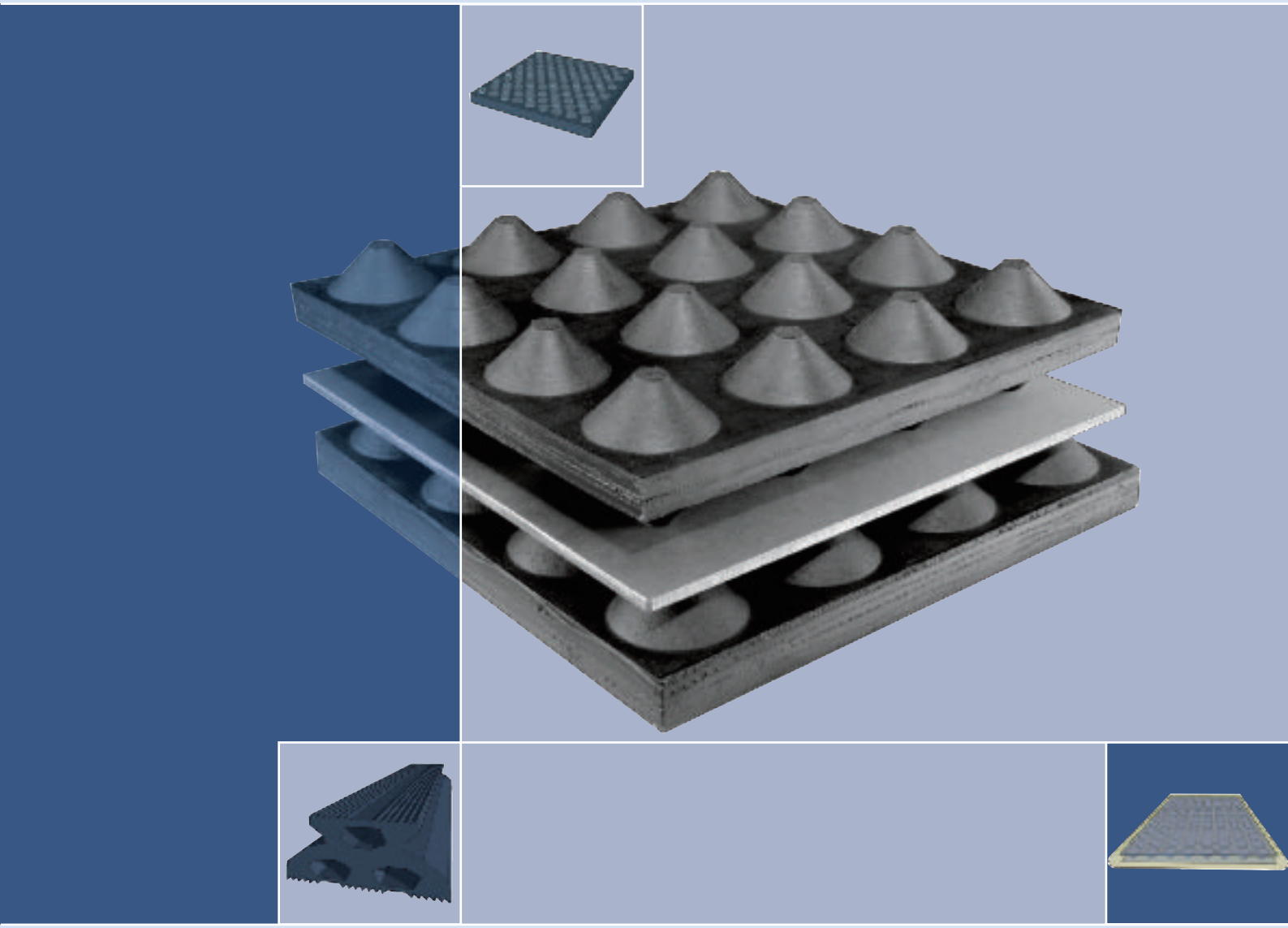
CALENBERG INGENIEURE

Elastomeric Bearings for Protection against Vibration and Structure-borne Noise



Elastic elements to reduce dynamic actions

Overview and selection tool

Fields of Applications

General

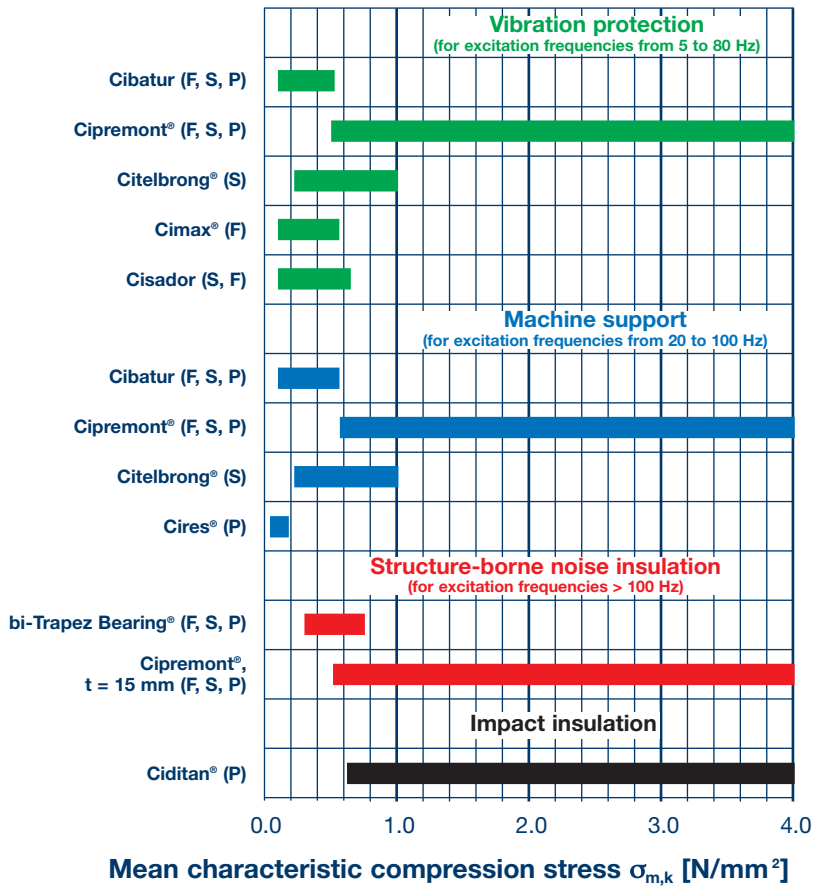
Calenberg elastomeric bearings have been in use since 1964. They show reliable and continuous functionality without ever having to be replaced. They have an excellent service life which is at least as long as that of the structure. The bearings have very little creep, they do not absorb water and work well at very high and very low temperatures. The product Cibatur for instance exhibits elastic properties even at –40°C.

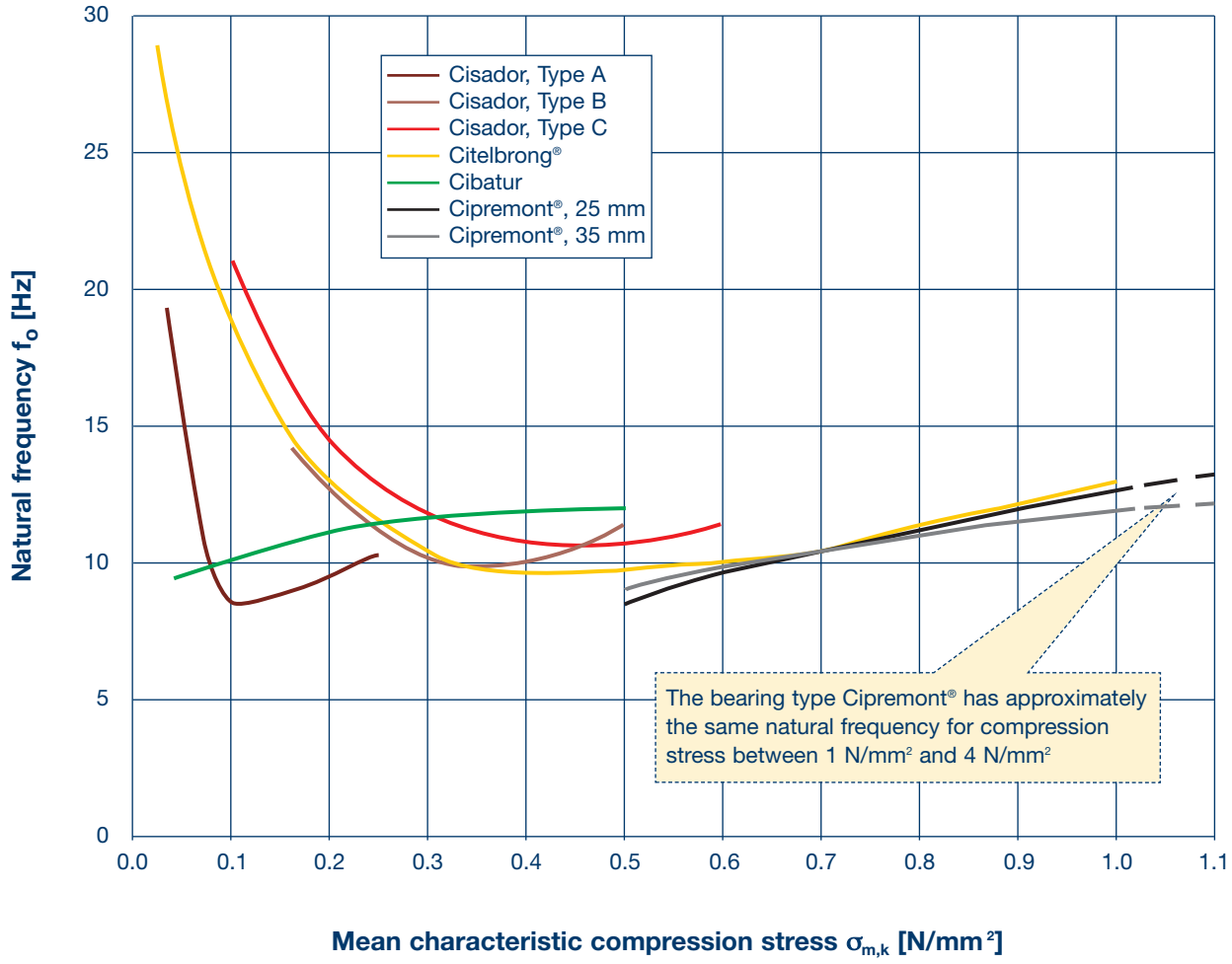
Vibration protection and structure-borne noise insulation

As an approximation a single degree of freedom system is adopted for the linear mass-spring-system so as to avoid rather complex vibration calculation and hence facilitate a relatively simple assessment. This initial approach deviates from the realistically occurring vibration behaviour but is considered sufficiently close as an initial approximation. By using this approach, elastomeric springs can be employed as protection against emission (reduction of radiation of vibration impact to the environment) as well as protection against immission (protection of a structure against vibration from the surrounding area).

The choice of suitable elastomeric elements in between individual structural members can substantially reduce vibration.

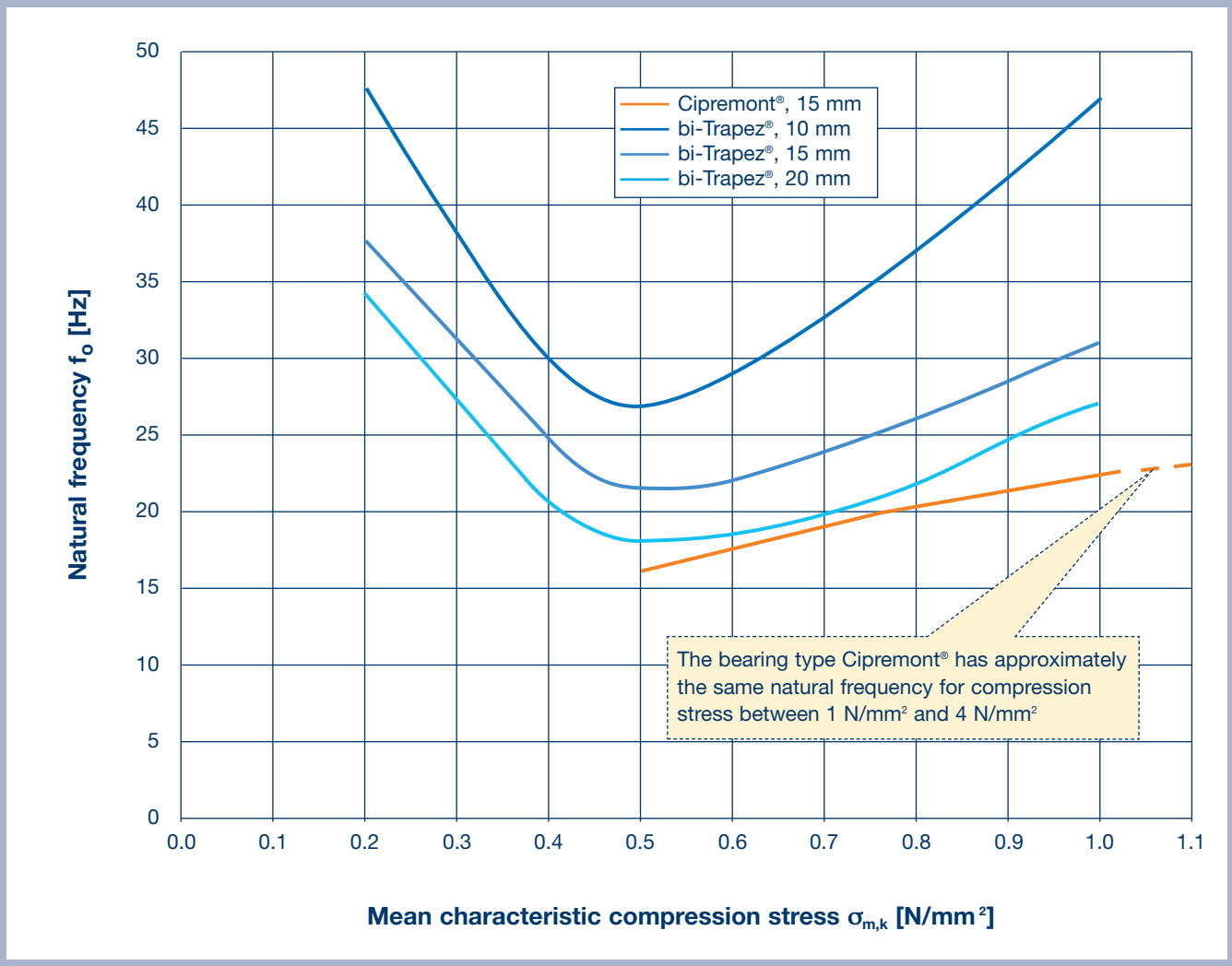
F = for large area support
S = for strip support
P = for point support

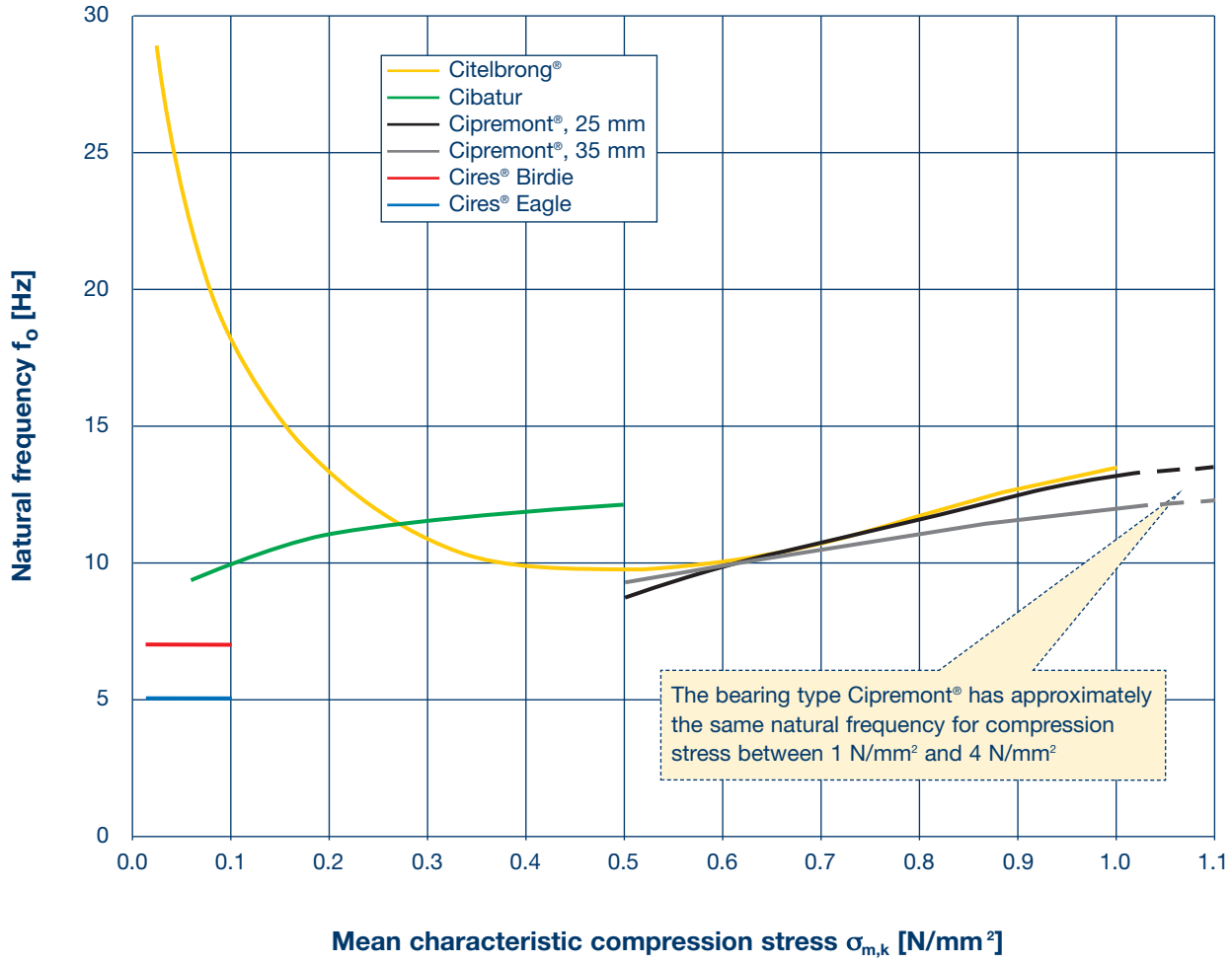




Vibration Protection

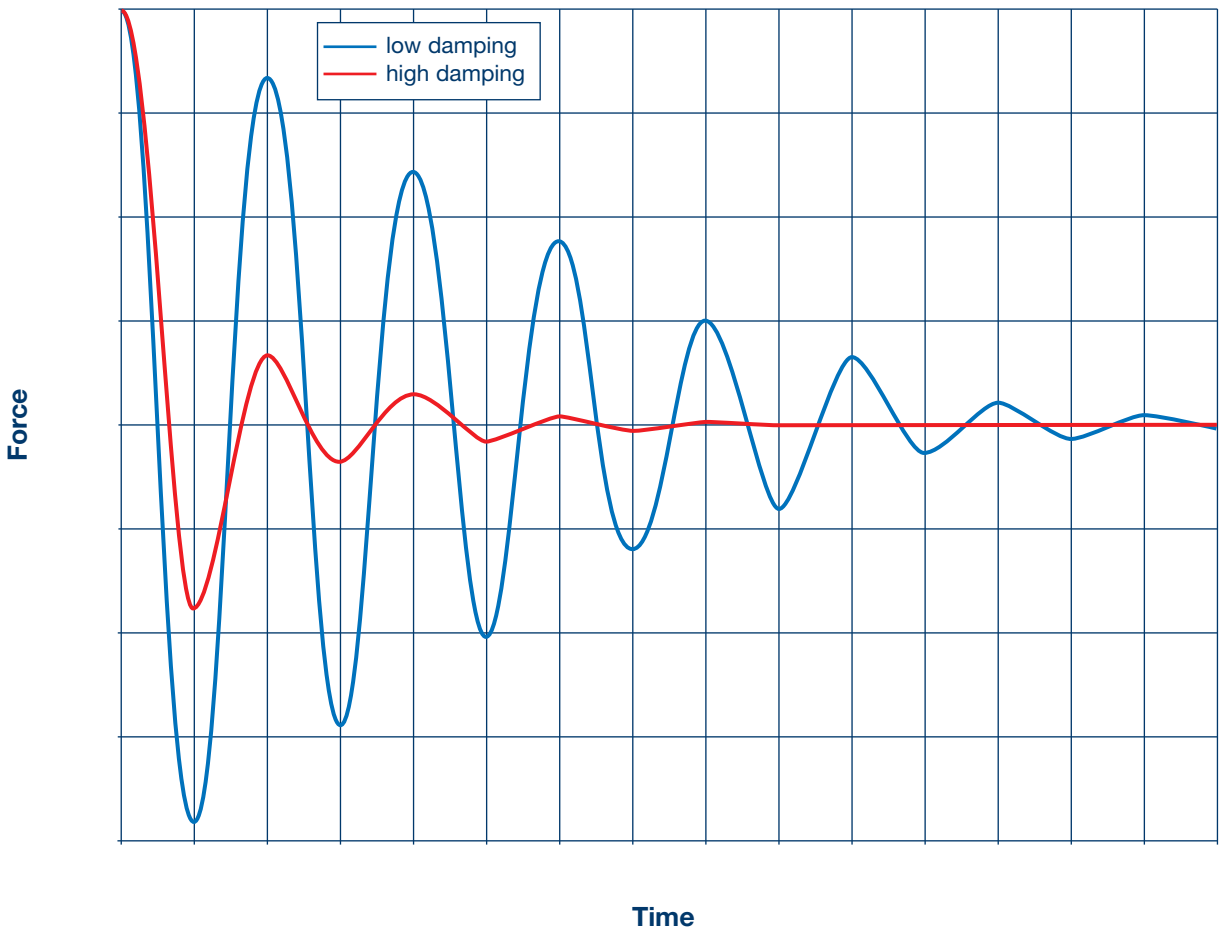
Structure-borne Noise Protection





Machine Support

Impact Insulation



Decay process of elastic materials with different damping in the case of impact excitation (schematic diagram)

Placing of elastomeric bearings for vibration isolation

Depending on the type of application and requirement of the elastomeric bearing it can generally be distinguished between planar, strip and point support application.

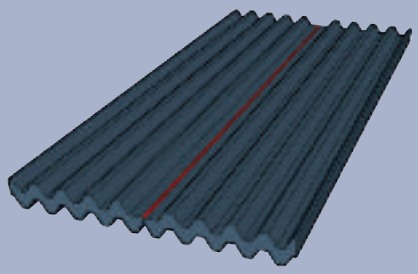
For all applications the bearing joint has to be prepared in such a way that concrete cannot enter the joint. In the case of planar applications the joints are protected by special joint covering strips.

In the case of strip or point support applications the bearing has to be fitted with an inflexible cover before concreting starts. This may be a filigree concrete slab as well as a timber or steel plate.

In the case of point support it is recommended for safety reasons to also cover the free bearing surface with soft material. The displacement of the bearing i.e. the free movement of the bearing must be guaranteed at all times.

Placing of Elastomeric Bearings

Product Description



bi-Trapez Bearing®

A high degree of vibration isolation and a high insulation index against structure-borne noise are achieved due to a low compression modulus for a load of up to 1 N/mm².

Technical Data:

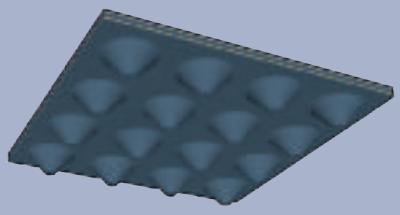
Effective compression stress range σ_{eff}: 0,3 – 0,7 N/mm²
Maximum compression stress $\sigma_{m,k}$: 1 N/mm²
Lowest natural frequency: 18 Hz

Field of Application:

Particularly suitable for impact sound insulation in staircases

Bearing Thickness:

10 mm 15 mm 20 mm



Cibatur

The profiled mat consists of a fibre reinforced elastomeric plate with elastic, truncated cone-shaped studs on the underside. It possesses a constant natural frequency over a wide loading range. The top layer is not only resistant to abrasion, oil and ozone but also insensitive to weather. Very high quality natural rubber mix is used for the elastic studs.

Technical Data:

Effective compression stress range σ_{eff}: 0,05 – 0,5 N/mm²
Maximum compression stress $\sigma_{m,k}$: 1,2 N/mm²
Lowest natural frequency: 9 Hz

Field of Application:

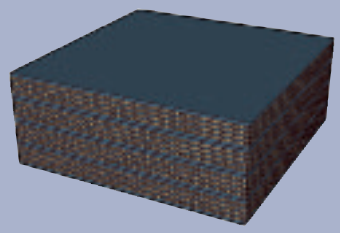
Particularly suitable for large areas under buildings

Bearing Thickness:

30 mm

Ciditan®

This elastomeric bearing has high stiffness which depending on the requirement is achieved by several fabric layers thereby restricting lateral strain considerably.



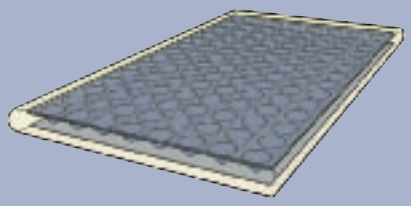
Technical Data:
On request
Design relates to the application and the technical requirements

Field of Application:
Especially suited for support of structural elements subject to considerable impact load.

Bearing Thickness:
30 mm 40 mm 50 mm

Cimax®

Is a patented waterproof, encased variant of the proven Cibatur mat. Cimax® was developed specifically for use under water.



Technical Data:

Effective compression stress range σ_{eff}:	0,05 – 0,5 N/mm²
Maximum compression stress $\sigma_{m,k}$:	1,2 N/mm²
Lowest natural frequency:	9 Hz

Field of Application:
Particularly suitable for support of structures below ground water level

Bearing Thickness:
35 mm

Product Description

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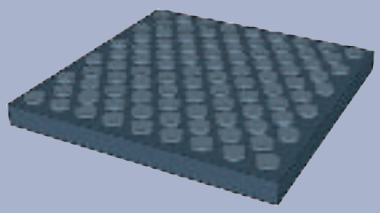


Cipremont®

Profiled heavy-duty unreinforced elastomeric bearing with little creep and constant natural frequency for a wide load range.

Technical Data:

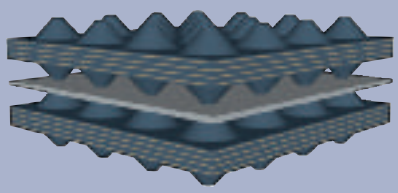
Effective compression stress range σ_{eff}:	0,5 – 4,0 N/mm²
Maximum compression stress $\sigma_{m,k}$:	5,0 N/mm²
Lowest natural frequency:	8 Hz

Field of Application:

Particularly suitable for support of machines and structures with high compression stress.

Bearing Thickness:

15 mm 25 mm 35 mm



Cires®

Highly elastic bearing, fibre-reinforced and profiled, for vibration isolation at low frequencies.

Technical Data:

Standard dimensions:	250 mm x 250 mm
Load range:	2 – 6 kN/element
Lowest natural frequency:	5 Hz

Field of Application:

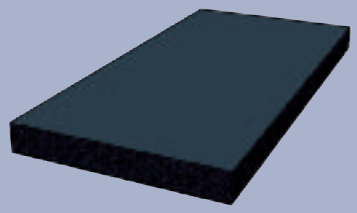
Particularly suitable for support of ventilation systems or similar

Bearing Thickness:

60 mm 125 mm

Cisador

Consists of microcellular EPDM material and is always placed in 2 layers of 15 mm thickness each. There are three types of Cisador which are used for different compression stress ranges.



Technical Data:

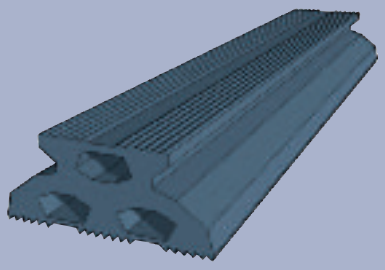
Effective compression stress σ_{eff}:	0,05 – 0,6 N/mm²
Maximum compression stress $\sigma_{m,k}$:	0,6 N/mm²
Lowest natural frequency:	10 Hz

Field of Application:
Particularly suitable for the support of structures and machines

Bearing Thickness:
30 mm

Citelbrong®

This profiled elastomeric strip is used for protection against vibration and structure-borne noise. The moulded shape allows large deflections at relatively high loads with resulting low natural frequencies.



Technical Data:

Effective loading range F_{eff}:	0,25 N/mm² – 0,80 N/mm² 37,50 kN/m – 120,00 kN/m
Lowest natural frequency:	10 Hz

Application:
Particularly suitable for strip support of machines

Bearing Thickness:
65 mm

Product Description

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Design Example

Support of a machine on a reinforced concrete foundation

Initial data:
Machine weight: 30 t

Foundation dimensions:
L x W x H = 8 m x 3 m x 1,5 m
Concrete density: 2,5 t/m³

Plan area: 24 m²
Volume of foundation: 36,0 m³
Weight of foundation: 90 t

Total weight: 120 t

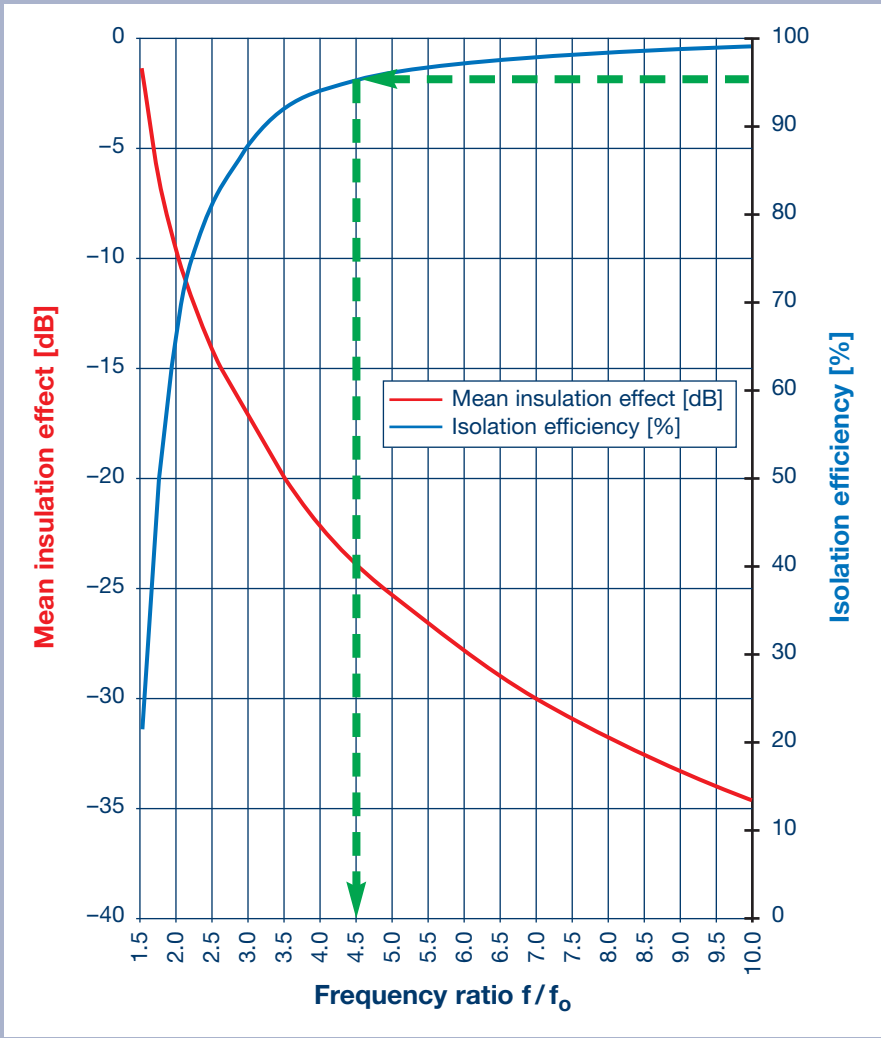
Compression stress σ_D: 0,05 N/mm²

Dominant excitation frequency f of rotational speed: 2500 rpm = 41,7 Hz

Target isolation efficiency ca. 95 %
⇒ taken from graph opposite:
Frequency ratio f/f_o = 4,5

Required natural frequency f_o:
41,7 / 4,5 = 9,3 Hz

Given the compression stress and the required natural frequency f_o a bearing type can be selected. For this example the type Cibatur is suitable.



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