

Linear recirculating ball bearing units KUVS



Linear guidance systems with linear recirculating ball bearing units KUVS allow wide distances between support points. Furthermore, the bearing clearance can be adjusted. Linear guidance systems with linear recirculating ball bearing units are four-row systems.

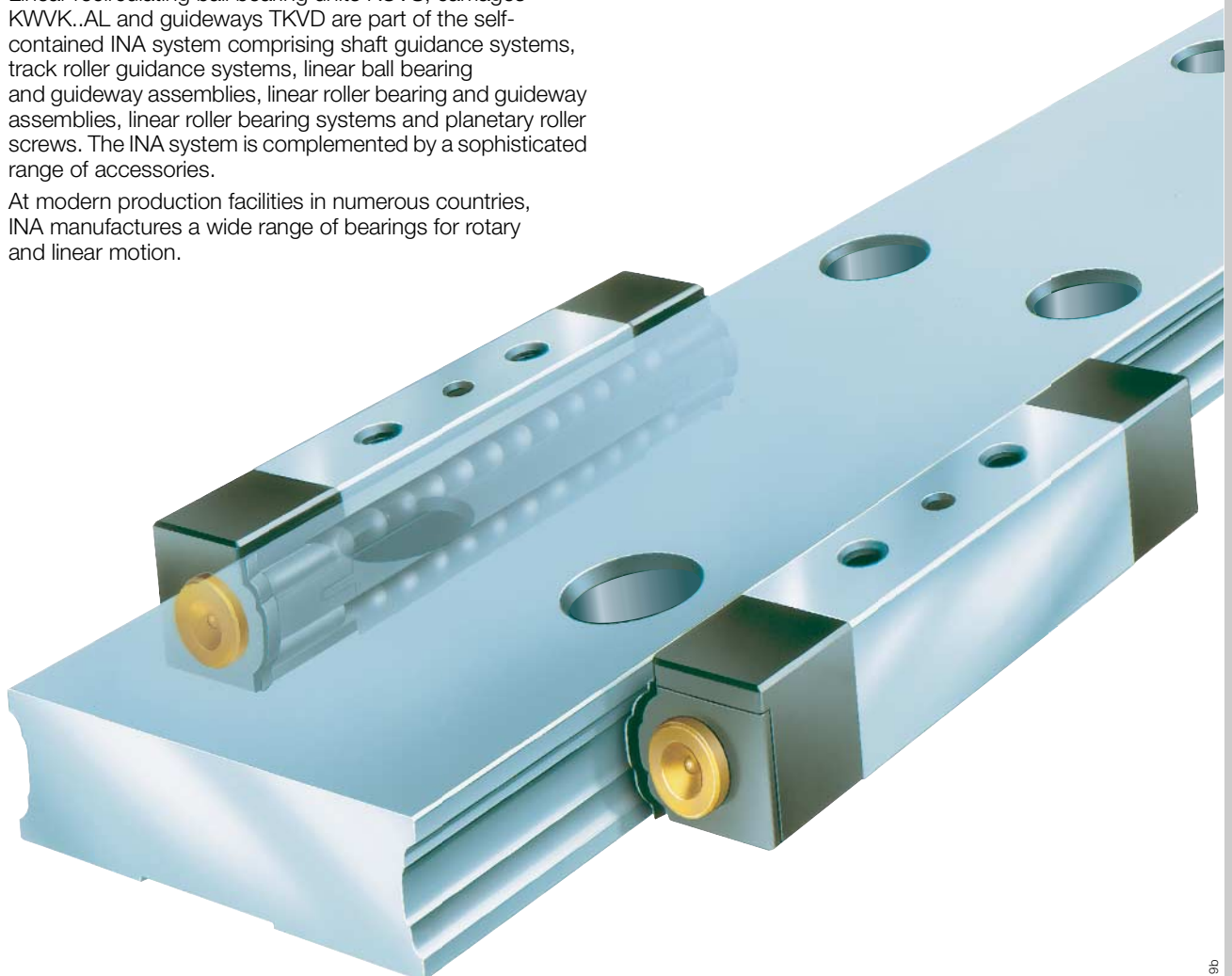
Despite their small envelope dimensions, linear recirculating ball bearing units KUVS have a high load carrying capacity. They run on guideways TKVD with raceways on one or both sides.

Carriages KWK..AL, in which linear recirculating ball bearing units KUVS are screw mounted, are combined with guideways TKVD to form four-row linear ball bearing and guideway assemblies.

Linear recirculating ball bearing units KUVS, carriages KWK..AL and guideways TKVD are part of the self-contained INA system comprising shaft guidance systems, track roller guidance systems, linear ball bearing and guideway assemblies, linear roller bearing and guideway assemblies, linear roller bearing systems and planetary roller screws. The INA system is complemented by a sophisticated range of accessories.

At modern production facilities in numerous countries, INA manufactures a wide range of bearings for rotary and linear motion.

The INA application engineering departments and engineering service can give expert assistance in the selection of bearings and guidance systems. Our engineers and technicians can provide comprehensive advice and prepare installation proposals based on our considerable experience, numerous investigations and the design programs derived as a result.



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Linear recirculating ball bearing units KUVS



Features

Linear guidance systems with linear recirculating ball bearing units KUVS

Linear guidance systems with linear recirculating ball bearing units KUVS consist of:

- linear recirculating ball bearing units KUVS or
 - carriages KWK..AL
- and
- guideways TKVD.

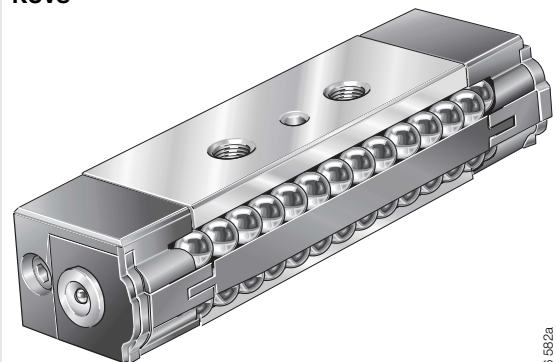
The balls and raceways are in two point contact with each other. The contact angles are 45° and are in an O type arrangement.

Corrosion-resistant designs

Linear guidance systems with linear recirculating ball bearing units KUVS are also available with the anti-corrosion coating "Corrotect®".

Linear recirculating ball bearing unit

KUVS



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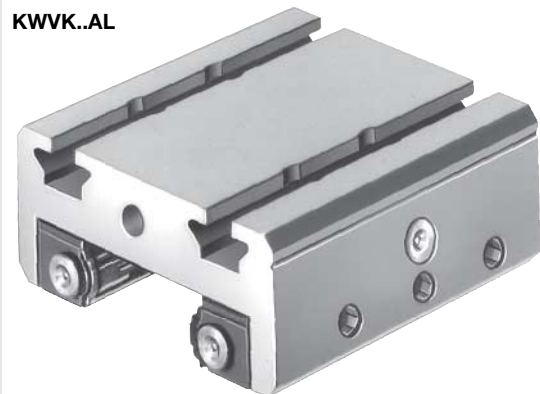
- load-bearing part with hardened and precision ground rolling element raceways
 - balls are recirculated in enclosed channels with plastic return elements
- full complement design
- threaded holes for mounting on the adjacent construction



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Carriage

KWK..AL



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- body made from anodised aluminium
- two or four ball bearing units fitted
- adjustable bearing clearance

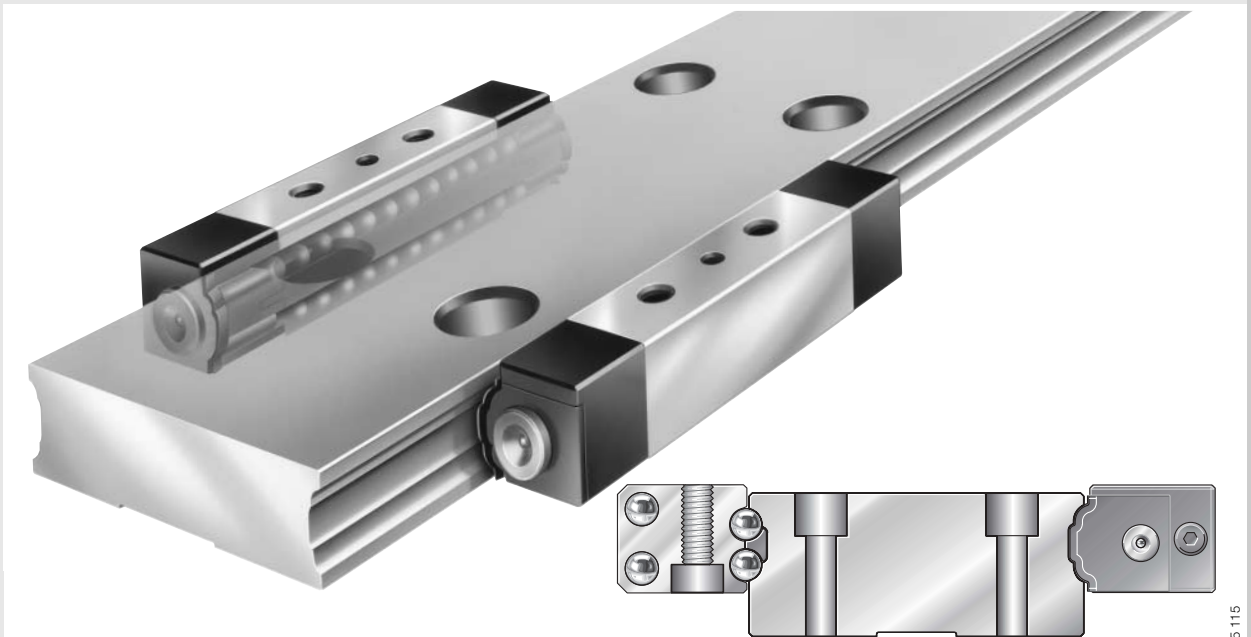


Further information on this electroplated coating is given in *INA Technical Product Information TPI 77: "Corrotect®" coatings for linear guidance systems.*



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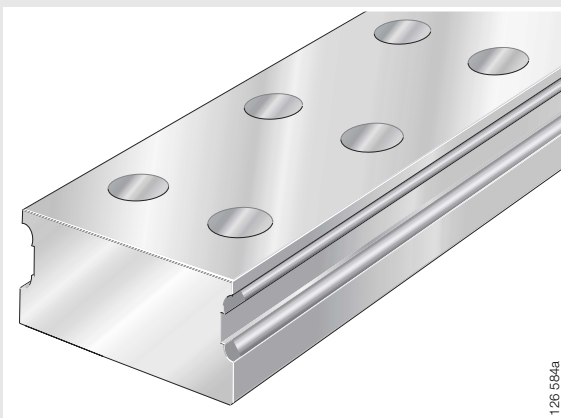
Linear recirculating ball bearing units with guideway



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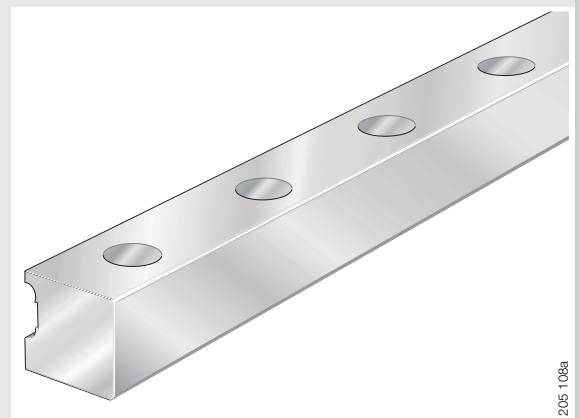
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Guideways



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- guideway
- TKVD 32
- TKVD 42
- TKVD 69



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- guideway
- TKVD 14
- TKVD 19



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Linear recirculating ball bearing units KUVS

Linear recirculating ball bearing units KUVS

Full complement linear recirculating ball bearing units KUVS (Figure 1) have a hardened and ground load-bearing body made from steel with two raceways. The raceways have profiled ends.

The balls are recirculated in enclosed channels with plastic return elements. A plastic crosspiece running between the end pieces retains the balls in the load-bearing body while the linear ball bearing unit is not mounted.

The linear recirculating ball bearing unit has two threaded through holes which are used for screw mounting on the adjacent construction.

Sealing

The linear recirculating ball bearing unit is sealed on all sides by the wipers on the end faces and on the sealing strips which form a gap seal in conjunction with the guideway.

Lubrication

Linear recirculating ball bearing units KUVS can be lubricated with grease or oil.

Lubrication nipples are pressed into both end faces of the linear ball bearing units. It is also possible to lubricate the linear ball bearing units from above via a hole (Figure 2) which need not be closed off if it is not used.

Delivered condition

Linear recirculating ball bearing units are supplied coated with an oil-based preservative.

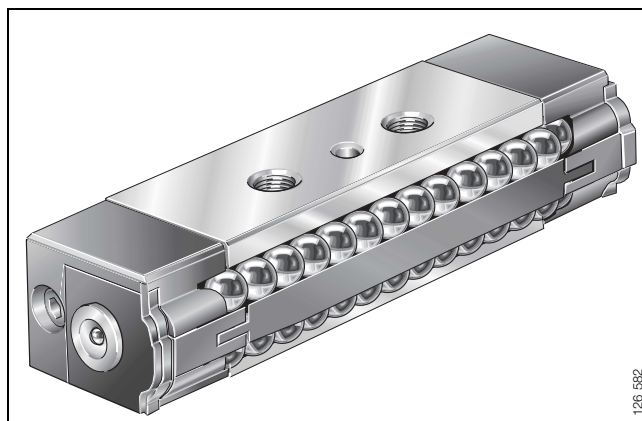


Figure 1 · Linear recirculating ball bearing unit KUVS

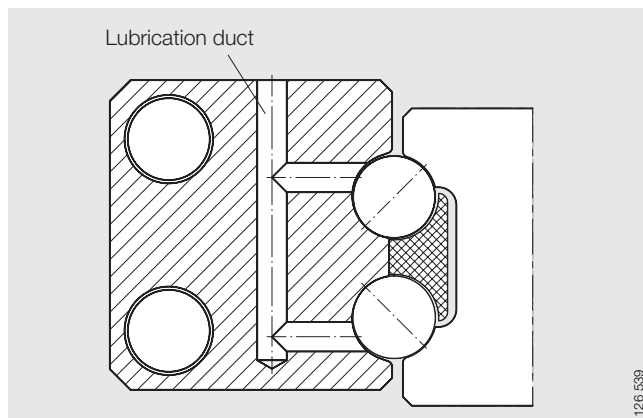


Figure 2 · Lubricant supply from above

Carriages KWK..AL

The carriage KWK..AL (Figure 3) has a saddle plate made from anodised aluminium and two linear recirculating ball bearing units KUVS as standard. Longer carriages with four linear recirculating ball bearing units are also available by agreement.

The screw mounting surfaces for the linear ball bearing units in the saddle plate are precision milled.

The carriage has T-slots for fixing to the adjacent construction. The slots can accommodate conventional hexagon nuts and T-nuts.

Clearance adjustment

The bearing clearance in a linear guidance system with carriages KWK..AL can be adjusted by three screws on the side of the carriage. The screws press into the back of the linear ball bearing unit.

Sealing

See section on linear recirculating ball bearing units KUVS.

Lubrication

See section on linear recirculating ball bearing units KUVS. A lubrication nipple is pressed into each longitudinal face of the carriage. Lubricant can be pressed into the upper hole of the linear ball bearing unit through this lubrication nipple.

Delivered condition

One linear recirculating ball bearing unit is ready mounted in the saddle plate.

The opposing linear ball bearing unit is screwed into place only finger tight. The clearance is adjusted on this side.

Linear recirculating ball bearing units are supplied coated with an oil-based preservative.

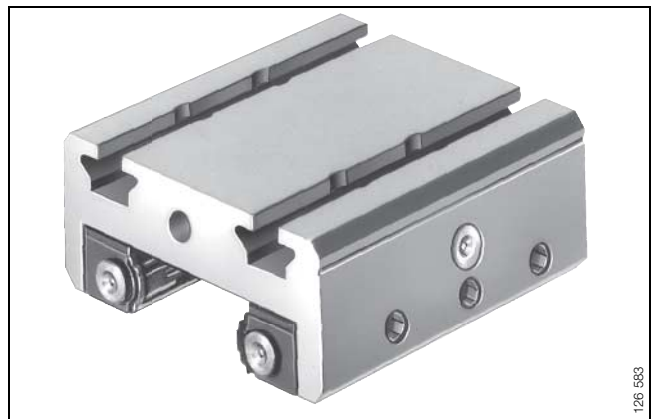


Figure 3 · Carriage KWK..AL

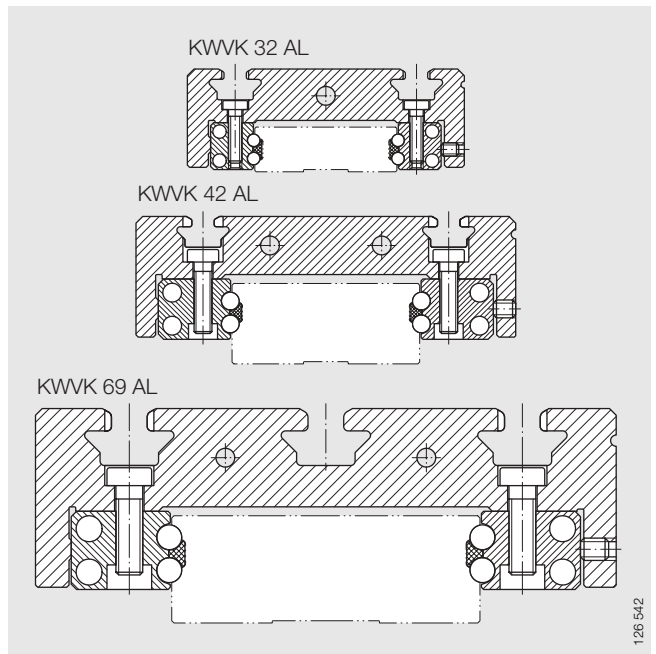


Figure 4 · Cross-sections of carriage KWK..AL

Guideways TKVD

Guideways TKVD are available in two designs:

- with raceways on both sides, TKVD 32, TKVD 42 and TKVD 69 (Figure 5)

- with raceways on one side, TKVD 14 and TKVD 19 (half guideway, Figure 6).

The guideways are made from hardened steel and ground on all sides. The raceways have a hardness of

- 670 HV to 840 HV.

The cylindrical counterbores of the fixing holes have sharp edges in order to give a flat guideway surface when closing plugs are inserted flush with the surface.

 Risk of injury!

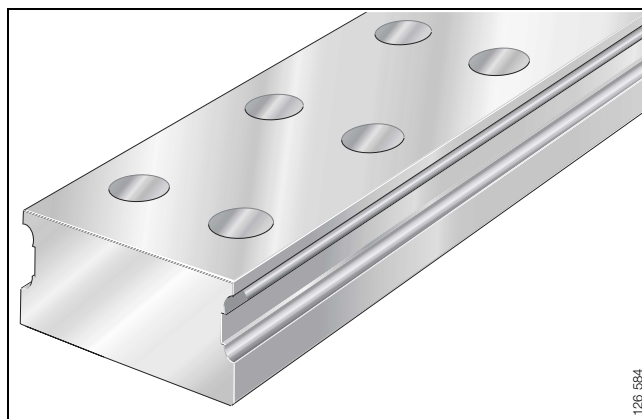


Figure 5 · Guideway TKVD 32, TKVD 42 and TKVD 69

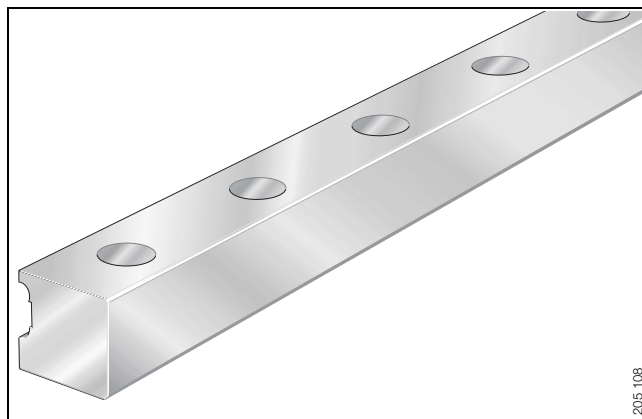


Figure 6 · Guideway TKVD 14 and TKVD 19

Multi-piece guideways

If single-piece guideways are not possible, the guideways can be assembled from sections matched to each other and marked (Figure 7).

Hole patterns (Figure 8)

Unless stated otherwise, guideways are supplied with a symmetrical hole pattern. An asymmetrical hole pattern may be available at customer request.

With a symmetrical hole pattern, $a_L = a_R$ (Figure 8 “top”), where $a_{L \min} \leq a_L \leq a_{L \max}$ and $a_{R \min} \leq a_R \leq a_{R \max}$.

With an asymmetrical hole pattern, $a_L \neq a_R$ (Figure 8 “bottom”). a_L is on the marked end of the guideway.

$$a_L = \frac{1}{2} \cdot (l_{\max} - n \cdot j_L)$$

l_{\max} mm
Guideway length

n -
Maximum possible number of hole pitches

j_L mm
Hole pitch (specified in *dimension tables*).

The minimum and maximum values for a_L and a_R must be observed (see *dimension table*)!

If they are not adhered to, the counterbore of a hole may be intersected.

Closing off the fixing holes

Fixing holes can be closed off using plastic closing plugs KA..TN or filled out with resin.

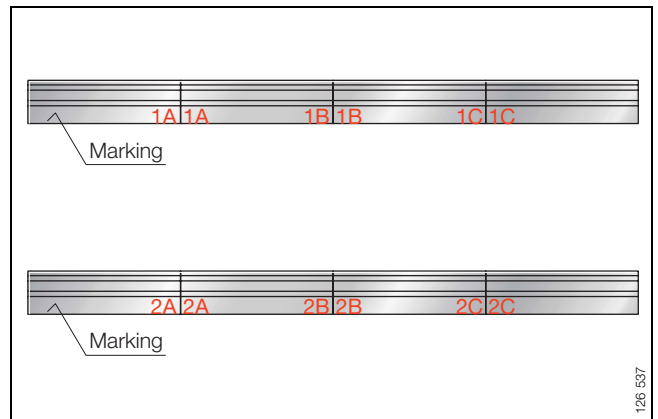


Figure 7 · Multi-piece guideways

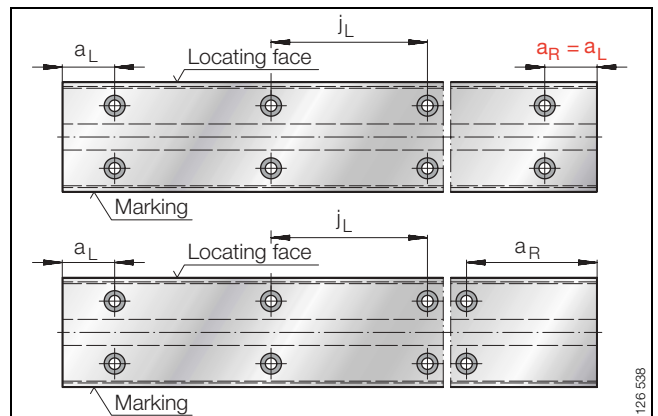


Figure 8 · Symmetrical and asymmetrical hole pattern



Accuracy

Table 1 shows the accuracy of linear recirculating ball bearing units KUVS and carriages KWK...AL in conjunction with a guideway TKVD.

The tolerances are arithmetic mean values. They relate to the centre point of the screw mounting or locating surfaces of the linear ball bearing unit KUVS or the carriage.

The dimensions ΔH and A_1 should always remain within the tolerances in Table 1, irrespective of the position of the guidance elements on the guideway.

The length tolerance of single-piece guideways is $\pm 0,1\%$. Multi-piece guideways have a length tolerance of ± 3 mm over the total length.

The positional tolerance limits the deviation of the hole centre point from the precise theoretical position (Figure 10).

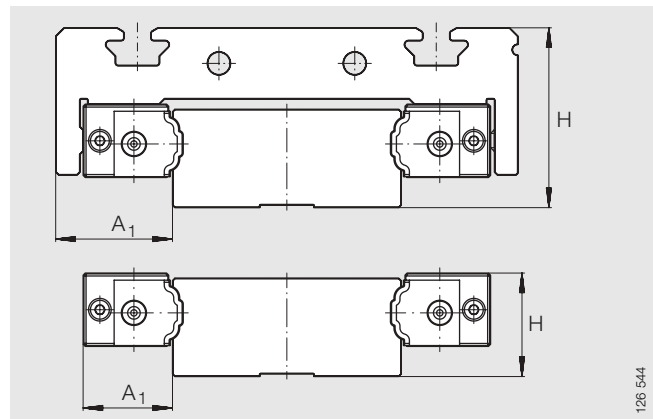
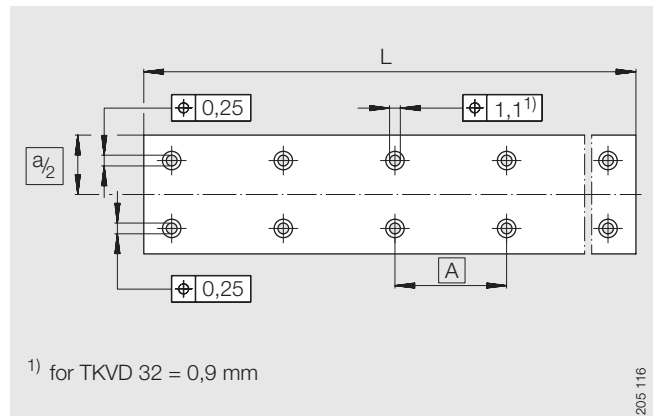


Figure 9 · Reference dimensions for accuracy



¹⁾ for TKVD 32 = 0,9 mm

Figure 10 · Tolerance for guideways TKVD, hole pattern to DIN ISO 1101

The parallelism tolerance of the guideways is shown in Figure 11.

Table 1 · Accuracy of linear ball bearing units and carriages

Dimension		KUVS Tolerance μm	KWK..AL Tolerance μm
Height tolerance	H	± 25	± 75
Height difference ¹⁾	ΔH	10	50
Spacing tolerance	A_1	± 25	± 125
Spacing difference ¹⁾	ΔA_1	20	100

¹⁾ Dimensional difference between several carriages on one guideway, measured at the same point on the guideway.

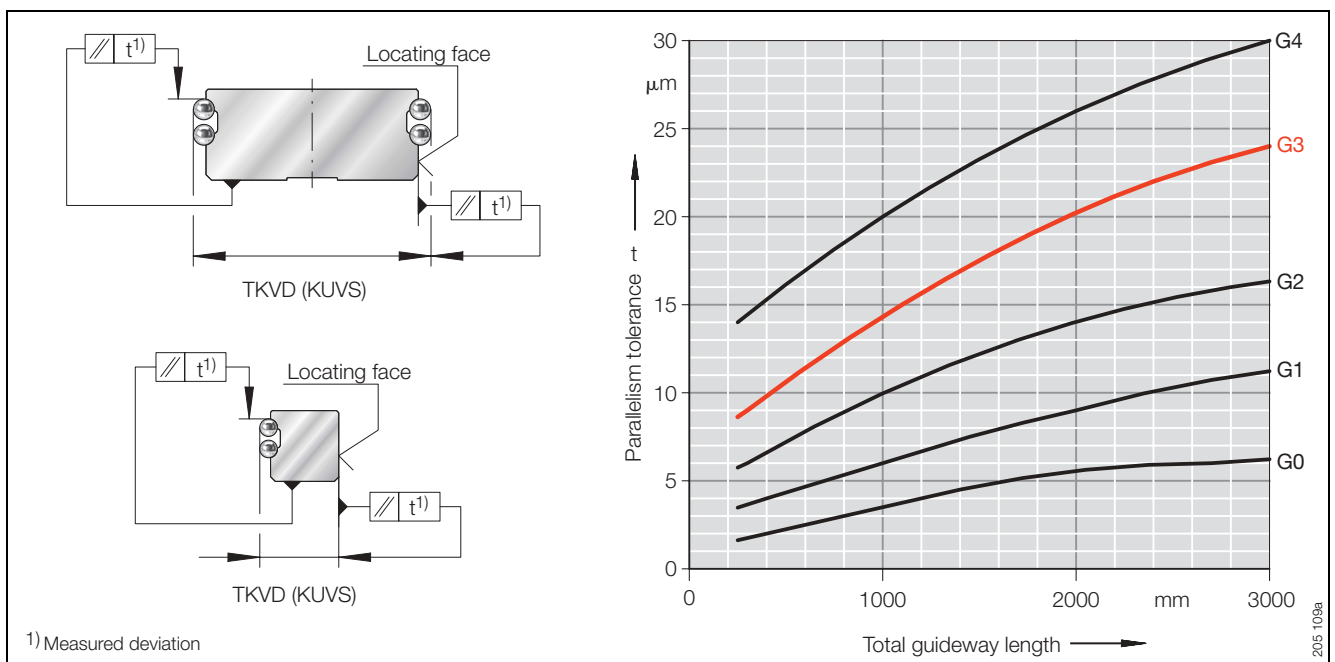


Figure 11 · Parallelism tolerance of guideways of series TKVD

Linear recirculating ball bearing units KUVS

Lubrication

Linear recirculating ball bearing units KUVS can be lubricated with grease or oil. Oil lubrication should be used in preference if possible.

The linear recirculating ball bearing units are supplied coated with an oil-based preservative as standard. The oil used is compatible with oils and greases having a mineral oil base. If greases with polycarbamide thickeners are used, please consult INA.

Linear recirculating ball bearing units run almost exclusively under mixed friction conditions. Doped lubricants (type P to DIN 51 502) should therefore be used in preference.

Lubricant supply

This is provided as standard:

- via funnel type lubrication nipples to DIN 3 405 on the end piece
- via the hole in the centre of the load-bearing body.

If a central lubrication system is used:

- via the hole in the centre of the load-bearing body.

The handling and use of lubricants is governed by national regulations for environmental protection and health and safety at work as well as information from the lubricant manufacturers. These regulations must be observed.

Lubricant oils and viscosity

Lubricant oils CLP or CGLP to DIN 51 517 and HLP to DIN 51 524 should be used in preference.

Viscosity

For operating temperatures between +10 °C and +70 °C, the viscosity should be between ISO VG 68 and ISO VG 220. For low temperatures, oils with lower viscosity must be used. For highly dynamic applications, lubricant oils to ISO VG 100 are recommended.

Compatibility

If no experience or guidelines from the oil manufacturer are available, lubricant oils must not be used until tests have been carried out to determine their behaviour in relation to:

- plastics
- elastomers
- non-ferrous and light metals.



Tests should only be carried out under dynamic conditions and at the appropriate operating temperature. The compatibility of oils must always be checked. In case of doubt, the lubricant manufacturer must be consulted.

Initial operation

The guideway and carriages must be oiled before initial operation and protected against solid and liquid contaminants. The carriages must be lubricated using at least the minimum oil quantity and moved back and forth during this process.

Table 2 · Minimum oil quantity and oil impulse quantity

Size	Minimum oil quantity Q_{\min} cm ³	Oil impulse quantity Q_{imp} cm ³ /h
KUVS 32	0,5 incl. 0,6	0,3
KUVS 42	0,5 incl. 0,6	0,3
KUVS 69	0,8 incl. 0,9	0,5

Minimum oil quantity

The minimum oil quantity is measured such that the oil ducts, rolling elements and raceways will be supplied with sufficient quantities of lubricant.

Table 2 shows the minimum oil quantity Q_{\min} for initial operation. If the stroke ratio is less than 0,5, please consult INA (stroke ratio: see page 13).

Oil impulse lubrication

Table 2 shows the oil impulse quantity Q_{imp} when a linear recirculating ball bearing unit is connected to a central lubrication system.

Pneumatic oil lubrication

The linear recirculating ball bearing units are also suitable for pneumatic oil lubrication.

Pneumatic oil lubrication may allow smaller quantities of oil to be used than stated in Table 2 (oil impulse lubrication). It is not possible to state definitive quantities since these are essentially dependent on the design of the central lubrication system.

The necessary oil quantity must therefore be determined under operating conditions.

Grease lubrication

INA recommends lithium soap greases with a mineral oil base. The viscosity should be between ISO VG 68 and ISO VG 100. For high loads, greases doped with EP additives are absolutely necessary.

Miscibility

Greases may be mixed if:

- they have the same base oil type
- they have matching thickener types
- they have similar base oil viscosities
 - the difference must not be more than one ISO VG class
- they have the same consistency (NLGI class).

In case of doubt, please consult INA.



The miscibility of synthetic oils must always be checked. In case of doubt, the lubricant manufacturer must be consulted.

Compatibility with process materials (e.g. cooling lubricants) must be checked.

Storage

Experience shows that INA linear guidance systems lubricated with greases having a mineral oil base can be stored for up to 3 years.

The following preconditions apply:

- closed storage room
- storage temperature between 0 °C and +40 °C
- relative humidity <65%
- protection against chemical agents (vapours, gases, fluids).

It is the user's responsibility to follow the directions given by the lubricant manufacturer.

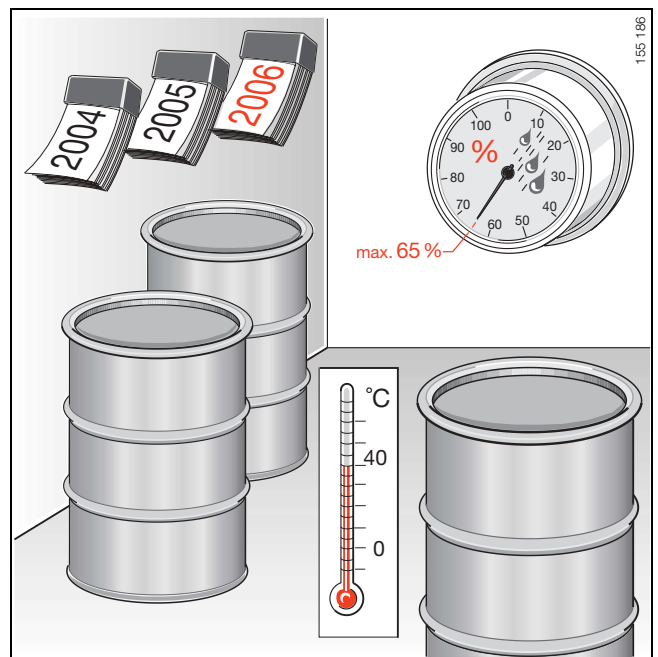


Figure 12 · Storage of greases

Initial operation

The guideways should be lightly greased before initial operation.

Before fitting, the linear recirculating ball bearing units should be filled with the initial grease quantity (Table 3). After fitting, the linear recirculating ball bearing units must be regreased via the lubrication devices connected until fresh grease emerges from the linear ball bearing units: the linear recirculating ball bearing units should be moved several times without load and regreased repeatedly.

Relubrication

The relubrication quantity is approximately 50% of the initial grease quantity. Relubrication should be carried out with several partial quantities at shorter intervals in preference to a single regreasing at the end of the relubrication interval.

The relubrication interval and quantity can only be determined precisely under operating conditions since it is not possible to calculate all the influences in advance. An observation period of adequate length must be allowed.

Relubrication interval

If the guide value for the grease operating life t_{fG} is less than the required operating duration of the linear unit, relubrication must be carried out.

Relubrication must be carried out at a time when the old grease can still be forced out of the carriage by the new grease.

A guide value for the relubrication interval for most applications is:

$$t_{fR} = 0,5 \cdot t_{fG} \text{ if } t_{fG} < t_{fE}$$

t_{fR} h
Guide value for relubrication interval in operating hours

t_{fG} h
Guide value for grease operating life in operating hours

t_{fE} h
Required operating duration in hours.

Table 3 · Size and initial grease quantity

Size	Initial grease quantity g
KUVS 32	0,2 incl. 0,3
KUVS 42	0,8 incl. 1
KUVS 69	2,0 incl. 2,5

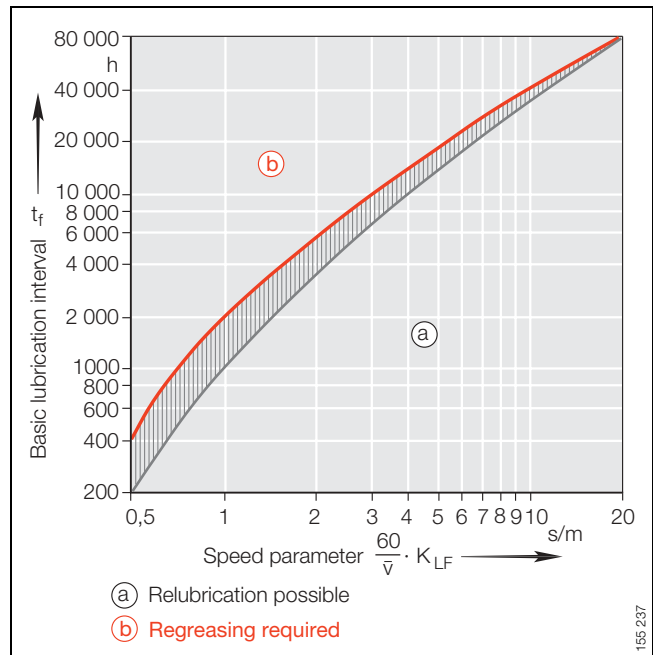


Figure 13 · Determining the basic lubrication interval

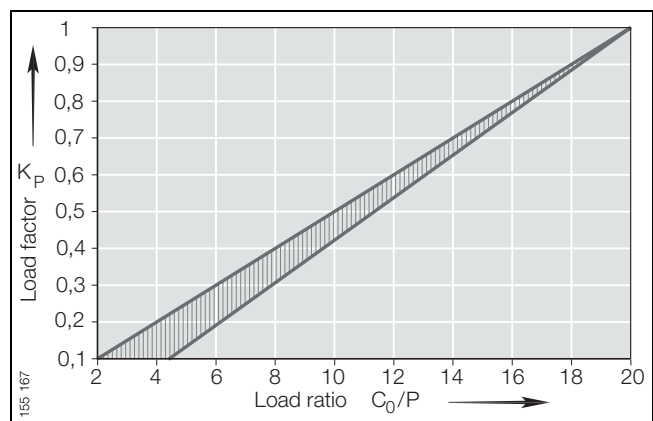


Figure 14 · Load correction factor K_P

Basic lubrication interval

The basic lubrication interval t_f is dependent on the speed parameter. It is determined using Figure 13.

The speed parameter is defined as follows:

$$\text{Speed parameter} : \frac{60}{v} \cdot K_{LF}$$

v m/min
Mean travel velocity

K_{LF} –
Bearing factor for KUVS: $K_{LF} = 1,5$.

The basic lubrication interval is valid under the following conditions:

- bearing temperature $< 70\text{ °C}$
- load ratio $C_0/P = 20$
- lubrication with high quality lithium soap grease
- no disruptive environmental influences
- stroke ratio between 1 and 10.

Load correction factor K_p

The correction factor K_p takes into consideration the greater strain on the lubricating grease at loads $C_0/P < 20$. The factors in Figure 14 are valid only for high quality lithium soap grease.

The preload must be taken into consideration.

Stroke ratio correction factor K_w

The correction factor K_w takes into consideration the travel distance to be lubricated. It is dependent on the stroke ratio and is determined using Figure 15. If the stroke ratio is < 1 or > 10 , the relubrication interval must be shortened in order to reduce possible fretting corrosion.

The stroke ratio is defined as follows:

$$\text{Stroke ratio} : \frac{H \cdot 10}{L_1}$$

L_1 mm
Effective saddle plate length C_1 from *dimension table*

H mm
Stroke length.

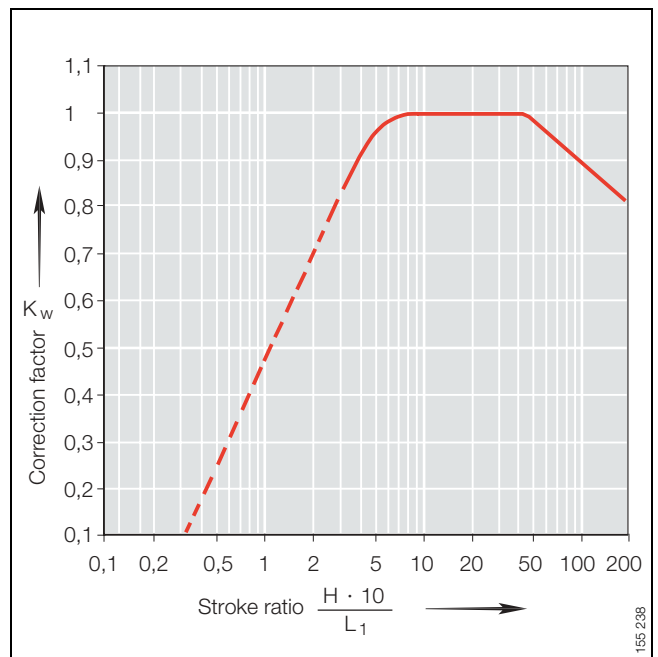


Figure 15 · Stroke ratio correction factor K_w

Environmental correction factor K_u

The correction factor K_u (Table 4) takes into consideration the effect of oscillations, vibration (leading to fretting corrosion) and shocks.

These subject the grease to additional strain.

All calculations are invalid if cooling lubricants or moisture penetrate the system.

Table 4 · Environmental correction factor K_u

Environmental influences	K_u
Slight	1,0
Moderate	0,8
Severe	0,5

Linear recirculating ball bearing units KUVS

The design of a bearing arrangement with linear recirculating ball bearing units KUVS or carriages KWK..AL is essentially determined by:

- the accuracy
- the rigidity
- the load carrying capacity.

This has a direct influence on the adjacent construction and primarily concerns:

- the geometrical and positional accuracy of the mounting surfaces
- the methods used to locate the guidance elements
- the sealing of the bearing arrangement.

Geometrical and positional accuracy of the mounting surfaces

The higher the requirements for accuracy and smooth running of the guidance system, the more attention must be paid to the geometrical and positional accuracy.

The mounting surfaces, i.e. the support and locating surfaces, should be designed according to the tolerances in Figure 16.

The surfaces can, for example, be produced using grinding or precision milling. The objective should be to achieve a mean roughness of $R_a 1,6$.

If the tolerances are not adhered to, the overall accuracy of the guidance system will be impaired, even though linear guidance systems with linear recirculating ball bearing units KUVS or carriages KWK..AL can partially compensate for inaccuracies.

The dimension ΔH (Figure 16) indicates the possible height offset of the support surface. For linear guidance systems with linear recirculating ball bearing units KUVS or carriages KWK..AL, the permissible dimension ΔH is:

$$\Delta H = 0,2 \cdot b$$

ΔH m
Height offset

b mm
Centre distance between guidance elements.

If the height offset is larger than that calculated using the above formula, this will affect the operating life.

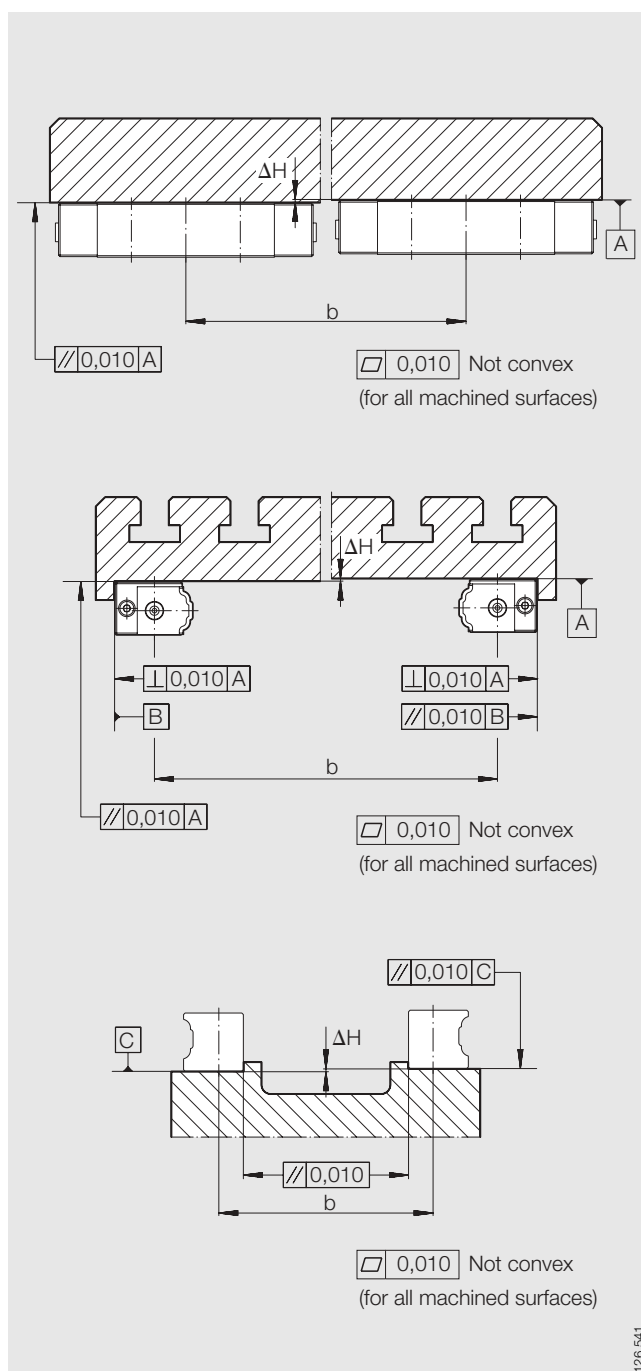


Figure 16 · Tolerances for mounting surfaces

Parallelism of mounted guideways

For two or more guideways parallel to each other, the parallelism according to Table 5 and Figure 16 must be observed.

If the maximum values (Table 5) are used, this may increase the displacement resistance.

Table 5 · Parallelism according to Figure 16 for mounted guideway

Guideway size ¹⁾	Parallelism t
	μm
TKVD 14	11
TKVD 19	13
TKVD 32	9
TKVD 42	11
TKVD 69	13

¹⁾ In the case of guideways TKVD 14 and TKVD 19, the locating face is the longitudinal face without a raceway.

Location

If high rigidity and high load carrying capacity are required, the guidance elements should be abutted or fixed by means of dowels on both sides against locating faces.

In order to avoid location defects, the holes in the adjacent construction must be carefully deburred.

The heights and corner radii of the locating faces correspond to the dimensions in Table 6 (Figures 17 and 18).

Table 6 · Locating heights and corner radii (Figures 17 and 18)

Size	r ₁ max.	h ₁	r ₂ max.	h ₂ max.
KUVS 42	1	5	1	5
KUVS 69	1	5	1	5
KWVK..AL 42	1	7	1	5
KWVK..AL 69	1	12	1	5

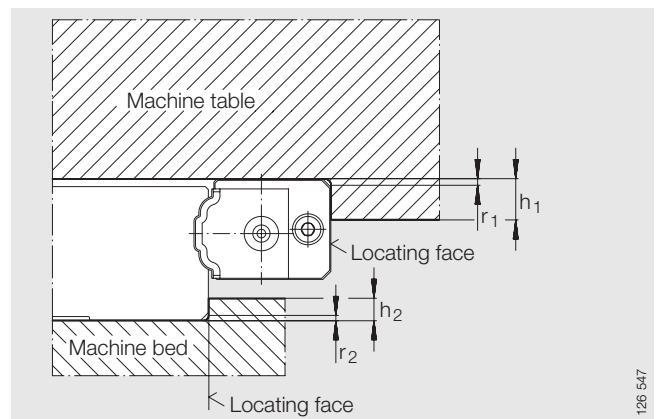


Figure 17 · Locating height and corner radii for linear recirculating ball bearing units KUVS

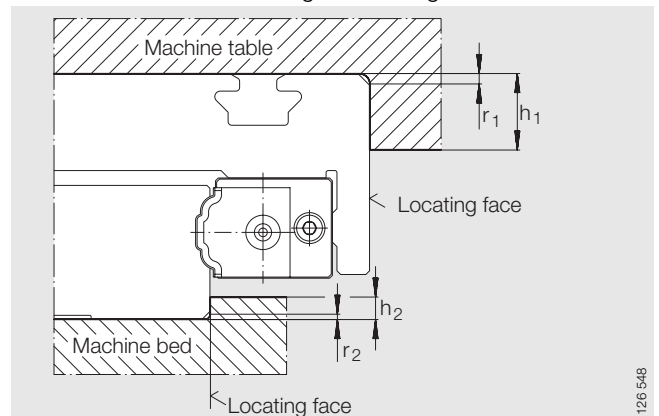


Figure 18 · Locating heights and corner radii for carriages KWVK..AL

Linear recirculating ball bearing units KUVS

Lubricant supply

Lubrication nipples in both end faces facilitate lubrication of the linear recirculating ball bearing unit KUVS. It is also possible to lubricate the linear ball bearing unit from above via a hole (Figure 2, page 4); which need not be closed off if it is not used.

The carriage KWK..AL is lubricated via the lubrication nipples in the linear recirculating ball bearing units. In addition, a lubrication nipple is inserted on each longitudinal face of the carriage through which lubricant can be pressed into the upper hole in the linear recirculating ball bearing units (Figure 3, page 5).

Sealing

The raceways must be kept clean at all times in order to prevent damage to the linear recirculating ball bearing units.

The linear recirculating ball bearing units are protected effectively against contamination by the wipers fitted as standard.

If a guideway is subjected to severe contamination or aggressive media, special measures must be used. One possibility is to cover the whole linear guidance system, for example by means of a telescopic cover or bellows.

Load carrying capacity and life

The load carrying capacity is described in terms of the basic dynamic load rating C , the basic static load rating C_0 and the basic static moment rating M_0 . The dimension tables state the values for C and C_0 as well as M_{0x} , M_{0y} and M_{0z} (Figures 19 and 20).

Basic rating life in 100 000 m

The basic rating life is reached or exceeded by 90% of a sufficiently large group of apparently identical bearings before the first evidence of material fatigue occurs.

$$L = \left(\frac{C}{P}\right)^3$$

$$L_h = \frac{833}{H \cdot n_{osc}} \cdot \left(\frac{C}{P}\right)^3$$

$$L_h = \frac{833}{\frac{v}{2}} \cdot \left(\frac{C}{P}\right)^3$$

L m
Basic rating life in 100 000 m

L_h h
Basic rating life in operating hours

C N
Basic dynamic load rating

P N
Equivalent dynamic load

H mm
Single stroke length for reciprocating motion

n_{osc} min⁻¹
Number of return strokes per minute

\bar{v} m/min
Mean travel velocity.



According to DIN 636-1, the equivalent dynamic load should not exceed $P = 0,5 \cdot C$.

Basic rating life in 10 000 m

In order to calculate the basic rating life in 10 000 m, the basic load rating C must be multiplied by a factor of 1,26; the calculation of life values in 10 000 m is common among Japanese rolling bearing manufacturers.

$$L_{5 \cdot 10^4} = \left(\frac{1,26 \cdot C}{P}\right)^3$$

Static load safety factor

The static load safety factor S_0 indicates the security with regard to permissible permanent deformation in the rolling contact without affecting guidance accuracy and smooth running:

$$S_0 = \frac{C_0}{P_0}$$

$$S_0 = \frac{M_0}{M}$$

S_0 –
Static load safety factor

C_0 N
Basic static load rating

P_0 N
Equivalent static bearing load (see “Equivalent bearing load”)

M_0 Nm
Static moment rating in load direction (M_{0x} , M_{0y} , M_{0z})

M Nm
Equivalent static moment in load direction.

If high demands are placed on accuracy and smoothness of running, the static load safety factor should not be less than $S_0 = 3$.

Permissible load

The permissible load is restricted by the load carrying capacity of the raceways and the strength of the screw connections and adjacent construction.

Tensile strength

If the fixing screw threads have sufficient strength, the linear recirculating ball bearing units can be subjected to loads up to the static load carrying capacity C_0 or M_0 .

Equivalent bearing load

Variable bearing load

Where the bearing load varies in steps, the equivalent dynamic load is calculated as follows:

$$P = \sqrt[3]{\frac{q_1 \cdot F_1^3 + \dots + q_z \cdot F_z^3}{100}}$$

P N
Equivalent bearing load

q %
Duration of particular steps

F N
Load applied during the particular step.

The equivalent static bearing load is defined as:

$$P_0 = F_{\max}$$

Variable speed

Where the speed varies in steps, the mean speed is calculated as follows:

$$\bar{v} = \frac{q_1 \cdot v_1 + q_2 \cdot v_2 + \dots + q_z \cdot v_z}{100}$$

\bar{v} m/min
Equivalent dynamic speed

q_i %
Duration as a proportion of the total operating time

v_i m/min
Variable speed.

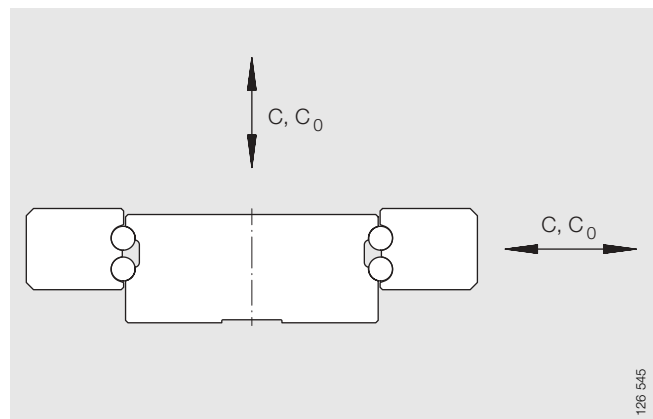


Figure 19 · Load directions

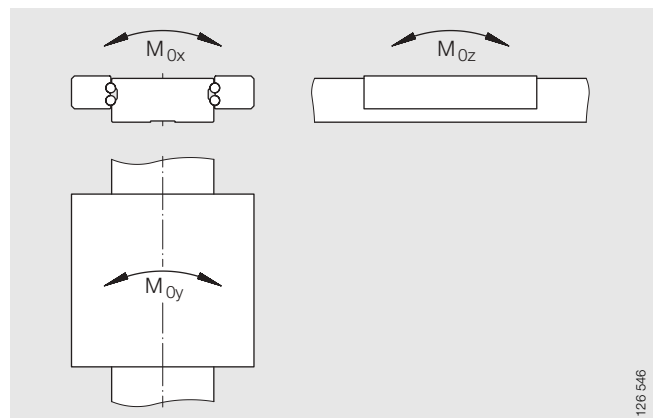


Figure 20 · Moments about x, y and z axes



Ordering example and ordering designation

Linear recirculating ball bearing units with guideway

Data on linear recirculating ball bearing units

Linear recirculating ball bearing units KUVS
Size 42

Data on guideway with asymmetrical hole pattern

Guideway for
linear recirculating ball bearing units TKVD
Size 42
Guideway length 420 mm
Spacing a_L 20 mm
Spacing a_R 40 mm

Ordering designation:

Item 1:

2×KUVS 42.

Item 2:

1×TKVD 42/420-20/40 (Figure 21).

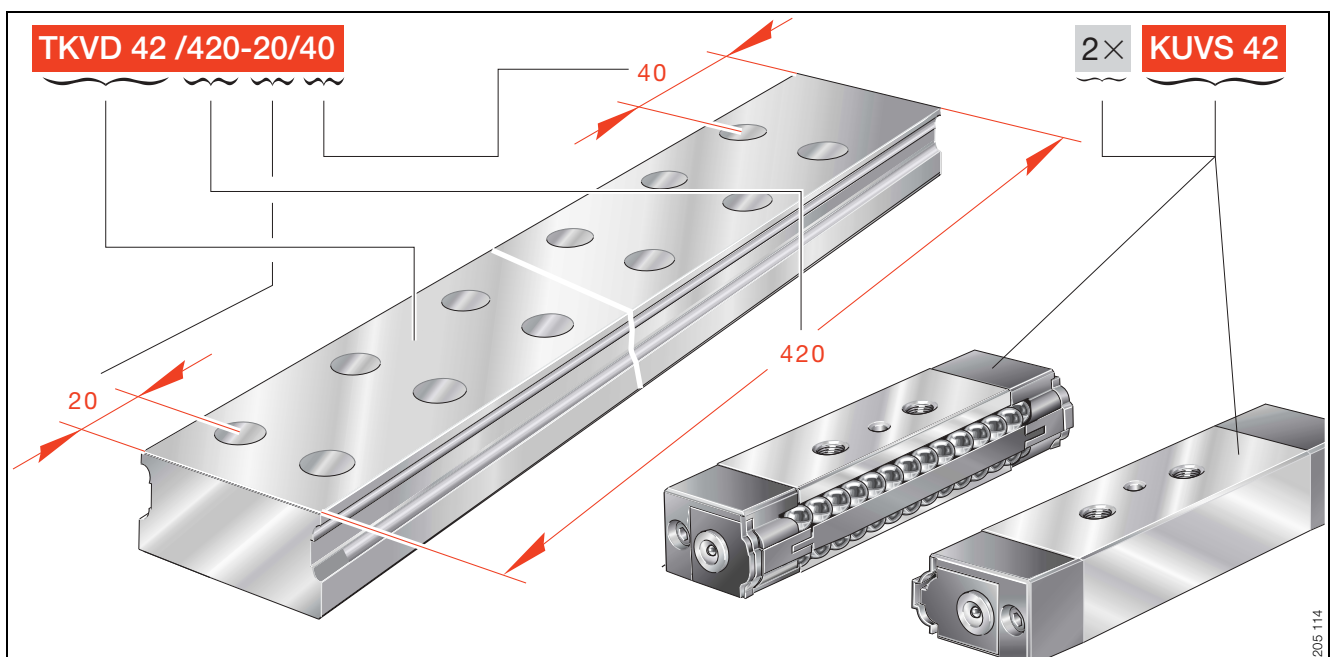


Figure 21 · Ordering example, linear recirculating ball bearing units with guideway

Linear recirculating ball bearing units

Series KUVS

Guideways

Series TKVD

Dimension table · Dimensions in mm

Linear recirculating ball bearing units		Guideway			Dimensions						Mounting dimensions				
Designation	Mass m ≈kg	Designation	Mass m ≈kg/m	Closing plug	H	B	L	h	b	$l_{max}^{3)}$	A_1	A_2	J_B	B_1	j_B
KUVS 32	0,025	TKVD 32	2,3	KA 8 TN	11	51,6	47	10	31,8	2000	9,9	5,5	40,6	–	18
KUVS 42	0,085	TKVD 42	5,54	KA 8 TN	19	75	71	18	42	2000	16,5	10	55	–	24
KUVS 42	0,085	TKVD 14	1,45	KA 8 TN	15	30	71	14	13,5	1500	16,5	10	–	32,4	6
KUVS 69	0,2	TKVD 69	12,42	KA 11 TN	25	114	96	24	69	2000	22,5	13	88	–	40
KUVS 69	0,2	TKVD 19	2,66	KA 11 TN	20	43	96	19	19,5	2000	22,5	13	–	44,4	8

1) For two linear recirculating ball bearing units in the case of TKVD 32, TKVD 42 and TKVD 69, one linear recirculating ball bearing unit in the case of TKVD 14 and TKVD 19.

2) The usable load carrying capacity is influenced by the connections between the guidance elements and the adjacent construction.

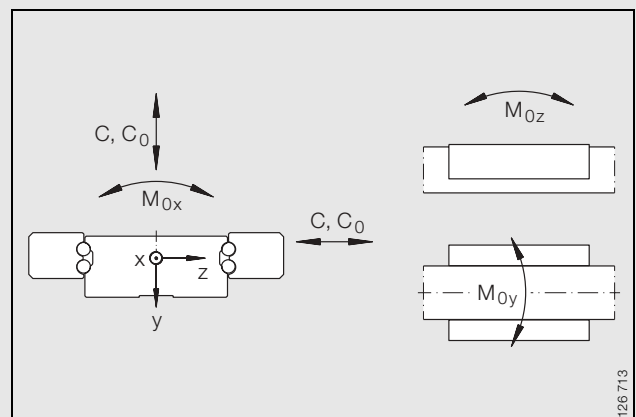
3) Maximum length l_{max} of single-piece guideways, longer guideways are supplied in several sections and are marked accordingly.

4) The dimensions a_L and a_R are dependent on the guideway length, for calculation see page 7.

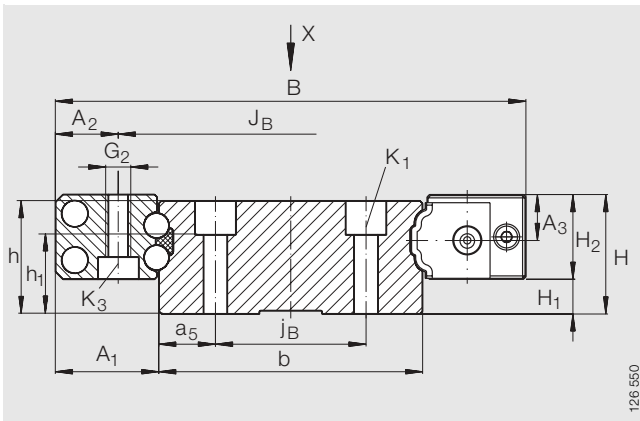
5) If there is a possibility of settling, the fixing screws should be secured against rotation.

Thread and screw diameters and tightening torques⁵⁾

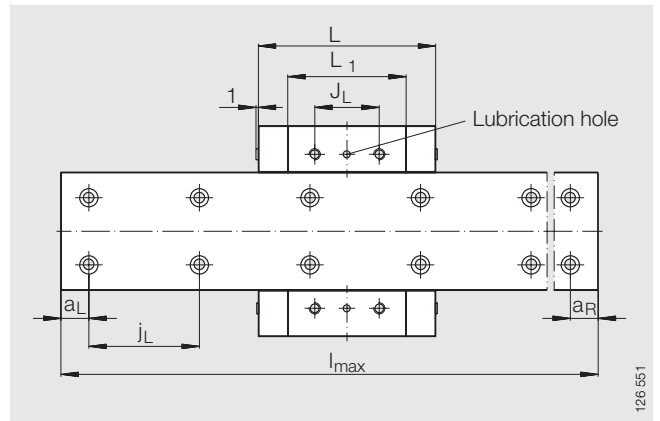
Designation	K_1 for screw to ISO 4762-12.9		G_2 for screw to ISO 4762-12.9		K_3 for screw to ISO 4762-12.9	
		Nm max.		Nm max.		Nm max.
KUVS 32	M3	2,5	M3	1,5	–	–
KUVS 42	M3	2,5	M4	3	M3	2,5
KUVS 42	M3	2,5	M4	3	M3	2,5
KUVS 69	M5	10	M6	10	M5	10
KUVS 69	M5	10	M6	10	M5	10



Load directions

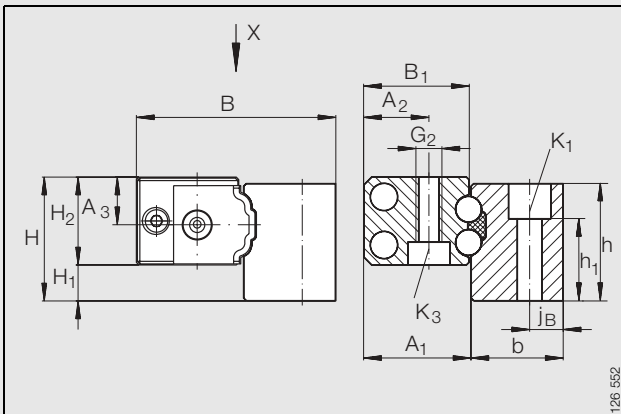


Two KUUVs with TKVD 32, TKVD 42 and TKVD 69

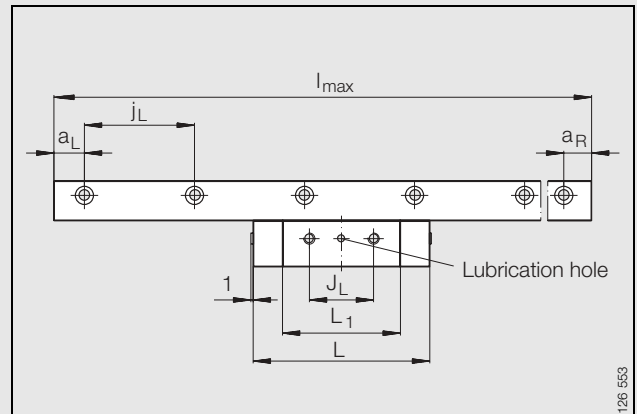


View X (rotated through 90°)

												Load carrying capacity ¹⁾²⁾				
a ₅	L ₁	J _L	j _L	a _{L min} ⁴⁾	a _{L max} ⁴⁾	a _{R min} ⁴⁾	a _{R max} ⁴⁾	H ₁	H ₂	A ₃	h ₁	C	C ₀	M _{0x}	M _{0y}	M _{0z}
												kN	kN	Nm	Nm	Nm
6,9	29,8	15	40	5	35	5	35	0,5	10,5	6	3,1	5,7	10,6	203	51	51
9	48,5	20	60	5	55	5	55	5,5	13,5	7,3	11,1	13,5	26	648	211	211
–	48,5	20	60	5	55	5	55	1,5	13,5	7,3	7,1	6,75	13	–	–	–
14,5	64	35	60	7	53	7	53	7,5	17,5	9,5	15,1	26	46,5	1872	492	492
–	64	35	60	7	53	7	53	2,5	17,5	9,5	10,1	13	23,25	–	–	–



KUUVs with TKVD 14, TKVD 19 (view and section)



View X (rotated through 90°)

Carriages

Series KWK..AL

Guideways

Series TKVD

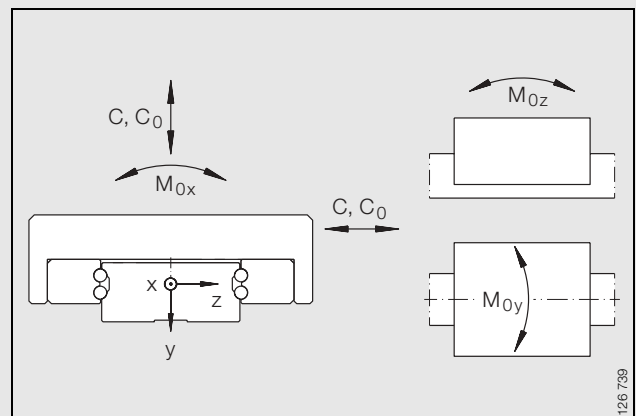
Dimension table · Dimensions in mm

Carriages		Guideway			Dimensions						Mounting dimensions					
Designation	Mass m ≈kg	Designation	Mass m ≈kg/m	Closing plug	H	B	L	h	b	l_{max}	A_1	A_2	J_B	j_B	a_5	B_6
KWK 32 AL	0,17	TKVD 32	2,3	KA 8 TN	26	62	50	10	31,8	2000	15,1	10,7	40,6	18	6,9	51,6
KWK 42 AL	0,45	TKVD 42	5,54	KA 8 TN	35	87	75	18	42	2000	22,5	16	55	24	9	75
KWK 69 AL	1,1	TKVD 69	12,42	KA 11 TN	47	130	100	24	69	2000	30,5	21	88	40	14,5	114

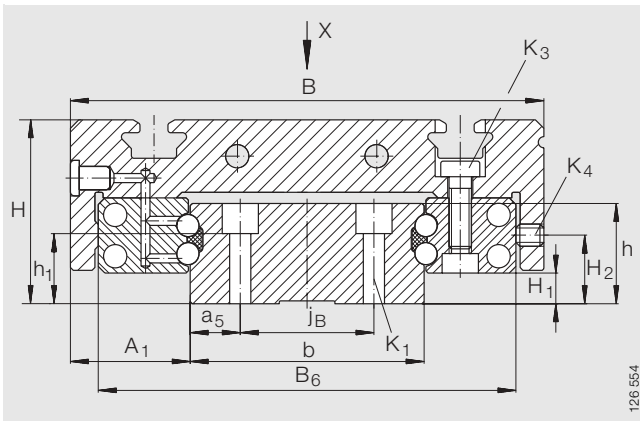
- 1) The usable load carrying capacity is influenced by the connections between the guidance elements and the adjacent construction.
- 2) Maximum length l_{max} of single-piece guideways, longer guideways are supplied in several sections and are marked accordingly.
- 3) The dimensions a_L and a_R are dependent on the guideway length, for calculation see page 7.
- 4) If there is a possibility of settling, the fixing screws should be secured against rotation.

Thread and screw diameters and tightening torques⁴⁾

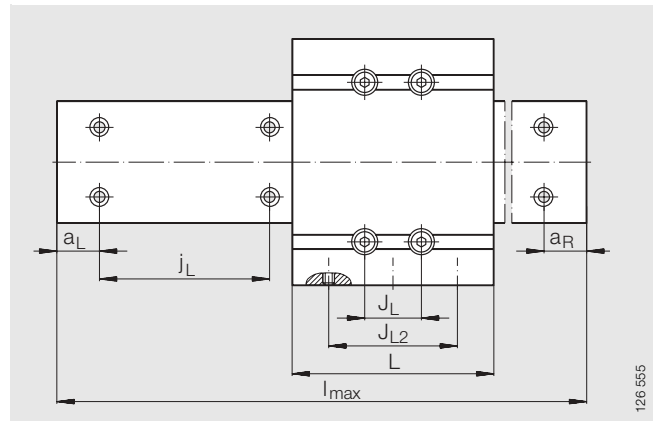
Designation	K ₁ for screw to ISO 4762-12.9		K ₃ for screw to ISO 4762-12.9		K ₄ for screw to ISO 4762-12.9
		Nm max.		Nm max.	
KWK 32 AL	M3	2,5	M3	0,6	M3
KWK 42 AL	M3	2,5	M4	2,1	M4
KWK 69 AL	M5	10	M6	4,8	M6



Load directions

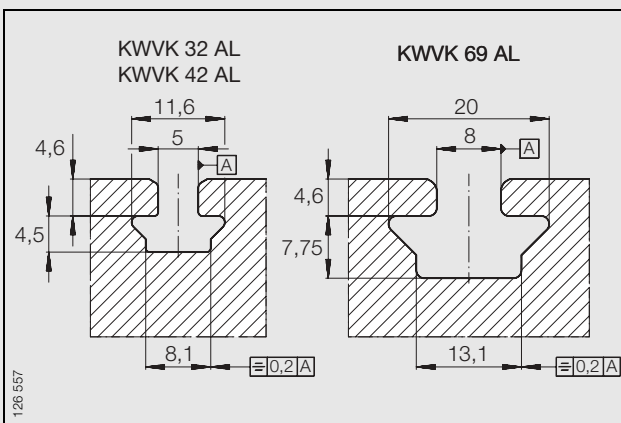


KWK..AL on TKVD

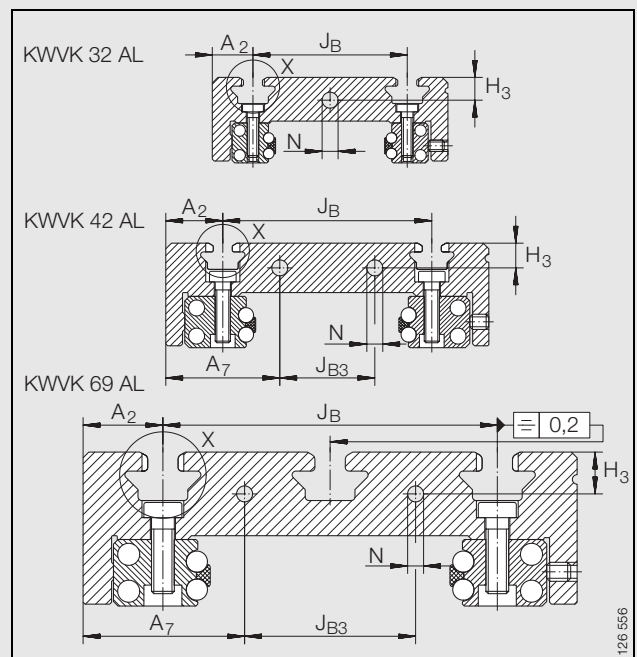


View X (rotated through 90°)

														Load carrying capacity ¹⁾				
A ₇	J _{B3}	J _L	J _{L2}	j _L	a _{L min} ³⁾	a _{L max} ³⁾	a _{R min} ³⁾	a _{R max} ³⁾	N	H ₁	H ₂	h ₁	H ₃	C	C ₀	M _{0x}	M _{0y}	M _{0z}
														kN	kN	Nm	Nm	Nm
–	–	15	25	40	5	35	5	35	4,2	0,5	6	3,1	7,5	5,7	10,6	203	51	51
31	25	20	40	60	5	55	5	55	4,2	5,5	12	11,1	8	13,5	26	648	211	211
42,5	45	35	55	60	7	53	7	53	4,2	7,5	17	15,1	11	26	46,5	1872	492	492



Detail X



Cross-section of carriages KWK..AL



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