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Wheels and castors guide

Wheels and castors guide

A few steps to the optimal product

1 Select your product.

Wheels, swivel and fixed castors or press-on bands / tyres can be used depending on the application.

Swivel castors can rotate, while fixed castors run in a fixed direction. The castors can be attached using a top plate, bolt hole, stem, expander or plug-in pin.
(See page 44, 104–111 for more information)

Product type	Wheel	Swivel castor	Fixed castor	Press-on band / tyre	
					
Fixing	**Top plate**	**Bolt hole**	**Stem**	**Expander**	**Plug-in pin**
					

2 Determine the required load capacity.

The load capacity required for a wheel or castor is calculated by dividing the dead weight of the transport equipment and its additional weight by the number of supporting wheels or castors.

The result is then multiplied by a safety factor dependent on the application conditions.
(See page 46 for more information)

$$T = \frac{E+Z}{n} \times S$$

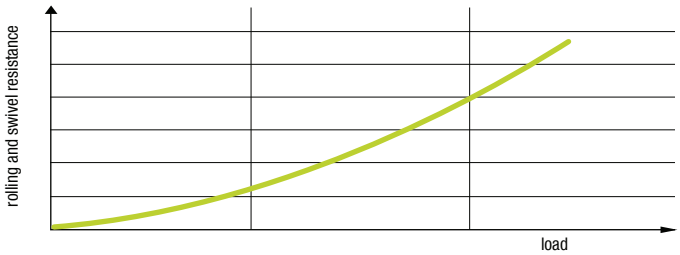
T = required load capacity per wheel or castor
E = dead weight of the transport equipment
Z = maximum additional weight
n = number of supporting wheels or castors
S = safety factor

3 Starting, rolling and swivel resistance. Manouevrability.

The starting, running and swivel resistance of a wheel or castor is largely dependent on the tread, wheel bearing, wheel Ø, overall load and the condition of the surface.
(See page 49 for more information)

The manouevrability of a transport equipment is dependent on the quantity and type of the castors which are used, as well as how they are arranged. These factors in turn affect load capacity, manoue-vrability, control, cornering and stability.
(See page 47 for more information)

Rolling and swivel resistance



Low rolling resistance
- large wheel Ø
- hard tread
- high tread elasticity
- ball bearing
- hard, smooth surface

Low swivel resistance (swivel castors)
- hard tread
- crowned tread
- large offset
- hard, smooth surface

4 Corrosion resistance. Temperature resistance. Chemical resistance.

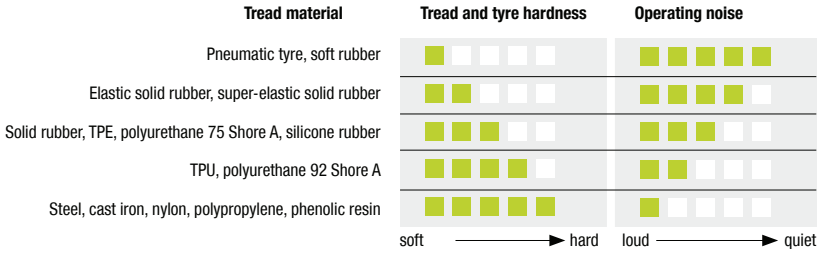
The service life and functionality of a wheel or castor depends to a certain extent on how well the materials used or their surface finish are capable of withstanding corrosion, temperature changes and chemical substances. Temperature and the duration of exposure are the most important factors.

Information about the chemical resistance of the different materials we use is provided in the table on page 51.

Example: checking resistance to hydrolysis

5 Select from a wide range of tread materials.

Hardness, shape and tread material have a significant impact on the operational comfort, smooth rolling performance and starting, rolling and swivel resistance of a wheel or castor. The tread (tyre) of a wheel should normally be softer than the surface. Otherwise the wheel may press into the surface and damage it.
(See page 52–59 for more information)



6 Select a wheel bearing type.

Selecting a suitable bearing will depend on the speed, load, environmental factors and the force required to move the transport equipment.

Plain bores are simple, but have an unfavourable friction coefficient. However, they have the worst coefficient of friction, leading to a relatively high starting and rolling resistance.

Roller bearings are robust, have a low rolling resistance and a small radial bearing clearance.

Ball bearings have the best starting and rolling properties, the smallest bearing clearance, a high load capacity and are also suitable for high speeds.
(See page 84–85 for more information)


Plain bore


Roller bearing


Ball bearing

7 Select a suitable bracket, version and options.

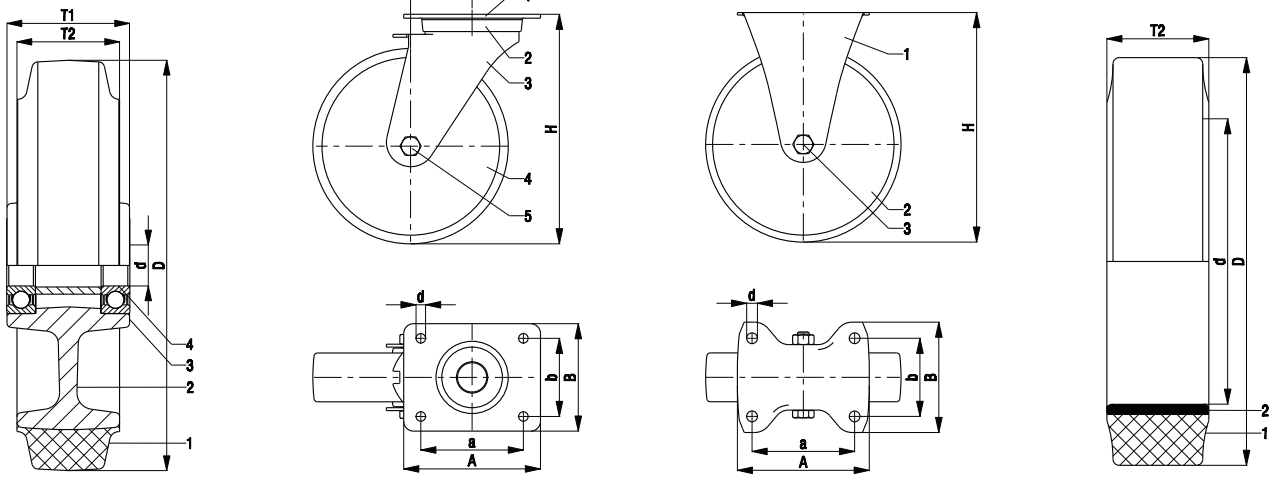
The suitable bracket for every application and all requirements. Pressed steel bracket in standard, stainless steel or heat-resistant version, welded steel heavy-duty bracket with or without suspension, or elegant synthetic bracket.

The functionality of wheels or castors can be enhanced by using different versions or options. Wheel and swivel head brakes to prevent swivel castors rolling and rotating, foot guard for avoiding foot injuries, electrically conductive treads for protection against electrostatic discharge and many more.

A detailed list of Blickle bracket series is available on page 86–102.
All versions and options are listed on page 112–117.

Wheels and castors guide

Basic information / definitions



Wheel

Designations:
1 = tread / tyre
2 = wheel centre / rim
3 = hub
4 = wheel bearing

Dimensions:
D = wheel diameter
d = bore diameter
T1 = hub length
T2 = wheel width

Wheels are made up of a tread / tyre, wheel centre / rim and a wheel bearing.

Wheels vary in terms of their load capacity, rolling resistance and rolling quality. The special properties of each individual wheel series are explained in detail from page 60 onwards.

Swivel castor

Designations:
1–3 = swivel bracket
1 = top plate
2 = swivel head (swivel bearing)
3 = swivel fork
4 = wheel
5 = wheel axle

Dimensions:
H = total height / mounting height
F = offset
A,B = plate dimensions
a,b = bolt hole spacing
d = bolt hole diameter

Swivel castors can be rotated around the vertical axis, improving the manouevrability of machinery, equipment, etc. A swivel head (swivel bearing) connects the fork (swivel fork) to the fitting. There is normally some horizontal distance between the centre of the swivel bearing and the wheel axle (offset), so the fork can swivel freely. This offset allows the castor to rotate easily without additional equipment. It also gives the castor a stable rolling characteristic when travelling straight.
Swivel castors can be fitted with different locks to brake

- the rotation of the wheel (wheel brake)
- the rotation of the wheel and the swivel motion of the fork (wheel and swivel head brake)
- the swivel motion of the fork (directional lock)

Fixed castor

Designations:
1 = fixed bracket
2 = wheel
3 = wheel axle

Dimensions:
H = total height / mounting height
A,B = plate dimensions
a,b = bolt hole spacing
d = bolt hole diameter

Fixed castors do not swivel and make it easier to move machinery, equipment, etc. in a particular direction without deviating.

Press-on band / tyre

Designations:
1 = tread / tyre
2 = steel-band

Dimensions:
D = outer diameter
d = internal diameter
T2 = width

Press-on bands / tyres consist of various elastomers and are fitted with a steel band or steel insert.

Press-on bands / tyres vary in terms of their load capacity, rolling resistance and rolling quality. The special properties of each individual press-on band / tyre are explained in detail on page 80–81.

The cross-sections of the wheels on the product pages only provide an example of that particular series. Wheels within the same series may have different designs due to technical reasons.

Wheels and castors guide

Classification of wheels and castors

International standards divide wheels and castors into the following categories:

- light-duty wheels and castors
- wheels and castors for transport equipment
- heavy-duty wheels and castors

Each of these are used for different applications and are subject to different test conditions.

Blickle light-duty wheels and castors

Light-duty wheels and castors and compact castors are normally used indoors. They are designed to handle speeds of up to 3 km/h. They have a load capacity of up to 280 kg (light-duty wheels and castors) or 1,750 kg (compact castors).
They maximise manouevrability and smooth rolling performance while reducing rolling resistance.
They are typically used for medical equipment, display stands, industrial kitchen equipment and similar applications.

The load capacity of Blickle light-duty wheels and castors and compact castors is tested on a rotating bench in accordance with DIN EN 12530 / ISO 22881

The main test conditions:
- speed: 3 km/h
- temperature: +15 °C to +28 °C
- hard, horizontal surface with obstacles with a height equal to 3 % of the wheel diameter
- test duration: the number of times that obstacles are crossed is equivalent to ten times the wheel diameter (in millimeters)
- rest time: max. 3 minutes after 3 minutes running time

Blickle wheels and castors for transport equipment

Wheels and castors for transport equipment are used for indoor and outdoor industrial applications. They are designed to handle speeds of up to 4 km/h.
They have a load capacity of up to 1,000 kg.
Wheels and castors for transport equipment are resistant to environmental factors, largely maintenance-free and capable of functioning properly for long periods.
They are typically used for machinery and equipment of all kinds, in addition to pallets, scaffolding, waste containers and the like.

The load capacity of Blickle wheels and castors for transport equipment is tested on a rotating bench in accordance with DIN EN 12532 / ISO 22883.

The main test conditions:
- speed: 4 km/h
- temperature: +15 °C to +28 °C
- hard, horizontal surface with obstacles at the following height:
  5 % of wheel diameter for wheels with soft tread (hardness < 90 Shore A)
  2.5 % of wheel diameter for wheels with hard tread (hardness ≥ 90 Shore A)
- test duration: 15,000 revolutions with a minimum of 500 crossing obstacles
- rest time: max. 1 minute after 3 minutes running time

Blickle heavy-duty wheels and castors

Heavy-duty wheels and castors are used to handle heavy loads and / or high speeds.
They are particularly strong in their design.
Castors with two wheels (twin wheel castors) are also used in this area to handle particularly heavy loads. Spring-loaded castors are particularly suitable when there is a need to avoid vibration during transport.
They are typically used on forklift trucks and industrial trucks, assembly and transport systems and similar equipment.

The load capacity of Blickle heavy-duty wheels and castors is tested on a rotating bench at a speed of 4 km/h in accordance with DIN EN 12532 / ISO 22883. Wheels and castors designed for higher speeds are tested for load capacity in accordance with DIN EN 12533 / ISO 22884.

The main test conditions according to DIN EN 12532 / ISO 22883:
- speed: 4 km/h
- temperature: +15 °C to +28 °C
- hard, horizontal surface with obstacles at the following height: 5 % of wheel diameter for wheels with soft tread (hardness < 90 Shore A)
  2.5 % of wheel diameter for wheels with hard tread (hardness ≥ 90 Shore A)
- test duration: 15,000 revolutions with a minimum of 500 crossing obstacles
- rest time: max. 1 minute after 3 minutes running time

The main test conditions according to DIN EN 12533 / ISO 22884:
- speed: 6 km/h, 10 km/h, 16 km/h, 25 km/h (standard: max. 16 km/h)
- temperature: +15 °C to +28 °C
- hard, horizontal surface with obstacles at the following height:
  5 % of wheel diameter for wheels with soft tread (hardness < 90 Shore A)
  2.5 % of wheel diameter for wheels with hard tread (hardness ≥ 90 Shore A)
- test duration: the number of times that obstacles are crossed is equal to five times the wheel diameter (in millimeters)
- rest time: max. 1 minute after 3 minutes running time

Dynamic load capacity

The load capacity listed for a wheel or castor is the load capacity which that wheel or castor was capable of withstanding when tested on a rotating bench in accordance with DIN EN 12527–12533 (ISO 22878–22884).

In order to determine the load capacity that a wheel or castor needs to have, it is important to know the dead weight of the transport equipment, the maximum additional weight and the number of supporting wheels or castors. When using four or more wheels or castors, the load on each individual wheel or castor may vary.
The necessary load capacity is calculated as follows:

$$T = \frac{E+Z}{n} \times S$$

T = required load capacity per wheel or castor
E = dead weight of the transport equipment
Z = maximum additional weight
n = number of supporting wheels or castors
S = safety factor

Wheels and castors with ball bearings are capable of exceeding speeds of 4 km/h with a reduced load capacity.

Recommended safety factors for different applications

The safety factor S is used to account for deviations from the standard application conditions (smooth surface, walking speed of 4 km/h, equal load distribution, travelling straight, ambient temperature of between 15 °C and 28 °C). The safety factor is affected by the speed of movement and the ratio of wheel Ø to the height of the obstacle. There are four different categories (see table).

Safety factors do not take tread wear into consideration.

Determining safety factor S

	Transport	Environment	Height of the obstacle	Safety factor
	manual	indoors	< 5 % of wheel Ø	1.0–1.5
	manual	outdoors	> 5 % of wheel Ø	1.5–2.2
	motorized	indoors	< 5 % of wheel Ø	1.4–2.0
	motorized	outdoors	> 5 % of wheel Ø	2.0–3.0

Static load capacity

If a wheel or castor is exposed to mainly static loads, its static load capacity is tested in accordance with ISO 22878. One of the criteria that this test looks at is the extent to which the tread flattens after a specific period.

Information about the static load capacity of our products is available in our product data sheets. You can contact us directly to request them or download them from www.blickle.com.

Wheels and castors guide

Manouevrability

Castors must be positioned to meet requirements for the manouevrability and steering of units and machines.
A number of different castor arrangements are described below.

Three swivel castors with identical mounting height

Suitable for small loads and narrow routes. The transport equipment is very easy to move in any direction. The transport equipment is relatively difficult to manouevre when travelling straight. This can be improved by fitting a directional lock to one of the three swivel castors. This castor arrangement can make the transport equipment more susceptible to tipping.

Load capacity	■■□□□
Manouevrability	■■■■■
When travelling straight	■■□□□
Cornering	■■■■□
Stability	■□□□□

Four swivel castors with identical mounting height

Suitable for narrow routes. The transport equipment is very easy to move in any direction. The transport equipment is relatively difficult to manouevre when travelling straight. Attaching directional locks to two swivel castors can improve this situation.

Load capacity	■■■■□
Manouevrability	■■■■■
When travelling straight	■■□□□
Cornering	■■■■□
Stability	■■■□□

Two swivel and fixed castors with identical mounting height

Most common castor arrangement, suitable for towing. The transport equipment is easy to manouevre when cornering and moving in a straight line. The transport equipment is relatively difficult to manouevre in tight spaces.
The fixed castor can be replaced with a wheel set, i.e. two wheels on an axle.

Load capacity	■■■■□
Manouevrability	■■■□□
When travelling straight	■■■■□
Cornering	■■□□□
Stability	■■■■□

Four fixed castors, with the central castors having a slightly higher mounting height

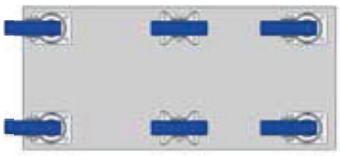
Cost-effective castor arrangement. The transport equipment is easy to manouevre when moving in a straight line. Arranging the load over the central fixed castors makes the transport equipment relatively easy to steer and rotate on the spot. This castor arrangement can make the transport equipment more susceptible to tipping and swinging.
The central fixed castors can be replaced with a wheel set, i.e. two wheels on an axle.

Load capacity	■■■□□
Manouevrability	■■□□□
When travelling straight	■■■■■
Cornering	■■■■■
Stability	■■□□□

Two swivel and two fixed castors, with the fixed castors having a slightly higher mounting height

Suitable for towing. The transport equipment is easy to manouevre when cornering and moving in a straight line and rotates easily on the spot. This castor arrangement can make the transport equipment more susceptible to tipping and swinging. We recommend using swivel castors with spring-loaded castors. The central fixed castors can be replaced with a wheel set, i.e. two wheels on an axle.

Load capacity	■■■□□
Manouevrability	■■■■□
When travelling straight	■■■■■
Cornering	■■■■■
Stability	■■□□□

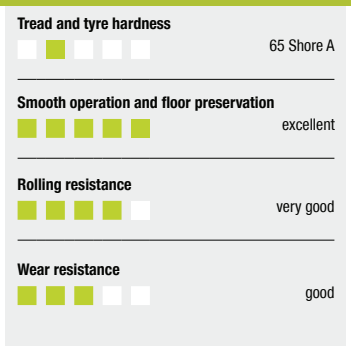


Four swivel castors and two fixed castors identical mounting height

Complicated castor arrangement, suitable for towing. The transport equipment is easy to manouevre when cornering and moving in a straight line and rotates easily on the spot. It is particularly well suited for heavy loads and long units. Constant surface contact of the fixed castors is required for manouevrability.
The central fixed castors can be replaced with a wheel set, i.e. two wheels on an axle.

Load capacity	■■■■■
Manouevrability	■■■■□
When travelling straight	■■■■■
Cornering	■■■■■
Stability	■■■■■

Blickle wheel series info box
Tread and tyre hardness. Smooth operation and floor preservation.



Blickle wheel series info box

To make it easier for you to choose the correct product, we provide a Blickle info box for each wheel series on the relevant page.
This provides an overview of the tread and tyre hardness of a wheel, its smooth operation and floor preservation, rolling resistance and wear resistance.

Tread and tyre hardness is rated on a scale from very soft to very hard, while the other categories are rated from satisfactory to outstanding.

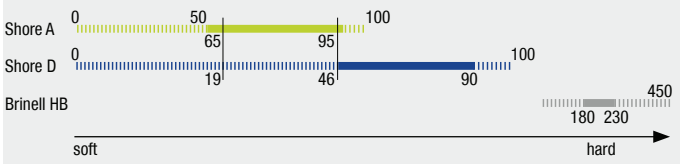
Tread and tyre hardness

The tread & tyre hardness is indicated in the info box in images on the product pages. The further the marking is to the right, the harder the tread. Hardness for

- elastomers and polyurethanes is provided in Shore A,
- Shore D for solid plastics and
- using the Brinell scale for metals.

There is no linear correlation between the various hardness testing methods. The values in the graphic were determined empirically and are provided for reference purposes.

Hardness ranges for Blickle wheel series



Material	Tread and tyre hardness
Pneumatic tyre / soft rubber	50–60 Shore A
Elastic solid rubber	65 Shore A
Super-elastic solid rubber	70 Shore A
Standard solid rubber	80 Shore A
Thermoplastic polyurethane (TPU), soft	80 Shore A
Thermoplastic rubber-elastomer (TPE)	85 Shore A
Polyurethane 75 Shore A	75 Shore A
Polyurethane 92 Shore A	92 Shore A
Thermoplastic polyurethane (TPU), hard	92–98 Shore A
Polypropylene	60 Shore D
Nylon	70 Shore D
Cast nylon	80 Shore D
Cast iron / steel	180–230 HB

Smooth operation and floor preservation

The higher the score in this category, the quieter the wheel is and the easier it is on surfaces.

Floor preservation
Hard treads put more strain on a floor than softer treads. A tread with five points in the smooth operation and floor preservation category has exceptionally good floor preservation qualities.

Floor surface preservation is measured on the basis of average floor pressure. Reference values for each tread material are provided to the right.

Smooth operation
In principle, vehicles tend to be quieter when they have large wheels with soft thick treads. Hard treads result in higher levels of noise than soft treads. A high score in the smooth operation and floor preservation category would therefore lead to expect low levels of vibration and noise emission when transporting goods.

Hard wheels can also be used with low levels of noise and a high degree of operational comfort when transporting light loads on a soft surface (e.g. carpet).

Calculating average floor pressure
The average floor pressure is calculated by dividing the radial force [N] by the wheel contact surface [mm²].

Material	Smooth operation / floor preservation	Average floor pressure
Pneumatic tyre / soft rubber		0.8 N/mm²
Elastic solid rubber		1.8 N/mm²
Super-elastic solid rubber		1.5 N/mm²
Standard solid rubber		3.5 N/mm²
Thermoplastic polyurethane (TPU), soft		4.0 N/mm²
Thermoplastic rubber-elastomer (TPE)		4.5 N/mm²
Polyurethane 75 Shore A		3.5 N/mm²
Polyurethane 92 Shore A		8.0 N/mm²
Thermoplastic polyurethane (TPU), hard		11.0 N/mm²
Polypropylene / nylon		40.0 N/mm²
Cast nylon		60.0 N/mm²
Cast iron / steel		>350 N/mm²

Blickle wheel series info box
Starting, rolling and swivel resistance. Wear resistance.

Starting, rolling and swivel resistance

Starting resistance reflects the amount of force required to get the wheel in motion when it is at a standstill.
Rolling resistance refers to the amount of force required to keep the wheel moving in a uniform manner.
Starting and rolling resistance are affected by the following factors:

- wheel diameter
- tread geometry
- tread & tyre hardness
- rebound resilience of the tread
- wheel bearing
- surface

Rolling resistance occurs as a result of the constant compression and decompression of the tread while the wheel is rolling (hysteresis).

Rolling resistance is measured using a test bench. Measurements are taken under ideal conditions:

- level, smooth, steel surface free of dirt and obstacles
- speed: 4 km/h
- temperature: +20 °C
- load: ⅔ of max. load capacity

These standardised conditions make it possible to compare the rolling resistances of different wheel series.

Different application conditions (surface quality, temperature, speed, etc.) must be taken into consideration when designing the running gear and can have a significant impact on rolling resistance.

Swivel resistance is the resistance required to align swivel castors in the direction of travel.

Swivel resistance is affected by the following factors:

1. Contact area of the wheel:
   The contact area of the wheel rotates around its centre when the swivel castor turns. This causes friction. The resistance is dependent on the interaction between the surface and the wheel tread, in addition to the size of the contact area.

2. Resistance of the swivel head:
   The structure and quality of the swivel head have an impact on its swivel resistance.

3. Offset of the swivel castor:
   The swivel resistance of the swivel castor is influenced by the distance between the centre of the swivel head and the centre of the contact area.

Material	Rolling resistance
Pneumatic tyre / soft rubber	good
Elastic solid rubber	very good
Super-elastic solid rubber	good
Standard solid rubber	satisfactory
Thermoplastic polyurethane (TPU), soft	very good
Thermoplastic rubber-elastomer (TPE)	very good
Polyurethane 75 Shore A (Softhane®)	very good
Polyurethane 75 Shore A (Besthane® Soft)	excellent
Polyurethane 92 Shore A (Extrathane®)	very good
Polyurethane 92 Shore A (Besthane®)	excellent
Thermoplastic polyurethane (TPU), hard	very good
Polypropylene / nylon	excellent
Cast nylon	excellent
Cast iron / steel	excellent

Wear resistance

The higher the point score in this category, the greater the wear resistance of the wheel.

In addition to other factors, the wear resistance incorporates the resistance to abrasion of elastomers or thermoplastic elastomers in accordance with ISO 4649. The resistance of other tread materials to abrasion was tested in accordance with ISO 4649.

Tread materials are assigned to different abrasion resistance categories in the graphic to the right.

Material	Wear resistance
Pneumatic tyre / soft rubber	satisfactory
Elastic solid rubber	good
Super-elastic solid rubber	good
Standard solid rubber	adequate
Thermoplastic polyurethane (TPU), soft	good
Thermoplastic rubber-elastomer (TPE)	satisfactory
Polyurethane 75 Shore A	very good
Polyurethane 92 Shore A	excellent
Thermoplastic polyurethane (TPU), hard	very good
Polypropylene	satisfactory
Nylon	good
Cast nylon	very good
Cast iron / steel	excellent

Wheels and castors guide

Environmental factors
Corrosion resistance. Temperature resistance. Electrical conductivity. Chemical resistance.

Corrosion resistance

The surfaces of wheel and castor components have different corrosion resistance levels depending on the surface coating.

Salt spray testing in accordance with DIN EN ISO 9227 is one of the most common test procedures for assessing the corrosion protection of different materials. The parts are corroded using a sprayed salt solution, and the amount of time until the formation of white rust and red rust is measured (in hours).

Surface protection	White rust	Red rust
zinc-plated, blue	~48 h	~96 h
zinc-plated, yellow	~144 h	~240 h
zinc-nickel		~720 h
powder coating		~192 h

The advantage of zinc-plated components is that they retain their corrosion protection despite minor damage. Zinc-plated parts are put through an additional chemical treatment called passivation. Yellow passivation provides greater protection against corrosion than blue passivation.
A zinc-nickel coating prevents the formation of white rust and can resist high temperatures. It can also be passivated and sealed.
Electrostatic powder coating involves spraying the powder used for the coating onto the component and then heating it.

INOX Corrosion-resistant stainless steel is well known for its corrosion resistance. The most commonly used material (1.4301 / AISI 304) is a high-alloyed chromium-nickel steel.
Stainless steel ball bearings are made from material 1.4034 / AISI 420.

Temperature resistance

The functionality of a wheel or castor is also dependent on temperature-related factors.
The relevant temperature for the tread is a combination of the ambient temperature and the heat generated by friction. The amount of friction depends on the material, shape and load of the tread, as well as the length and surface properties of the distance travelled.

Friction resistance increases slightly at low temperatures. Furthermore, factors like cold and heat can reduce the load capacity and stability of plastics.
The load capacity and service life of treads decrease considerably with higher temperatures. High static loads and high temperatures also increase the risk of the wheel flattening. For this reason, Blickle developed special treads and wheel materials that can be used at high temperatures. For more information, please refer to heat-resistant wheels and castors on page 440–470.
The rigidity and hardness of many elastomer treads (particularly rubber and many polyurethane elastomers) increase significantly at low temperatures, while losing a significant amount of their elasticity. However, Blickle does provide special polyurethane elastomers that remain elastic and flexible in temperatures down to -30 °C.

Electrical conductivity

The electrical conductivity of wheels and castors provides protection against electrostatic discharges caused by transport equipment or the transported goods.

A wheel or castor is considered electrically conductive if its ohmic resistance does not exceed 10^4 Ω (product code suffix: -EL or -ELS).
A wheel or castor is considered antistatic if its ohmic resistance is between 10^5 and 10^7 Ω (product code suffix: -AS).

The coating can be removed from coated components like rims or wheel centres at the point where the assembly is fixed to the transport equipment to ensure that they are conductive. Conductivity should be tested by the operator at regular intervals as it can be impacted by dirt on the tread or other environmental factors.

Chemical resistance

Special attention must be given to the chemical resistance of a wheel or castor if they are likely to come into contact with aggressive substances. The table to the right provides reference values that you can use to compare the chemical resistance of different materials to chemical substances.
Please note that chemical resistance depends not only on the nature of the aggressive substance but also on how concentrated it is, the duration of contact and other conditions like temperature and air humidity.

Mixtures of different chemicals can have completely different effects to those listed in the table. The information provided is by no means legally binding. Please contact us if you are uncertain about anything or have any questions.

Wheels and castors guide

Environmental factors
Chemical resistance

+ resistant
0 resistant under certain conditions
x not resistant
L pitting, stress cracks
- no information

	Concentration in %	Rubber	TPE	Nylon	Polypropylene (PP Copo)	Polyurethane (ester) TPU / Extrathane / Softhane / Vulkollan	Polyurethane (ether) Besthane / Besthane Soft	Stainless steel (V2A, 1.4301, AISI 304)
1-Propanol		+	0	+	+	0	0	+
Acetaldehyde	40	0	+	0	+	0	+	0(L)
Acetic acid (ethanoic acid)	30	x	0	x	x	x	x	+
Acetone		+	0	+	+	0	x	+
Acrylic acid > 30 °C		-	+	x	+	x	x	-
Alkyl alcohol		+	+	0	+	0	0	+
Alkylbenzenes		x	0	+	0	-	-	+
Aluminum acetate, aqueous		+	+	+	+	x	0	+
Amines, aliphatic		0	0	+	+	x	x	+
Ammonia, aqueous	20	+	+	+	+	x	x	+
Ammonium carbonate, aqueous		+	+	-	+	x	x	+
Ammonium chloride		+	+	-	+	x	x	0(L)
Ammonium hydroxide, aqueous	10	-	+	-	+	x	x	+
Ammonium nitrate, aqueous		0	+	+	+	0	+	+
Ammonium salts		-	-	-	+	-	-	-
Ammonium sulfate, aqueous		0	+	+	+	+	+	+
Amyl acetate, aqueous		0	+	+	0	x	x	+
Aniline (aminobenzene)		x	0	0	+	x	x	+
Beer		+	+	+	+	+	+	+
Benzine		x	x	+	0	+	+	+
Benzol		x	x	+	x	x	x	+
Bitumen		x	0	+	+	+	+	+
Bleaching lye (sodium hypochlorite)	10	x	+	x	0	x	0	0(L)
Borax (sodium tetraborate)		+	+	+	+	+	+	+
Boric acid, aqueous	10	+	+	0	+	0	+	+
Bromine		x	0	x	x	x	x	x
Butter		x	+	+	+	+	+	+
Calcium salts, aqueous		+	+	x	+	0	0	+
Carbolineum		x	-	+	+	x	x	-
Carbon monoxide, dry		0	+	+	0	x	x	+
Carbon tetrachloride		x	x	+	x	x	x	+
Castor oil		+	+	+	+	+	+	+
Caustic potash, aqueous (potassium hydroxide)		0	+	+	+	0	+	+
Caustic soda (sodium hydroxide)		+	+	+	+	x	x	+
Chlorine, hydrogen chloride		x	0	x	x	x	x	x
Chromic acid, aqueous	10	x	0	0	+	x	0	+
Citric acid, aqueous	10	+	+	+	+	+	+	+
Copper chloride, aqueous		+	+	0	+	0	+	x
Copper salts, aqueous	10	-	+	x	+	0	+	-
Cottonseed oil		x	x	+	+	+	+	+
Cresols		x	x	x	0	x	x	+
Crude oil		x	x	+	+	+	+	+
Cyclohexanol (Hexalin, Anol)		0	0	+	0	0	x	+
Cyclohexanone		0	0	+	0	0	x	+
Descaler, aqueous	10	-	-	+	+	0	+	+
Detergent solution, 80°C		+	+	+	0	x	0	+
Dichlorobenzene		x	x	+	0	x	x	+
Dichloroethene		x	0	-	-	x	x	-
Diethylene glycol		+	+	0	+	0	0	+
Dimethyl ether		0	0	+	x	+	+	+
Dimethylaniline		x	0	0	x	x	x	+
Dimethylformamide		0	+	+	+	x	0	+
Ethanol		+	0	0	+	+	+	+
Ether (Diethylether)		x	0	+	x	+	+	+
Ethyl acetate (acidic ether)		0	0	+	0	x	x	0
Ethylene (ethene)		x	+	0	+	+	+	x
Fatty acids (oleic acids)		x	0	+	+	0	+	+
Flue gas		0	-	-	-	x	x	+
Formaldehyde (methanal)	30	+	+	+	+	0	0	+
Formamide, pure (methanamide)		+	0	+	+	x	x	+
Formic acid	10	0	+	x	+	x	x	+
Furfural (furfurol)		x	x	0	x	x	x	+

+ resistant
0 resistant under certain conditions
x not resistant
L pitting, stress cracks
- no information

	Concentration in %	Rubber	TPE	Nylon	Polypropylene (PP Copo)	Polyurethane (ester) TPU / Extrathane / Softhane / Vulkollan	Polyurethane (ether) Besthane / Besthane Soft	Stainless steel (V2A, 1.4301, AISI 304)
Glycol (ethylene glycol)		+	+	0	+	0	0	+
Hexan		x	0	+	0	+	+	+
Hydraulic fluid		x	x	+	0	x	x	+
Hydrochloric acid, aqueous	30	0	+	x	+	x	0	x
Iodine tincture		+	+	x	+	x	x	0(L)
Iron chloride, aqueous	10	0	+	x	+	0	+	x
Iron sulfate (iron vitriol)	10	+	+	0	+	0	+	+
Isopropyl chloride		x	0	+	0	x	x	-
Isopropyl ether (diisopropyl ether)		0	0	x	x	+	+	+
Lactic acid		x	+	x	+	x	x	0
Magnesium salts, aqueous	10	+	+	+	+	0	+	0(L)
Malic acid		0	+	+	+	x	0	+
Mercury chloride, aqueous		+	+	x	+	+	+	0(L)
Methyl alcohol (methanol)		0	+	0	+	+	0	+
Methyl ethyl ketone (butanone)		x	0	+	0	x	x	+
Methylene chloride (dichloromethane)		x	x	x	x	x	x	+
Milk		+	+	+	+	0	+	+
Mineral oils		x	x	+	0	+	+	+
Monobromobenzene (bromobenzene)		x	x	+	0	x	x	+
Mortar, cement, chalk		+	+	+	+	0	0	+
Mustard		-	-	+	+	+	+	0(L)
Naphthalene (mineral naphtha)		x	0	+	0	0	0	+
Nickel chloride, aqueous	10	+	+	0	+	0	+	0(L)
Nickel sulfate, aqueous	10	0	+	0	+	0	+	+
Oleic acid (oleinic acid, fatty acid)		x	0	+	+	0	+	+
Oxalic acid, aqueous	10	0	+	0	+	x	x	0
Ozone, atmospheric concentration		x	0	x	0	+	+	-
Palmitic acid (hexadecanoic acid)		x	0	+	0	0	+	+
Phenylbenzene (biphenyl, dibenzol)		x	x	-	-	x	x	+
Phosphoric acid, aqueous	10	0	+	x	+	0	+	+
Plant oils		x	x	+	0	+	+	+
Potassium chloride, aqueous (sylvin)	10	0	+	+	+	+	+	+
Potassium hydroxide, aqueous (caustic potash, potash lye)		0	+	+	+	0	+	+
Potassium sulfate		+	+	+	+	+	+	+
Propane		x	0	+	+	+	+	+
Road salt (solutions)		+	+	+	+	0	+	0(L)
Skydrol		x	x	+	+	x	x	+
Sodium carbonate, aqueous (soda)	10	+	+	+	+	x	x	+
Sodium chloride, aqueous (table salt)	10	0	+	+	+	0	+	0(L)
Sodium hydroxide, aqueous (caustic soda)	10	+	+	+	+	x	x	+
Sodium phosphate, aqueous	10	+	+	+	+	+	+	+
Sodium silicate, aqueous	10	+	+	+	+	x	0	+
Sodium sulfate, aqueous (Glauber salt)	10	0	+	+	+	0	+	+
Sodium sulfide, aqueous	10	0	+	+	+	0	0	+
Sodium thiosulfate, aqueous (antichlor)	10	0	+	+	+	0	+	0(L)
Stearic acid, aqueous		x	+	+	0	x	+	+
Sulfuric acid		0	+	x	+	x	x	+
Tannic acid	10	+	+	+	+	0	+	+
Tartaric acid, aqueous	10	+	+	0	+	0	+	+
Toluene (methylbenzene)		x	x	+	x	x	x	+
Trichloroethylene		x	x	0	0	x	x	+
Turpentine		x	x	+	x	x	x	+
Uric acid, aqueous	10	+	+	+	+	0	-	0(L)
Urine		+	+	+	+	0	+	0(L)
Vaseline		x	0	+	0	+	+	+
Wastewater		-	+	+	+	0	0	-
Water (seawater)		+	+	+	+	0	0	0(L)
Water up to 80°C		0	+	+	0	x	+	+
Water, cold		+	+	+	+	+	+	+
Xylene		x	x	+	x	x	x	+
Zinc chloride, aqueous	10	+	+	0	+	x	x	x

Material description for wheel treads

Rubber

Compared to polyurethane, plastic and metal, rubber treads offer a high level of operational comfort and outstanding floor surface preservation. On the other hand, their starting and rolling resistance is higher when compared to the other tread materials. In addition to their excellent quality standards, Blickle rubber treads provide specially-tailored mechanical properties depending on the type of rubber that is used. They are resistant to a wide variety of aggressive substances, with the exception of oils (see “Chemical resistance”, page 50–51).

By combining rubber treads with different wheel centre materials, we can provide wheels that meet almost every application requirement in any application environment.

Thermoplastic rubber elastomer (TPE)

Thermoplastic rubber elastomers are non-marking, quiet and provide a relatively low level of rolling and swivel resistance. TPE treads contain a small amount of oil and could therefore staining sensitive surfaces.

Technical details:
- colour grey, non-marking
- hardness 85 ± 3 Shore A

Optional:
- electrically conductive, grey, non-marking, leak resistance ≤10^4 Ω

Solid rubber

Solid rubber tyres can be used for a wide variety of applications. They are vibration-absorbing and impact-resistant.
Black, standard, solid rubber can mark sensitive surfaces. A non-marking, grey, solid rubber tread can be used as an alternative in such cases.

Technical details:
- colour black
- hardness 80 +5 / -10 Shore A

Optional:
- colour grey, non-marking
- electrically conductive, leak resistance ≤10^4 Ω
- high temperature resistant version up to +200 °C (VEHI series)
- high temperature resistant version up to +260 °C (VKHT series)

Blickle Soft

Soft rubber “Blickle Soft”

Our “Blickle Soft” soft rubber tyres are based on a specially-developed highly-elastic rubber compound. The tread is vibration-absorbing and has extremely good floor preservation properties. Our “Blickle Soft” soft rubber also provides outstanding operational comfort and low levels of starting and rolling resistance, even on challenging surfaces. It can therefore be used as a puncture-proof alternative to pneumatic tyres.

Technical details:
- colour black
- hardness 50 + 5 Shore A

Optional:
- colour grey, non-marking

Material description for wheel treads

Rubber

Blickle Comfort

Two-component solid rubber “Blickle Comfort”

The “Blickle Comfort” two-component solid rubber tyre is vibration-absorbing, has good floor preservation properties and provides good operational comfort. The special design incorporates a solid rubber core and a highly elastic tread, giving the “Blickle Comfort” two-component solid rubber tyre a higher load capacity and a lower level of starting and rolling resistance than a traditional solid rubber tyre.

Technical details:
- colour black
- hardness 65 ± 4 Shore A (Rubber core 90 Shore A)

Optional:
- colour grey, non-marking (tread hardness: 56 ± 4 Shore A)

Blickle SoftMotion

Soft rubber “Blickle SoftMotion”

The “Blickle SoftMotion” soft rubber tyre has a special tread made of high-quality elastic solid rubber, which transforms rolling into a smooth gliding motion. The tread is vibration-absorbing and has extremely good floor preservation properties. The tyre is vulcanised onto the wheel centre. This allows the wheels to withstand even high levels of lateral stress. The thick tread, with its specially-designed contour and hardness of 55 Shore A, has a particularly high level of elasticity and low rolling resistance due to the use of a high-quality rubber compound.

Technical details:
- colour grey, non-marking
- hardness 55 ± 3 Shore A

Blickle EasyRoll

Elastic solid rubber “Blickle EasyRoll”

Elastic solid rubber tyres are based on a special rubber compound containing a high proportion of natural rubber. Alongside the traditional properties of a solid rubber tread, they provide increased operational comfort, a particularly high load capacity and extremely low starting and rolling resistance due to the elasticity of the Blickle elastic solid rubber tread.

Elastic solid rubber press-on bands are available in two different versions:
- The first is designed for smooth rolling. This version is resistant to abrasion and boasts a particularly low level of starting and rolling resistance.
- The second is designed for drive quality. This version maximises resistance to abrasion while maintaining a low level of starting and rolling resistance.

Technical details:
- colour black
- hardness 65 ± 3 Shore A

Optional:
- colour grey, non-marking
- colour blue, non-marking
- friction wheel quality, 70 ± 5 Shore A
- electrically conductive, black leak resistance ≤10^4 Ω
- antistatic, grey, non-marking, leak resistance ≤10^7 Ω

Blickle TempLine® Comfort

Silicone rubber “TempLine® Comfort”

Heat-resistant silicone-elastomer is non-marking, abrasion-resistant, highly elastic, suitable for autoclaves, ageing resistant, odourless, physiologically harmless and resistant to UV radiation. However, it is not resistant to strong lyes, chlorinated hydrocarbons and aromatic hydrocarbons. While the mechanical properties are adequate, silicone-elastomers provide a high level of operational comfort and consistently low levels of deformation.

Heat-resistant silicone-elastomer can be used in temperatures between -25 °C and +250 °C.

Technical details:
- colour black, non-marking
- hardness 75 ± 4 Shore A

Optional:
- colour grey, non-marking

Material description for wheel treads

Rubber

Pneumatic tyre

Rubber pneumatic tyres are vibration-absorbing and have extremely good floor preservation properties. They also provide outstanding operational comfort and a low level of rolling resistance, even on poor quality surfaces. The thickness of the tyre is given in the form of a ply rating. Light tyres have a ply rating of between 2 and 4, while heavy tyres have a ply rating of between 6 and 10. To optimise performance and guarantee a long service life, we recommend maintaining the tyre pressure specified in the relevant table to prevent damage to the tyre.

The wheel and tyre dimensions provided here apply to new tyres that are not bearing a load. Their width and diameter may change when they are in use.

Technical details:
- colour black
- hardness 60 ± 5 Shore A

Optional:
- colour grey, non-marking

Super-elastic solid rubber

Super-elastic solid rubber tyres are multicomponent tyres. Their rubber core is made up of a tough rubber compound with reinforced steel-wires. This keeps the tyres seated securely on the rim, even under heavy loads.
A highly elastic cushion layer keeps tyre temperatures low, even when transporting heavy loads at high speed.
The thick, abrasion-resistant tread protects the tyre against external damage and ensures that they remain in service for a long time. This makes the tyre particularly suitable for challenging application conditions. Super-elastic solid rubber tyres also provide outstanding operational comfort and a low level of rolling resistance, even on poor quality surfaces. They are puncture-proof and maintenance-free, can be steered precisely and have an abrasion-resistant tread. All of these factors and their good structural integrity make them superior to pneumatic tyres.

The wheel and tyre dimensions provided here apply to new tyres that are not bearing a load. Their width and diameter may change when they are in use.

Technical details:
- colour black
- hardness 70 ± 4 Shore A

Optional:
- colour grey, non-marking
- antistatic, leak resistance ≤10^7 Ω

Wheels and castors guide

Material description for wheel treads

Polyurethane

Polyurethane wheel treads are non-marking, non-staining, elastic, highly abrasion-resistant and have good floor preservation properties. They also have particularly long service lives and excellent resistance to a wide range of aggressive substances (see “Chemical resistance”, page 50–51).

In addition to this, they have low levels of starting and rolling resistance and are also suitable for higher speeds.

Blickle develops its own reaction-casted polyurethanes by combining different diisocyanates, polyols and cross-linking agents. The properties of our products are affected by the type and proportion of raw materials that are used and the reaction conditions.

Blickle Extrathane®

Blickle Softhane®

Thermoplastic polyurethane (TPU)

Blickle uses thermoplastic injection-moulded polyurethane-elastomer (TPU) in a wide range of wheels for varied applications. In addition to hard wheels (POTH series: heavy-duty design for transport equipment and heavy-duty applications, PATH series: lightweight design for light-duty and transport applications), Blickle also manufactures wheels with a soft tread, which are specifically designed for use in hygienic areas (POTHS series), as well as guide rollers (FPTH, FPU series).
The soft version of the TPU provides a particularly high level of operational comfort and vibration absorption.
Wheels with a TPU tread in the FPTH series are also hydrolysis resistant.

Technical details:
- colour:
  blue (POTHS series)
  dark grey (PATH, POTH, FPTH series)
  brown (FPU series)
- hardness:
  80 ± 5 Shore A (POTHS series);
  92 ± 3 Shore A (FPTH series);
  94 ± 3 Shore A (PATH, POTH series);
  98 ± 2 Shore A (FPU series)

Optional:
- electrically conductive, grey, non-marking, leak resistance ≤10^4 Ω

Polyurethane-elastomer Blickle Extrathane®

Blickle Extrathane® is a reaction-casted, hard polyurethane-elastomer. It is particularly resistant to cut and tear propagation, and provides a low level of starting and rolling resistance.
Blickle Extrathane® is provided in a non-marking light brown or grey (antistatic version) as standard, and has a hardness of 92 ± 3 Shore A. Blickle can also provide other colours and hardness levels if adequate quantities are required.

Technical details:
- colour light brown
- hardness 92 ± 3 Shore A

Optional:
- antistatic, grey, non-marking, leak resistance ≤10^7 Ω
- extra crowned tread

Polyurethane-elastomer Blickle Softhane®

Blickle Softhane® is a reaction-casted, soft polyurethane-elastomer. It is particularly good at absorbing vibrations and preserving floor surfaces. It also offers a low level of starting and rolling resistance.
Blickle Softhane® is provided in a non-marking green or grey (antistatic version) as standard, and has a hardness of 75 ± 5 Shore A. Blickle can also provide other colours and hardness levels if adequate quantities are required.

Technical details:
- colour green
- hardness 75 + 5 Shore A

Optional:
- antistatic, grey, non-marking, leak resistance ≤10^7 Ω
- extra crowned tread

Material description for wheel treads

Polyurethane

Blickle Besthane®

Polyurethane-elastomer Blickle Besthane®

Blickle Besthane® is a reaction-casted, hard polyurethane-elastomer. Blickle Besthane® offers a lower level of starting and rolling resistance than Blickle Extrathane®, in addition to being hydrolysis resistant. Wheels with a Blickle Besthane® tread are highly resistant to heat buildup under dynamic load and are particularly suitable for higher speeds of up to 16 km/h.
This tread is available in brown as standard and has a hardness of 92 ± 3 Shore A. Other colours, hardness levels and electrically conductive versions are available if adequate quantities are required.

Technical details:
- colour brown
- hardness 92 ± 3 Shore A
- hydrolysis resistant

Optional:
- crowned tread (ALB series)

Blickle Besthane® Soft

Polyurethane-elastomer Blickle Besthane® Soft

Blickle Besthane® Soft is a reaction-casted, soft polyurethane-elastomer. Blickle Besthane® Soft offers a lower level of starting and rolling resistance than Blickle Softhane®, in addition to being hydrolysis resistant. Wheels with a Blickle Besthane® Soft tread are resistant to heat buildup under dynamic load and are particularly suitable for higher speeds of up to 16 km/h.
This tread is available in blue as standard and has a hardness of 75 + 5 Shore A. Other colours and hardness levels are available if adequate quantities are required.

Technical details:
- colour blue
- hardness 75 + 5 Shore A
- hydrolysis resistant

Optional:
- extra crowned tread

Vulkollan®

Vulkollan® is a reaction-casted, hard polyurethane-elastomer with similar properties to Blickle Besthane®. They are particularly resistant to dynamic loads. Due to its mechanical properties, Vulkollan® is primarily used for guide rollers in conveying systems and for drive wheels in industrial trucks.

Vulkollan® will change colour when exposed to UV radiation.

Technical details:
- colour natural
- hardness 92 ± 3 Shore A

Optional:
- hardness 95 ± 3 Shore A

Material description for wheel treads

Synthetic

Blickle's synthetic product range includes thermoplastic and thermoset substances. Nylon, cast nylon and polypropylene are thermoplastics. These are impact-resistant, non-marking, non-staining, corrosion-resistant and odourless. Their material properties vary significantly depending on the exact composition of the substance. They are therefore used for a wide range of applications. Phenolic resin is a thermoset substance with a particularly high level of heat resistance.

Polypropylene

Polypropylene is an injection-moulded thermoplastic material. It provides a low level of rolling resistance, does not absorb moisture and is resistant to a wide range of aggressive substances (see "Chemical resistance", page 50–51). Polypropylene has a lower load capacity than nylon.

Technical details:
- colour natural white (PPN series)
  colour black (PP series)
- hardness 60 ± 5 Shore D

Optional:
- electrically conductive, leak resistance ≤10^4 Ω

Nylon

Nylon is an injection-moulded thermoplastic material. It is hygienic, highly abrasion-resistant and has a very low level of starting and rolling resistance. They are also resistant to a wide variety of aggressive substances (see "Chemical resistance", page 50–51). Nylon can absorb and release moisture. Its dimensions can therefore fluctuate depending on the moisture and temperature in the area.

Special heat-resistant nylons are used in temperatures of up to 170 °C.

Technical details:
- colour natural white (PO series)
  colour black (POA series)
- hardness 70 ± 5 Shore D

Optional:
- electrically conductive, grey, non-marking, leak resistance ≤10^4 Ω
- colour blue
- heat-resistant version (colour natural, 85 ± 5 Shore D)

Cast nylon

Cast nylon is a thermoplastic, reaction-injected plastic. It is highly abrasion resistant, hygienic and resistant to a wide range of aggressive substances (see "Chemical resistance", page 50-51). It also provides a much lower level of starting and rolling resistance.
Cast nylon has a much higher load capacity than nylon.

The relatively high floor pressure of cast nylon should be taken into consideration if you intend to use it on pressure-sensitive floors.

Technical details:
- colour natural beige
- hardness 80 ± 3 Shore D

Material description for wheel treads

Synthetic

Phenolic resin

Phenolic resin is a thermoset substance.
It is capable of handling static loads and is suitable for thermally-challenging environments.
Wheels made of phenolic resin are not particularly suitable for rough surfaces or crossing obstacles due to the high level of operation involved and their limited amount of mechanical resistance.

Phenolic resin can be used in temperatures between -35 °C and 260 °C. It is capable of withstanding 300 °C for a short time.

Technical details:
- colour black
- hardness 90 ± 3 Shore D

Material description for wheel treads

Metal

Metal treads have an extremely high load capacity and maintain their tensile strength and hardness in a wide range of temperatures.

One disadvantage is that they exert a relatively high level of floor pressure. This should be taken into consideration if they are used on pressure.

Cast iron

Blickle cast iron wheels are made of robust lamellar EN-GJL-250 (GG 25) grey cast iron, which meets DIN EN 1561 / ISO 185 standards or EN-GJS-400-15 (GGG 40) ductile cast iron, which meets DIN EN 1563 / ISO 1083 standards. Cast iron is extremely robust and wear-resistant, and can be used in temperatures between -100 °C and +600 °C. The graphite component provides cast iron's established dry running properties for plain bores and increases corrosion resistance.

Technical details:
- colour silver (lacquered)
- hardness 180–220 HB
- electrically conductive, leak resistance ≤10^4 Ω

Steel

Steel wheels are made of heat-treatable steel that is particularly suitable for wheels.
They have a higher load capacity than wheels made of grey cast iron and are therefore more resistant to dynamic loads.
However, steel wheels do exert more floor pressure than cast iron wheels.

Technical details:
- hardness 190–230 HB
- electrically conductive, leak resistance ≤10^4 Ω