

Special Coatings Special Materials

Foreword

Special coatings

In order that standard components can function for long periods, without maintenance and reliably even under extreme operating conditions, the Schaeffler Group has developed various coatings for such requirements.

These coatings increase the corrosion resistance and/or wear resistance of the surface.

The selection of the coating is always dependent on the area of operation and the application.

Special materials

For four-row linear recirculating ball bearing and guideway assemblies KUVÉ there are, in addition to the special coating Corrotect[®] and the thin dense chromium coating Protect A and Protect B:

- corrosion-resistant steel
- amagnetic steel
- metal end pieces
- ceramic rolling elements.

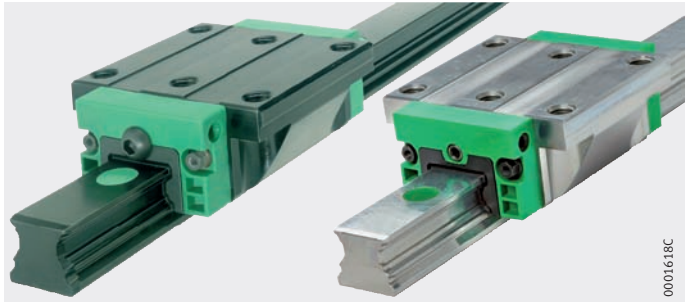
The guidance systems are thus highly suitable for clean rooms and applications in electronic component manufacture as well as in the pharmaceutical and food industries.

Product overview Special coatings

Special coating Corrotect®

Anti-corrosion protection

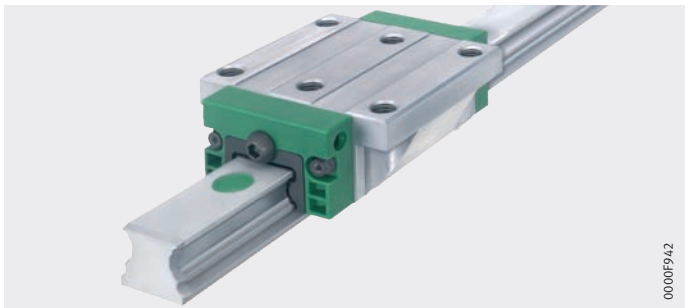
KUVE...-B-RRF, KUVE...-B-RROC



Thin dense chromium coating Protect A

Anti-corrosion protection and
anti-wear protection

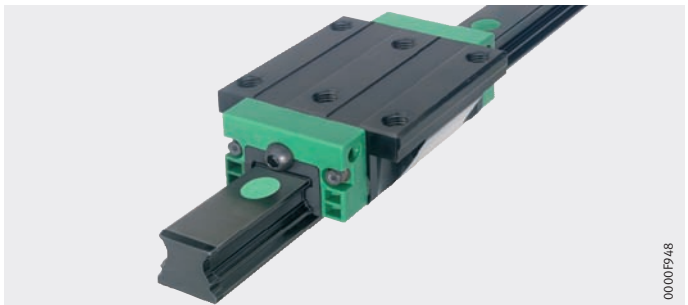
KUVE...-B-KD



Thin dense chromium coating Protect B

Anti-corrosion protection and
high anti-wear protection

KUVE...-B-KDC



Special coatings

Features

Types of coatings

Components at risk of corrosion are protected by the:

- special coating Corrotect[®], see page 4
- thin dense chromium coating Protect A, see page 7
- thin dense chromium coating Protect B, see page 9.

Advantages of thin dense chromium coating

The high hardness of the thin dense chromium coating and the special surface structure give an anti-wear effect. The columnar structure has a certain capacity for storage of lubricant. This ensures adequate lubricant in the rolling element contact zone even under extreme environmental and operating conditions.

A particularly high level of wear resistance together with a very high anti-corrosion effect is achieved by the coating Protect B, which has an additional chromium mixed oxide layer (LC).

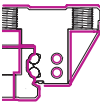
Due to its surface quality, this ensures separation of the contact between the rolling element and chromium layer and thus gives emergency running characteristics and reduction of wear under extreme operating conditions. Even under highly unfavourable environmental conditions, this coating still acts in a supportive capacity to the lubricant.

Since the coating increases the wear resistance of the base material, the preload is maintained over an extended period.



For use in the food industry, compliance with exacting environmental and health conditions must be achieved.

The coating Corrotect[®] (-RROC) and Protect A (-KD) is free from Cr(VI) and can therefore be used in this sector.



Special coatings

Special coating Corrotect®

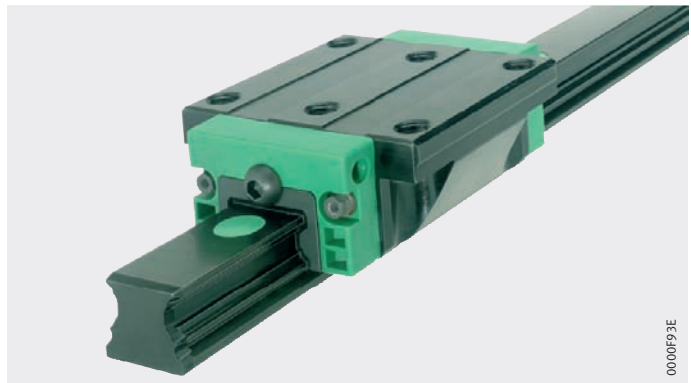
Anti-corrosion protection

Corrotect® is a surface coating applied by electroplating, *Figure 1*. It is an extremely thin anti-corrosion coating with cathodic protection and black chromate passivation. Under load, it is compacted into the surface roughness profile and partially worn away.

In parts coated with Corrotect®, running-in occurs in the area of the seal and an optically bright area develops as a result. Due to the remote cathodic protection mechanism, formation of rust in this area can also be prevented.

KUVE..-B-RRF

Figure 1
Special coating
Corrotect®



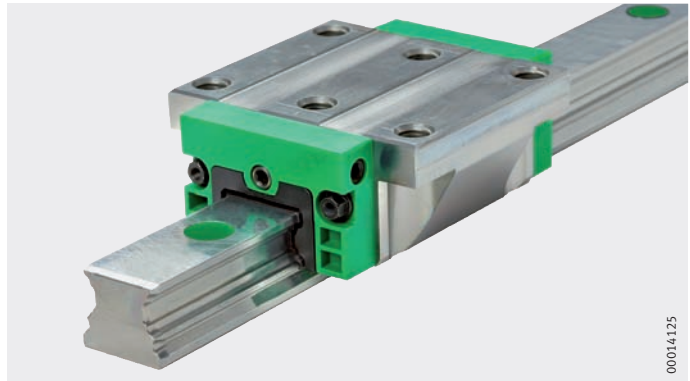
Advantages

The special coating Corrotect®:

- is resistant to moisture, salt spray mist, contaminated water and weak alkaline or weak acidic cleaning agents
- does not impair the load carrying capacity, in contrast to the use of corrosion-resistant steels
- is extremely resistant to corrosion
- offers protection against rust on all surfaces
- gives protection against rust even on smaller bright spots due to the cathodic protection effect
- gives protection against EP additives
- has good thermal conductivity.

Use in the food industry

For application in the food industry, the Schaeffler Group also offers the special coating Corrotect® free from Cr(VI), *Figure 2*. It thus fulfils the RoHS requirements in accordance with EU Guideline 2002/95/EG. All other advantages are identical with the standard Corrotect® coating.



KUVE..-B-RROC

Figure 2
Special coating
Corrotect® free from Cr(VI)

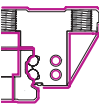
Application

Components coated with Corrotect® are particularly suitable where corrosion resistance is the most important factor. The coating is also used very successfully to prevent adhesion of weld spray.

Available products

The following products in the field of linear motion are available with the Corrotect® coating:

- linear recirculating roller bearing and guideway assemblies RUE..-E, RUE..-E-L-KT
- linear recirculating ball bearing and guideway assemblies KUVE..-B, KUVE..-B-KT
- shafts W
- hollow shafts WH
- guideways LFSR
- profiled track rollers LFR
- linear ball bearings KB, KS, KH.



Special coatings

Suffixes Components coated with Corrotect[®] containing Cr(VI) have the suffix RRF, see section Ordering designation.
Components coated with Corrotect[®] free from Cr(VI) have the suffix RROC, see section Ordering designation.

Ordering designation The ordering designation for a recirculating ball guidance system KUVE25-B coated with Corrotect[®] containing Cr(VI) and two carriages, accuracy G3 and preload class V1 is:
■ KUVE25-B-W2-G3-V1-RRF/
The ordering designation for a recirculating ball guidance system KUVE45-B-KT coated with Corrotect[®] free from Cr(VI) and one carriage, accuracy G2 and preload class V1 is:
■ KUVE45-B-KT-W1-G2-V1-RROC/

Technical/physical data for Corrotect[®] Technical/physical data for the special coating Corrotect[®], see table.

Data

Characteristics	Special coating Corrotect [®]	
	Containing Cr(VI) ³⁾	Free from Cr(VI)
Suffix	RRF	RROC
Colour	Black	Colourless, blue to iridescent
Layer thickness ¹⁾	0,5 µm – 3 µm	0,5 µm – 3 µm
Number of layers	1	1
Composition	Zinc alloyed with iron and cobalt	Zinc alloyed with iron
Layer hardness	300 HV	300 HV
Anti-corrosion protection ²⁾	96 h	96 h
Anti-wear protection	–	–
Maximum single-piece length	3 500 mm	3 500 mm
Free from Cr(VI)	No	Yes

1) Thickness in functional area.

2) Salt spray test to DIN 50 021.

3) Parts containing Cr(VI) are not suitable for the food industry.

Thin dense chromium coating Protect A

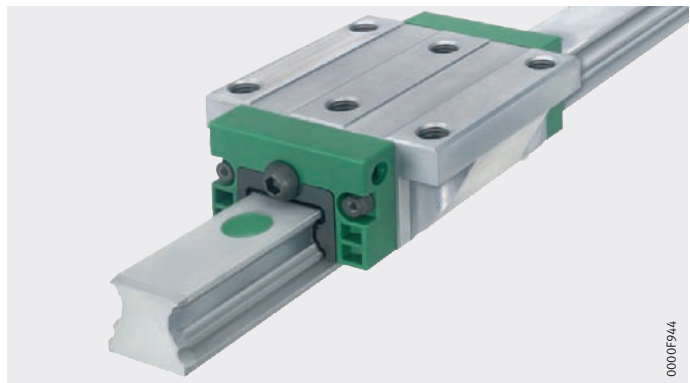
Anti-corrosion protection and
anti-wear protection

Protect A is a pure chromium coating with a columnar surface structure, *Figure 3*.

The coating is applied by electroplating. The parts to be coated are heated to approx. +50 °C. Since no structural changes occur, the parts retain full dimensional stability.

The matt grey chromium layer retains a certain amount of lubricant between the pearls. As a result, effective anti-wear protection is achieved even under mixed friction or slippage conditions.

The temperature range of the guidance system is between –10 °C and +100 °C.



KUVE..-B-KD

Figure 3
Thin dense chromium coating
Protect A

Advantages

The thin dense chromium coating Protect A:

- is resistant to various chlorides, various oils, sulphur compounds, chlorine compounds and weak acidic media
- does not influence the load carrying capacity and operating life of the coated products
- has higher wear resistance due to its high hardness
- ensures effective anti-wear protection even under mixed friction conditions
- offers good protection against EP additives
- has good thermal conductivity
- is moderately resistant to corrosion
- prevents false brinelling under vibration while stationary
- is free from Cr(VI).

Special coatings

Application Protect A does not contain Cr(VI). Components with this coating are therefore particularly suitable for use in the food industry, medical equipment and in all applications with the same or identical requirements.

The coating is recommended for use under particularly small stroke lengths and vibration while stationary.

Available products The following products in the field of linear motion are available with the Protect A coating:

- linear recirculating roller bearing and guideway assemblies RUE...-E, RUE...-E-L-KT
- linear recirculating ball bearing and guideway assemblies KUBE...-B, KUBE...-B-KT.

Other products in the shaft and track roller range are available by agreement with the Protect A coating.

Suffixes Components coated with Protect A have the suffix KD, see section Ordering designation.

Ordering designation The ordering designation for a recirculating ball guidance system KUBE25-B with Protect A coating and two carriages, accuracy G3 and preload class V1 is:

- KUBE25-B-W2-G3-V1-KD/

Technical/physical data for Protect A Technical/physical data for the thin dense chromium coating Protect A, see table.

Data

Characteristics	Data
Suffix	KD
Colour	Matt grey
Layer thickness ¹⁾	0,5 µm – 4 µm
Number of layers	1
Composition	Pure chromium layer with pearly surface
Layer hardness	900 HV – 1 300 HV
Anti-corrosion protection ²⁾	8 h
Anti-wear protection	Under mixed friction
Maximum single-piece length	4 000 mm
Free from Cr(VI) ³⁾	Yes

1) Thickness in functional area.

2) Salt spray test to DIN 50 021.

3) Parts free from Cr(VI) are suitable for the food industry.



When using Protect A, coated carriages and coated guideways must always be combined. If coated carriages are used with uncoated guideways, for example, this will lead to a reduction in preload.

Thin dense chromium coating Protect B

High anti-corrosion protection and
anti-wear protection

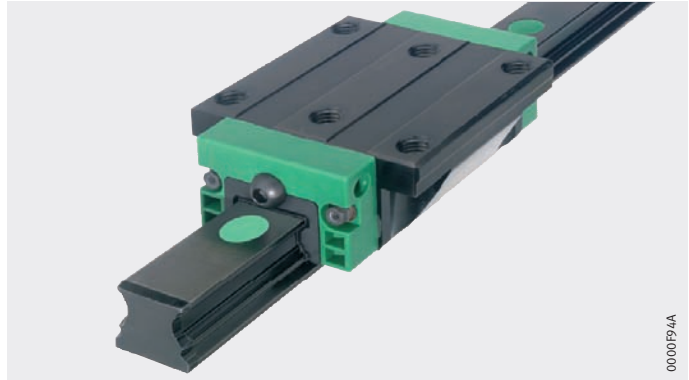
Protect B has a two-layer structure. A thin dense chromium coating (Protect A) is covered with chromium mixed oxide, *Figure 4*.

The corrosion resistance is provided by the chromium mixed oxide layer. This layer acts in a supportive capacity to the lubricant when used in aggressive atmospheres and at high temperatures.

The temperature range of the guidance system is between $-10\text{ }^{\circ}\text{C}$ and $+100\text{ }^{\circ}\text{C}$.

KUVE...-B-KDC

Figure 4
Thin dense chromium coating
Protect B



Advantages

The thin dense chromium coating Protect B:

- is resistant to various chlorides, various oils, sulphur compounds, chlorine compounds and weak acidic media
- does not influence the load carrying capacity and operating life of the coated products
- improves the running-in behaviour
- offers effective anti-wear protection under inadequate lubrication
- offers good protection against EP additives
- acts in a supportive capacity to the lubricant by means of the second layer in aggressive atmospheres and at high temperatures
- has good thermal conductivity
- offers high anti-wear protection together with high anti-corrosion protection
- prevents false brinelling under vibration while stationary.

Special coatings

Application Where high requirements for anti-corrosion protection are present and continuous lubrication cannot be ensured, Protect B is the suitable coating.

Available products The following products in the field of linear motion are available with the Protect B coating:

- linear recirculating roller bearing and guideway assemblies RUE..-E, RUE..-E-L-KT
- linear recirculating ball bearing and guideway assemblies KUV..-B, KUV..-B-KT.

Other products in the shaft and track roller range are available by agreement with the Protect B coating.

Suffixes Components coated with Protect B have the suffix KDC, see section Ordering designation.

Ordering designation The ordering designation for a recirculating ball guidance system KUV25-B with Protect B coating and two carriages, accuracy G3 and preload class V1 is:

- KUV25-B-W2-G3-V1-KDC/

Technical/physical data for Protect B Technical/physical data for the thin dense chromium coating Protect B, see table.

Data

Characteristics	Data
Suffixes	KDC
Colour	Black
Layer thickness ¹⁾	0,5 µm – 5 µm
Number of layers	2
Composition	Thin dense chromium coating (Protect A) covered with chromium mixed oxide
Layer hardness	950 HV
Anti-corrosion protection ²⁾	96 h
Anti-wear protection	Under inadequate lubrication
Maximum single-piece length	4 000 mm
Free from Cr(VI) ³⁾	No

¹⁾ Thickness in functional area.

²⁾ Salt spray test to DIN 50 021.

³⁾ Parts containing Cr(VI) are not suitable for the food industry.

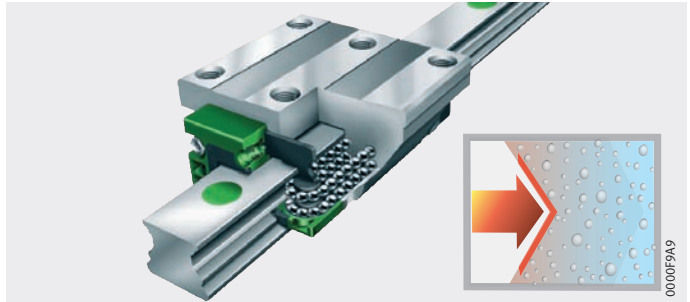


When using Protect B, coated carriages and coated guideways must always be combined. If coated carriages are used with uncoated guideways, for example, this will lead to a reduction in preload.

Product overview Special materials

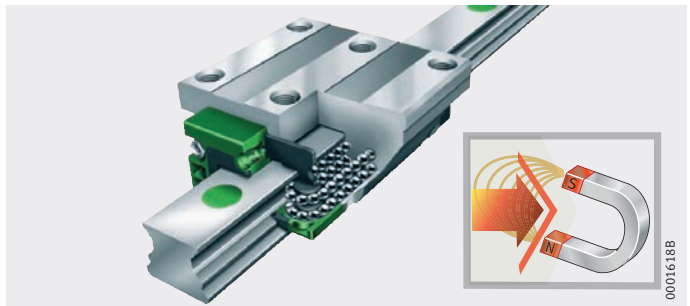
Corrosion-resistant steel

KUVE...-B-RB



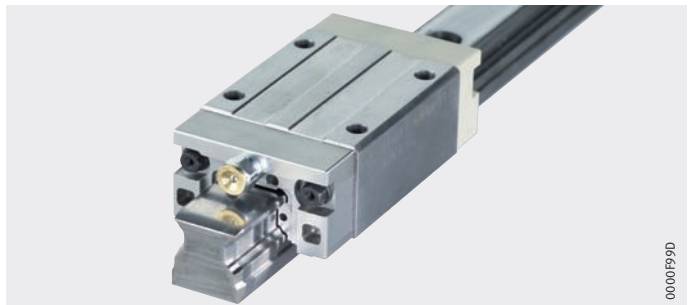
Amagnetic steel

KUVE...-B-AM



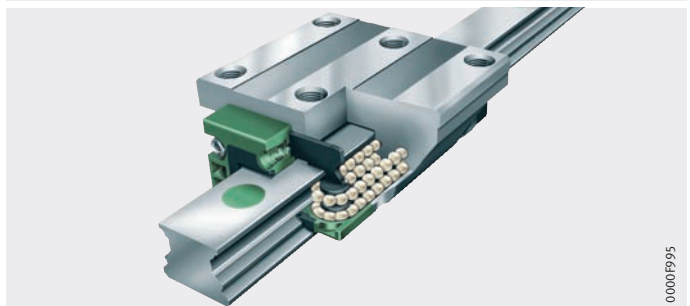
Metal end pieces

KUVE...-B-MKS



Ceramic rolling elements

KUVE...-B-HCB



Special materials

Materials for KUVE

For four-row linear recirculating ball bearing and guideway assemblies KUVE there are, in addition to the special coating Corrotect® and the thin dense chromium coating Protect A and Protect B:

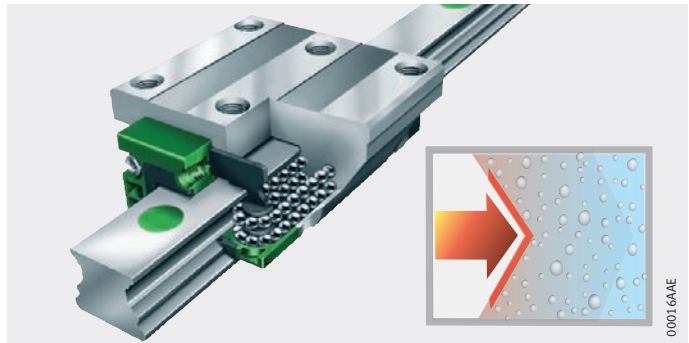
- corrosion-resistant steel
- amagnetic steel
- metal end pieces
- ceramic rolling elements.

Corrosion-resistant steel

All metal parts in KUVE..-B-RB are made from corrosion-resistant martensitic steel, *Figure 1*. Due to the special quench and tempering process and surface treatment, this material has high corrosion resistance. It is therefore also suitable for use in aqueous media, heavily diluted acids, alkalines or salt solutions.

KUVE..-B-RB

Figure 1
Corrosion-resistant steel



Advantages

These guidance systems have the following advantages:

- They achieve basic load ratings equivalent to 70% of the standard values.
- They are available in all accuracy and preload classes.
- Corrosion-resistant carriages can be used in any combination with the standard guideways, allowing replacement without any restrictions.
- The existing range of accessories can be used to its full extent.
- The complete sealing arrangement is already integrated.

Application

The guidance systems are suitable for clean rooms and applications in electronic component manufacture as well as in the pharmaceutical and food industries.

Suffixes

The suffix is RB; see section Ordering designation.

Ordering designation

The ordering designation for the guidance system KUVE25-B with two carriages, accuracy G3, preload class V1 and guideway length 1300 mm is:

- KUVE25-B-W2-G3-V1-RB/1300

Available sizes

KUVE15-B and KUVE25-B; other sizes available by agreement.



Special materials

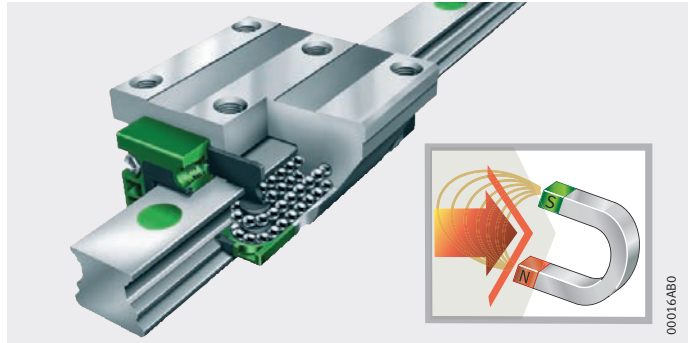
Amagnetic steel

KUVE..-B-AM is made from corrosion-resistant amagnetic steel, *Figure 2*.

Due to the special hardening process, the material achieves a hardness suitable for use in rolling bearings without developing a material structure that creates magnetic properties.

KUVE..-B-AM

Figure 2
Amagnetic steel



Advantages

Amagnetic guidance systems have the following advantages:

- All metal parts are made from corrosion-resistant steel.
- They achieve basic load ratings equivalent to 60% of the values for the standard guidance system.
- The magnetic permeability is very low ($\mu_r < 1,02$).
- They are available in all accuracy and preload classes.
- They can be used in any combination with the standard guideways, allowing replacement without any restrictions (standard guideway corrosion-resistant or amagnetic guideway).
- The existing range of accessories can be used to its full extent.
- The complete sealing arrangement is already integrated.

Application

Since no additional anti-corrosion coating is necessary, the guidance systems are highly suitable for use in clean rooms and the manufacture of electronic components, medical equipment and the food industry.

Suffixes

The suffix is AM, see section Ordering designation.

Ordering designation

The ordering designation for the guidance system KUVE25-B with two carriages, accuracy G3, preload class V1 and guideway length 500 mm is:

- KUVE25-B-W2-G3-V1-AM/500

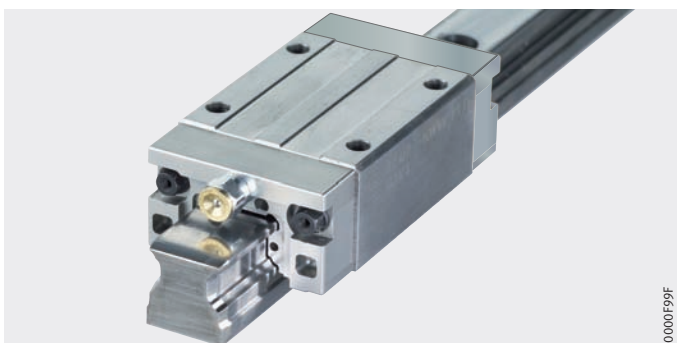
Available sizes

KUVE20-B and KUVE25-B; other sizes available by agreement.

Metal end pieces KUVE..-B-MKS has end pieces made from corrosion-resistant steel, *Figure 3*.

KUVE..-B-MKS

Figure 3
Metal end pieces



Advantages

The metal end pieces have the following advantages:

- They can be combined with amagnetic guidance systems.
- They can be used, due to their high strength compared to plastic designs, in applications where a particularly robust construction is required.
- They are resistant to gamma radiation.
- They are resistant to temperatures up to +150 °C.
- They are suitable for use in vacuum and clean rooms.
- They are available for all accuracy and preload classes.
- They are unsealed in the standard design.
- The guidance system is supplied with a preservative only, however special lubricants are available by agreement.
- Depending on the operating conditions (e.g. temperature) an integrated complete sealing arrangement and the range of accessories can be used.

Application

Due to the increased strength of the end piece, the guidance system is particularly suitable for extreme applications, for example at high temperatures or under radiation.

Suffixes

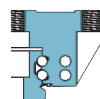
The suffix is MKS, see section Ordering designation.

Ordering designation

The ordering designation for the guidance system KUVE25-B with metal end pieces and one carriage, accuracy G2, preload class V1 and guideway length 1500 mm is:
■ KUVE25-B-W1-G2-V1-MKS/1500

Available sizes

KUVE15-B and KUVE25-B; other sizes available by agreement.



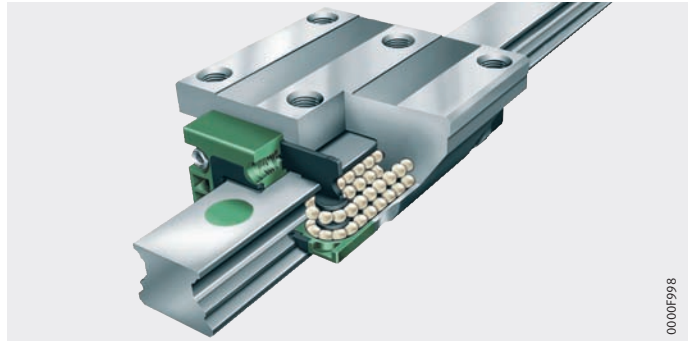
Special materials

Ceramic rolling elements

In combination with coatings or special materials, ceramic rolling elements can be used in hybrid bearings.

Ceramic is light, has a long operating life and offers significant advantages in many applications. Ceramic balls are characterised by their low inherent mass together with high hardness, rust resistance and electrical insulation.

KUVE..-B-HCB has ceramic rolling elements, *Figure 4*.



KUVE..-B-HCB

Figure 4
Ceramic rolling elements

Advantages

The guidance systems with ceramic rolling elements:

- have a longer rating life, depending on the application
- achieve basic load ratings equivalent to 70% of the standard values
- have lower bearing temperatures
- require less lubricant
- are corrosion-resistant when used in combination with corrosion-resistant or coated saddle plates and guideways
- do not allow any magnetism to occur between the rolling elements
- do not conduct electrical current
- allow higher speeds when used in combination with appropriate guidance system components
- can be fitted with the existing accessories
- are interchangeable with the standard range.

Application

Due to their amagnetic characteristics, linear recirculating ball bearing and guideway assemblies with ceramic rolling elements are used in many applications in medical equipment, laboratories and clean rooms as well as in the manufacture of electronic components.

Suffixes

The suffix is HCB, see section Ordering designation.

Ordering designation

The ordering designation for the guidance system KUVE25-B with two carriages, accuracy G3, preload class V1 and guideway length 250 mm is:

- KUVE25-B-W2-G3-V1-HCB/250

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