ACEolator
Isolates Undesired Vibrations

Vibration Technology
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For local support please contact your ACE distributor on page 64 and 65.
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. A team of 25 engineers work in this country alone on further developing the product range every day.

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. These include industrial and safety shock absorbers, profile dampers, rotary dampers, industrial gas springs, brake cylinders, vibration isolators, air springs and oil brakes.

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.

We are your specialists for industrial damping technology

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<th>Safety Products</th>
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<tr>
<td>LOCKED Clamping Elements, Safety Shock Absorbers, TUBUS Single Hit Damper</td>
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<table>
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<th>Vibration Control</th>
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<td>Rubber-Metal Isolators, Vibration-Isolating Plates, Low-Frequency Air Spring Elements</td>
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<table>
<thead>
<tr>
<th>Industrial Motion Control</th>
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</thead>
<tbody>
<tr>
<td>Gas Springs Push Type, Gas Springs Pull Type, Hydraulic Dampers, Hydraulic Feed Controls, Rotary Dampers, TUBUS Spring</td>
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<thead>
<tr>
<th>Industrial Automation Control</th>
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<tbody>
<tr>
<td>Industrial Shock Absorbers, TUBUS Profile Dampers, TUBUS Press Dampers, SLAB SL-030 to SL-300</td>
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Our Complete Product Range
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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.
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 $1/\text{s}$) 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 $\eta$ 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 ($\eta = f_e / f_0$).

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 ($\eta = f_e / f_0 = 1$).

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.

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

Isolation range

Natural frequency (Hz)

Resonance transmissibility

Transfer 1:1

PAL pneumatic isolators

PLM pneumatic mounts

Elastomer support

Isolating plate

Signal conversion via "Fast Fourier Transformation" or "FFT".
### Frequency and weight ranges

<table>
<thead>
<tr>
<th>Type</th>
<th>Effective Direction</th>
<th>Load Range kg</th>
<th>Natural Frequency Range Hz</th>
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<tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEV</td>
<td>45 - 5900</td>
<td>8 - 24</td>
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<td>COM</td>
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<td>0.7 - 8.2</td>
<td>8 - 16</td>
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<tr>
<td>UMO</td>
<td>For plate thickness G1*: 8 - 545, radial 4 - 300; For plate thickness G2*: 24 - 2065, radial 10 - 640; axial 15 - 24, radial 10 - 19</td>
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<tr>
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* See page 41.

### Application overview

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<th>Type</th>
<th>Machines</th>
<th>Transfer systems</th>
<th>Construction Transport</th>
<th>Blower Fan</th>
<th>Foundations</th>
<th>Control units</th>
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<th>Off-road vehicles</th>
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### Frequency and Weight Ranges / Application Areas

#### Vibration-Isolating Plates

<table>
<thead>
<tr>
<th>Type</th>
<th>Load Range N/mm²</th>
<th>Natural Frequency Range Hz</th>
</tr>
</thead>
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<tr>
<td>SLAB</td>
<td>0.002 - 0.5</td>
<td>12 - 50</td>
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<tr>
<td>CEL</td>
<td>0.35 - 2.1</td>
<td>11 - 60</td>
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<tr>
<td>PAD</td>
<td>0 - 13.8</td>
<td>for shock absorption only</td>
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#### Low-Frequency Air Spring Elements

<table>
<thead>
<tr>
<th>Type</th>
<th>Load Range kg</th>
<th>Natural Frequency Range Hz</th>
</tr>
</thead>
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<tr>
<td>PLM</td>
<td>20 - 8800</td>
<td>3 - 10</td>
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<tr>
<td>PAL</td>
<td>36 - 42 000</td>
<td>1.3 - 2.7</td>
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#### Engines & Generators

<table>
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<th>Load Range</th>
<th>Natural Frequency Range</th>
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</thead>
<tbody>
<tr>
<td>kg</td>
<td>Hz</td>
</tr>
</tbody>
</table>

#### Rubber-Metal Isolators

- LEV
- CM
- COM
- AAM
- SFM
- BM
- UMO
- FL

#### Vibration-Isolating Plates

- SLAB
- CEL
- PAD

#### Air Spring Elements

- PLM
- PAL

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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.

Using the diagram

Example
A user has a 1,000 kg machine with 1,800 l/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.

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.
Example Diagram

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

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 (pre-tensioned 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

Levelling Mounts

Height-adjustable machine feet

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.
**LEV M10 to M24**

<table>
<thead>
<tr>
<th>Type</th>
<th>Min. Load</th>
<th>Max. Load</th>
<th>Natural Frequency Range</th>
<th>M</th>
<th>L (mm)</th>
<th>D (mm)</th>
<th>H (mm)</th>
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<tbody>
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<td>LEV-52224-M12</td>
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<td>450</td>
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<td>M12x1.75</td>
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<td>LEV-52226-M20</td>
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<td>2040</td>
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<td>M20x2.5</td>
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<td>41</td>
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<tr>
<td>LEV-52229-M24</td>
<td>1815</td>
<td>5900</td>
<td>8 - 24</td>
<td>M24x3.0</td>
<td>180</td>
<td>230</td>
<td>57</td>
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</table>

Standard delivery with hexagon nut

**Installation sketch**

- Lock screw is secured against the machine foot after the machine has been levelled out.
- Metal housing with high load-support capacity
- Neoprene elastomer.
  The machine is prevented from moving.
CM Cup Mounts

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**

<table>
<thead>
<tr>
<th>Type</th>
<th>Min. Load</th>
<th>Max. Load</th>
<th>M</th>
<th>Screw-in Depth</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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**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-VSC1 / CM-VSC2

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

Notes

CM – Cup Mounts
The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.
COM Compression Mounts
Pre-tensioned high-performance bearing surfaces

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
- Pre-tensioned to 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**

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<th>W (mm)</th>
<th>H (mm)</th>
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* The colour code is for identifying the loading capacity. The products are marked in colour accordingly.

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

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* The colour code is for identifying the loading capacity. The products are marked in colour accordingly.
COM-5250x / COM-5252x / COM-5254x

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

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

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

## COM-5217x

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* The colour code is for identifying the loading capacity. The products are marked in colour accordingly.
COM-5256x / 5257x

1. Static deflection (mm) vs. Load per isolator (kg)
2. Natural frequency (Hz) vs. Static deflection (mm)
3. Excitation frequency (Hz) vs. Static deflection (mm)

Notes
The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.
COM-5216x

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
All Attitude Mounts
Vibration-isolating fasteners

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**: AAM-5642x
- **Dimensions**:
  - 3/8" Hex: 24.9
  - 1/2" Hex: 18.3
  - 28.7
  - 35.9
  - 45.2

### AAM-5220x

- **Type**: AAM-5220x
- **Dimensions**:
  - 1/2" Hex: 26.6
  - 38.6
  - 34.9
  - 44.5

### Table: AAM - All Attitude Mounts

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

**Standard material: Silicone**

---

### Table: AAM – All Attitude Mounts

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

**Standard material: Neoprene, silicone alternatively available**
AAM-5220x

Notes
The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.
AAM-5642x

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

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<th>B</th>
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</table>
The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.
The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.

Notes
BM
Bubble Mounts
Low-frequency vibration isolators

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.

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

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* The colour code is for identifying the loading capacity. The products are marked in colour accordingly.
BM-5064x / BM-5068x

1. Load per isolator (kg)
2. Natural frequency (Hz)
3. Static deflection (mm)

Notes
The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.
UMO
Universal Mounts
Universal connection isolators

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

Quick fastening elements

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

**Sheet assembly**

**Blind hole assembly**

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<th>Pressure / Shear</th>
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<th>B (mm)</th>
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<td>16.5</td>
<td>5.0</td>
<td>27.0</td>
<td>1.5</td>
<td>6.5</td>
<td>3.0 - 4.0</td>
</tr>
</tbody>
</table>

1. Corresponds to mounting hole
2. Sheet thickness
3. Tightening torque T I (Drawing 01)
4. Tightening torque T II (Drawing 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
Universal Damping Plates

SLAB damping plates of model series SL-170 to SL-720 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/m² to 720 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

**Diagram 1:**
- Load (N/mm²) x 0.001 vs. Natural frequency (Hz)
- Static load limits: SL-275, SL-210, SL-170
- Isolation levels: 50%, 60%, 70%, 80%, 90%

**Diagram 2:**
- Static deflection (mm) vs. Static load limit
- Static load limits: SL-275, SL-210, SL-170

**Diagram 3:**
- Excitation frequency (Hz) vs. Excitation frequency (Hz)
- Isolation levels: 50%, 60%, 70%, 80%, 90%

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

**Standard colours:**
- SL-170: Yellow
- SL-210: Blue
- SL-275: Green

**Standard thicknesses:**
- SL-xxx-12: 12.5 mm
- SL-xxx-25: 25 mm
SL-450 / SL-600 / SL-720

1. Load (N/mm²) × 0.01 vs. Natural frequency (Hz)
2. Static load limit SL-720, SL-600, SL-450
3. Excitation frequency (Hz) vs. Static deflection (mm)

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

Standard colours
SL-450: Orange
SL-600: Dark blue
SL-720: Black

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

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Vibration-Isolating Plates
SLAB – Universal Damping Plates
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
The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.

**CEL-200 / CEL-300**

1. **Load per isolator (kg)**
   - CEL-300-4
   - CEL-300-2
   - CEL-300-1

2. **Static load limit CEL-300**
   - CEL-300-1
   - CEL-300-2
   - CEL-300-4

3. **Static deflection (mm)**
   - CEL-200-1
   - CEL-200-2
   - CEL-200-4

**Standard thicknesses**
- CEL-xxx-1: 12.7 mm
- CEL-xxx-2: 25.4 mm
- CEL-xxx-4: 50.8 mm

**Notes**
- The diagrams represent a simplified form of the preselection. Liability and compensation claims are excluded.
PAD
Rugged Fibre and Elastomer Plates

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.

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.

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.
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.
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.

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

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.
PLM

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>M</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>Max. Load</th>
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</thead>
<tbody>
<tr>
<td>PLM 1</td>
<td>76</td>
<td>60.5</td>
<td>6.9</td>
<td>M10</td>
<td>12.0</td>
<td>73</td>
<td>25</td>
<td>65</td>
<td>3.2</td>
<td>45</td>
</tr>
<tr>
<td>PLM 3</td>
<td>106</td>
<td>89</td>
<td>6.9</td>
<td>M12</td>
<td>13.5</td>
<td>105</td>
<td>56</td>
<td>65</td>
<td>3.2</td>
<td>135</td>
</tr>
<tr>
<td>PLM 6</td>
<td>130</td>
<td>108</td>
<td>7.4</td>
<td>M12</td>
<td>13.5</td>
<td>127</td>
<td>60</td>
<td>90</td>
<td>3.2</td>
<td>250</td>
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<td>PLM 12</td>
<td>175</td>
<td>152</td>
<td>7.4</td>
<td>M12</td>
<td>13.5</td>
<td>171</td>
<td>100</td>
<td>90</td>
<td>3.2</td>
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<td>216</td>
<td>14.2</td>
<td>M16</td>
<td>19.0</td>
<td>245</td>
<td>138</td>
<td>90</td>
<td>4.8</td>
<td>1100</td>
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<td>PLM 48</td>
<td>343</td>
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<td>610</td>
<td>400</td>
<td>90</td>
<td>6.4</td>
<td>8800</td>
</tr>
</tbody>
</table>

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
Low-Frequency Air Spring Elements

PAL – Air Spring Elements with Automatic Level Control

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.

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

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The figures are not to the same scale.
### Low-Frequency Air Spring Elements

**PAL – Air Spring Elements with Automatic Level Control**

### PAL

<table>
<thead>
<tr>
<th>Type</th>
<th>D1 mm</th>
<th>D2 mm</th>
<th>H (pressureless) mm</th>
<th>H (Max. Stroke) mm</th>
<th>L mm</th>
<th>Max. Load* kg</th>
<th>Special design only on request</th>
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</thead>
<tbody>
<tr>
<td>PAL 18-6</td>
<td>165</td>
<td>152</td>
<td>153</td>
<td>160</td>
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<td>800</td>
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<td>153</td>
<td>163</td>
<td>270</td>
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<td>315</td>
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<td>PAL 36-6</td>
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<td>330</td>
<td>2500</td>
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<td>370</td>
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<td>600</td>
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<td>11 560</td>
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<td>130</td>
<td>153</td>
<td>159</td>
<td>221</td>
<td>385</td>
<td></td>
</tr>
</tbody>
</table>

* At a maximum operating pressure of 7 bar

### Isolation properties

<table>
<thead>
<tr>
<th>Natural frequency</th>
<th>PAL xx-6 Hz</th>
<th>Pal xx-12 Hz</th>
<th>Damping</th>
<th>PAL xx-6 %</th>
<th>Pal xx-12 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>vertical</td>
<td>2.5 - 2.7</td>
<td>1.5 - 1.7</td>
<td>vertical (adjustable)</td>
<td>6 - 20</td>
<td>6 - 20</td>
</tr>
<tr>
<td>horizontal</td>
<td>2.0 - 4.5</td>
<td>2.0 - 4.5</td>
<td>horizontal</td>
<td>5 - 6</td>
<td>5 - 6</td>
</tr>
</tbody>
</table>

**Note**

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

- Piston
- Membrane
- Level control valve
- Damping chamber
- Spring chamber
in Countries without ACE Facility

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(not distributor for gas springs and HB dampers)

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www.ilan-gavish.co.il

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MEXICO
OBR Equipamientos Industriales Ltda.
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Fax: +56-25 44 19 65
www.taylorautomatizacion.cl

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www.ace-ace.com
Calculation sheet for your applications

We would be happy to send you a design proposal for your application. In order to obtain a better picture of your application before establishing contact, we would like to ask you to send us the following basic information.

Please send us a sketch or drawing so that our application technicians understand the case. For the drawing, please use the designated field or send us a dimensioned sketch with a copy of the calculation sheet to mail@aceolator.eu. You can also simply use our calculation sheet at www.aceolator.eu.

Project designation

Description of the application

Please enter the technical data for the calculation here

Excitation frequency / speed Hz ____________________ or 1/s ____________________

Weight of system in kg

Weight distribution

Machine dimensions (mm) length _______________ width _______________ height _______________

Number of support points (quantity)

Dimensions of the support points (mm) length _______________ width _______________ diameter _______________

Desired degree of isolation

Environmental influences

Need / year (quantity)

Contact Details

Company ____________________________________________

Name ______________________________________________

Department _________________________________________

Street/PO Box ______________________________________

Postcode/City _______________________________________

Country ____________________________________________

Telephone __________________________________________

E-Mail _____________________________________________

Please copy, complete and fax to ACE
+49 (0)2173 - 9226 - 89

or use our Calculation Form on Website
www.aceolator.eu

Fax your inquiry form to +49 (0)2173 - 9226 - 89

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ACEolator
Isolates Undesired Vibrations

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