

Material properties metals (Brass, stainless steel, zinc die cast)

Material	Unit	Brass	Stainless steel	Zinc die cast
Material abbreviation		CuZn39Pb3	X8CrNiS18-9	GB-ZnAl4Cu1
Further names			1.4305	ZP0410
Basic properties				
Halogen-free		yes	yes	yes
Phosphorous-free		yes	yes	yes
Silicone free		yes	yes	yes
Physical properties				
Water-tightness	[g/cm ³]	8,45	7,9	6,7
Moisture absorption at +23 °C	[%]	0	0	0
Linear shrinkage	[%]	n.i.	n.i.	0,6–1,1
Thermal properties				
Flammability to UL94		(not inflammable)	(not inflammable)	(not inflammable)
UL test number		not UL-tested	not UL-tested	not UL-tested
Melting point	[°C]	895	ca. 1450	380
Thermal conductivity	[W/mK]	117	n.i.	110
Mechanical properties				
Tensile modulus	[GPA]	ca. 96	200	85
Impact strength at +23 °C	[kJ/m ²]	n.i.	n.i.	n.i.
Notched impact strength at +23 °C	[kJ/m ²]	ca. 200	n.i.	n.i.
Hardness		n.i.	n.i.	n.i.
Electrical properties				
Specific electrical resistance	[Ω x mm ² /m]	0,066	0,73	n.i.
Resistance				
Weather		1–2	1–2	2
UV		1–2	1–2	1–2
Ozone		1–2	1–2	n.i.
Ozone 20 ppm in air		1–2	1–2	n.i.
Ozone 1 ppm in water		1–2	1–2	n.i.
Ageing		1–2	1–2	2–3
Acetone (2 %)		2	1	n.i.
Ethanol (40 Vol.)		1	1	1–2
Ammonia dry/moist		2/X	2/n.i.	n.i.
Benzene		1	1	2
Petrol Normal/ Super fuel to DIN		1	1	1–2
Brake fluid (Hydraulic-BASF)		n.i.	1–2	n.i.
Steam (Sterilization DIN 58946)		2–3	1–2	n.i.
Diesel fuel to DIN		2	1	n.i.
Crude oil/fuel oil/mineral oil		2	1	1–2
Faeces		n.i.	1–2	n.i.
Gear oil, mild alloy		2	1–2	2
Hydraulic oil (mineral oil based)		2	1–2	2
Potassium hydroxide solution		3	1–2	2
Kerosene		n.i.	n.i.	n.i.
Carbon dioxide		3	1	n.i.
Paints		1	1	1
Solvents		1	1	1–2
Stove enamelling (150 °C)		1	1	1
Glue		2	1	n.i.
Air, atmospheric		1	1	1
Air, containing oil vapor		2	1	1
Seawater		3	2	3
Methanol		1	1	n.i.
Sodium chloride (aqueous)		3	3	2–3
Oil (vegetable, etheric)		2	1–2	n.i.
Petroleum		2	1	n.i.
Phosphoric acid (50 %)		X	2	X
Nitric acid (40 %)		X	2	X
Hydrochloric acid (38 %)		X	3	X
Sulphuric acid (30 %)		X	X	X
Soap solution (80 °C/<10 Gew.%)		2	2	2
Silicon oils and greases (≤ 80 °C)		2	2	n.i.

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Turpentine (oil)		2	2	n.i.
Transformer oil (DIN 51507) (50 °C)		n.i.	2	n.i.
Drinking water		1	1	1
Detergent solution (heavy-duty) (20 °C/80 °C)		n.i.	2	2

Key for resistance ratings:

1 = very good resistance

2 = good resistance

3 = mean/conditional resistance

X = not resistant

n.i. = no information

Z.e. = determine precise composition

The values provided here are guideline values only, based on our current state of knowledge and cannot be used as the basis for any legally binding assurance of certain characteristics or concrete cases of application. To ascertain the concrete suitability of a particular product, a test of the finished part under the specific application conditions is necessary.

Material properties thermoplastics

Material	Unit	Polyamide		Polyamide		Polyethylene	Acrylonitrile butadiene styrene	High density polyethylene	Polyoxymethylene
Material abbreviation		PA6	PA6.6	PA6 GF	PA6.6 GF	PP	ABS	PE-HD	POM
Basic properties									
Halogen-free		yes	yes	yes	yes	yes	yes	yes	yes
Phosphorous-free		yes	yes	yes	yes	yes	yes	yes	yes
Silicone free		yes	yes	yes	yes	yes	yes	yes	yes
Physical properties									
Water-tightness	[g/cm ³]	1,14	1,13	1,35	1,35	0,90	1,05	0,95	1,41
Tensile strength	[MPa]	40	56	95	140	20	32	20	65
Moisture absorption at +23 °C	[%]	2,5–3,0	2,5–3,0	2,5–3,0	2,5–3,0	0,1	0	0	0,17
Thermal properties									
min. sustained application temp. static dynamic	[°C]	–40	–40	–40	–40	–40	–40	–20	–40
	[°C]	–20	–20	–20	–20	–20	–20	–20	–20
max. sustained application temperature	[°C]	80–110	80–120	90–120	100–140	90–100	70–90	70–90	90–110
Mechanical properties									
Tensile modulus (ISO 527)	[MPa]	1300	1800	6500	7200	1200	2500	1100	3000
Impact strength at +23 °C (ISO 179/1eA)	[kJ/m ²]	30	15–25	40–60	10–18	3–20	5–20	5	4–10
Ball penetration hardness (ISO 2039-1)	[MPa]	75	80	110	170	36–90	50–95	28	160
Electrical properties									
Dielectric strength	[kV/mm]	60	80	70	75	100	120	150	120
Specific volume resistance	[Ω x cm]	1012	1012	1012	1012	1017	1015	1017	1015

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The specific material properties of plastics offer new and cost-effective design possibilities. Plastic products such as plastic nuts or screws have a great number of advantages, including electrical isolation, low weight, elasticity, toughness, scratch resistance, resistance to corrosion, chemicals and the influence of the weather. The color of plastic parts can also be matched to that of the finished product.

Polyamide 6 and 6.6

Very good mechanical properties in regard to tensile characteristics, fatigue, shocks, friction and wear. Very good resistance to solvents: petroleum, lubricating oils, petrol, benzene, acetone, trichloroethylene, petroleum ether. Not affected by the majority of acids in the dilute state. Hardly flammable to self-extinguishing.

Polyamide 6 and 6.6 GF

In contrast to PA 6 and 6.6, the properties of these materials are enhanced in the following areas for the most part: superior mechanical behavior in respect of tension and bending (low shock value). Better thermal behavior.

High-pressure polyethylene PE-HD

Excellent electrical isolation, low loss factor, high resistivity and resistance to changes in shape, does not affect foodstuffs, low coefficient of friction.

Polyoxymethylene, Polyacetal POM

Good chemical behavior, good mechanical properties (fatigue resistance). Very good long-term dimensional stability, not affect by mold fungus or storage in the soil.

Further technical informations about materials upon request.