Form and Foam Parts
Trygonal
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We are an internationally active group of independent seal manufacturers and plastics processors. Our group manufactures all types of seals and plastic mouldings such as O-rings, rubber mouldings, rubber-metal compounds, foam mouldings, semi-finished products and machines for metal-cutting seal production. In addition, state-of-the-art production techniques are used.

We develop the component together with the customer. Based on the component application, it is determined whether the part must be foamed or cast. Polyurethanes offer a very large number of possible solutions. No matter whether it is a lightweight yet ultra-stable special foam, a casting component with excellent mechanical properties or a particularly tough integral foam, Trygonal will develop the right solution for you.

**PUR Foam types**
- Soft foam — Visco-elastic foam
- Integral foam
- Hard foam
- Hard integral foam
- Casting resins

In different densities, degrees of hardness and colours
All processed polyurethanes can additionally be equipped with flame retardants, antistatic and many other special additives.

**Approvals**
- Flame protection
- Radiation protection
- Food application

**Applications**
- Automotive, construction, mining, railways, power generation (power plants, solar energy and wind power), aircraft construction, semiconductors, mechanical engineering, medical technology and mobile hydraulics

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- 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.
Introduction to polyurethane products

Material
Polyalcohols and polyisocyanates are extracted from petroleum products. There are two types of product: Polyether and polyester.

The raw density (measured in kg/m³) of a PUR soft foam is specified as the minimum raw density depending on the application. In general, the higher the bulk density, the higher the performance characteristics.

The hardness, measured as compression hardness in kPa or indentation hardness, measured in N, can be set very low (soft) to very high (hard).

Casting resins or integral foams with closed and solid outer skin can also be measured in Shore A and D.

Environmental/hygienic aspects/odour/recycling/waste disposal
PUR soft foams are physiologically harmless according to our state-of-the-art science and technology. They are odourless and easy to clean; disposal and recycling are possible.

Manufacturing processes
We have various manufacturing processes available for the most diverse materials and part types.
- Low pressure dosing machines
- High pressure dosing machines

Liquid, reactive starting materials are used in this process. If polyols, isocyanates and blowing agents (usually water) are mixed, the polyol reacts with the isocyanate in a polyaddition to PUR (polyurethane foam) and the blowing agent forms gas inclusions (in the case of water, the blowing agent reacts with part of the isocyanate, releasing carbon dioxide). Additives and blowing agents are added to the polyol, so that usually two components are used.

The properties can be adjusted according to the selection of the starting material. Thus, the use of long-chain polyols produces soft to elastic foams, or short-chain polyols produce strongly cross-linked, hard foams.

For the production of moulded foam parts, the formulated mixture is transferred to a metal or plastic mould and the foaming process takes place. After opening the mould, the finished part can be removed. This process can also be used to produce complex 3D parts.

Manufacturing tolerances
The hardness settings of the foam qualities have tolerances of up to 20%. For the other properties, minimum or maximum values are specified.

The parts from the mould shrink by approx. 1 percent.

Special settings and variants
We can produce special material, colour and shape combinations according to your wishes.

These are, for example: electrically conductive, viscoelastic, acid- or heat-resistant materials.

Further applications of polyurethane materials

Surface protection (skinning/painting)
- The suitability of polyurethanes for coating all types of surfaces is determined by their service life and resistance to corrosion and weathering.
- Upholstery elements can also be supplied with skin.

Adhesives
- Polyurethanes are so versatile that they are also available in the form of adhesives that securely bond very different materials such as wood, rubber, cardboard or glass.
- Furthermore, different PUR foams can be bonded together to form composites.

Seals
- Polyurethane seals prevent liquids or gases from penetrating or escaping through gaps and crevices. There is a wide variety of seal types on the market today.
- Trygonal offers you over 140 individual profile types, which we can adapt to your application.

Application limits and possibilities
The figure below shows the materials manufactured, offered and processed by Trygonal. The figure shows the PUR foam application limits as well as the corresponding volume weight and stiffness of the respective foam type.

In contrast to other manufacturers Trygonal can also offer many derived materials with different properties and therefore a wide range of elastomers.

On the following pages the main characteristics, the physical, chemical and ecological properties as well as their application in sealing technology are shown.
## Polyurethane Systems – Overview

**Automobile:**
- FMVSS 302

**Rail vehicle construction:**
- DIN 5510 (S3, SR2, ST2), EU TL 45545

**Aircraft construction:**
- ABD 0031, FAR 25.853

**Furniture industry:**
- California 117 Section A Part 1

**Construction sector:**
- DIN 4102 B2

**Leisure industry:**
- M2, UNI 9175/87 (= CSE 4/83): Class 1.IM, BS 5852 crib 5

**Electrical industry:**
- UL 94 V0

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**Note:**
Soft Foam hardness can be controlled during manufacturing.

### Polyurethane Systems

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Volumetric weight, grams/litre</th>
<th>Flame protection</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Soft Foam</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PUR soft 050</td>
<td>Soft Foam</td>
<td>RG 050</td>
<td>•</td>
<td>Office furniture industry, cushions, supports, seat rolls etc.</td>
</tr>
<tr>
<td>PUR soft 100</td>
<td>Soft Foam</td>
<td>RG 100</td>
<td>•</td>
<td>Upholstery industry, couches, seats, furniture etc.</td>
</tr>
<tr>
<td>PUR soft 150</td>
<td>Soft Foam</td>
<td>RG 150</td>
<td>•</td>
<td>Special applications</td>
</tr>
<tr>
<td>PUR soft 200</td>
<td>Soft Foam</td>
<td>RG 200</td>
<td>•</td>
<td>Special applications</td>
</tr>
<tr>
<td>PUR soft PP150</td>
<td>Soft Foam</td>
<td>RG 150</td>
<td>•</td>
<td>Special applications</td>
</tr>
<tr>
<td>PUR soft PP250</td>
<td>Soft Foam</td>
<td>RG 250</td>
<td>•</td>
<td>Special applications</td>
</tr>
<tr>
<td><strong>Rigid Foam</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PUR rigid 0050</td>
<td>Insulating Rigid Foam (0.03 W/mk)</td>
<td>RG 050</td>
<td>•</td>
<td>Insulation, pipelines, refrigeration, slides, boilers etc.</td>
</tr>
<tr>
<td>PUR rigid 0250</td>
<td>Insulating Rigid Foam</td>
<td>RG 250</td>
<td>•</td>
<td>Insulation moulded parts, facade insulation, tunnel construction, parts for fittings</td>
</tr>
<tr>
<td>PUR rigid 0500</td>
<td>Insulating Rigid Foam</td>
<td>RG 500</td>
<td>•</td>
<td>No insulations</td>
</tr>
<tr>
<td>PUR rigid 0750</td>
<td>Insulating Rigid Foam</td>
<td>RG 750</td>
<td>•</td>
<td>No insulations</td>
</tr>
<tr>
<td><strong>Integral Foam</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PUR skin 15-65</td>
<td>Integral Foam</td>
<td>15-65</td>
<td>•</td>
<td>Furniture industry, handles, steering wheels, custom seats etc.</td>
</tr>
<tr>
<td>PUR skin 35-85</td>
<td>Integral Foam</td>
<td>35-85</td>
<td>•</td>
<td>Special applications</td>
</tr>
<tr>
<td>PUR skin 60-98</td>
<td>Integral Foam</td>
<td>60-98</td>
<td>•</td>
<td>Special applications</td>
</tr>
</tbody>
</table>
| **Note:**
Integral Foam Shore A is a multifunctional system - specific customer-specific properties can be produced: visco-elastic, controllable skin thickness, etc. Fillers of various types can also be added.

For technical questions and product designs, our team of experts is at your disposal at any time.
### Polyurethane Systems – Overview

**PUR Foam types**

- **Soft Foam**
  - Open-cell foam: The walls between the individual cells are open and can therefore absorb liquids.

- **Integral Foam**
  - Integral foams have a closed thick outer skin and an open-cell core.

- **Rigid Foam**
  - Open-cell hard foam, liquids can be absorbed.

- **Hard-Integral Foam**
  - Hard, closed outer skin, liquids are not absorbed.

**Casting resins**

- For elastic to hard-elastic parts, moulds or toolings.

**RG**

- Volumetric weight e.g. RG 35 - 35 kg/m³ or 35 gr/dm³

**Shore A**

- Specified for soft elastomers measured with a needle with blunted tip.

**Shore D**

- Specified for hard elastomers measured with a needle running at a 30° angle.

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<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Volumetric weight, grams/litre volume</th>
<th>Flame protection</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard-Integral Foam</td>
<td>Hard Integral Foam, self-isolating</td>
<td>RG 400</td>
<td>★</td>
<td>More favourable shuttering parts etc.</td>
</tr>
<tr>
<td></td>
<td>RG 700</td>
<td></td>
<td>★</td>
<td>Most common equipment and machine casing, good quality</td>
</tr>
<tr>
<td></td>
<td>RG 500</td>
<td></td>
<td>★</td>
<td>Surface can be painted subsequently</td>
</tr>
<tr>
<td></td>
<td>RG 650</td>
<td></td>
<td>★</td>
<td>Specialised components, backwoods, chain etc.</td>
</tr>
</tbody>
</table>

**Note:**

Hard integral foams are used for visible parts. They can be produced in all colours and shapes.

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<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Hardness, Shore A</th>
<th>Flame protection</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casting resins</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PUR resin 1565</td>
<td>Casting elastomer</td>
<td>15-65 A</td>
<td></td>
<td>Soft moulded parts, rollers, handles, cranks, arm rests etc.</td>
</tr>
<tr>
<td>PUR resin 5085</td>
<td>Casting elastomer</td>
<td>50-85 A</td>
<td></td>
<td>Rollers, abrasion protection, seals</td>
</tr>
<tr>
<td>PUR resin 6598</td>
<td>Casting elastomer</td>
<td>65-98 A</td>
<td></td>
<td>Coating and rollers, bushes, shock absorbers, bullet traps, etc.</td>
</tr>
<tr>
<td>PUR resin 4070 D</td>
<td>Casting elastomer</td>
<td>40-70 D</td>
<td></td>
<td>Formwork, technical moulded parts for the machine industry</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Electronics industry, for high loads</td>
</tr>
</tbody>
</table>

**Note:**

Coating resins offer an almost infinite variety of adjustment possibilities such as mechanics, current conduction resistance, hardness, rebound, flame retardancy and much more.

For technical questions and product designs, our team of experts is at your disposal at any time.
## Applications

<table>
<thead>
<tr>
<th>Seats</th>
<th>Medical technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seats, back and head cushions for railways and public transport</td>
<td>Insulations</td>
</tr>
<tr>
<td>Manufactured according to railway standard EN 45545 Norm</td>
<td>Heat and sound insulation</td>
</tr>
<tr>
<td>For high demands and long service life</td>
<td>Loungers, seats and supports</td>
</tr>
<tr>
<td>Upholstery for the furniture industry – Loungers and chairs</td>
<td>Special seals</td>
</tr>
<tr>
<td>Mattresses and arm rests</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Arm rests</th>
<th>Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm rests for trains and buses</td>
<td>Seat and back parts</td>
</tr>
<tr>
<td>Handles, knobs</td>
<td>Handles and sun visors</td>
</tr>
<tr>
<td>Seating wheels</td>
<td>Covers</td>
</tr>
<tr>
<td>Bolsters</td>
<td>Spoiler</td>
</tr>
<tr>
<td>Fairings/Covers</td>
<td>Arm rests</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Edge protector</th>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covers</td>
<td>Cases</td>
</tr>
<tr>
<td>Galleries</td>
<td>Boardings</td>
</tr>
<tr>
<td>Bins</td>
<td>Castors and wheels</td>
</tr>
<tr>
<td>Hazard strip</td>
<td>Supports and supports</td>
</tr>
<tr>
<td>Knee and chin protection</td>
<td>Gaskets and seals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact protection</th>
<th>Sports and Leisure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buffers for mountain railways</td>
<td>Components for rides, like:</td>
</tr>
<tr>
<td>Bumpers for cleaning vehicles</td>
<td>seat and back rests, safety bars</td>
</tr>
<tr>
<td>Covers</td>
<td>Components for mountain railways and chair lifts, such as:</td>
</tr>
<tr>
<td>Sidewall claddings</td>
<td>seat units, side panels, handles, stoppers</td>
</tr>
<tr>
<td>Stoppers</td>
<td></td>
</tr>
</tbody>
</table>

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Form and Foam Parts
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
Vibration Technology and Gripper Rails

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