

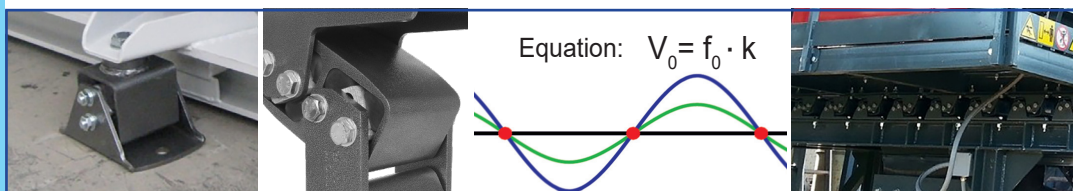
TC2 - S.Q.

TC2 **TECNIDEA CIDUE** **S.r.l.**

...ideas in motion...

n° 37
October 2026

Inside you will find: Mechanics - Updates



NEWSPAPER
Technical News

EN

FOLLOW US ON



www.linkedin.com/company/tecnidea-cidue-srl/

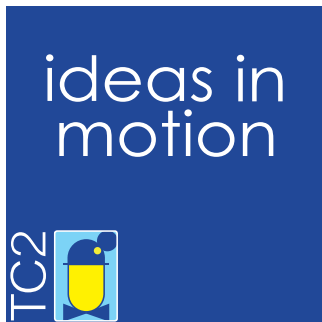
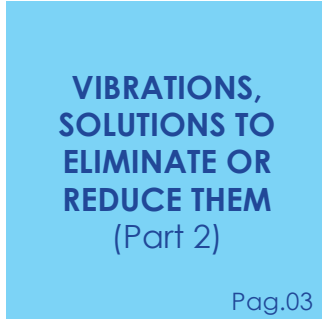


TECNIDEA CIDUE
S.r.l.



...ideas in motion...

COVERED TOPICS: VIBRATIONS - VIBRATING MACHINES



TC2 APHORISM

How many ways are there to do things?

ONE and only **ONE**, do it right...!
Every other way is wrong.

Franco Canova
Franco Canova

Edited by Franco Canova – Tables and drawings Eng. Enrico Caceffo

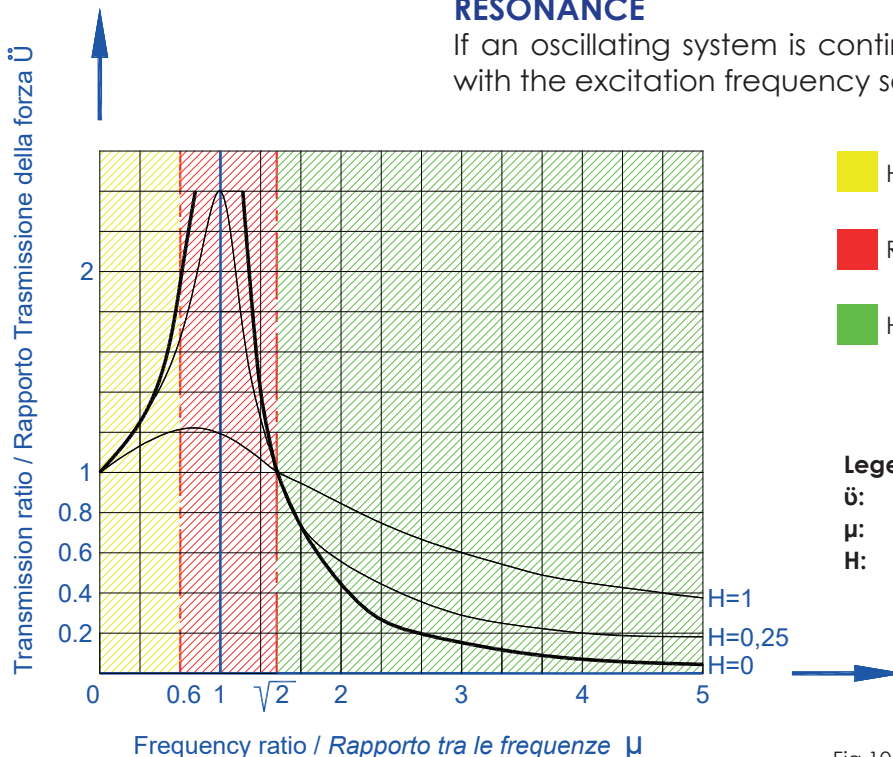
Franco Canova: Ideas Creations Inventions

VIBRATIONS, SOLUTIONS TO ELIMINATE OR REDUCE THEM

SECOND PART

RESONANCE

If an oscillating system is continuously stressed, it will oscillate with the excitation frequency set to it (f_0).



 Hypo-critical

 Resonance

 Hyper-critical

Legend:

$\ddot{U}$: excitation force

μ : f_0 / f_n

H : degree of damping

Fig.10



DUMPING

A force with limited duration, in an elastic system, produces oscillations that will gradually die out over time, this effect is caused solely by the damping elements.

Damping curves of a sinusoidal oscillating system

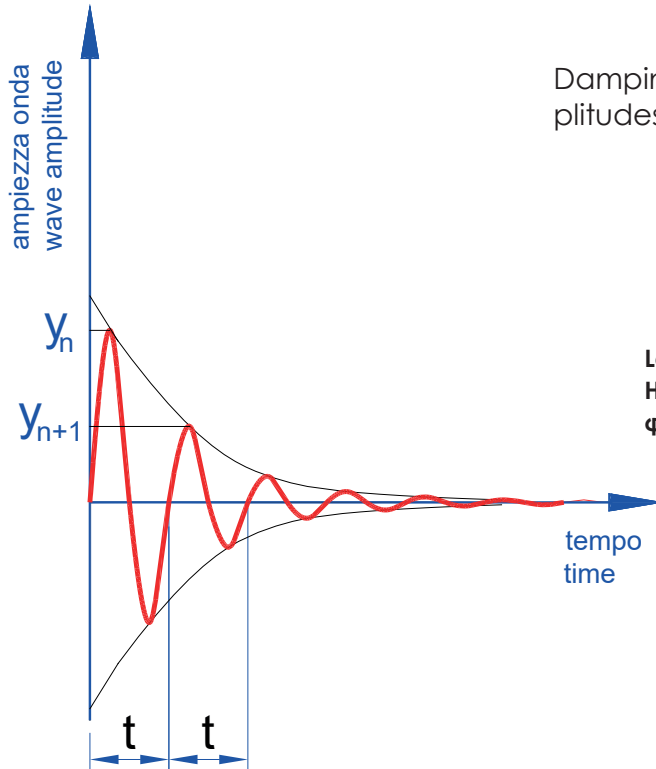


Fig.11

Damping **H** is given by the ratio of two or more amplitudes **y** consecutive

$$\frac{y_{n+1}}{y_n} = e^{-2H\pi} = e^{-\varphi\pi} \quad (\text{Formula 6})$$

Legend:

H: degree of damping
φ: mechanical loss coefficient

The loss coefficient of a steel spring is very low and equivalent

$$\varphi = 0,004 \div 0,016 \quad (\text{Fig.12})$$



Fig.12

Low damping spring

In elastomers, however, depending on the hardness and type the damping is high and equal to:

$$\varphi = 0,1 \div 0,4 \quad (\text{Fig.13})$$



Fig.13

VIB Type Y High Damping Rubber Shock Absorber

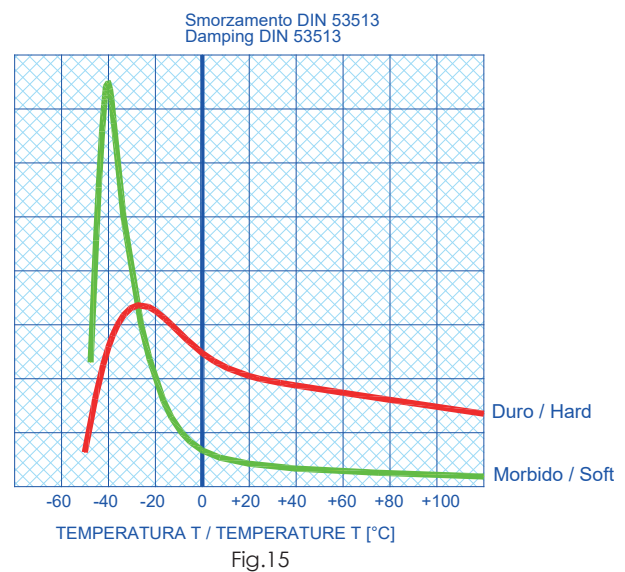
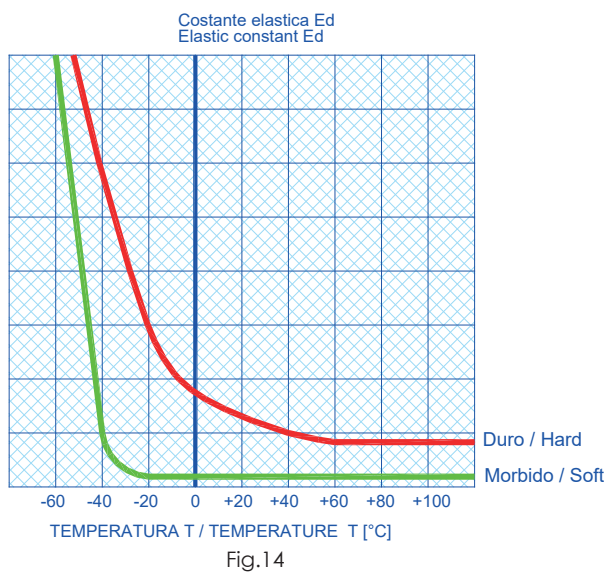


There are **three** damping systems:

1: by Coulomb - **2:** for hysteresis - **3:** for viscosity

1: Typical of **Coulomb** dampings are friction dampings such as the metal blade and the metal cable. They require starting force and special features for isolation from hits. These isolations are constant and do not depend on speed.

2: Hysteresis dampings are based on the molecular structure of materials and are typical of all elastomers. The level of insulation of these products depends on the compound, hardness and temperature. Stiffness and damping of a natural rubber elastomer **NR** as a function of temperature



3: Viscosity damping does not depend on temperature and is practically proportional to velocity. Silicone-based shock absorbers are used with the springs, which, thanks to their viscosity, are ideal for absorbing vibrations.

Relationships between the different characteristic damping values:

DAMPING TYPE	SYMBOL	RELATION				
		Λ	ξ	Ψ	ϕ	H
Logarithmic decrease	$\Lambda =$	Λ	$\frac{\xi}{50}$	$\frac{\Psi}{2}$	$\pi \cdot \phi$	$2 \cdot \pi \cdot H$
Percentage damping DIN 53513	$\xi =$	$\Lambda \cdot 50$	ξ	$25 \cdot \Psi$	$\pi \cdot \phi \cdot 50$	$\pi \cdot H \cdot 100$
Relative damping	$\Psi =$	$2 \cdot \Lambda$	$\frac{\xi}{25}$	Ψ	$2 \cdot \pi \cdot \phi$	$4 \cdot \phi \cdot H$
Mechanical loss coefficient	$\phi =$	$\frac{\Lambda}{\phi}$	$\frac{\xi}{50 \cdot \phi}$	$\frac{\Psi}{2 \cdot \phi}$	ϕ	$2 \cdot H$
Degree of damping	$H =$	$\frac{\Lambda}{2 \cdot \phi}$	$\frac{\xi}{100 \cdot \phi}$	$\frac{\Psi}{4 \cdot \phi}$	$\frac{\phi}{2}$	H



VIBRATION ISOLATION

The mass **M** supported elastically by flexible elements having the purpose of isolating it, due to the force **F₁** creates oscillatory movements with amplitude **y** as per the following formula:

$$y = \frac{F_1}{E_d} \cdot \frac{1}{\sqrt{\left[1 - \left(\frac{f_0}{f_n}\right)^2\right]^2 + 4 \cdot H^2}} \quad [m] \quad (\text{Formula 7})$$

Legend:

- F₁**: amplitude of the dynamic force (N)
- E_d**: dynamic spring constant (N/m)
- f₀**: exciter frequency [Hz]
- f_n**: natural frequency (Hz)
- H**: degree of damping

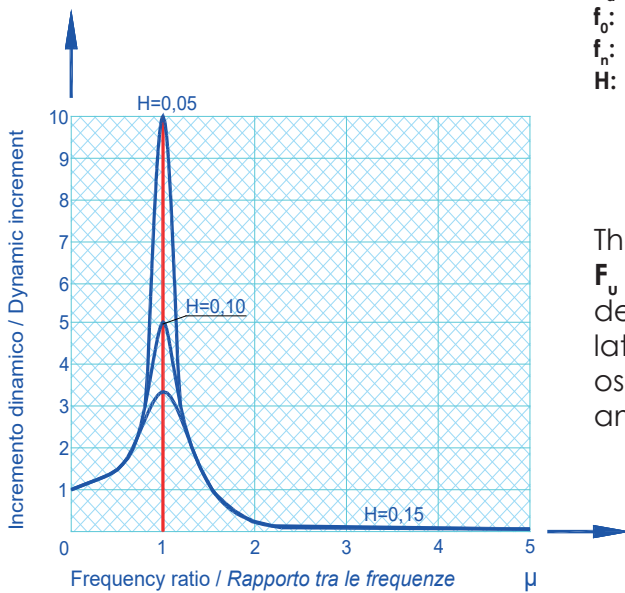


Fig.16

The ratio between the amplitude of the force on the **F₀** support and the amplitude of the exciter force **F₀** determines the effectiveness of active vibration isolation. For passive insulation, the ratio between the oscillation value **ym** of the mass and the oscillation amplitude of the support base **yu** is considered.

INSULATING EFFECT

The insulating value **K** is the vibration reduction index and is given by:

$$K = 20 \log \left[\sqrt{\frac{1 + 4 \cdot H^2}{\left[1 - \left(\frac{f_0}{f_n}\right)^2\right]^2 + 4 \cdot H^2}} \right] \quad [dB] \quad (\text{Formula 8})$$

Legend:

- H**: degree of absorption
- f₀**: exciter frequency [Hz]
- f_n**: natural frequency [Hz]

The insulation value **ξ** is indicated as a percentage (%) and refers to a specific frequency and in an oscillating system generate insulation only under the given conditions.

$$\xi = 100 \left[1 - \sqrt{\frac{1 + 4 \cdot H^2}{\left[1 - \left(\frac{f_0}{f_n}\right)^2\right]^2 + 4 \cdot H^2}} \right] \quad [\%] \quad (\text{Formula 9})$$

DEFINITION OF VIBRATION INSULATORS

Vibration isolations are determined by consulting the diagram below and making an estimate. For a more precise search for oscillatory systems, other movement possibilities must be permitted. The oscillating mass can be represented by single masses connected to each other by springs and shock absorbers; this system has numerous degrees of freedom and natural frequencies:

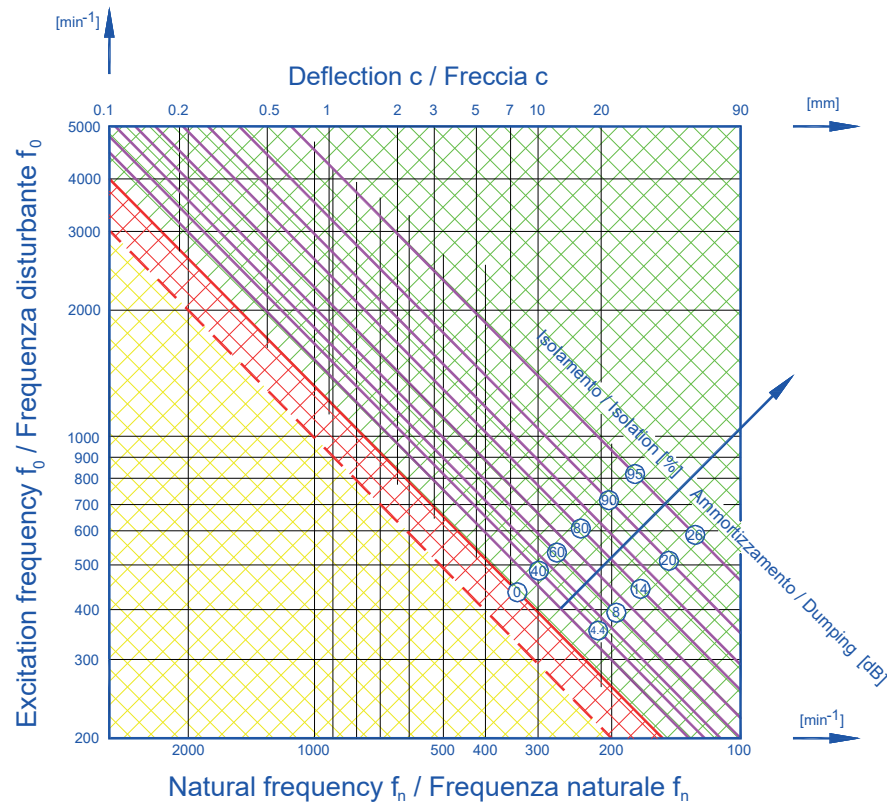


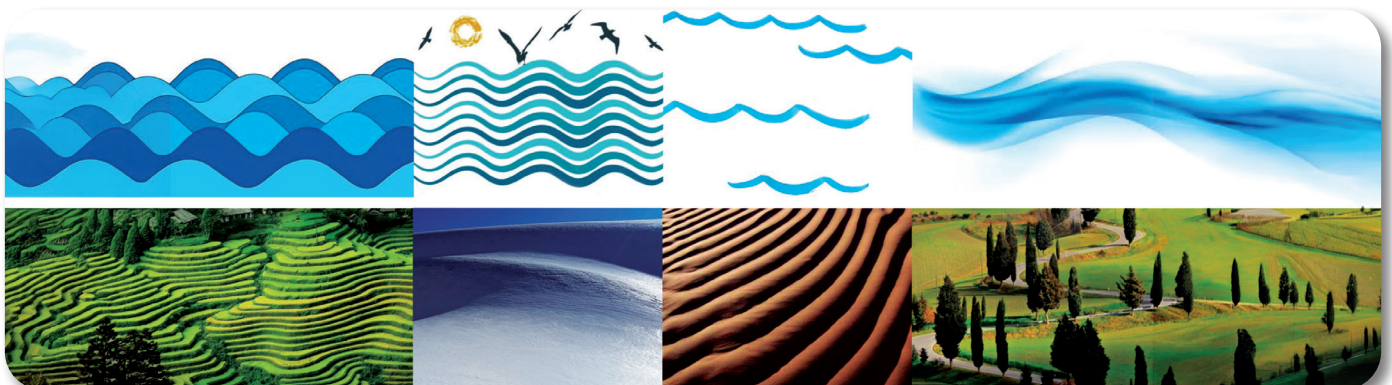
Fig.17

EFFECTS OF VIBRATIONS

These can be referred to the operating system of plants or more generally to the various types of machines; more difficult to identify and therefore to intervene are those referring to production workers and more generally to people.

Below we indicate the value groups that should be considered:

- oscillatory amplitude **y** (mm)
- oscillation speed **V** (mm/s)
- oscillation acceleration **at** (mm/s²)
- **KB** value of the derived dimension



EFFECT OF VIBRATIONS ON CARPENTRY

The standard **DIN4150 part 3** is the one concerning the acceptable oscillation speed in machines:

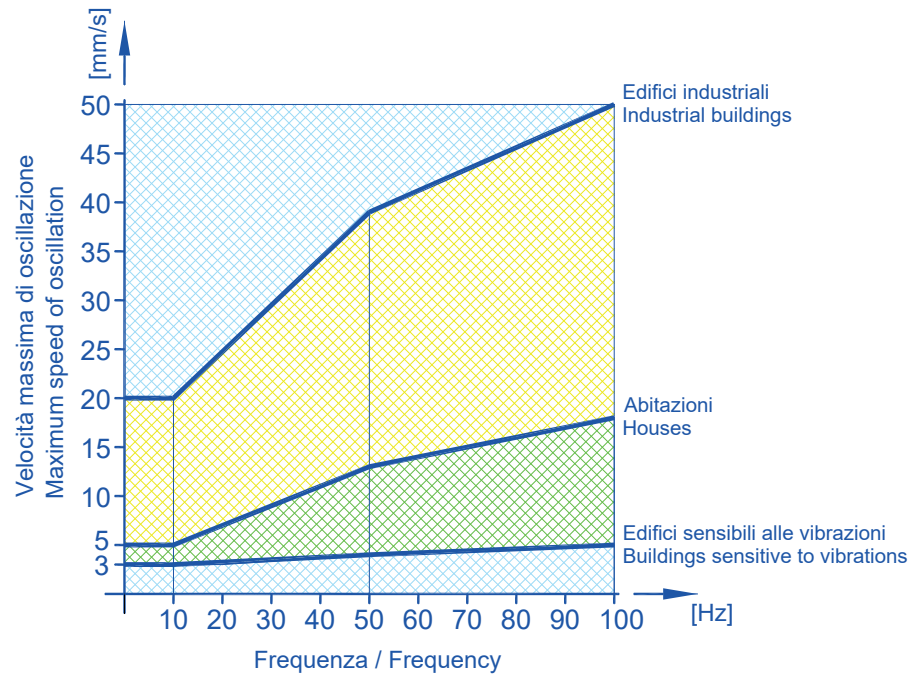


Fig.18

The **ISO 2372/73**, **UDI2063**, **ISA420** standards broadly illustrate the rules referring to systems and machines:

CLASSES OF SENSITIVITY	SENSITIVITY TO THE VIBRATIONS	ACCEPTABLE PARAMETERS	
		1 - 10 Hz Acceleration [mm/s ²]	10 - 100 Hz Velocity [mm/s]
I	HIGH	6,3	0,1
II	AVERAGE	63	1
III	LIMITED	250	4
IV	NONE	> 250	> 4





EFFECT OF VIBRATIONS ON PEOPLE

Based on experience, combined with practical experiments, the **KB** element is determined as the value of the vibration effect, using the graph below. Graph with curves of particular sensitivity. Data referring to inhabited areas and production complexes.

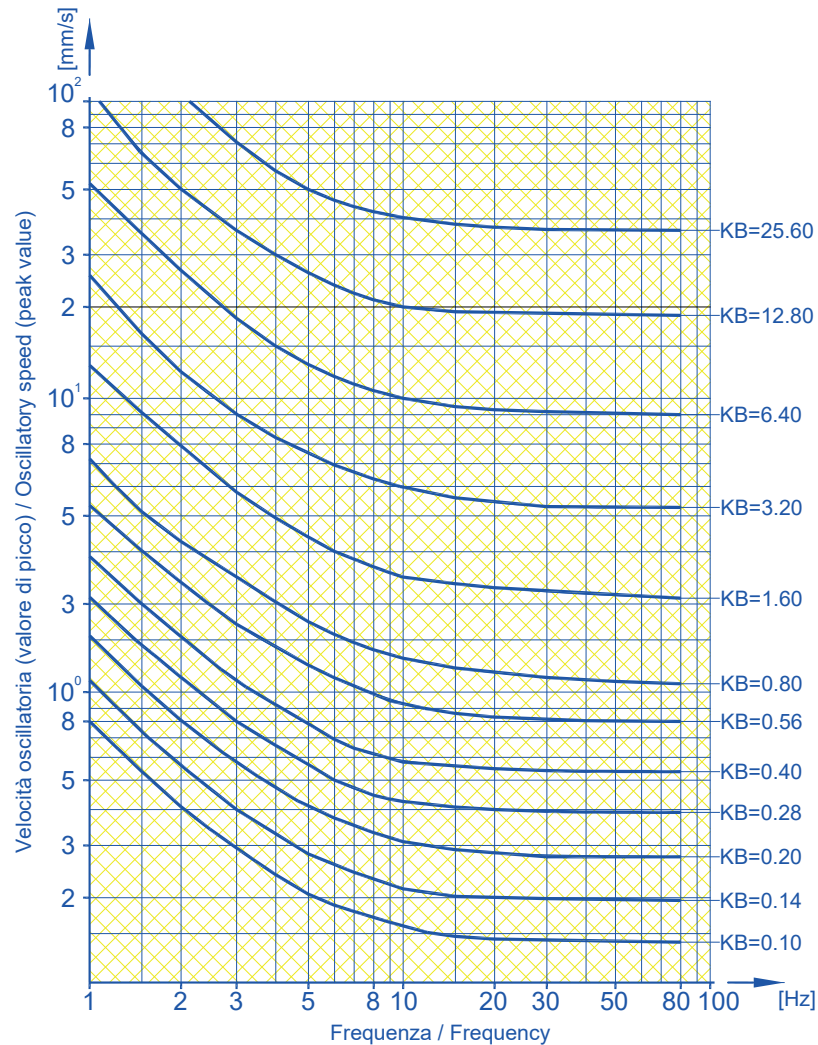


Fig.19 - Grafico con curve di particolare sensibilità

At a certain frequency the **KB** value can be calculated based on the oscillatory velocity **v**, or from the acceleration **a** of the oscillation

$$KB = y \cdot \frac{0,8 \cdot f^2}{\sqrt{1 + 0,032 \cdot f^2}} \quad [\text{mm}] \quad (\text{Formula 10})$$

$$y = \frac{v}{2\pi f} = \frac{a}{4\pi^2 f^2} \quad [\text{mm}] \quad (\text{Formula 11})$$

Legend:

- f:** frequency (Hz)
- y:** oscillatory amplitude (mm)
- v:** oscillation speed (mm/s)
- a:** oscillation acceleration (mm/s²)

CONCLUSIONS: RESONANCE CURVE

The amplitude of the resonance curve is the synthesis of the relationship between the different factors at play, such as damping, insulation, transmission factor and frequency ratio as can be seen from the graph illustrated below (Fig.20)

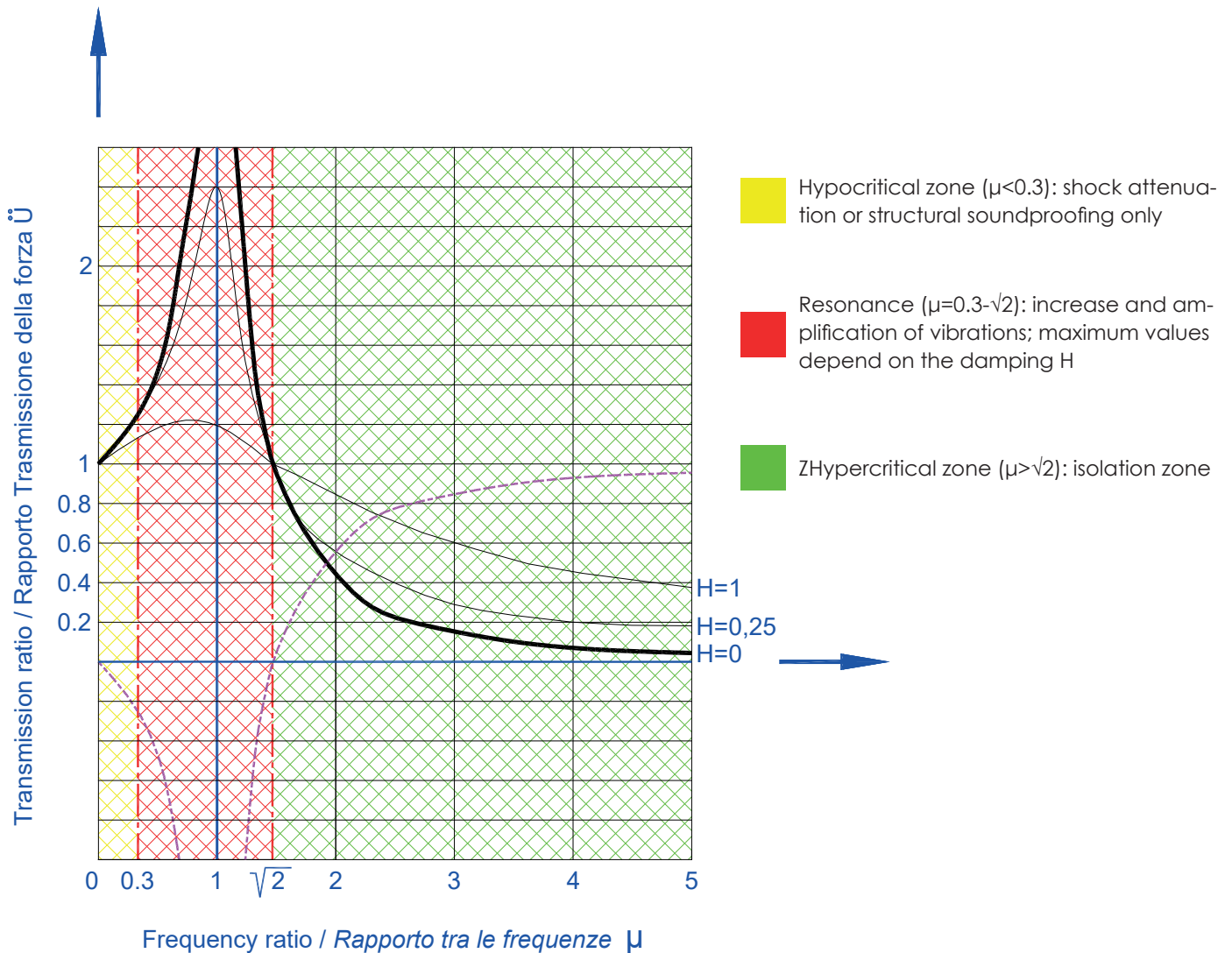


Fig.20

The frequency ratio determines the transmissibility, for values above $\sqrt{2}$ they present an insulating value, below, they show an expansion of the transmissibility.

In active and passive insulations the extension ratios are equal, while the degree of insulation effectiveness depends on the frequency ratio and damping.

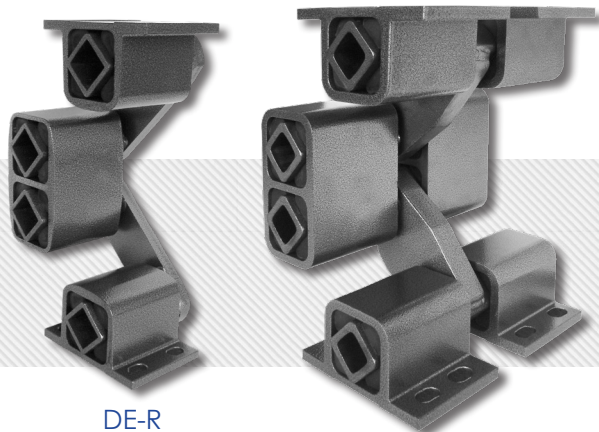


VIB - TECNIDEACIDUE PRODUCT RANGE



OSCILLATING MOUNTINGS

SYM



DE-R



CR-P

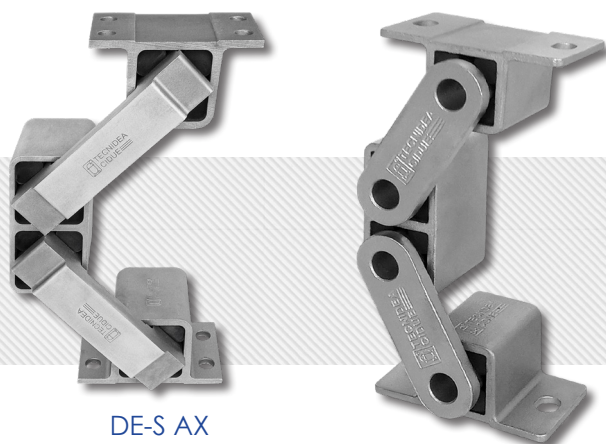
AN-D - AN



OSCILLATING MOUNTINGS - INOX / ANOX



DE-HX

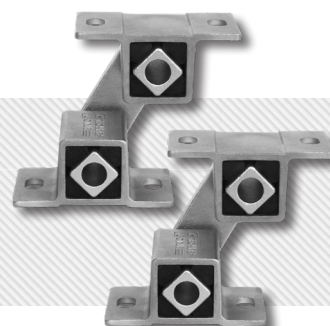


DE-S AX



DE-C AX

DMX



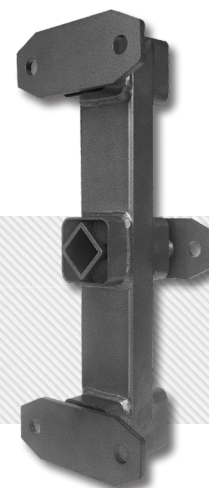
OSCILLATING MOUNTINGS

BT-F



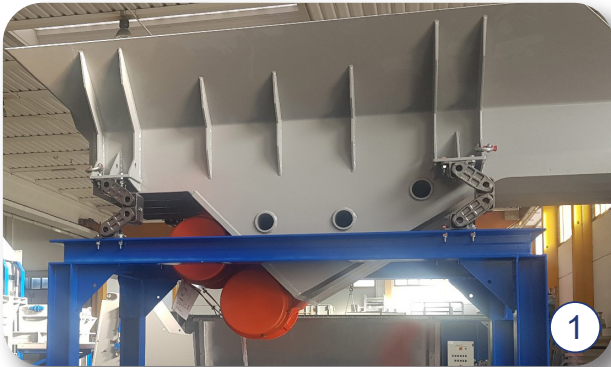
TP-S

TD-F

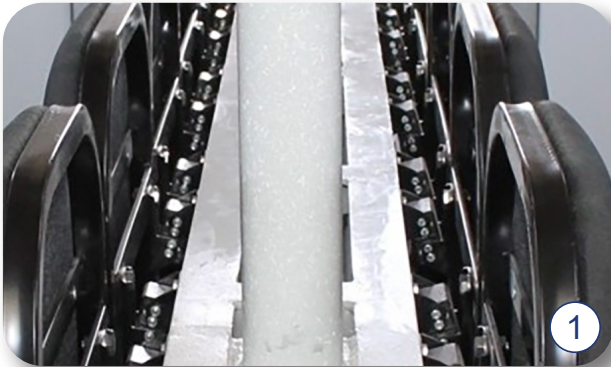


TD-S

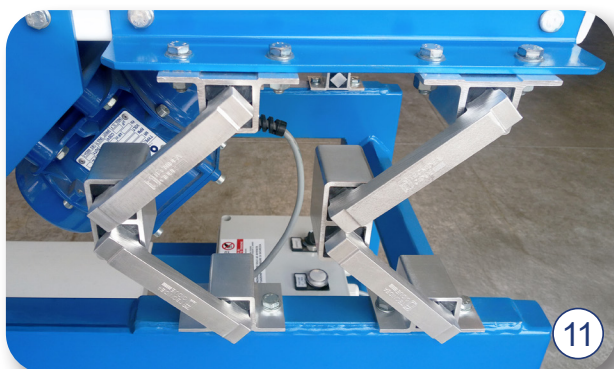
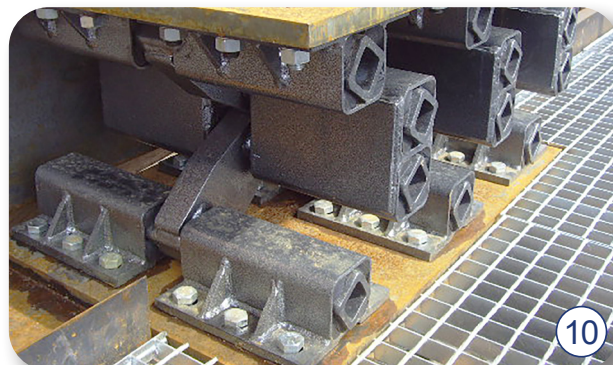
VIBRATING MACHINES



APPLICATIONS EXAMPLES



APPLICATIONS EXAMPLES



 **TECNIDEA CIDUE**
S.r.l.
ideas in motion...

TECNIDEA CIDUE SRL

Via Apollo XI, 12
37057 San Giovanni Lupatoto (Verona) - ITALY
TEL: +39 045 8750250 FAX: +39 045 8750288
E-MAIL: sales@tecnideacidue.com
WEB SITE: www.tecnideacidue.com



Periodic technical information

Your comments are welcome.
(E-MAIL: comm@tecnideacidue.com)

