

What is PA 6 G EN

PA 6 G

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

PA 6 G is the cast variant of polyamide 6 – cast nylon. Thanks to its special manufacturing process it is stiffer, harder and more dimensionally stable than extruded PA 6 and, above all, available in large dimensions and thick cross-sections – ideal for large gears, rollers and wear parts.

Classification and basic character

PA 6 G (cast polyamide 6, also cast nylon) is a semi-crystalline engineering thermoplastic of the polyamide family. Chemically it is PA 6, but it is not extruded – it is cast directly in a mould. This results in a particularly high degree of crystallinity and thus higher stiffness, hardness, heat deflection temperature and dimensional stability, as well as a very low-stress material. Like all polyamides, PA 6 G absorbs moisture.

How PA 6 G is produced and processed

PA 6 G is produced by anionic polymerisation of ϵ -caprolactam directly in a mould – the liquid monomer polymerises pressure-free into the finished semi-finished stock (casting). This allows very large and thick-walled plates, rods, tubes and near-net-shape castings to be produced that would hardly or not at all be available by extrusion. The result is lower-stress and more highly crystalline than extruded PA 6. We machine precision and large parts from this stock; we take moisture absorption into account for tight tolerances.

Mechanical and physical properties

PA 6 G reaches (dry) a yield stress of around 75 MPa at a modulus of about 3,400 MPa and a density of roughly 1.15 g/cm³. Compared with extruded PA 6 it is stiffer and harder, very abrasion- and wear-resistant and still tough. It has very good sliding properties and good weldability. In the conditioned (moist) state, toughness increases and stiffness decreases somewhat.

Moisture absorption – the special feature of PA

Like all polyamides, PA 6 G absorbs moisture from the environment – depending on the climate up to about 2.5 % (more when stored in water), slightly less than extruded PA 6. 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 G 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 +110 °C, briefly up to around 170 °C – slightly higher than extruded PA 6 thanks to the higher crystallinity. Not flame retardant (UL 94 HB). Physiologically safe grades for food contact are available.

PA 6 G or extruded PA 6?

Both are chemically PA 6, but differ in manufacture and properties:

- PA 6 G (cast) – higher stiffness, hardness, HDT and dimensional stability, lower stress, available in very large/thick-walled dimensions; ideal for large parts
- PA 6 (extruded) – somewhat tougher/more impact-resistant, cheaper, in smaller standard dimensions; ideal for small to medium parts
- For large gears, rollers and thick-walled components, PA 6 G is usually the first choice

When PA 6 G is the right choice

PA 6 G pays off when large, stiff and wear-resistant parts are required – for example:

- Large gears, pinions, chain and rope wheels
- Large idler, deflection and rope rollers
- Thick-walled plates and large castings (near-net-shape)
- Sliding and wear parts with high surface pressure
- Components for offshore, subsea, wind power and conveyor technology

When PA 6 G 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. 110 °C or requirements for flame retardancy (only UL 94 HB)
- Very high chemical or temperature requirements – then PVDF, PPS or PEEK
- Small, simple parts in standard dimensions – extruded PA 6 is more economical here

What does PA 6 G cost?

PA 6 G is somewhat more expensive than extruded PA 6, as casting is more elaborate. As a rough guide, semi-finished stock (natural rod/plate) ranges from about 8–20 €/kg; oil- or MoS₂-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 G machines excellently – turning, milling, drilling and sawing produce clean results with a good surface finish. Thanks to the low-stress cast structure it is particularly suitable for dimensionally accurate large parts. Because of the moisture absorption and 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 and large 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

- Higher stiffness, hardness and dimensional stability than extruded PA 6
- Low stress, available in very large/thick-walled dimensions
- High abrasion and wear resistance, good sliding properties
- Good machinability and weldability
- 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. 110 °C continuous use
- Somewhat more expensive than extruded PA 6

Practical tip: for large, stiff and dimensionally stable parts PA 6 G is the first choice; for small standard parts we use the more economical extruded PA 6. Where the highest dimensional accuracy under humidity is required we recommend POM, and for aggressive chemistry or high temperatures PVDF, PPS or PEEK.

Typical Properties

- Higher stiffness and hardness (cast polyamide)

Product Examples

- Large gears, pinions and chain wheels
- Idler, deflection and rope rollers

Typical Industries

- Mechanical and plant engineering
- Automotive engineering

- Very good dimensional stability, low stress
- High abrasion and wear resistance
- Good toughness and impact strength
- Very good sliding properties
- Good machinability and weldability
- Available in very large/thick-walled dimensions
- Food-grade variants available
- Thick-walled plates and large castings
- Plain bearings, bushings and sliding strips
- Wear and guide parts
- Components for offshore, subsea and wind power
- Insulating and electrical components
- Components for food processing
- Oil and gas / subsea
- Wind power
- Conveyor technology & automation
- Construction industry
- Food industry
- Meat, fish and poultry processing

	Test Method	Unit	Value
General Properties			
Density	DIN EN ISO 1183-1	g / cm ³	1.15
Moisture absorption	DIN EN ISO 62	%	2.5
Flammability (thickness 3 mm / 6 mm)	UL 94		HB / HB
Mechanical Properties			
Yield stress	DIN EN ISO 527	MPa	75
Elongation at break	DIN EN ISO 527	%	45
Tensile modulus	DIN EN ISO 527	MPa	3400
Notched impact strength	DIN EN ISO 179	kJ / m ²	3
Shore hardness	DIN EN ISO 868	scale D	83
Thermal Properties			
Melting temperature	ISO 11357-3	°C	216
Thermal conductivity	DIN 52612-1	W / (m * K)	0.25
Specific heat capacity	DIN 52612	kJ / (kg * K)	1.70
Coefficient of linear thermal expansion	DIN 53752	10 ⁻⁶ / K	80
Service temperature, long-term	Average	°C	-40 ... 110
Service temperature, short-term (max.)	Average	°C	170
Heat deflection temperature	DIN EN ISO 75, method A, HDT	°C	95
Electrical Properties			
Dielectric constant	IEC 60250		3.7
Dielectric dissipation factor (50 Hz)	IEC 60250		0.02
Volume resistivity	DIN EN 62631-3-1	Ω * cm	10 ¹⁵

	Test Method	Unit	Value
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 G 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.

Liedtke
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