

## 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
<b>Basic properties</b>				
Halogen-free		yes	yes	yes
Phosphorous-free		yes	yes	yes
Silicone free		yes	yes	yes
<b>Physical properties</b>				
Water-tightness	[g/cm <sup>3</sup> ]	8,45	7,9	6,7
Moisture absorption at +23 °C	[%]	0	0	0
Linear shrinkage	[%]	n.i.	n.i.	0,6–1,1
<b>Thermal properties</b>				
Flammability to UL94		(not inflammable)	(not inflammable)	(not inflammable)
UL test number		not UL-tested	not UL-tested	not UL-tested
min. sustained application temp. static	[°C]			
dynamic	[°C]			
max. sustained application temperature	[°C]			
Melting point	[°C]	895	ca. 1450	380
Thermal conductivity	[W/mK]	117	n.i.	110
<b>Mechanical properties</b>				
Tensile modulus	[GPA]	ca. 96	200	85
Impact strength at +23 °C	[kJ/m <sup>2</sup> ]	n.i.	n.i.	n.i.
Notched impact strength at +23 °C	[kJ/m <sup>2</sup> ]	ca. 200	n.i.	n.i.
Hardness		n.i.	n.i.	n.i.
<b>Electrical properties</b>				
Specific electrical resistance	[Ω x mm <sup>2</sup> /m]	0,066	0,73	n.i.
<b>Resistance</b>				
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

Material	Unit	Brass	Stainless steel	Zinc die cast
Material abbreviation		CuZn39Pb3	X8CrNiS18-9	GB-ZnAl4Cu1
Further names			1.4305	ZP0410
Silicon oils and greases ( $\leq 80^\circ\text{C}$ )		2	2	n.i.
Turpentine (oil)		2	2	n.i.
Transformer oil (DIN 51507) ( $50^\circ\text{C}$ )		n.i.	2	n.i.
Drinking water		1	1	1
Detergent solution (heavy-duty) ( $20^\circ\text{C}/80^\circ\text{C}$ )		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.

(Source: Jacob GmbH)

## Material properties thermoplastics

Material	Unit	Polyamide	Polyamide	Polyamide	Polyamide	Polyethylene	Polyoxymethylene
Material abbreviation		PA6 V-2	PA6 V-0	PA6 V-2	PA6 GF30	PE	POM
<b>Colors</b>							
		RAL 7001 RAL 7035 RAL 9005	RAL 7032 RAL 7035 RAL 9005	RAL 7001	RAL 7001 RAL 7035 RAL 9005		
<b>Basic properties</b>							
Halogen-free		yes	yes	yes	yes	n.i.	n.i.
Phosphorous-free		yes	yes	yes	n.i.	n.i.	n.i.
Silicone free		yes	yes	yes	yes	n.i.	n.i.
<b>Physical properties</b>							
Water-tightness	[g/cm <sup>3</sup> ]	1,12	1,1–1,5	1,13/1,15	1,36	0,92	1,40
Moisture absorption at +23 °C	[%]	2,0–3,0	2,0–3,0	2,6/3,4	2,0	n.i.	0,2
Linear shrinkage	[%]	1,2–2,5	1,2–2,5	1,2–2,5	0,5–1,5	n.i.	1,2–3,2
<b>Thermal properties</b>							
Flammability to UL94		V2 hardly flammable	V0 extinguishes	V2 hardly flammable	HB	n.i.	HB
UL-Test number		E86034	E86034	E86068	E86034	n.i.	E41871
min. sustained application temp. static	[°C]	-40	-40	-40	-40	-35	-40
dynamic	[°C]	-20	-20	-20	-25	-30	-30
max. sustained application temperature	[°C]	125	125	ca. 120	ca. 115	90	90
Plastic yield at high temperature (ISO 75) Method A	[°C]	65	85	65	210	n.i.	105
(ISO 75) Method B	[°C]	160	185	160	220	n.i.	n.i.
Melting point	[°C]	221	225	ca. 220	225	ca. 120	ca. 165
Thermal conductivity	[W/mK]	ca. 0,22	ca. 0,22	0,22	0,24	0,3–0,5	n.i.
<b>Mechanical properties</b>							
Tensile modulus	[MPa]	ca. 3200	ca. 3300	3300	9500	n.i.	2700
Impact strength at +23 °C (ISO 179/1eU)	[kJ/m <sup>2</sup> ]	no breakage	no breakage	no breakage	no breakage	n.i.	210
Notched impact strength at +23 °C (ISO 179/1eA)	[kJ/m <sup>2</sup> ]	ca. 4,5	ca. 3,2	ca. 4,5	4–10	n.i.	6
Ball penetration hardness (ISO 2039-1)	[MPa]	ca. 130	ca. 130	n.i.	ca. 200	n.i.	145
<b>Electrical properties</b>							
Specific volume resistance (IEC 60093)	[Ω x cm]	1 E 15	1 E 15	n.i.	1 E 15	n.i.	1 E 13
CTI Comparative tracking index (IEC 60112)	[V]	600	600	n.i.	575	n.i.	600
<b>Resistance</b>							
Weather		generally resistant	generally resistant	generally resistant	generally resistant	2	n.i.
UV		generally resistant	generally resistant	generally resistant	generally resistant	generally resistant	UV sensitive
Ozone		3	3	3	3	n.i.	X
Ozone 20 ppm in air (RT)		n.i.	n.i.	3	3	n.i.	3
Ozone 1 ppm in water (RT)		n.i.	n.i.	2	2	n.i.	n.i.
Ageing		n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
Acetone (2%) (RT)		1	1	2	2	2–3	2
Ethanol (40 Vol.) (RT)		2	2	2	2	1	2
Ammonia (20% by weight) (RT)		1	1	2	2	1	2
Benzene (RT)		1–2	1–2	2	2	X	2
Petrol Normal/ Super fuel to DIN (RT)		1	1	2	2	X	2
Brake fluid (Hydraulic-BASF) (60 °C)		1–2	1–2	2	2	2	2
Steam (Sterilization DIN 58946)		3	3	3–X	3–X	X	2
Diesel fuel to DIN		1	1	2	2	2	2
Crude oil/fuel oil/mineral oil (RT)		1	1	2	2	2	2
Faeces		2	2	n.i.	n.i.	1	n.i.
Gear oil, mild alloy (≤ 130 °C)		n.i.	n.i.	2	2	n.i.	2
Hydraulic oil (mineral oil based) (100 °C)		2	2	2	2	3	n.i.
Potassium hydroxide solution		1	1	3 (50% by wgt)	3 (50% by wgt)	1	3 (50% by wgt)
Kerosene		2	2	n.i.	n.i.	X	n.i.
Carbon dioxide		1	1	n.i.	n.i.	1	n.i.

Material	Unit	Polyamide	Polyamide	Polyamide	Polyamide	Polyethylene	Polyoxymethylene
Material abbreviation		PA6 V-2	PA6 V-0	PA6 V-2	PA6 GF30	PE	POM
Paints		2	2	n.i.	n.i.	Z.e.	n.i.
Solvents (RT)		1-2	1-2	2	2	Z.e.	2
Stove enamelling (150 °C)		n.i.	n.i.	2	2		3
Glue (RT)		n.i.	n.i.	2	2	1	2
Air, atmospheric (RT)		1	1	2	2	up to 90 °C	2
Air, containing oil vapor		1	1	n.i.	n.i.	up to 90 °C	n.i.
Seawater		1	1	2	2	1	2
Methanol (RT)		1-2	1-2	2 (9-14%)	2 (9-14%)	1	2
Sodium chloride (aqueous) (RT)		1	1	3 (10% by wgt)	3 (10% by wgt)	1	n.i.
Oil (vegetable, etheric) (RT)		2-3	2-3	2	2	2-3	2
Petroleum (80 °C)		1-2	1-2	2	2	2-3	2
Phosphoric acid (50%)		X	X	X	X	1	X
Nitric acid (40%)		X	X	X	X	X	X
Hydrochloric acid (38%)		X	X	X	X	1	n.i.
Sulphuric acid (30%)		X	X	X	X	1	n.i.
Soap solution (80 °C/<10 Gew.%)		1	1	2	2	1	2
Silicon oils and greases (≤ 80 °C)		1-2	1-2	2	2	1	2
Turpentine (oil)		1-2	1-2	2 (1%)	2 (1%)	3	2
Transformer oil (DIN 51507) (50 °C)		1-2	1-2	2	2	3	2
Drinking water		1	1	2	2	1	2
Detergent solution (heavy-duty) (20 °C/80 °C)		/3	/3	2/3	2/3	1	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.

(Source: Jacob GmbH)

## Material properties sealing rings, sealing inserts, sealing grommets

Material abbreviation	Unit	CR/NBR	NBR	NBR	SBR
		Polychloroprene- nitrile rubber	Acrylonitrile butadiene rubber	Acrylonitrile butadiene rubber	Styrene butadiene rubber
<b>For article series (examples)</b>					
Sealing rings for PERFECT cable glands		●			
Multiple sealing inserts for PERFECT cable glands					
Sealing inserts for WADI cable glands		●	●		
Sealing inserts for UNI DICHT cable glands					
Multiple sealing rings					●
Simple and flat cable sealing rings					●
Flat sealing rings on external threads		● (only CR)			
O-rings				●	
Rubber bushings		● (only CR)			
Sealing grommets		● (only CR)			
<b>Basic properties</b>					
Halogen-free		no	n.i.	yes	n.i.
Phosphorous-free		n.i.	n.i.	yes	n.i.
Silicone free		n.i.	n.i.	yes	n.i.
<b>Thermal properties</b>					
UL-Test number		n.i.	n.i.	n.i.	n.i.
Combustibility		extinguishes	n.i.	n.i.	n.i.
Flame resistance		very good	unsatisfactory	n.i.	unsatisfactory
min. temporary application temperature	[°C]	-40	-40	-35	-40
min. sustained application temperature	[°C]	-20	-30	-30	-30
max. sustained application temperature	[°C]	100	110	80	100
max. temporary application temperature	[°C]	130	130	100	110
<b>Mechanical properties</b>					
Hardness	[Shore A]	30-90	70-80	70-80	30-90
Tensile strength	[N/mm <sup>2</sup> ]	7-25	7-12	≥ 10	7-30
Notched impact strength		good	good	n.i.	good
Abrasion resistance		very good/good	very good/good	n.i.	very good/good
Gas permeability (Diffusion)		mediocre permeable	mediocre permeable	n.i. n.i.	good permeable
<b>Electrical properties</b>					
Dielectric strength		mediocre	mediocre	poor	very good
<b>Resistance</b>					
Weather		1-2	3	3	X
UV		1-2	2	2	3
Ozone		2	3-X	X	X
Ageing		1-2	1	1	2-3
Acetone		1	X	X	3
Ethanol		1	1	1	1
Ammonia water-free		2	1-2	1-2	2
Benzene		X	3-X	X	X
Petrol Normal/ Super fuel to DIN		3-X	2	2-3	X
Brake fluid		3	3	Z.e.	X
Steam		X	up to 100 °C	up to 80 °C	X
Diesel fuel to DIN		3	1	1	X
Crude oil		3	1	1-2	X
Faeces fluid		1	1	n.i.	1
Fuel oil		3	1	1	X
Hydraulic oil (mineral oil based)		3	1	1	X
Potassium hydroxide solution		1	1	2	1
Kerosene		3-X	2	2	X
Carbon dioxide		1	1	1	1
Paints		Z.e.	Z.e.	Z.e.	Z.e.
Glue		1	1	1	2
Air, atmospheric, oil-free		up to 90 °C	up to 90 °C	up to 80 °C	up to 70 °C
Air, containing oil vapor		up to 90 °C	up to 100 °C	up to 80 °C	X

Key for resistance ratings:  
 1 = very good resistance  
 2 = good resistance  
 ● = material used for article

3 = mean/conditional resistance  
 X = not resistant

n.i. = no information  
 Z.e. = determine precise composition

	SBR/NBR	MQV	EPDM	FKM	TPE	PE	Centellen
	Styrene butadiene rubber with nitrile	Silicone rubber	Ethylene Propylene Terpolymere rubber	Fluorinated rubber	Thermoplastic elastomer	Polyethylene	
				•	•		
					•		
	•	•					
				•		•	•
		•	•				
	n.i.	n.i.	n.i.	no	yes	n.i.	n.i.
	n.i.	n.i.	n.i.	yes	yes	n.i.	n.i.
	n.i.	no	n.i.	yes	yes	n.i.	n.i.
	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
	unsatisfactory	unsatisfactory	n.i.	very good	n.i.	n.i.	n.i.
	-40	-80	-60	-25	-40	-40	n.i.
	-30	-50	-50	-20	-30	-30	-200
	100	175	120	200	140	80	200
	110/120	230	130	220	n.i.	100	350
	50-60	20-80	25-90	65-75	61	15,7 (H10)	n.i.
	5-10	4-9	7-20	9-11	10	5	11
	good	unsatisfactory	n.i.	mediocre	n.i.	n.i.	n.i.
	good/mediocre	mediocre	n.i.	good	n.i.	n.i.	n.i.
	mediocre permeable	very good permeable	very good permeable	impermeable	n.i.	n.i.	impermeable
	mediocre	very good	good	good	n.i.	> 25 kV/mm	n.i.
	3	1	n.i.	1	n.i.	2	1
	2-3	1	n.i.	1	1 (for black)	n.i.	2
	3-X	1	2	1	no cracks	n.i.	2
	2-3	1	n.i.	1	n.i.	n.i.	n.i.
	2-3	2	1	X	n.i.	2-3	2
	1-2	2	1	1	2	1	2
	1-2	2	1	X	n.i.	1	2
	X	X	X	2	n.i.	X	2
	X	X	X	1	n.i.	3	2
	3-X	X	X	Z.e.	3	2	n.i.
	3-X	X	up to 130 °C	up to 80 °C	n.i.	X	up to 175 °C
	X	3	X	1	n.i.	2	2
	X	3	X	1	n.i.	2	2
	1	1	1	Z.e. (1)	n.i.	1	1
	3-X	3	X	1	n.i.	2	2
	3-X	2	X	1	n.i.	3	2
	1-2	3	1	3	n.i.	1	n.i.
	3-X	3	X	1	n.i.	X	2
	1	1	1	1	n.i.	1	n.i.
	Z.e.	Z.e.	Z.e.	Z.e.	n.i.	Z.e.	n.i.
	2	1	3	1	n.i.	Z.e.	n.i.
	70 °C	up to 230 °C	up to 120 °C	up to 200 °C	n.i.	up to 90 °C	n.i.
	3-X/Z.e.	up to 150 °C	X	up to 200 °C	n.i.	up to 90 °C	n.i.

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.

(Source: Jacob GmbH)

Cable glands

Material abbreviation	Unit	CR/NBR	NBR	NBR	SBR
		Polychloroprene-nitrile rubber	Acrylonitrile butadiene rubber	Acrylonitrile butadiene rubber	Styrene butadiene rubber
Solvents for paints		Z.e.	Z.e.	Z.e.	Z.e.
Seawater		1	1	1	3
Methanol		1	1	1 (up to 20 °C)	2
Mineral oil		2-3	1	1	X
Sodium chloride (aqueous)		1	1	1	1
Oil (vegetable, etheric)		2	1	n.i.	3-X
Petroleum		3	1	1	X
Phosphoric acid (50 %)		1-2	2	X	2-3
Nitric acid (40 %)		X	X	X	X
Hydrochloric acid (38 %)		3	3	X	2-3
Sulphuric acid (30 %)		2	2	3	2-3
Soap solution		1	1	1	1
Silicon oils and greases		1	1	1	n.i.
Turpentine (oil)		X	1	3 (up to 60 °C)	X
Transformer oil (Pyranole)		X	1	1	X
Drinking water		2 (up to 70 °C)	1 (up to 100 °C)	1 (up to 100 °C)	1 (up to 70 °C)
Detergent solution		2	1	1	1
Sugar (aqueous)		1	1	1	1

Key for resistance ratings:  
 1 = very good resistance  
 2 = good resistance  
 ● = material used for article

3 = mean/conditional resistance  
 X = not resistant

n.i. = no information  
 Z.e. = determine precise composition

**Explanation of the material tables**

The tables provide summarized non-binding guideline values. The information supplied is intended as an aid to working with the equipment and permits only an initial selection to be made. It refers to parts not subjected to load. The list of materials makes no claim to completeness, and was drawn up largely on the basis of documentation provided by the raw material manufacturers. No legally binding assurance of certain characteristics or concrete case of application may be derived from the information provided. No warranty is accepted for the workmanship of raw materials used in our products. To ascertain their suitability in concrete cases, a product test under specific application conditions and qualified advice by material engineers and designers is necessary.

**Notes on the different levels of resistance:**

- 1 Very good resistance: Material is unlikely to be destroyed by the chemical product in question.
- 2 Good resistance: Material may be expected to demonstrate good to fair serviceability. After exposure to the relevant chemical product, it may be destroyed in time.
- 3 Medium/conditional resistance: Material is likely to demonstrate limited serviceability when coming into sporadic contact with the relevant chemical product. Continuous contact destroys the material.
- X Not resistant: The material cannot be recommended for this application.

**Free of silicone and PWIS**

The usage of silicone and other paint-wetting impairment substances is being vastly used in the production of our cable glands and accessories. Nevertheless we are unable to provide the assurance of absolute silicone- and PWIS-free execution as a residual risk of diffusion or contamination from the environment caused by PWIS and silicone-like products cannot be ruled out.

**Weather resistance**

External exposure to weather is caused by a combination of chemical effects (oxygen, water, ozone, atmospheric pollution) with simultaneous exposure to heat and UV radiation. This interaction places a considerable strain on plastics. An unsuitable choice of materials can lead to destruction of products within a short period.

**Sustained application temperature**

Temperature resistance over years. Within this time, the physical properties of the material alter due to heat ageing to a degree considered reasonable for technical components in accordance with experience values.

	SBR/NBR	MVQ	EPDM	FKM	TPE	PE	Centellen
	Styrene butadiene rubber with nitrile	Silicone rubber	Ethylene Propylene Terpolymere rubber	Fluorinated rubber	Thermoplastic elastomer	Polyethylene	
	3-X/Z.e.	Z.e.	Z.e.	Z.e.	n.i.	Z.e.	n.i.
	2	3	1	1	2	1	n.i.
	1-2	2	1	1-2	3	1	2
	3-X	3	X	1	n.i.	2	2
	1	1	1	1	n.i.	1	2
	3-X	2	2-3	Z.e.	n.i.	2-3	2
	3-X	X	X	1	n.i.	2-3	n.i.
	2-3	1	1	1	n.i.	1	2
	X	X	2	2	X	X	X
	3	X	1	1-2	2-3	1	3
	3	3	1	1	2	1	3
	1	2	1	1	n.i.	1	n.i.
	1-2	1	1	1	n.i.	1	n.i.
	X	3	X	1	n.i.	3	2
	X	3	X	1	n.i.	3	2
	1 (up to 70°C)	2	1 (up to 120°C)	1 (up to 80°C)	2	1	1
	1	2	1	n.i.	n.i.	1	n.i.
	1	1	1	1	n.i.	1	n.i.

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.

(Source: Jacob GmbH)

### Temperature range

**Dynamic:** In the specified temperature range, the cable gland is capable of resisting a shock with an energy value that must not exceed the equivalent value in the shock impact category classified by the manufacturer in accordance with EN 50262.

**Static:** In the specified temperature range, the correctly fitted cable gland with its lead installed as per specifications must not be subjected to any further forces (shock, tension, pressure, etc.). The fastening place (e.g. housing), the cable gland and the inserted lead must be in a position of rest. A fixed lead must be in a position of rest. Fixed cable routing must be complied with. The cable gland should not be regarded as a single component. Instead, the user must consider the sum of all predominant ambient conditions at the site of installation.

### Literature sources

Technical data sheets – guideline values for materials of different raw material manufacturers, Compendium of plastics, Franck, Vogel-Verlag, Plastic polymer materials, Krebs/Anvodet, Rubber-cautschouc-elastomers, Krebs