LISEGA

VICODA®

INDUSTRY

Vibration reduction at Industrial machines

VICODA® is a product brand of LISEGA Group

VIBRATION REDUCTION
SUPPORTING ACCORDING TO SPECIFICATIONS
VIBRATION CONTROL
INNOVATIVE TECHNOLOGIES
COMPREHENSIVE RANGE OF PRODUCTS
OPTIMUM, TAILORED SOLUTIONS
INTERNATIONAL STANDARDS
COMPREHENSIVE MANUFACTURING EXPERTISE
INDEPENDENT QUALITY MANAGEMENT
INTERDISCIPLINARY TEAMS
WIDE RANGE OF SERVICES
EXTENSIVE EXPERIENCE
GLOBAL PRESENCE
HIGH EFFICIENCY

VICODA®

Vibration-isolated installation of machinery and plants

With the VICODA® product brand, the multinational company LISEGA SE is expanding its product range to include steel spring elements, viscoelastic dampers and tuned mass dampers.

These products are used for isolating structure-borne noise and vibrations and are particularly suitable for the vibration-isolated installation of machines and plants.

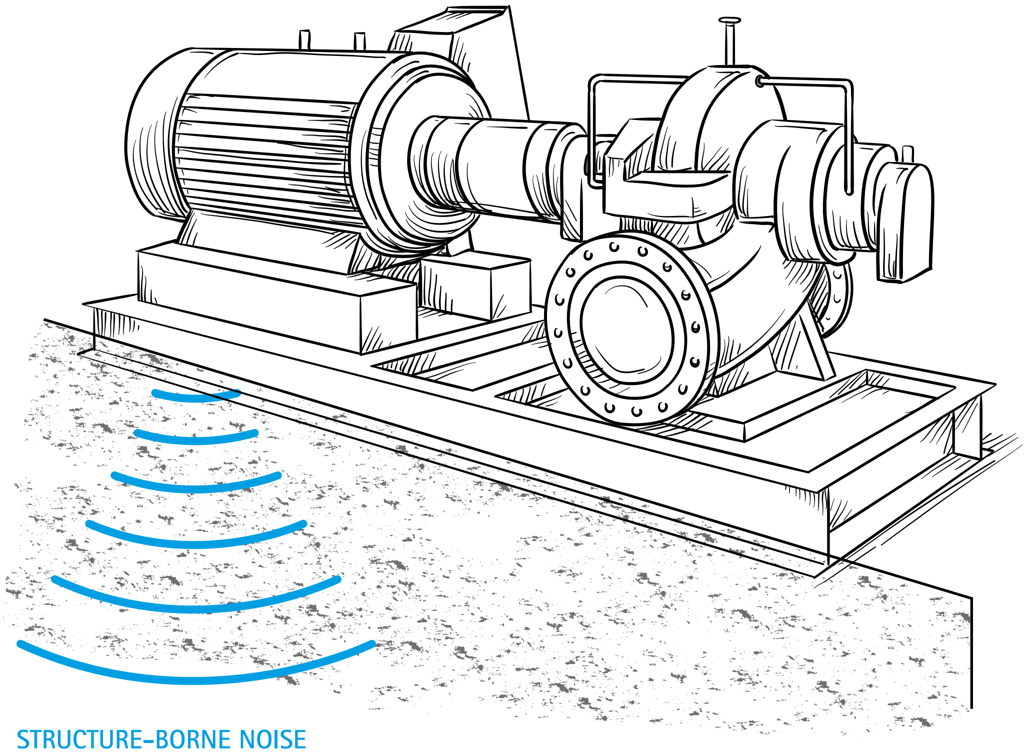
All key design and development methods for damping, limiting or isolating unwanted vibrations are used and further developed to achieve this.

We operate our own production facilities around the world to ensure exceptionally high product quality and prompt delivery. All products meet the quality requirements of the well-established standard regulations.

Industrial machines cause vibrations and structure-borne noise

Operating industrial machinery produces vibrations that may have a detrimental effect on building structures, adjacent machines and personnel.

This is why industrial plant operators and machine manufacturers must include vibration protection in the planning phase in order to comply with occupational health and safety and immission protection requirements and to reliably ensure that the machinery is operated in a cost-effective manner.

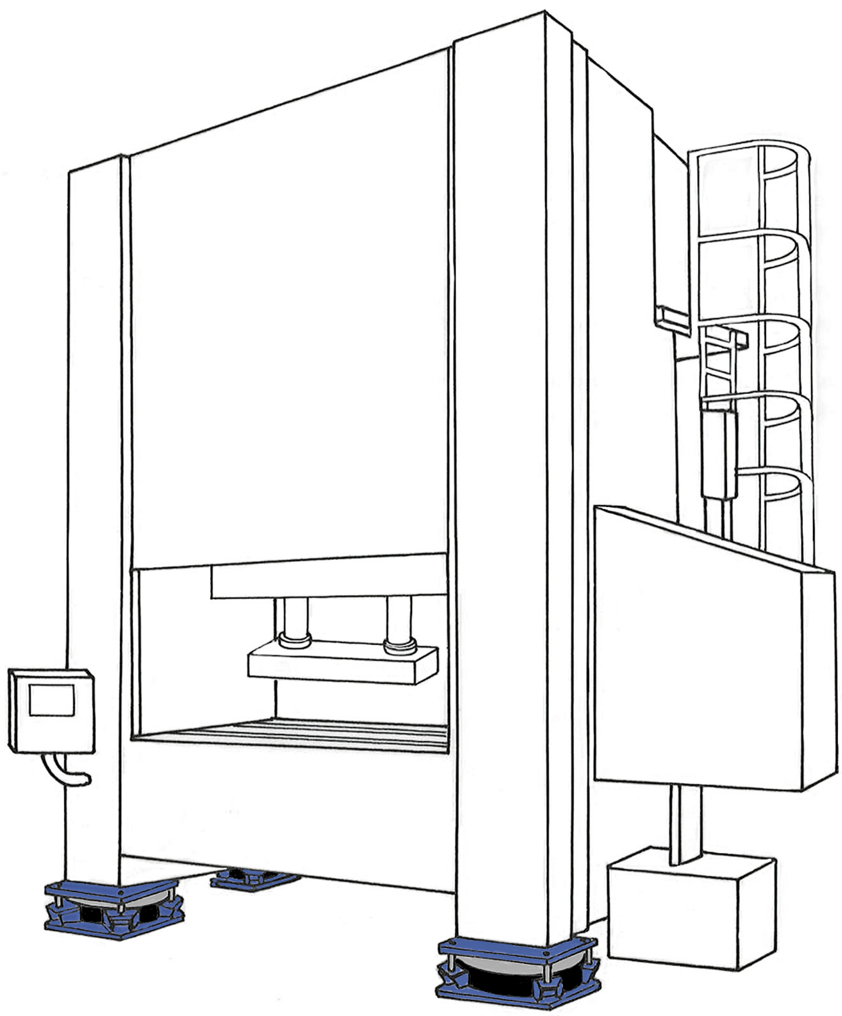


EFFECTIVE SOLUTIONS FOR REDUCING VIBRATIONS

Vibrations

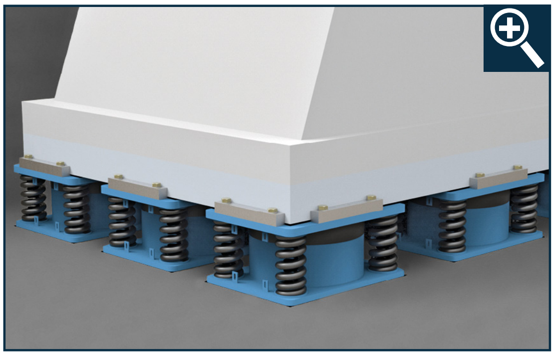
The wide variety of industrial machinery and industrial applications requires a case-by-case solution for reducing vibrations. Some machines generate vibrations due to the process. Other machines are sensitive to vibrations from their environment.

Some common sources of vibration include forging hammers, forming presses, crushers, and diesel generators. High-precision machine tools or measuring machines, for example, are extremely sensitive to vibrations from the environment. Machine rooms frequently feature a combination of sources and receivers. Some machines with the characteristic vibration excitation and potential damage patterns are illustrated in the following examples.



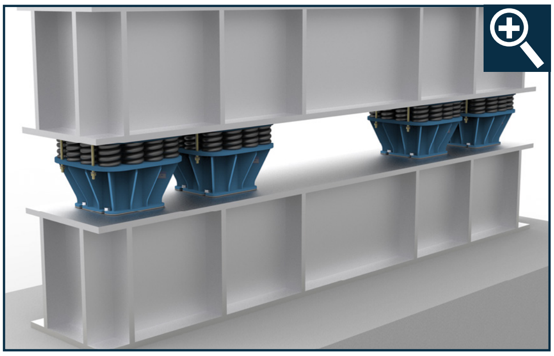
Dynamic decoupling of heavy-duty machines

... by forging hammers



With forging hammers, the forming energy is usually applied to the workpiece by dropping a ram. They can be classified into drop hammers, double acting hammers and counterblow hammers. The forming energy with the ram is produced by the mass of the drop hammer and the height of the drop.
Double-acting hammers achieve exceptionally high forming energies and impact velocities due to the additional acceleration of the hammer. With counterblow hammers, the upper ram is kinematically or hydraulically coupled with the lower ram and the impact velocity is also increased here. All forging hammers feature a primarily vertical impact excitation or impact sequence. Typical features include the deformation impacts and the final bounce impact, in which the workpiece is not deformed any further and all the impact energy is transferred to the foundation. This may cause significant damage, such as cracking of foundations or surrounding building structures.

... by forming presses



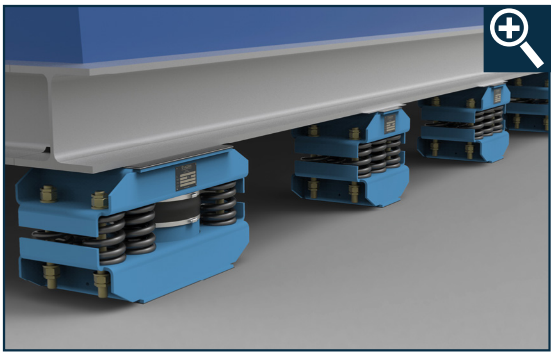
Forming presses may be classified according to their operation and excitation. In hydraulic presses, the pressure of the hydraulic medium and the inertia of the ram generate a vertical, impact-type forming force. In crank, eccentric and screw presses, the movement of the ram is specified by a gearbox. The forming energy is generally provided by flywheel masses which are engaged and then decelerated during the forming process. State-of-the-art servo presses can operate without flywheels in some cases and can be freely programmed with regard to movement. Presses usually produce superimposed impulsive force and moment excitations. In addition to a vertical movement, there may be tilting movements around the horizontal axis or rotating movements around the vertical axis. The resulting vibrations may overload the press foundations if the design is not suitable.

... by centrifuges

Centrifuges are generally used to separate liquids from solids and operate on the centrifugal principle. Large centrifugal forces are generated at high speeds. Vibrations can occur if the rotor is operated when it is out of balance due to uneven distribution of the material to be centrifuged. Settlement effects can further intensify these imbalances. If the bearings are not sufficiently secure, the unbalanced forces can damage the bearings in the centrifuge or even cause the rotor to break.

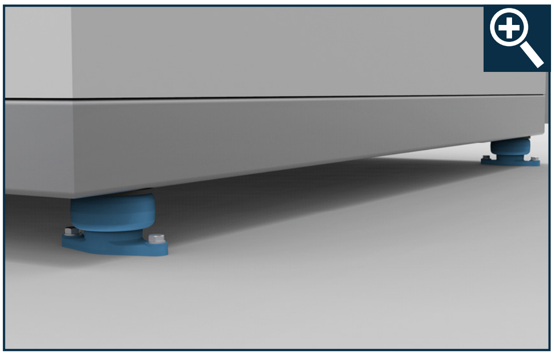
... by gas and diesel generators

Gas and diesel generators are commonly used for decentralized power supplies. They are made up of an engine and a generator to produce electricity, which are usually positioned on a common frame. Vibrations are caused, for example, by imbalanced forces during operation or if a generator short-circuit occurs. Diesel generators are usually used as emergency power generators in hospitals or in the maritime sector on ships, where high demands are placed on vibration protection and decoupling of structure-borne noise. In earthquake areas, emergency generators must remain operational during and immediately after an earthquake.



... by testing machines

Dynamic testing machines, such as resonance pulser and hydropulser or unbalance exciters are used, for example, for fatigue testing of components and may produce large harmonic loads at a specified frequency. Hydropulsers can also generate impulsive or stochastic excitation forces though the hydraulic control system. Vibrations can spread into the foundation if the foundation is solid and into neighboring buildings through the foundation soil.



... by crushing machines

Crushing machines may include, for example, crushers for coarse crushing and mills for fine crushing. Crushers and mills are frequently used to prepare rock and coal, etc. for further processing. Crushers may included, for example, cone crushers, roll crushers, impact crushers, and hammer crushers.
While cone crushers and roll crushers operate on the principle of pressure crushing and usually work at low speeds, impact crushers and hammer crushers generate high working speeds. Mills further pulverize the material to be ground and can be designed, for example, as roller mills or disk mills. The excitation forces in crushers and mills are normally stochastic and impulsive. The impacts lead to regular wear on the bearings and, if the design is faulty, to damage to the foundations.

... on high-precision manufacturing machines

High-precision and finishing machine tools must be protected from vibrations caused by the environment in order to maintain component tolerances and surface qualities, e.g. in a press shop or when installed on a floor slab that is susceptible to vibrations.

... on measuring machines

Coordinate measuring machines, for example, are considerably more sensitive to external vibrations. Here, the vibrations from the environment must be reduced through elastic mounting or structural measures such that the measurement accuracy is not affected.

... in machine rooms

In machine rooms, multiple machines operate together, in many cases chained at similar rates and frequently with similar excitation frequencies. The operation of a transfer press line may, for example, generate undesirable vibrations if presses operate in the same cycle and, when the workpieces are transported further, their masses are accelerated and braked in the same cycle. In this case, the oscillations may increase (beat). Other examples include bodymakers that operate in synchronization to produce beverage cans with a high throughput, or machine centers that produce a large number of identical parts through machining. In particular, when several machines of the same type are installed on one floor slab, we recommend a vibration analysis, since resonance effects can further amplify vibrations.

Vibration protection during earthquakes

Industrial machines in earthquake regions require special protective measures. Otherwise, there is a risk of damage or even destruction of the plant or individual plant components in case of an earthquake. LISEGA has developed technical solution concepts for earthquake-proof foundation isolation to ensure effective earthquake isolation and to counteract costly plant failure. Customized solutions are designed, manufactured and installed based on these concepts, depending on the application.

The advantages offered by these solutions include:
- passive permanent earthquake protection
- the durability and an almost virtually maintenance-free system
- effective in all spatial directions

The solution: The vibration-isolated installation of industrial machines

The vibration-isolated installation significantly reduces the transmission of dynamic loads to the foundation. This ensures that fewer vibrations are transmitted to the surrounding area and prevents damage, such as cracks in foundations or even bearing damage. The vibration-isolated installation is ideal both for source isolation of large machines that generate vibrations and for receiver isolation of sensitive manufacturing and measuring machines. Additional damping must be provided depending on the application. The method selected for damping and the damping parameter are especially important, since they have a direct impact on the vibration isolation effect.

A wide range of products for vibration isolation and damping

VICODA® steel spring elements are normally used for the vibration-isolated installation of machines. A large number of specific series are available for the various applications. Their design is adapted, manufactured and delivered according to the requested requirements.

The products are used, for example, for the foundation insulation of precision machines against vibrations from their environment. In numerous applications, the VICODA® spring elements feature integrated dampers to sufficiently absorb the vibration energy during a variety of operating processes. This prevents resonances and ensures that there are no unacceptable machine movements. In the case of shock-type processes (in forging hammers and presses) in particular, it is ensured that the machine movement rapidly abates and, for example, that the press comes to a standstill again before the next operation.

Viscoelastic or solid dampers are used depending on the application. Separate dampers are always used when there is a need for particularly high system damping for certain eigenmodes or also specific load cases (earthquakes).

Product parameters

- Wide load range: 1 kN to 2,700 kN
- Operational stability according to EC3
- Low natural frequency (1.0 Hz to 8 Hz) of the system, which results in the highest isolation effect
- Horizontal spring rates from 20% to 130% of the vertical spring rate
- Surface coatings for corrosivity categories up to C5 according to DIN EN ISO 12944
- Individual damping dimension with integrated dampers as a spring and damper combination according to requirements
- A variety of damping media takes the individual application into consideration

An excerpt from our product range for press spring elements and hammer spring elements is available on pages 10 to 13. Spring elements from other VICODA® catalogs can also be used depending on the application. We will be happy to provide support to ensure the ideal design and selection of the spring elements.

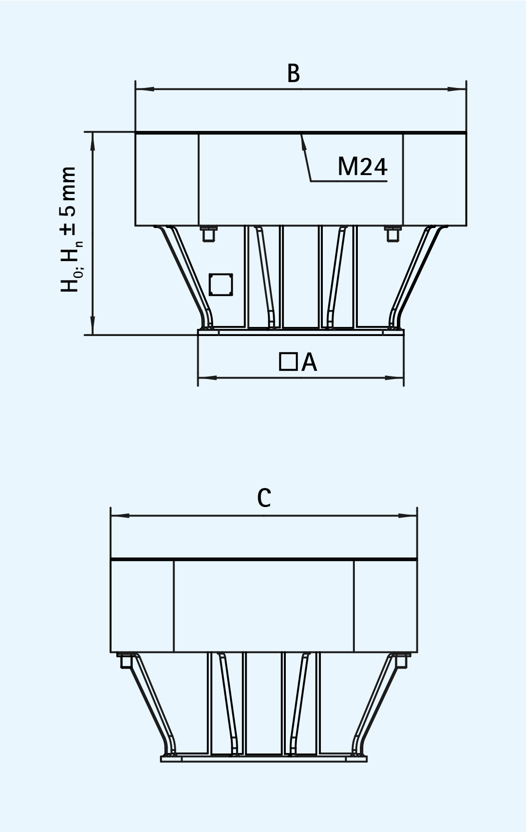
If the ideal solution is an elastic bearing with elastomers, dynamic elastomeric bearings from the LISEGA subsidiary Calenberg Ingenieure can be planned and offered (page 14).

Specific damping for high vibration reduction

S-WV-4020-14../13

LEGEND

H_0: Unloaded height H_n: Height at nominal load

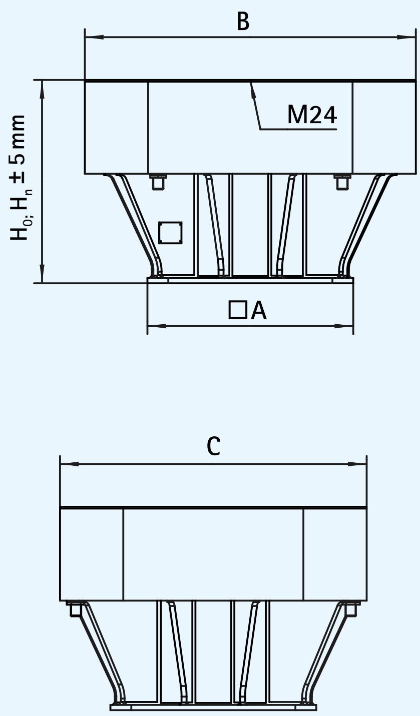


S-WV-4020../13								
Type	Nominal load [kN]	Ver. stiffness [kN/mm]	Hor. stiffness [kN/mm]	A [mm]	B [mm]	C [mm]	Height [mm] H_0	Height [mm] H_n
S-WV-4020-14.0/13	1354	104.1	112.2	592	952	882	600	587
S-WV-4020-14.2/13	1406	108.2	114.0					
S-WV-4020-14.4/13	1459	112.2	115.7					
S-WV-4020-14.6/13	1511	116.3	117.5					
S-WV-4020-14.8/13	1564	120.3	119.3					
S-WV-4020-14.10/13	1616	124.3	121.0					
S-WV-4020-14.12/13	1669	128.4	122.8					
S-WV-4020-14.14/13	1721	132.4	124.6					
S-WV-4020-14.16/13	1774	136.5	126.3					
Max. weight approx.: 960 kg								

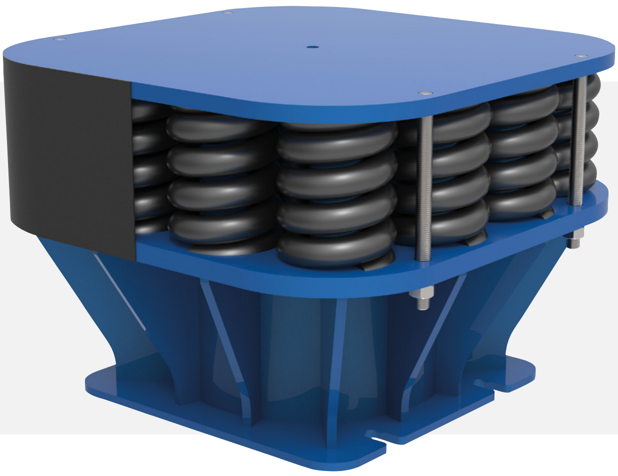
(*) Specification of heights and weights without fabric panels and compensating plates

COMMENTS:
1) Calculation according to DIN EN 13906-1
2) Natural frequency at nominal load 4.4 Hz
3) 2x4 mm fabric panels and compensating plates as needed
4) Damping of up to 15 % can be achieved, depending on the input variables.

S-WV-4020-8../20 | S-WV-4020-10../20 | S-WV-4020-12../20



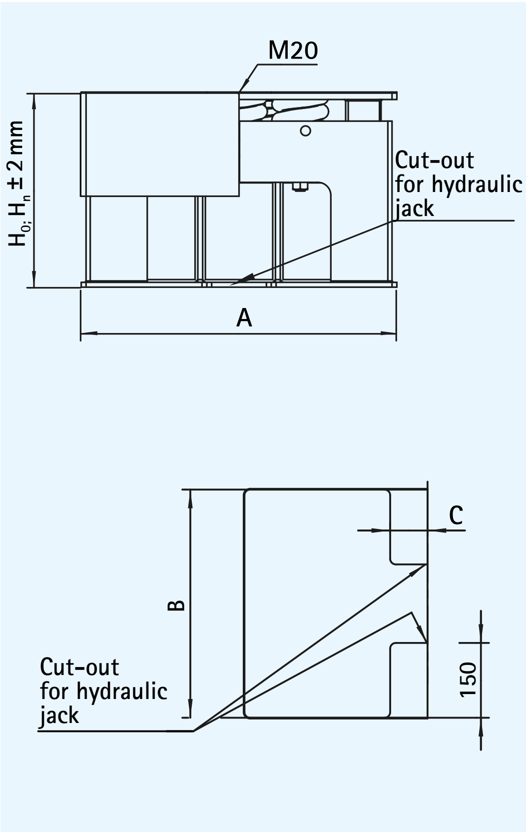
S-WV-4020../20								
Type	Nominal load [kN]	Ver. stiffness [kN/mm]	Hor. stiffness [kN/mm]	A [mm]	B [mm]	C [mm]	Height [mm]	
							H_0	H_n
S-WV-4020-8.0/20	853	42.6	36.3	592	830	830	600	580
S-WV-4020-8.2/20	905	45.2	37.1					
S-WV-4020-8.4/20	957	47.8	37.9					
S-WV-4020-8.6/20	1009	50.4	38.7					
S-WV-4020-10.0/20	1066	53.3	45.4					
S-WV-4020-10.2/20	1118	55.9	46.2					
S-WV-4020-10.4/20	1170	58.5	47.0					
S-WV-4020-10.6/20	1222	61.1	47.7					
S-WV-4020-12.0/20	1279	64.0	54.5					
S-WV-4020-12.2/20	1331	66.6	55.3					
S-WV-4020-12.4/20	1383	69.2	56.0					
S-WV-4020-12.6/20	1435	71.8	56.8					
S-WV-4020-12.8/20	1487	74.4	57.6					
S-WV-4020-12.10/20	1539	76.9	58.4					
S-WV-4020-12.12/20	1591	79.5	59.2					
Max. weight approx.: 900kg								



(*) Specification of heights and weights without fabric panels and compensating plates

COMMENTS:
1) Calculation according to DIN EN 13906-1
2) Natural frequency at nominal load 3.5 Hz
3) 2x4 mm fabric panels and compensating plates as needed
4) Damping of up to 15 % can be achieved, depending on the input variables.

S-WVG-4020-9../13 | S-WVG-4020-12../13 | S-WVG-4020-16../13



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<tr><th>H_0</th><th>H_n</th></tr>
<tr><td>S-WVG-4020-9.00/13</td><td>870</td><td>66.9</td><td>72.1</td><td rowspan="6">984</td><td rowspan="11">614</td><td rowspan="11">100</td><td rowspan="17">600</td><td rowspan="17">587</td></tr>
<tr><td>S-WVG-4020-9.03/13</td><td>949</td><td>73.0</td><td>74.8</td></tr>
<tr><td>S-WVG-4020-9.06/13</td><td>1028</td><td>79.1</td><td>77.4</td></tr>
<tr><td>S-WVG-4020-9.09/13</td><td>1107</td><td>85.1</td><td>80.1</td></tr>
<tr><td>S-WVG-4020-9.10/13</td><td>1133</td><td>87.1</td><td>81.0</td></tr>
<tr><td>S-WVG-4020-9.13/13</td><td>1212</td><td>93.2</td><td>83.6</td></tr>
<tr><td>S-WVG-4020-12.00/13</td><td>1160</td><td>89.3</td><td>96.2</td><td rowspan="11">1174</td></tr>
<tr><td>S-WVG-4020-12.05/13</td><td>1292</td><td>99.4</td><td>100.6</td></tr>
<tr><td>S-WVG-4020-12.10/13</td><td>1423</td><td>109.5</td><td>105.0</td></tr>
<tr><td>S-WVG-4020-12.15/13</td><td>1554</td><td>119.6</td><td>109.4</td></tr>
<tr><td>S-WVG-4020-12.18/13</td><td>1633</td><td>125.6</td><td>112.1</td></tr>
<tr><td>S-WVG-4020-16.00/13</td><td>1547</td><td>119.0</td><td>128.2</td><td rowspan="6">804</td><td rowspan="6">170</td></tr>
<tr><td>S-WVG-4020-16.05/13</td><td>1678</td><td>129.1</td><td>132.6</td></tr>
<tr><td>S-WVG-4020-16.10/13</td><td>1810</td><td>139.2</td><td>137.1</td></tr>
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<tr><td>S-WVG-4020-16.20/13</td><td>2072</td><td>159.4</td><td>145.9</td></tr>
<tr><td>S-WVG-4020-16.25/13</td><td>2204</td><td>169.5</td><td>150.3</td></tr>
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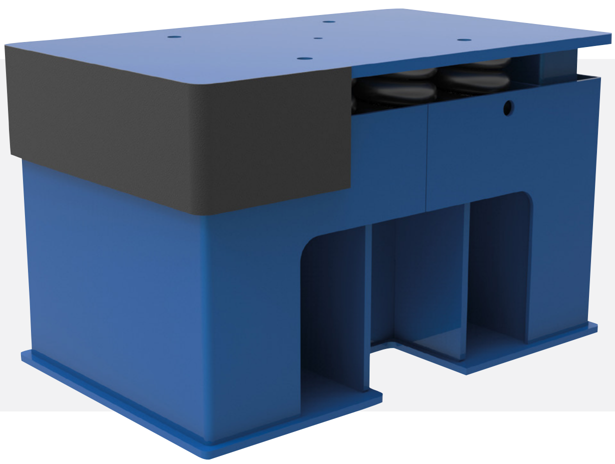
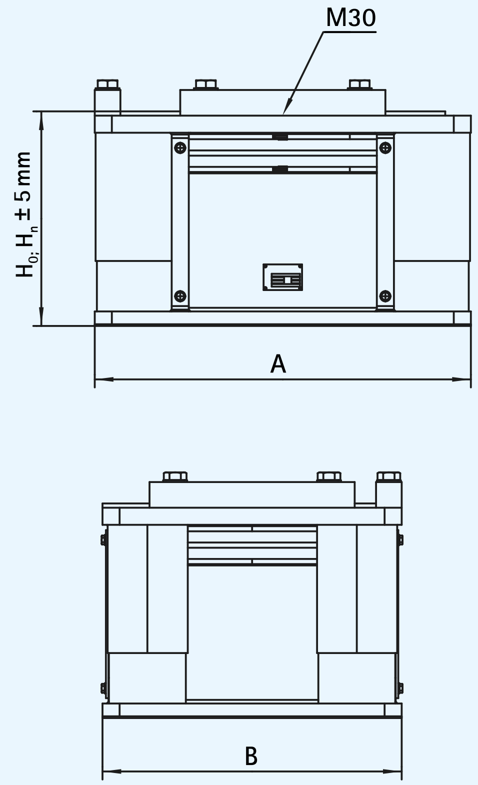


(*) Specification of heights and weights without fabric panels and compensating plates

COMMENTS:
1) Calculation according to DIN EN 13906-1
2) Natural frequency at nominal load 4.4 Hz
3) 2x4 mm fabric panels and compensating plates as needed
4) Damping of up to 15 % can be achieved, depending on the input variables.

S-WV-3041-4../20 | S-WV-4010-4../10



S-WV-3041-4../20

Type	Nominal load [kN]	Ver. stiffness [kN/mm]	Hor. stiffness [kN/mm]	A [mm]	B [mm]	Height [mm]	
						H_0	H_n
S-WV-3041-4.0/20	124	6.2	2.7	880	700	500	480
S-WV-3041-4.4/20	150	7.5	2.9				
Max. weight approx.: 735 kg							

(*) Specification of heights and weights without fabric panels and compensating plates

COMMENTS:
1) Calculation according to DIN EN 13906-1
2) Natural frequency at nominal load 3.5 Hz
3) 2x4 mm fabric panels and compensating plates as needed
4) Damping of up to 15 % can be achieved, depending on the input variables.

S-WV-4010-4../10

Type	Nominal load [kN]	Ver. stiffness [kN/mm]	Hor. stiffness [kN/mm]	A [mm]	B [mm]	Height [mm]	
						H_0	H_n
S-WV-4010-4.0/10	92	9.2	6.8	880	700	500	490
S-WV-4010-4.4/10	116	11.6	7.3				
Max. weight approx.: 590 kg							

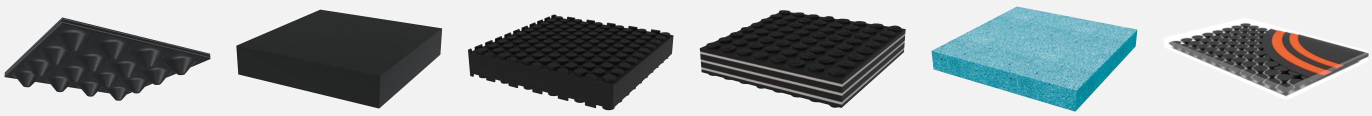
(*) Specification of heights and weights without fabric panels and compensating plates

COMMENTS:
1) Calculation according to DIN EN 13906-1
2) Natural frequency at nominal load 5.0 Hz
3) 2x4 mm fabric panels and compensating plates as needed
4) Damping of up to 15 % can be achieved, depending on the input variables.

Machine isolation with elastomeric bearings

In order to minimize the transmission of vibrations and structure-borne noise to the environment, elastomeric bearings with tuning frequencies from 7 Hz can also be used. During operation, machines, ventilation and air-conditioning systems, as well as other technical equipment, are subject to undesirable vibrations and excitations caused by impact processes. The resulting forces transmit structure-borne noise into the building structure, producing tangible vibrations and audible secondary airborne noise. This reduces the quality of living and working comfort in the adjacent rooms.
Calenberg offers individual bearings both for the vibration insulation of machines (source insulation) and for the insulation of highly sensitive equipment against shocks and vibrations from the environment (receiver insulation).

The technical and high-quality Calenberg elastomeric bearings, which are made of natural rubber, synthetic rubber compounds as well as foamed polyurethane, effectively isolate vibrations and secondary airborne noise. The elastomeric bearings are UV, ozone and weather-resistant and offer long-lasting performance. This means that the service life of the products is comparable to or longer than that of the machine. Special profiling optimizes the performance of certain elastomeric bearings. As a result, the products reach an almost identical natural frequency over a wide compressive stress range. The elastomeric bearings are resistant to hydrolysis and are ideal for use at low and high temperatures.

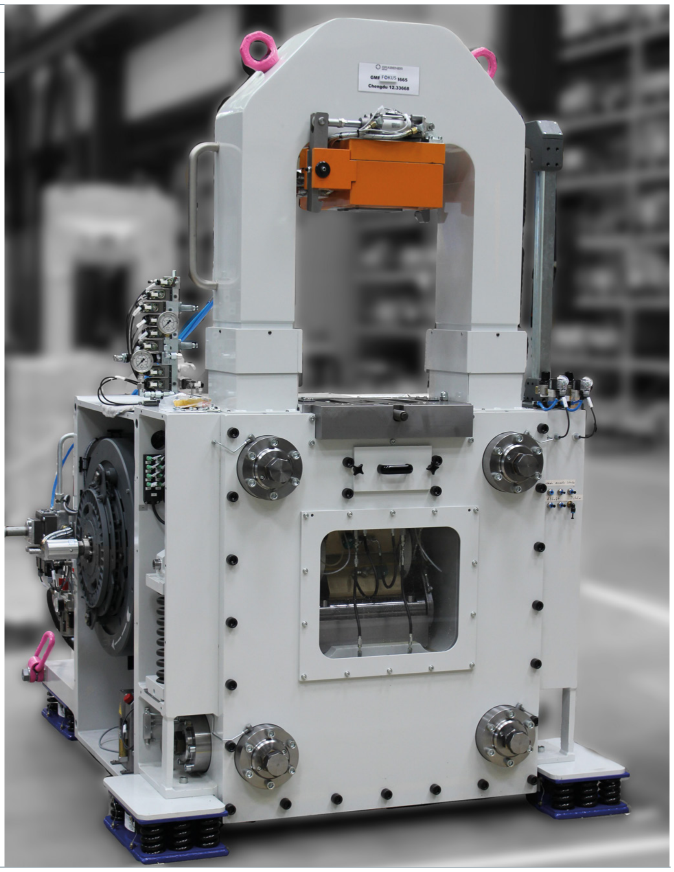


Highly effective and cost-efficient solutions

Project examples

Vibration-isolated installation of a forming press

Customer	Gräbener Pressensysteme GmbH & Co. KG
Country	Germany
Year	2016
Technical details	Medal stamping press GMP 360 Coin diameter 50 mm Stroke rate 80 strokes / min Ejector force 50 kN Engine power 15.9 KW
Solution	Delivery of 4 spring / Damper elements Degree of damping > 10 Max. load capacity 130 kN

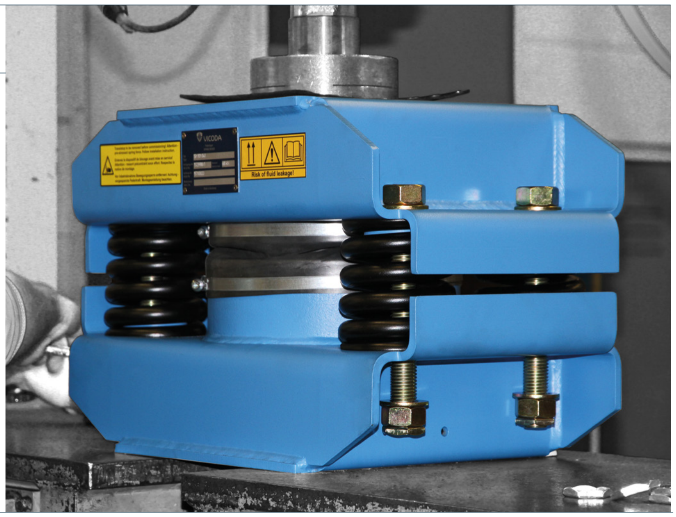


Vibration-isolated installation of a knuckle-joint press

Customer	BSH Hausgeräte GmbH
Country	Germany
Year	2006
Technical details	Pressing force 8000 kN Stroke rate 20-25 strokes / min Total sprung weight Approx. 225 t
Solution	Delivery of 4 spring elements Vertical bearing frequency 4.2 Hz Load capacity per spring element 600 kN

Vibration-isolated installation of a gas engine

Customer	Kawasaki Heavy Industries, Ltd.
Country	Japan
Year	2016
Technical details	Gas engine and generator on steel frame m = 106 t
Solution	Delivery of 10 spring elements Degree of damping 11% Max. load capacity per spring element 147 kN



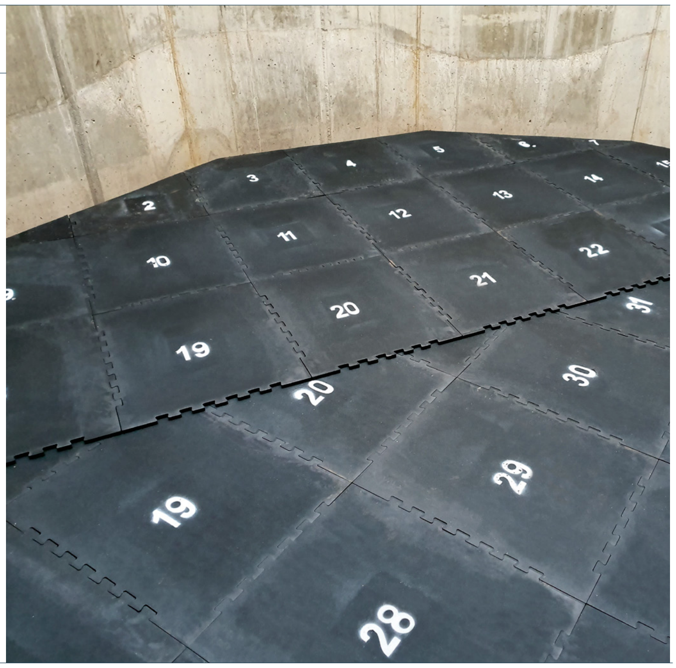
Elastic decoupling of a forging press

Customer	Walor-Vöhrenbach
Country	Germany
Year	2021
Technical details	Pressing force 2500 t Stroke rate 10 strokes / min Total sprung weight approx. 250 t
Solution	4 spring damper elements Vertical bearing frequency approx. 5 Hz Max. load capacity per spring damper element 1590 kN 2 high-performance viscous damper RS35 757 with a damping parameter of up to 1000 kNs/m

Elastic decoupling of ventilation units

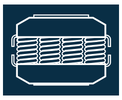
Customer	Bundesanstalt für Materialforschung und -prüfung (BAM) The German Federal Institute for Materials Research and Testing
Country	Germany
Year	2013
Task	To protect office units from secondary airborne noise, machines and equipment were decoupled in BAM's technical center.
Solution	Aluminum strips with integrated Cisador® were installed under the base plates of the equipment and machines. This reduced emissions and ensured a quieter working environment.

Elastic bearing of a drop impact tester



Country	Germany
Year	2019
Task	In order to reduce the wear of the plant and the transmission of vibrations to the surrounding area, the slab and foundation were supported with elastic bearings.
Solution	The closed-cell and water-resistant Cisador® only changes its mechanical properties to a minimum, even after many millions of drops. As a result, the drop impact tester can be operated for well over a decade without having to replace the elastic bearing.

Excerpt of customer references



Spring elements, viscoelastic dampers and elastomeric bearings for vibration-isolated installation

Industrial machines

- Vibration-isolated installation of a gas cooler, Switzerland
- Elastic decoupling of a gas cooler, China
- Vibration isolation of a steam condenser, Switzerland
- Elastic decoupling of an axial fan, Spain
- Vibration-isolated installation of a diaphragm compressor, Germany
- Vibration isolation of a gas engine, Japan
- Vibration isolation of a fan, Hungary
- Elastic decoupling of an AXIAL FAN (SAF & FAF), Greece
- Elastic decoupling of an AXIAL FAN, Greece

Forming machines

- Machine isolation forming presses, pressing forces: 6.3 - 10 - 14 und 20 MN, France
- Elastic decoupling of a forming presses, pressing force: 20 MN, Brazil
- Elastic bearing of a forming presses, pressing force: 16 MN, Brazil
- Machine isolation of a forging press, pressing force: 10 MN, Bolivia
- Machine isolation of an eccentric press, pressing force: 20 MN, Poland
- Vibration-isolated installation of a press line, press forces: 25 - 16 - und 12 MN, Mexico
- Elastic decoupling of a hydraulic forging hammer, forming energy 125 kJ, Russia
- Machine isolation of a forging hammer, forming energy 52 kJ, Russia
- Machine isolation of a Smeral forging press, pressing force 20 MN, Germany

LISEGA SE | GERMANY
Gerhard-Liesegang-Straße 1
27404 Zeven
P. O. Box 1357
27393 Zeven

T. | +49(0)4281–713-0
M. | info@de.lisega.com
www.lisega.com

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