

High temperature and chemical resistance: The High-Tech Problem Solver – iglidur® X



Over 250 dimensions available from stock

Temperature resistant from -100°C to $+250^{\circ}\text{C}$ in continuous operation

Universal resistance to chemicals

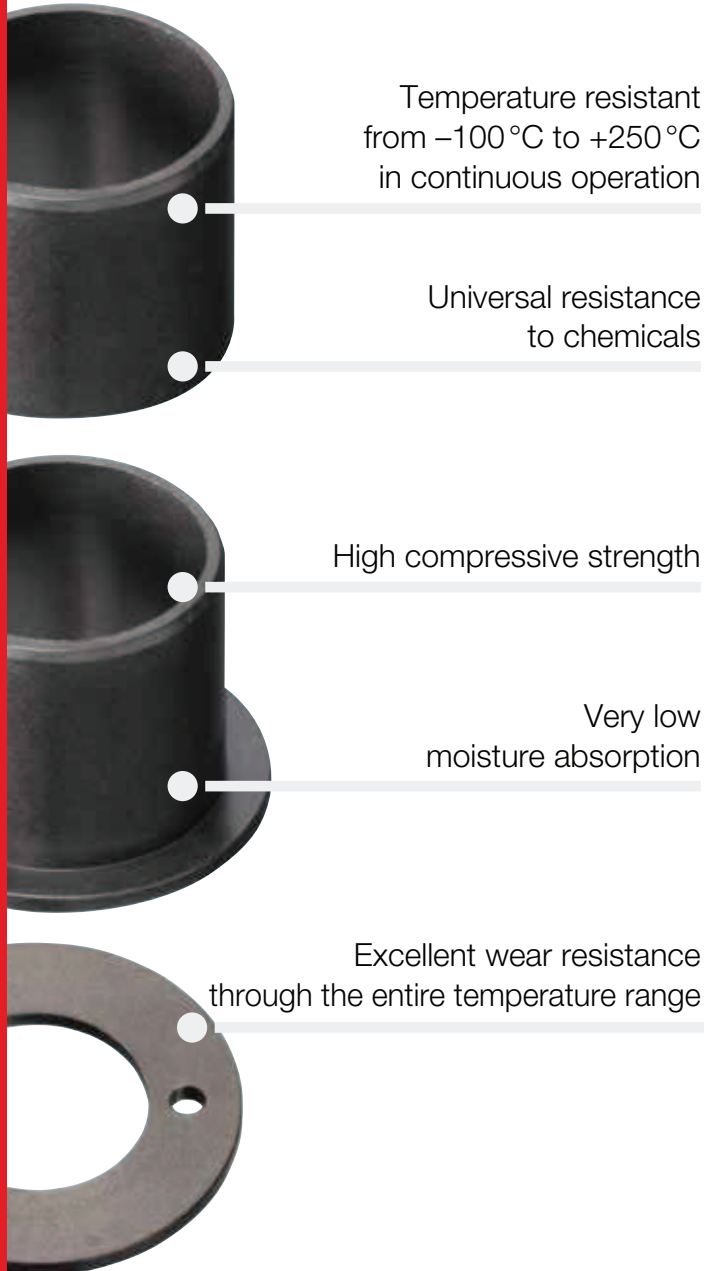
High compressive strength

Very low moisture absorption

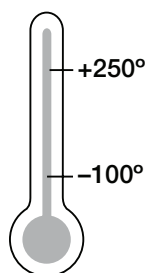
Excellent wear resistance through the entire temperature range

iglidur® X | The High-Tech Problem Solver

High temperature and chemical resistance. iglidur® X is defined by its combination of high temperature resistance with compressive strength, along with high resistance to chemicals. iglidur® X is designed for higher speeds than other iglidur® bearings.



Temperature



When to use it?

- For pressure loads up to 150 MPa
- For linear movements with stainless steel at high temperatures
- Universal resistance to chemicals
- Temperature resistant from -100 °C to +250 °C in continuous operation (short term to +315 °C)
- Very low moisture absorption
- High wear resistance over the entire temperature range



When not to use it?

- For very low wear at high loads
 - ▶ iglidur® Q2, page 555
 - ▶ iglidur® Z, page 327
- For economical underwater applications
 - ▶ iglidur® H370, page 375
- For edge pressure
 - ▶ iglidur® Z, page 327

Product range

3 types
> 250 dimensions
Ø 2–75 mm

iglidur® X | Application Examples



Typical sectors of industry and application areas

- Beverage technology ● Woodworking
- Plastic processing industry ● Aerospace engineering ● Cleanroom etc.

Improve technology and reduce costs –
310 exciting examples for iglidur® plain bearings online

► www.igus.eu/iglidur-applications



► www.igus.eu/bottle-filling



► www.igus.eu/drillrig



► www.igus.eu/ultraviolet-radiation



► www.igus.eu/flangedball-valves

Material properties table			
General properties	Unit	iglidur® X	Testing method
Density	g/cm³	1.44	
Colour		black	
Max. moisture absorption at +23 °C/50 % r.h.	% weight	0.1	DIN 53495
Max. water absorption	% weight	0.5	
Coefficient of sliding friction, dynamic against steel	μ	0.09–0.27	
pv value, max. (dry)	MPa · m/s	1.32	
Mechanical properties			
Modulus of elasticity	MPa	8,100	DIN 53457
Tensile strength at +20 °C	MPa	170	DIN 53452
Compressive strength	MPa	100	
Max. static surface pressure (+20 °C)	MPa	150	
Shore-D Hardness		85	DIN 53505
Physical and thermal properties			
Max. long term application temperature	°C	+250	
Max. short term application temperature	°C	+315	
Min. application temperature	°C	−100	
Thermal conductivity	W/m · K	0.6	ASTM C 177
Coefficient of thermal expansion (at +23 °C)	K ^{−1} · 10 ^{−5}	5	DIN 53752
Electrical properties ¹⁾			
Specific volume resistance	Ωcm	< 10 ⁵	DIN IEC 93
Surface resistance	Ω	< 10 ³	DIN 53482

²⁾ The good conductivity of this product might lead to the corrosion of metallic counterparts under certain conditions.

Table 01: Material properties table

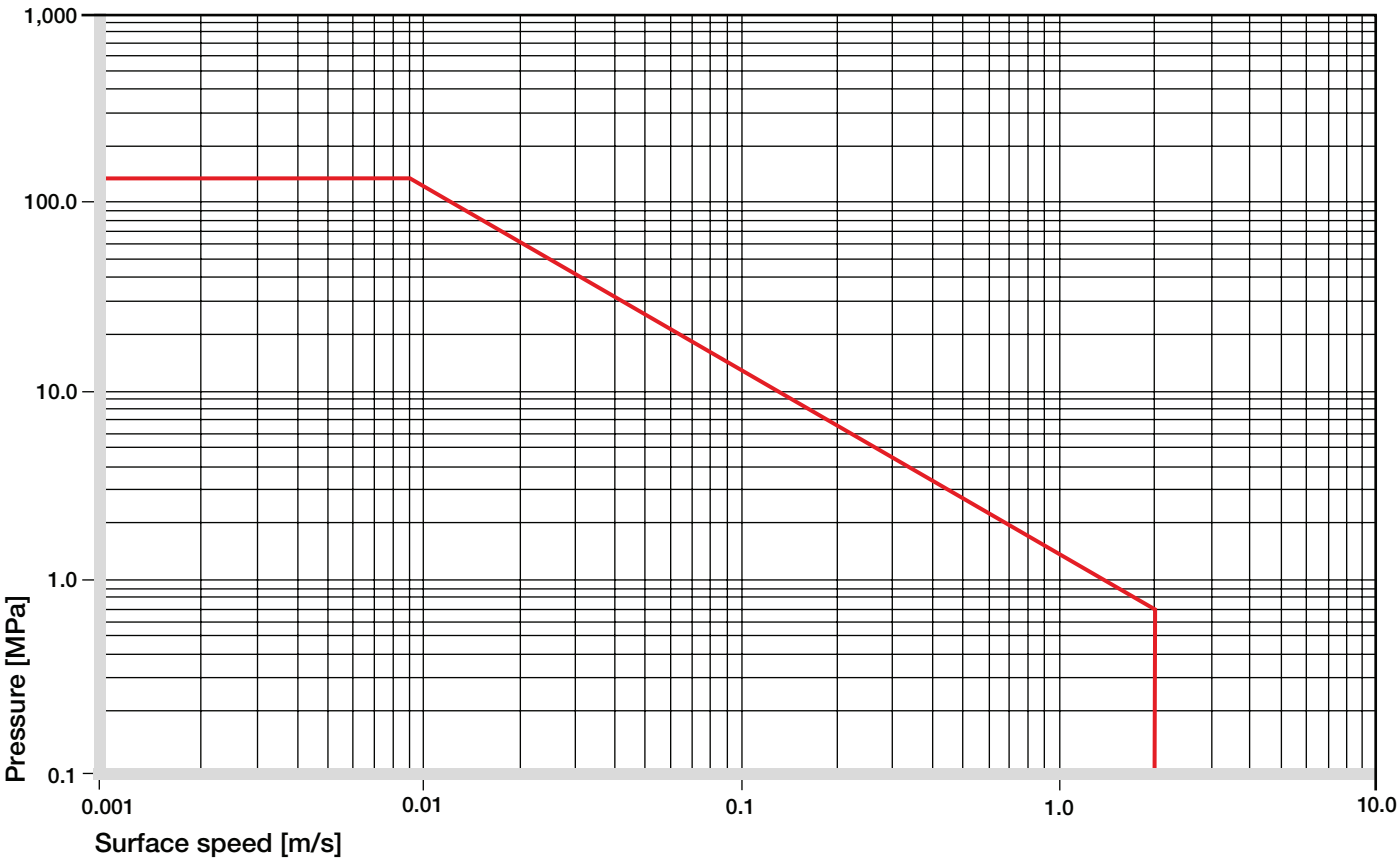


Diagram 01: Permissible pv values for iglidur® X with a wall thickness of 1 mm dry running against a steel shaft at +20 °C, mounted in a steel housing

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iglidur®
X

iglidur® X has an excellent combination of high temperature resistance, high compressive strength, and excellent resistance to chemicals. The aspect of temperature resistance and pressure susceptibility is also reflected in the pv diagram.

Mechanical Properties

With increasing temperatures, the compressive strength of iglidur® X plain bearings decreases. The Diagram 02 shows this inverse relationship. However, at the longterm maximum temperature of +250 °C the permissible surface pressure is almost 32 MPa. The recommended maximum surface pressure is a mechanical material parameter. No conclusions regarding the tribological properties can be drawn from this.

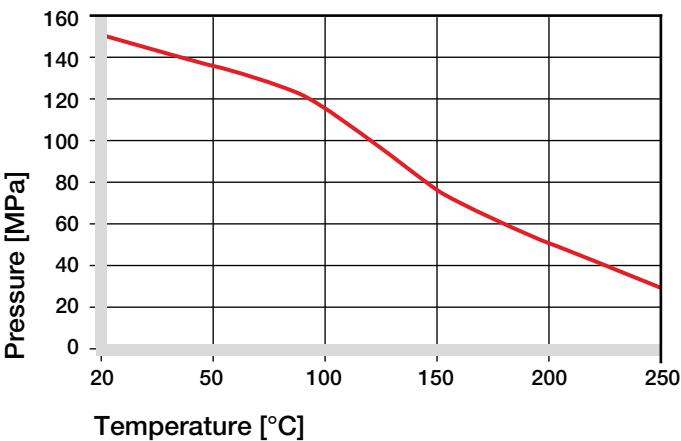


Diagram 02: Recommended maximum surface pressure as a function of temperature (150 MPa at +20 °C)

Diagram 03 shows how iglidur® X plain bearings deform elastically under load.

► Surface Pressure, page 63

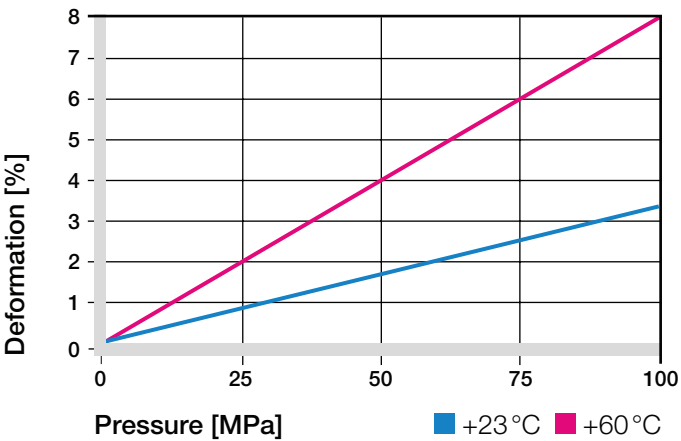


Diagram 03: Deformation under pressure and temperature

Permissible Surface Speeds

iglidur® X is designed for higher speeds than other iglidur® bearings. This is due to its high temperature resistance and excellent thermal conductivity. One benefit of this is seen in the maximum pV value of 1.32 MPa · m/s. However, in this case, only the smallest radial loads may act on the bearings. At the given speeds, friction can cause a temperature increase to maximum permissible levels.

► Surface Speed, page 65

m/s	Rotating	Oscillating	Linear
Continuous	1.5	1.1	5
Short term	3.5	2.5	10

Table 02: Maximum running speed

Temperatures

In terms of temperature resistance iglidur® X has also taken on a leading position. Having a permissible long term application, temperature of +250 °C, iglidur® X will even withstand +315 °C short term. As with all thermoplastics, the compression resistance of iglidur® X decreases with increasing temperature. However, the wear drops considerably when used within the observed temperature range of +23 °C to +150 °C. In certain cases, relaxation of the bearing can even occur at temperatures of more than +170 °C. This leads, after re-cooling, to the bearing moving out of the housing. At temperatures over +170 °C the axial security of the bearing in the housing needs to be tested. If necessary, secondary measures must be taken to mechanically secure the bearing. Please contact us if you have questions on bearing use.

► Application Temperatures, page 66

iglidur® X	Application temperature
Minimum	−100 °C
Max. long term	+250 °C
Max. short term	+315 °C
Add. securing is required from	+135 °C

Table 03: Temperature limits

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Friction and Wear

Similar to wear resistance, the coefficient of friction also changes with the load. The coefficient of friction increases with an increase in surface speed. On the other hand, an increased load has an inverse effect: the coefficient of friction decreases (see Diagrams 05 and 06). This explains the excellent performance of iglidur® X plain bearings for high loads.

- Coefficients of Friction and Surfaces, page 68
- Wear Resistance, page 69

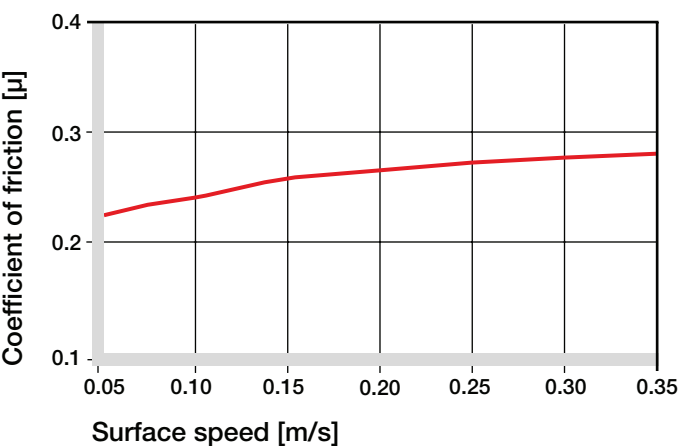


Diagram 05: Coefficient of friction as a function of the pressure, v = 0.01 m/s

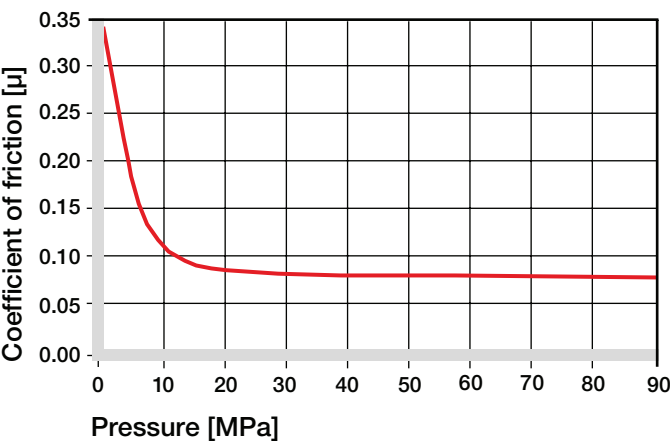


Diagram 06: Coefficient of friction as function of the shaft surface (Cf53 hardened and ground steel)

Shaft Materials

Friction and wear, to a high degree, are also dependent on the shaft material. Shafts that are too smooth increase the coefficient of friction of the bearing. Ground surfaces with an average roughness Ra of 0.6 to 0.8 μm are ideal. Diagrams 07 to 10 show results of testing different shaft materials with plain bearings made of iglidur® X. For low loads in rotating operation, the best wear values are found with 303 Stainless and HR Carbon Steel shafts. However, above a load of 2 MPa the bearing wear greatly increases with these two shaft materials. For the higher load range, hard chromed shafts or Cf53 shafts give good results. In oscillating operation at low loads, similar wear values for Cf53 and 303 stainless steel shafts occur. The wear is somewhat higher than during rotational movements. If the shaft material you plan to use is not contained in this list, please contact us.

- Shaft Materials, page 71

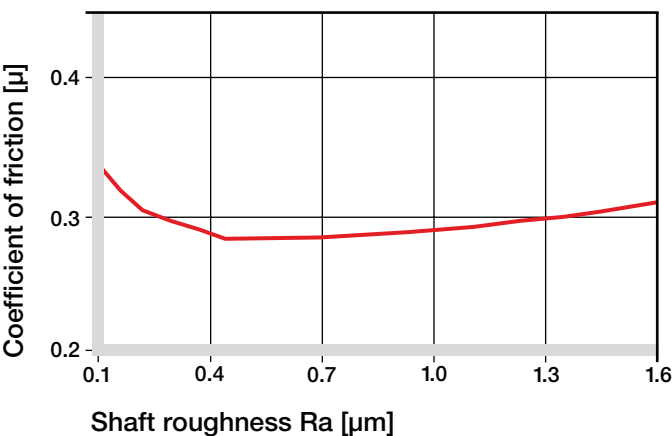


Diagram 07: Coefficient of friction as function of the shaft surface (Cf53 hardened and ground steel)

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X

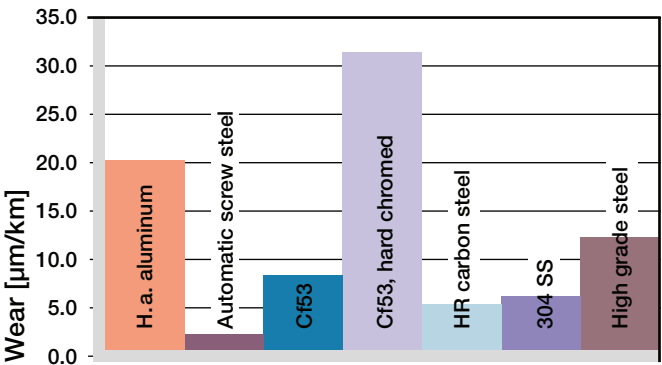


Diagram 08: Wear, rotating with different shaft materials, pressure p = 1 MPa, v = 0.3 m/s

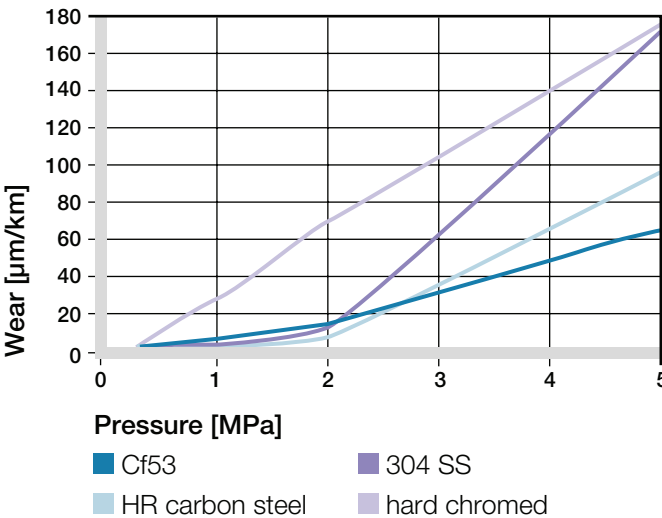


Diagram 09: Wear with different shaft materials in rotational operation, as a function of the pressure

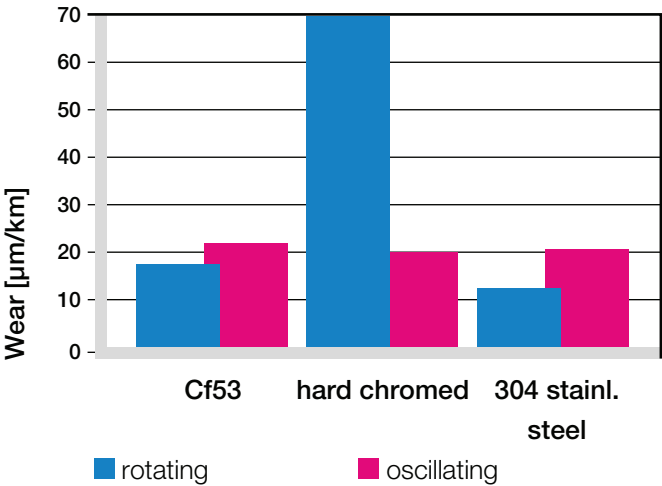


Diagram 10: Wear for rotating and oscillating applications with different shaft materials, p = 2 MPa

iglidur® X	Dry	Greases	Oil	Water
C.o.f. µ	0.09–0.27	0.09	0.04	0.04

Table 04: Coefficient of friction against steel (Ra = 1 µm, 50 HRC)

Additional Properties

Chemical Resistance

iglidur® X plain bearings have almost universal chemical resistance. The material is only attacked by concentrated acids.

► Chemical Table, page 1258

Medium	Resistance
Alcohol	+
Hydrocarbons	+
Greases, oils without additives	+
Fuels	+
Diluted acids	+
Strong acids	–
Diluted alkalines	+
Strong alkalines	+

+ resistant 0 conditionally resistant – not resistant
All data given at room temperature [+20 °C]

Table 05: Chemical resistance

Radiation Resistance

Plain bearings made from iglidur® X are resistant to radiation up to an intensity of 1 · 10⁵ Gy. iglidur® X is the most radioactive resistant material of the iglidur® product range. iglidur® X is extremely resistant to hard gamma radiation and withstands a radiation dose of 1,000 Mrad without detectable change in its properties. The material also withstands an alpha or beta radiation of 10,000 Mrad with practically no damage.

UV Resistance

The excellent material properties of iglidur® X do not change under UV radiation and other weathering effects.

Vacuum

In a vacuum environment iglidur® X plain bearings can be used virtually without restrictions. Outgassing takes place to a very limited extent.

Electrical Properties

iglidur® X plain bearings are electrically conductive.	
Volume resistance	< 10 ⁵ Ωcm
Surface resistance	< 10 ³ Ωcm



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Moisture Absorption

The moisture absorption of iglidur® X plain bearings is very low. It is approximately 0.1% by weight in the standard atmosphere. So even in applications under water, iglidur® X bearings can be used without alterations of the assembly conditions. The maximum moisture absorption is 0.5 % by weight.

Maximum moisture absorption

At +23 °C/50 % r.h.	0.1 % weight
Max. water absorption	0.5 % weight

Table 06: Moisture absorption

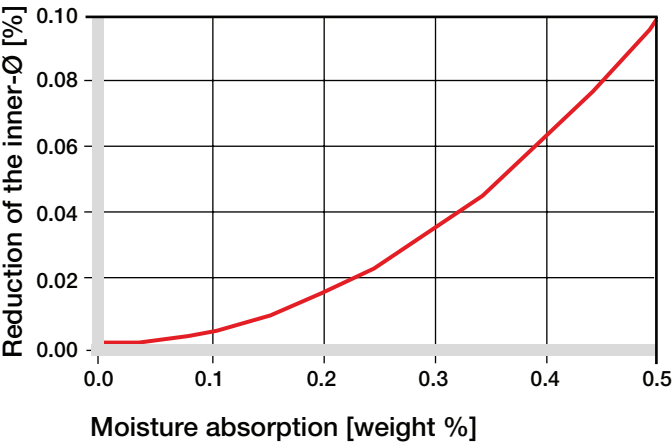


Diagram 11: Effect of moisture absorption plain bearings

Installation Tolerances

iglidur® X plain bearings are standard bearings for shafts with h-tolerance (recommended minimum h9). The bearings are designed for pressfit into a housing machined to a H7 tolerance. After being assembled into a nominal size housing, in standard cases the inner diameter automatically adjusts to the F10 tolerances. For particular dimensions the tolerance differs depending on the wall thickness (please see product range table).

► Testing Methods, page 75

Diameter d1 [mm]	Shaft h9 [mm]	iglidur®X F10 [mm]	Housing H7 [mm]
up to 3	0–0.025	+0.006 +0.046	0 +0.010
> 3 to 6	0–0.030	+0.010 +0.058	0 +0.012
> 6 to 10	0–0.036	+0.013 +0.071	0 +0.015
> 10 to 18	0–0.043	+0.016 +0.086	0 +0.018
> 18 to 30	0–0.052	+0.020 +0.104	0 +0.021
> 30 to 50	0–0.062	+0.025 +0.125	0 +0.025
> 50 to 80	0–0.074	+0.030 +0.150	0 +0.030

Table 07: Important tolerances plain bearings according to ISO 3547-1 after pressfit