UMOs can be installed in any spatial position and effectively decouple two components from each other. A galvanised metal limiting sleeve is vulcanised into the elastomer cylinders. The UMOs can be used within the wide temperature range of -30 °C to +80 °C.

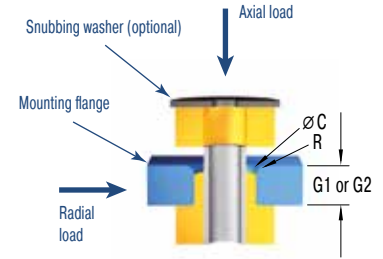
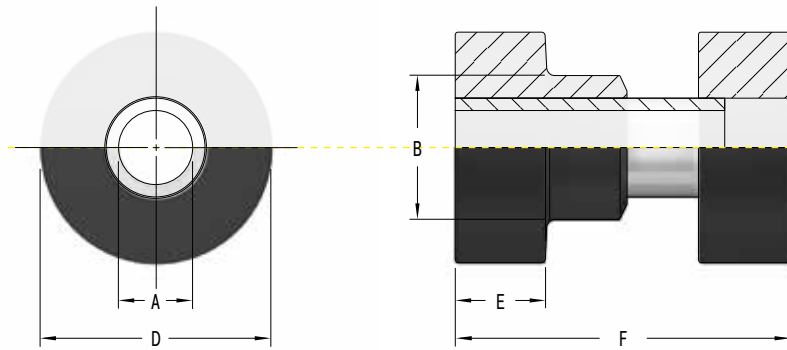
Properties

- Can be installed in all spatial axes
Can be used for shear, compressive and tensile loads
- Simple design
- Fail-safe with the use of stop washers
- All metal parts galvanised (ROHS compliant)
- Rubber part made of neoprene (chloroprene rubber), silicone available on request
- Operating temperature range -30 °C to +80 °C

Areas of application

- Machinery and equipment
- Conveying systems
- Compressors
- Generators
- Shipbuilding
- Construction machines
- Agricultural machines
- Off-road vehicles
- Transport industry

UMO-600xx



∅ C = Mounting hole in flange
R = Required radius
F = Length in installed condition

Type	A mm	B mm	∅ C mm	D mm	E mm	F mm	G1 mm	G2 mm	R mm
UMO-60011 - 60015	9.9	19.8	19.0	31.8	12.7	31.8	9.4		0.75
UMO-60021 - 60025	13.5	33.3	31.8	47.5	19.8	49.3	12.7	14.2	1.5
UMO-60031 - 60035	16.3	39.4	38.1	64.3	22.9	62.2	19.1	22.4	2.0
UMO-60041 - 60045	23.9	58.4	57.2	88.9	25.4	73.2	25.4	28.0	3.0
UMO-60051 - 60055	26.9	64.8	63.5	124.0	31.8	85.9	25.4	28.4	3.0

Type	Colour Code*	Shore (+5)	Load with plate thickness G1				Load with plate thickness G2			
			axial kg	radial kg	fn Hz	T max. Nm	axial kg	radial kg	fn Hz	T max. Nm
UMO-60011	yellow	35	20	10	15	40				40
UMO-60012	red	45	40	15	15	40				40
UMO-60013	green	55	65	20	15	40				40
UMO-60014	blue	65	115	25	15	40				40
UMO-60015	white	75	140	30	15	40				40
UMO-60021	yellow	35	30	20	15	160	60	25	12	160
UMO-60022	red	45	55	40	15	160	80	30	12	160
UMO-60023	green	55	75	60	15	160	110	40	12	160
UMO-60024	blue	65	120	80	15	160	175	75	12	160
UMO-60025	white	75	175	130	15	160	285	125	12	160
UMO-60031	yellow	35	40	30	15	300	95	40	11	300
UMO-60032	red	45	70	50	15	300	160	65	11	300
UMO-60033	green	55	105	75	15	300	220	100	11	300
UMO-60034	blue	65	150	110	15	300	390	175	11	300
UMO-60035	white	75	230	165	15	300	600	315	11	300
UMO-60041	yellow	35	70	50	15	800	125	60	10	800
UMO-60042	red	45	140	100	15	800	230	105	10	800
UMO-60043	green	55	180	140	15	800	350	155	10	800
UMO-60044	blue	65	230	180	15	800	530	265	10	800
UMO-60045	white	75	365	265	15	800	950	440	10	800
UMO-60051	yellow	35	140	70	15	1,120	515	110	10	1,120
UMO-60052	red	45	230	100	15	1,120	875	155	10	1,120
UMO-60053	green	55	320	140	15	1,120	1170	275	10	1,120
UMO-60054	blue	65	410	215	15	1,120	1600	400	10	1,120
UMO-60055	white	75	545	300	15	1,120	2065	640	10	1,120

* The colour code is for identifying the loading capacity. The products are marked in colour accordingly.



FL

Vibrations are easily isolated in different directions

Quick Fastening Elements
Load range 0.4 kg to 28 kg

FLs are removable quick fastening elements for vibration isolation and shock absorption as well as the isolation of structure-borne noise. Their extremely simple design is so selected that only one element can be used to effectively decouple two components from each other by tightening a fastening screw.

Standard metric screws (M3 to M8) can be used to tighten the connecting elements; no additional special tools are required. The FL elastic fasteners can be fixed via the screw connection into blind holes to connect panel elements to existing structures, for example. The inner threaded insert serves as an expansion element for fastening. The EPDM material used is resistant to ozone, oil and most acids. Standard FLs are available in 5 sizes from M3 to M8.

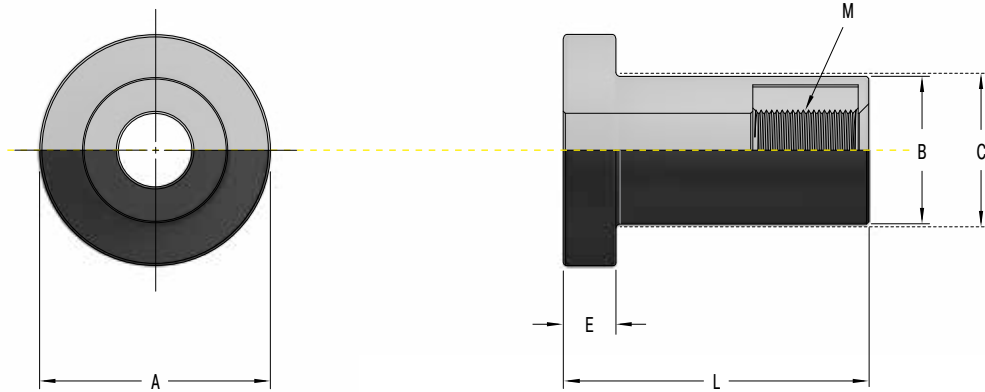
Properties

- Easy handling
- Efficient decoupling of housings
- No special tools necessary
- Isolates structure-borne noise
- Fail-safe
- Resistant to oil and UV radiation
- Rubber part made of neoprene (chloroprene rubber)
- Operating temperature range -30 °C to +80 °C

Areas of application

- Machines and assemblies
- Tiling, sheets and flanges
- Attachments to buildings
- Vehicles and transport industry
- Construction machines

FL-Q-x



Type	Sheet assembly		Blind hole assembly	M	A mm	B mm	C ¹ mm	E mm	L mm	P ² mm	T I ³ Nm	T II ⁴ Nm
	Pressure kg	Shear kg										
FL-Q-3	5	2.5	1.0	M3	9	6.7	7.2 ⁰ _{-0.3}	2.5 ^{+0.4} ₀	11.5 ⁺¹ _{-0.5}	0.6 - 2.5	0.4 - 0.5	0.3 - 0.4
FL-Q-4	7	3.5	1.0	M4	12	8.5	9.3 ⁰ _{-0.3}	3.0 ^{+0.4} ₀	14.5 ^{+1.5} _{-0.5}	0.8 - 3.3	0.4 - 0.6	0.4 - 0.5
FL-Q-5	10	5.0	1.5	M5	15	9.8	10.2 ⁰ _{-0.3}	3.5 ^{+0.4} ₀	18.0 ^{+1.5} _{-0.5}	0.8 - 4.3	0.6 - 1.0	0.5 - 0.6
FL-Q-6	14	7.0	3.0	M6	18	12.0	12.7 ⁰ _{-0.3}	4.0 ^{+0.4} ₀	21.0 ^{+/-1}	1.5 - 5.0	2.3 - 3.5	0.7 - 0.9
FL-Q-8	28	14.0	5.0	M8	24	16.0	16.5 ⁰ _{-0.5}	5.0 ^{+0.4} ₀	27.0 ^{+/-1}	1.5 - 6.5	3.0 - 4.0	1.6 - 1.8

- 1 Corresponds to mounting hole
- 2 Sheet thickness
- 3 Tightening torque T I (Drawing 01)
- 4 Tightening torque T II (Drawing 02)

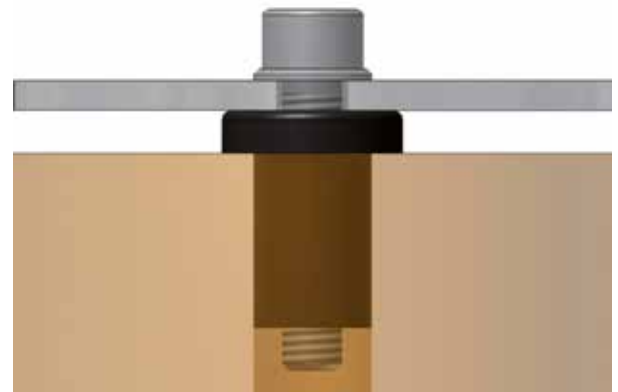
Sheet assembly

Drawing 01



Blind hole assembly

Drawing 02



02

Vibration-Isolating Plates



SLAB

Universal Damping Plates

For application on foundations for plants and machines, compressors, in pump stations, generators, for insulations, measuring tables, buildings, etc.



CEL

Low-Frequency Damping Plates

For use in foundations, buildings, transport routes, bridges, stairs, test benches, pump stations, generators, compressors, machines, etc.



PAD

Rugged Fibre and Elastomer Plates

For isolating and protecting foundations, e.g. of presses, plants, machines, as well as for use in pump stations, crane runways, bridges and heavy-duty applications

Vibration-isolation made to measure

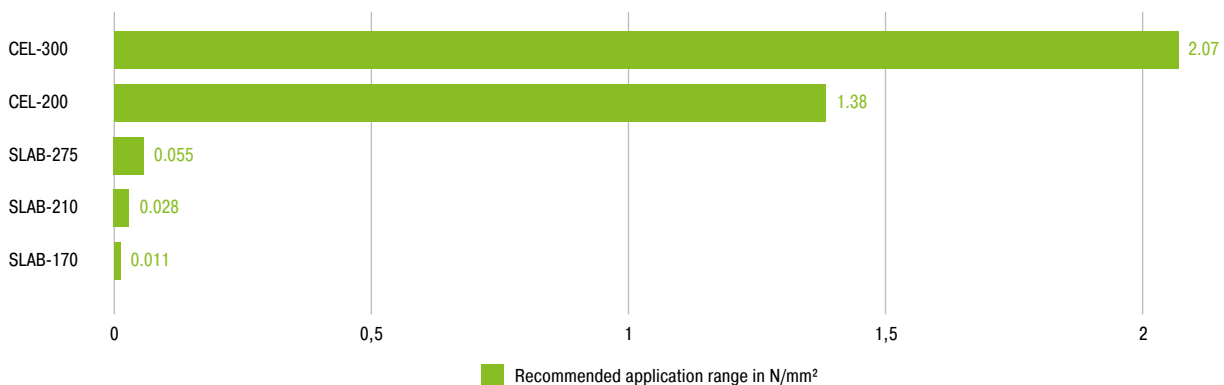
Variable, flexible, custom-made

Vibration-isolating ACE plates are used whenever an adjusted isolation of vibrations and structure-borne noise is required.

The right damping solution for standard applications can be simply found by using the selection diagrams (following pages). The right material type can be identified independently of the load via the desired damping in relation to the excitation frequency. The ideal plate size can be quickly calculated on the basis of the load area.

A rough preselection of suitable plate materials can be made by consulting the permissible surface pressures of different plate materials.

Application range according to surface pressure



The SLAB and CEL plates can either be ordered in their standard size or cut according to customer request. We require the desired specifications and quantities for calculating the required parts.

The custom-cutting of the plates allow the realisation of almost any shape and solution. In addition, various plates can be layered, glued and combined with reinforcing plates (steel) or sliding layers (PTFE).

The PAD product group is made from fibre-reinforced plate material used for very high loads of up to 13.8 N/mm².



SLAB

Customisable in many forms

Universal Damping Plates

Natural frequency 12 Hz to 50 Hz

Load range 0.002 N/mm² to 0.055 N/mm²

SLAB damping plates of model series SL-170 to SL-275 are universally applicable elastic PUR materials which are manufactured according to a patented formula and can be used for a large number of applications.

The plates with standard sizes of 170 kg/m³ to 275 kg/m³ serve as starting materials for the vibration isolation of different applications in industry and construction. The static and dynamic product properties are used as the basis for the selection of the most suitable damping solution.

The material determination (see selection diagram) is used to make the preselection of the correct damping material, after which, in a second, easy step, the suitable dimensions of the support are determined. SLABs are delivered as pre-fabricated standard plates or can be freely cut from the raw material (roll and plate material).

Standard SLABs are supplied in material thickness of 12.5 mm and 25 mm. On request, the sizes of delivered plates can be cut freely from the standard 800 x 1,500 mm stock. Sample plates with dimensions 220 x 150 mm and the respective thicknesses are available for test purposes and small applications, with maximum machinable dimensions up to 5,000 x 1,500.

Properties

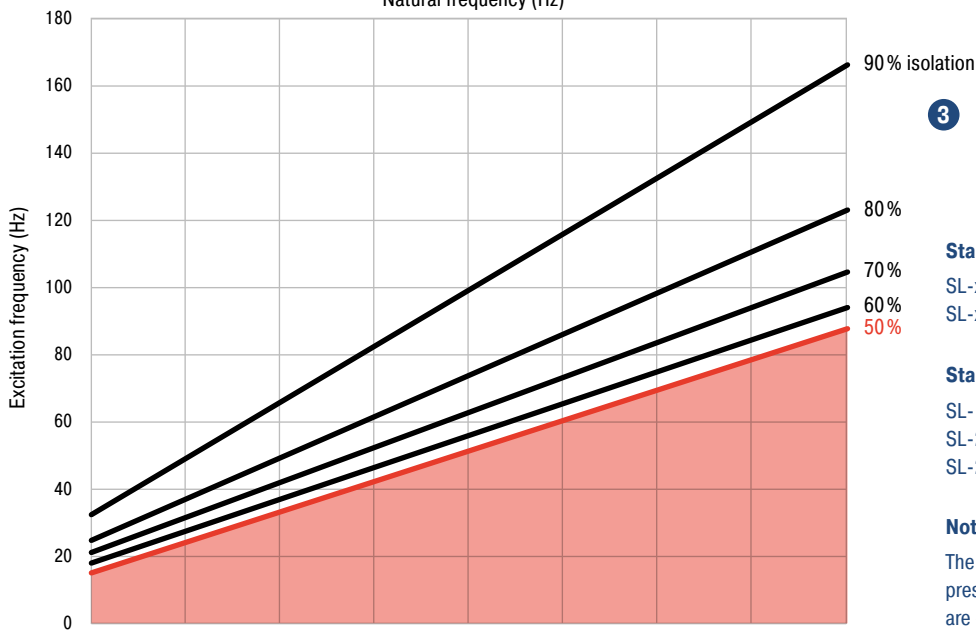
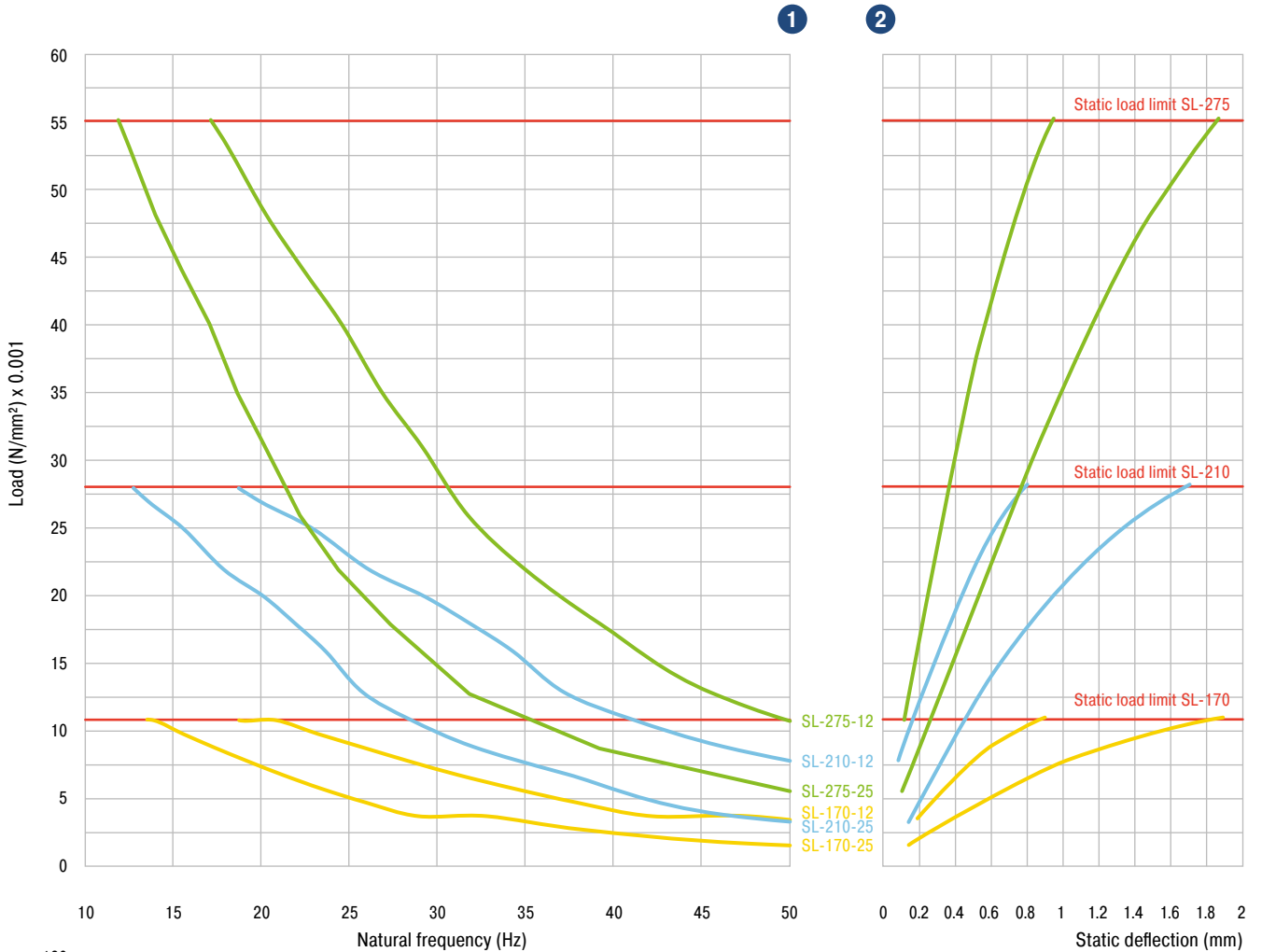
- Can be cut to many different shapes (water jet cutting)
- Can be combined to any desired isolation packages
- On-site vibration measurement and selection
- Special dimensioning software, no additional costs for designing
- Highly damping PUR
- Operating temperature range -30 °C to +70 °C

Areas of application

- Foundations of plants and machines
- Compressors
- Pump stations and generators
- Pipeline isolation
- Test benches, measuring tables and their foundations
- Buildings
- Staircase bearing surfaces



SL-170 / SL-210 / SL-275



Standard thicknesses

- SL-xxx-12: 12.5 mm
- SL-xxx-25: 25 mm

Standard colours

- SL-170: Yellow
- SL-210: Blue
- SL-275: Green

Notes

The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.

Damping Pads

from the SLAB series



www.ace-ace.com



SLAB 030 to SLAB 300

Fast, flexible and adapted to your conditions

It is simply adhered to assemble.

Whether pads, cuts or drawing parts, stocked SLAB pads in combination with our freely programmable cutting machine ensure maximum flexibility with excellent delivery speed.

Free service hotline, T +49 (0)2173 - 9226-4100



CEL

Efficient decoupling of vibrations

Low-Frequency Damping Plates

Natural frequency 11 Hz to 60 Hz

Load range 0.35 N/mm² to 2.1 N/mm²

CEL damping plates are produced from a special nitrile rubber which damps at low-frequencies.

The damping plates can be custom-cut and glued together to form multiple layers depending on the application. The tried-and-tested CEL damping plates are used in the field of machine and plant engineering. Here the plates take charge of isolating the floor or foundation to the plant or machine. Damaging vibrations are prevented, increasing production or measuring quality.

Properties

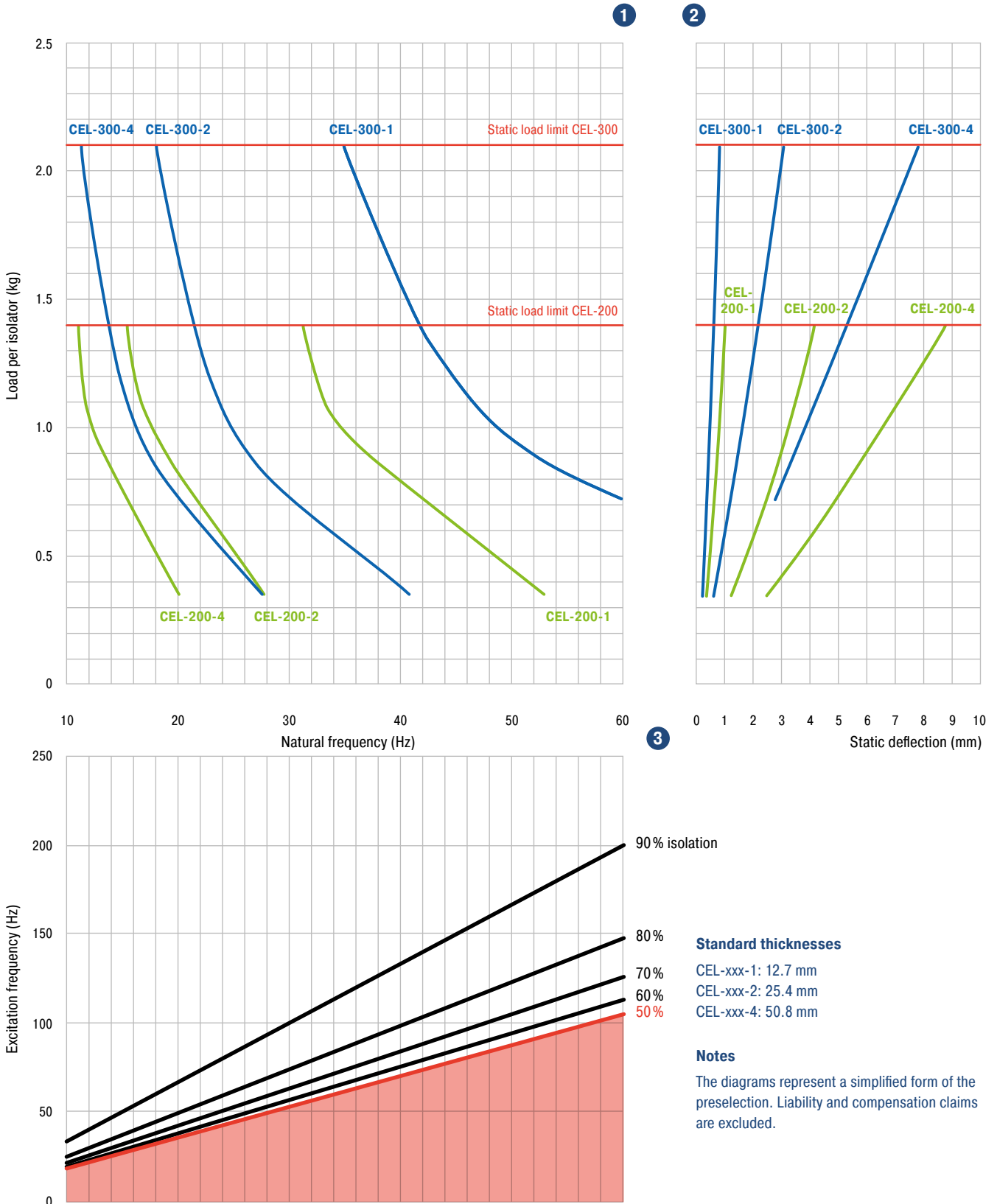
- Can be combined to form any desired isolation packages or glued together
- On-site vibration measurement and selection
- Special dimensioning software, no additional costs for designing
- Operating temperature range -20 °C to +65 °C

Areas of application

- Foundations of plants and machines
- Compressors
- Pump stations and generators
- Pipeline isolation
- Test benches, measuring tables and their foundations
- Buildings
- Transport routes, bridges
- Staircase bearing surfaces



CEL-200 / CEL-300





PAD

Robust for cushioning heavy loads

Rugged Fibre and Elastomer Plates

Natural frequency for shock absorption only

Load range 0 N/mm² to 13.8 N/mm²

The PAD fibre and Elastomer Plates combine the positive properties of isolating elastomer bearing surfaces with the reinforcing effect of fibre inlays.

The PADs are rugged damping plate for use in heavy-duty applications, e.g. under crane runways, in steel construction, pipeline construction and the coal, iron and steel industry. Due to their physical properties, the PAD plates provide outstanding damping against shocks and impacts and isolate vibrations and structure-borne noise.

Depending on the shape and selected dimensions, PADs can withstand compressive loads of up to 69 N/mm². In general, the maximum surface pressure is 13.8 N/mm².

Properties

- Rugged
- Can be custom-cut
- Low creep tendency
- Thickness: 1,185 kg/m³
- Operating temperature range -55 °C to +95 °C

Areas of application

- Foundations of presses, plants and machines
- Impact plates
- Pipelines
- Conveying systems
- Pump stations and generators
- Crane runways
- Bridges
- Heavy-duty applications

Due to the layered structure, the material exhibits excellent compressibility. This allows spring deflections to be reached without material flow (custom-fit installation complying with defined dimensions possible). The excellent material properties are also apparent in the very good creep behaviour under load. For example, under continuous static load, the material only exhibits a creep tendency of approx. 5%.

Depending on the application, the PADs can be custom-cut to meet customer specifications and be used as supports, discs and sleeves with an isolating/damping effect.

Note

PADs consist of organic material subject to batch-based fluctuations

PADs meet the following military specifications: MIL-C-882 and MIL-E-5272A.

The PADs are resistant to most oils, water vapour, water, mould and brine. Their operating temperature range is between -55 °C and +95 °C.

The hardness of PADs is 90 ±5 shore A.

The standard plates are available in different thicknesses, graduated between 1.6 and 25.4 mm. Other thicknesses are available by combining the standard thicknesses via gluing. A combination with steel plates or PTFE plates as equal layers is also available on request.

Selection and calculation

As with a conventional shock absorption application, the selection of a suitable material thickness and material dimensions is based on the consideration of the kinetic energy in the system in relation to the desired damping value. The hysteresis curve for the respective material is then taken as the basis for selecting the correct material dimensions, such as the length, width and height of the damper.

To measure the kinetic energy, we suggest you to try our shock absorption calculation software which we offer on our website free of charge. No need even to register, you can easily enter the required values here and obtain a suitable solution recommendation.

Our in-house and field application technicians are happy to assist you with this as with other issues.

03

Low-Frequency Air Spring Elements



PLM

Pneumatic Air Spring Elements

For an efficient isolation of measuring equipment, high-speed presses and machines.



PAL

Air Spring Elements with Automatic Level Controls

Isolation against disruptive vibrations and level-adjustment for test and measuring equipment. Isolating at extremely low-frequencies, these components are used in the automotive industry and in aerospace engineering.



PLM

Easy to use,
wide selection

Pneumatic Air Spring Elements
Natural frequency 3 Hz to 10 Hz
Load range 20 kg to 8,800 kg

PLM air spring elements offer low-frequency vibration and shock isolation for measuring stations, coordinate measuring machines, fans, air compressors, motor and generator units, high-speed presses and more.

The PLM air spring series comprises low-frequency vibration and shock isolators which reduce undesirable vibrations while simultaneously levelling the supported devices.

When used as a vibration damper, the internal air chamber already guarantees a significant isolating effect from 5 Hz upwards. In an optimally loaded condition, the natural frequency is 3.0 Hz. PLM air spring elements also isolate in a pressure-free state.

The vertical natural frequency of the elastomer body is approximately 10 Hz, meaning that disturbances above 14 Hz are isolated.

The ratio of vertical to horizontal natural frequency is roughly 1:1 with high horizontal stability.

For applications with shock or impact loads, the elastomer wall design of the PLM air springs offer high dynamic spring deflection. If one wishes simultaneously to retain the low natural frequency of 3 Hz, the use of external arrestors is recommended in order to prevent the air springs from breaking through.

The PLM design features a vulcanised thread insert, by means of which the air springs can be inflated either with a standard tyre valve or a pneumatic fitting. Special connections are not necessary.

The isolators are delivered with a valve. They are inflated and levelled manually with the aid of hand pumps or adaptors connected to an air supply. If a compressed air fitting is mounted on the air springs, they can be connected to the controlled air supply system. This facilitates the pressurisation and the level control. In the event that no level control valve is used, a control unit can be provided to regulate the pressure and the height of the air springs linked to each other.

In addition, the PLM air spring elements can be supplied with automatic level control valves for height regulation. Each master isolator has a built-in level control valve which functions as a load detector and position sensor.

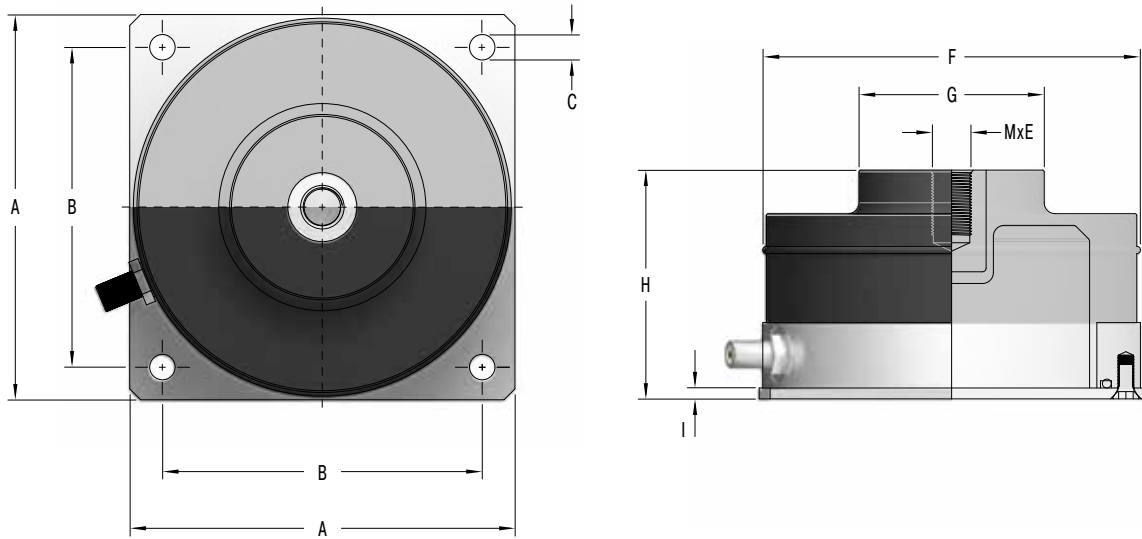
Properties

- Low natural frequency of 3 Hz
- Easy level control via integrated valve
- Height regulation control on request
- Ratio of horizontal to vertical natural frequency 1:1

Areas of application

- Measuring tables
- Test benches
- High-speed presses
- Production plants

PLM



Type	Max. Load kg	M	A mm	B mm	C mm	E mm	F mm	G mm	H mm	I mm
PLM 1	45	M10	76	60.5	6.9	12.0	73	25	65	3.2
PLM 3	150	M12	106	89	6.9	13.5	105	56	65	3.2
PLM 6	250	M12	130	108	7.4	13.5	127	60	90	3.2
PLM 12	550	M12	175	152	7.4	13.5	171	100	90	3.2
PLM 24	1100	M16	254	216	14.2	19.0	245	138	90	4.8
PLM 48	2200	M16	343	305	14.2	19.0	338	190	90	4.8
PLM 96	4400	M24	470	406	20.6	22.4	468	267	90	6.4
PLM 192	8800	M24	610	508	20.6	22.4	610	400	90	6.4

Any number of parallel air springs can be added in order to increase the loading capacity of the overall system.

Our technicians are happy to assist you in the selection process and provide any support you require.

Selection and calculation

The best isolation values can be achieved for the use of PLM air springs when the maximum load of the individual air spring elements is utilised to the fullest extent possible.

In standard applications, it is sufficient to select PLM air spring elements on the basis of the weight of the machine or plant to be isolated. If the maximum isolation effect is to be realised, additional weights (steel or e.g. granite plates) may have to be added so as to achieve the maximum permitted load range and thus the ideal isolation effect.

Note

When commissioning, please ensure that pressure is first applied on the PLM air spring elements before they are filled to the desired operating pressure (max. 5 bar for sizes 1 and 3; max. 6 bar for the remaining sizes) using the valve.

A separate usable control unit can be used to check the operating condition and adjust to the desired amount.

PAL

Air Spring Elements with Automatic Level Controls

Air spring elements of the PAL series offer superior low-frequency vibration isolation for measuring devices, electron microscopes, MRT equipment, coordinate measuring machines and precision manufacturing machines.

PAL air spring systems use level-controlled air springs. These isolators are ideal for conditions which require a constant level and vibration isolation at the same time. The PAL isolators meet all important requirements for measuring devices, electron microscopes, measuring stations and precision manufacturing machines.



Standard PAL isolators have a natural frequency of up to 1.7 Hz – depending on the height of the isolator. Even lower natural frequencies (up to 0.5 Hz) are possible for isolators manufactured according to customer specifications.



Properties

- Height-adjustable
- Low-frequency isolation, natural frequencies of up to 0.5 Hz possible

Areas of application

- Test and measuring equipment
- Aircraft and automotive test benches
- Foundation bearing surfaces

Extremely low-frequency-calibrated precision isolators for use in high-resolution measuring and testing systems.

A complete PAL system consists of at least three master isolators for a 3-point level control. Each isolator has a built-in level control valve which functions as a load detector and height control. Any number of slave isolators can be added in order to bear the overall weight of the equipment.

The scope of supply of a system contains a control unit, automatic level control valves, pneumatic lines and all the additional pneumatic accessories required for a complete system installation.

PAL air springs react quickly to changes in load or balance, with deviations from a preset position being automatically readjusted.

The performance of an air spring system is always a compromise between natural frequency (isolation), the resetting accuracy of the level control valve and the control setting time.

The control setting time is defined as the time required by the isolation system to reach a preset reference value again after a defined disturbance.



The disturbance can be caused by environmental factors or inherent machine forces, such as the movement of the measuring bridge of a measuring machine.

The control setting time is minimised with an optimal damping effect and an adequate flow through the valve. Long control setting times are not acceptable for air springs, as this can induce errors in repeat accuracy in the case of precision measuring devices and positioning machines as well as lower part throughput rates.

Depending on the application, ACE offers many different level control valves. The decisive variables for designing an acceptable solution are the valve flow-through and rigidity, as well as accuracy characteristics. Reset accuracies of +/- 0.15 mm or +/- 0.025 mm are available. The valve flow-through and rigidity are selected on the basis of the air spring design and the damping.



PAL-3 to PAL-9
Small size



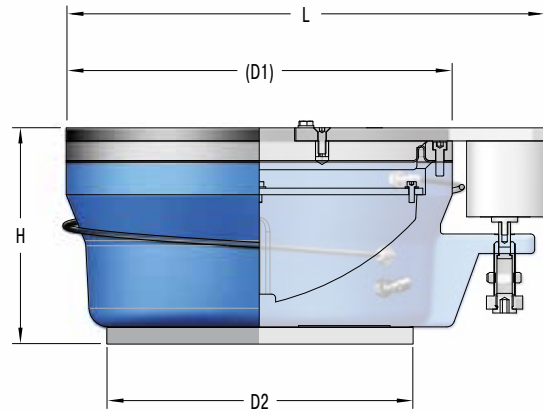
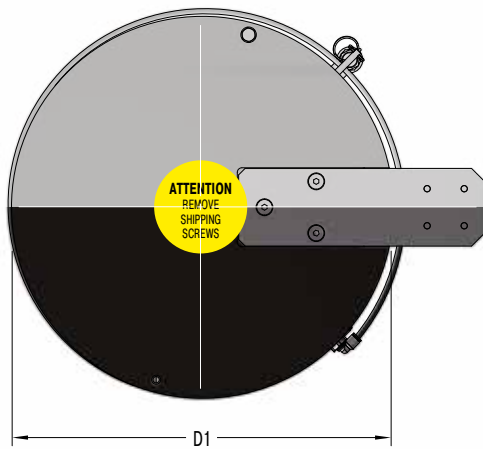
PAL-18 to PAL-1000
Large size



PAL-5.5-2.5
with level control valve PALV 5-5

The figures are not to the same scale.

PAL



Type	D1 mm	D2 mm	H (pressureless) mm	H (Max. Stroke) mm	L mm	Max. Load* kg	Special design only on request
PAL 21-6	200	150	153	163	270	950	
PAL 21-12	200	200	305	315	270	950	■
PAL 36-6	220	190	153	163	290	1,630	
PAL 36-12	220	220	305	315	290	1,630	■
PAL 55-6	260	230	153	163	330	2,500	
PAL 55-12	260	260	305	315	330	2,500	■
PAL 75-6	300	265	153	163	370	3,400	
PAL 75-12	300	285	305	315	370	3,400	■
PAL 133-6	380	350	153	163	450	6,030	
PAL 133-12	380	380	305	315	450	6,030	■
PAL 255-6	530	470	153	165	600	11,560	
PAL 255-12	530	460	305	317	600	11,560	■
PAL 416-8	640	585	203	215	710	18,200	
PAL 3-2.5	80	80	64	70		133	
PAL 5.5-2.5	100	100	64	70	177	245	
PAL 9-4	130	130	94	98		385	
PAL 9-6	130	130	153	159		385	

* At a maximum operating pressure of 7 bar

Note

The maximum permissible horizontal movement of the PAL air spring elements can be limited to 3 mm, if necessary.

Isolation properties

Natural frequency	PAL xx-6 Hz	Pal xx-12 Hz	Damping	PAL xx-6 %	Pal xx-12 %
vertical	2.5 - 2.7	1.5 - 1.7	vertical (adjustable)	6 - 20	6 - 20
horizontal	2.0 - 4.5	2.0 - 4.5	horizontal	5 - 6	5 - 6

Design service and analysis

Low-frequency vibrations and strong shocks and force peaks influence the accuracy, production quality and productivity of high-performance and precision machinery.

The specifications for the maximum permissible accelerations and vibrations are often prescribed by the manufacturers of testing, measuring and production machines. Our expert team is happy to assist you with analysing the site conditions and selecting the right isolators for complying with the required system parameters.

On request, we execute highly precise measurements on site and document the respective target and actual conditions or develop suitable system solutions with our customers. Requirements and solution models may vary widely from case to case.

Our technicians are happy to assist you in the selection process and provide any support you require.

Application examples



Measuring tables, example: coordinate measuring machine

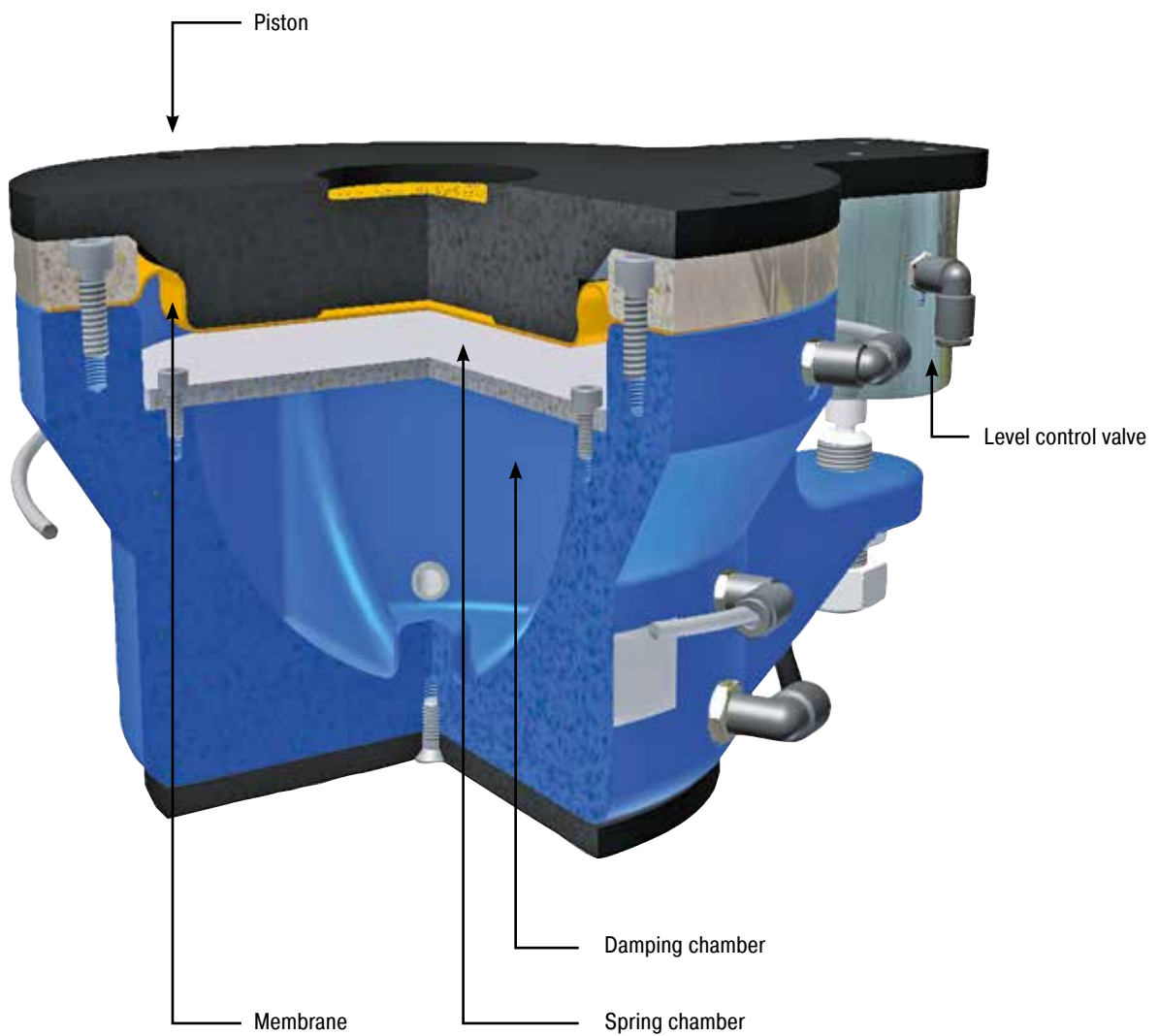


Test benches, example: street simulation test bench

PAL

Air Spring Elements with Automatic Level Control

Structure



in Countries without ACE Facility

ARGENTINA, CHILE, PARAGUAY, URUGUAY

NEW CLEVERS SA
 Avenida Larrazabal 1949 - CABA
 T +54-9 11 7700 0035
 info@clevers.com.ar
 www.clevers.com.ar

AUSTRIA

ACE STOSSDÄMPFER GMBH
 Albert-Einstein-Straße 15, 40764 Langenfeld
 Germany
 T +49-2173-9226-4000
 F +49-2173-9226-29
 www.ace-ace.de
 (distributors on request)

BELARUS

BIBUS (BY) COOO
 8th Per. Ilyicha 13a, office 2.1
 246013 Gomel, Belarus
 T +375-232 29 31 39
 www.bibus.by
 (not distributor for gas springs and HB dampers)

BELGIUM

ACE STOSSDÄMPFER GMBH
 Albert-Einstein-Straße 15, 40764 Langenfeld
 Germany
 T +31-165 71 44 55
 benelux@ace-int.eu
 www.ace-ace.com
 (distributors on request)

BRASIL

OBR EQUIPAMENTOS INDUSTRIAIS LTDA.
 Dona Francisca, 10.190 - Galpão 4
 Distrito Industrial Norte - CEP: 89.219-615
 T (47) 3435-4464 | (11) 2067-3698
 obrsc@obr.com.br
 www.obr.com.br

BULGARIA

LD GMBH
 5, Asen Yordanov Blvd.
 1592 Sofia, Bulgaria
 T +359-2 931 97 30 / 926 90 11
 www.ld-gmbh.com

CROATIA

BIBUS ZAGREB D.O.O.
 Anina 91, 10000 Zagreb, Croatia
 T +385-1 3818 004
 F +385-1 3818 005
 www.bibus.hr
 (not distributor for gas springs and HB dampers)

For gas springs & HB dampers please contact:
 ACE STOSSDÄMPFER GMBH
 Albert-Einstein-Straße 15, 40764 Langenfeld
 Germany
 T +49-2173-9226-4100
 www.ace-ace.com

CZECH REPUBLIC

BIBUS S.R.O.
 Videnska 125, 619 00 Brno, Czech Republic
 T +420-547 125 300
 www.bibus.cz
 (not distributor for gas springs and HB dampers)

DENMARK

AVN AUTOMATION A/S
 Bergsoesvej 14, 8600 Silkeborg, Denmark
 T +45-70 20 04 11
 F +45-86 80 55 88
 www.avn.dk

ECUADOR, COLOMBIA, GUYANA

STABILUS BRASIL
 Av. Tancredo de Almeida Neves, 1135 Itajubá,
 MG, Brazil
 T +55 3629 5000
 info@stabilus.com.br
 www.stabilus.com

FINLAND

NESTEPAINE OY
 Makituvantie 11, 01510 Vantaa, Finland
 T +358-20 765 165
 www.nestepaine.fi

MOVETEC OY

Suokalliontie 9, 01740 Vantaa, Finland
 T +358-9 5259 230
 www.movetec.fi

FRANCE

BIBUS FRANCE
 ZI du Chapotin, 233 rue des frères Voisin
 69970 Chaponnay, France
 T +33-4 78 96 80 00
 F +33-4 78 96 80 01
 www.bibusfrance.fr
 (not distributor for gas springs and HB dampers)

For gas springs & HB dampers please contact:
 ACE STOSSDÄMPFER GMBH
 Albert-Einstein-Straße 15, 40764 Langenfeld
 Germany
 T +49-2173-9226-4100
 www.ace-ace.com

GEORGIA

TECHVITAS LLC
 Gotua str. #3, 0160, Tbilisi, Georgia
 T +995-558 110 992
 www.techvitas.ge

HUNGARY

BIBUS KFT.
 Almáskert út 9, 2220 Vecses, Hungary
 T +36-29-557-763
 www.bibus.hu
 (not distributor for gas springs and HB dampers)

Gas spring & HB damper specialists:
 DUNA CONSULTING KFT.
 Gábor Áron u. 18.
 2013 Pomáz, Hungary
 T +36-1 433 4700 / +36-30 26 36 576
 F +36-1 264 8900
 www.acegazrugo.hu

IRELAND

HANLEY CONTROLS CLONMEL LTD.
 Gortnaflour, Clonmel, Co. Tipperary
 T +353-52-6122722
 info@hccl.ie
 www.hccl.ie

ISRAEL

ILAN & GAVISH
 AUTOMATION SERVICE LTD.
 24, Shenkar Street, Qiryat-arie 49513
 PO Box 10118, Petha-Tiqva 49001, Israel
 T +972-39 22 18 24
 F +972-39 24 07 61
 www.ilan-gavish.co.il

Medital Novelty Ltd.
 Shacham Street 36, Petach Tikva, Israel
 T +972 73-2000200
 novelty@medital.co.il
 www.medital.co.il

ITALY

R.T.I. S.R.L.
 Via Chambery 93/107V, 10142 Torino, Italy
 T +39-011-70 00 53
 F +39-011-70 01 41
 www.rti-to.it

LITHUANIA

TECHVITAS
 Dubysos g. 66A, 94107 Klaipeda, Lithuania
 T +370-46 355 494
 www.techvitas.lt

LUXEMBOURG

ACE STOSSDÄMPFER GMBH
 Albert-Einstein-Straße 15, 40764 Langenfeld
 Germany
 T +31-165 71 44 55
 benelux@ace-int.eu
 www.ace-ace.com
 (distributors on request)

NETHERLANDS

ACE STOSSDÄMPFER GMBH
Albert-Einstein-Straße 15, 40764 Langenfeld
Germany
T +31-165 71 44 55
benelux@ace-int.eu
www.ace-ace.com
(distributors on request)

NORWAY

BERGSLI-HANTEK AS
P.O. Box 2553
3702 Skien
T +47-3550 3550
post@hantek-as.no
www.bergslihantek.no

PERU

DESTACO INGENIEROS SAC
HQ: Jr. Atalaya 250 Breña
Shop-store: Jr. Ramón Cárcamo 565 Int. 144-145
Zip: 15082, Lima
M +51-998371570
www.destacoingenieros.com

POLAND

BIBUS MENOS SP. Z.O.O.
ul. Spadochroniarzy 18, 80-298 Gdańsk, Poland
T +48-58 660 95 70
www.bibusmenos.pl
(not distributor for gas springs and HB dampers)

PORTUGAL

AIRCONTROL INDUSTRIAL S.L.
Alameda Fernao Lopes 31A
Torre 2 - Miraflores
1495-136 Alges (Lisboa), Portugal
T +351-21 410 12 57
F +351-21 410 56 08
www.aircontrol.es

BIBUS PORTUGAL LDA
Rua 5 de Outubro, 5026
4465-079 S. Mamede de Infesta, Porto, Portugal
T +35-122 906 50 50
F +35-122 906 50 53
www.bibus.pt
(not distributor for gas springs and HB dampers)

ROMANIA

BIBUS SES S.R.L.
134/1 Calea Lugojului, 307200 Ghiroda, Timis,
Romania
T +40-356 446 500
www.bibus.ro
(not distributor for gas springs and HB dampers)

RUSSIA

BIBUS O.O.O.
Str Zemskaja 94, 198205 Saint Petersburg, Russia
T +7 812 309 41 51
www.bibus.ru
(not distributor for gas springs and HB dampers)

SERBIA

BIBUS INDUSTRY DOO ŠABAC
Ćirila i Metodija 15, 15000 Šabac, Srbija
T +381-60 60 60 572
imi@bibus.rs
www.bibus.rs

SLOVAKIA

BIBUS SK S.R.O.
Trnavska cesta, 94901 Nitra, Slovakia
T +421-37 7777 950
www.bibus.sk
(not distributor for gas springs and HB dampers)

SLOVENIA

INOTEH D.O.O.
K Zeleznici 7, 2345 Bistrica ob Dravi, Slovenia
T +386-02 665 1131
F +386-02 665 2081
www.inoteh.si
(not distributor for gas springs and HB dampers)

For gas springs & HB dampers please contact:
ACE STOSSDÄMPFER GMBH
Albert-Einstein-Straße 15, 40764 Langenfeld
Germany
T +49-2173-9226-4100
www.ace-ace.com

SOUTH AFRICA

PNEUMARK CONTROLS
94A Crompton Street, Pinetown, 3610
South Africa
T +27-31 701 0421
F +27-86 551 2026
www.pneumark.co.za

SPAIN

AIRCONTROL INDUSTRIAL S.L.
Paseo Sarroeta 4
20014 Donostia-San Sebastian, Spain
T +34-943 44 50 80
F +34-943 44 51 53
www.aircontrol.es

BIBUS SPAIN S.L.
Avda Ricardo Mella, 117 D, 36330 Vigo, Spain
T +34-986 24 72 86
F +34-986 20 92 47
www.bibus.es
(not distributor for gas springs and HB dampers)

SWEDEN

HYDNET AB
Raseborgsgatan 9, 164 74 Kista, Sweden
T +46-8 59 470 470
F +46-8 59 470 479
www.hydnet.se

SWITZERLAND

BIBUS AG
Allmendstrasse 26, 8320 Fehraltorf, Switzerland
T +41-44-877 50 11
F +41-44-877 58 51
www.bibus.ch
(not distributor for gas springs and HB dampers)

For gas springs & HB dampers please contact:
ACE STOSSDÄMPFER GMBH
Albert-Einstein-Straße 15, 40764 Langenfeld
Germany
T +49-2173-9226-4100
www.ace-ace.com

TURKEY

BIBUS INDUSTRIAL INC.
İkitelli OSB Bedrettin Dalan Boulevard
Vip Plaza Kat:2 No:43-44, 34490 Basaksehir,
Istanbul, Türkiye
T +90-444 20 38
F +90-212 249 88-34
info@bibus.com.tr
www.bibus.com
(not distributor for gas springs and HB dampers)

Gas spring & HB damper specialists:
POVVER PNÖMATİK A.S.
Necatibey Cad. No:44 Kat:2
34425 Karaköy/Istanbul, Turkey
T +90-212 2938870
F +90-212 2936877
www.powerpnomatik.com

UKRAINE

BIBUS UKRAINE TOV
Mashinobudivnykiv Str., 5A
Chabany, 08162 Kiev Region, Ukraine
T +380-44 545 44 04
F +380-44 545 54 83
www.bibus.com.ua
(not distributor for gas springs and HB dampers)

JSC TECHVITAS
Pyrohivskiy shliakh St, 28, 03083, Kyiv, Ukraine
T +380 44 5030152
www.techvitas.com.ua



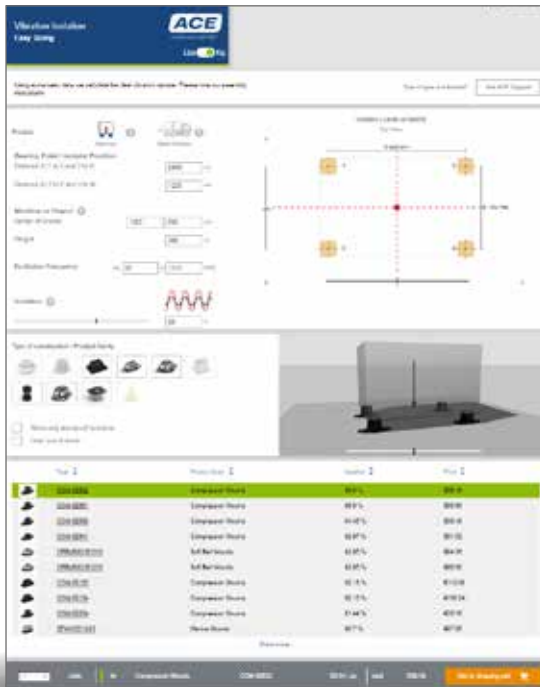
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ACE Stoßdämpfer GmbH

Albert-Einstein-Straße 15

40764 Langenfeld

Germany

T +49 2173 - 9226-10

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