



Technology



ROSTA Rubber Suspension System

ROSTA multi-purpose rubber suspension elements are designed for ultimate versatility – to push, pull, or tension. These torsional elements combine the function of a spring, damper and bearing in one unit. The combination of four special pretensioned rubber inserts, the core and the surrounding housing form an integral spring device – no additional axial retention components are necessary. They can be used for angles of oscillation of up to $\pm 30^\circ$, the acceptable frequency can be increased by reducing the angle of operation below 30° . The dampening effect of the spring, caused by molecular friction within the rubber inserts, lies in the ideal range of approx. 20% of the impact or input vibration. Since ROSTA elements employ no metal contact, operation is completely silent and maintenance-free. These highly wear resistant and clean machine components offer

optimum noise absorption and an efficient vibration reduction (hysteresis) in all kinds of industrial installations and machines. The ROSTA elements are unaffected by mud, dirt, water, salt, sunlight and can withstand temperatures from -40°C to $+80^\circ\text{C}$ (-40°F to $+180^\circ\text{F}$). A specially developed heat resistant elastomeric compound has been developed that will allow these elements to be used in applications up to 120°C (250°F), and another synthetic insert has been developed for use in applications with constant contact with mineral oil products. (These products are available by special request.) Due to its unique rubber in compression design, neither shear nor bending stresses occur in the elastomeric inserts; therefore the operating life of the ROSTA elements is far longer than comparable vulcanized rubber elements.

ROSTA AG is a company certified in accordance with the standard ISO 9001 since December 1992.



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ROSTA Rubber Suspension Units – Ideal «Modules» for Modern Machine Construction

By virtue of its standardized modular construction the multi-purpose ROSTA rubber suspension unit system can be employed in practically all spheres of modern machine construction as elastic torsion springs, pivot bearings and oscillation dampers. Thanks to the different profile versions of the inner and outer squares also fixing brackets and mountings, connection possibilities to customer-side constructions are almost unlimited. Different material qualities (steel and light metal profiles, also cast models) for inner and outer squares are available depending on the size of the unit and the specific application.

The **vibration-bonded** ROSTA rubber suspension units of standard quality ("Rubmix 10") are fitted with elastomeric elements on a natural rubber base. The specific quality was developed especially for the characteristic rotary-rocking movement of the units. It is characterized by an ideal combination of high rebound resilience, low permanent deformation, high notch toughness and good natural damping. Pure synthetic elastomers ("Rubmix 20" and "Rubmix 40", see supplementary information on page 11) are available for applications in media which are unsuitable for natural rubber. Installations of these however produces slightly different characteristics and torque values as compared with the standard elements with the elastomeric quality "Rubmix 10" described below.

As the illustration shows, the ROSTA rubber suspension element combines the function of a **spring**, a **damper** and a **bearing**.

"Spring Function"

Employed over the range of $\pm 30^\circ$, the unit shows a slightly progressive curve. Depending on the particular unit length, the resulting torque increases or decreases in a linear fashion. According to application, the rubber suspension

element can also be installed in the pretensioned state; i.e. it then operates for example over the torsion angle range of $+10^\circ$ to $+30^\circ$. Advantages compared with all kinds of steel springs are: high natural damping, shock load capabilities, oscillation and vibration damping, largely resistant to corrosion and with long service lives.

"Damping Function"

The molecular friction (hysteresis) in the elastomeric elements leads to a partial absorption of the applied dynamic forces. Additionally, the bonded rubber bearing almost totally cuts out solid-borne noise. These properties favour the use of the rubber suspension unit as a impact stop, oscillation damper or pivot bearing with high natural damping. The benefits in comparison with conventional damping units are the very compact dimensions, multi-purpose facility and the low cost of the ROSTA rubber suspension unit.

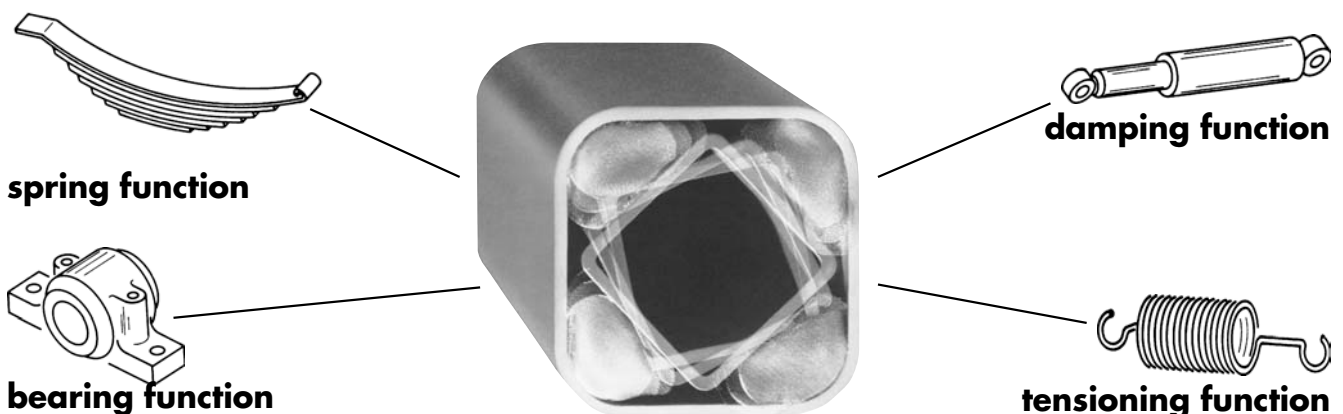
"Bearing Function"

As a maintenance-free pivot bearing for alternating oscillating or vibrating movement sequences the ROSTA rubber suspension unit is an ideal alternative to ball-, needle- or sleeve-bearings which are subject to high wear with alternating oscillations, due to insufficient lubrication.

The ROSTA rubber suspension unit is **optimally** and **cost-effectively** employed when it performs two to three of the above main functions, avoiding the installation of additional components.

The following pages of this catalogue contain detailed information on possible applications, installation proposals, combinations, and technical data of the ROSTA "modules". For further information, contact us or one of our agents. Our technical service will be pleased to assist you.

Superior Technology

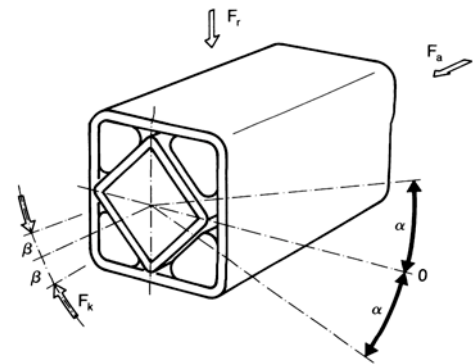




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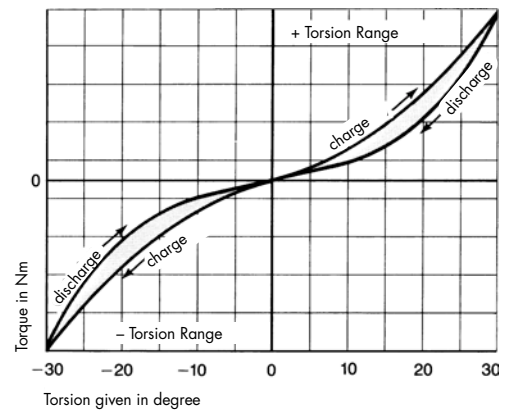
Function

The ROSTA rubber suspension units are mainly designed for applications as torsional springs. Depending on the particular function, not only torsional forces are applied to the spring device. Usually, additional radial F_r , axial F_a and/or cardanic F_c forces have to be taken into consideration. The torques are given on pages 17 to 24 and the permissible radial, axial, and cardanic capacities on page 25.



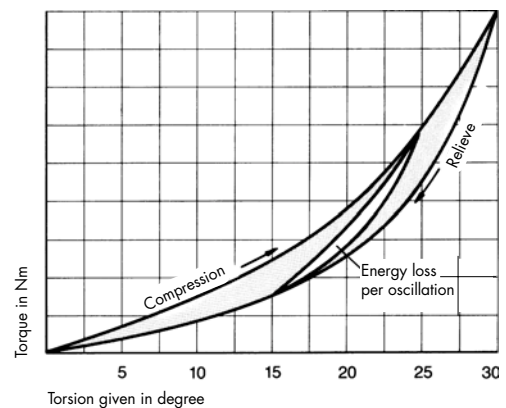
Spring Characteristic

Corresponding to the unique system of the ROSTA rubber suspension units an analogous and slightly progressive spring characteristic may be achieved, when load is applied in the full torsion range of $\pm 30^\circ$. If linear or decreased spring characteristic is required, the design of the lever ratio has to be altered and/or a curved-shape guidance has to be installed. Please note, elastomerics are incompressible, i.e. of constant volume.



Damping Factor

The zone between the compression- and the relieve-curve represents the loss of energy. The grade of the achieved damping effect depends on the temperature, acceleration, and the angle of oscillation. The damping rate of the ROSTA rubber suspension unit lies within the possible range of 15 to 20%. If the ROSTA rubber suspension unit is installed under a torsional pretension of e.g. 15° and the relevant tension goes up to 25° , the energy loss is much below as the opposite table shows.



Natural Frequency

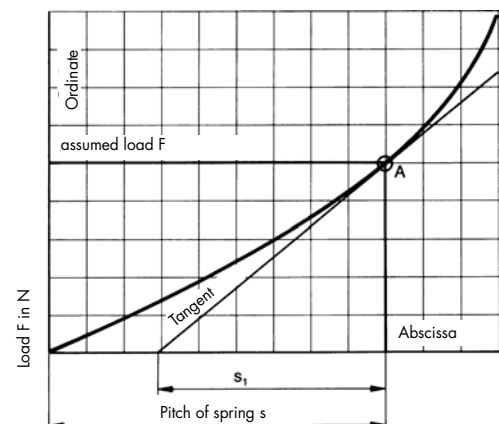
The vertical deflection under load is decisive to the resulting natural frequency of the suspension. Due to the parable form of the ROSTA spring characteristic a tangent has to be set at the assumed load F on the curve (A) in order to measure the deflection s_1 .

Calculation formula:

$$n_e = \frac{300}{\sqrt{s_1}} \approx \text{min}^{-1}$$

Example: $s_1 = 5 \text{ cm}$:

$$n_e = \frac{300}{\sqrt{5.0}} \approx 134 \text{ min}^{-1}, \text{ or } 2.2 \text{ Hz}$$



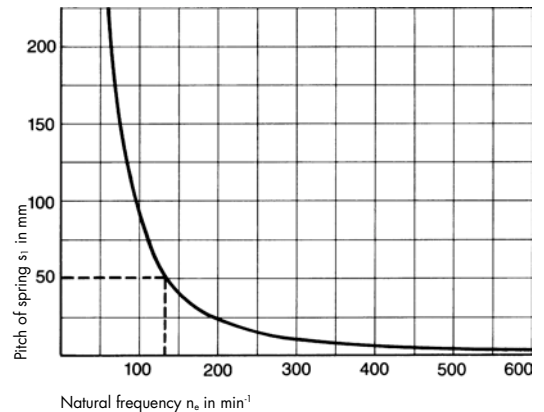


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Natural Frequency in Relation to the Deflection under Load

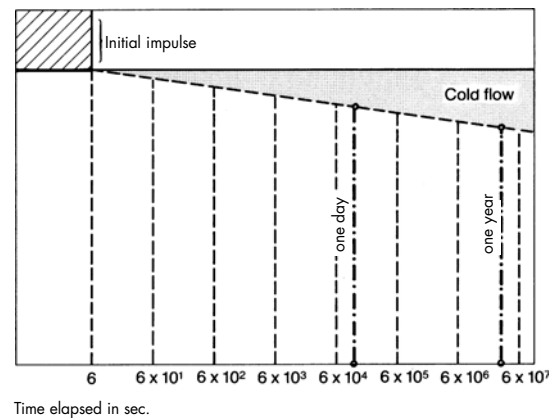
This table shows clearly the relation between deflection s_1 to natural frequency n_0 in min^{-1} .

Examples of frequencies:	1 mm $\hat{=}$	960 min^{-1} / 16 Hz
	10 mm $\hat{=}$	300 min^{-1} / 5 Hz
	50 mm $\hat{=}$	134 min^{-1} / 2.2 Hz
	100 mm $\hat{=}$	96 min^{-1} / 1.6 Hz



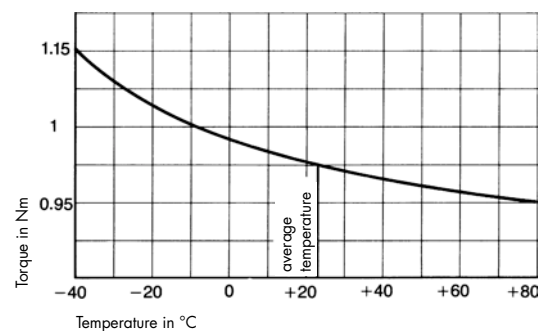
Cold Flow and Setting

If load is permanently applied over a certain period of time to elastic materials (e.g. rubber suspensions), deformation occurs (cold flow). Cold flow appears during a linear logarithmic sequence. According to the respective diagram more than **50%** of the permanent deformation has been compensated **after only one day of service**. The empirical setting factor of the ROSTA rubber suspension units lies within 3° to 5° , i.e. the inner core does not move back to the neutral 0-position. This fact has to be taken into consideration when designing!



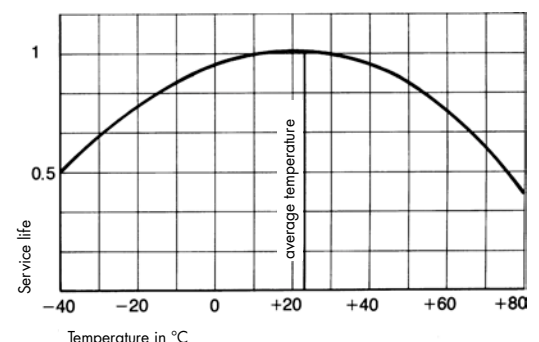
Temperature Influence

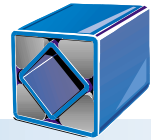
The ROSTA rubber suspension units of standard quality "Rubmix 10" are designed to be applied in temperatures of -40°C to $+80^\circ\text{C}$ (-40°F to $+180^\circ\text{F}$). With rising temperature the mechanical stiffness of the rubber and consequently the torque decrease within acceptable tolerances. The same effect occurs to the damping factor, i.e. the hysteresis decreases, too. Under low temperature conditions (minus temperatures) the resulting torque and the corresponding hysteresis increase. Due to the molecular friction the rubber inserts warm up. Therefore the effective element temperature has not to correspond with the ambient temperature.



Service Life

When the suspension units are selected properly, i.e. operating within the given specifications and average surrounding factors, no loss of performance and functionality may be expected for many years. Extremely low or high **permanent** temperatures influence the life time of the rubber suspension considerably. The opposite service life curve shows the deduction of the life expectation to factor 1 at extreme \pm -temperatures.

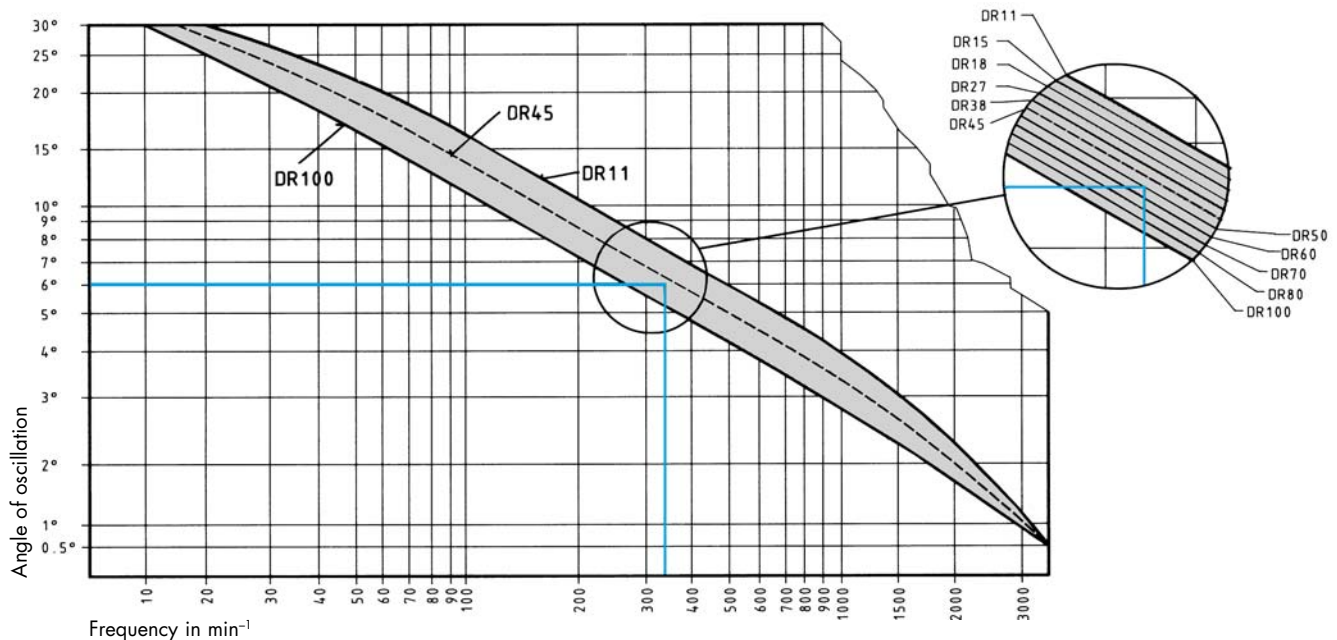




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Permissible Frequencies

Selection table for the determination of the max. permissible frequencies depending on the element size (type DR 11, 15, 18, etc.) and angle of oscillation. The higher the frequency in rpm⁻¹, the lower the angle of oscillation has to be and vice versa.



Example: A rubber suspension unit type DR 50 (no matter what length) can be submitted to an angle of oscillation of $\pm 6^\circ$ (from neutral position) at a max. frequency of 340 rpm⁻¹. For applications with pretensioned element position (e.g. oscillating from $+12^\circ$ to $+24^\circ$) check-back with ROSTA is required.

Chemical Resistance

The ROSTA rubber suspension units are equipped with elastomeric inserts with a natural rubber base (standard quality "Rubmix 10"). The ROSTA technology represents a high rubber standard supported by decades of experience and empirical know-how. The resistance to most chemical agents is good. For particular applications, however, the units need additional protection or synthetic rubber (quality

"Rubmix 20" or "Rubmix 40") must be ordered. Please note, the technical characteristic alters compared with the standard quality.

The following table is merely a guideline; of importance is always the degree of concentration of the chemical solvent. Therefore, we suggest to make practice oriented tests or ask our technical service.

Rubmix	10	20	40	Rubmix	10	20	40
- Acetic acid up to 25%	o	+	++	- Lubrication oil	oo	o	o o
- Acetone	+	+	+	- Milk	+	o	+
- Alcohol	++	++	++	- Nitric acid up to 10%	o	o	++
- Ammonia	+	+	++	- Petroleum	oo	oo	+
- Benzole	oo	oo	o o	- Phosphoric acid up to 85%	++	++	++
- Citric acid	++	++	++	- Seawater	+	+	+
- Formic acid	++	++	++	- Soda lye up to 25% (20°)	++	++	++
- Fruit juice	++	++	++	- Soda lye up to 85%	+	+	+
- Fuel oil (Diesel)	oo	+	o o	- Sugar molasse	++	++	++
- Gasoline	oo	o	o o	- Sulphuric acid up to 10%	++	++	++
- Glycerine	++	++	++	- Tannic acid	++	+	+
- Hydraulic oil	oo	+	o o	- Tartaric acid	++	++	+
- Hydrochloric acid up to 15%	++	o	++	- Toluene	oo	oo	o o
- Hydrogen sulphide	oo	o	+	- Varnish solvent	oo	oo	o o
- Javel water	+	oo	+	- Water	++	++	++
- Lactic acid	++	++	++	- Wine	++	++	++

++ excellent + good o sufficient oo insufficient



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ROSTA Quality "Rubmix 10" = Standard Quality

This standard quality rubber, especially developed for ROSTA machine components is characterized by extremely high shape stability (memory) and even after years shows only slight aging phenomena (cold flow). The elastic inserts are designed for the typical rotary-rocking movements of the ROSTA rubber suspension units and are nearly wearfree. The basic material is natural rubber, stabilized by vulcanization and adapted to the mechanical stresses in the ROSTA element with chemical additives and heat treatment. The elements which are treated prior to the vibration-bonding of the rubber spring elements in a protective bath are conditionally oil-resistant, i.e. occasional contact with

materials containing mineral oil will not affect the service life. However, in the case of permanent contact with mineral oil, "Rubmix 20" quality with synthetic elements should be selected. The standard quality should be used over a temperature range from -40°C to $+80^{\circ}\text{C}$ (-40°F to $+180^{\circ}\text{F}$). (On account of the different, and in some cases considerably ascending setting curve of the two qualities, "Rubmix 20" and "Rubmix 40" should only be used in applications with **permanent oil contact or in the high temperature range.**) Otherwise the standard quality "Rubmix 10" will guarantee optimal function of the ROSTA rubber suspension unit.

Rubber Quality "Rubmix 20" = Oil-resistant

For the application of ROSTA rubber suspension units in permanent contact with media containing mineral oil, such as grease, all kinds of fuel, oil mist, thinner, etc. The elastic inserts are based on a synthetic CR rubber with good oil resistance. Mechanical characteristics are similar to those of natural rubber. As the torque and load values for this

version vary only slightly from those of the standard quality, they are not separately listed. The maximum permissible temperature range is between -30°C and $+90^{\circ}\text{C}$ (-22°F and $+194^{\circ}\text{F}$). These units are marked with a yellow dot.

Rubber Quality "Rubmix 40" = Heat-resistant

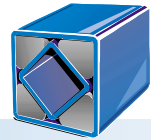
For use in ambient temperatures of between $+80^{\circ}\text{C}$ ($+180^{\circ}\text{F}$) to a maximum of $+120^{\circ}\text{C}$ ($+250^{\circ}\text{F}$), ROSTA rubber suspension units, tensioners and oscillation elements type AU, AS-P/C, AD-P/C and drive heads type ST in sizes DR 15, 18, 27, 38, 45 and 50 are available as special versions with heat-resistant elastomeric inserts "Rubmix 40". These units are for use in high temperature applications (rubber suspension elements in hot ambient, chain tensioners in driers and in the engine-/air conditioning sector, rocker arms for hot product shaker conveyors, etc.). Compared with standard quality the basic characteristic of

the heat-resistant ROSTA rubber suspension units is an approximately 40% reduced torque. The radial, axial and cardanic loading capacities of these units is also approximately 40% below the values mentioned on page 26. The natural damping and the cold flow/setting of the elastomeric elements in "Rubmix 40" are some 50% higher than with the standard quality. The consequently reduced permissible frequencies and dynamic spring values **should therefore be subject to special enquiries for the application in question.** These units are marked with a red dot.

Check and Tolerances

ROSTA AG is a company certified according to the standard ISO 9001. Accordingly all products are subject to periodic function and quality controls. Properties of the rubber elements monitored in particular in the inhouse physical laboratory are Shore hardness, compression set, friction, rebound resilience, tensile strength, elongations to

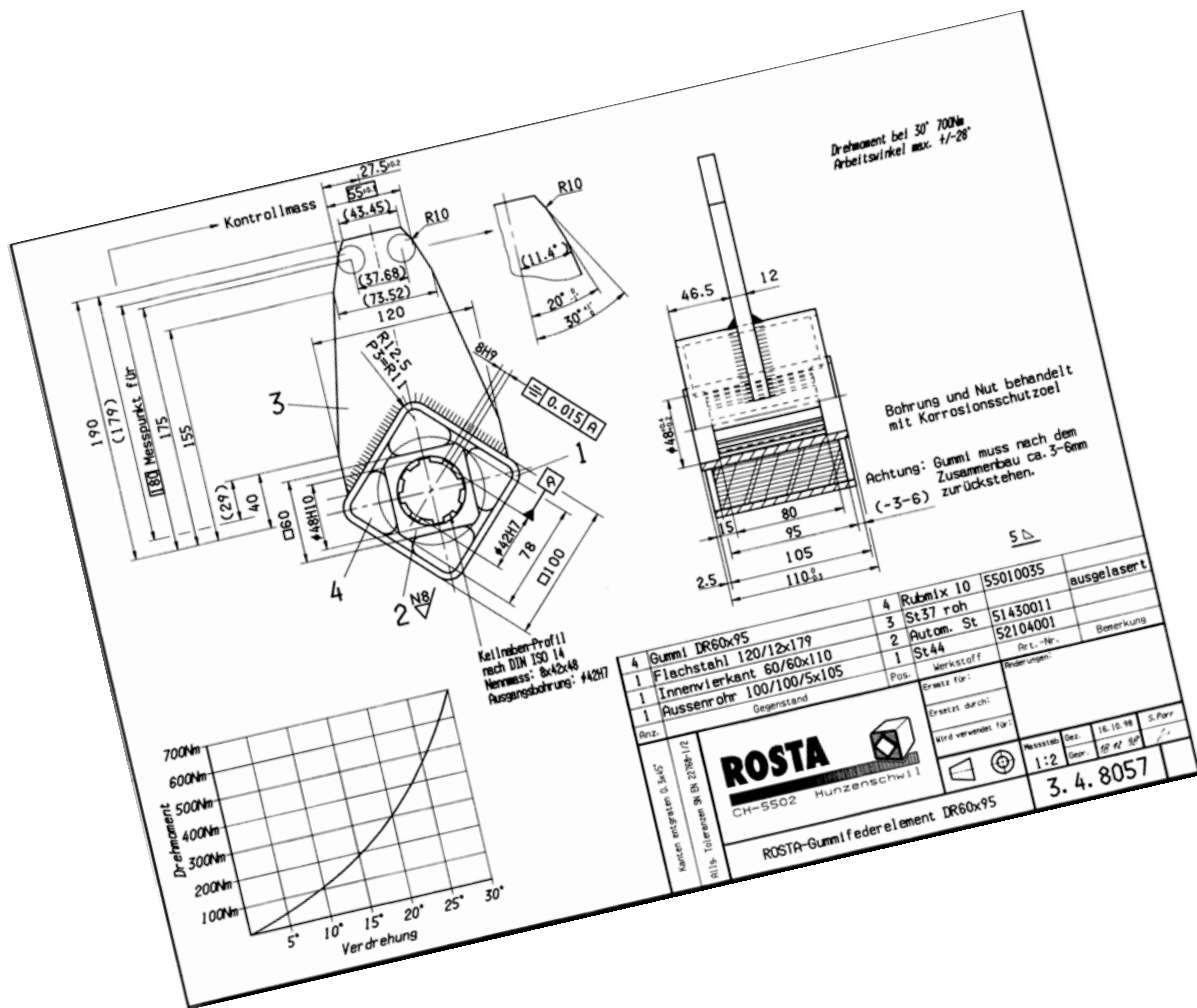
cold flow and aging. Dimensional tolerances of the rubber inserts are defined according to DIN 7715 and Shore hardness according to DIN 53505. The resulting spring values of the elements are normally within the tolerance range of $\pm 15\%$, **but are usually essentially tighter!**



Special Elements

In case our standard production program doesn't meet your requirements you don't have to try to square the circle. We develop and manufacture custom-made elements for you. These customised mountings perfectly fit your machines and installations. You will be given the exclusive rights on them to secure your spare parts sales. More than a third of the ROSTA machine components are customised elements. They may be welded, cast, sintered, laminated or made of plastic.

You can get a special surface protection or an individual varnish for your elements. Our modular system allows to adapt the sizes of the elements, their torque values and their spring effect to your individual requirements. The ROSTA special elements offer best adaptability and fast assembling. They allow you to control your spare parts business very easily. Your profit is our highest aim.



ROSTA Rubber Suspension Units in Special Steel

Most standardised ROSTA rubber suspension units are available in special steel from stock (material complying with ISO 1.4301/AISI 304 specifications). These are welded constructions slightly differing from the standard executions, not only in their size but also in their characteristics. Don't hesitate to ask for further information on our INOX elements. **We also manufacture units in stainless steel custom-made for you.**

