GERB
Vibration Control Systems

Vibration Isolation of Buildings

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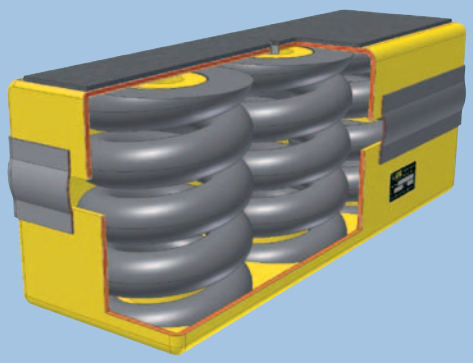


Non-prestressable spring element

Attractive plots in central and convenient locations often come with a major disadvantage – specifically, vibration or structure-borne noise that might be caused by:

- Metro or other well used railway lines,
- heavy truck traffic passing by on uneven roads or nearby bridges,
- heavy machinery being operated in neighboring industrial facilities.

Noise and vibrations can significantly reduce the general value of properties. And quite often the extent of ground-borne vibration tends to be initially underestimated. Indeed, it is only once the building has been completed that the consequences are fully felt with floors vibrating, and walls and floors becoming the radiating surface of secondary noise.

Unfortunately, subsequent counter-measures are often difficult to implement or even outright impossible or – if there is a solution – it is likely to take up considerable amounts of time and money.

Therefore, to avoid costly problems in the future, it is imperative that both the building owners and architects consider this highly important issue at an early stage.

The reality is that conventional foundations cannot do much to prevent the transmission of disturbing vibrations onto the building. Measures at the vibration source are often not possible or insufficient. Furthermore, structural measures taken in the building seldom prove to be successful and may actually constrain the creativity of the architect or building owner, or alternatively the functionality of the building.

Eventually, to eliminate risks for people, machines or buildings, it might well become necessary to implement special measures to the building's foundations, whether it be a residential or office building, a hotel or retirement home, a concert hall, conference center or a modern facility with vibration-sensitive production.

GERB base isolation by steel spring support gives you such an opportunity.

Prestressable spring element for vibration isolation of buildings

The worldwide first residential building spring supported for vibration isolation, 4 Hz – Berlin, Germany 1986

Protection of Buildings from Noise and Vibration

As a standard, GERB designs highly-elastic support systems for buildings to vertical system natural frequencies (support frequencies) of 3 to 5 Hz, and, in special cases, even as low as 2 Hz. Consequently, the vibration attenuation capability of such systems already starts at vibration frequencies as low as 5 Hz, or even lower.

This not only eliminates the transmission of ground-borne noise in a highly effective manner, but also mechanical vibrations with frequencies of 10-20 Hz, which are often found in the vicinity of railway lines, are reduced by 80 % or more.

In particular, low-frequency ground-borne vibrations are amplified by building floor resonances and these in turn are especially notable on the higher floors of a construction. Meanwhile, for higher frequency vibrations, the isolation efficiency of the system is even higher.

Even under difficult conditions, the system allows to keep building vibration levels safely below the limits indicated in the respective standards.

The GERB base isolation systems make use of spring elements that feature helical steel springs. Such systems have been used throughout the world for many decades in the field of vibration isolation of heavy machinery with high static and dynamic loads.

Since 1985, GERB vibration isolation systems have also been very successfully and sustainably used for the base isolation of buildings. Prior to this GERB spring systems had already been installed in more than 500 instances to protect buildings from any subsidence damage caused by mining. In such scenarios they automatically compensate for any differential movements of the foundations in case of a fault.

Furthermore, in the field of earthquake protection, GERB spring elements combined with Visco-dampers® are used in a number of different countries.

Spring supported cinema building close to a railway station – Siegburg, Germany

2 spring supported buildings close to an elevated city highway – Paris, France

Spring element, type SU

GERB Spring Elements

GERB spring elements are comprised of high-quality helical steel springs that are made of spring steel. These are sandwiched between steel plates or welded steel housings. Stiffness and loading capacity of the elements are defined by the type and quantity of the springs included.

Helical steel springs show a linear load/deflection curve within their range of operation. Their wide deflection range makes them ideal for the elastic support of buildings, enabling the lowest support frequencies that guarantee the highest possible performance. Single spring elements take loads starting from 100 up to 2000 kN or even higher. Due to their high horizontal stiffness, these elements are also suitable to take wind loads. Horizontal restraints are usually not required. The single spring elements are simply fixed to the adjacent structure by means of adhesive resilient pads, which are part of the delivery. Fixing by bolts is not necessary.

Additional measures optionally applied to GERB spring elements include

- elastic (noise-stop) pads and
- the GERB Coil Resonance Damping System (CRDS)

These measures ensure significant vibration attenuation improvements in the acoustic frequency range.

Vibration isolation of a townhouse above metro line – Berlin, Germany

Spring supported residential house – Berlin, Germany

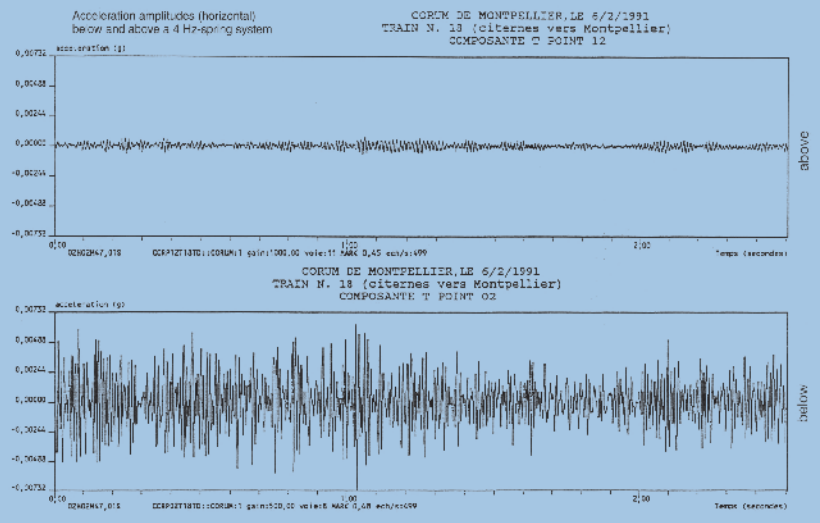
Positioning of prestressed spring elements – Boston, USA

High-frequency test stand for springs (GERB R & D Dept.)

Steel springs and housings are provided with a special long-term anti-corrosion coating according to GERB work standards.

GERB spring elements are fatigue-proof and maintenance-free. And thanks to reserves in the stresses, they offer an almost unlimited service life.

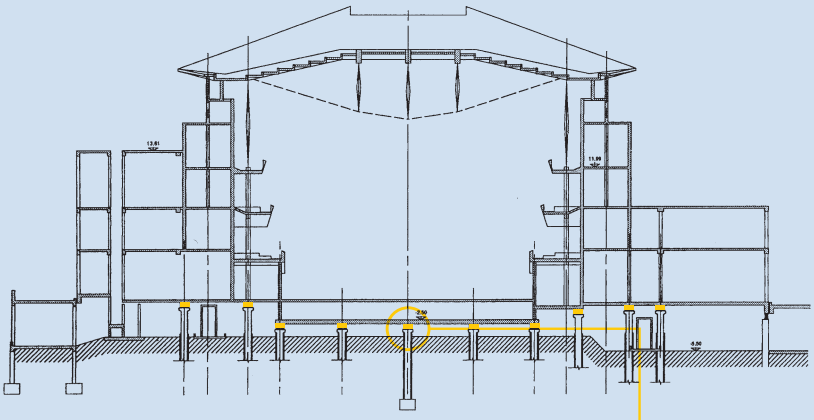
GERB spring elements for building isolation are designed to international standards. They are produced in company-owned manufacturing plants that maintain a rigorous quality assurance system.



Acceleration amplitudes (horizontal) below and above a 4 Hz-spring system

Spring support in underground car park

Spring units below Bridgewater Concert Hall



System Design and Installation

A base isolation system is usually designed based on the results of a preceding vibration survey.

GERB spring elements are commonly located either underneath buildings, or in pockets arranged within basement walls, or alternatively on top of walls and columns above ground level.

Types and the number of spring elements are determined in close cooperation between the architect, structural engineer, and GERB's specialists. A wide range of standardized spring elements is available with closely graduated load capacities, which enable the engineer to adapt the spring system precisely and safely to the individual building loads. This ensures that the final static spring deflection will meet the required dynamic conditions at every support location. In addition, a wide range of elements of different design ensures reasonable wall and column head sizes to a great extent. As a result, GERB spring elements make possible optimized and reliable planning in regard to not only statical and dynamical terms, but also economic terms, which is the general basis of a long-term and effective protection from disturbing vibrations.

As an option, GERB spring elements are available as prestressable or non-prestressable versions. In both instances, the same dynamic efficiency is possible. In the case of small or medium sized buildings, non-prestressable elements represent a cost-effective and equally efficient solution. Meanwhile, prestressable design elements deliver additional advantages for building construction and subsequent spring adjustments that may particularly occur in large buildings with a complex design.

Bridgewater Concert Hall with 3.5 Hz system – Manchester, GB

IMAX Cinema with 3.5 Hz isolation system – London, GB

GERB Vibration Control Systems

Vibration Isolation of Buildings
Reference List (Excerpt)

Country	City	Project	Total Design Load [kN]	Support Frequency [Hz]
Australia	Sydney	Conservatorium of music	32,000	3.5
China	Shanghai	2 Concert hall buildings	370,000	3.8/4.1
Czech Republic	Prague	Broadcasting building	83,000	3.5
Finland	Helsinki	6 Residential buildings	150,000	3.5
France	Aix-en-Provence	Opera house	30,000	3.7
	Montpellier	Opera house	230,000	4.0
	Paris-La Défence	Hotel	220,000	3.5
	Paris	Laboratory, Institut Pasteur	126,000	4.0
	Paris	Cinema	42,000	4.0
	Paris	Office/Residential building	304,000	3.7
	Paris	Theatre	23,000	3.3
	Roissy	Sheraton Airport Hotel	280,000	3.5
	Sceaux	Residential building	130,000	4.0
Germany	Berlin	17 Residential buildings	384,500	3.5 - 5.0
	Nuremberg	6 Single-family homes	20,000	4.0
	Munich	Office building	160,000	3.0
	Bonn	Hotel	65,000	3.5
	Cologne	Residential building (120 Ap.)	240,000	3.5
	Siegburg	Multiplex Cinema	150,000	3.5
	Verden/Aller	Concert hall building	25,000	3.9
Great Britain	London	Office building	215,000	3.7
	London	6 Single-family homes	25,600	3.5
	London	IMAX Cinema	50,000	3.5
	London	Retail and office building	100,000	3.5
	London	BBC Broadcasting building	134,000	3.5
	Manchester	Concert hall building	300,000	3.5
Hong Kong	Hong Kong	Theatre building	300,000	3.5
Italy	Milan	3 Residential buildings	450,000	2.4 - 3.5
The Netherlands	The Hague	Cultural Centre	24,000	3.5
Spain	Barcelona	Hospital building	530,000	3.5
	Barcelona	Office building	3,200	3.5
	Madrid	Residential building	212,000	3.5
Sweden	Stockholm	Residential building	13,500	3.5
USA	Atlanta, Georgia	22 Single-family homes	11,000	3.7
	Dallas,Texas	Convention Center Hall	375,000	3.2

Residential houses with 3.5 Hz isolation system – London, GB

Residential buildings, partially spring supported on top of a railway station – Stockholm, Sweden

GERB
worldwide

GERB Services

- Worldwide consultancy
- Design of the base isolation system
- Manufacture and delivery of spring elements
- Installation or supervision of installation, fine tuning
- Inspections

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