

What is PC EN

PC (polycarbonate)

PC (polycarbonate) – amorphous, transparent high-performance thermoplastic, extremely impact-resistant and heat-resistant

PC (polycarbonate) is an amorphous, crystal-clear engineering thermoplastic known above all for its exceptional impact strength – PC is considered virtually unbreakable and is used, among other things, for safety glazing and machine guards. At the same time, with a continuous service temperature of up to about 120 °C, it is considerably more heat-resistant than acrylic glass (PMMA). Well-known brand names are Makrolon® and Lexan®.

Classification and basic character

PC belongs to the amorphous thermoplastics and therefore has no defined melting point, but softens above the glass transition temperature (around 147 °C). Its outstanding feature is extreme toughness: PC is barely breakable even at low temperatures and exceeds the impact strength of acrylic glass many times over. It is stiff, dimensionally stable and transparent (about 89 %), yet comparatively soft and scratch-sensitive at the surface. PC is also sensitive to many chemicals.

Impact strength, heat and transparency

PC combines three properties that set it apart from other transparent plastics: exceptionally high impact strength ("no break" in the unnotched Charpy test), a high heat deflection temperature with continuous service up to about 120 °C, and good transparency of about 89 %. Standard PC is normally flammable (UL 94 HB); however, flame-retardant grades (V-2/V-0) are available. This makes PC the preferred material when transparency must be combined with shatter resistance and higher temperature.

How PC is made and processed

PC is produced by polycondensation (mainly from bisphenol A and a carbonate source). For engineering parts it is extruded or cast into sheets, rods and tubes. From these semi-finished products we machine components – milling, turning, drilling and sawing produce clean results. PC can also be cold-bent (line bending) and thermoformed; before thermoforming it must be pre-dried due to its hygroscopy. After machining, annealing can be useful to relieve internal stresses. PC is only conditionally suitable for laser cutting (dark cut edge).

Mechanical, thermal and chemical properties

PC reaches a yield stress of about 60 MPa with a tensile modulus around 2,300 MPa and a density of about 1.20 g/cm³. Characteristic is the high elongation at break (>80 %) and the very high notched impact strength (about 65 kJ/m²) – PC is tough rather than brittle. The service temperature ranges from about -40 °C up to a continuous +120 °C, short-term to around 135 °C; the Vicat softening temperature is about 145 °C. Chemically, PC is sensitive: it is attacked by many solvents, alkalis and hydrocarbons and then tends to stress cracking; without UV protection it yellows outdoors.

When PC is the right choice

PC is worthwhile whenever transparency must be combined with shatter resistance, higher temperature or electrical insulation – for example:

- Safety and protective glazing, machine guard screens
- Impact-resistant sight windows, protective shields and visors
- Transparent components at temperatures above about 80 °C (up to 120 °C)
- Housings and insulating parts in electronics and electrical engineering
- Sterilisable components in medical and laboratory technology

When PC is NOT the right choice

Equally important are the limits of the material:

- Contact with solvents, alkalis or hydrocarbons (strong risk of stress cracking)
- Permanent outdoor use without UV protection – natural PC yellows; then UV-stabilised grades or PMMA
- Scratch- and abrasion-loaded surfaces – PC is soft; then hard-coated grades, PMMA or glass
- Highest optical clarity and non-yellowing – then PMMA
- Very tight budget – PMMA is usually cheaper

What does PC cost?

PC is a mid-priced engineering thermoplastic and is usually above acrylic glass (PMMA) but below high-performance plastics. As a rough guide, semi-finished stock prices are in the range of about 6–15 €/kg. The component price is determined mainly by the semi-finished shape and dimension, material utilisation (offcut), machining effort and lot size. We are happy to quote binding prices on request based on your drawing.

Processing at Liedtke

PC machines well – milling, turning, drilling and sawing produce clean, dimensionally accurate results. We also offer cold bending (line bending), thermoforming, polishing and bonding. Before thermoforming we pre-dry PC due to its hygroscopy; after machining, annealing can relieve internal stresses. Because of its stress-cracking sensitivity, we avoid solvent-based cutting fluids. This is how we reliably produce impact-resistant, transparent precision and protective parts – from single pieces to series production.

Advantages and disadvantages at a glance

An honest assessment – and how the disadvantages can be mitigated in practice:

Advantages

- Extremely high impact strength – virtually unbreakable, even in the cold
- High heat deflection temperature (continuous service up to ~120 °C)
- Good transparency (~89 %) and high stiffness
- Good electrical insulator; flame-retardant grades (V-0) available
- Good machinability, cold-bendable and thermoformable

Disadvantages

- Soft, scratch-sensitive surface (without hard coating)
- Sensitive to solvents, alkalis and hydrocarbons (stress cracking)
- Only limited weathering resistance without UV protection (yellowing)
- Higher price and slightly lower clarity than PMMA

Practical tip: PC plays to its strengths wherever transparency meets shatter resistance and higher temperatures – for example in safety glazing and machine guards. Where highest scratch resistance, non-yellowing and weathering resistance are required, acrylic glass (PMMA) is the better and cheaper choice; for permanent outdoor use, we recommend UV-stabilised PC grades.

Typical Properties

- Extremely high impact strength (virtually unbreakable)
- High heat deflection temperature (up to ~120 °C)
- Good transparency (~89 %)
- High stiffness and dimensional stability
- Good electrical insulator

Product Examples

- Safety and protective glazing
- Machine guard screens and protective shields
- Impact-resistant sight windows and visors
- Housings and insulating parts in electronics
- Sterilisable medical and laboratory parts

Typical Industries

- Mechanical and plant engineering
- Safety and glazing technology
- Electronics and electrical engineering
- Medical and laboratory technology
- Lighting and illumination technology
- Food industry

- Flame-retardant grades (V-0) available
- Good machinability and thermoformability
- Suitable for food contact
- Transparent components for higher temperatures

	Test Method	Unit	Value
General Properties			
Density	DIN EN ISO 1183-1	g / cm ³	1.20
Water absorption (24 h)	DIN EN ISO 62	%	0.3
Light transmission (3 mm)	DIN 5036-3	%	~ 89
Flammability	UL 94		HB (V-0 grades available)
Mechanical Properties			
Yield stress (23 °C)	DIN EN ISO 527	MPa	60
Elongation at break	DIN EN ISO 527	%	>80
Tensile modulus	DIN EN ISO 527	MPa	2300
Impact strength (Charpy, unnotched)	DIN EN ISO 179	kJ / m ²	no break
Notched impact strength (Charpy)	DIN EN ISO 179	kJ / m ²	65
Thermal Properties			
Glass transition temperature	ISO 11357	°C	~ 147
Vicat softening temperature	DIN EN ISO 306, Vicat B 50	°C	145
Heat deflection temperature	DIN EN ISO 75, method A, HDT	°C	130
Service temperature, long-term	Average	°C	-40 ... 120
Coefficient of linear thermal expansion	DIN 53752	10 ⁻⁶ / K	65
Electrical Properties			
Volume resistivity	DIN EN 62631-3-1	Ω * cm	>10 ¹⁵
Dielectric strength	IEC 60243	kV / mm	~ 30

The values stated are typical average values for colourless polycarbonate (PC); they serve as an aid to material selection and are not a legally binding warranty of specific properties. PC is amorphous and has no melting point. Fire behaviour and building material class are grade-dependent (flame-retardant grades available). PC is attacked by many solvents, alkalis and hydrocarbons and then tends to stress cracking; without UV protection it has only limited weathering resistance. Media resistance must be verified case by case. Food-contact suitability depends on the grade. Price information is a rough, non-binding guide and may vary depending on market situation, grade, dimension and quantity.