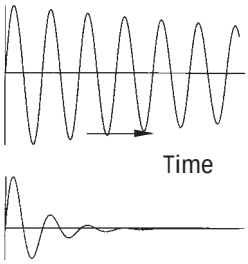
ROSTA-Anti-vibration Mountings

Shock and Vibration absorbing Machine Mounts
high degree of isolation – tear proof – absorption of solid born noise

ROSTA
swinging solutions

TECHNOLOGY

With a **relatively hard** machine support or mounting, the amplitude of the installed equipment is minimal, but the resulting isolation efficiency is much less than with a more resilient mounting. Although technically the isolation efficiency of a **soft** mounting is very high, it impairs the machine stability and can lead to uncontrolled operation of the installation (example: distorted frames on production machines). Hence, for the machine type in question, an ideal compromise must be sought between the level of the isolation efficiency and permissible spring deflection. As a general rule the mountings of machine tools, machining centers etc. should be **hard** whilst those for equipment such as compressors, generators and pumps, etc., should be relatively **soft.** Rubber as an elastic medium is probably the most universal material used for vibrational damping.



Steel spring
(no self-damping)

Rubber spring
(self-damping)

Its special properties render it particularly suitable for damping and springing elements. Rubber elements can accept considerable overloads for a short time without suffering any damage. In contrast to steel springs, under dynamic loading, rubber elements convert the energy absorbed into heat by internal molecular friction.
This process – known as damping – is continuous and it is always required whenever resonance can occur or shocks have to be reduced quickly.

Two basically different types of rubber loading were made use of in the design of ROSTA anti-vibration mountings:
– pure tensile or pressure loading for the anti-vibration mountings of the types V, ISOCOL and N. These relatively simple elements cover the medium natural frequency band between 15 and 30 Hz.
– loading via lever of pretensioned rubber elements by torsional or flexing motion of the ROSTA rubber suspension units in so-called spring dampers. This system allows the construction of anti-vibration mountings in the low frequency range between 2 and 10 Hz. These are types ESL and AB.

The following survey of the entire product range shows the advantages and applications of the various types. For complex applications and in the case of queries, do not hesitate to get in touch with us – our technical service department is at your disposal.

Superior Technology

isolating in all directions

self adhesive on both sides

wide frequency range

efficient absorption

free standing or mounting by bolts

unique levelling system

ROSTA

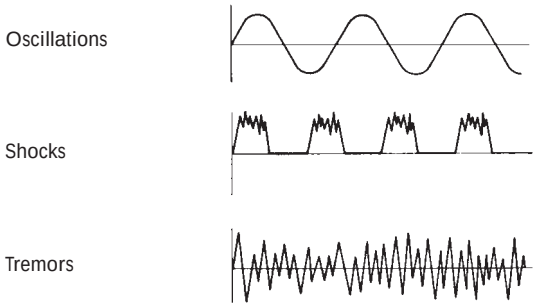


Fig. 1

Isolation of Vibrations and Solid-borne Noise

There are basically three different forms of vibration, as shown in fig. 1.
The overcritical type of mounting is used for isolating vibrations and tremors, while for isolating shocks the subcritical type of mounting is generally employed.

$$\text{Overcritical: } \frac{\text{Interfering frequency (machine)}}{\text{Natural frequency (damper)}} = > 1$$

$$\text{Subcritical: } \frac{\text{Interfering frequency (machine)}}{\text{Natural frequency (damper)}} = < 1$$

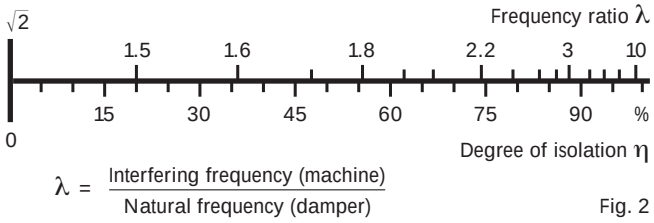


Fig. 2

Mechanical Vibrations

The basic principle of vibration isolation technique is to isolate the source of interference, or the object to be protected, from its surroundings. This is achieved by suitable frequency adaptation – the higher the frequency ratio, the higher the degree of isolation. See fig. 2.

Acoustic isolation ratio related to steel:	Steel	1 : 1
	Bronze	1 : 1.3
	Cork	1 : 400
	Rubber	**1 : 800**
	Air	1 : 90 000

Fig. 3

Absorption of Solid-borne Noise

While interference forces are isolated on the basis of vibrational theory, the isolation of sound transmission through solid-borne bodies is governed by the laws of wave mechanics. The isolation efficiency depends on the acoustic stiffness of the contacting materials between machine and structure. The table in fig. 3 shows the absorption efficiency of some material. A steel rubber compound normally offers a highly efficient isolation of the solid-borne noise.

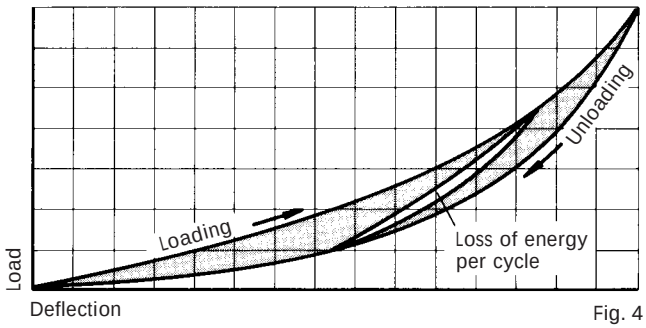


Fig. 4

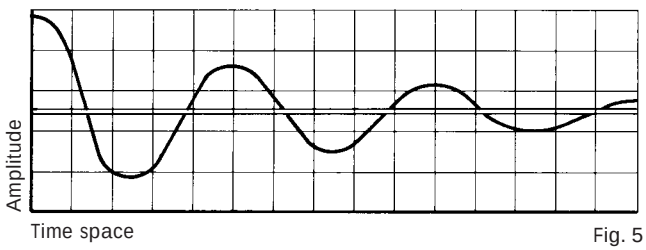
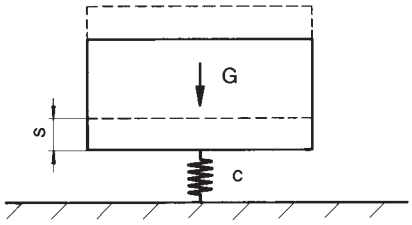


Fig. 5

Damping

In the ROSTA type mounts is damping a function of the internal molecular friction in the rubber material during oscillation and vibration. The resulting energy loss is converted into heat during the vibration process. The area (fig. 4) between the loading and unloading curves corresponds to the energy loss or damping in the ROSTA elements.
In practice, the damping characteristic becomes important when the vibrations of an elastically supported machine is passing through the resonance field and an oscillation could build up. The natural isolation properties of the ROSTA anti-vibration mountings limit this build-up to a minimum due to the high energy loss. Vibrations are absorbed as soon as they occur.
The amplitude/time characteristic demonstrates the high efficiency of the rubber damping material.



Natural frequency $n_e = \frac{300}{\sqrt{s\ (\text{in cm})}} = \text{min}^{-1}$

or $\frac{5}{\sqrt{s\ (\text{in cm})}} = \text{Hz}$

Fig. 6

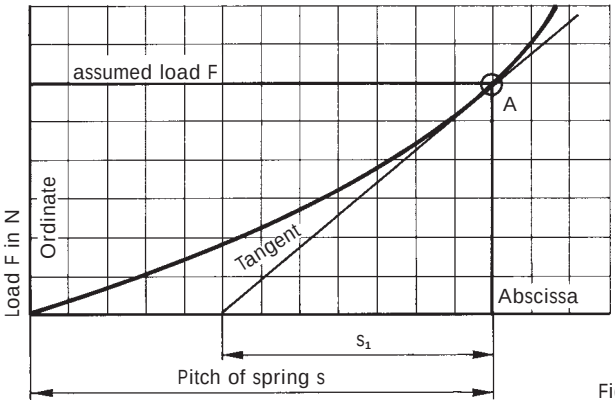


Fig. 7

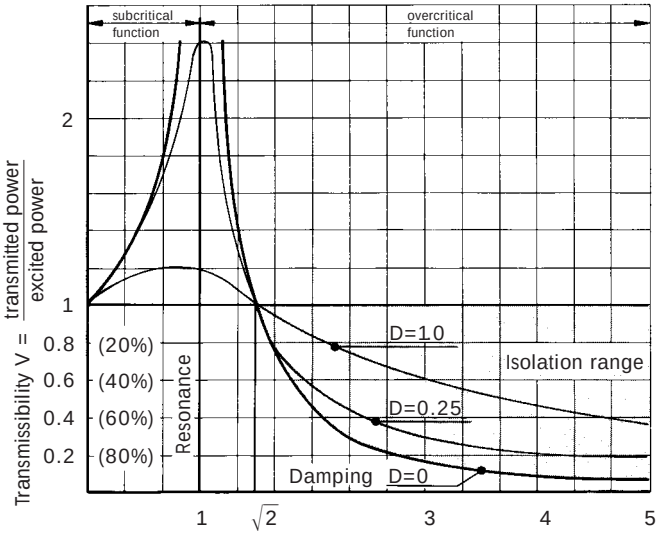


Fig. 8

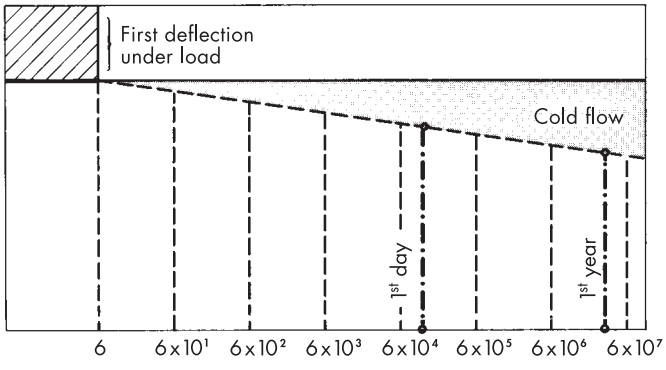


Fig. 9

Natural Frequency of the Vibration Damper

Even simple applications require some elementary knowledge of vibration isolation. An important factor in this connection is the natural frequency of the damper which is measured in rpm or Hz, i.e. the number of oscillations per minute or second which lead to resonance excitation.
The natural frequency n_e is a function of the spring travel s (cm) under a load G (N) and can be calculated from the formula given in fig. 6.

Natural Frequency with Parabolic Spring Characteristic

It is only with vibration dampers comprising steel springs that the damper's natural frequency can be derived directly from the measured spring travel according to the formula in fig. 6. Steel springs have a linear characteristic and hence a spring constant. But they have no damping and are only suitable for pure swing mountings.

All other damping materials such as rubber, cork etc., are deformed under load and the effective measured spring travel is greater than the actual resulting natural frequency. Rubber springs have a slightly parabolic characteristic and the natural frequency resulting from the applied load is therefore essentially higher than the calculated value in conformity with the spring travel (fig. 7: s_1 determines the frequency). The following catalogue frequency values are measured and derived from the s_1 spring travel.

Hence the natural frequency values must lie outside the resonance field. An undesirable build-up of vibrations is likely to occur wherever the exciting frequency n_{err} and natural frequency n_e are the same.

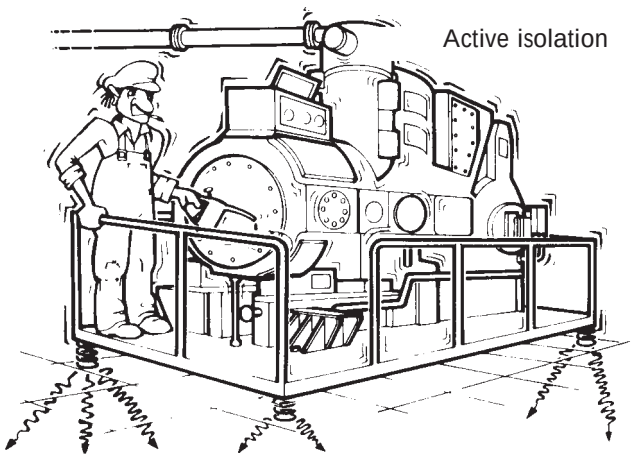
$\lambda < 1$: damping is not exactly definable and solid-borne noise isolation is reduced

$\lambda = 1$: oscillation build-up, peak values depending on self-damping D within the resonance field

$\lambda > \sqrt{2}$: vibration isolation efficiency η dependent on λ, also efficient solid-borne noise isolation

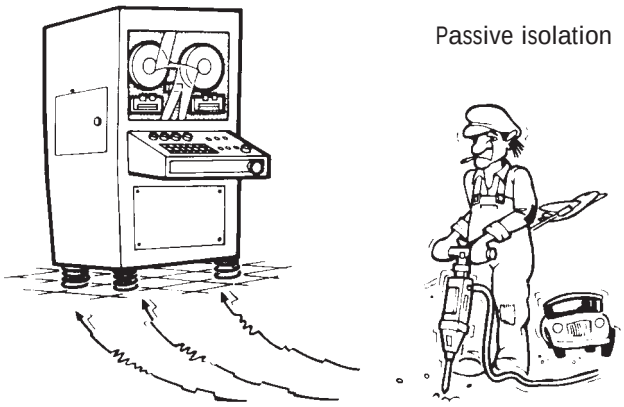
Cold Flow

During the course of time, all elastic materials deform more or less permanently under load, which becomes apparent by a slight increase in deflection and cold flow. This cold flow exhibits a linear characteristic on a logarithmic time base. The diagram in fig. 9 shows that more than half of the total cold flow occurring in one year has taken place after loading for one day. The max. setting of ROSTA anti-vibration mountings is approx. +10% of the nominal spring travel according to the catalogue.



Active isolation

Fig. 10



Passive isolation

Fig. 11

Active and Passive Isolation

In practice, elastic intermediate supports or mountings are installed for two different reasons:

Practical Considerations
The use vibration damping machine mountings and supports permits continuously **flexible** installation of a machine line. Conventional floor anchorages can be almost totally dispensed with and the machines rapidly and simply converted to new production sequences. Furthermore, the normally standard integrated levelling facilities are a simple way to compensate for uneven floor surfaces.

Protective Considerations
Personnel, environment, building structure and the machines themselves are efficiently protected by the **vibration compensating** machine supports. Vibrations and shocks are considerably reduced and the working environment improved.

Active or direct isolation signifies the damping of the vibrations and shocks from an operating machine, i.e. to prevent vibrations being transferred to foundation, adjacent rooms, building etc. To be taken into account in each case here are the interfering frequency, the machine structure and its site. This is the most frequent type of vibration isolation and occurs in almost all factories or households.

Passive or indirect isolation signifies the shielding of sensitive equipment such as weighing and measuring instruments, laboratory appliances etc. from vibrations and shocks. Here the technical requirements can be highly dependent on the environment since interference is often external in origin; from the street, railways or large building sites. The assistance of the specialist engineer is frequently necessary to define this spectrum.

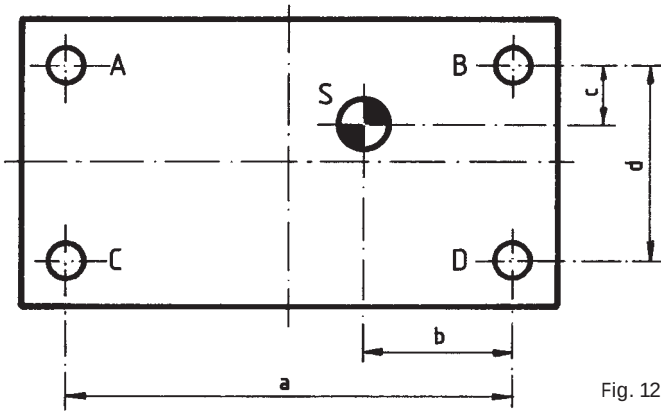


Fig. 12

A, B, C, D Mounting points of anti-vibration mountings
S Center of gravity

Defining the Supporting Forces

a) Position of ROSTA anti-vibration mountings on / under the machine frame

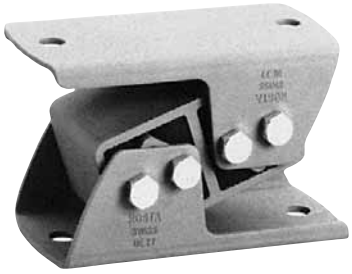
Install all elements so that the loading or spring travel is uniform. Whenever – as so often in practise – asymmetric center of gravity circumstances and hence differing loads and spring travels are encountered, the supporting forces can be determined according to fig. 12. In such cases, differences in spring travel are to be equalized with the aid of spacer plates.

Load on point

$$A = S \frac{b}{a} \cdot \frac{d-c}{d} \qquad B = S \frac{a-b}{a} \cdot \frac{d-c}{d}$$

$$C = S \frac{b}{a} \cdot \frac{c}{d} \qquad D = S \frac{a-b}{a} \cdot \frac{c}{d}$$

PRODUCT RANGE



ROSTA Anti-vibration Mounting Type ESL Page 71

ROSTA anti-vibration mountings type ESL are intended for the absorption of medium and low frequency vibrations and are designed to accept compression, tension and shear loading as well as combined loadings. They can be installed in any desired position and are also ideal for ceiling and wall mounting. Due to the mechanically secured principle of the anti-vibration mountings type ESL no tearing off is possible. These elements are maintenance-free, insensitive to water and dirt and suitable for temperatures from –40 °C to +80 °C. The housing and core of the elements up to size 45 are made of light alloy with steel brackets. The housing of size 50 is made of GGG 40. All elements are paint-finished.

ROSTA Anti-vibration Mounting Type V Page 72

ROSTA anti-vibration mountings type V are multi-directional dampers and are designed to accept compression, tension and shear loading as well as combined loadings. They can be installed in any desired position and are also ideal for ceiling and wall mounting. Due to the mechanically secured principle of the anti-vibration mountings type V no tearing off is possible. These elements are maintenance-free, insensitive to water and dirt and suitable for temperatures from –40 °C to +80 °C. The core is made of light alloy, the outer housing and brackets of steel. All elements are paint-finished.

ROSTA Anti-vibration Mounting Type N
ROSTA Baseplate Type P Pages 73 / 74

The ROSTA anti-vibration mounting type N consists of an isolating plate with a bonded metal cover and a levelling screw. This special levelling system is screwed directly into the machine frame. It can be adjusted from the side. The connection link between the cover and the levelling screw compensates for slightly sloping floors (up to about 5°). The adhesive isolating plate is resistant to oils and chemicals. It is suitable for temperatures of –40 °C to +80 °C.
The Baseplate P is required for floor fixing in case of excessive lateral motions.

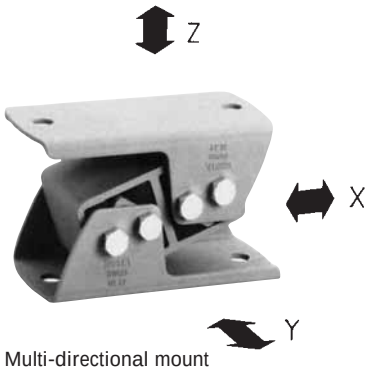
ROSTA Anti-vibration Mounting Type NOX Page 73

The ROSTA anti-vibration mountings types NOX 70 M16 and NOX 120 M20 have been developed especially for the food processing industry and the chemical process technology. The NOX is able to compensate a ground unevenness of up to 5°. The covering plate surrounds the oil- and acid-resistant anti-vibration plate made of synthetic rubber material. The non-skid machine support with a natural frequency of 19 to 22 Hz offers best active vibration dampening.

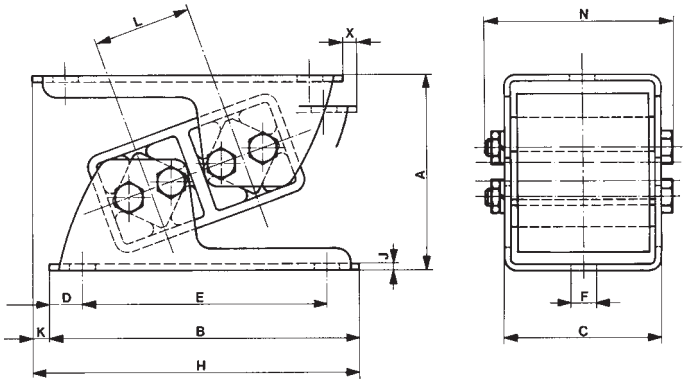
ROSTA Adhesive Isolation Plate Type ISOCOL
ROSTA Anti-vibration Mounting Type ISOCOL U Page 75

The ROSTA adhesive isolation plate type ISOCOL is a highly efficient damping element. The plate is self-adhesive and resistant to oils and chemicals. It is made of 3 layers, and suitable for temperatures from –40 °C to +80 °C. The plate can be fixed on the floor or on machine frames by simply removing the protective foil on both sides of the plate. The adhesiveness of the element can even be increased by wetting the plate with a nitro thinner.
The anti-vibration mounting type ISOCOL U consists on an extra cover plate made of grey cast iron. The notch in the centre of the cover plate facilitates the mounting of a possible levelling screw. However, it is also possible to use the retaining edge for lateral guidance of the machine frame, which doesn't require any additional fixing.

ANTI-VIBRATION MOUNTING TYPE ESL



Multi-directional mount
for compression, tension
and shear loading



Art. No.	Type	Load in N on axes Z÷Z	A un-loaded	A max. load	B	C	D	E	ØF	H	J	K	L	N	X max.	Weight in kg
05 021 001	ESL 15	– 400	54	44	85	49	10	65	7	90.5	2	5.5	25.5	58.5	1.54	0.36
05 021 002	ESL 18	300 – 1200	65	52	105	60	12.5	80	9.5	110.5	2.5	5.5	31	69	1.87	0.62
05 021 003	ESL 27	1000 – 2000	88	72	140	71	15	110	11.5	148	3	8	44	85.3	2.65	1.28
05 021 004	ESL 38	1800 – 3500	117	93	175	98	17.5	140	14	182	4	7	60	117	3.62	3.40
05 021 005	ESL 45	3200 – 6000	143	115	220	120	25	170	18	234.5	5	13.1	73	138	4.40	5.25
05 021 006	ESL 50	5500 – 9000	165	134	225	142	25	175	18	240	6	15	78	163	4.73	10.00

The max. load on X÷X axes is the double value from Z÷Z axes.
The max. load on Y÷Y axes is 20% from Z÷Z axes.

Applications

For active and passive isolation of vibrations and maximum damping of solid-borne noise transmission in: weighbridges and scales, measuring systems, control equipment, rotary machinery such as compressors, refrigerating systems, blowers, pumps, mills, mixers, shock-absorbent buffers, etc.

For installation guidelines see ⟶

The elements must generally be installed in the same direction

Fig. a) Dynamic forces longitudinal

Fig. b) Dynamic forces lateral

Fig. c) Wall mounting

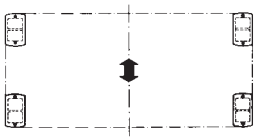


Fig. b

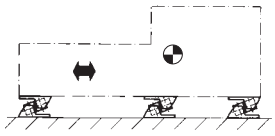


Fig. a

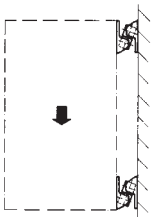
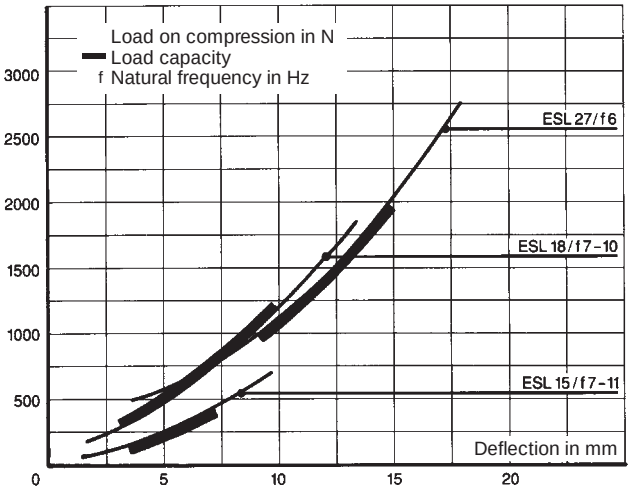
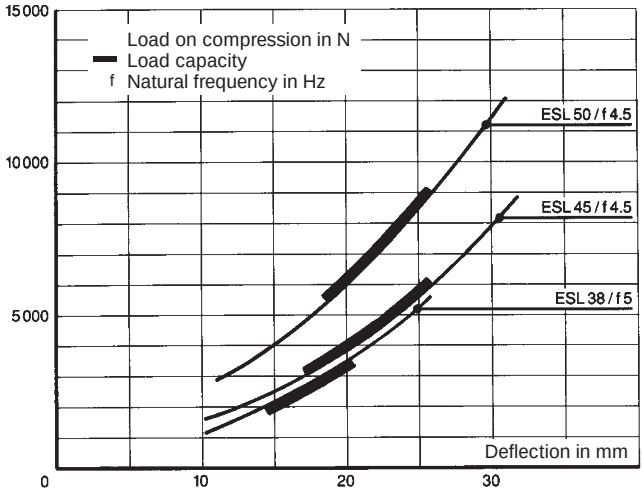


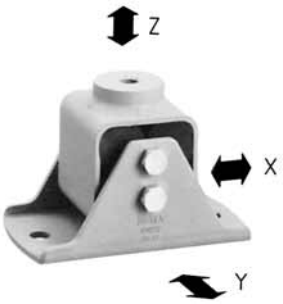
Fig. c





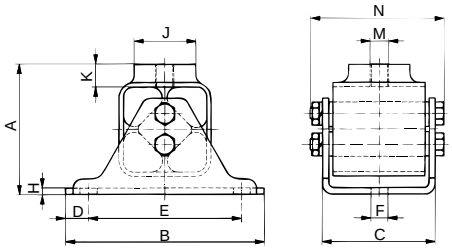
ROSTA

ANTI-VIBRATION MOUNTING TYPE V

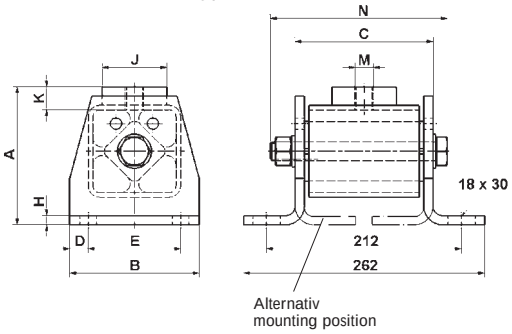


Multi-directional mount
for compression, tension
and shear loading

Type V 15 – 45



Type V 50



Art. No.	Type	Load in N on axes X ÷ X; Z ÷ Z	A	B	C	D	E	ØF	M	N	H	ØJ	K	Weight in kg
05 011 001	V 15	– 800	49	80	51	12.5	55	9.5	M 10	58.5	3	20	10	0.30
05 011 002	V 18	600 – 1600	66	100	62	12.5	75	9.5	M 10	74	3.5	30	13	0.70
05 011 003	V 27	1300 – 3000	84	130	73	15	100	11.5	M 12	85.3	4	40	14.5	1.25
05 011 004	V 38	2600 – 5000	105	155	100	17.5	120	14	M 16	117	5	45	17.5	2.45
05 011 005	V 45	4500 – 8000	127	190	122	25	140	18	M 20	148	6	60	22.5	4.64
05 011 006	V 50	6000 – 12000	150	140	150	20	100	–	M 20	194	10	70	25	7.46

The max. load on Y ÷ Y axes is 10 % from Z ÷ Z and X ÷ X axes.
Momentary shock loads of 2.5 g in Z ÷ Z and X ÷ X axes are admissible.

Applications

For active and passive isolation of vibrations and damping of solid-borne noise transmission in crushing plants, compressors, blowers, pumps, rotary converters, generators, mills, crane track supports, etc.

For installation guidelines see →

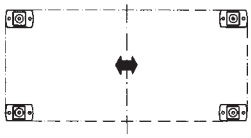


Fig. a

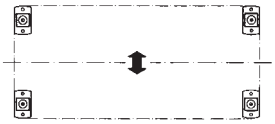


Fig. b

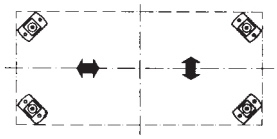
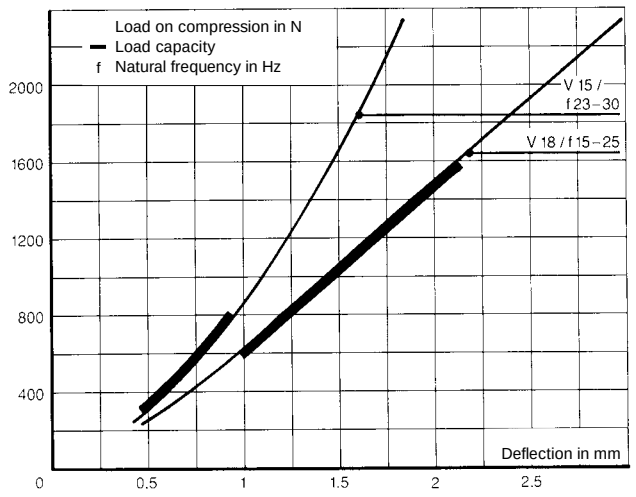
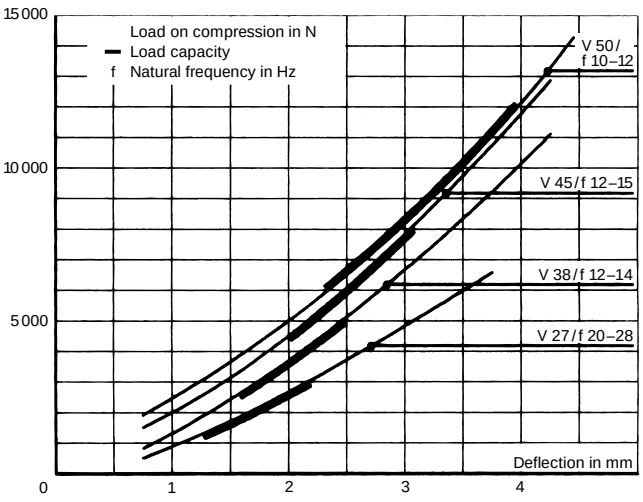


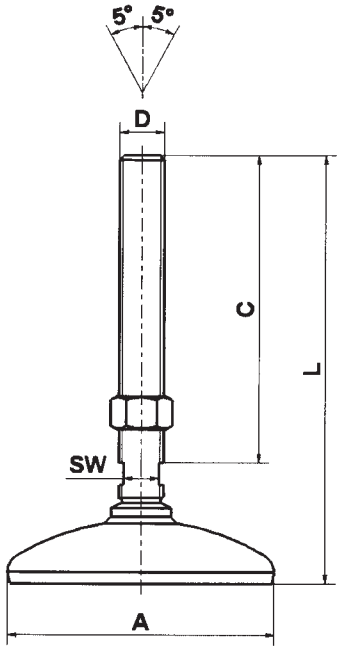
Fig. c

Fig. a) Dyamic forces longitudinal
Fig. b) Dynamic forces lateral
Fig. c) Dynamic forces undeterminant





ANTI-VIBRATION MOUNTING TYPE N / NOX



Art. No.	Type	Material Shaft	Material Socket	Load in N	Natural frequency in Hz	Dimensions in mm ØA	C	D	L	SW	Weight in kg
05 058 001	N 70/71 M12		galvanized	0 – 6000	22 – 25	80	55	M 12	100	10	0.30
05 058 002	N 70/71 M16	galvanized	and	5000 – 12000	19 – 22	80	136	M 16	182	13	0.50
05 058 004	N 120/121 M20		blue painted	10000 – 20000	19 – 22	120	139	M 20	195	16	0.95
05 058 102	NOX 70 M16	INOX	INOX	5000 – 12000	19 – 22	80	136	M 16	182	13	0.50
05 058 103	NOX 120 M20	1.4305	1.4301	10000 – 20000	19 – 22	120	139	M 20	195	16	0.95

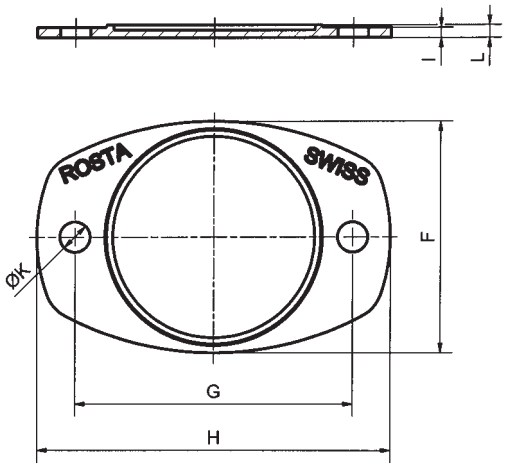
Applications

For damping vibrations and solid-borne noise transmission in machinery and apparatus also requiring levelling, such as: air conditioning plants, woodworking machinery, pumps, tanks, containers, transport systems, light tooling machines, assembly lines and workshop equipment.

Mounting guidelines

The levelling screw of the mount shall be turned into the machine base; fine tuning of the height shall be made from the side on milled groove of the spindle with flat wrench. Rubber pad has a hardness of 50 ShA.
By the need of big series, we can supply the mount in different colours with individual company logo.
The ROSTA-mount is “FDA” food approved.

Baseplate P



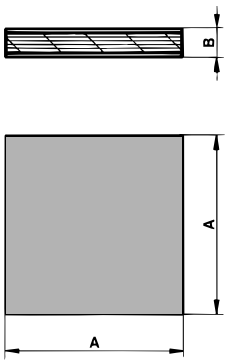
Art. No.	Type	Accessoires to	Material	F	G	H	I	Ø K	L	Weight in kg
05 060 101	P 70/71	N 70/71	light alloy	92	110	140	4	12	5	0.10
05 060 102	P 120/121	N 120/121	light alloy	135	170	210	5	16	7	0.25

Mounting guidelines

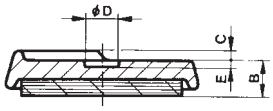
The baseplate allows a firm floor positioning of the mount by appearance of high shear forces. The circular side bulges of the plate are keeping the mount in position. The baseplate shall be bolted on the floor, in order to keep the required installation position.

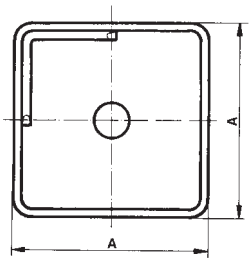
ANTI-VIBRATION MOUNTING
TYPE ISOCOL / TYPE ISOCOL U

ISOCOL



ISOCOL U





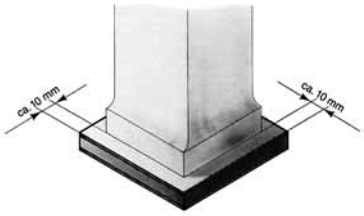
ISOCOL

Art. No.	Type	Load	A	B	Weight in kg
05 030 001	ISOCOL 50	–1500 N	50	8	0.02
05 030 002	ISOCOL 80	1200 N–3800 N	80	8	0.05
05 030 003	ISOCOL 400	20–60 N/cm²	400	8	1.30

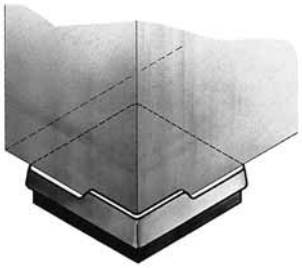
ISOCOL U

Art. No.	Type	Load	A	B	C	D	E	Weight in kg
05 040 001	ISOCOL U 50	–1500 N	60	14	3	11	2	0.15
05 040 002	ISOCOL U 80	1200 N–3800 N	90	15	3	14	2	0.40

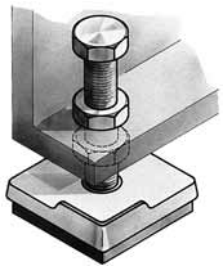
Installation Guidelines



In order to obtain optimal stabilisation of the machine, it is recommended to allow the ISOCOL plates to protude approx. 10 mm from the machine base. The single plates must be mounted such that the load is evenly distributed.



In case there is no levelling necessary it is possible to push the ISOCOL U elements directly under the machine base, up to the retaining edge. Additional fixation is not necessary.



In case the element includes a levelling screw, the ISOCOL U mounting is placed directly on the notch in the centre of the base plate, which allows the element to be levelled.

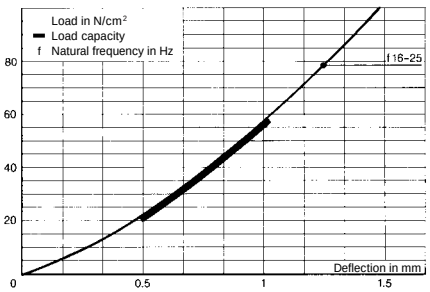
Applications

For extremely low heights, for the damping of vibrations and solid-borne noise transmission in substructures and building such as air conditioning plants, heating boilers, pumps, office machines, computer systems, laboratory equipment, wood working machines and workshop equipment, etc.

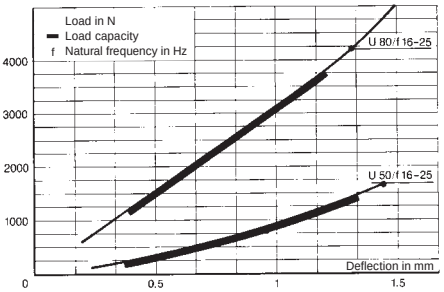
Remarks

The customer is free to make tailor-made sizes from the ISOCOL 400 plates (400 x 400 mm). Standardised sizes are available.

ISOCOL



ISOCOL U



ROSTA

APPLICATIONS

Pasta mixing machine type V

Belt conveyor hanging on type V

Impact damper with type ESL

Packaging machine on type N mounts

Impact station for belt conveyor on type ESL

Impact plate equipped with type ESL

Cooling compressors on type ESL mounts