


Vibration Reduction in Mechanical and Plant Engineering



» Elastically mounted devices are more cost-effective and efficient in the long term

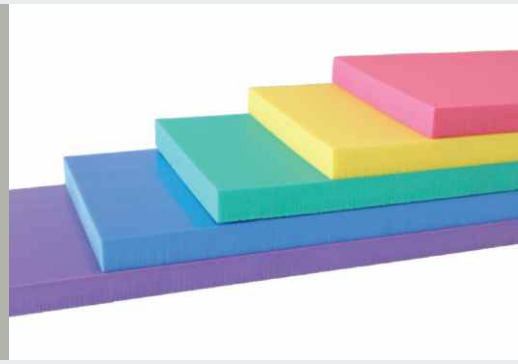
» Vibration protection increases the value of production processes and adjoining residential buildings and working spaces

» The long-term effectiveness of the materials is guaranteed

1 | Minimizing Vibrations and Noise



Foundation bedding of a pump with Sylomer®



For optimum results: high-tech materials Sylomer® and Syldyn®

Machines generate vibrations, causing noise and damage.

Vibrations and their consequences are not only detrimental to the immediate surrounding area, they also negatively affect manufacturing and quality processes in the vicinity and disrupt the neighbourhood and the environment.

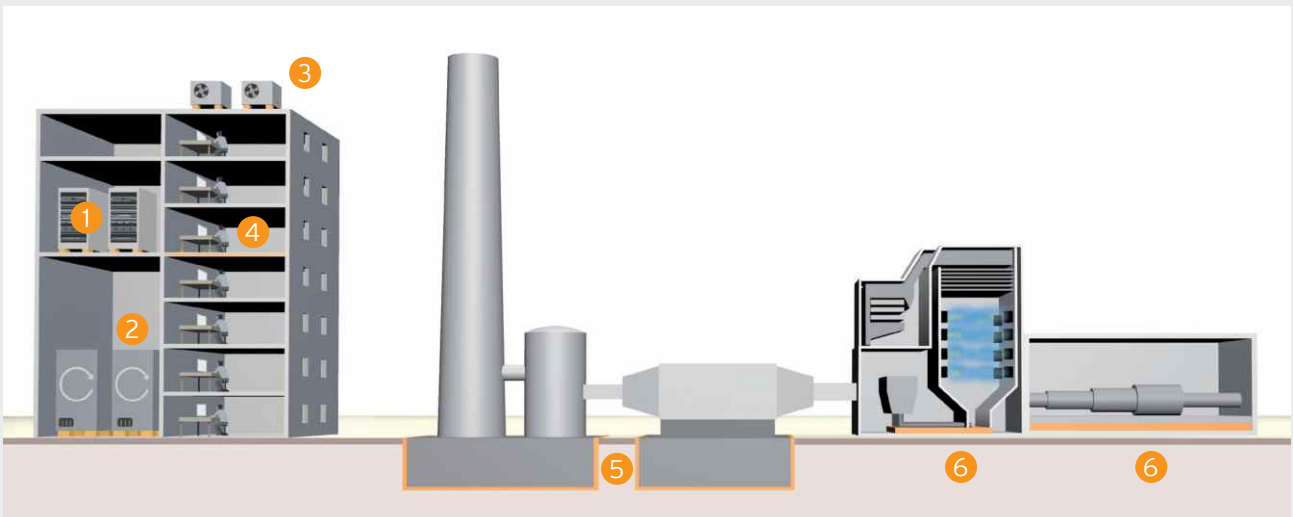
Why use elastic mountings for machines?

- Elastically mounted devices are more cost-effective and efficient in the long term.
- Optimum vibration solutions usually account for less than 1% of the initial cost. But solutions that are added later are often expensive and less effective.
- Vibration protection increases the value of office space, production processes and adjoining residential buildings.

The advantages of the Getzner solution

- Elastic bedding on Sylomer® and Syldyn®, in or under a machine, effectively reduces vibrations and structure-borne noise.
- The bearings are easy to install, maintenance-free and are consistently effective throughout the service life of the machine.
 - As the bedding is individually calculated and adapted, it is possible to achieve a low natural frequency and greater effectiveness.

Measures to protect devices, machines and the surroundings from vibrations



- 1 Server mounting
- 2 Machine bearing

- 3 Bearing of air-handling-units*
- 4 Floating floor, bearing of sensitive equipment

- 5 Foundation bedding
- 6 Machine foundation bearings

* Refer to brochure "Vibration Solutions for Technical Facility Equipment"

2 | Potential Solutions and Benefits

Challenge

When technical equipment is operated, solid objects and machine components start vibrating. This produces structure-borne noise and secondary airborne noise. Vibrations, noise and sometimes even health hazards are the unwanted result.

Vibration solution requirements

On the one hand, effective vibration isolation must be able to absorb existing static and dynamic loads. On the other hand, the dynamic reaction of the mounting should be soft and less rigid than comparable materials (such as rubber or cork). Statically and dynamically occurring forces should be dampened both vertically and horizontally.

Solution description

Source isolation

An elastic intermediate layer can dampen the high dynamic forces of a machine. This reduces the passage of disruptive vibrations and decouples the vibration source from the surroundings, e.g. presses, compressors.

Recipient isolation

Elastic bedding protects machines and sensitive components against the vibrations of instruments that have not been decoupled. The machine is isolated from the surroundings, e.g. measuring equipment, servers.

Solutions



Point bearing
(Machine base)



Strip bearing



Full-surface bearing



Machine components



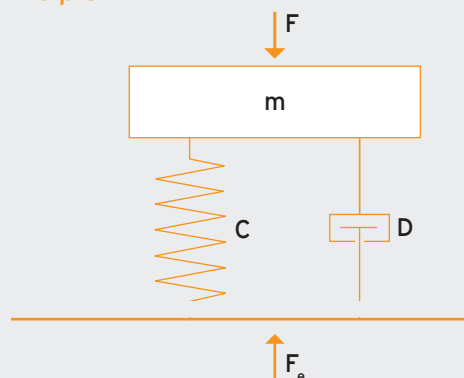
Foundation bedding

The single mass oscillator principle

$$f_0 = \frac{1}{2\pi} \cdot \sqrt{\frac{c}{m}} = \frac{1}{T}$$

T = period length in s
 f_0 = natural frequency in Hz
 c = spring constant in N/m
 m = vibrating mass in kg

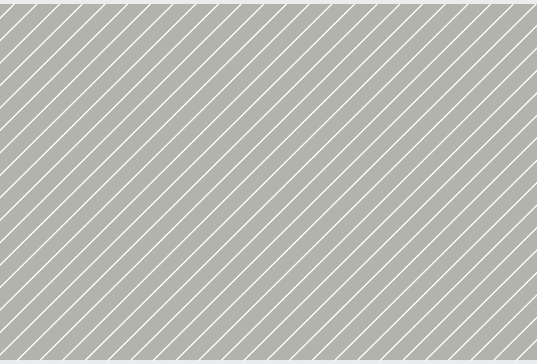
C = spring
 F = force
 D = damper



Working principle

Sylomer® and Syldyn® combine spring and damper properties in materials.

The mode of operation is based on the principle of a single mass oscillator.



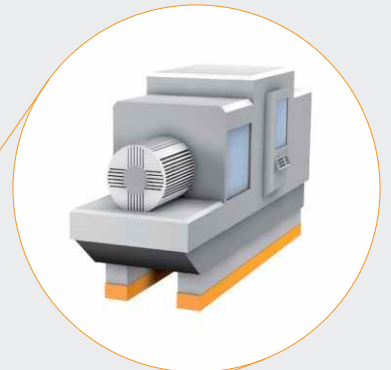
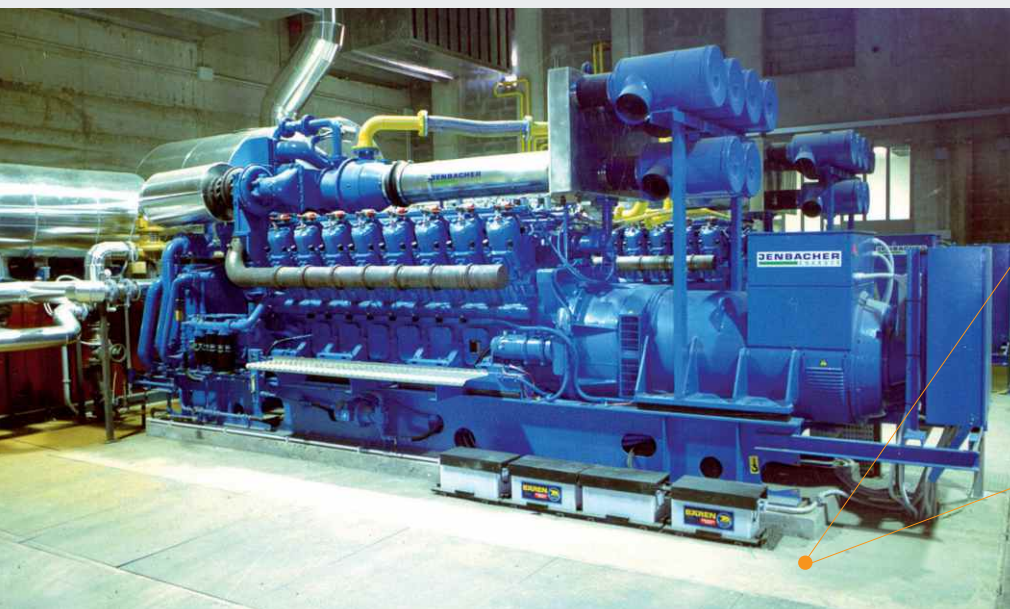
Various application areas

Point bearings for a air handling unit

The benefits of the Getzner solution

- More cost-effective
- Properties can be calculated to tailor effectiveness
- The long-term effectiveness of the materials is guaranteed over the entire service life of the machine
- Zero-maintenance
- Highly effective at a low construction height and deflection (protecting electrical and mechanical connections)
- Natural frequencies from 6Hz are achievable*
- Load ranges from 0.5 t/m² to 600 t/m²
- Tolerance compensation for unevenness
- Can be used as springs, dampers or as a spring/damper combination
- Individually adaptable geometry (adapted to the local installation situation)
- Elastically decoupled pre-stressed bearings and screw connections can absorb tensile forces
- The bearings absorb high dynamic forces as well as horizontal and vertical forces
- The material properties are consistent, as none of the constituents can permeate

* Lower natural frequencies can be achieved with Isotop® spring elements.



Combined heat and power plant
GE Jenbacher

3 | Materials and Services

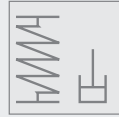


Sylomer® - high elasticity and long service life

Universally applicable elastic PU material, **spring/damper combination**, proven in the field for more than 45 years

Material characteristics:

- Mixed cellular
- Static range of use from 0.011 N/mm² to 1.2 N/mm²
- Load peaks up to 6.0 N/mm²
- Very low amplitude dependence
- Low creep tendency
- Proven long-time behaviour
- High fatigue strength
- No frequency dependence
- Finely graded range (10 standard types) for optimum system design



Sylodyn® - high dynamic durability

Technical spring with pronounced dynamic and highly elastic properties, proven in the field for more than 20 years

Material characteristics:

- Closed cell
- Static range of use from 0.075 N/mm² to 6.0 N/mm²
- Load peaks up to 18.0 N/mm²
- Very low amplitude dependence
- Low creep tendency
- Proven long-time behaviour
- High fatigue strength
- No frequency dependence
- Finely graded range (7 standard types) for optimum system design



Sylodamp® - high damping

Dampers with special energy-absorbing properties, proven in the field for more than 15 years

Material characteristics:

- Mixed cellular
- Static range of use from 0.005 N/mm² to 0.5 N/mm²
- Viscoelastic PU construction
- High internal damping
- Mechanical loss factor between 0.46 and 0.61
- Graded range (6 standard types) for optimum system design

Material functions: vibration isolation, vibration damping, shock absorption



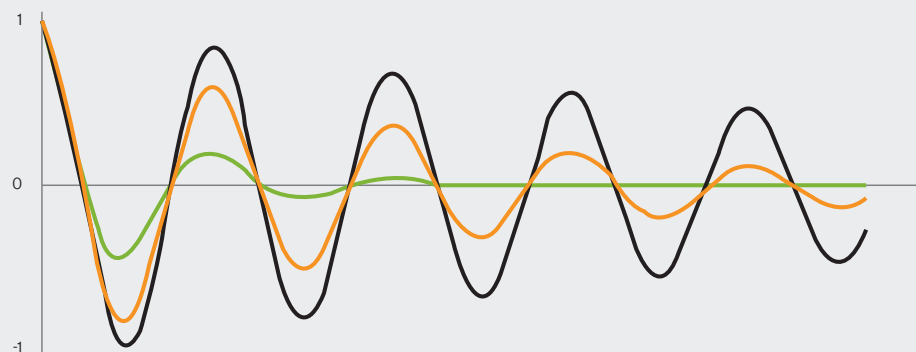
Sylomer®



Sylodyn®



Sylodamp®





Elastic decoupling of a production plant for food

Services from Getzner: a one-stop shop

Support in the planning phase

- Calculating the bearing
- Measuring the excitation spectra
- Vibration analysis of buildings
- Taking seismic requirements into account
- Drawing up installation plans
- Advising on connection details

Online calculation tool

- Calculating the optimum mounting

High-tech materials from our in-house research and development team

- Guaranteed long-term effectiveness
- Consistently effective over the entire service life of the machine
- Maintenance-free bearings

Installation and assembly

- Installation support provided by trained specialists
- No interruptions to the construction process

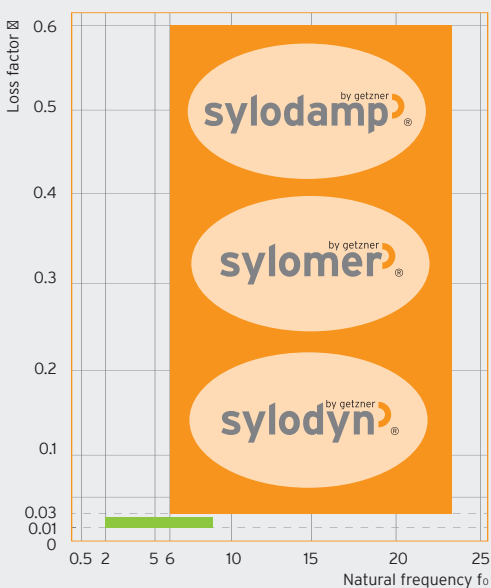
Cooperation with recognised and independent experts

Decades of experience around the world in providing bearings for machines

Option of developing special bearings and material combinations

Potential areas of application compared

The graphic shows the different properties of the product families with regard to suspension and damping.



	Loss factor η	Natural frequency f_0
Sylomer® and Sylodyn®	0.03 to 0.6	6 to 23
Isotop® steel springs	0.01	2 to 8
Steel ¹	0.0004	0.5 to 5
Compact elastomers ¹	0.03 to 0.3	6 to 25
Foamed elastomers ¹	0.03 to 0.6	2 to 25
Cork ¹	0.1 to 0.2	30 to 60
Air springs ¹	0.005 to 0.020	0.5 to 5

¹ Source: VDI 2062 - Sheet 2, 2007 edition as per Tab. 2

4 Applications Overview



Elastically mounted heat pump



Elastically mounted combined heat and power plant

Elastically mounted pump



Pump bearing

Task:
Vibration-suppressing bearing for different speeds and rotations, elastic connectors

Advantages:
Natural frequencies from 8 Hz, full-surface bearing, suitable for applying to in-situ concrete

Benefits:
Reduces structure-borne noise and secondary airborne noise

Combined heat and power plant Foundation bedding



Bearing for a combined heat and power plant

Task:
Decoupling the frame for damping higher amplitudes

Advantages:
Natural frequencies from 8 Hz, extremely resistant to chemicals

Benefits:
Reduces structure-borne noise and secondary airborne noise, maintenance-free bearings, long service life

Elastically mounted air conditioning



Treadmill bearing

Task:
Reduces the level of impact on the joints and transfer of structure-borne noise into the building

Advantages:
The required damping is achieved thanks to the high loss factor. Rapid elastic recovery makes it suitable for use on treadmills.

Benefits:
Jogging is better for the joints and less vibrations and pulses are transferred to the floor and the building

Treadmill bearing



Helicopter landing pad bearing

Task:
Hospitals are protected against disruptive vibrations during landing and take-off

Advantages:
Safeguards against uplift forces, assembly is quick and easy

Benefits:
Elastic bedding with Getzner TFB XT (table foundation on point bearing) allows hospital life to continue without disruption



A longer service life for a paper-making machine



Maximum decoupling for safety



A pleasant working environment close to turbines

Bearing for a papermaking machine

Task:

The amplitude on the surface of the foundation should not exceed $3\mu\text{m}$ (value O-P). This guarantees smooth operation and protects the surroundings from vibration.

Advantages:

Vibration isolation is noticeably more effective than rubber, especially at higher excitation frequencies, simple installation.

Benefits:

Smooth operation and consistent printing quality for the papermaking machine

Microscope bearing

Task:

Complete decoupling of the optical parts of a microscope, protection against the structural vibrations of the building

Advantages:

High damping during movement of the swivel arm, materials can be cut to size in any geometric shape (for all machine joints), high damping factor.

Benefits:

Complete vibration decoupling of the optical system. A stable microscope image, unaffected by vibrations

Turbine bearing

Task:

The surroundings must be protected against the vibrations of the turbines.

Advantages:

The foundation bedding efficiently reduces secondary airborne noise, protecting the surrounding buildings and machines against the vibrations of the turbines.

Benefits:

This increases the service life of the machines and the buildings. The noise and vibration levels are reduced, which improves working conditions.



On the right, bearing of an air conditioner: elastic decoupling with Sylomer®.

On the left, a helicopter landing pad in Interlaken: making sure that "sensitive" buildings stay peaceful

5 | References



Foundation bearing for the hydro power plant Steigs in Mels (CH)



Elastic decoupling of an industrial washing machine



Strip bearing of a cogeneration plant

References (extract)

- Foundation bedding for vacuum pumps, paper mill in Mörrum (SE)
- Foundation bedding for a papermaking machine, Kahoku Shimpo Publishing Co. (JP)
- Foundation bedding for a steel cutting installation, BRC Spencer, Coatbridge (UK)
- Transformer mounting, Electricité de France, Paris (FR)
- Gear decoupling, Hanseatische AG wind turbines (DE)
- Mounting for a water pumping station, M.C.E. Riyadh (SA)
- Mounting for an 18 metric ton, 2 MW combined heat and power plant (DE)
- Table foundation bearing for a helicopter landing pad, Interlaken hospital (CH)
- Vibration decoupling for combined heat and power plants, GE Jenbacher (AT)
- Bedding for HVAC systems, Oslo opera house (NO)
- Elastic bedding for textile machines, Lindauer Dornier (DE)
- Oil pump bearing for pipeline, Dutch oil company (NL)
- Foundation bedding for generators, EGAT Electricity Generating (TH)
- Base plate bedding for a telescope, Cape Girardeau, Missouri (USA)
- Lift mountings, Berlin Brandenburg Airport (DE)
- Foundation bedding for ball mill, Hebel GmbH, Germering (DE)

More on this subject

Rolling mill in Reutte, 1985

The rolling mill in Reutte (A) is just one example of the outstanding durability of Getzner materials. The foundation has a full-surface mounting that efficiently decouples the vibrations of the rollers at their source. Measurements taken in 1986 and 2013 prove that this solution is maintenance-free. There were no relevant changes in effect.

Fact sheet "Long-time behaviour of elastically mounted heavy foundations"

Further information:

- Increasing value through elastic shielding of buildings
- Construction Mat - Efficient Impact Noise Insulation
- Vibration solutions for technical facility equipment
- Safe vibration isolation in fire-prone areas

You can find the relevant documents at www.getzner.com/downloads

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