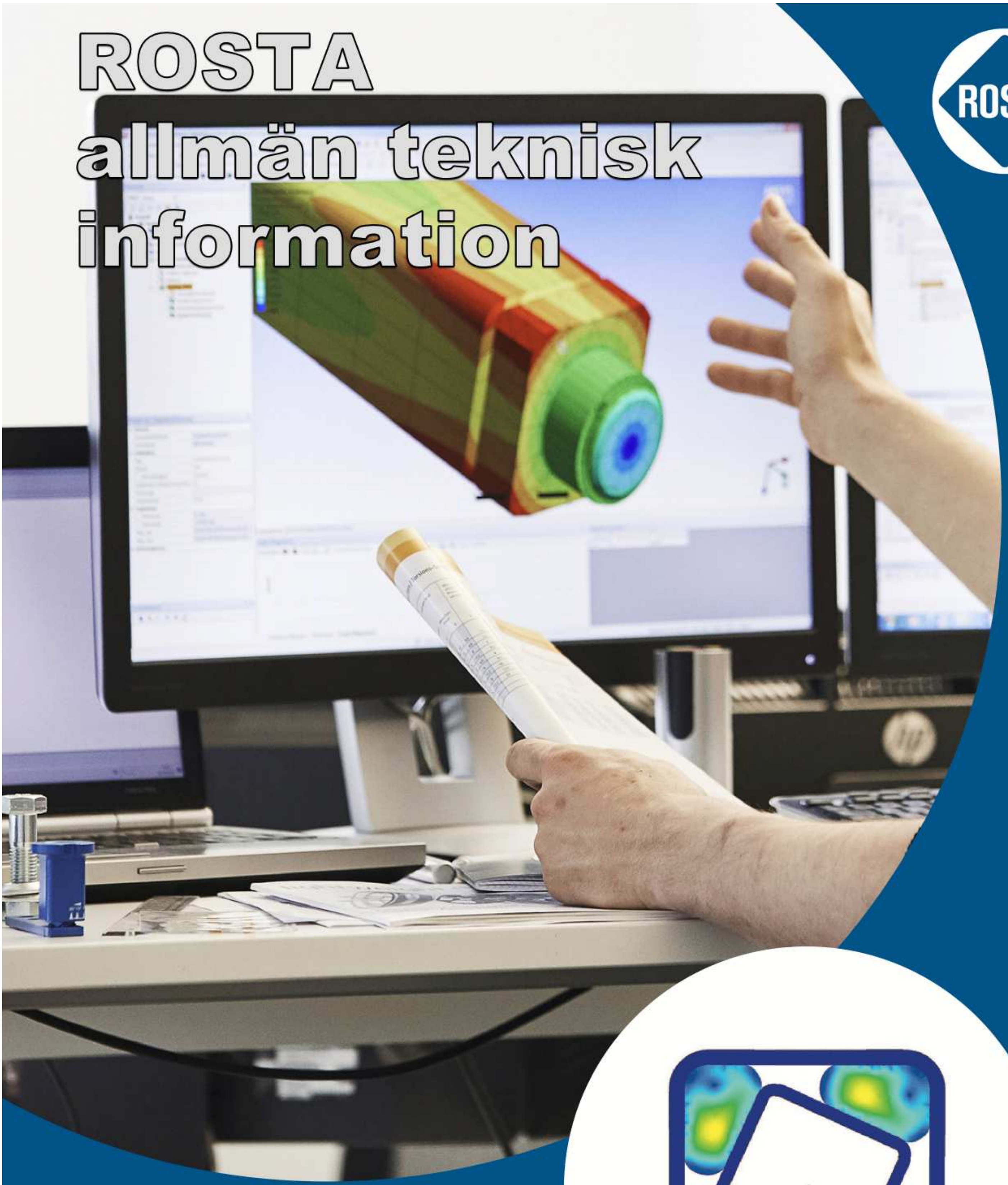
ROSTA allmän teknisk information



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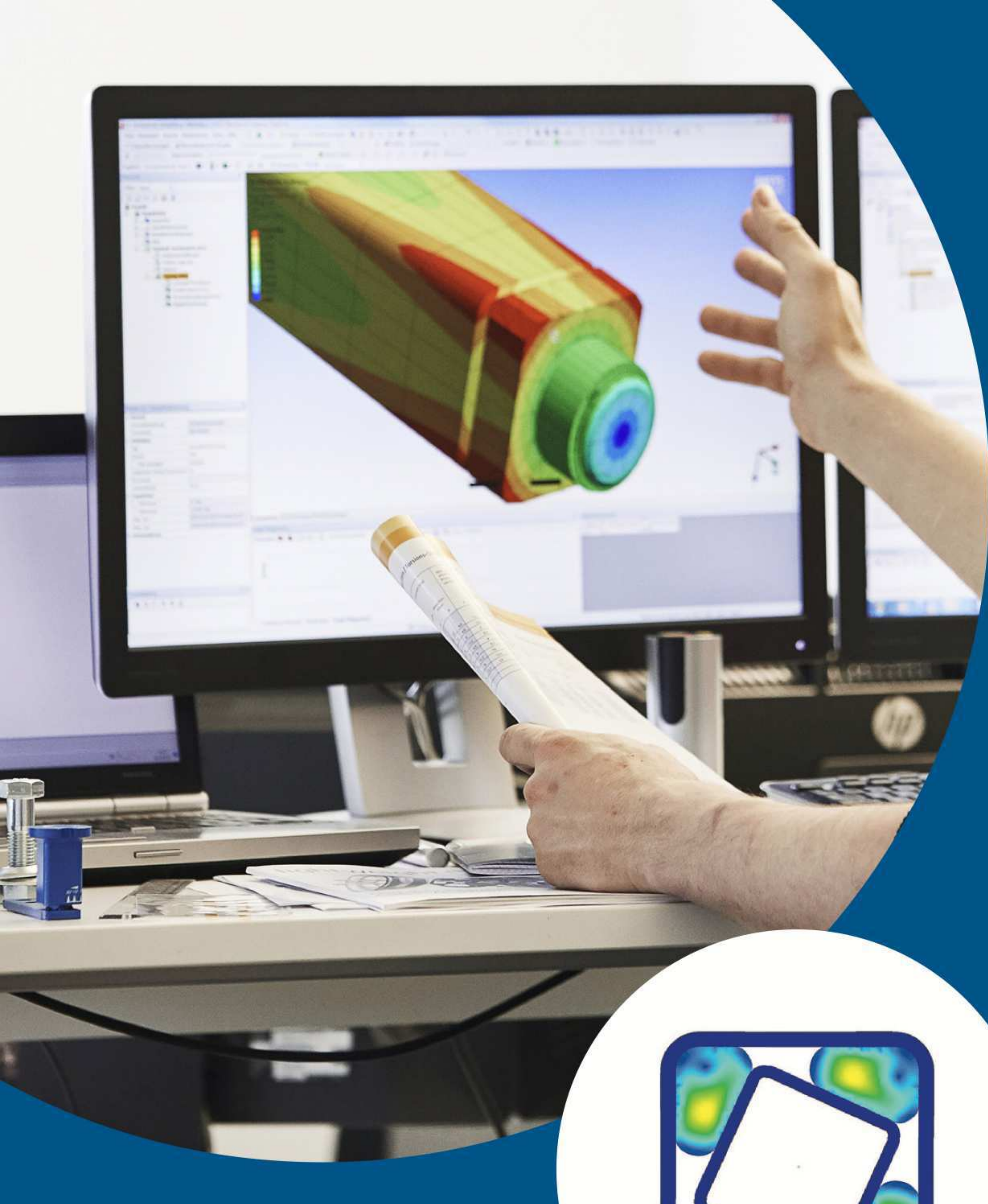

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TECHNOLOGY

A unique spring system from experienced specialists

We at ROSTA have experienced the needs and solved the problems of our customers for 75 years. Together with our customers, we analyse their applications and concerns based on decades of experience. We help them to optimise their products and plants and improve their process safety. The result is higher productivity and a true competitive advantage.
Who doesn't want that?

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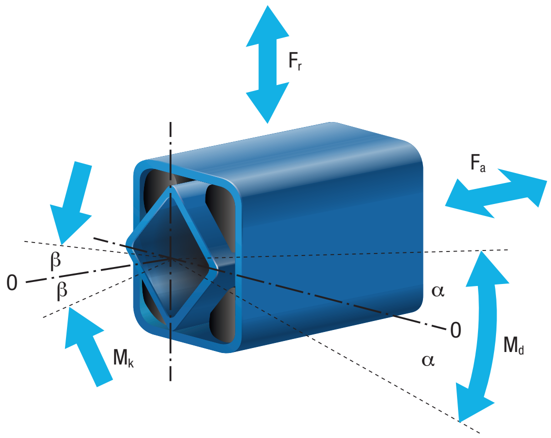
TABLE OF CONTENTS TECHNOLOGY

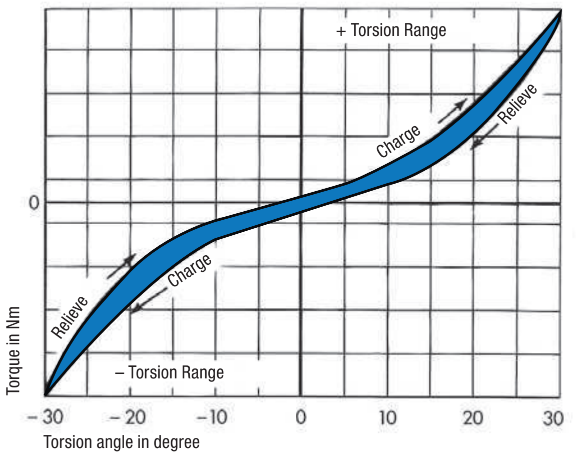
ROSTA Basics

Function



The ROSTA rubber suspension elements are mainly designed for applications as torsional spring devices offering operation angles of ± 30°. Depending on the particular function, not only torsional moments are generated by pivoting the spring device. According to the specific application additional radial F_r, axial F_a and / or cardanic M_k forces have usually to be taken in consideration. The occurring torques of the different elements and the additional load characteristics are indicated in the respective chapter.

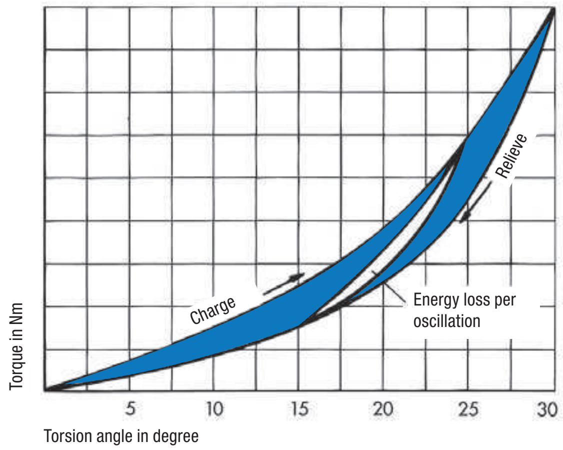
Spring characteristic

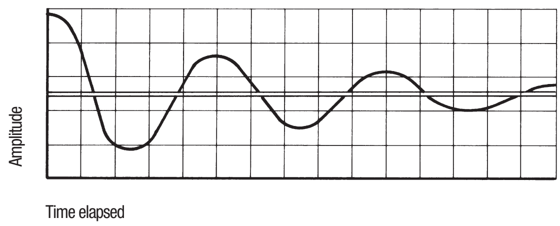


Due to the specific construction characteristics of the ROSTA rubber suspension element, pivoting the device ± results in a slightly progressive spring characteristic. The torsion angle is limited to ± 30 for most elements.

ROSTA Basics

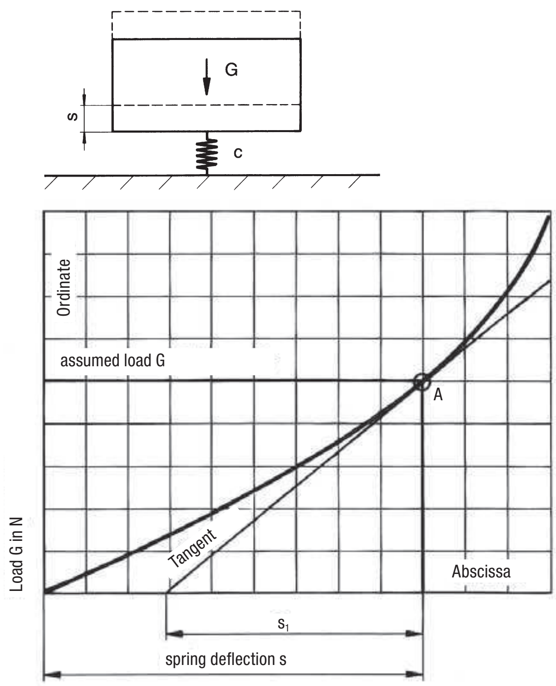
Damping





The occurring hysteresis in the ROSTA element is addicted to the resulting energy loss work in the rubber inserts during the pivoting activity of the spring device. In the process of the element actuation a part of the resulting energy is transformed into frictional work generating heat. The shaded surface between load and relieve headline indicates the effective energy loss. At element actuation out of the zero position up to 30°, the resulting average energy loss is at 15 to 20 %. At the actuation of a pre-tensioned element, the resulting ± working angle is usually only a few degrees, therefore the energy loss reduces within a limit (see graph).
Uniquely animated element oscillations fade within short term, due to the occurring energy loss at each following post-pulse oscillation. (Very important at the use of ROSTA screen mountings – during the operation procedure of the screen the resulting power loss in the ROSTA mountings is neglectable; during the running down phase, close to the resonance frequency of the suspensions, an important amplitude exaggeration occurs. The high energy loss in the ROSTA screen mountings dampens and absorbs these exaggerations within only a few post-pulse oscillations.)

Natural frequency



The determination of the natural frequency of a ROSTA suspension has to be carried out by spreading the tangent at the loading point «A» on the parabolic arc of the load deflection curve. The resulting distance s_1 on the axis of abscissa comes up to the arithmetical spring deflection in mm, required for the determination of the natural frequency.

Natural frequency $n_e = \dfrac{300}{\sqrt{s_1} \text{ (in cm)}} = \text{min}^{-1}$

or $f_e = \dfrac{5}{\sqrt{s_1} \text{ (in cm)}} = \text{Hz}$

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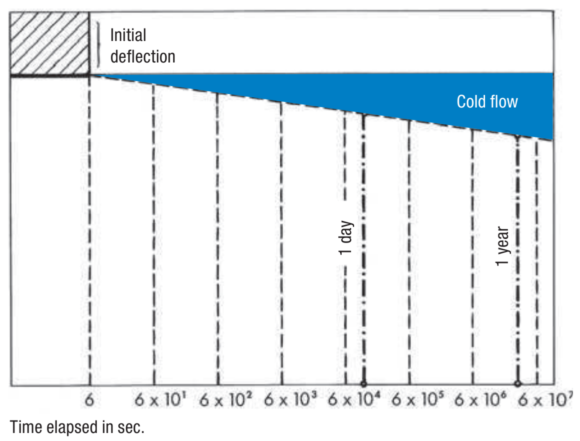
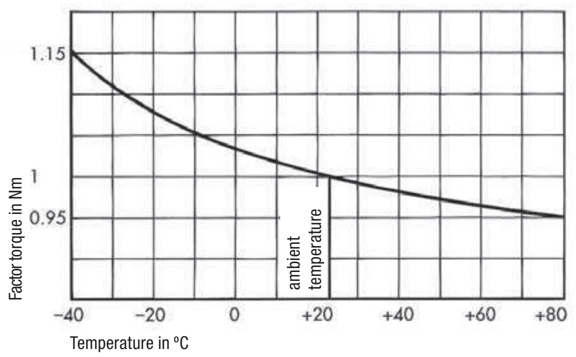
Cold flow and settling of the rubber suspensions



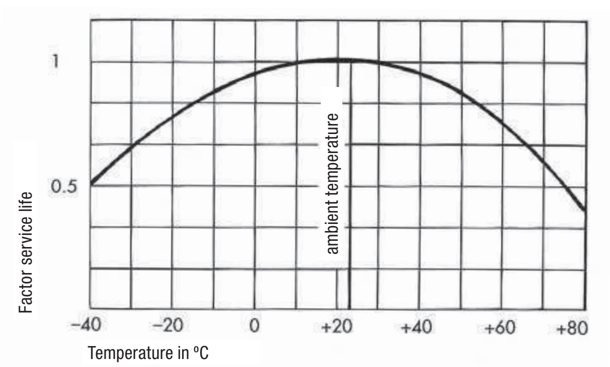
All elastic materials show more or less permanent measurable deformation over time when subjected to a load. This is noticeable in a relatively small additional deflection, the cold flow. This cold flow runs over a linear logarithmic time scale. The illustration shows that after being under a load for one day, already compensates for more than half of the flow deformation of a year; after one year of use, the overall element setting is largely compensated (depending on the temperature and frequency). Empirical findings show that the settling factor lies within a 3° to 5° loss of the element to the neutral 0° position, with combined vibrating bearings at approx. +10 % of the respective nominal deflection according to the catalogue specification.

Temperature influence



The ROSTA rubber suspension elements are designed in the standard rubber quality «Rubmix 10» for use in the temperature range of –40 °C to +80 °C. As the temperature rises, the mechanical torque strength decreases. This decrease is at a low approx. 5% in the upper temperature range (+80 °C). At lower ambient temperatures, i.e. in the minus range, the mechanical torsional stiffness increases (at –40 °C up to 15 %). The internal damping of the elements undergoes a similar process: when the temperature drops, the damping percentage increases and then falls again when the temperature rises. Due to the internal friction (energy loss work), the rubber inserts in the suspension elements warm up with every movement, meaning the effective element temperature may vary in relation to the ambient temperature.

Service life



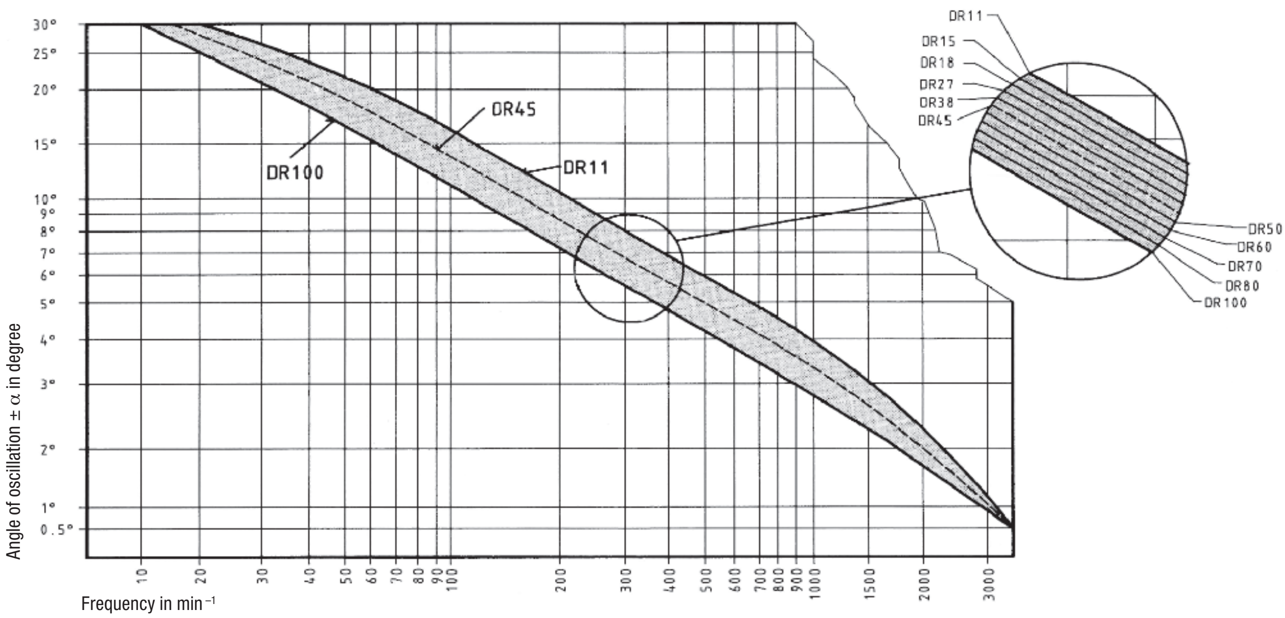
Provided the rubber suspension elements are selected according to the technical specifications, i.e. are operating within the given frequencies and oscillation angles and under the mentioned surrounding conditions, no loss of performance and functionality can be expected for many years. Extremely low or high permanent surrounding temperatures considerably shorten the lifetime expectancy of the rubber suspension elements. The opposite service life curve indicates the relevant life deduction at extreme ± temperatures from factor 1 at room temperature of +22 °C.

Quality control and tolerances

Since December 1992 ROSTA AG has been an ISO 9001 standard certified development, manufacture and distribution company. All products undergo regular functional and quality testing. The rubber inserts are continuously tested and controlled on the test machines of the in-house laboratory with regard to Shore A hardness, compression set, abrasive wear, rebound resilience, tensile strength, breaking elongation and aging behaviour. The dimensional tolerance of the rubber inserts is defined according DIN 7715 standard and the Shore A hardness according to DIN 53505 standard. The inner-core profiles and housings of the rubber suspension elements are subject to the tolerance guidelines of the relevant production process and respective supplier (e. g. cast, extruded, edge rolled) and the individual material consistence (e. g. aluminium casting, steel tube, nodular cast iron part, etc.). The resulting torsional moments and spring deflections of the ROSTA rubber suspension elements are within a tolerance range of ± 15 % at the most, but usually lie in a much narrower range!

ISO 9001
ISO 14001
BUREAU VERITAS
Certification

Permissible frequencies



Alignment chart for determining the permissible frequencies and oscillation angles in relation to the respective rubber suspension element type (DR 11, 15, 18, etc.).
The higher the frequency in min^{-1}, the lower the oscillation angle should be and vice versa.

Example: (see blue indication on chart) A rubber suspension of type DR 50 may be rotated from the neutral position (0°) to an oscillation angle of ± 6° by a max. frequency of 340 min^{-1}. For applications of «pre-tensioned» elements working, e. g. under 15° of pre-tension and describing oscillation angles of ± 5° at 250 min^{-1}, it is absolutely necessary to consult ROSTA.

Rubber qualities

The majority of all ROSTA rubber suspension elements are equipped with the standard quality «Rubmix 10» rubber inserts. This rubber quality is based on a high content of natural rubber, offers good shape memory, low settling factors (cold flow), high mechanical strength and moderate aging behaviour (little embrittlement/hardening of the rubber inserts).

Where high oil consistency, heat resistance or even greater torques are required, other resilient inserts with the corresponding characteristics can be installed in the rubber suspension elements.

Special qualities on request.

Rubber quality	Factor in relation to the list «torque and loads» (chapter 2 rubber suspension elements)	Working temperature	Material	Comments
Rubmix 10	1.0	−40° to +80°C	NR	– Standard quality – Highest elasticity – Lowest cold flow
Rubmix 20	approx. 1.0	−30° to +90°C	CR	– Good oil-resistance – Elements marked with yellow dot
Rubmix 40	approx. 0.6	−35° to +120°C	EPDM-Silicone	– High temperature resistance – Elements marked with red dot
Rubmix 50	approx. 3.0	−35° to +90°C	PUR	– Max. oscillation angle ±20° – Limited oscillation frequencies – No permanent water contact – Elements marked with green dot

Chemical resistance

The standardised ROSTA rubber suspension elements are equipped with «Rubmix 10» elastic inserts. These have a high chemical resistance compared to many media. For specific applications, however, the elements must provided with additional protection or synthetically constructed elastomer inserts should be used («Rubmix 20», «Rubmix 40» or «Rubmix 50»), which will slightly the characteristics compared to the standard quality (see Rubber qualities).

The resistance table below is only a guideline and is incomplete. In practical use, data for the concentration of the respective medium and the operating temperature are required to determine the resistance. Please contact us in this regard.

Rubmix	10	20	40	50
Acetone	+	oo	++	oo
Alcohol	++	++	++	o
Benzene	oo	oo	oo	oo
Caustic soda solution up to 25% (20°)	++	++	++	oo
Citric acid	++	+	o	oo
Diesel	oo	+	oo	+
Formic acid	+	+	o	oo
Glycerine	+	+	++	oo
Hydraulic fluid	o	+	oo	oo
Hydrochloric acid up to 15%	++	+	o	oo
Javelle water	o	+	++	oo
Lactic acid	++	++	++	+

Rubmix	10	20	40	50
Liquid ammonia	+	+	++	oo
Lubricating grease and oil	oo	+	oo	+
Nitric acid up to 10%	oo	+	+	oo
Nitro thinner	oo	oo	oo	oo
Petrol (fuel)	oo	o	oo	++
Petroleum	oo	+	oo	++
Phosphoric acid up to 85%	oo	oo	oo	oo
Seawater	++	+	++	oo
Sulphuric acid up to 10%	+	o	o	oo
Tannic acid	++	+	++	oo
Toluene	oo	oo	oo	oo
Treacle	++	++	++	o

++ excellent consistency, + good consistency, o sufficient consistency, oo insufficient consistency

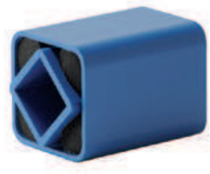
RUBBER SUSPENSION ELEMENTS

Rubber suspension elements

Description of inner squares

A
Suitable for alternating deflection via the element rest position. Nominal sizes 15 to 45: Fastening with 2 to 4 continuous screws (of which nominal sizes 27 to 45 with threads are available).

C
Attachment with central screw for frictional connection with 360° adjustment. For optimum frictional connection, please remove the paint on the front side. Alternating deflection up to max. ± 10°.

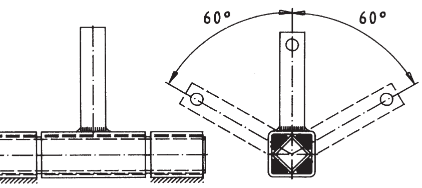


S
For plug-in connections, select plug-in length at least 2 × light dimension «C». The inserted square must be blank, with a tolerance of h9 to h11. The corners may be over-rotating, the inner radius is max. 1.5 mm). Up to nominal size 18, a frictional connection can be made with one screw. No reciprocal deflection over the element zero position.

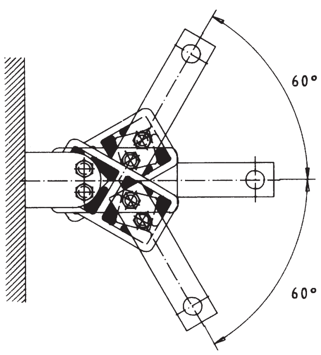
Serial and parallel connection

Serial connection
Double oscillating angle (± 60°) with a constant torque.

I

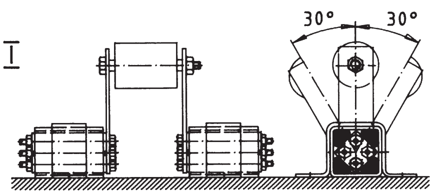


II

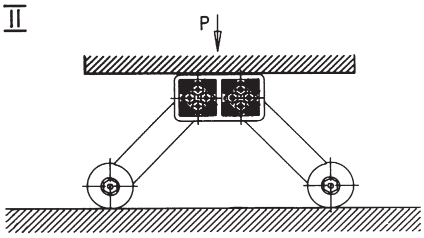


Parallel connection
Double torque at constant oscillating angle (± 30°).

I



II



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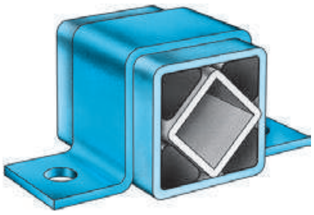
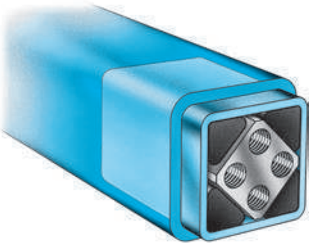
Rubber suspension elements

Examples of fixations

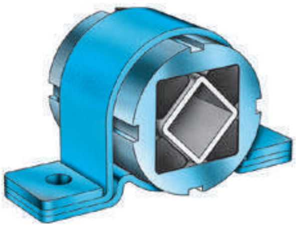
Housing



Outer tube with bracket BR



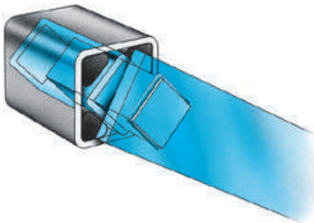
Plug-in connection



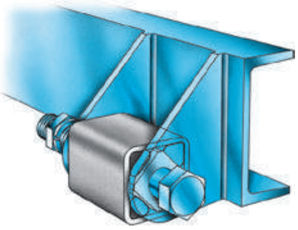
Round housing with bracket BK

Outer housing in clamping jaw

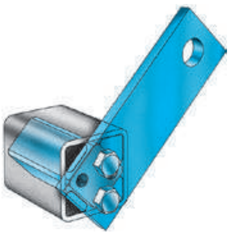
Inner Square Section



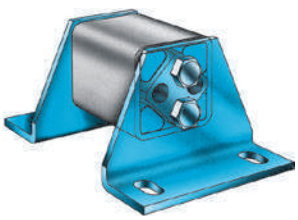
Plug-in connections: inner square made of tubular steel, lever arm with welded-on square profile



Inner square section with a central through bore



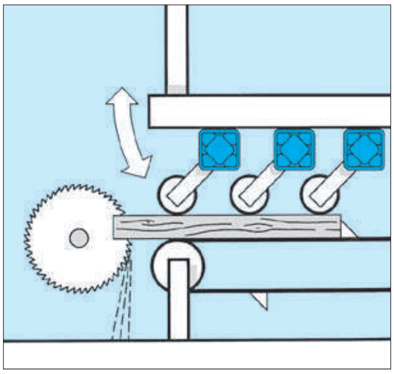
Inner square with through holes and bolted-on lever arm



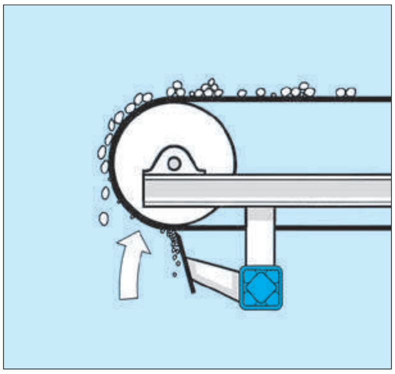
Inner square with through holes and brackets WS

Rubber suspension elements

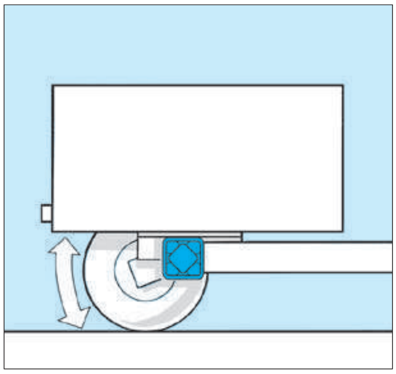
Application examples



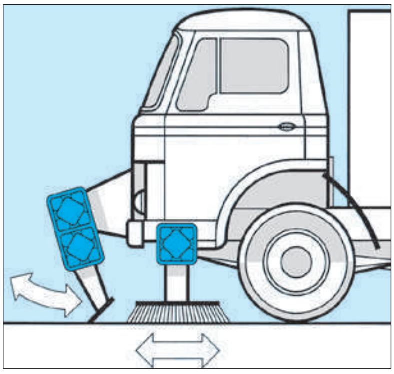
Pressure rollers in saw device



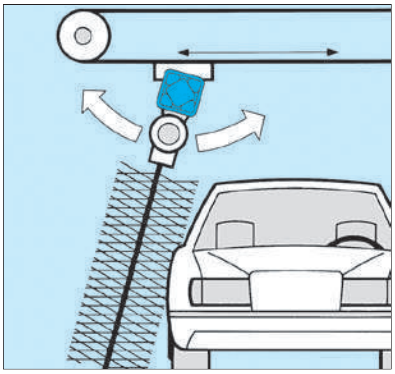
Conveyor-belt scraper



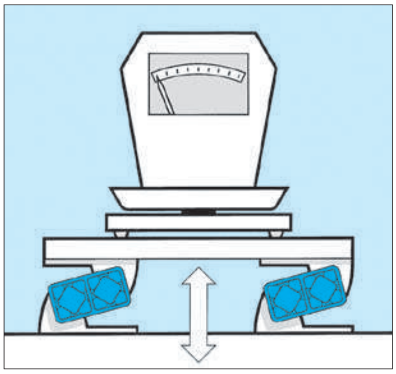
Independent wheel suspension



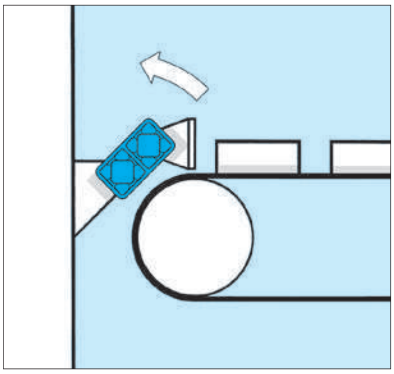
Elastic scraper / brushing joint



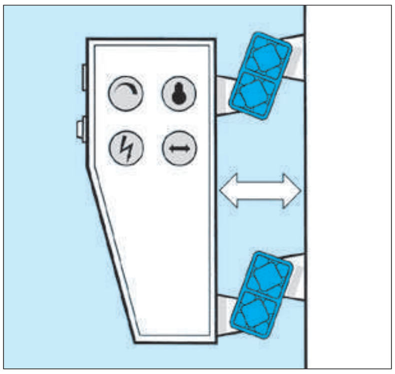
Self-aligning bearing for cleaning brushes



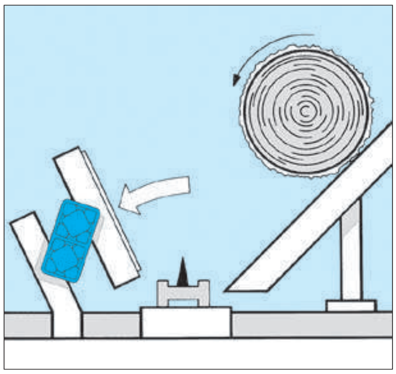
Passive insulation



Shock absorber



Control unit insulation

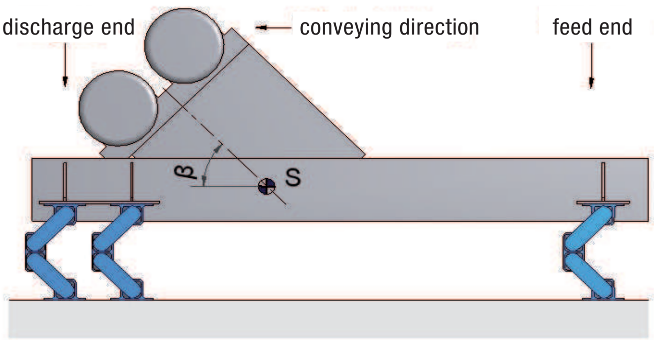


Impact suspension in feeder

OSCILLATING MOUNTINGS

Oscillating mountings – free oscillating systems

Calculation bases



Subject	Symbol	Unit
Mass of the empty channel and drive *	m_0	kg
Products on the channel *	m_m	kg
Total vibrating mass	$m = m_0 + m_m$	kg
Mass distribution: feed end	% feed end	%
discharge end	% discharge end	%
Acceleration due to gravity	g	9.81 m/s²
Load per corner feed end	F feed end	N
Load per corner discharge end	F discharge end	N
Working torque of both drives	AM	kgcm
Oscillating stroke empty channel	sw_0	mm
Oscillating stroke in operation	sw	mm
Motor revolutions	n_s	min^{-1}
Centrifugal force of both drives	Fz	N
Oscillating machine factor	K	
Machine acceleration	$a = K \cdot g$	g

Calculation formulas

Loading per corner

$$F_{\text{feed end}} = \frac{m \cdot g \cdot \%\ \text{feed end}}{2 \cdot 100} \qquad F_{\text{discharge end}} = \frac{m \cdot g \cdot \%\ \text{discharge end}}{2 \cdot 100} \quad [\,N\,]$$

Oscillating stroke

$$sw_0 = \frac{AM}{m_0} \cdot 10 \qquad sw = \frac{AM}{m} \cdot 10 \quad [\,mm\,]$$

Centrifugal force

$$F_z = \frac{\left(\frac{2\pi}{60} \cdot n_s\right)^2 \cdot AM \cdot 10}{2 \cdot 1000} = \frac{n_s^2 \cdot AM}{18'240} \quad [\,N\,]$$

Oscillating machine factor

$$K = \frac{\left(\frac{2\pi}{60} \cdot n_s\right)^2 \cdot sw}{2 \cdot g \cdot 1000} = \frac{n_s^2 \cdot sw}{1'789'000} \quad [\,-\,]$$

* When determining the weight, take into account:
– High coupling or sticking of humid bulk material
– Channel running full
– Fully stacked screen deck with humid material
– Weight distribution with and without conveyed material
– Centrifugal force does not run through the center of gravity (channel full or empty)
– Sudden impact loading occurs
– Subsequent additions to the screen structure (e. g. additional screening deck)

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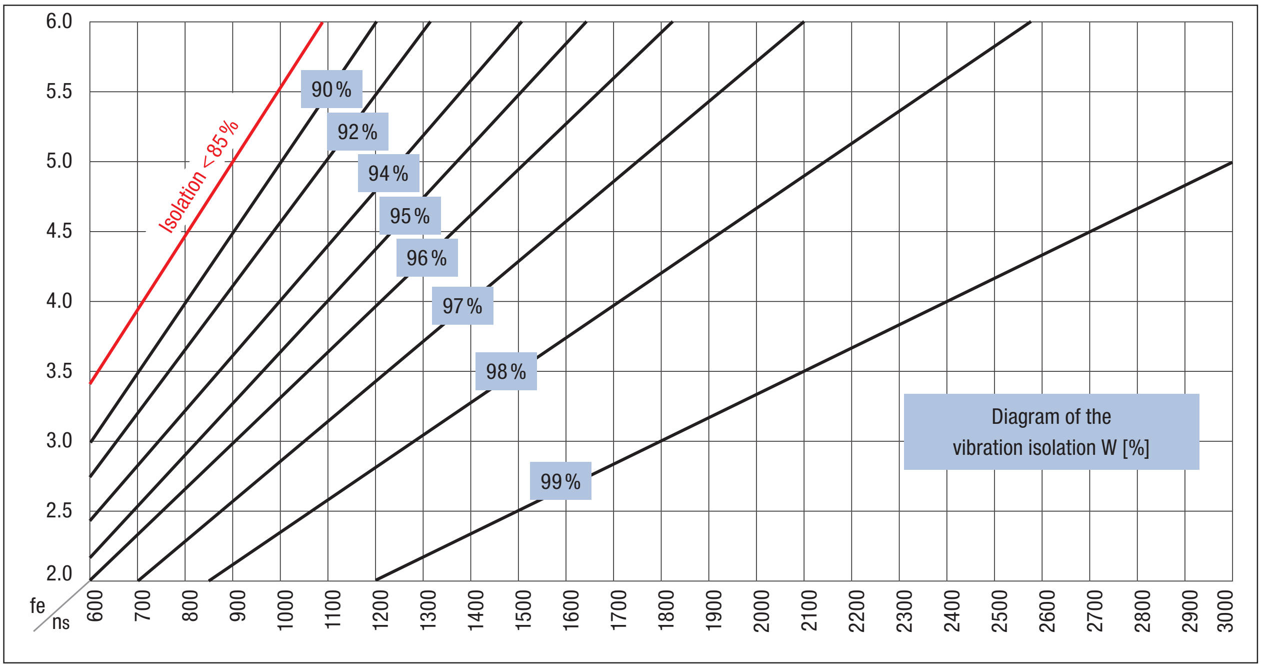
Oscillating mountings – free oscillating systems

Vibration isolation



Calculation formula

$$W = 100 - \frac{100}{\left(\frac{n_s}{60 \cdot fe}\right)^2 - 1} \ [\,\%\,]$$

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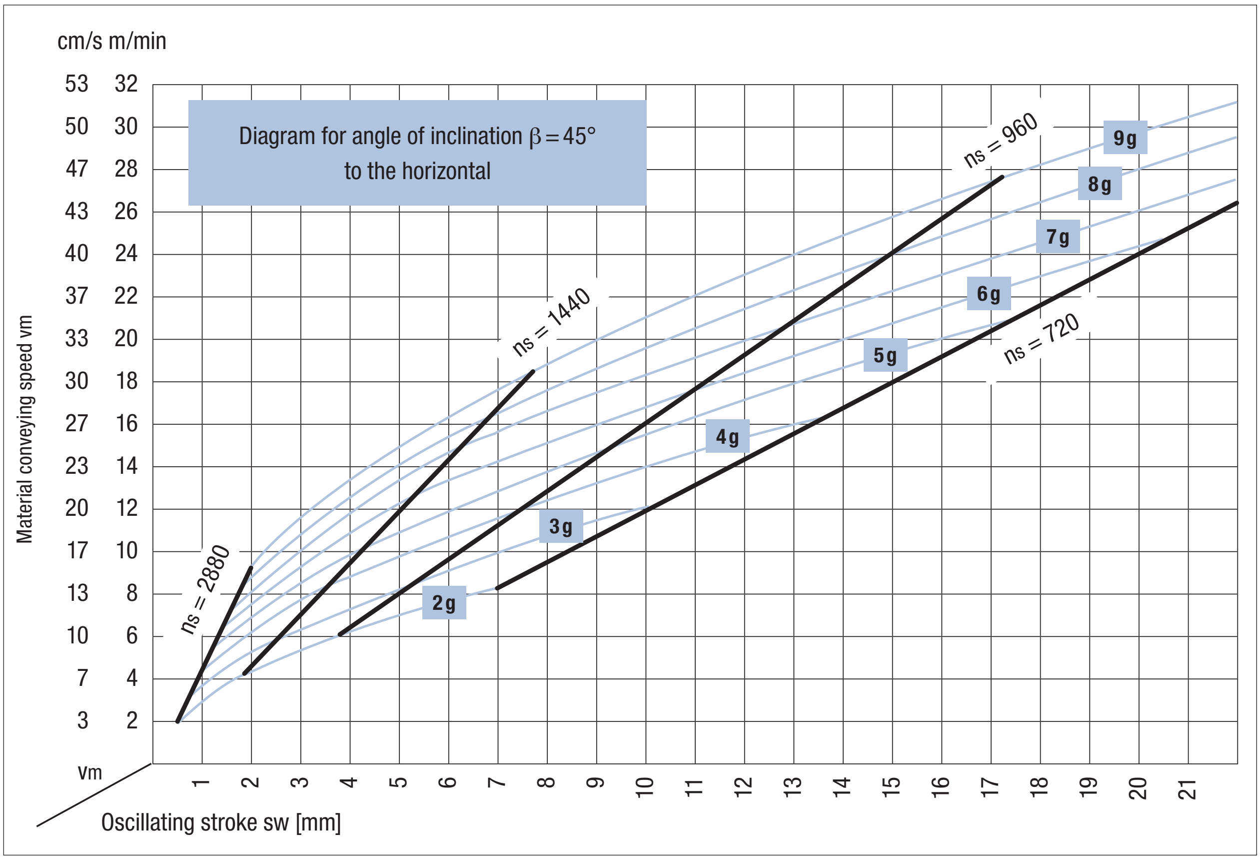
Oscillating mountings – free oscillating systems

Average material conveying speed v_m



Main influencing factors

– Conveying ability of the material
– Height of the bulk goods
– Inclination of screen base
– Drive angle of the exciters in linear oscillators
– Position of the centre of gravity

The material speed on circular motion screens varies and depends largely on the tilt of the screen box.

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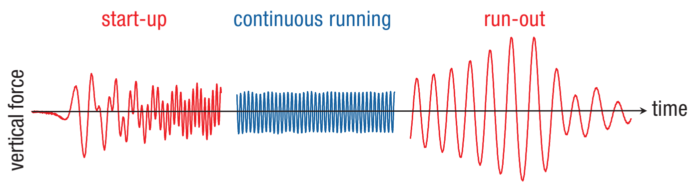
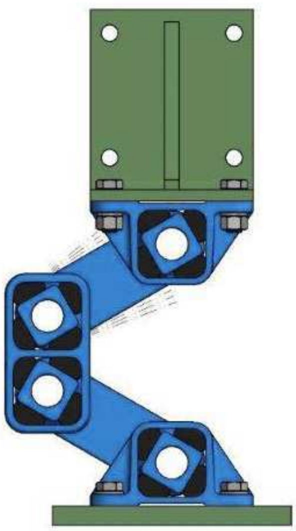
Oscillating mountings – free oscillating systems

Operating and resonance behaviour



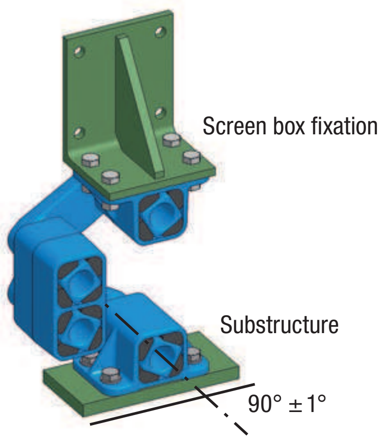
Laboratory measurements of a typical development of the residual forces on a ROSTA screen suspension:

At the screen start-up and run-out, the element's natural frequency is passed through. During the resulting amplitude superelevation, the four rubber suspension elements generate a high level of damping, which greatly reduces the vibration amplitudes. The screen box therefore stops fully after only a few strokes.



The rocker arm fixed to the screen carries out the greater part of the oscillations. The rocker arm fixed to the substructure remains virtually stationary, provides a strong cushion and ensures a low natural frequency and therefore a good insulation on the base frame.

Alignment of the elements



The mounting axis has to be arranged at a right angles (90°) to the conveying axis, with maximum tolerance of ±1°.

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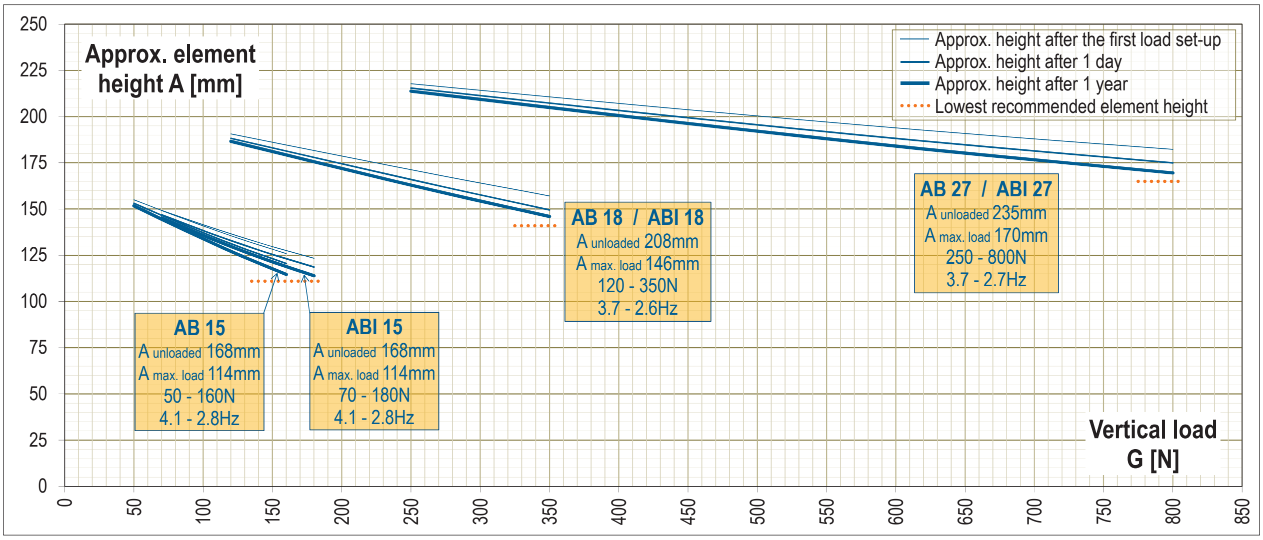
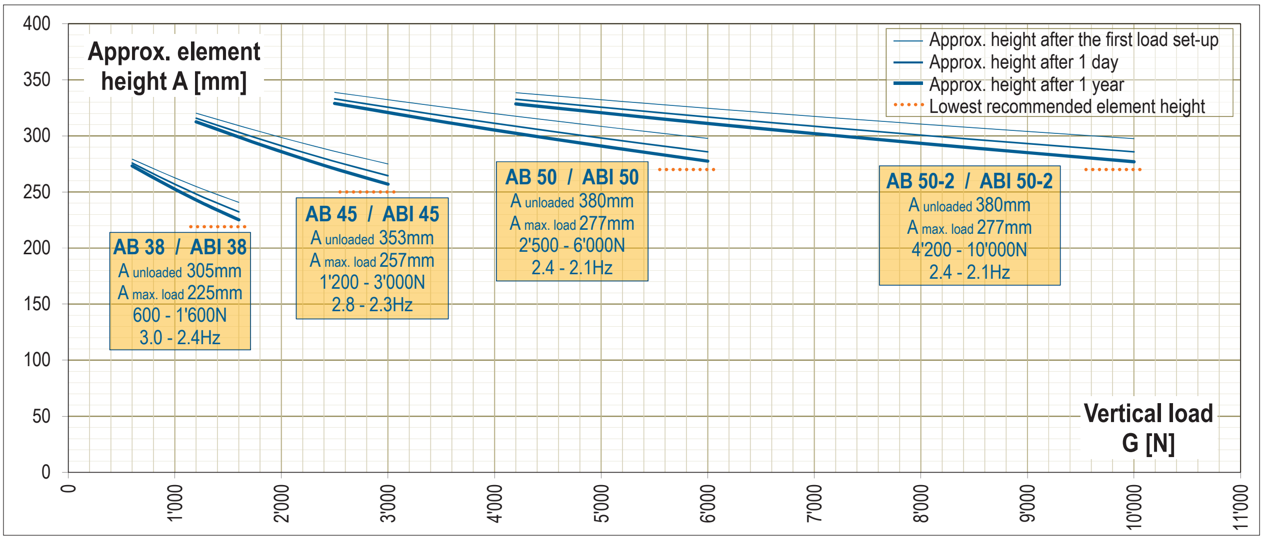
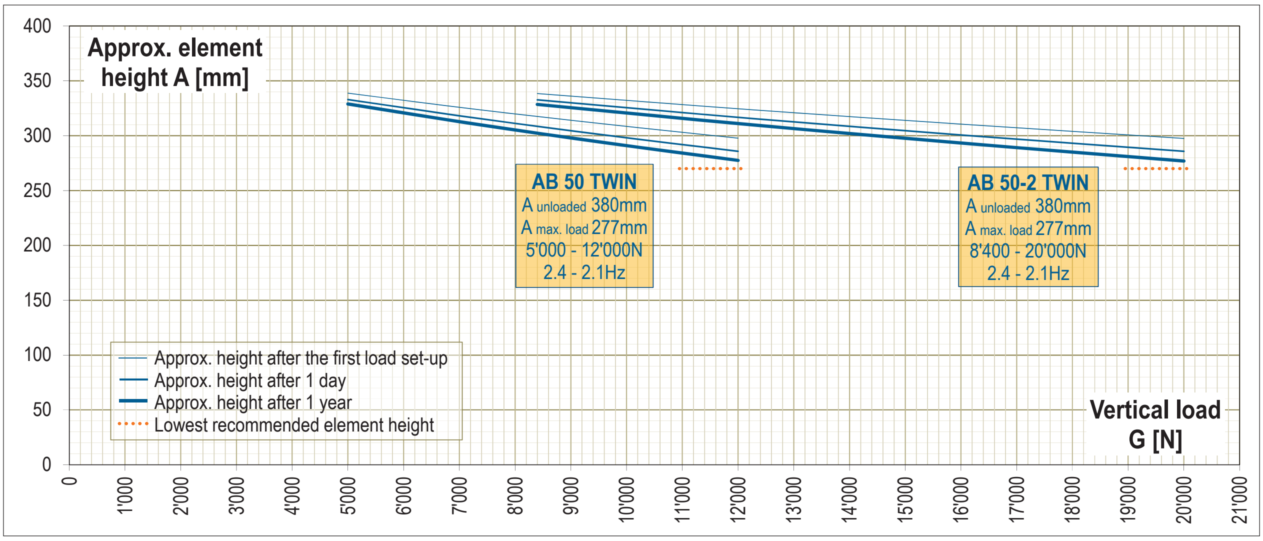
Oscillating mountings – free oscillating systems

Element heights and setting behaviour AB and ABI

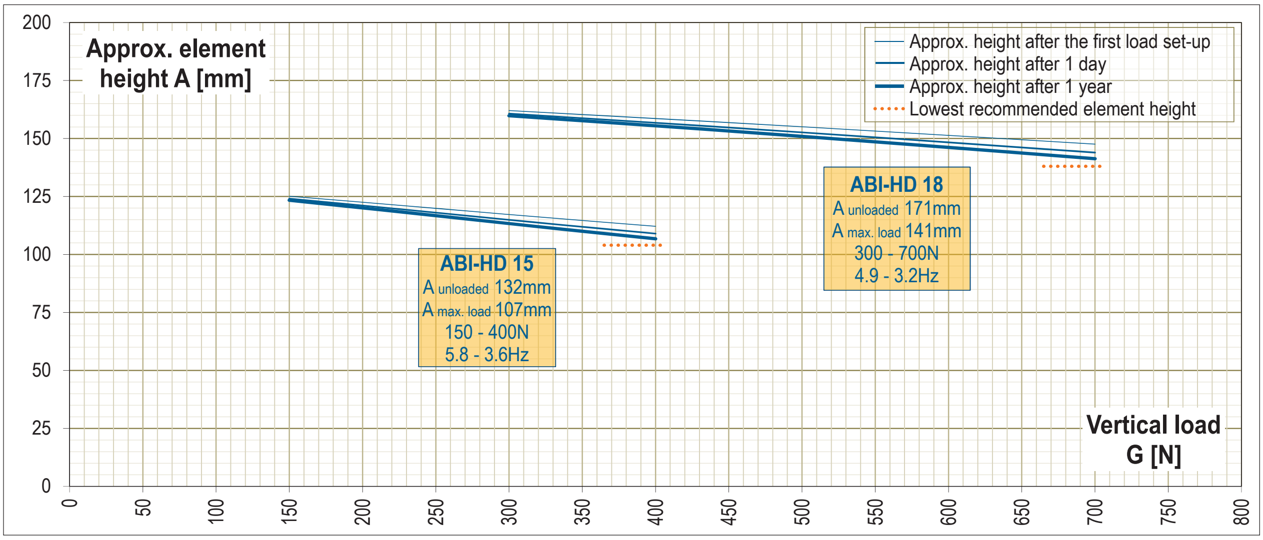


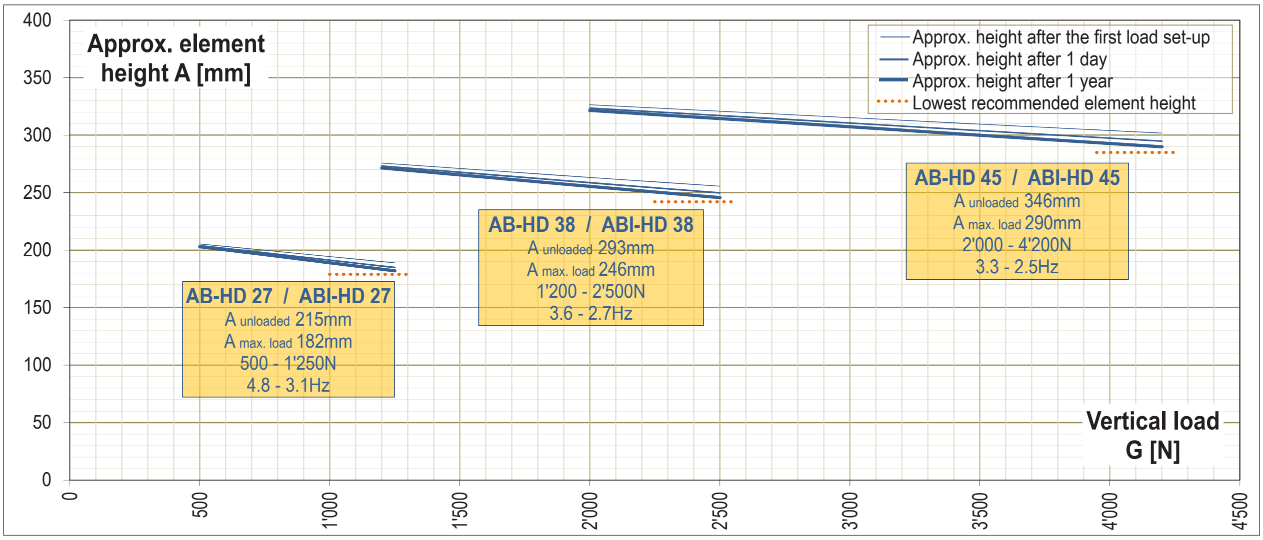


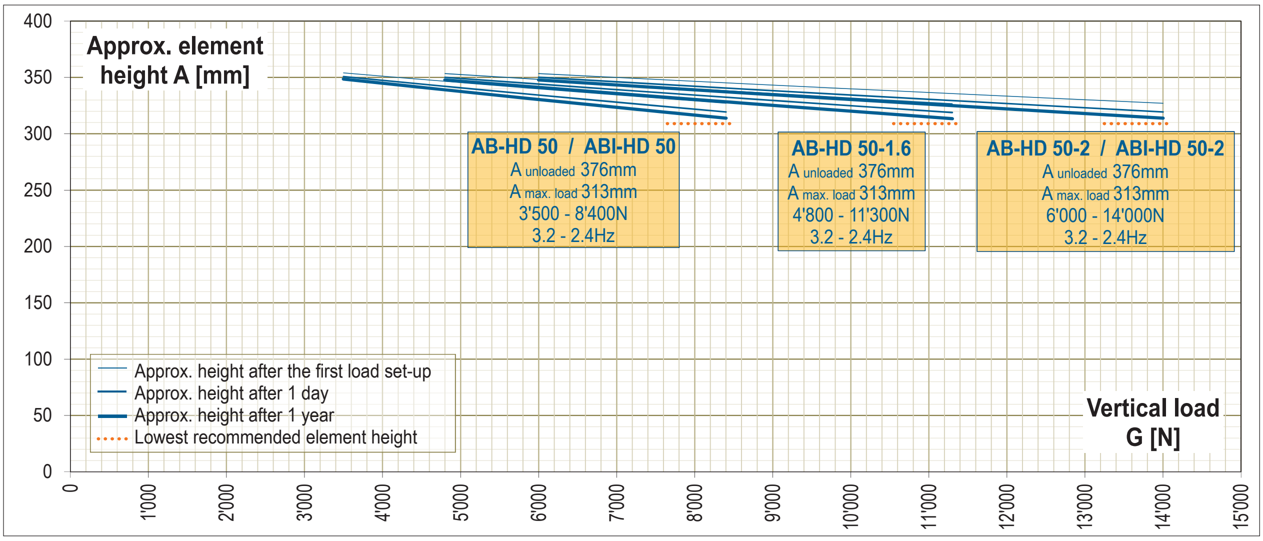


Oscillating mountings – free oscillating systems

Element heights and setting behaviour AB-HD and ABI-HD



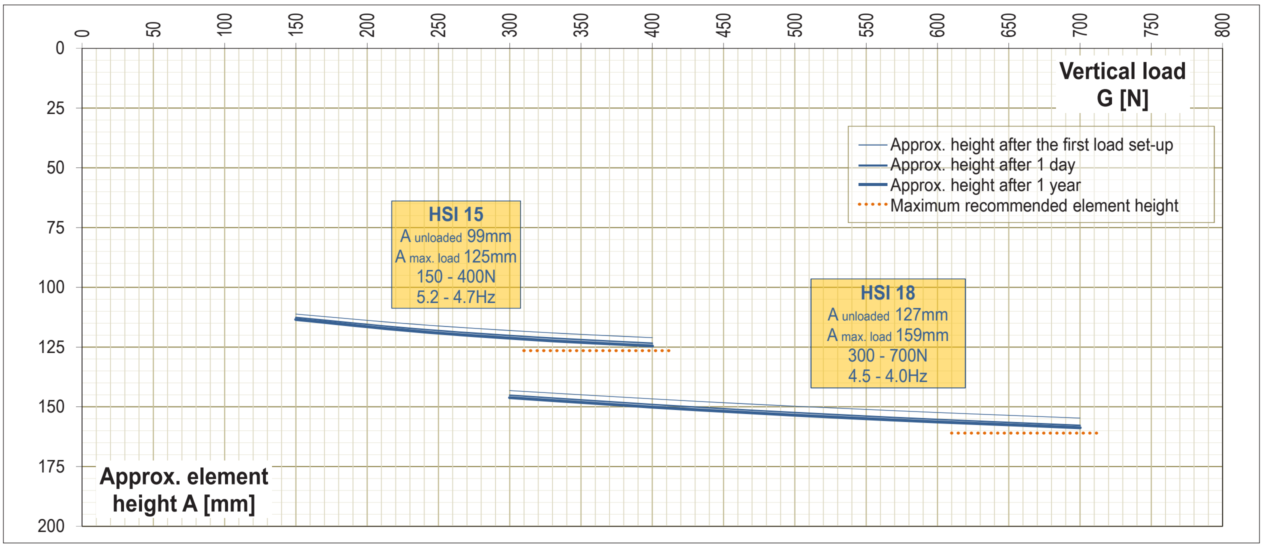


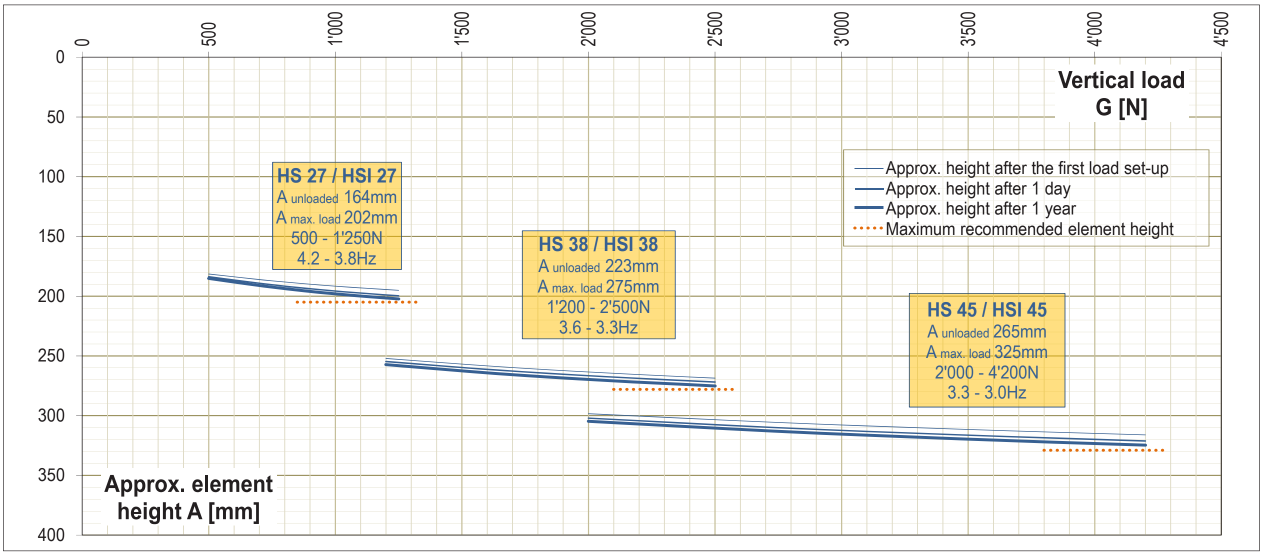


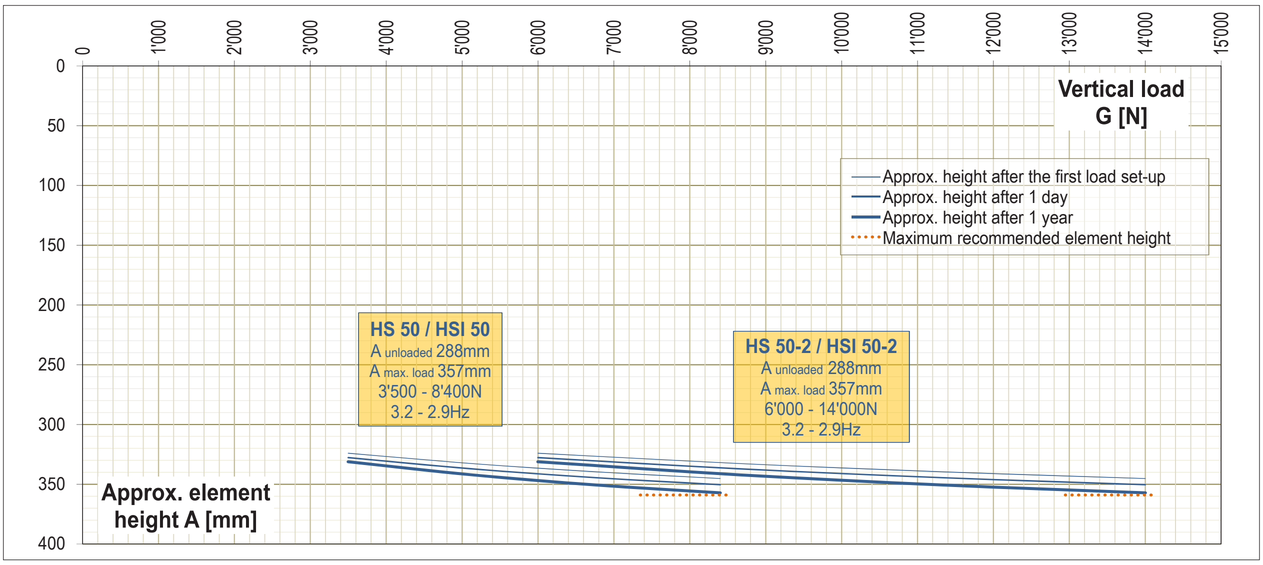
7

Oscillating mountings – free oscillating systems

Element heights and setting behaviour HS and HSI

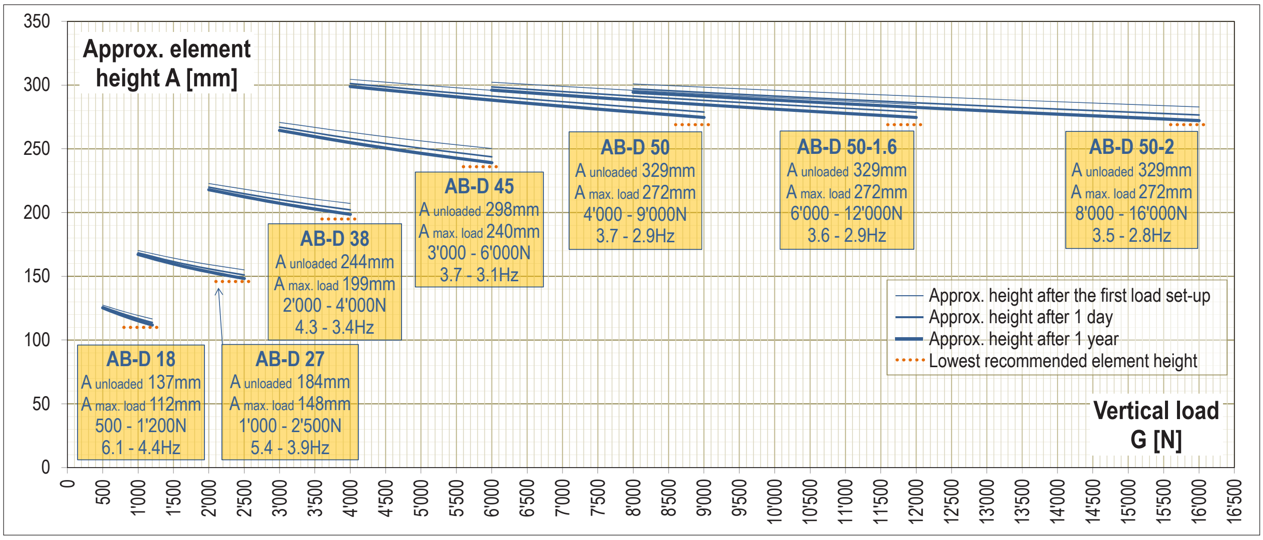






Oscillating mountings – free oscillating systems

Element heights and setting behaviour AB-D



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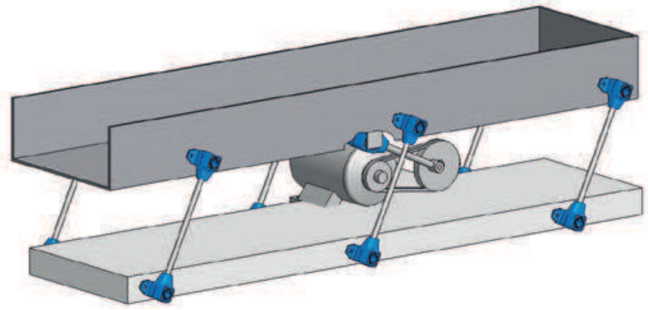
Oscillating mountings – guided systems

One mass systems without spring accumulators: calculation



	Subject	Symbol	Unit
Length, weight	Weight empty trough *	m_0	kg
	Weight of feeding material *		kg
	Weight of oscillating mass	$m = m_0 + m_m$	kg
Drive parameter	Eccentric radius	R	mm
	Stroke	$sw = 2 \cdot R$	mm
	Rpm on trough	n_s	min^{-1}
	Gravity acceleration	g	$9.81\ m/s^2$
	Oscillating machine factor	K	
	Acceleration	$a = K \cdot g$	m/s^2
	Total spring value of system	c_t	N/mm
Rocker arms	Quantity of rockers **	z	
	Load per rocker	G	N
	Center distance of elements	A	mm
Drive	Acceleration force	F	N
	Drive capacity approx.	P	kW
Spring value of natural frequency shaker	Dynamic torque	Md_d	Nm/°
	Dynamic spring value per rocker	c_d	N/mm
	Dynamic spring value of all rockers	$z \cdot c_d$	N/mm
	Resonant ability factor	i	

* When determining the weight, take into account:
– High coupling factor or sticking of wet and humid material
– Possible stemming of the trough

** Distance of the rocker max. 1.5 metres.

Calculation formulas

Oscillating machine factor

$$K = \frac{\left(\frac{2\pi}{60} \cdot n_s\right)^2 \cdot R}{g \cdot 1000} = \frac{n_s^2 \cdot R}{894'500}\ [-]$$

Total spring value of system

$$c_t = m \cdot \left(\frac{2\pi}{60} \cdot n_s\right)^2 \cdot 0.001 \quad [\text{N/mm}]$$

Load per rocker

$$G = \frac{m \cdot g}{z} \quad [\text{N}]$$

Acceleration force (for ST selection)

$$F = m \cdot R \cdot \left(\frac{2\pi}{60} \cdot n_s\right)^2 \cdot 0.001 = c_t \cdot R\ [\text{N}]$$

Drive capacity approx.

$$P = \frac{F \cdot R \cdot n_s}{9550 \cdot 1000 \cdot \sqrt{2}} \quad [\text{kW}]$$

Dynamic spring value per rocker

$$c_d = \frac{Md_d \cdot 360 \cdot 1000}{A^2 \cdot \pi} \quad [\text{N/mm}]$$

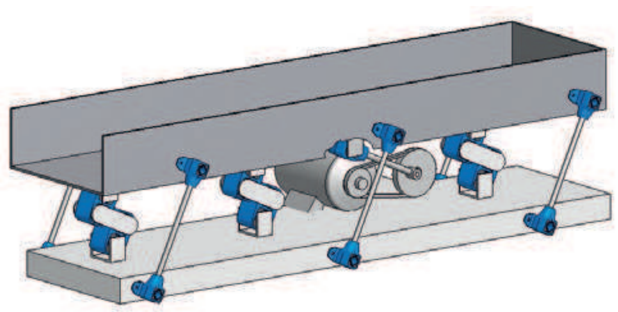
Resonant ability factor

$$i = \frac{z \cdot c_d}{c_t}\ [-]$$

By a resonant ability factor $i \geq 0{,}8$ the system is usually titled «natural frequency shaker».

Oscillating mountings – guided systems

One mass system with spring accumulators: calculation



Calculation analog one mass systems without spring accumulators with following additions:

	Subject	Symbol	Unit
Spring accumulators	Quantity	z_s	
	Dynamic spring value per item	c_s	N/mm
	Dynamic spring value of all items	$z_s \cdot c_s$	N/mm
	Resonant ability factor	i_s	

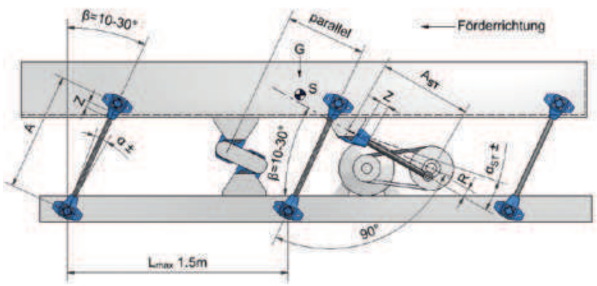
Calculation formulas

Resonant ability factor with accumulators

$$i_s = \frac{z \cdot c_d + z_s \cdot c_s}{c_t} \; [-]$$

By a resonant ability factor is ≥ 0.8 the system is usually titled «natural frequency shaker».

One mass conveyor system: installation instructions



Distance between rockers L_{max}:

– Usually, the distance between the rockers in the longitudinal direction must not exceed 1.5 metres.

– With chutes wider than 1.5 m, we recommend fitting a third row or multiple rows of rockers on the underside of the chute base or to install spring accumulators to improve the stability.

Mounting position drive head ST:

For one mass shaker systems it is recommendable to position the drive head slightly ahead of the center of gravity of the trough, towards the discharge end.

Angle of attack β:

The angle of attack β of the rocker must be between 10° and 30° to the perpendicular line, depending on the process and the conveying speed. (The optimum combination of a fast conveying speed and the high material throw is given at the angle of attack $\beta = 30°$.) The operating direction of the drive rod should be at 90°, i.e. the thrust angle of attack β is accordingly between 10° and 30° to the horizontal line.

Oscillation angle α:

The parameters for the oscillation angle and speed must be within the permissible range, see «permissible frequencies» in chapter 7 Technology.

Screw grade:

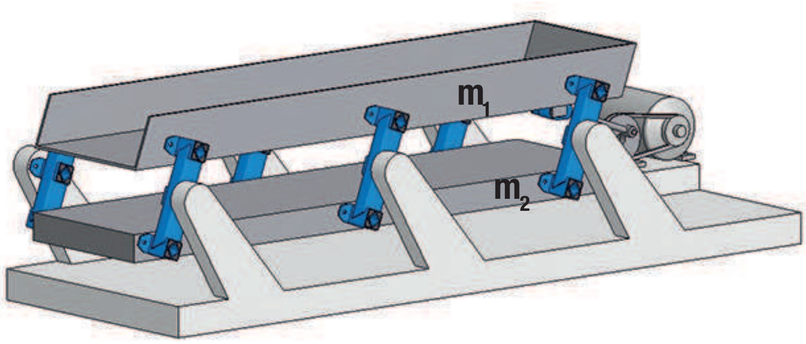
Select screw grade 8.8 and mount with correct tightening torque.

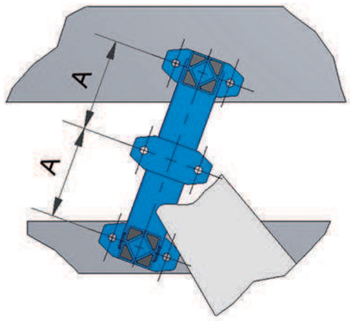
Thread length Z:

The thread length Z is at least 1.5 × the nominal thread size.

Oscillating mountings – guided systems

Two mass system with direct mass balance





- Max. acceleration of approx. 5 g and max. chute length of approx. 25 metres
- Double rockers made from ROSTA elements AR, AD-P or AD-C
- Optimal balance of forces with $m_1 = m_2$
- Calculation same as for one mass system, with the following difference:

Actuated mass incl. material coupling	m_1 [kg]
Driven mass incl. material coupling	m_2 [kg]
Total oscillating mass	$m = m_1 + m_2$ [kg]

Dynamic spring value per rocker [N/mm]

$$c_d = \frac{3 \cdot Md_d \cdot 360 \cdot 1000}{2 \cdot A^2 \cdot \pi} \quad [\mathrm{N/mm}]$$

- Calculation of c_t and F with the new total oscillating mass m
- Introduction of force with the ST at any point along the chute, 90° to the rocker axis
- For customised rockers with different centre distances A, please contact ROSTA

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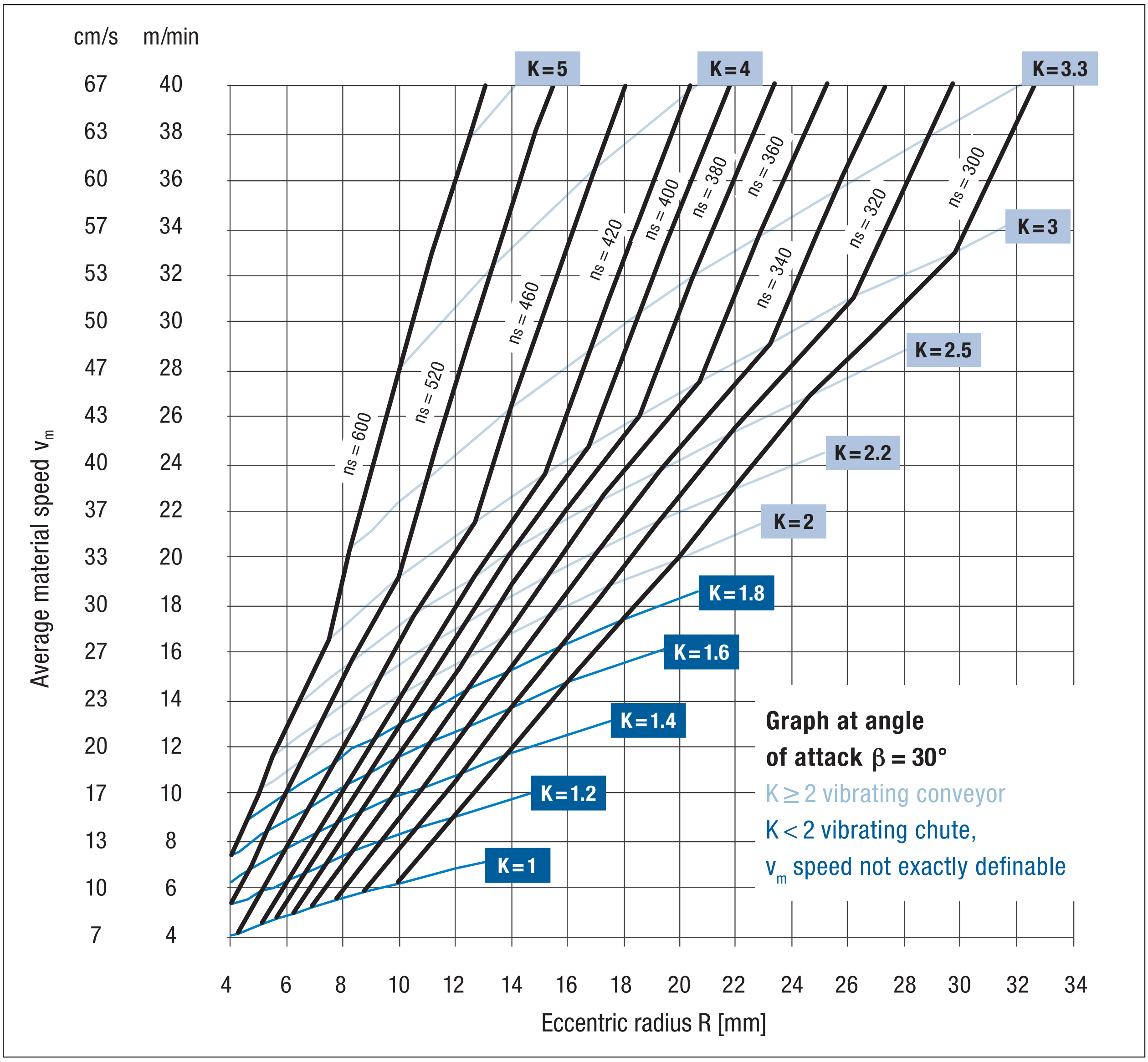
Oscillating mountings – guided systems

Average material conveying speed v_m



Main influence factors:
– bulk height
– sieve surface texture
– drive angle and thus rocker angle of attack
– feeding capacitiy is dependent on shape and humidity of the material, e.g. dry, fine-grained material needs correction factors up to 30 %.

By acceleration factors K > 2 and rocker mounting angles of β = 30° (to the perpendicular line) the vertical acceleration is getting bigger than 1 g, therefore the material starts lifting from the trough bottom = material throw.

7

Oscillating mountings – guided systems

Maximum load G, speed n_s and oscillation angle α

Size (e.g. AU 15)	max. load capacity per rocker [N]				max. revolutions n_s [min^{-1}] *	
	K < 2	K = 2	K = 3	K = 4	$\alpha \pm 5°$	$\alpha \pm 6°$
15	100	75	60	50	640	480
18	200	150	120	100	600	450
27	400	300	240	200	560	420
38	800	600	500	400	530	390
45	1 600	1 200	1 000	800	500	360
50	2 500	1 800	1 500	1 200	470	340
60	5 000	3 600	3 000	2 400	440	320

Please contact ROSTA for higher machine parameters and elements with greater loads.
The revolutions are usually ns = 300 to 600 min^{-1} and oscillation angle α to max. ±6°.
*see «permissible frequencies» in chapter 7 Technology.

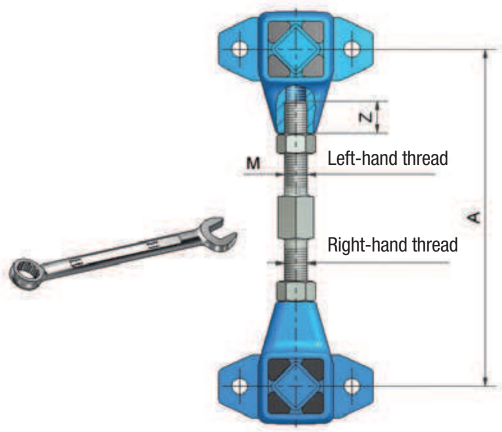
The oscillation angle α of each component must be within the permissible range of application (n_s and α), i.e. rockers, drive rods and spring accumulator.

Calculating the oscillation angle for rockers

Eccentric radius R [mm]
Center distance A [mm]
Oscillation angle α ± [°]

$$\alpha = \arctan\left(\frac{R}{A}\right) [°]$$

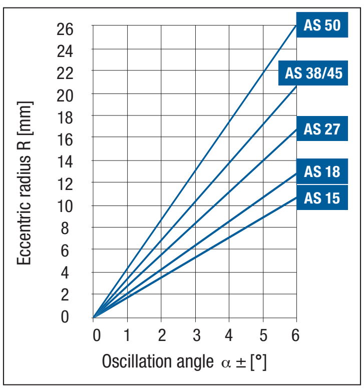
AU / AUI: Connection rod



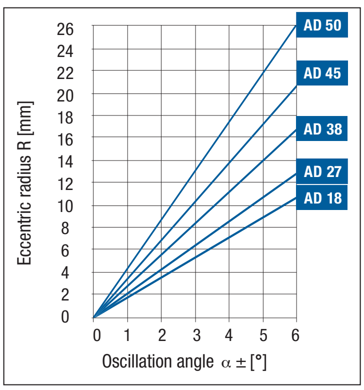
The customer manufactures the connection rod, preferably with a left and right-hand thread. Together with the corresponding oscillating mountings, the distance between the mountings (A) can be freely adjusted. Using a standard threaded rod (with «only» a right-hand thread) may be more economical, but it is less accurate.
The centre distance A must be set identically for all rockers and the thread length Z must be at least 1.5 × M.

AS / AD: Resulting oscillation angle α from eccentric radius R

Single rocker AS



Double rocker AD

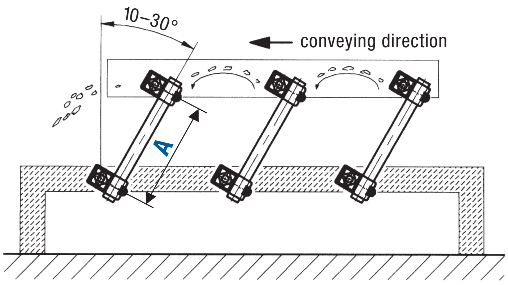


7

Oscillating mountings – guided systems

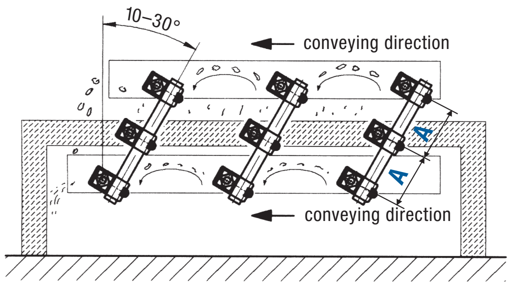
AR: Single, double and two-way Rocker

Single rocker



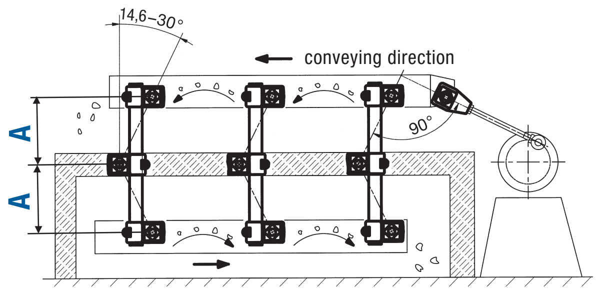
The two AR elements are pushed onto a round tube. The desired center distance is set on a straightening plate and then fixed by tightening the clamp.

Double rocker



With three AR elements, the tube wall thickness is adjusted to the centre distances A, see «dimensioning of the connecting tubes». The counterweight can be used as an additional conveyor trough with the same conveying direction.

Two-way rocker



The three AR elements mounted in the boomerang configuration create a two-way material flow. Tube wall thickness according to «dimensioning of the connecting tubes». This two-way conveying flow can simplify the conveying process and the mass balance is maintained with this arrangement.

AR: Dimensioning of the connecting tubes

For double rockers and two-way rocker

Type	Tube-ø	thickness of tube	max. centre distance A	resulting min. angle of attack β [°] with two-way rocker
AR 27	30	3	160	26.0
		4	220	19.5
		5	300	14.6
AR 38	40	3	200	27.5
		4	250	22.6
		5	300	19.1
AR 45	50	5	300	23.4
		8	400	18.0

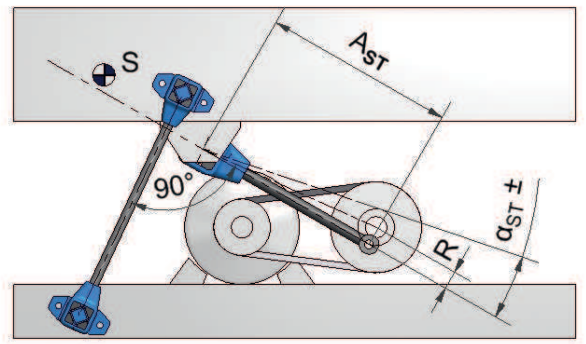
The customer provides the connecting tubes.

For single rockers with AR 27 or AR 38, it is sufficient for the tubes to have a wall thickness of 3 mm up to A = 300 mm.

For different centre distances A, please contact ROSTA.

Oscillating mountings – guided systems

ST / STI: Length of drive rod A_{ST} and eccentric radius R



To introduce the force in balance, the deflection angle α_{ST} of the drive rod must not exceed ±5.7°. This corresponds to a ratio R : A_{ST} of 1:10.

Calculation deflection angle

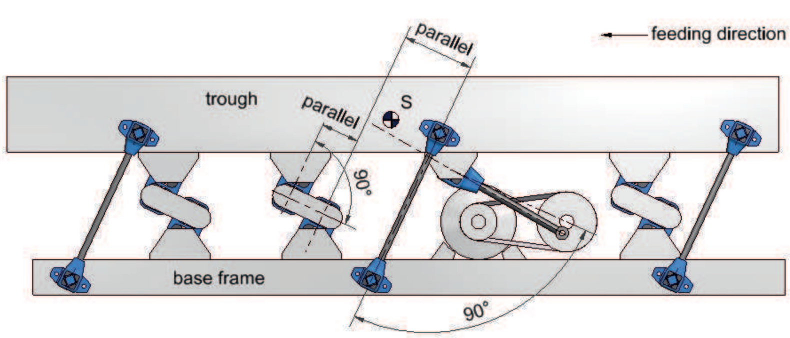
Eccentric radius R [mm]
Center distance A_{ST} [mm]
Deflection angle α_{ST} ± [°]

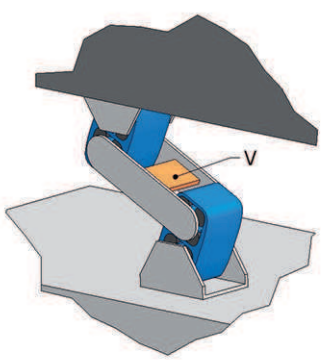
$$\alpha_{ST} = \arcsin\left(\frac{R}{A_{ST}}\right) \; [°]$$

DO-A: Operating parameters and installation guidelines

Example deflection angle DO-A (series connection)	Accumulator cons. of 2 × DO-A 45				Accumulator cons. of 2 × DO-A 50			
	R	sw	max. n_s	max. K	**R**	sw	max. n_s	max. K
± 6°	**15.3**	30.6	360	2.2	**16.4**	32.8	340	2.1
± 5°	**12.8**	25.6	500	3.6	**13.6**	27.2	470	3.4
± 4°	**10.2**	20.4	740	6.2	**10.9**	21.8	700	6

The connecting levers made by the customer, between the DO-A elements, are at 90° to the DO-A element axis. A cross bracing can be installed installed (V) if required. The DO-A elements are parallel to each other and parallel to the rockers; they are attached by means of a fork construction at a rigid point on the vibrating conveyor and base frame.



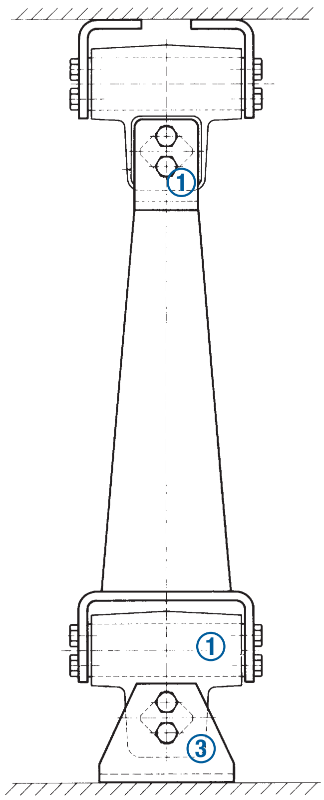


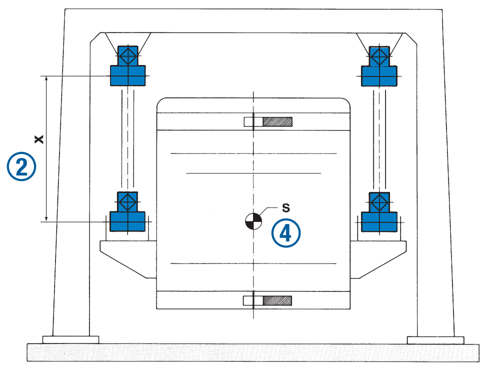
7

Oscillating mountings – gyratory sifters

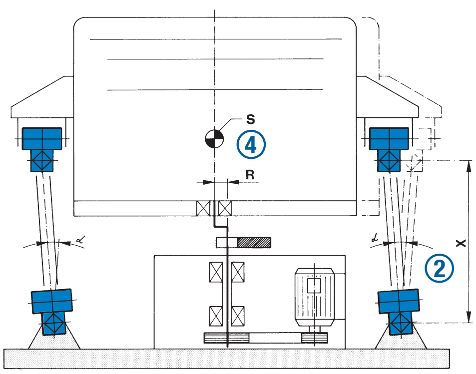
AK: Installation guidelines for gyratory sifters

1. Arrange the two inner elements offset by 90° (even torsional load).
2. Connect the AK, adjust the installation height. Even when the sifters are at an angle, the column height «X» must be identical.
3. Angle supports type WS can be used up to AK 50 (see chapter 2 rubber suspension elements).
4. To avoid unwanted tilting and turning, the screen box's centre of gravity «S» is positioned on or within the universal joint column.





Hanging and freely oscillating gyratory sifter



Standing gyratory sifter with positive crank shaft drive

AK: Calulation for gyratory sifters

Machine type: standing gyratory sifter with positive crank drive

Description	Symbol	Unit
Total oscillating mass (material included)	m	kg
Eccentric radius	R	mm
Length of support column	X	mm
Oscillation angle (out of R and X)	$\alpha \pm$	°
Quantity of support columns	z	pcs.
Load per column	G	N

Calculation formula

Oscillation angle

$$\alpha = \arctan \left(\frac{R}{X} \right) [°]$$

Load per column

$$G = \frac{m \cdot g}{z} \; [N]$$

Limitation of application parameters see «permissible frequencies» in chapter 7 Technology.

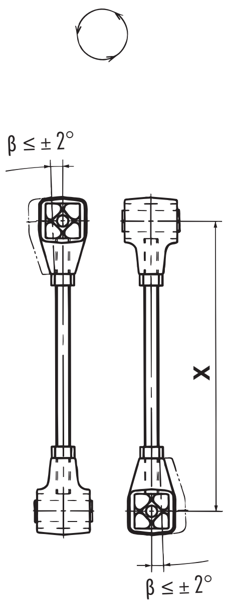
7

Oscillating mountings – gyratory sifters

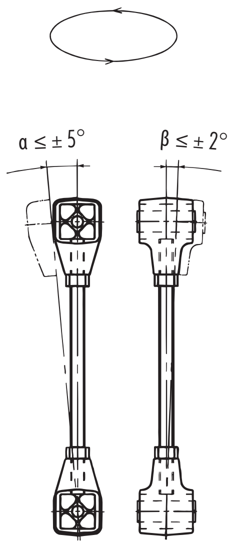
AV: Installation guidelines for gyratory sifters

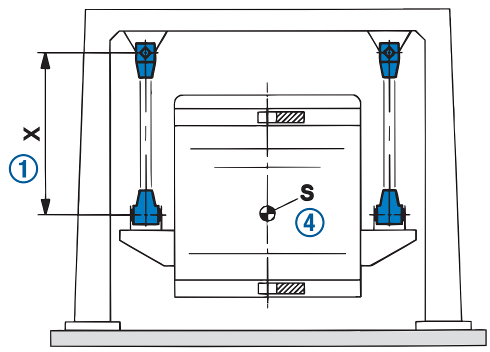
1. With the right-hand and left-hand threaded versions, the length X of the suspension rod can easily be adjusted. X has to be identical for all columns and the specified angle limitations must be respected!
2. Installing the two elements in a crosswise configuration moves the gyratory sifter in a circular motion.
3. Installing the two elements in the same configuration moves the gyratory sifter in an elliptical motion.
4. To avoid unwanted tilting or turning, the centre of gravity of the screen box «S» is positioned at the same level or slightly below the suspension rod's attachment.
5. Please consult ROSTA in the selection of AV elements for standing gyratory sifters.

2 circular oscillation



3 elliptical oscillation





AV: Calculation for gyratory sifters

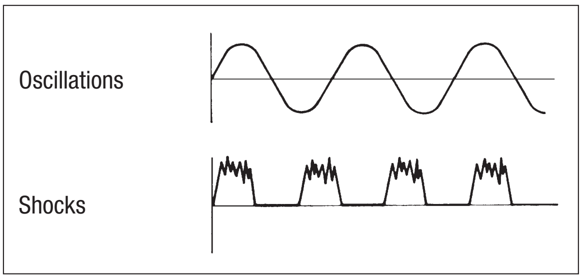
Description	Symbol	Unit	Calculation formula
Total oscillating mass (material included)	m	kg	**Oscillation angle**
Eccentric radius 2	R	mm	$\beta = \arctan\left(\frac{R}{X}\right)$ [°]
Length of suspension rod	X	mm	
Oscillation angle (out of R and X), shall not exceed ±2° 2	β±	°	
Quantity of suspension rods	z	pcs.	**Load per suspension rod**
Load per suspension rod	G	N	$G = \frac{m \cdot g}{z}$ [N]

Limitation of application parameters see «permissible frequencies» in chapter 7 Technology.

VIBRATION DAMPERS

Vibration dampers

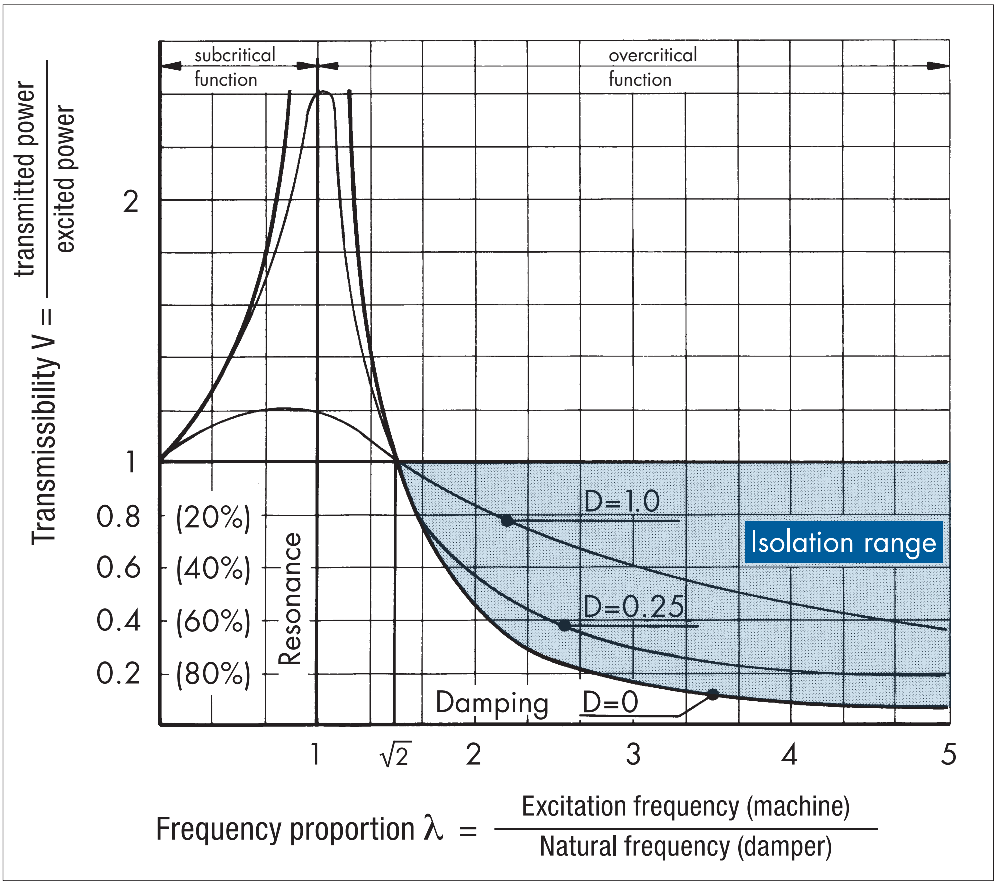
Isolation of oscillations and shocks



Manufacturers of vibration dampers usually offer different designs of machine mounts with varying natural frequencies, to meet the required detuning between the excitation frequency of the machine to be mounted and the natural frequency of the damper.

The vibration technology basically differentiates between two different oscillation patterns. Oscillations are usually eradicated with supercritical designed machine mounts, while shocks are eradicated with subcritical ones.

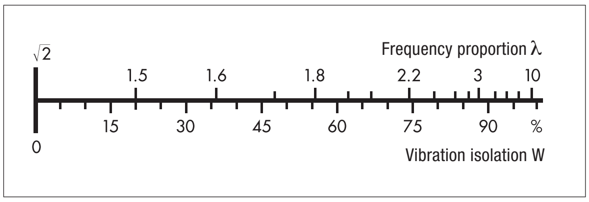
Frequency proportion λ



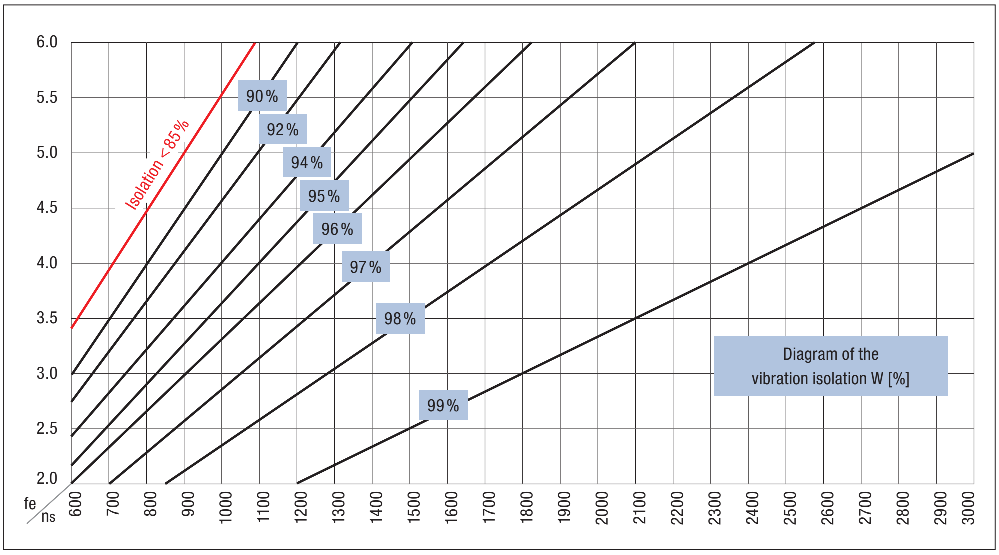
λ > √2: Overcritical: vibration isolation, definable effectiveness W, and efficient structure-borne sound insulation
λ = 1: Resonance range: amplified resonance, maximum values depend on the internal insulation D within the resonance range
λ < 1: Subcritical: no definable vibration isolation and lower structure-borne sound insulation

Vibration dampers

Overcritical installations (λ > √2)



For overcritical mounts, the natural frequency values of the mounts must be at least √2 below the excitation frequencies of the machine or unit. As a rule, a damper with a relatively large spring deflection performance under load is selected. Most units, compressors, motors, blowers and generators are mounted overcritical making them relatively «soft». The resulting frequency ratio provides information about the expected isolation effectiveness of the mount. The line scale opposite and the calculation give the expected insolation W as a %.



$$W = 100 - \frac{100}{\left(\frac{n_s}{60 \cdot fe}\right)^2 - 1} \, [\%]$$

n_s =
Revolution exciter (machine) [rpm]

fe =
Natural frequency damper [Hz]

Subcritical installations (λ < 1) and resonance range (λ = 1)

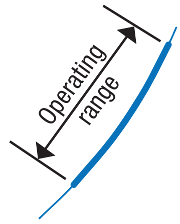
Subcritical installations
A damper with high mechanical strength and low deflection behaviour (high mounting stability) is usually used on subcritical mounts. With this type of mounting, it is possible to damp impacts and shocks from relatively slow-moving machines such as mixers, crushers (cone crushers), punching presses, shears, etc. On machines with subcritical mounts, the resulting efficacy of the isolation insulation cannot be calculated – it can only be determined by comparing the values before and after.

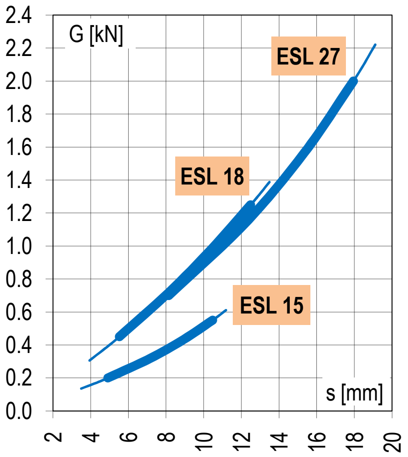
Resonance range
Any coincidence between the exciter frequency and the natural frequency of the damper lead to an undesired, uncontrollable swinging up of the machine to be stored.

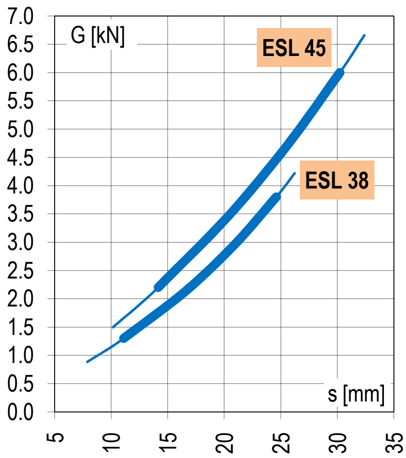
Vibration dampers

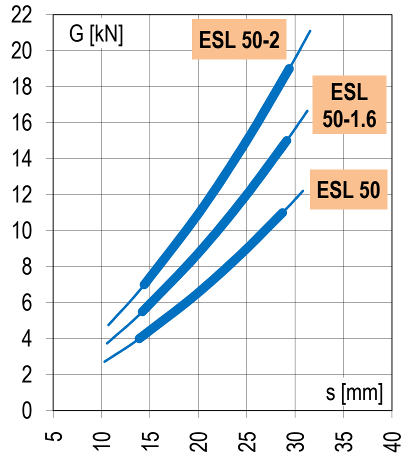
ESL: Deflection curves and setting behaviour

The deflection graphs already contain an initial cold flow that occurs after the first hours of operation. The final cold flow is approx. s × 1.09.
These deflection values are based on our catalogue data and are to be taken as guidelines. Please also refer to our tolerance data in chapter 7 «Technology – ROSTA Basics».





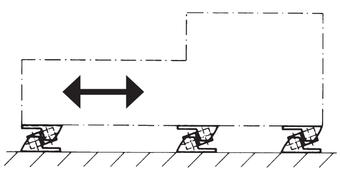




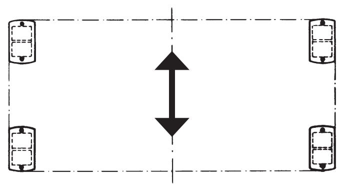
ESL: Installation guidelines

The ESL elements must generally be installed in the same direction.

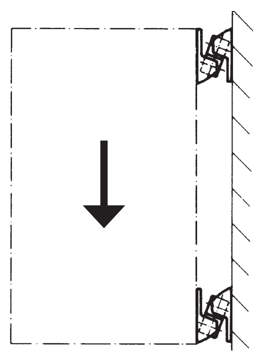
Dynamic forces longitudinal



Dynamic forces lateral



Wall mounting
(Please follow mounting direction)



7

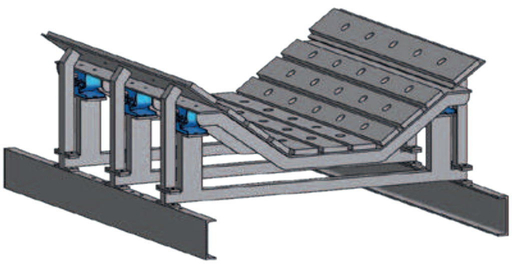
Vibration dampers

ESL: Transfer stations in belt conveyor systems

Size and quantity of ESL for the absorption of the occurring kinetic energy

Weight biggest lump [kg]	Drop height [m]																		
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
10	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
20	4	4	4	4	4	4	4	4	4	6	6	6	6	6	6	6	6	6	6
30	4	4	4	4	4	6	6	6	6	6	6	6	6	6	8	8	8	8	8
40	4	4	4	4	6	6	6	6	6	6	8	8	8	8	6	6	6	6	6
50	4	4	4	6	6	6	6	6	8	8	8	6	6	6	6	6	6	8	8
60	4	4	6	6	6	6	8	8	8	6	6	6	6	6	8	8	8	8	8
70	4	6	6	6	6	8	8	6	6	6	6	6	8	8	8	8	8	8	8
80	4	6	6	6	8	8	6	6	6	6	8	8	8	8	8	8	8	8	8
90	4	6	6	6	8	6	6	6	6	8	8	8	8	8	8	8	8	8	8
100	4	6	6	8	8	6	6	6	8	8	8	8	8	8	8	8	8	8	8
110	6	6	6	8	6	6	6	8	8	8	8	8	8	8	8	8	8	10	10
120	6	6	8	8	6	6	8	8	8	8	8	8	8	8	8	10	10	10	10
130	6	6	8	6	6	6	8	8	8	8	8	8	8	8	10	10	10	10	12
140	6	6	8	6	6	8	8	8	8	8	8	8	8	10	10	10	10	12	12
150	6	6	8	6	6	8	8	8	8	8	8	8	10	10	10	12	12	12	12
200	6	8	6	8	8	8	8	8	8	10	10	12	12	12	14	14	16	16	16
300	8	6	8	8	8	10	10	12	12	14	16	16							
400	6	8	8	8	10	12	14	16	16										
500	8	8	8	10	12	14	16												

Typ	Max. absorption of energy per ESL
ESL 38	250 Nm
ESL 45	375 Nm
ESL 50	750 Nm
ESL 50-1.6	1 000 Nm
ESL 50-2	1 250 Nm



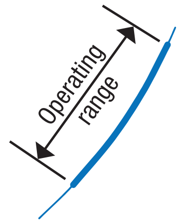
Transfer stations equipped with ROSTA Type ESL vibration dampers offer a progressive deflection characteristic that effectively dampens the kinetic energy created when the falling material makes impact. This protects the surface of the belt's coating from cracking, dramatically reduces the level of continuous material wear and protects the substructure from premature failure.

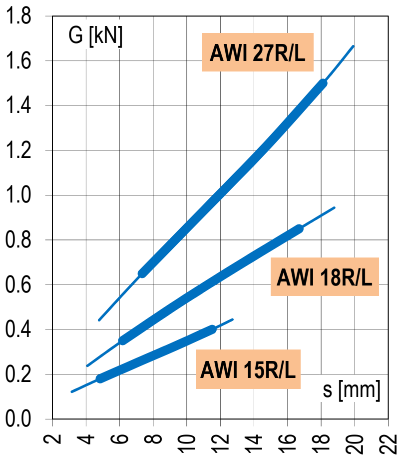
7

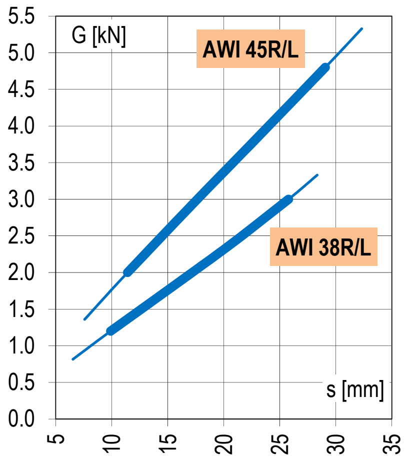
Vibration dampers

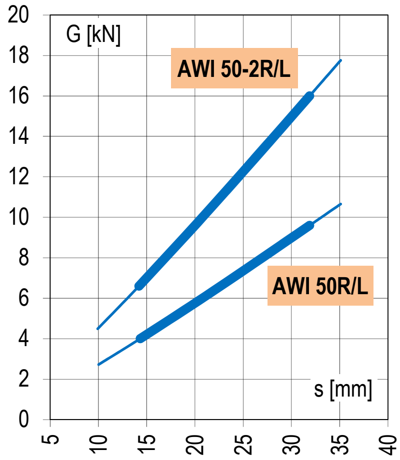
AWI: Deflection curves and setting behaviour

The deflection graphs already contain an initial cold flow that occurs after the first hours of operation. The final cold flow is approx. s × 1.09.
These deflection values are based on our catalogue data and are to be taken as guidelines. Please also refer to our tolerance data in chapter 7 «Technology – ROSTA Basics».





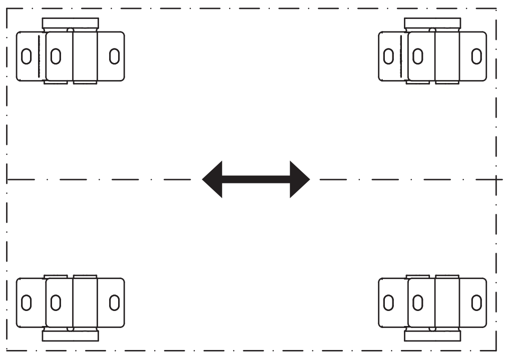




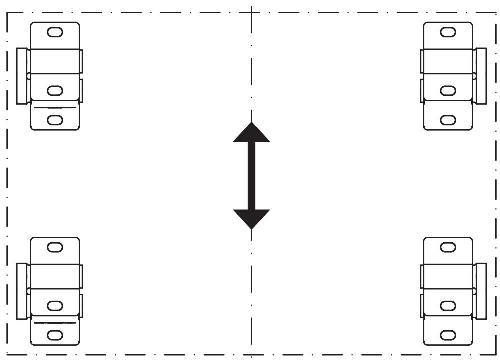
AWI: Installation guidelines

The AWI elements must generally be installed in the same direction.

Dynamic forces longitudinal



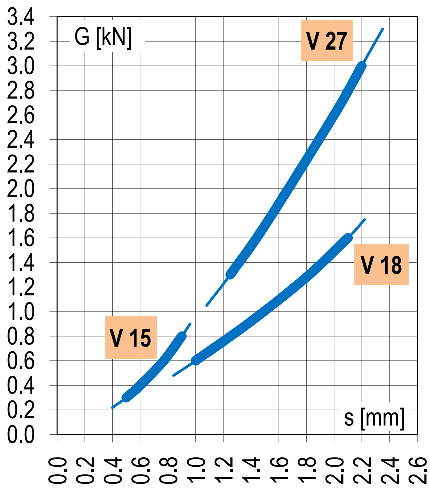
Dynamic forces lateral

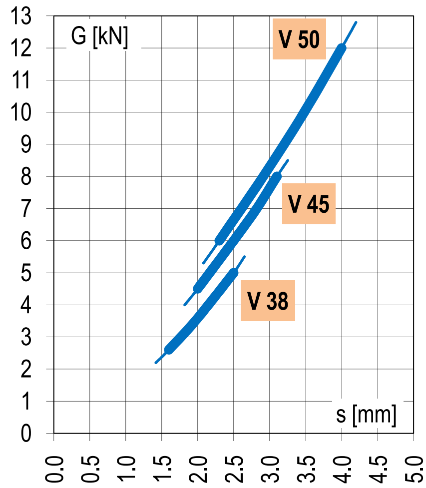


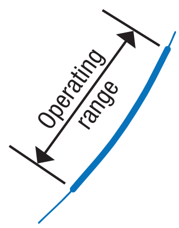
7

V: Deflection curves and cold flow behaviour

These deflection values are based on our catalogue data and are to be taken as guidelines.
Please also refer to our tolerance data in chapter 7 «Technology – ROSTA Basics».



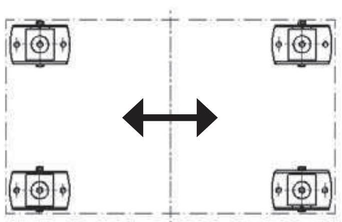




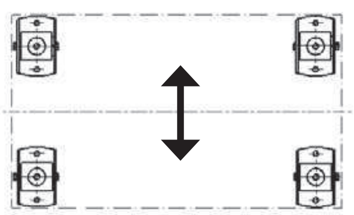
V: Installation guidelines

The V elements installed in the same direction hold load to G_{max} in X- and Z-direction.

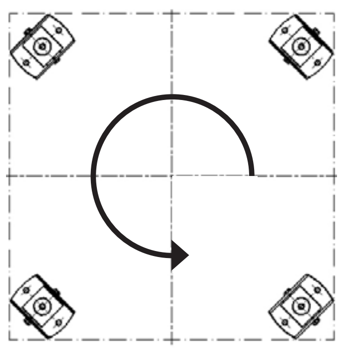
Dynamic forces longitudinal



Dynamic forces lateral



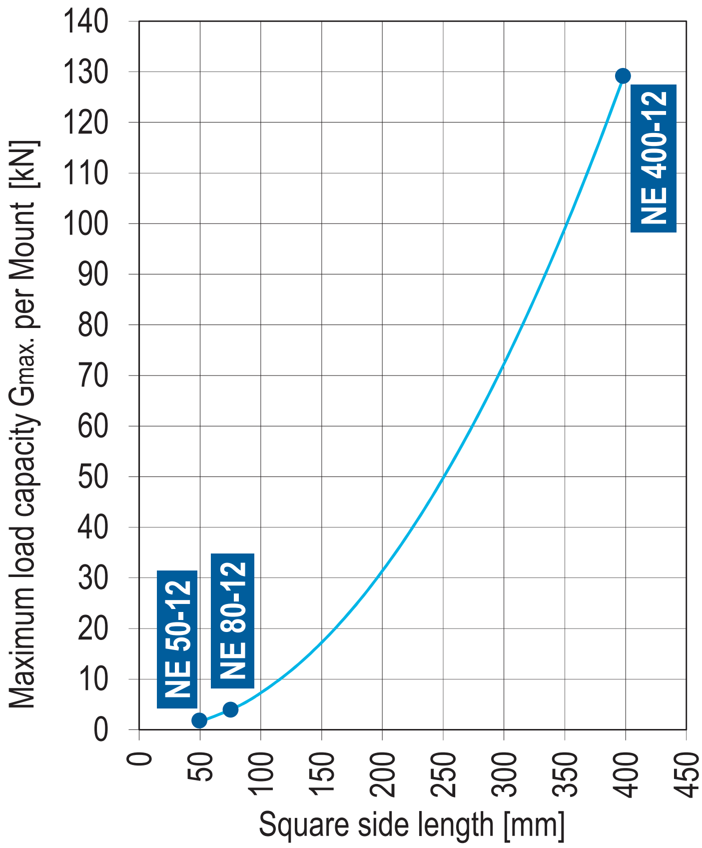
45° diagonal configuration by rotary motions. Reduced load capacities.



7

NE: Maximum load and options

Maximum load sizes NE 50-12 to 400-12:

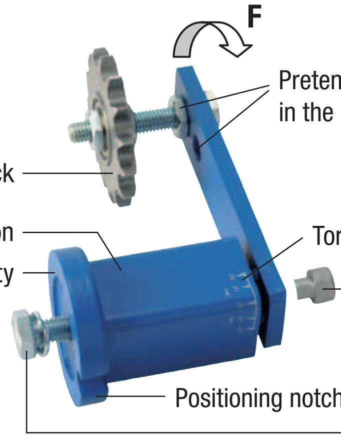


Options on request:
– Adhesive layer
– Different length and width, maximum dimensions are 1.5 × 5 m.
– Material thickness of 8, 12.5 and 25 mm; multiple thickness 37.5 and 50 mm.

TENSIONER DEVICES

Tensioner devices

Tensioner device



Tensioning force F

Tensioning forces for lever position «normal» for SE / SE-G / SE-R / SE-R / SE-I

Size SE	Pre-tension ∢ 10°		Pre-tension ∢ 20°		Pre-tension ∢ 30°	
	F [N]	s [mm]	F [N]	s [mm]	F [N]	s [mm]
11	18	14	48	27	96	40
15	25	17	65	34	135	50
18	75	17	185	34	350	50
27	150	23	380	44	810	65
38	280	30	720	60	1500	88
45	520	39	1350	77	2650	113
50	740	43	2150	86	4200	125

The tensioning force can be continuously adjusted. The max. pre-tensioning angle is 30° out of neutral position.

When fixing the sprockets, riders and rollers in arm-position «hard», tensioning force will increase on about 25 %.

SE-W: 40 % lower tensioning force than standard versions (Rubmix 40). SE-FE: see SE-FE in chapter 5.

Tightening torque M_A

	Quality 8.8	Quality 12.9 for SE-F / SE-FE
M6	10 Nm	17 Nm
M8	25 Nm	41 Nm
M10	49 Nm	83 Nm
M12	86 Nm	145 Nm
M16	210 Nm	355 Nm
M20	410 Nm	690 Nm
M24	750 Nm	

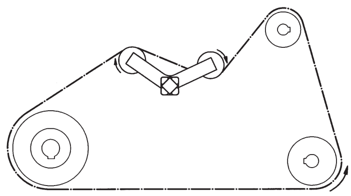
Table mentioning the tightening torque for the central screw (included in scope of delivery).

Tensioner devices

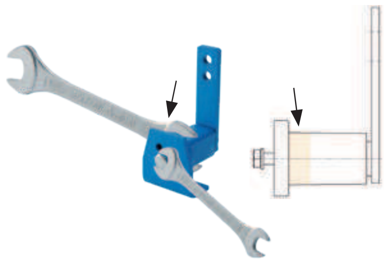
Installation guidelines

«Z» layout
If chain tensioning wheels/chain sliders or tension rollers are mounted on the outer lever side, the distance «Z» should be as low as possible. The maximum pre-tensioning force F should not exceed 50 % (~ 20° pre-tensioning).

Use of SE-B Boomerang® tensioners
In very long chain and belt drives it was recommendable to install on the slack-side several tensioners, in order to compensate occurring elongation. The «Boomerang» with its bent double-arm equipped with two chain sprockets or a combination of grooved pulley and flat-roller (belt-drives) offers a triple-compensation of chain and belt elongations, due to S-shape contact-arc.



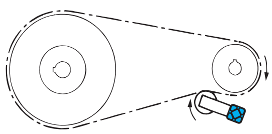
Assembly
The central screw is tightened slightly. The tensioner housing is set with a wrench and tightened in the desired direction. Then tighten the screw with the appropriate M_A tightening torque. Position the wrench near the flange bottom.



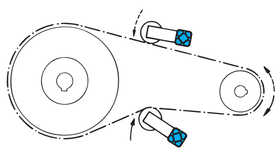
Chain or belt drives
Further assembly instructions specific for chain or belt drives on the following pages.

Installation guidelines for chain drives

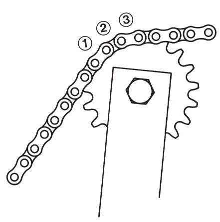
Standard positioning
The ROSTA tensioning device should be placed on the slack-side of the chain drive, close by the smaller sprocket wheel in order to enlarge its contact-arc, therefore contact application from outer side of drive. In mounted position the tensioner-arm should stay close to parallel to the chain run, in drain direction. By extremely long chain drives it is recommendable to install several tensioners or the type «Boomerang®» in order to enlarge the slack compensation.



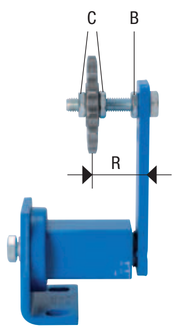
Reversible chain drive
On reversing chain drives, we recommend installing two chain tensioners, one per chain strand. Due to the constantly alternating slackening, depending on the direction of travel of the drive, both tensioners should only be pre-tensioned to a maximum of 20° to retain a free return angle of 10° when changing from the «slack section» to the «working section».



Sprocket teeth engaged
When tightening for the first time, at least 3 teeth of the sprocket must be engaged with the chain. The free length of the chain between tensioning wheel and the next sprocket should be at least 4 sections.



Chain track
The tensioner sprocket and the chain sliders should be positioned on the track between 2 nuts «C». The chain track can be precisely set by adjusting the setting range R. The lock nut «B» is always tight.

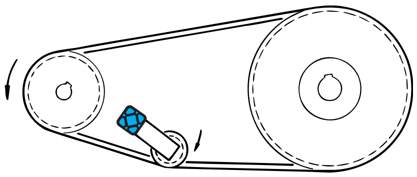


7

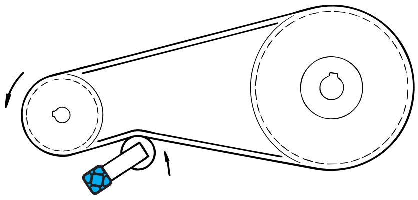
Tensioner devices

Installation guidelines for belt drives

1. Layout in belt drives



Tensioning from inside the belt drive with a V-belt pulley
- When installing in the slack section, both belt pulleys must have sufficient wrap angles (driver and driven).
- For vibration-intensive drives with very long centre distances, it is recommended use deep-grooved pulleys.



Tensioning with flat roller on the back of the belt
- Roll diameter should be at least ⅔ of the diameter of the smallest pulley.
- Roll width approx. 20 % bigger than the overall width of the belt unit.
- When installing in the slack section, both belt pulleys must have sufficient wrap angles (driver and driven).

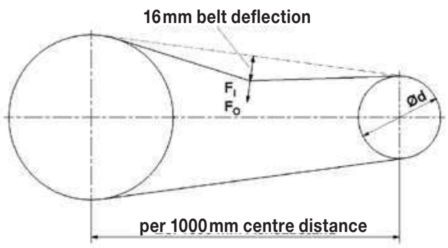
2. Selection of the ROSTA tensioner device

Reference value table for the most commonly used V-belt types

V-belt type	Width [mm]	Height [mm]	Diam. of smaller pulley [mm]	Initial operation test-force F_I** [N]	Operational test-force F_0** [N]	Size SE* (without SE-W, SE-B and SE-FE) 1 belt	2 belts	3 belts	4 belts	5 belts
XPZ, SPZ	10	8	56–71	20	16	11	18	18	18	18
			75–90	22	18	11	18	18	18	27
			95–125	25	20	15	18	18	18	27
			≥125	28	22	15	18	18	27	27
XPA, SPA	13	10	80–100	28	22	15	18	18	27	27
			106–140	38	30	15	18	27	27	27
			150–200	45	36	18	18	27	27	27
			≥200	50	40	18	18	27	27	38
XPB, SPB	16	13	112–160	50	40	18	18	27	27	38
			170–224	62	50	18	27	27	38	38
			236–355	77	62	18	27	38	38	38
			≥355	81	65	18	27	38	38	38
XPC, SPC	22	18	224–250	87	70	18	27	38	38	38
			265–355	115	92	27	38	38	45	45
			≥375	144	115	27	38	38	45	45
Z	10	6	56–100	5–7.5		11	11	11	15	15
A	13	8	80–140	10–15		11	15	18	18	18
B	17	10	125–200	20–30		15	18	18	27	27
C	22	12	200–400	40–60		18	27	27	38	38
D	32	19	355–600	70–105		18	27	38	38	45

* General basic selection criteria:
- F Resulting tensioning force by a pre-tension angle of 20° (see tensioning force F)
- F_I Initial operation test-force according guidelines of the belt manufacturer
- z Quantity of belts in drive
- 2 Multiplier for the compensation of belt-slippage and/or of centrifugal force generated on belt strands.

$$F = F_I \cdot z \cdot 2$$



** required test-force for belt deflection of 16 mm per 1000 mm of centre distance. The relevant deflection by shorter or longer centre distance has to be interpolated accordingly.

7

MOTORBASES

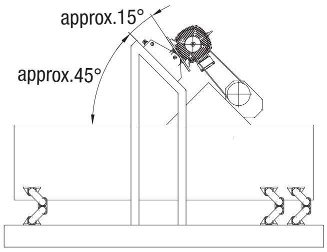
Motorbases

Usual positioning of the ROSTA motorbases

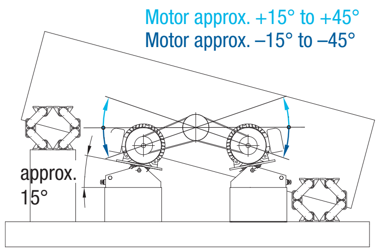
These recommendations are based on practical experience, a test run will show the ideal adjustment.

Vibrating screen applications

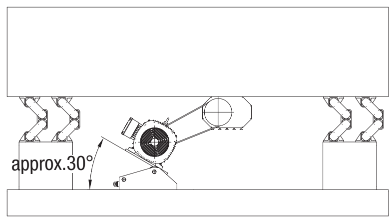
«Overhead» configuration



«Alongside» configuration

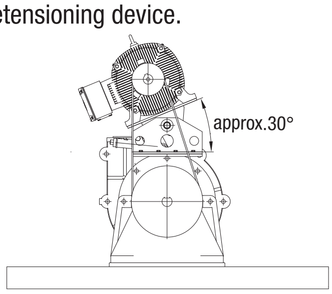


«Underneath» drive, feeder
Increased offset and larger motobase recommended.

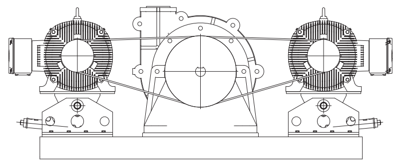


Pump applications

«Overhead» configuration
Motor plate «off-set», towards the pretensioning device.

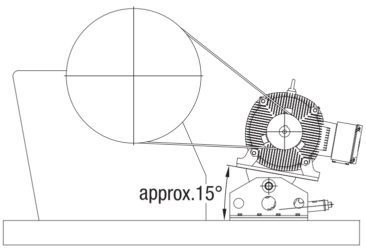


«Alongside» configuration

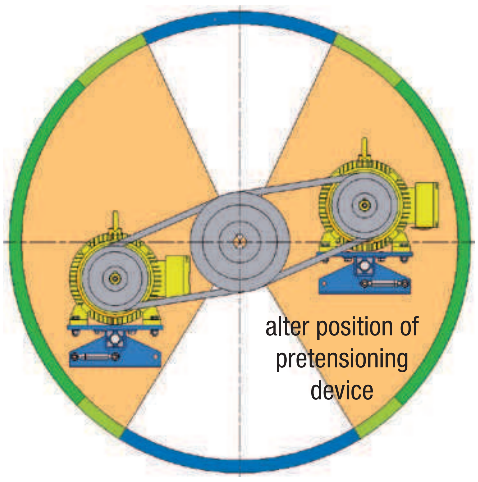


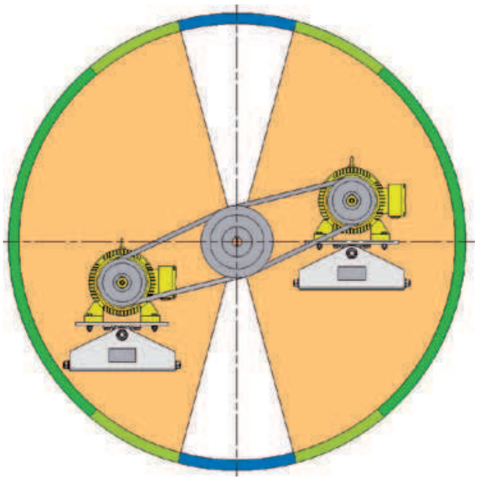
Crusher applications

Variable loads
Motor plate offset, in the direction of the pre-tensioning unit.



Range of application MB 27 and MB 38





Longest tensioning path, ideal positioning range of the MB

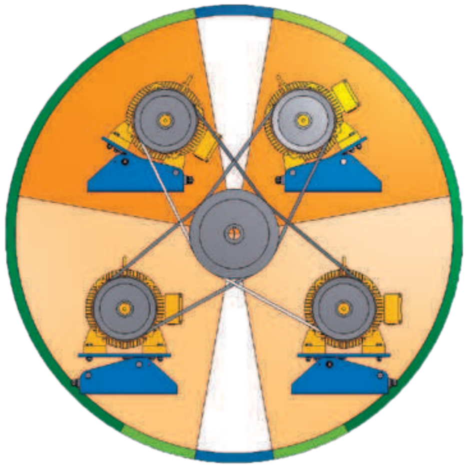
Possible positioning range of the MB

Contact ROSTA

7

Motorbases

Range of application MB 50



Top drive area:
Motor plate is tilted 30°

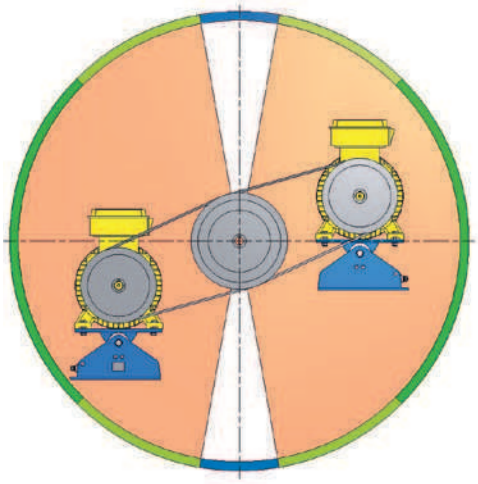
Drive area below:
Motor plate is horizontal

Longest tensioning path, ideal positioning range of the MB

Possible positioning range of the MB

Contact ROSTA

Range of application MB 70

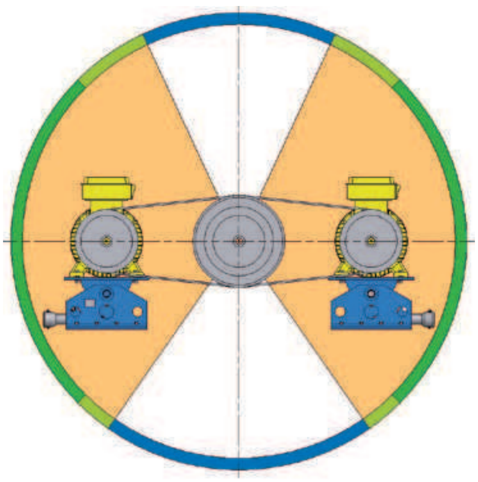


Longest tensioning path, ideal positioning range of the MB

Possible positioning range of the MB

Contact ROSTA

Range of application MB 100

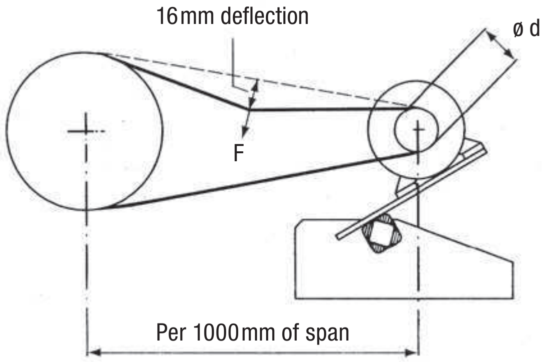


Longest tensioning path, ideal positioning range of the MB

Possible positioning range of the MB

Contact ROSTA

Test forces for belt tensioning



The ROSTA motorbase MB can be precisely pre-tensioned by means of the mechanical pretensioner in accordance with the test force prescribed by the belt manufacturer. The standard values of the test forces for the most common V-belt profiles are listed in the table. This simplified way to determine the pre-tension is sufficient in most applications.

Exception

In the case of vibrating screens, only tighten the belts so far as to guarantee they won't slip at the start and when they are running.

Standard values for the most common types of V-belts

V-belt type	Width [mm]	Height [mm]	**Diameter d of smaller pulley [mm]**	Initial operation test-force F_I* [N]	Operational test-force F_0* [N]
XPZ, SPZ	10	8	**56–71**	20	16
			75–90	22	18
			95–125	25	20
			≥125	28	22
XPA, SPA	13	10	**80–100**	28	22
			106–140	38	30
			150–200	45	36
			≥200	50	40
XPB, SPB	16	13	**112–160**	50	40
			170–224	62	50
			236–355	77	62
			≥355	81	65
XPC, SPC	22	18	**224–250**	87	70
			265–355	115	92
			≥375	144	115
Z	10	6	**56–100**	5–7.5	
A	13	8	**80–140**	10–15	
B	17	10	**125–200**	20–30	
C	22	12	**200–400**	40–60	
D	32	19	**355–600**	70–105	

* Test force for penetration depth of 16 mm per 1000 mm of centre distance.
(Derive the necessary penetration depth at intermediate lengths proportional to 16 mm / m.)

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Vårt sortiment

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