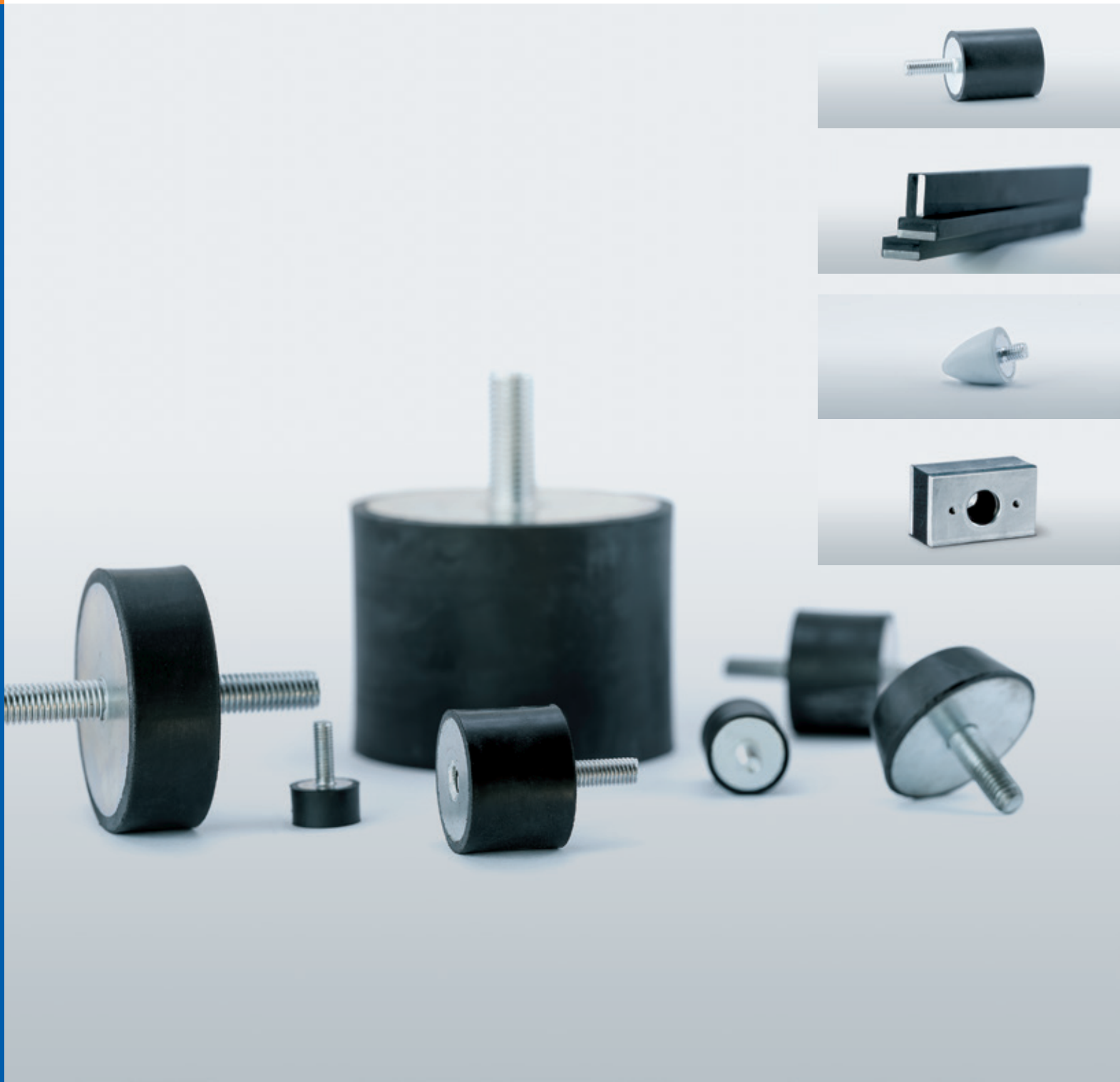
trygonal
GROUP

Vibration Technology and Gripper Rails



- We are a sealing and plastic parts manufacturer
- We see ourselves as a partner to our customers
- We are independent, holistic and solution-oriented
- We are an international network company and we work world-wide
- We see our company culture like life: varied, complex and exciting
- We value greatly the individuality and the expertise of the staff
- We are committed to high professional ethics and integrity in all we do

All this creates a passionate, innovative and dynamic team to support your business.

Trygonal Vibration Technology – Rubber-Metal Buffers and Rails

We are an active international group of independent seal manufacturers and plastics processors. In our group, we produce all types of gaskets and plastic parts such as O-rings, moulded rubber parts, metal rubber compounds, foam moulded parts, semi-finished products and machines for machining seals. The latest production techniques are used.

The ongoing mechanisation of our environment is characterised by the increased use of machines and systems which in turn can cause a variety of vibrational situations. Our product range offers a technically robust and appropriate solution for these vibration conditions.

On the following pages you will find information on vibration technology, quality, service and the calculation method for our standard rubber-metal buffers (type A to TC) and our rubber-metal rails.

A wide variety of other rubber-metal elements, such as rubber-metal bushings and bearings, machine feet, hollow rubber springs etc. can be also offered on request.

Rubber-Metal Buffers

Buffers are characterised by their strength and robustness. The wide range of dimensions allows multiple options for usage.

Product benefits

- Effective dampening and cushioning of impacts
- Easy to install
- RoHS compliant

Application

Buffers are particularly suitable for elastic travel limiting and for cushioning impacts on mobile and non-mobile units, machines and generally as stops.

Rubber-Metal Rails

Rails are used often where the use of buffers is not possible due to lack of space or high loads.

Product benefits

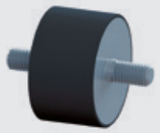
- Can be stored individually
- Flexible according to each load
- Universal application / multiple use options
- RoHS compliant

Application

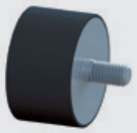
Gripper Rails are suitable for the storage of the heaviest machines, plants, aggregates and foundations. In addition they are suitable for the storage of marine engines, large stationary motors, lathes, elevator machines and vibrating machines.

Delivery Programme Rubber-Metal Buffers

Type A
with threaded bolt
on both sides

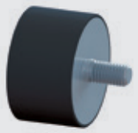


Type B
with threaded bolt
and internal thread



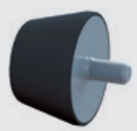
Type C
with internal thread
on both sides

Type D
with one-sided
threaded bolt



Type E
with one-sided
internal thread

Type F
with one-sided
threaded bolt



Typ H (Concave Buffer)
with one-sided
threaded bolt

Type J
with one-sided
threaded bolt

Type K
with one-sided
internal thread

Type L
with one-sided
internal thread

Type TA
with threaded bolt
on both sides

Type TC
with internal thread
on both sides

Delivery Program Rubber-Metal Rails

Type A (Gripper Rail)
with metal
on one side only

Type B
with metal
on both sides

Please go to the relevant Rubber-Metal Buffer or Gripper Rail section online for more technical and measurement information.
Please refer to the Trygonal website for our calculation tables and databases.

Characteristics of vibrating elements

Construction

In principle, the design of vibrating elements in vibration technology is always the same. An elastomer spring core adapted to the application is vulcanized to a metallic carrier element. For this purpose, the metallic carrier element is wetted with a bonding system (adhesion promoter), introduced into a preheated mould and the vulcanization mould is filled with rubber and vulcanized out.

Materials

The elastomeric spring core has a defined springing or damping behaviour in shape and material. The standard spring core is a natural rubber (NR) with 55 ° ShA. This material is recognised for its high resilience and low creep. The metal elements are adapted to the specific application. Through this product-specific adaptation a simple fastening, load distribution and load introduction in the elastomer spring core is achieved. An additional surface treatment can protect the metal body against environmental influences.

Binding

A durable corrosion-resistant connection between elastomeric spring core and the metallic carrier element is ensured by intensive pre-treatment of the metals, the application of a two-layer adhesion promoter and vulcanization

Load limits

Statically acting forces relative to the spring core can cause thrust, pressure, rotational thrust, or pressure-thrust stresses.

As a general guideline, the following stress limits can be established for the standard material NR (natural rubber) with approx. 55 °ShA

Type of Load	Static	Dynamic	Shock
	N/cm²	N/cm²	N/cm²
Thrust	15	10–20	45
Pressure	50	40–60	200
Rotary Shear	20	15–25	90
Pressure Boost	50	40–60	200
Train	–	–	150

The occurrence of peak stresses at the bonding edges and the notch sensitivity of the rubber should avoid permanent tensile loads. Short-term tensile loads resulting from an impact can be absorbed within the stress limits.

Please note that this information is based on empirical values and can not be accepted for its universality.

Standard quality

NR (Natural Rubber)

Special qualities

NBR = Perbunan® (Nitrile-Butadiene Rubber)

CR = Neoprene® (Chloroprene Rubber)

FPM = Viton® (Fluoro Rubber)

EPDM = Ethylene-Propylene-Diene-Rubber

PUR = Vulkollan® Polyurethan

More qualities on request

Standard Shore hardness

55 ± 5 Shore A (medium hardness)

Hardening from 30 to 93 Shore A available on request

Metal parts for rubber-metal buffers

Steel galvanized or chromated

Alternative support members, e. g. Stainless steel, brass, aluminum, etc. available on request

Metal parts for rubber-metal rails

Black steel or steel lacquered

Alternative support members, e. g. Stainless steel, brass, aluminum, etc. available on request

Dimensions for rubber-metal buffers

Through to 200 mm diameter

Special dimensions on request

Dimensions for rubber-metal rails

Through to 2000 mm length

Special dimensions for width, height, length and geometry available on request

Operating temperature

See table "Properties of selected elastomer materials"

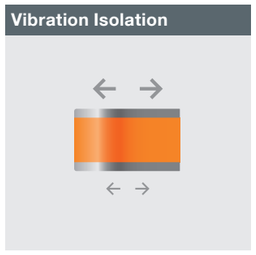
Modes of action

Basics

Machines and systems produce vibrations that cause oscillations and noises. These physical changes can be transferred to surrounding machines, plants and buildings and can impact the surroundings. Body vibration as well as shock and other vibrations can have a profound impact on people, the environment, the operation of machines and equipment and the quality of products. Vibration technology products can reduce the transmission of vibration and body vibrations to the environment (active interference suppression) or the effects of vibrations from the environment on sensitive systems and equipment (passive interference suppression).

The following explanations help explain and understand the concepts of vibration technology.

Vibration Isolation



The mass of the object, the spring rate of the elastic spring core, the restoring force of the spring elements and the mass inertia form the natural frequency of a stored machine. Therefore with a single support of the installation, the resonance oscillates with its natural frequency and the decaying amplitude (oscillation range).

Sound Insulation

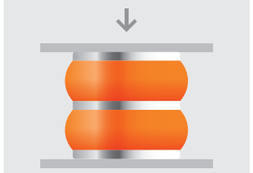
Sound waves are mechanical vibrations, which can be transmitted from one body to another by rigid connections (known as body sound). Natural rubber (NR) or elastomers are very effective materials to help isolate the body structure.

Shock and Shock Isolation

Through shock or impact, the oscillating or bearing elements are subjected to high kinetic energy at sudden notice. This energy is converted into spring work. The maximum energy may be 2 to 2.5 times as great as the statically permissible load. The spring curve and the surface determine the maximum energy consumption of vibration and / or bearing elements.

Types of stress

Pressure Stress

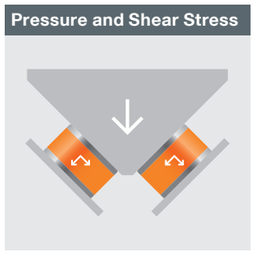


Pressurised bearing elements are not just determined by the compressive stress but by the prevention of the transverse expansion of an elastomer spring core. The largest shear stresses occur at the outer bonding edges. If great forces or a hard bearing are expected, pressure-resistant bearing elements, which are often multi-part, are used.

Shear Stress

If large spring movements are required for medium loads, vibration-resistant elements are used. The simple shear load results in a linear force-displacement diagram. If vibrating or bearing elements with small cross-sections connect high heights between metal parts, then unwanted bending stresses can occur. A declining spring curve can occur and strongly impact the fatigue strength of the vibration and bearing elements.

Pressure and Shear Stress

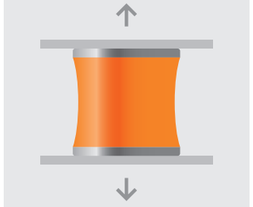


For large spring movements at medium and high loads, bearing elements are used in pairs and angularly arranged for use as in the diagram. The pressure/shear distribution achieved in this way prevents damaging bending stresses.

Rotary Shear Stress

Rubber-metal casings are suitable for the elastic absorption of torques. The twisting of the metal sleeves results in a thrust load in the elastomer spring core. The cross-sectional size of the spring core determines the torsional stiffness of the rubber-metal casing.

Tensile Stress



If a rubber-metal element is subjected to tensile stress, a constriction of the elastomer spring core occurs due to the need for volume constancy. Unfavourable stress peaks occur at the metal edges and adversely affect the fatigue strength of the rubber-metal element under varying loads. Tensile stresses should be avoided as far as possible.

Properties of selected elastomer materials

Properties	Materials												
	NR Natural Rubber	IR Isoprene	SBR Styrol-Butadiene Rubber	BR Butadiene Rubber	IIR Isobutylene-Isoprene Rubber	EPDM Ethylene-Propylene-Diene Rubber	NBR Nitrile-Butadiene Rubber	CR Chloroprene Rubber	AU,EU Polyurethane Rubber	MVQ Silicone Rubber	FQ Fluoro-Silicone Rubber	FKM Fluoro Rubber	PUR Polyurethane
Tear resistance, non-reinforced	1	5	2	6	4	5	5	3	2	6	6	5	1
Tear resistance, reinforced	1	2	2	4	3	3	2	2	1	4	4	3	–
Elongation at failure	1	1	2	3	2	3	2	2	2	4	4	3	2
Rebound resilience	2	2	3	1	6	3	3	3	3	3	3	5	2
Abrasion resistance	2	2	2	1	3	3	2	2	1	5	5	4	1
Initial tearing resistance	2	2	3	5	3	3	3	2	3	6	6	3	1
Electrical volume resistance	1	1	2	2	2	2	4	3	3	1	1	4	2
Temperature range, hot air + °C	90	90	100	100	140	150	130	120	120	200	200	220	80
Temperature range, cold – °C	50	40	40	60	40	40	40	30	20	80	80	25	35
Alkali resistance	3	3	3	3	2	2	3	2	5	5	4	1	6
Ageing resistance	3	3	3	3	2	1	3	2	2	1	1	1	1
Fuel resistance	6	6	4	5	6	5	1	2	1	5	1	1	2
Hot water	3	3	2	3	1	2	3	2	5	5	4	2	6
Ozone resistance	4	4	4	3	2	1	3	2	2	1	1	1	1
Oil and grease resistance	6	6	5	6	6	4	1	2	4	4	4	4	2
Acid resistance	3	3	3	3	2	1	4	3	5	5	4	1	6

1 = Excellent | 2 = very good | 3 = good | 4 = moderate | 5 = poor | 6 = unsuitable

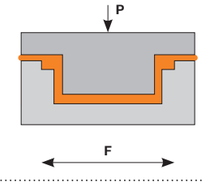
Quality and tolerances

Unless explicitly stated otherwise, all rubber-metal elements NR (natural rubber) with a hardness of 55 ±5 Shore A (medium hardness) are used as a metal element for the spring core or ST 37 (galvanized, chromated or bare). The elastomer properties are tested according to the following relevant standards.

The following standards are given as examples:

- DIN 53504 Tensile strength (N/mm^2) and breaking elongation (%)
- DIN 53505 Hardness measurement (Shore A)
- DIN 53512 Density (g/cm^3) and the rebound resilience (%)
- ISO 3302-1 class M3 for rubber-metal buffers
- ISO 3302-1 class M4 for rubber-metal rails

Nominal Size Allowed mm				Tolerance class M3		Tolerance class M4	
				Measure F ±mm	Measure C ±mm	Measure F ±mm	Measure C ±mm
	Up to		6,3	0,25	0,40	0,50	0,50
from	6,3	to	10	0,30	0,50	0,70	0,70
from	10	to	16	0,40	0,60	0,80	0,80
from	16	to	25	0,50	0,80	1,00	1,00
from	25	to	40	0,60	1,00	1,30	1,30
from	40	to	63	0,80	1,30	1,60	1,60
from	63	to	100	1,00	1,60	2,00	2,00
from	100	tp	160	1,30	2,00	2,50	2,50
from	160			±0,8%	±1,3%	±1,5%	± 1,5%



F refers to each dimension in horizontal direction.

C refers to each dimension in press direction **(P)**

Customer service and packaging

We can support you with the following services:

- Technical consulting for individual problem solving and moulding concepts
- Design and material-appropriate design of the components
- Prototyping and product optimisation
- On request, application-specific material mixtures, metal types, refinements (e.g., surface treatment) are available
- Special buffers and special rails according to your requirements and drawings
- Design of complete bearings
- An extensive assortment of standard items is always available

Trygonal Group

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Vibration Technology and Gripper Rails
Seals
Customised and Large Sealing Solutions
O-rings and Static Sealing Profiles
Materials and Semi-Finished Products
Machines, Software and Tools
Plastic Turned and Milled Parts, 3D Printer Parts
Rubber Parts and Membranes
Rubber-Metal and Rubber-Plastic Components
Form and Foam Parts

Germany

Trygonal Group GmbH

Neue Heimat 22
D-74343 Sachsenheim-Ochsenbach

Phone: +49 (0) 7046-9610-0
Fax: +49 (0) 7046-9610-33
info@trygonal.com

Switzerland

Trygonal Schweiz AG

Joweid Zentrum 2
CH-8630 Rüti ZH

Phone: +41 (0) 55 212 45 00
rueti@trygonal.com

Spain

Trygonal Iberia SL

Polígono Borda Berri, nº 13 Módulo C4
E-20140 Andoain (Gipuzkoa)

Phone: +34 (0) 943 303 900
iberia@trygonal.com

France

Technical consulting & sales

Phone: +33 (0) 6 44 39 61 80
france@trygonal.com

Austria

Trygonal GmbH

Industriering 5
A-9020 Klagenfurt

Phone: +43 (0) 463/310095
klagenfurt@trygonal.com

Trygonal Kunststoffinnovationen GmbH

Tragösser Straße 53
A-8600 Bruck an der Mur

Phone: +43 (0) 3862 27722-0
office@trygonal.com

Trygonal ATYP SERVICE

Beethoven Straße 1
A-2231 Strasshof

Phone: +43 (0) 2287/22235
atyp@atyp.com

Your Contact

www.trygonal.com