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What is PA 6 EN

PA 6

PA 6 (polyamide 6 / nylon 6) – semi-crystalline engineering thermoplastic

PA 6 is one of the most widely used engineering plastics – a tough, wear-resistant all-rounder with very good sliding and damping properties. Ideal for mechanically loaded functional parts such as gears, bearings and rollers.

Classification and basic character

PA 6 (polyamide 6, also nylon 6) is a semi-crystalline engineering thermoplastic of the polyamide family. It is characterised by high toughness, impact and abrasion resistance, very good sliding properties and pronounced sound and vibration damping. A special feature is its moisture absorption: it increases toughness but reduces stiffness and hardness and changes the dimensions.

How PA 6 is produced and processed

PA 6 is produced by ring-opening polymerisation of ε-caprolactam into long polyamide chains. Extruded semi-finished stock (rods, plates, tubes) is machined into precision parts; large-volume and thick-walled parts are often cast directly as cast polyamide (PA 6 G) by anionic polymerisation – yielding a lower-stress, more highly crystalline material. For dimensionally accurate parts we take moisture absorption into account and condition the stock if required.

Mechanical and physical properties

PA 6 reaches (dry) a yield stress of around 80 MPa at a modulus of about 3,200 MPa and a density of roughly 1.14 g/cm^3. The material is exceptionally tough and impact-resistant, very abrasion- and wear-resistant and has very good sliding properties at a low coefficient of friction. Added to this is good sound and vibration damping. In the conditioned (moist) state, toughness increases further while stiffness decreases.

Moisture absorption – the special feature of PA 6

Unlike POM or PEEK, PA 6 noticeably absorbs moisture from the environment – depending on the climate up to about 3 % (more when stored in water). This makes the material tougher and more impact-resistant, but reduces stiffness and hardness and causes dimensional changes due to swelling. In thick-walled parts only the surface layer is affected, the core remains dry. For tight tolerances we take the swelling into account or condition the material specifically.

Chemical and thermal resistance

PA 6 is well resistant to fuels, oils, greases, many solvents and alkalis. It is not resistant to strong acids, strongly oxidising media and – over longer periods – to hot water (hydrolysis). The service temperature ranges from about -40 °C to a continuous +85 °C, briefly up to around 160 °C. PA 6 is a good electrical insulator but not flame retardant (UL 94 HB). Physiologically safe grades for food contact are available.

When PA 6 is the right choice

PA 6 pays off when toughness, wear resistance and good sliding properties at a moderate price are required – for example:

- Highly loaded plain bearings, bushings, gears and rollers
- Impact- and shock-loaded parts (high impact strength)
- Sound- and vibration-damping components
- Wear parts in conveyor technology and mechanical engineering
- Components in food processing (food-grade variants)

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When PA 6 is NOT the right choice

Just as important are the limits of the material:

- Highest dimensional accuracy under changing humidity – POM is often the better choice here
- Permanent contact with hot water/steam or strong acids (hydrolysis/attack)
- Continuous use above approx. 85–100 °C or requirements for flame retardancy (only UL 94 HB)
- Applications with very high chemical or temperature requirements – then PVDF, PPS or PEEK
- Precision parts that must stay absolutely dry and dimensionally stable permanently

What does PA 6 cost?

PA 6 is one of the economical engineering plastics. As a rough guide, semi-finished stock (natural rod/plate) ranges from about 5–15 €/kg; cast polyamide (PA 6 G), oil- or glass-fibre-filled and coloured grades are higher. The part price is mainly determined by grade, stock form and dimension, material utilisation (waste), machining effort and batch size. We are happy to quote binding prices on request based on your drawing.

Machining at Liedtke

PA 6 machines well – turning, milling, drilling and sawing produce clean results with a good surface finish. Because of the moisture absorption and the comparatively high thermal expansion, for tight tolerances we take the swelling and shrinkage behaviour into account and condition the stock if required. This lets us reliably produce precision parts – from single parts to series production.

Advantages and disadvantages at a glance

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

Advantages

- Very high toughness and impact strength
- High abrasion and wear resistance
- Very good sliding and damping properties
- Good machinability and weldability, low material price
- Good resistance to oils, greases and fuels

Disadvantages

- Absorbs moisture – dimensional and property changes
- Not resistant to strong acids and hot water (hydrolysis)
- Not flame retardant (UL 94 HB), limited to approx. 85–100 °C continuous use
- Lower dimensional accuracy than POM under fluctuating humidity

Practical tip: where the highest dimensional accuracy is required we choose POM; where high temperatures or aggressive chemistry prevail, PVDF, PPS or PEEK. For tough, wear-resistant and damping functional parts, however, PA 6 is the most economical choice – for tight tolerances we condition the stock specifically.

Typical Properties

- Very high toughness and impact strength
- High abrasion and wear resistance
- Very good sliding properties
- Good sound and vibration damping
- Good machinability and weldability
- Good resistance to oils, greases, fuels
- Good electrical insulation properties
- Food-grade variants available

Product Examples

- Plain bearings, bushings and sliding strips
- Gears, pinions and sprockets
- Rollers and rope sheaves
- Impact strips and buffers
- Guide and wear parts
- Idler and tensioning rollers (conveyor technology)
- Insulating and electrical components
- Components for food processing

Typical Industries

- Mechanical and plant engineering
- Conveyor technology & automation
- Food industry
- Meat, fish and poultry processing
- Bakery and confectionery
- Automotive engineering
- Aerospace
- Agriculture & commercial vehicles

	Test Method	Unit	Value
General Properties			
Density	DIN EN ISO 1183-1	g / cm³	1.14
Moisture absorption	DIN EN ISO 62	%	3.0
Flammability (thickness 3 mm / 6 mm)	UL 94		HB / HB
Mechanical Properties			
Yield stress	DIN EN ISO 527	MPa	80
Elongation at break	DIN EN ISO 527	%	50
Tensile modulus	DIN EN ISO 527	MPa	3200
Notched impact strength	DIN EN ISO 179	kJ / m²	3
Shore hardness	DIN EN ISO 868	scale D	82
Thermal Properties			
Melting temperature	ISO 11357-3	°C	220
Thermal conductivity	DIN 52612-1	W / (m * K)	0.23
Specific heat capacity	DIN 52612	kJ / (kg * K)	1.70
Coefficient of linear thermal expansion	DIN 53752	10^{-6} / K	90
Service temperature, long-term	Average	°C	-40 ... 85
Service temperature, short-term (max.)	Average	°C	160
Heat deflection temperature	DIN EN ISO 75, method A, HDT	°C	75
Electrical Properties			
Dielectric constant	IEC 60250		3.9
Dielectric dissipation factor (50 Hz)	IEC 60250		0.02
Volume resistivity	DIN EN 62631-3-1	Ω * cm	10^{15}
Surface resistivity	DIN EN 62631-3-2	Ω	10^{13}
Dielectric strength	IEC 60243	kV / mm	20

The values given are typical average values for unreinforced PA 6 natural; they serve as an aid to material selection and are not a legally binding warranty of specific properties. Polyamides absorb moisture, which changes mechanical properties and dimensions; the values apply to dry material. Price figures are rough, non-binding guide values and may vary depending on market situation, grade, dimension and quantity. Actual values may deviate depending on the semi-finished stock, grade and degree of crystallinity.

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