

ISOLATING | DAMPING | TUNING

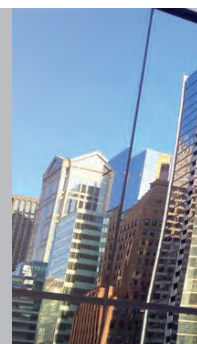


**For each vibration problem
the optimum solution**



VICODA

Vibration Control › Devices › Applications



SAFETY

for personnel, facilities and environment

AVAILABILITY

for plants, installations and construction

LONGEVITY

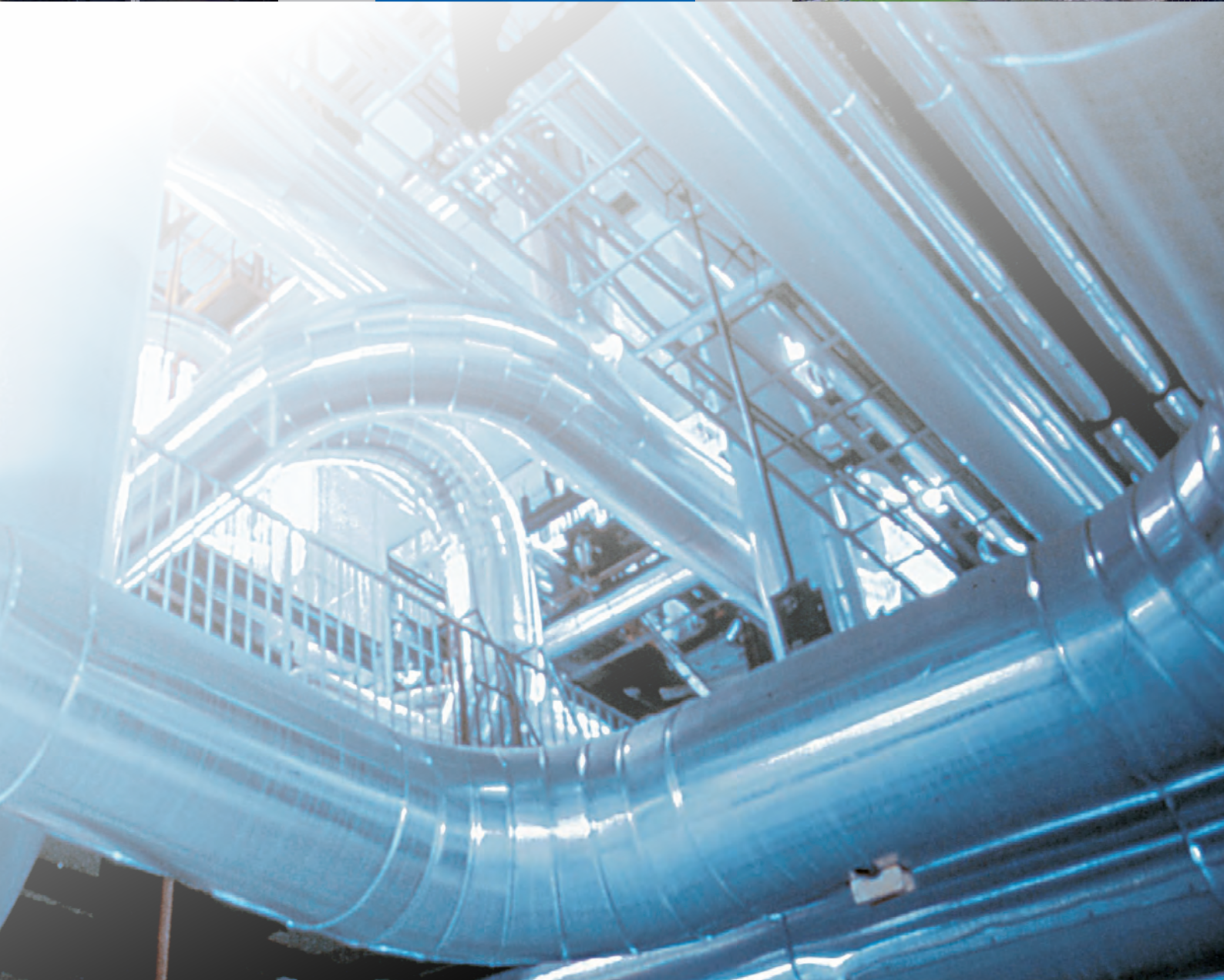
for the amortization of investments

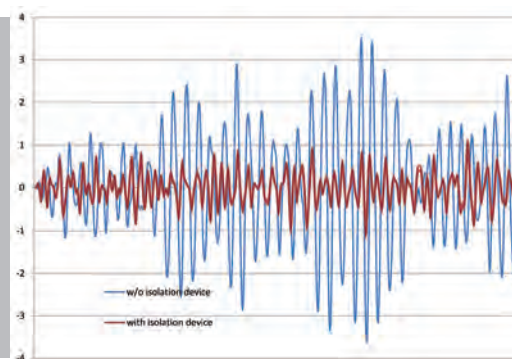




VICODA

Vibration Control › Devices › Applications





WHAT DOES VICODA STAND FOR?

Nomen est Omen - the name says it all, denoting the three key areas forming the focus of the VICODA business field, sophisticated vibration technology:

Vibration

Control

→ analysis and solutions for vibration problems

Develop

→ availability of a comprehensive product range

Applications

→ complete range of services including engineering, installation and monitoring

The VICODA management team from left to right:

*Dr. Steffen Pankoke - Board Member, Prof. Dr. Horst Peter Wölfel - Vice Chairman of the Board,
Hans-Herlof Hardtke - Chairman of the Board, Dr. Georg Friberg - Managing Director*



OUR MISSION

VICODA's mission is to serve and support customers to control unwanted vibrations in the field of **plant engineering, large infrastructures** and **buildings**. Due to extensive expertise in vibration control and a comprehensive product line, the most suitable solution to each specific problem can be supplied.

Depending on cause and characteristics, vibration-related problems can take many forms.

The techniques adopted to solve these problems can be correspondingly diverse.

VICODA is specialized not only in one single technology but combines under one roof all the most important systems for damping, reducing or isolating undesirable vibrations. The user can thus expect the best possible advice and our ambition to offer the optimum solution in each specific case.

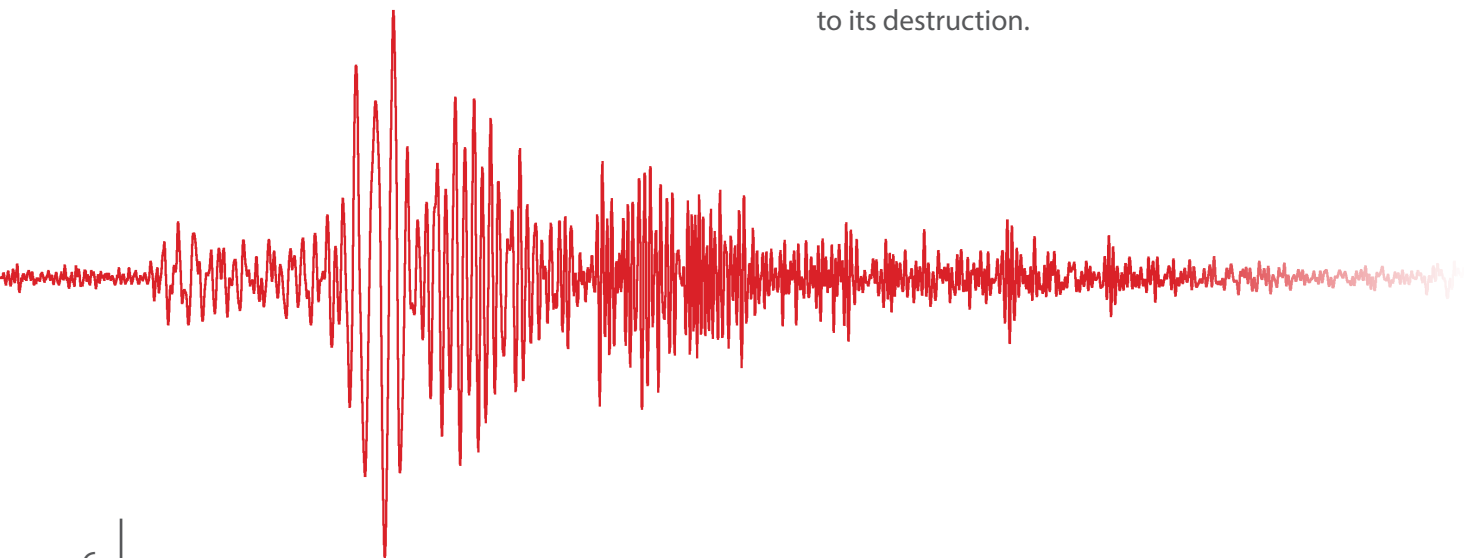


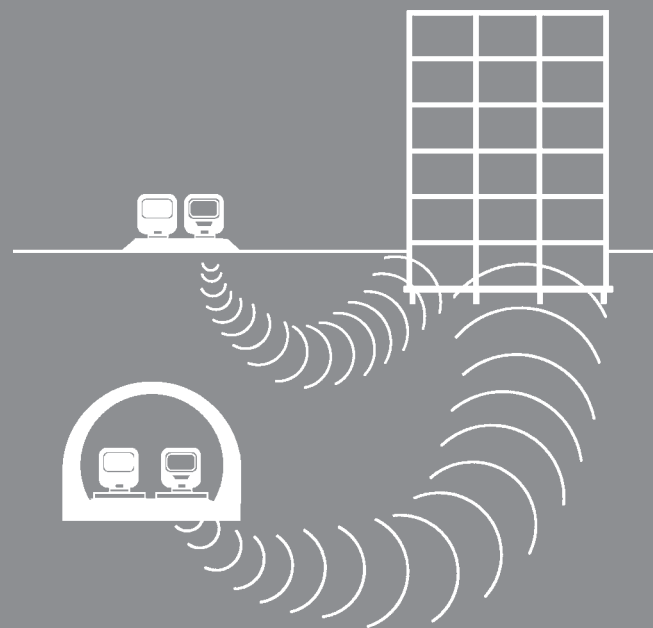
RISK OF DAMAGE THROUGH VIBRATIONS

Vibrations are dynamic loads presenting a serious risk of damage through material overstressing that can be detrimental to the service life of plant installations and structures. In extreme cases vibration can lead to the complete breakdown or destruction of the facility. Slender structures and components with low natural frequencies and

weak self-damping characteristics are particularly susceptible in this respect.

A particularly critical case arises when the excitation frequency coincides with the natural frequency of the object. Resonance effects can then build up vibrations in the swinging body, leading to its destruction.





Long-term operational vibrations can also lead to material fatigue, causing the formation of cracks and breakage even at low amplitudes.

Natural disasters such as heavy storms or earthquakes are external influences that can significantly exceed the supposed probability of damage and thus the permissible loads. In general, the chance of damage depends on the frequencies, amplitudes and load duration in each case.



CAUSE OF VIBRATIONS

Vibrations can arise through internal excitation such as mechanical or hydrodynamic processes or external ones such as wind loads or earthquakes.

Internal excitations

Internal excitations mostly arise from rotating masses originating from the operation of machines, aggregates and processing facilities.

Typical sources are pumps, centrifuges, compressors, rolling mills, presses, forge hammers and other large machine tools.

Moreover, internal excitation frequently arises in pipe systems of processing facilities through flow-dynamic processes in the transport of fluids or gases. Hazardous peak loads can also be caused by incidents such as pressure surges resulting from water hammer or the sudden closure of valves.

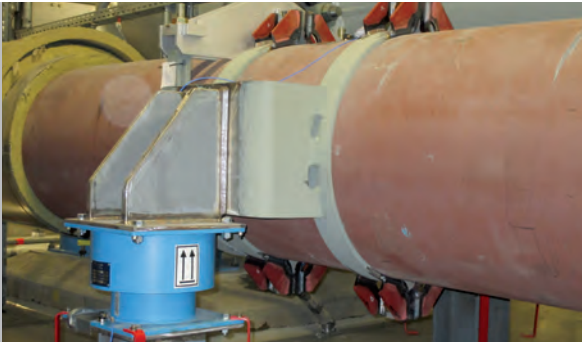
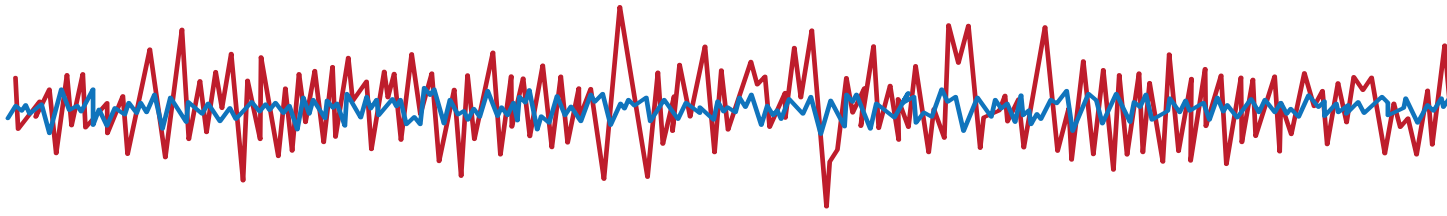




External excitations

External excitations due to factors such as wind and earthquakes can also cause severe damage or complete destruction of structures. Wind loads can in fact create serious problems in high buildings and slender bridges. Earthquakes can produce powerful shocks with a high risk of cracks and the collapse of entire constructions.

Traffic loads are also very often a source of unwanted vibrations. Railways in densely inhabited areas may cause discomfort by raising noise and vibrations levels in plants and buildings. Furthermore, slender and light bridges, such as footbridges for instance, may build up vibrations originating even from pedestrians.



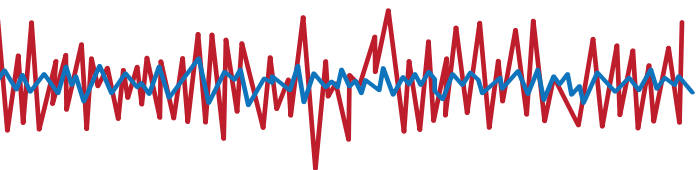
VIBRATIONS ARE CONTROLLABLE

Isolating | Damping | Tuning

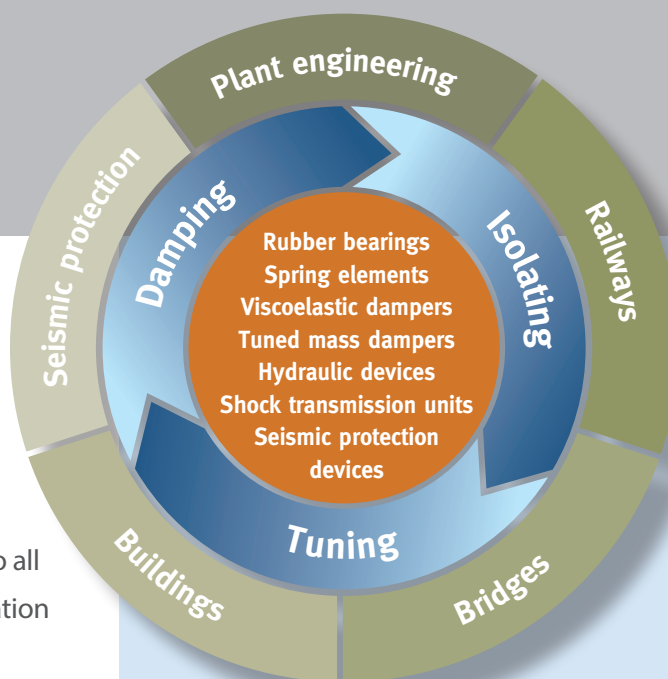
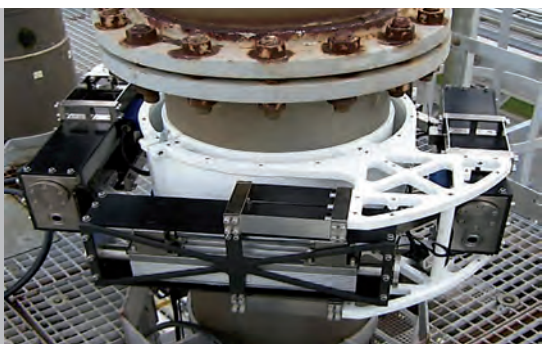
In plant or building construction the general aim is to exclude possible vibration stresses in the facilities by way of design and layout. If this is not possible for economic reasons, the vibration due to operation (internal excitation), as well as vibrations arising from external sources, can be effectively reduced to a harmless level using appropriate techniques and devices for vibration reduction.

VICODA provides the adequate techniques and a full range of appropriate devices for damping, isolating or tuning undesirable vibrations in all industrial fields.

This includes the sector of large machine tools, as well as components in plant installations such as pipe systems. Isolating entire buildings or specific sections in which vibrations may be particularly harmful also forms part of the VICODA performance package. This also applies to tuning structures to external impulses by acting on their natural frequencies. Tuned mass dampers are appropriate means for the mitigation of vibrations in slender structures such as bridges and high-rise buildings.



**There is no compromise
in safety – the best is just
good enough!**

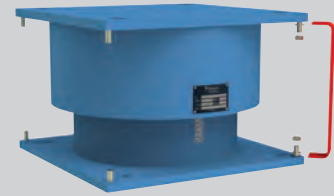
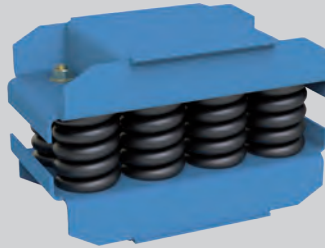
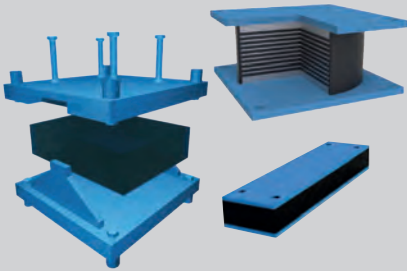


In order to provide the best possible answer to all kinds of vibration problems, sufficient information on the causes and behaviour of the vibrations should be available. If the reasons for the phenomena are unknown to the user, a specific analysis can be performed by highly qualified and experienced specialists from VICODA.

COMPLETE PRODUCT SPECTRUM

Solving a vibration problem is nothing you can take off the shelf: it requires qualified vibration engineering that considers the individual situation together with a comprehensive range of high-quality vibration technology devices that will combine to create the distinct best solution. As no single product exists to comply with all

the different requirements possible, VICODA has on hand a **complete product program of all essential types of vibration control devices**. Tailored to the respective form of vibration, its intensity, characteristics and installation layout, the optimum solution in each case can therefore be provided.



ELASTOMER BASED SYSTEMS

Rubber Bearings and Elastomeric Mats are effective as vibration isolators for structures and machines. They are suitable for the higher frequency ranges of external excitations.

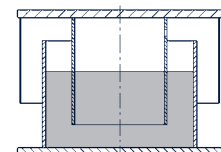
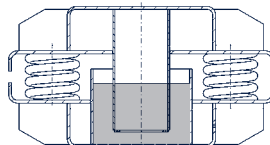
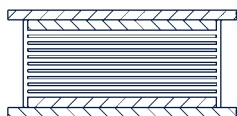
SPRING BEARINGS

Preloaded steel **Spring Packages** are effectively used for vibration isolation of structures and large machines.

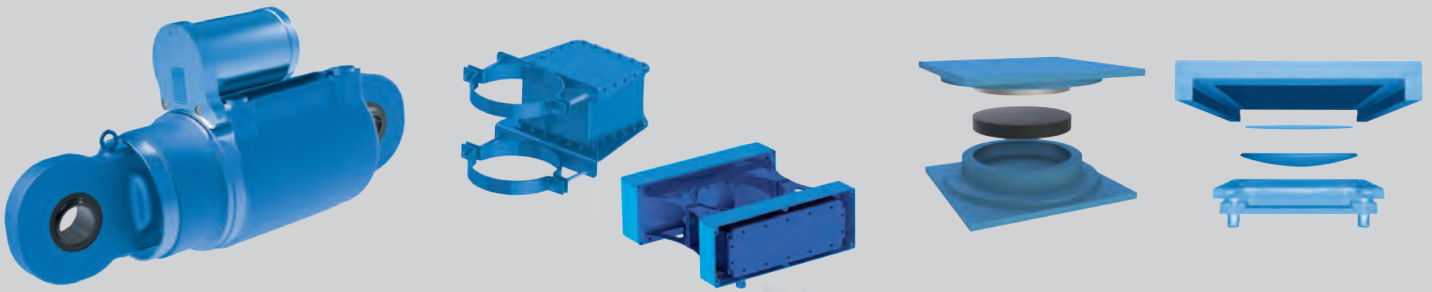
They provide load support and allow for vertical and horizontal displacement. Spring bearings can be supplied including additional viscoelastic damping.

VISCOELASTIC DAMPERS

VICODA Viscoelastic Dampers reduce operational vibrations at high damping forces. They allow displacements in all degrees of freedom and react in all positions. VICODA viscoelastic dampers provide additional damping to the vibration isolation of structures and heavy duty machinery. Easy to use and highly effective, they can be applied to damp vibrations in all industrial areas, especially where displacements need to be considered, for instance in complex piping systems.



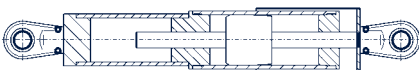
There is no “one-fits-all” solution – the right fit is needed for each individual case!



HYDRAULIC DEVICES AND FLUID DAMPERS

Shock Transmission Units (STU) are hydraulic devices. They act to protect endangered components from shock impulses in large structures and buildings, if at the same time relative movements between structure and fixed bearings must be allowed.

Deviating from a common hydraulic cylinder, an adjustable valve inserted in the piston controls the flow of hydraulic fluid from one cylinder chamber to the other. By this means different hydraulic circuits for different damping performances are available. The characteristics, load and stroke of the hydraulic dampers follow the specific requirements of the user in each case.

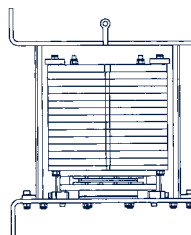


TUNED MASS DAMPERS

A special type of damping device is the **Tuned Mass Damper (TMD)**. The application of this special design is expedient in case there is no space or abutment available for the installation of a common damper design.

TMDs function by adding mass, a spring and an internal damper to a structure or a pipe system affected by vibration. To be effective, TMDs need to be tuned to the natural frequency of the object to be protected.

VICODA delivers passive as well as active TMDs.



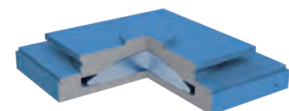
BEARINGS AND SEISMIC PROTECTION

Rubber Bearings allow horizontal movements and rotations. **Pot Bearings** offer a simple and well tested system to transfer forces. They allow or restrain movements in different directions. **Spherical Bearings** are the most up-to-date technology, providing the most efficient and most durable design.

Seismic isolators

High Damping Rubber Bearings and **Lead-Rubber Bearings** are special designs providing base isolation and energy dissipation for structures in areas prone to seismic events.

Pendulum Isolators offer state-of-the-art seismic protection. They are used to mitigate and damp earthquake effects in both bridge and building design.



TECHNICAL SERVICES

VICODA supplies not only products but solutions, delivering a full package of services throughout the entire engineering process.



Engineering support

Vibration problems are complex. Our engineers are at your disposal to give support in order to approach problems properly and work out the most suitable solution.

Vibration diagnostics

In the event of a vibration problem an analysis starts with a visit to the site in order to determine the root cause. For this, amplitudes and frequencies at defined points are recorded and then processed using special software. A custom-tailored solution to the case is then offered.

Installation

Besides the supply of products, VICODA is ready to perform the complete installation of the devices, or if requested only supervision can be carried out.

Monitoring

For the observation of the long-term behavior of the construction concerned, fitted bearings or means of damping can be equipped with corresponding monitoring devices.

FIELDS OF APPLICATION

VICODA is active in all areas where vibrations need to be absorbed by dampers or isolated at source.



The main fields of application are:

- Heavy duty machines
- Industrial plants
- Bridges and infrastructure
- Buildings
- Railways

Industrial plants - Isolation of machines

There are specific products and techniques to isolate heavy machines such as engines, compressors, pumps or forge hammers. These devices are placed between the machine and the foundations, isolating the vibration at source and preventing it from spreading into the foundations and the surroundings.

Analysis



Solution Design



Damping of piping

Specified devices and techniques are available to damp and reduce vibration in complex piping systems in power plants, petrochemical installations, refineries and other industrial facilities.

Tuned Mass Dampers for bridges and structures

Through the use of tuned mass damper technology, vibrations from different sources (wind, earthquakes, traffic etc.) can be significantly reduced.

Earthquake protection

For endangered bridges, buildings and large structures earthquake protection is most effective through base isolation and damping.

Vibration protection of buildings

Several applications are available to isolate buildings from external vibration (such as nearby railway lines or plants) or to provide internal isolation for e.g. dance halls, theatres or machines in operation.

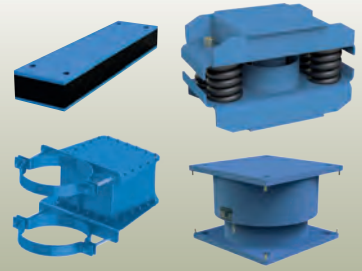
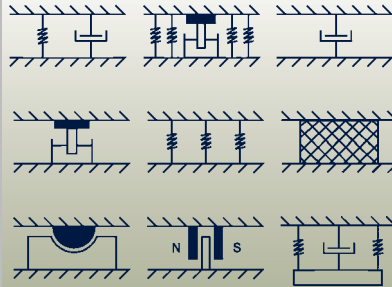
Railway line isolation

Isolation techniques for railway lines are available to prevent vibration due to the passage of trains from spreading to surrounding buildings. Several applications are available for bridges, tunnels and standard lines affected.



THE VICODA SOLUTION PROCESS

Even most complex vibration problems can be successfully mastered through the VICODA Process. The VICODA experts provide all the necessary competences from one hand – the VICODA approach.



1. Analysis

Most important for a sound solution is a sound analysis, including the review of design documents and an on-site data assessment of the vibration parameters. The gathered data are analyzed with latest structural analysis tools such as dynamic finite element models. Based on the results the source of the vibration problem can be identified and classified.

2. Solution Design

Striving for the optimum solution for a specific vibration problem, VICODA selects the most suitable solution strategy out of the complete range of strategies:

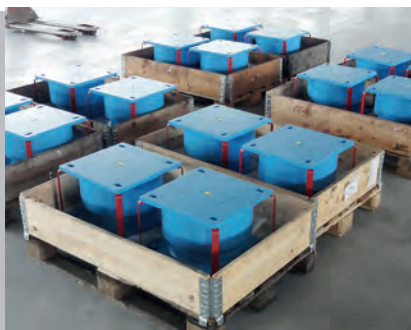
Reducing the excitation – Isolating – Damping – Absorbing - De-tuning

Parameters of the selected solution strategy like isolation frequencies, damping ratios or absorber frequencies are identified and the parameters of the selected devices are determined correspondingly.

3. Product Selection

For different solution strategies different vibration control products are required. Due to the diversity of vibration control problems these products need to correspond to a wide range of application parameters.

To comply with these requirements VICODA provides a complete portfolio of specially designed vibration control products.



4. Product Supply

Following the strict rules of an approved quality management system VICODA products are meeting highest quality standards. Due to the skilled and experienced workforce, state-of-the-art production equipment and special production control procedures short delivery times can be reliably assured.

All performance testing of the products can be done in VICODA's own test lab

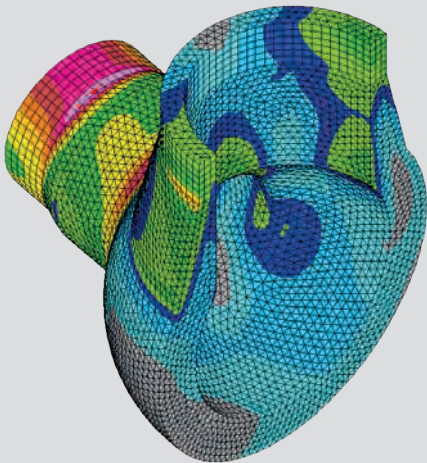
5. Installation & Startup

Qualified and experienced personnel is on hand to install the VICODA products and put them into operation. It is part of the process to check the result of the solution and to fine-tune parameters if necessary. The technical documentation can be provided.

6. Vibration Monitoring

For the surveillance of the safety and approvable operation of the structure a monitoring system is an effective solution. This method allows reliably to detect structural modifications and damages in an early stage so that maintenance can be planned based on the actual condition of the system.

VICODA provides the most recent monitoring systems including the respective data collection equipment and data analysis tools.



COMPETENCE

As sophisticated technology is required in the field of vibration control it is vital for project engineers to be able to rely on experienced and competent advice.



WÖLFEL Headquarters in Höchberg, Germany



LISEGA Headquarters in Zeven, Germany



At VICODA, practical experience and expert theoretical knowledge complement each other perfectly.

While **LISEGA**, the major shareholder, is the world market leader in pipe support technology, **Wölfel**, an important fellow-stakeholder, has long been established as the leading engineering partner in vibration technology.

Whether it is a question of practical matters such as design, application technology, manufacture or logistics, or whether the focus is on implementation of theoretical principles for analysis, monitoring or vibration-related calculations, an expert partner will always be on hand.





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