

Carbon and Graphite Materials for Mechanical Seals

Automotive & Mechanical Applications



Broad Base. Best Solutions.



Scenic SCENIC PRECISE ELEMENT INC.
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SGL GROUP
THE CARBON COMPANY

Tribological Behavior

Friction

Friction depends on

- surface finish of the mating surfaces
- rubbing speed
- specific loading
- type and quantity of lubricating medium

Preferred Counterface Materials

- Gray cast iron
- Chromium cast
- Chrome steel
- Aluminum oxide
- Tungsten carbide
- Silicon carbide
- Carbon
- DLC-coated materials

The following coefficients of friction (μ) can be assumed as a guide:

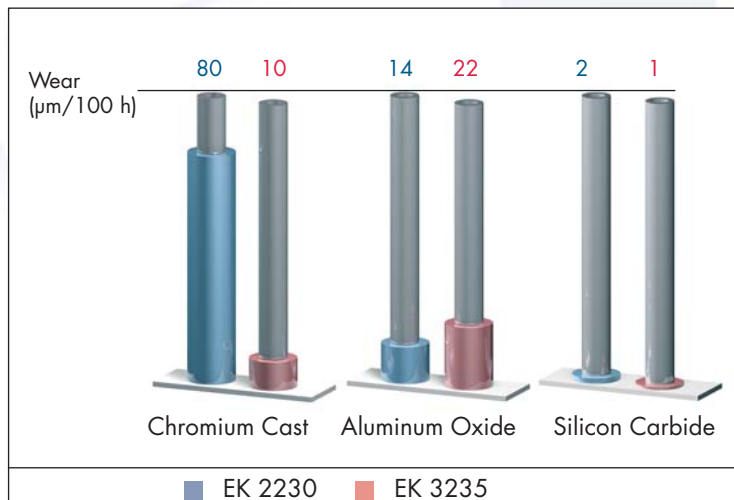
Wet running: $\mu = 0.01 - 0.05$

Mixed running: $\mu = 0.05 - 0.10$

Dry running: $\mu = 0.10 - 0.25$



Wear rates as a function of the counterface material, using EK 2230 and EK 3235 at a steady rubbing speed of 4.4 m/s and steady medium pressure of 10 bar for different counterface materials (chromium cast, aluminum oxide and silicon carbide). Medium: demineralized water.



Carbon and Graphite by SGL Group

Fields of Application

- Fuel pumps
- Chemical pumps
- Process pumps in refineries
- Seals for agitators and autoclaves
- Cold and hot water pumps
- Pumps for household and garden appliances
- Water pumps for automobiles
- Heat removal loop pumps in nuclear power stations
- Pumps for the beverage industry.

Applications

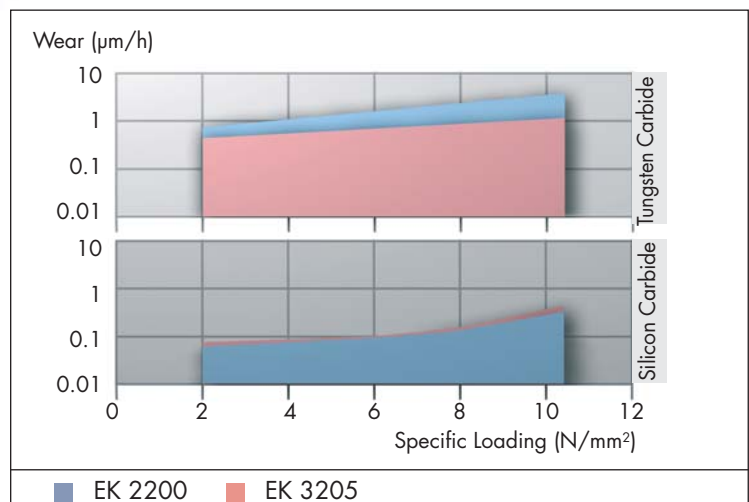
Carbon and graphite materials are used in mechanical seals in cases where gases or liquids with low hydrodynamic lubricating action have to be sealed.

Service Life

It is difficult to give expected wear figures as in practice many factors have to be considered, for example:

- mating materials
- rubbing speed
- loading
- surface finish of mating surfaces
- presence of solid impurities in the medium being sealed
- operating conditions.

Wear rates as a function of the rubbing speed against carbide materials, taking as examples EK 2200 and EK 3205 at a steady rubbing speed of 9 m/s and increasing load. Medium: demineralized water.



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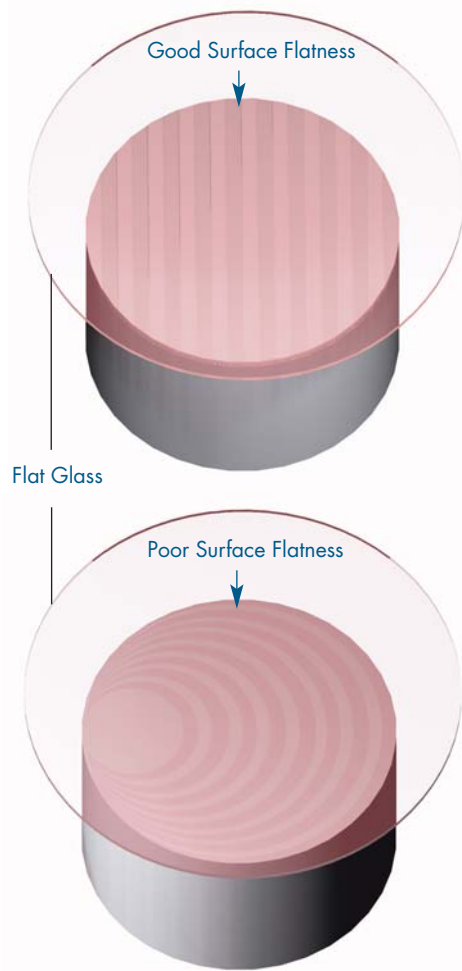
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Tolerances and Dimensions According to Manufacturing Process and Typical Batch Sizes

Mechanical Seals	Manufacture	Economic Batch Size	Tolerances
Pressed-to-size carbon graphite mechanical seals	Tool-dependent manufacture for large-batch production up to Ø 75 x 25 mm standard	Beginning at 2,500 units	Tolerances $\pm 0.5\%$ of the nominal size, simple to average complex geometries
RIDURID® and graphite-filled plastic mechanical seals	Material-dependent manufacture for large batches using the familiar process of plastics forming (injection molding, hot pressing)	Beginning at 5,000 units	Tolerances from IT 9 are achievable Possible without any limitation on the geometry
Carbon graphite mechanical seals	Machining for one-piece rings up to Ø 550 mm	1 – 5,000 units	Tolerances from IT 6 are achieved

Surface Flatness of Rubbing Faces



All of the above forming processes offer significant savings when the special features of carbon and graphite materials are considered at the design stage.

Take advantage of SGL Group's technical support at the design stage.

Surface Flatness of Rubbing Faces

The optimal function of the seal is essentially dependent on the parallelism deviation of the two sliding partners. This is determined with the help of an interference testing set.

The following deviations are permissible according to experience for carbon graphite mechanical seals (related to the outside diameter of the sealing surface):

1 light band = 0.297 μm ; measured using interference test equipment



Number of Light Bands	2	3	5	8
Diameter in mm	< 75	75-150	150-225	> 225

Material Grade Recommendations for Mechanical Seal Applications

Wet Running

Average Load (typically < 10 MPa x m/s)

Temperature	Manufacture	Material*	Application examples
Up to 200 °C/392 °F for use with predominantly neutral to acidic medium	Large-batch production tool-dependent up to Ø 75 mm	EK 2230 pressed-to-size carbon graphite synthetic resin-impregnated	Automotive water pumps, household appliances
		RIDURID® V 1774 synthetic resin-bonded graphite (p x v ≤ 5 MPa x m/s)	Oil burner pumps
Up to 550 °C/1,022 °F (in oxidized atmosphere up to 400 °C/752°F) for use with predomi- nantly neutral to alkaline medium	Large-batch production tool-dependent up to Ø 75 mm	EK 3235 antimony-impregnated pressed-to-size carbon graphite	Process seals, fuel pumps, cooling compressors
		EK 2239 pressed-to-size carbon graphite "all carbon" (acidic to alkaline medium, temperature up to 400 °C/752 °F)	Dishwasher pumps, automotive water pumps

Highest Load (typically > 10 MPa x m/s)

Temperature	Manufacture	Material*	Application examples
Up to 200 °C/392 °F for use with predomi- nantly neutral to acidic medium	Small-batch standard dimensions up to Ø 550 mm	EK 2200 synthetic resin-impregnated carbon graphite	Mechanical seals, e.g. for feed water pumps in power stations
Up to 550 °C/1,022 °F (in oxidized atmosphere up to 400 °C/752 °F) for use with predominantly neutral to alkaline medium	Small-batch standard dimensions up to Ø 550 mm	EK 3205 antimony-impregnated carbon graphite	Mechanical seals, e.g. for compressors

Dry Running

Temperature	Manufacture	Material*	Application examples
Up to 200 °C/392 °F	Small-batch standard di- mensions up to Ø 550 mm	EK 2240 synthetic resin-impreg- nated carbon graphite	Mechanical seals, e.g. for agitators
	Large-batch production tool-dependent up to Ø 75 mm	EK 2250 synthetic resin-impregnated carbon graphite	Seals, disks
Up to 550 °C/1,022 °F (in oxidizing atmosphere up to 400 °C/752 °F)	Small-batch standard dimensions up to Ø 550 mm	EK 3245 antimony-impregnated carbon graphite	Mechanical seals, e.g. for autoclaves, off shore gas seals
	Large-batch production tool-dependent up to Ø 75 mm	EK 3255 antimony-impregnated carbon graphite	Seals, disks

* Proof of gas tightness available on request for all materials.
Certificates for use in the food industry are available.

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