Duroplast	Technopolymer	Elastomers
This group includes plastic materials which solidify by chemical reactions. They closely crosslink into spatial lattice patterns of macromolecules which gives Duroplast material high mechanical strength and surface hardness. Their elasticity is low, however. The curing process is irreversible. Unlike Technopolymer, Duroplast cannot be melted because it is rigid up to degradation temperature. Phenolic resins are among the most commonly used Duroplast materials. In general, the molecular crosslinking of Duroplast creates good chemical stability. The coloring options of components made of Duroplast are limited.	With increasing temperature and once the softening point is exceeded, this group of Technopolymer melts, can be heat distorted and solidifies again after cooling. This process can be repeated any number of times. Unlike Duroplast, there is no chemical reaction during processing. Technopolymer materials can be subdivided into amorphous and partially crystalline plastics. The disordered structure of amorphous materials allows the production of transparent components by injection moulding right through to crystal-clear parts. Partially crystalline Technopolymer have a structure resulting in enhanced mechanical properties and temperatures of use. The wide variety of different Technopolymer and their options of modifications allow the production of “tailor-made” construction materials with respect to mechanical properties, chemical resistance, temperature resistance and different colors.	A feature of elastomers is that they can be deformed under minimal tensile or compressive stress. When the force effect decreases or no longer exists, the parts automatically return to their original, undeformed shape. Thus, they demonstrate the typical behavior of rubber. In chemical terms, these are macromolecules which are interconnected by only a few chemical crosslinking bridges. With thermoplastic elastomers, the cross-links soften under the influence of heat, thus demonstrating a thermoplastic behavior. By way of modification, elastomers can be made in varying degrees of hardness. They can be dyed easily by adding color pigments. Material characteristics of Elastomers → *Page 2162 ff.*

Information

The above details are general values without claiming to be complete. Material properties may vary widely through additives, modifications and environmental influence factors.

The details are unsuitable as the sole basis for constructions. The data may not be used in place of tests to determine the suitability of a material for a specific purpose.

No warranty or liability will be accepted fort the above specifications and details.

	Duroplast	Technopolymer			
Symbol	**PF 31**	**PA 6**	**PA 6 GF30**	**PA-HP**	**PA-T**
Description	Phenolic resin	Polyamide	Polyamide with 30 % glass fibre	High performance Polyamide	Polyamide transparent
Yield stress in MPa	–	80 / 50	– / –	– / –	90
Tensile strength in MPa	60	– / –	180 / 110	240 / 165	–
Tension-E-Module in MPa	9000	3000 / 1500	9000 / 6500	21000 / 15500	2800
Ball indentation hardness in MPa	250	150 / 70	220 / 150	– / –	140
Temperature resistance:					
• max. short-term	180 °C	180 °C	200 °C	215 °C	180 °C
• max. long-term	140 °C	80 °C	120 °C	150 °C	90 °C
• min. application temp.	–20 °C	–40 °C	–40 °C	–40 °C	–30 °C
Resistance to: *					
• Oil, greases	+	+	+	+	+
• Solvents: Tri	o	+	+	+	+
Per	o	+	+	+	+
• Acid: weak	+	o	o	o	–
strong	–	–	–	–	–
• Alkalines: weak	+	+	o	o	+
strong	–	o	–	–	+
• Petrol	+	+	+	+	+
• Alcohol	+	+	+	o	–
• hot water	o	o	o	o	–
• UV light / weather exposure	–	o	o	o	o
Fire behaviour (UL 94)	V-0	HB	HB	HB	V-2
General	This Duroplast material on phenolic resin basis with organic filler has the following properties: High stiffness and hardness, low tendency to creep, high heat forming resistance, low thermal linear expansion, high surface slip resilience, low flammability. Phenolic resins are available only in dark colour shades. They are not suitable for use with food. Typical applications include thermally insulating operating elements.	The material group Polyamide 6 (partially crystalline) offers universal materials for mechanical function components in mechanical engineering. Polyamides are: - cold-temperature resistant - impact stress resilient and impact resistant - abrasion resistant Reinforced Polyamides, such as PA 6 GF30 or PA-HP, combine high stiffness and rigidity with extreme impact strength, properties which make them highly robust under mechanical stress. Polyamide PA-T (amorphous) is translucent with a slightly yellow transparency. Typically used for oil level sight glass.			

* + resistant, o conditionally resistant, – non-resistant

	Technopolymer			
Symbol	**PE-HD**	**PE-LD**	**POM-C**	**POM-H**
Description	Polyethylene high density	Polyethylen low density	Polyacetal (Copolymer)	Polyacetal (Homopolymer)
Yield stress in MPa	30	10	65	72
Tensile strength in MPa	25 ... 30	8 ... 10	–	70
Tension-E-Module in MPa	1450	200	2700	3100
Ball indentation hardness in MPa	57 (Standard H132/30)	15 (Standard H49/30)	145	174
Temperature resistance:				
• max. short-term	100 °C	100 °C	140 °C	140 °C
• max. long-term	90 °C	70 °C	90 °C	80 °C
• min. application temp.	-80 °C	–80 °C	–50 °C	–50 °C
Resistance to: *				
• Oil, greases	+	+	+	+
• Solvents: Tri	+	–	–	–
Per	+	–	+	+
• Acid: weak	+	+	+	+
strong	+	–	–	–
• Alkalines: weak	+	+	+	+
strong	+	+	+	+
• Petrol	+	+	+	+
• Alcohol	+	+	+	+
• hot water	+	o	+	o
• UV light / weather exposure	o	o	o	o
Fire behaviour (UL 94)	HB	HB	HB	HB
General	Polyethylene is a very versatile thermoplastic polymer. It is colorless in its basic form. Polyethylene is physiologically safe, practically odorless, and tasteless. These properties make it ideal for the food and packaging industry. Polyethylene is shockproof and impact-resistant. It has good sliding properties and absorbs virtually no moisture.		Polyacetals (partially crystalline) are universal materials used in function components for precision engineering and in apparatus construction. They feature excellent properties: - low friction resistance - good abrasion resistance - good resilience - good fatigue resistance - good chemical resistance Typical applications include snap-fit elements (form-locking connecting elements).	

* + resistant, o conditionally resistant, – non-resistant

	Technopolymer			
Symbol	**PC**	**PP GF20**	**PSU**	**PTFE**
Description	Polycarbonate	Polypropylene with 20% glass fibre	Polysulfon	Polytetra-fluorethylene
Yield stress in MPa	63	33	70	4
Tensile strength in MPa	–	–	70	20
Tension-E-Module in MPa	2400	2900	2400	600
Ball indentation hardness in MPa	110	80	147 (H358/30)	26
Temperature resistance:				
• max. short-term	140 °C	140 °C	180 °C	300 °C
• max. long-term	125 °C	100 °C	160 °C	260 °C
• min. application temp.	–100 °C	0 °C	–100 °C	–200 °C
Resistance to: *				
• Oil, greases	o	+	+	+
• Solvents: Tri	–	o	o	+
Per	–	o	o	+
• Acid: weak	+	+	o	+
strong	–	+	o	+
• Alkalines: weak	–	+	+	+
strong	–	+	+	+
• Petrol	–	+	–	+
• Alcohol	o	+	+	+
• hot water	–	+	+	+
• UV light / weather exposure	o	o	-	+
Fire behaviour (UL 94)	V-2	–	V-0	V-0
General	Polycarbonates (amorphous) are translucent plastic materials with following properties: High strength, in particular high impact resistance, good optical properties, self-extinguishing. but: sensitive to chemicals and stress cracking, not suitable for high dynamic stress loads, notch sensitive at edges and corners.	Propylenes (partially crystalline) are universal standard plastic materials with balanced property levels: Average strength, stiffness, impact resistance, low density, excellent chemical resistance but very bad cold temperature properties. Embedded glass fibre, e.g. PP GF20, enhances stiffness and strength. Typical applications for propylenes are armatures.	The primary feature of Polysulfon is its very high heat resistance and good resistance to chemicals. Typical fields of application are electrical engineering, electronics, mechanical engineering, and medical technology where high heat resistance is needed, while also allowing transparency.	Polytetrafluor-ethylene is characterized in particular by very low friction coefficients and very high chemical and thermal resistance. PTFE is a preferred material for friction bearings, guides, seals, anti-stick coatings and insulators.

* + resistant, o conditionally resistant, – non-resistant

	Elastomers		
Symbol	**NR**	**CR**	**FPM, FKM**
Trade name		Neoprene®	Viton®
Chemical description	Natural rubber	Chloroprene rubber	Fluorine elastomer Fluorine rubber
Hardness (Shore A)	30 … 90	30 … 90	65 … 90
Temperature resistance • short-term • long-term	 –60° … +130 °C –40° … + 80 °C	 –30° … +150 °C –25° … +100 °C	 –30° … +280 °C –20° … +230 °C
Tensile strength in N/mm²	–	25	20
Wear resistance / Abrasion resistance	good	good	good
Resistance to: * • Oil, greases • Solvents • Acid • Alkalines • Petrol • UV light / weather exposure	 - o o o - -	 + o + + - +	 + + + + + +
General	NR is a material with very good physical properties and excellent mechanical strength. It is used e.g. for spring elements.	CR is one of the most frequently used synthetic rubbers with a wide range of applications for parts which require exceptional resistance to ageing.	FPM is unmatched for applications with contact to fuels, oils, solvents, as well as many acids and caustic solutions; resistant to atmospheric and environmental influences. Due to its high price its use is restricted to high quality rubber parts which are exposed to extremely heavy wear resistance. Viton® is a registered trademark of DuPont performance rubbers.

* + resistant, o conditionally resistant, – non-resistant

Information of hardness data for Elastomers

Hardness data of vulcanized or thermoplastic elastomers are measured using the Shore scale. This value is determined by measuring the indention depth of a spring-loaded indenter into the material. A low indention depth is a high Shore value, a high indention depth a low Shore value.

Different indenter shapes are used depending on the materials being examined. The elastomer materials used in Ganter products are measured according to “Shore A” with a blunt indenter with a tip angle of 35°.

	Elastomers		
Symbol	**NBR**	**H-NBR**	**EPDM**
Trade name	Perbunan®	-	-
Chemical description	Acrylonitrile butadiene rubber	Hydrogenated acrylonitrile butadiene rubber	Ethylene propylene diene rubber
Hardness (Shore A)	25 ... 95	85	70 ... 85
Temperature resistance • short-term • long-term	 –40° ... +150 °C –30° ... +120 °C	 - –25° ... +150 °C	 –40° ... +150 °C –40° ... +120 °C
Tensile strength in N/mm²	25	11	14
Wear resistance / Abrasion resistance	good	good	very good
Resistance to: * • Oil, greases • Solvents • Acid • Alkalines • Petrol • UV light / weather exposure	 + o o + + -	 + + o + + +	 - o + + - +
General	NBR is a synthetic special rubber for rubber parts with high requirements for resistance to swelling when in contact with oils and fuels. Standard material for o-rings.	H-NBR is obtained through full or partial hydrogenation of NBR. This significantly improves the resistance to heat, ozone and aging. The resulting materials are characterized by high mechanical strength and high abrasion resistance. Media resistance is comparable to NBR.	EPDM is a synthetic all-purpose rubber characterized by its high steam and hot water resistance. Also worth mentioning are its outstanding resistance to aging, weathering and environmental influences as well as acids and alkalines. The material is used in sealings and tubings.

* + resistant, o conditionally resistant, – non-resistant

	Elastomers		
Symbol	**MVQ, VMQ**	**PUR**	**TPE**
Trade name	Elastosil®	Bayflex®	Santoprene®
Chemical description	Silicone rubber	Polyurethane	Thermoplastic elastomer
Hardness (Shore A)	3 ... 90	65 ... 90	55 ... 87
Temperature resistance • short-term • long-term	 –50° ... +250 °C –30° ... +200 °C	 –40° ... +130 °C –25° ... +100 °C	 –40° ... +150 °C –30° ... +125 °C
Tensile strength in N/mm²	12	20	8,5
Wear resistance / Abrasion resistance	good	excellent	good
Resistance to: * • Oil, greases • Solvents • Acid • Alkalines • Petrol • UV light / weather exposure	 o o - - o +	 + o - - + +	 + + + + + +
General	MVQ offers very good mechanical properties over a very wide temperature range with satisfactory oil resistance. In comparison with other elastomers, MVQ has exceptionally high purity and is therefore used in particular in food and pharmaceutical applications.	PUR is known for exceptionally good mechanical characteristics with very good resistance to atmospheric and environmental influences. In addition, the extreme resistance to tearing and to wear, should also be mentioned.	TPE is a thermoplastic rubber, the performance characteristics of which are comparable to those of many customary vulcanised special rubbers. TPE is a multi-purpose material with outstanding dynamic fatigue strength and excellent resistance to ozone and atmospheric influences (environmental influences).

* + resistant, o conditionally resistant, – non-resistant

	Elastomers
Symbol	**TPU**
Trade name	Desmopan® / Elastollan®
Chemical description	Thermoplastic Polyurethane rubber
Hardness (Shore A)	55 ... 85
Temperature resistance • short-term • long-term	 –50° ... +120 °C –30° ... + 90 °C
Tensile strength in N/mm²	50
Wear resistance / Abrasion resistance	very good
Resistance to: * • Oil, greases • Solvents • Acid • Alkalines • Petrol • UV light / weather exposure	 + - - o o +
General	TPU has generally good physical properties, making it ideal for demanding applications in virtually all industrial areas. In addition to the very high wear and abrasion resistance, the excellent tear growth resistance and cold flexibility of the material at low temperatures should also be mentioned. TPU can be made for a large hardness range and from an ergonomic point of view it can also be used advantageously due to its good surface feel (Softline!).

* + resistant, o conditionally resistant, – non-resistant