Technical information about the products from PAVO AG

All products, which are based on the PAVO-Rubber Suspension Unit, achieves the spring force by rubber bodies. The rubber is the key material for the function, and has specific properties such other materials used in suspension systems.
In this letter, we inform our customers about the characteristics, which are not described as performance data in the documents for the different product groups, but are quality-relevant characteristics for use.

Rubber compound

The PAVO AG equipped approximately 95% of the rubber suspension units with the standard rubber quality, which is based on a proportion of synthetic rubber and a proportion of natural rubber. This base rubber compound is optimized by fillers. Therewith the mechanical properties, the durability and the performance data are adjusting. The accurate formulation of the rubber mixture and the parameters in the production are protected and accessible only to us.

- High resistance to ageing and therefore constant performance data over the entire period of use.
- Good chemical resistance and low abrasion values
- Balance between damping and rebound resilience
- Low compression set (DVR) also at elevated temperature in the highest stress field of the rubber body
- Large field of application concerning temperature -55°C to + 85°C

Tolerances

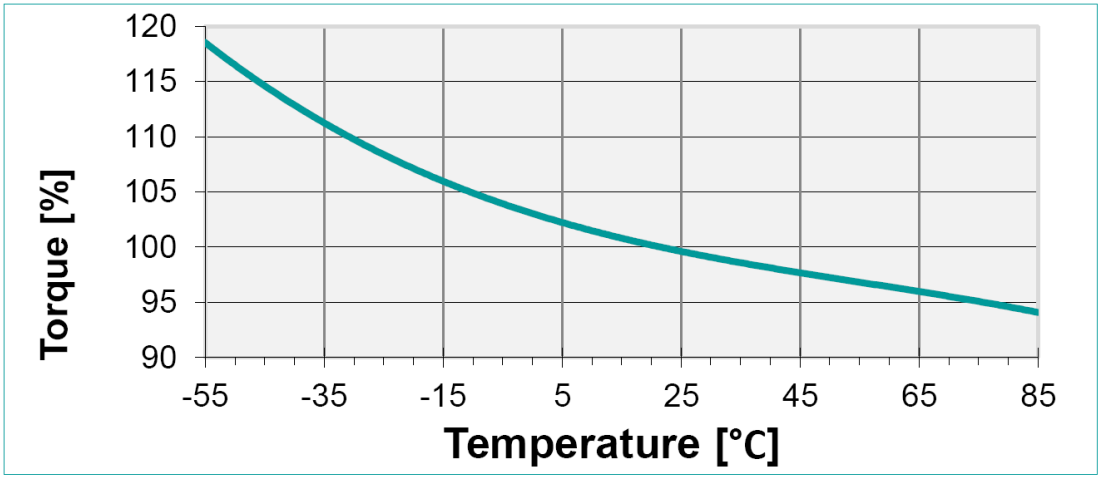
Trough the part of synthetic rubber is used constant raw materials for a good replication. In combination with natural rubber, which has high mechanical properties, the mixture is optimally for this application. So, the rubber profiles are exact in case of shape and technically have tight tolerances. Also, together with the assembled metal components its results low differences in the performance data.

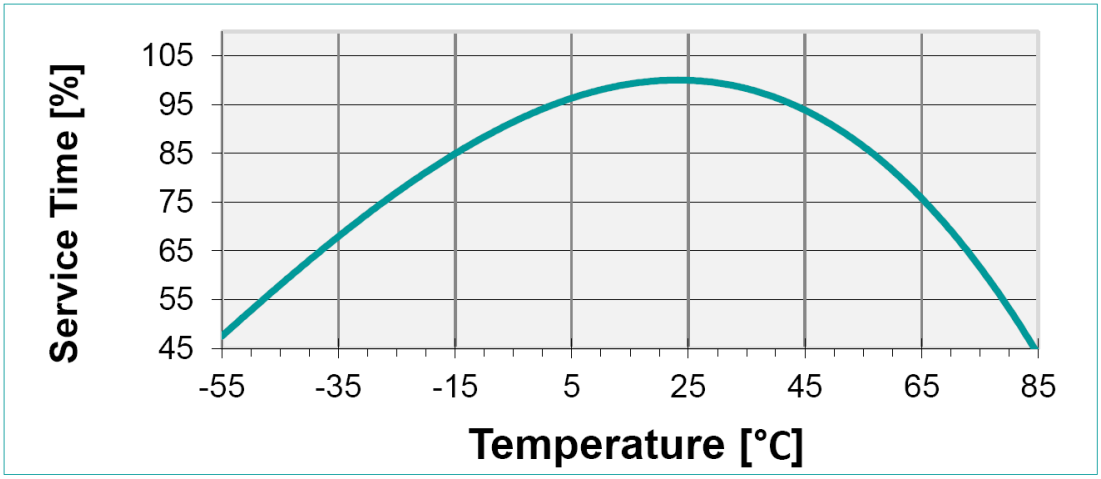
In manufacturing where not defined we meet the following tolerances:

- Tolerance for cutting or forming manufacturing	ISO 2768-mK
- Tolerance for welded constructions	EN ISO 13920-AE
- Tolerances for cast constructions	ISO 8062-3DCTG 7
- Electroplated	EN 12329-FE // Zn 15-20 // B
- Hot galvanizing (450°C)	ISO 1461-S235J / 50-150
- Phosphatising	DIN 12476-Fe // 2nph / g 2-5 IT4
- Painting (RAL 5020 + RAL 2011)	powder coating 80µ

Temperature

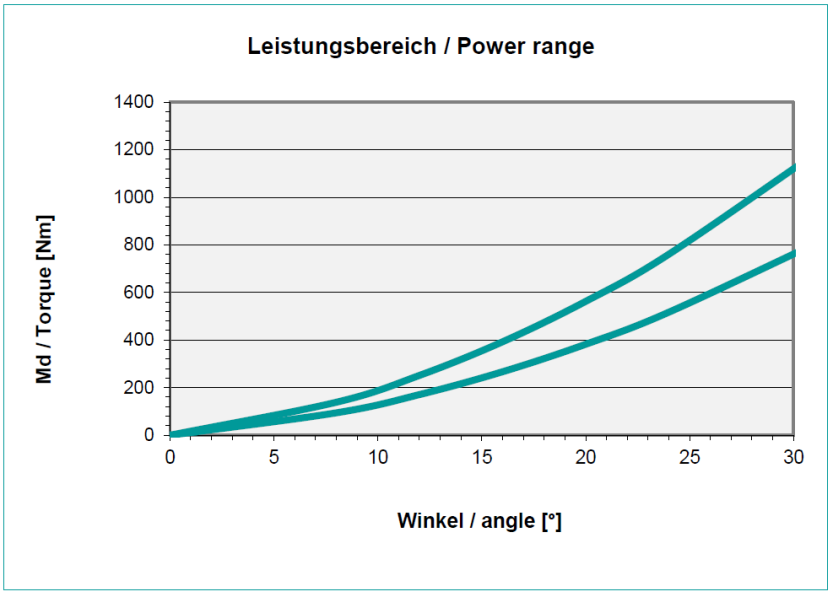
The PAVO-Rubber Suspension Units are suitable for use in a temperature range of -55°C to 85°C. The performance data and the service time vary in dependence with temperature. The performance data are lower by increasing temperature and are higher by decreasing temperature.





Dynamic stiffness

With higher excitation frequency, the rubber spring performance is significantly higher than in a steel spring and can reach at the maximum excitation frequency the 1.5 times of the value.



Chemical resistance

The following table shows the resistance of the most asked substance. Information to other substances or in another concentration you will get under info@pavo.ch

chemical resistance			
Acetone	B	Sea water / salt water	A
Alcohol	A	Lactic acid watery, cold	A
Formic acid	A	Sodium hydroxide solution 50%, 50°C	A
Ammonia liquid + gas (cold)	A	Nirto	D
Petrol	D	Olive oil (cold)	C
Benzene	D	Petroleum	D
Boric acid	A	Phosphoric acid 50%, 50°C	A
Chlorine	D	Radioactive radiation	C
Diesel oil	B	Salmoniak	A
Natural gas	B	Nitric acid 10%	D
Acetic acid 30%	B	Hydrochloric acid 20%, 50°C	B
Fat vegetable + animal	A	Lubricating oil	D
Fruit juices	A	Sulphuric acid 25%, 50°C	B
Glycerin	A	Tannins (tannic acid)	B
Hydraulic fluid HFC 60°C	A	Diluted hydrogen peroxide	B
Hydraulic fluid HSC	B	Tartaric acid	A
Liquid manure / urine	A	Citric acid	A
Javelle water	C	Treacle	A

A	excellent resistance	No or only insignificant interference
B	good resistance	insignificant interference
C	moderate resistance	sufficient usage property
D	no resistance	Use is not recommended

Aging

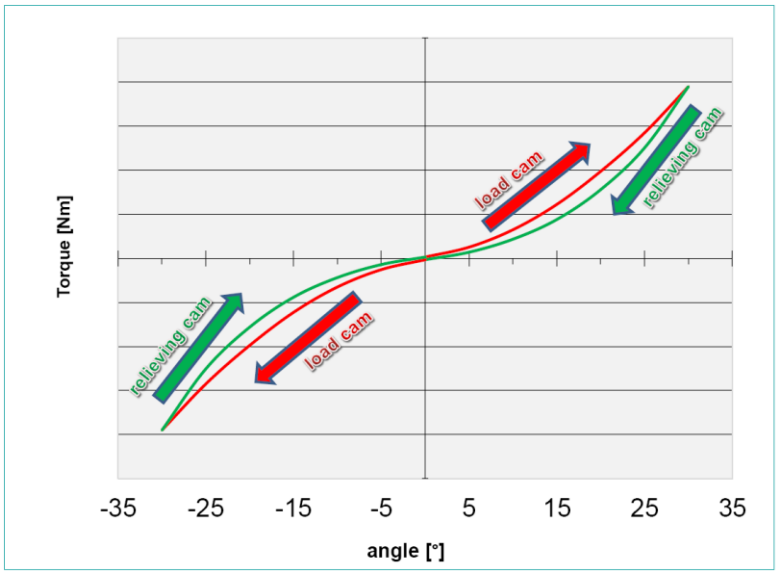
The following parameters change as follows:

DVR DIN ISO 815 [24h, 23°C,50%]	3-4%
DVR DIN ISO 815 [168h, 23°C,50%]	5-6%

Artificial aging [168h, 70°C]	
Hardness (Shore A) DIN 53 505	+~2°
Tensile Strength DIN 53 504	-~1.5MPa
Elongation at break DIN 53 504	-~1/6
Tear Strength DIN 34-1	unchanged

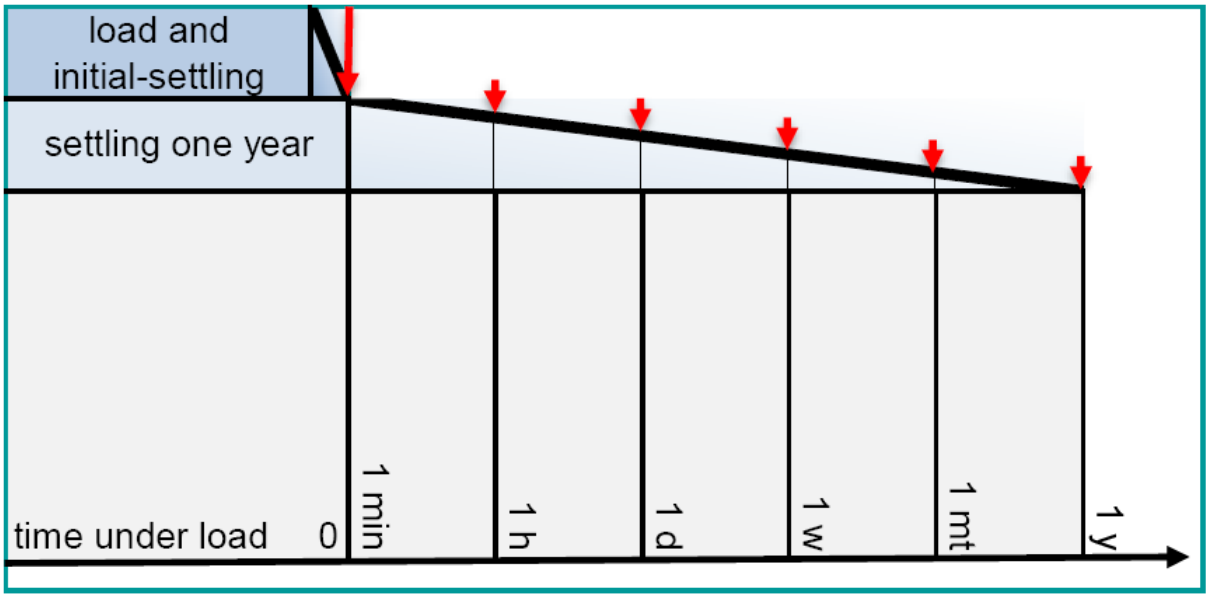
Characteristics of the PAVO-Rubber Suspension Unit

With the torsion in the longitudinal axis will be generated a righting moment back to the starting position. A slightly progressive spring characteristic is achieved by the specific compression and shaping. Based on the rubber-specific behaviour arise a typical hysteresis curve.



All elastic materials have a measurable settling and a compression set (DVR). This means that rubber give way in the load direction depending on the time, the load, the load change, the excitation frequency and the temperature after discharge not goes more fully back to the initial position.

Our rubber compound is developed with a lowest possible settling and a small compression set (DVR). Nevertheless, the settling in elastic materials can never prevented completely. After the vulcanization by the assembling process the shape of the rubber body is changed. In this process, arise also unwanted stresses in the rubber bodies. The largest proportion of this stress removes at the first initial load and in the following 24 hours. The rest of the settling is removes within a year and is then no longer measurable.

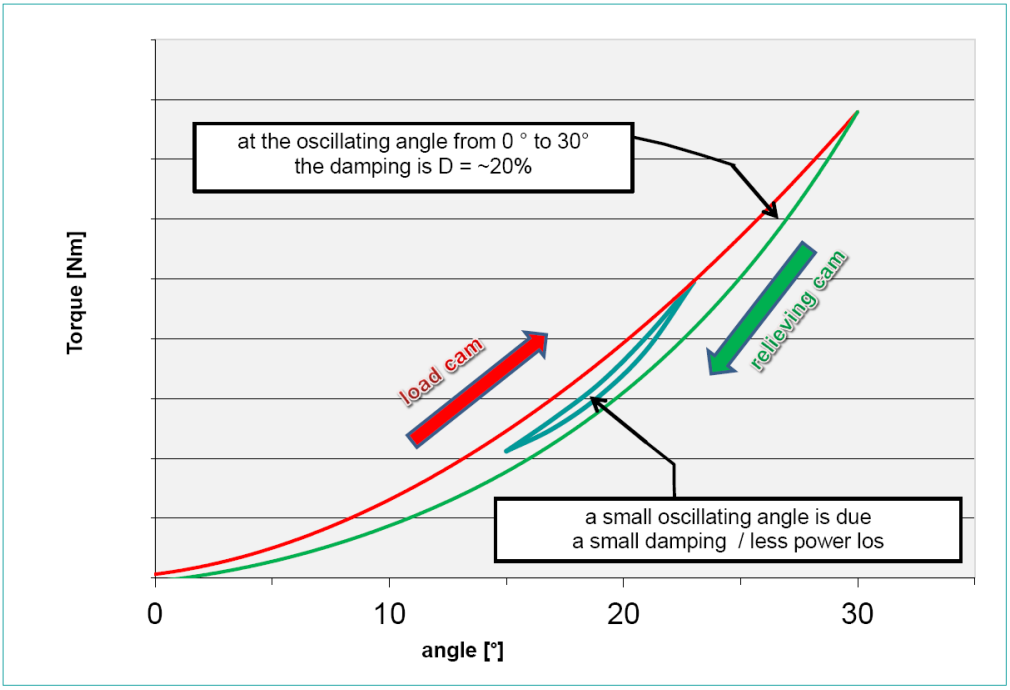


Because we bring a technical product in the market, the data of the settling can be relevant for the selection of the products or the construction of the plants.
In our technical product documents, we report the usage-relevant settling for the different product groups. Therefore, we report for example in the data of the PAVO-Screen Mountings the resulting settling of the various products at maximum load within the first day and after one year in a graph.

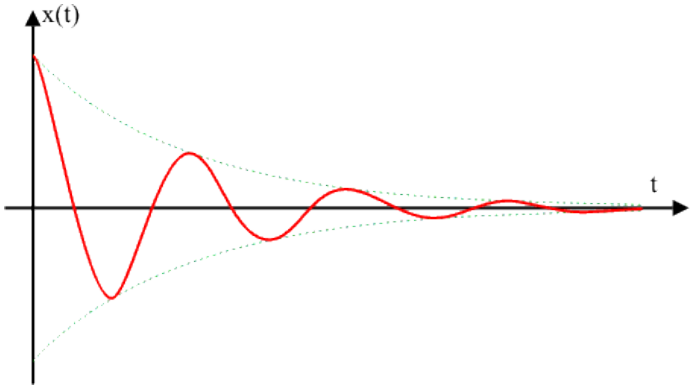
The compression set is approximately 10% of the torsion angle under load.

Damping

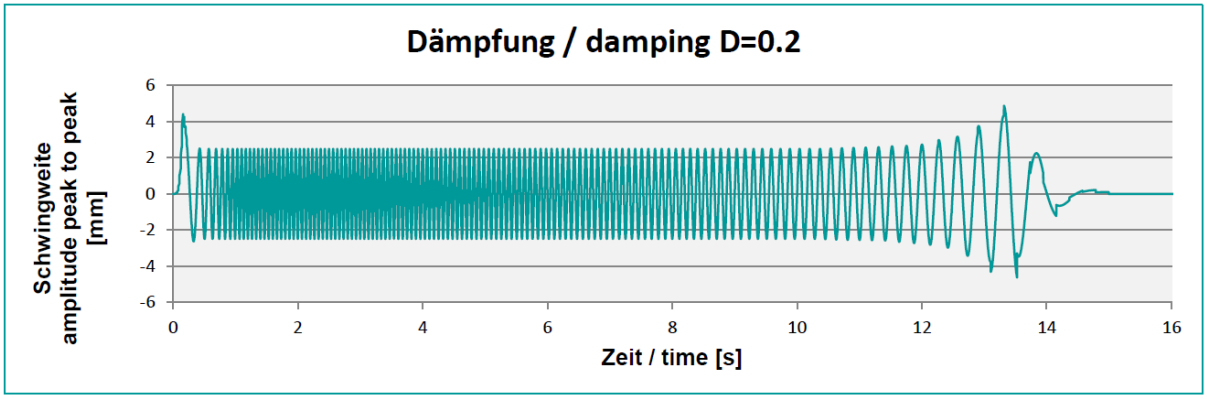
Is the PAVO-Rubber Suspension unit twisted, result between the load curve and the discharge curve with respect to the torque at the same torsional angle a difference. The friction between the threads of the molecule is converted to heat. This work generates a damping, which is dependent by the torsion angle and the angular velocity.



The result is a larger damping at a large torsion angle with less excitation frequency. Adverse shocks and vibrations are reduced in a few deflections.

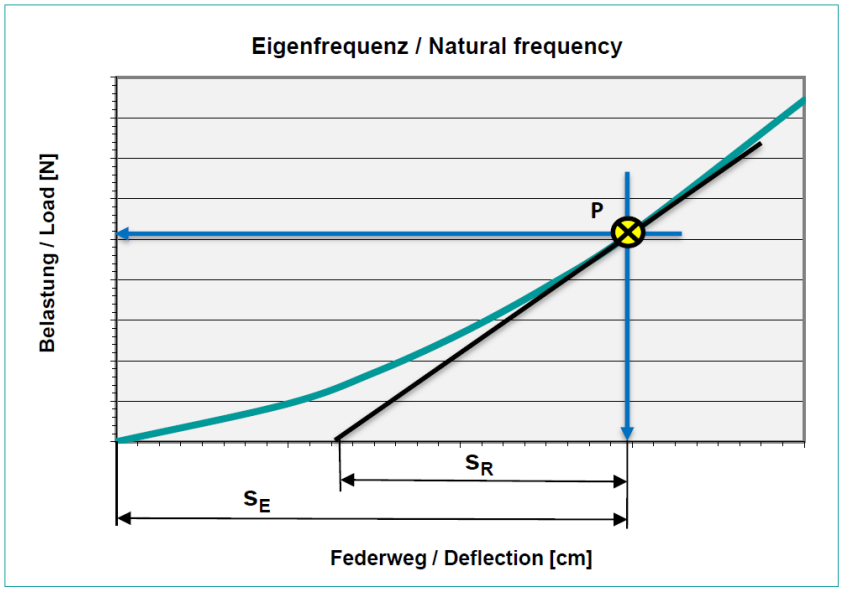


It results a small damping at a small oscillating angle with high excitation frequency. In operation with harmony-excited oscillations, only a small proportion is converted to heat. As soon as the amplitude peak to peak increases up in case of the resonance passage to the maximum of 2.3 times higher, the oscillating is reduced in a few deflections by increasing damping.



Natural frequency

With the deflection way (S_E), which results by a load, the natural frequency (f_e) of the spring system can be calculated. If the spring characteristic progressively is determined by applying the tangent at the intersection point (P) on the load axis and we get the relevant deflection way (S_R).



Natural frequency [Hz] $\boldsymbol{fe} = \frac{\mathbf{5}}{\sqrt{\boldsymbol{sR}}}$

Natural frequency [min^{-1}] $\boldsymbol{ne} = \frac{\mathbf{300}}{\sqrt{\boldsymbol{sR}}}$

Solid-borne sound

The solid-borne sound energy spreads out through solid, homogeneous materials made in metals, which will have used in general mechanical engineering and materials for buildings have a very low loss-value, which varies depending on temperature. Thus, the solid-borne sound energy is also published on a wide distance and can have negative consequences. Different materials have a multiple higher loss-value. The separation of solid materials with such insulation materials stop the solid-borne sound distribution.

The relevant sound velocity is determined by the density and modulus of elasticity.
Thus, the following materials have an average velocity of:

Steel: 5050m/s, aluminum: 5200m/s, copper: 3500m/s

Masonry: 3500m/s to 4000m/s, PVC hard: 1700m/s

Materials with good insulation properties have an average velocity of:

Air: 334m/s at 20°C, cork 500m/s and rubber: 150m/s

With all PAVO-Rubber Suspension Units can be achieved in principle an optimum solid-borne sound insulation.

Construction

The PAVO-Rubber Suspension Units consists of the external profile, the inner profile and the rubber bodies adjacent in the four corners of the inner contour of the outside profile.

Even if the rubber bodies are damaged, the core part in the closed part of the external profile is held and there is a break-proof protection.

Maintenance-free

Our products do not require special maintenance. Please follow our guidelines to the:
Storage, cleaning and aging behavior.

By in strict keeping of all limits and protect against all harmful emissions in have in use standing rubber suspension units a service time of:
1-shift operation (8 h/day) about 7-8 years
2-shifts operation (16 h/day) about 5-7 years
3-shifts operation (24 h/day) about 3-5 years

Quality management

Now, we do not have a certified quality system. Nevertheless, our processes comply with the following international standards:

- ISO 9001:2010 Quality Management System
- ISO 14001:2015 Environmental Management System
- REACH (including the RoHS directive RoHS II + SVHC Candidates_2017/01/12)