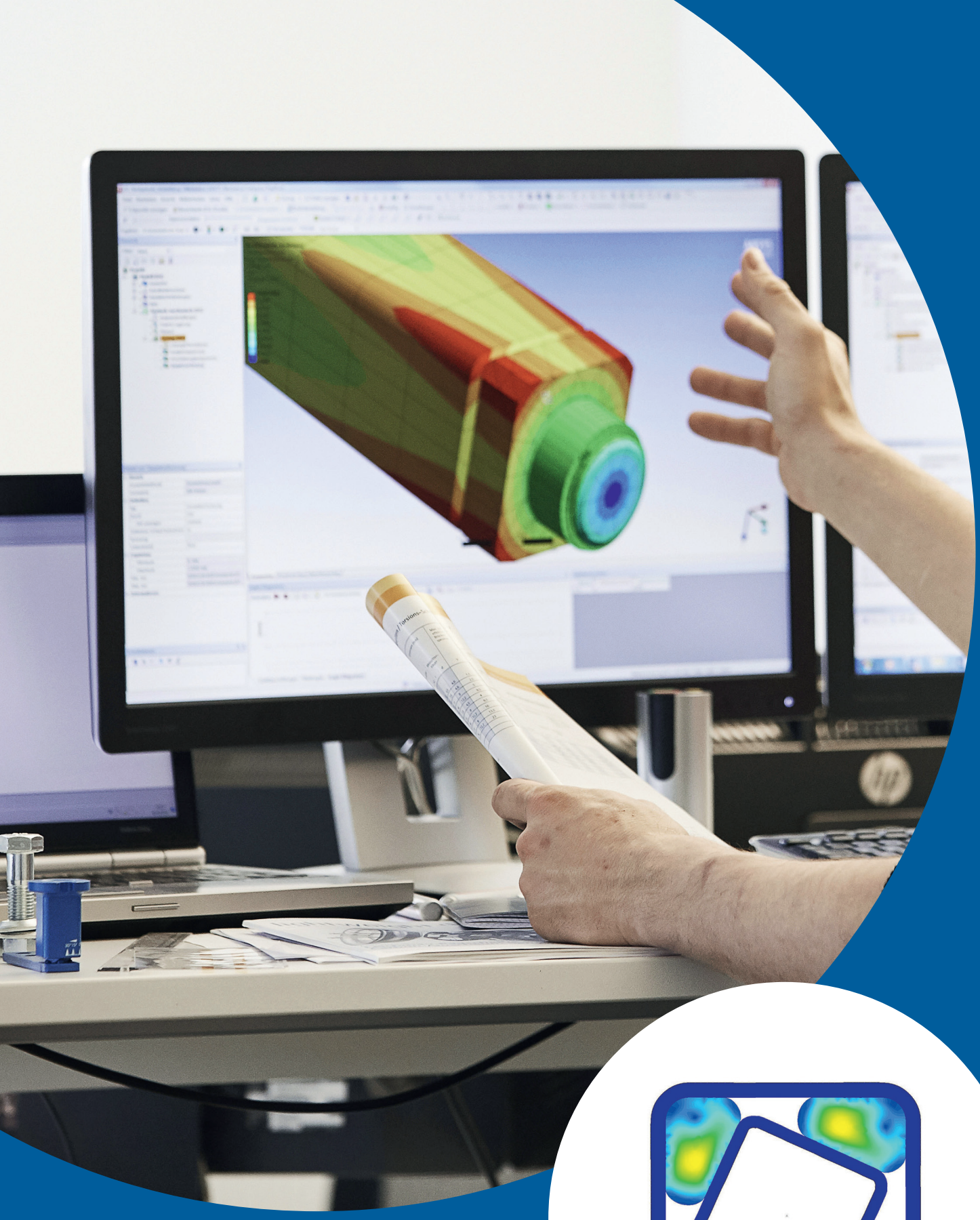

TECHNOLOGY

A unique spring system from experienced specialists

We at ROSTA have experienced the needs and solved the problems of our customers for more than 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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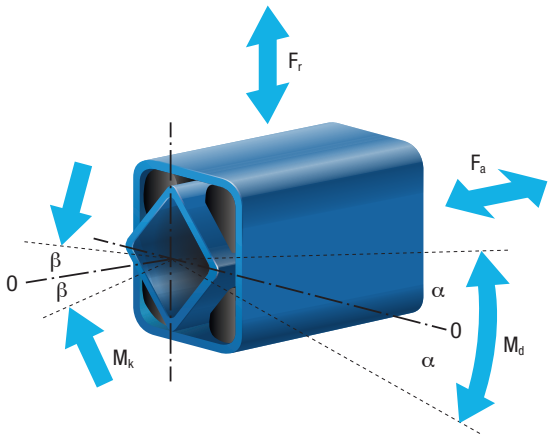
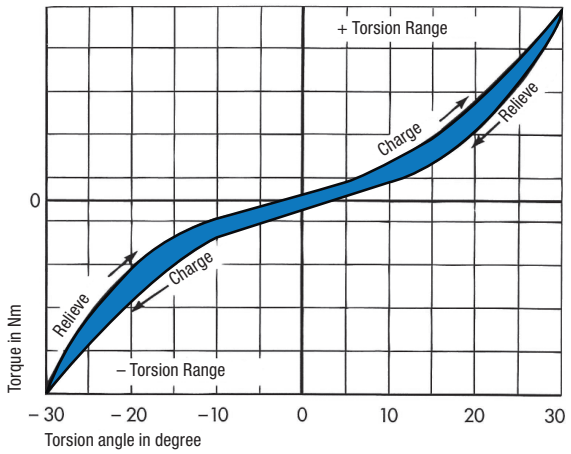
Function



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.

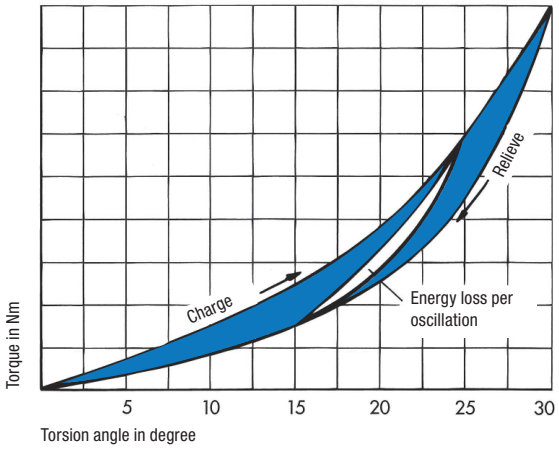
Spring characteristic

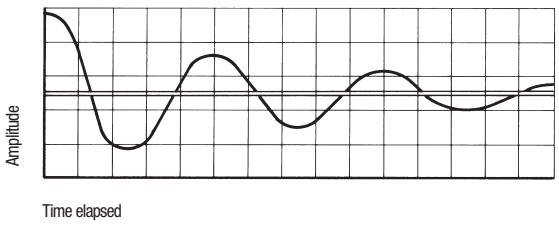


Due to the specific construction characteristics of the ROSTA rubber suspension element, pivoting the device ± results in a slightly progressive spring characteristic. The torsion angle is limited to ± 30 for most elements.

ROSTA Basics

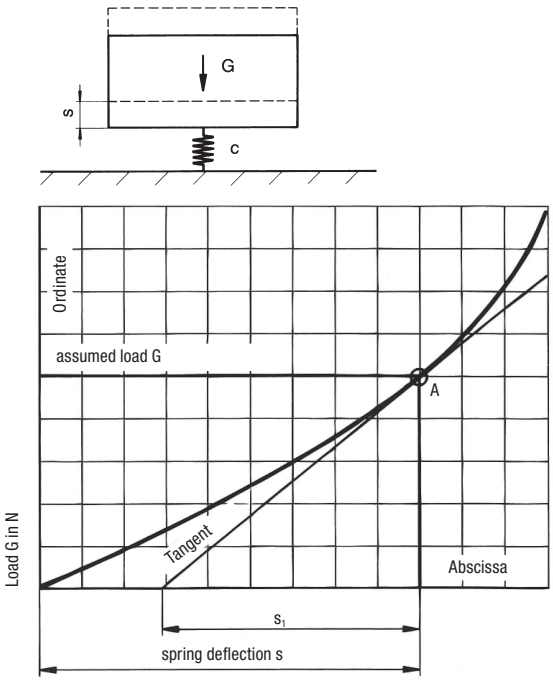
Damping





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



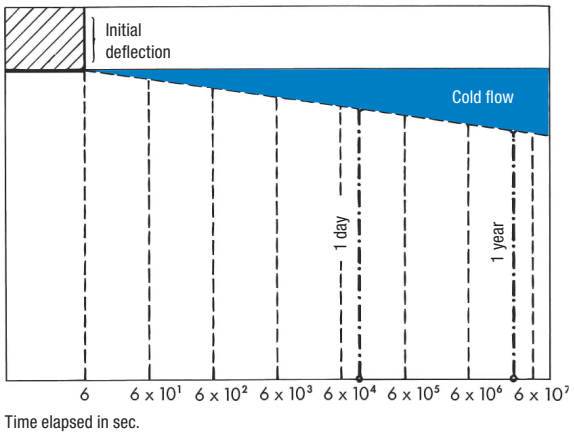
The determination of the natural frequency of a ROSTA suspension has to be carried out by spreading the tangent at the loading point «A» on the parabolic arc of the load deflection curve. The resulting distance s_1 on the axis of abscissa comes up to the arithmetical spring deflection in mm, required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

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

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

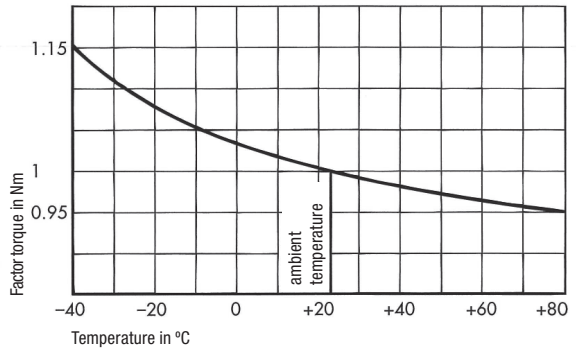
ROSTA Basics

Cold flow and settling of the rubber suspensions



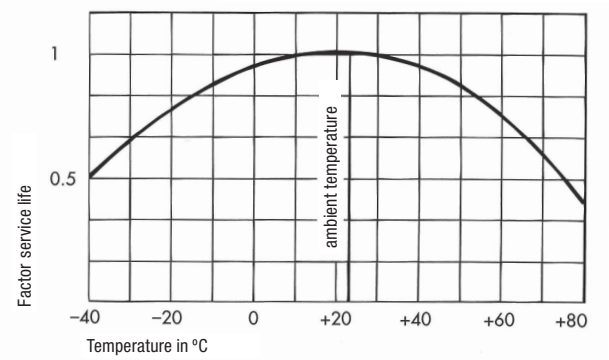
All elastic materials show more or less permanent measurable deformation over time when subjected to a load. This is noticeable in a relatively small additional deflection, the cold flow. This cold flow runs over a linear logarithmic time scale. The illustration shows that after being under a load for 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



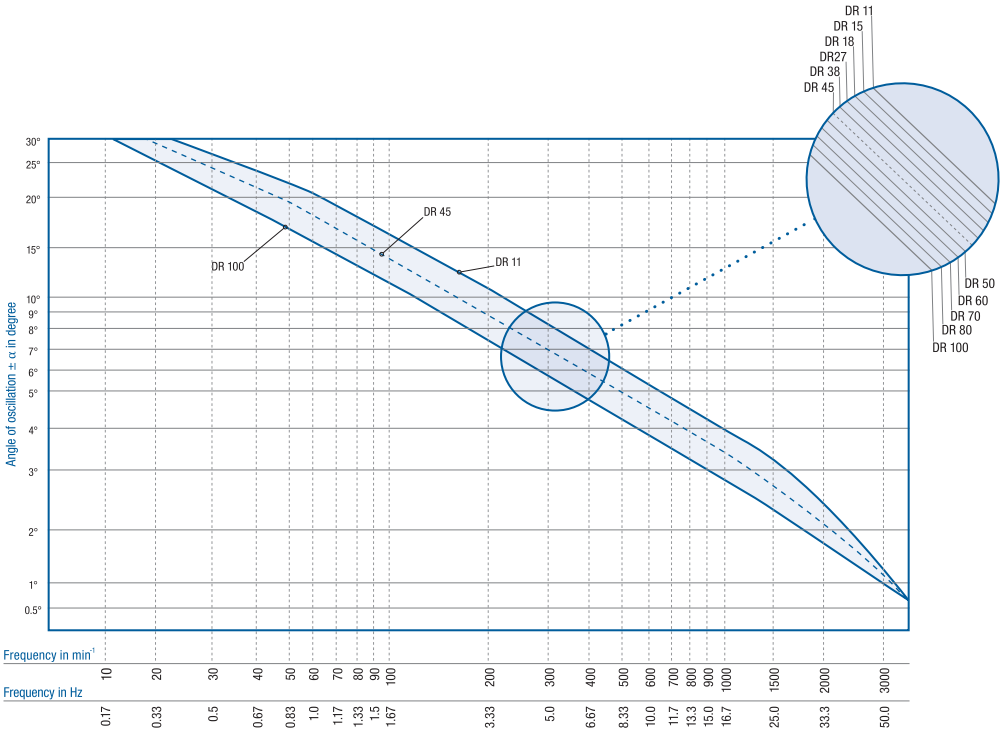
Provided the rubber suspension elements are selected according to the technical specifications, i. e. are operating within the given frequencies and oscillation angles and under the mentioned surrounding conditions, no loss of performance and functionality can be expected for many years. Extremely low 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.

ROSTA Basics

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 or R20
Rubmix 40	approx. 0.6	–35° to +120°C	EPDM-Silicone	– High temperature resistance – Elements marked with red dot or R40
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 or R50

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