item

# Linear Units KLE

## Notes on Use and Installation

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Warning! Failure to observe this safety instruction can result in material damage, serious injury or death

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Note! Failure to observe this safety instruction can result in material damage

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Observe directions for disposal

Observe directions for disposal

## General safety information

The details and information in this assembly guide are provided for the purposes of describing the product and its assembly only. This information does not discharge the user from the obligation to carry out his own assessments and checks. It is important to bear in mind that our products are subject to a natural process of wear and ageing. These notes contain important information that will enable you to use the product safely and appropriately. When sold, rented out or otherwise passed on to another party, this product must be handed over with the assembly guide.

When assembling, operating and maintaining the KLE (compact Linear Unit), it is important to ensure that all moving elements are secured so that they cannot be switched on and moved unintentionally. Rotating and moving parts can cause serious injury! You must therefore read and follow the safety instructions set out below.

All work on and with the KLE must be performed with “safety first” in mind.

- Always switch off the drive assembly before you start working on the KLE.
- Ensure the drive unit is not switched on unintentionally, e.g. by affixing warning notices at the activation point or by removing the fuse from the power supply.
- Do not place your hand within the operating range of the moving parts on the KLE when the unit is still switched on.
- Fit guards and covers to the moving parts of the KLE to ensure they are not touched unintentionally.
- Observe the regulations pertaining to accident prevention and environmental protection that apply in the country and place of work where the product is being used.
- Use only item products that are in perfect working order.
- Failure to use original spare parts will invalidate the product warranty!
- Check the product for obvious defects.
- Use the product only within the performance range described in the technical data.

- Ensure that all the safety equipment associated with the product is present, properly installed and in full working order.
- Do not alter the position of safety equipment, circumvent it or render it ineffective.

KLE 6 60x60 LR and KLE 8 80x80 LR, as described here, corresponds to the state of the art and takes into account the general principles of safety applicable at the time this assembly guide was published. Nevertheless, failure to observe the safety instructions and warning notices in this assembly guide may result in personal injury and damage to property. We will assume no liability for any resulting damage or injury.

We reserve the right to make technical changes that represent technical advances. Keep this assembly guide in a place where it can be easily accessed by all users. Observe the directions contained in the main user guide for the completed machine. The general safety information applies to the entire lifecycle of the partly completed machine.

1. During transportation
Observe the handling instructions on the packaging. Until it is assembled, the product must be stored in its original packaging, protected from moisture and damage. Ensure that moving parts are secured when in transit and cannot cause any damage.

2. During assembly
Always deactivate the power to the relevant system part and ensure it is not live before installing the product and/or plugging it in or unplugging it. Ensure the system cannot be switched back on. Lay cables and lines in such a way that they cannot be damaged and do not represent a trip hazard. Avoid areas that pose slip, trip and fall hazards.

3. During commissioning
Allow the product to acclimatise for a few hours before starting to use it. Ensure that the partly completed machine is securely and safely integrated into the completed machine. Only start up a product that has been installed in full.

4. During operation
Ensure that only persons who have been authorised by the operator have access to the immediate operating area of the system. This also applies when the system is not in operation. It must not be possible to actuate moving parts unintentionally. During emergencies, malfunctions or other irregularities, deactivate the system and ensure that it cannot be switched back on. Prevent the possibility of persons becoming trapped in the system's hazard zone.

5. During cleaning
Close all openings with suitable protective equipment to ensure that cleaning agents cannot penetrate the system. Do not use aggressive cleaning substances. Do not use a high-pressure cleaner when cleaning the system.

6. During maintenance and servicing work
Carry out the prescribed maintenance work at the intervals stipulated in the user guide. Ensure that no cable links, connections or components are removed while the system is live and under pressure. Ensure the system cannot be switched back on.

7. During disposal
Dispose of the product in accordance with the national and international regulations that apply in your country.

The KGT 6 60 P20 is designed for indoor operation.

## Correct use

The compact linear unit is a component and must only be used in accordance with the technical data and safety requirements set out in this document. If the compact linear unit is combined with a motor and control unit, an incomplete machine is generated in the sense of the MRL 2006/42/EC. The Declaration of Incorporation is enclosed for the version with motors and controls, from item GmbH. Internal company requirements and the regulations that apply in the country where the product is being used must be observed. You must not make any design modifications to the KLE yourself. We will assume no liability for any resulting damage or injury.

You may only assemble, operate and maintain the KLE if:

The compact Linear Unit has been integrated properly and safely into the completed machine,

You have carefully read and understood the assembly guide,

You are appropriately qualified,

You are authorised to do so by your company,

You are using only original equipment from the manufacturer.

Unsafe or inappropriate use of the compact Linear Unit runs a risk of serious injury through crushing and cuts.

The KGT 6 60 P20 is designed for indoor operation.

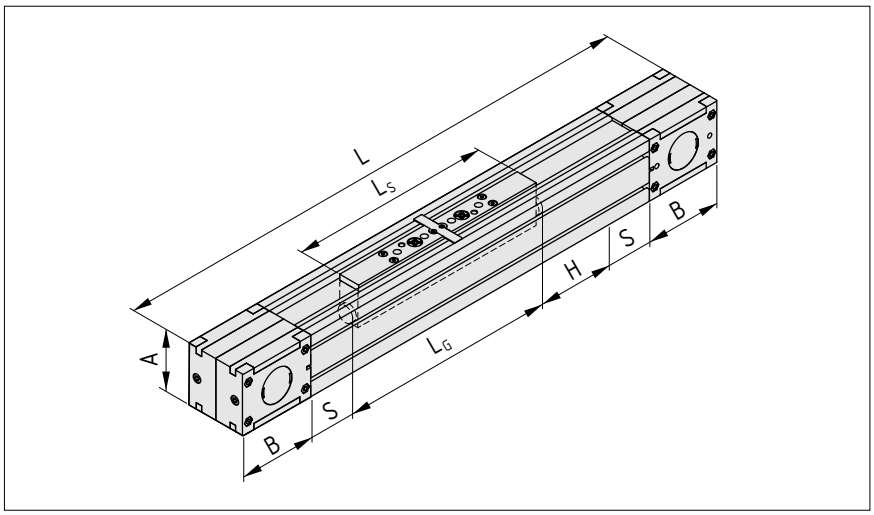
## Improper use

Improper use is defined as any use of the product for purposes other than those authorised in the assembly guide and under the definition of correct use. We will assume no liability for any resulting damage or injury.

## Selecting suitable Linear Units KLE Design

Linear Unit KLE 6 60x60 LR 0.0.605.07

Linear Unit KLE 8 80x80 LR 0.0.605.02

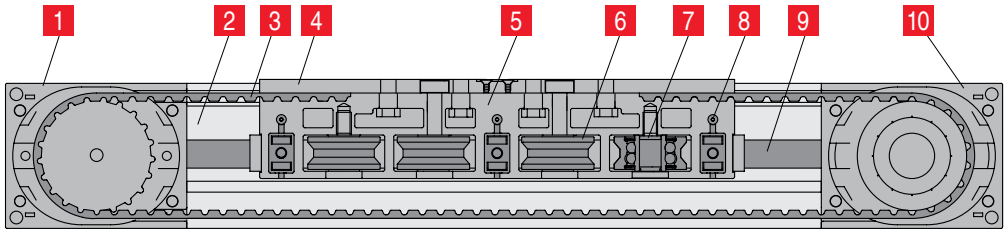



| | | KLE 6 60x60 | KLE 8 80x80 |
|---|---|---|---|
| L [mm] | Max. overall length | 6,150 | 6,200 |
| L [mm] | Min. overall length | 400 | 600 |
| $L_S$ [mm] | Slide length visible | 190 | 262 |
| $L_G$ [mm] | Slide length | 198 | 273 |
| B [mm] | Reverse Unit length | 75 | 100 |
| A [mm] | Reverse Unit hight | 60 | 80 |
| $S_{min}$ [mm] | Minimum safety | 26 | 63.5 |
| H [mm]<br>$H_{max}$ | Travel<br>Max. travel at min. safety | 5,750 | 5,600 |

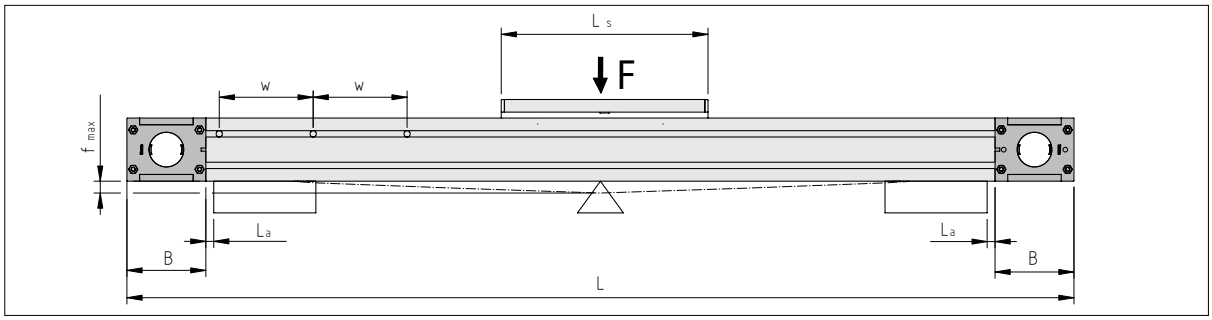
Table 1 Geometry

The safety distance S is a reserve distance to accommodate tolerances and carriage overtravel under high loads and accelerations at the reversal point. It must be factored into the equation depending on the capabilities of the drive and Controller, but in any event should not be smaller than shown!

## Article names, geometry




| | Article name | Order number |
|---|---|---|
| 1 | Timing Belt Drive KLE 6 60x60 LR | 0.0.605.18 |
| | Timing Belt KLE 8 80x80 LR | 0.0.604.95 |
| 2 | Profile 6 60x60 KLE | 0.0.603.83 |
| | Profile 8 80x80 KLE | 0.0.600.42 |
| 3 | Timing Belt R 25 AT5 PAR | 0.0.604.06 |
| | Timing Belt R 34 AT10 PAR | 0.0.600.28 |
| 4 | Cover Plate KLE 60x60 | |
| | Cover Plate KLE 80x80 | |
| 5 | Carriage KLE 6 60x60 | 0.0.604.23 |
| | Carriage KLE 8 80x80 | 0.0.600.26 |
| 6 | Roller D10/D14, eccentric bearing | |
| 7 | Roller D10/D14, centric bearing | |
| 8 | End Cap and Lubricating System with three grease nipples | |
| 9 | Shaft D10/D14 | |
| 10 | Reverse Unit KLE 6 60x60 LR | 0.0.604.21 |
| | Reverse Unit KLE 8 80x80 LR | 0.0.600.49 |
| | Strip KLE 6 60x60 (see page 10) | 0.0.608.29 |
| | Strip KLE 8 80x80 | 0.0.608.30 |
| | Cover Profile KLE 6 60x60 | 0.0.603.88 |
| | Cover Profile KLE 8 80x80 section on Proximity Switches) | 0.0.600.54 |

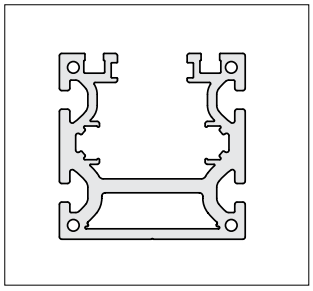



| | | | KLE 6 60x60 | KLE 8 80x80 |
|---|---|---|---|---|
| $L_s$ | [mm] | Carriage length | 198 | 273 |
| B | [mm] | Width of Reverse Units | 75 | 100 |
| W | [mm] | Distance between maintenance holes | 85.5 | 119 |
| $L_a$ | [mm] | Minimum distance from support to Reverse Unit | 10 | 10 |
| L | [mm] | Max. overall length | 6,150 | 6,200 |
| L | [mm] | Min. overall length | 400 | 600 |
| $f_{max}$ | [mm/m] | Profile deflection | ≤ 1 | ≤ 1 |

Table 2 Geometry

The maximum deflection, $f_{max}$ of the system is governed by the dimension of the profile cross-section, the free profile length and the force applied.

The KLE housing must be given appropriate support if the linearity of movement has to be very precise.



| Y / Z | KLE 6 60x60 | KLE 8 80x80 |
|---|---|---|
| $I_y$ | 44.32 $cm^4$ | 135.59 $cm^4$ |
| $I_z$ | 57.46 $cm^4$ | 179.77 $cm^4$ |
| $I_t$ | 7.23 $cm^4$ | 20.31 $cm^4$ |
| $W_y$ | 13.08 $cm^3$ | 29.88 $cm^3$ |
| $W_z$ | 19.15 $cm^3$ | 44.94 $cm^3$ |

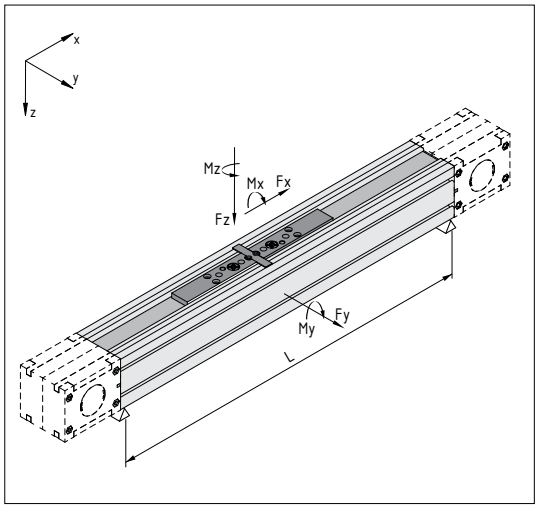
Table 3 Profile data

Deflection $f_{max}$ is calculated using the mass moments of inertia of the profile.

## General technical data

| | KLE 6 60x60 | KLE 8 80x80 |
|---|---|---|
| Static load factor per Roller $C_0$ [N] | 2,470 | 4,400 |
| Dynamic load factor per Roller C [N] | 4,400 | 7,800 |
| Repeatability [mm] | ± 0.1 | ± 0.1 |
| $V_{max}$ [m/s] | 10 | 10 |

Table 4 Technical data




| KLE | $M_{x\,max}$ [Nm] | $M_{y\,max}$ [Nm] | $M_{z\,max}$ [Nm] | $F_{x\,max}$ [N] | $F_{y\,max}$ [N] | $F_{z\,max}$ [N] |
|---|---|---|---|---|---|---|
| 6 60x60 | 25 | 50 | 100 | 500 | 750 | 500 |
| 8 80x80 | 50 | 100 | 150 | 1.500 | 1,500 | 1.000 |

Table 5 Simplified maximum load data for 10,000 km duty cycle

If loads are combined, the general rule governing the total load also applies:

$$\frac{|M_x|}{M_{x\,max}} + \frac{|M_y|}{M_{y\,max}} + \frac{|M_z|}{M_{z\,max}} + \frac{|F_y|}{F_{y\,max}} + \frac{|F_z|}{F_{z\,max}} \leq 1$$

## Assembly

The KLE is constructed from assemblies and cut-to-size elements and must be checked for completeness prior to actual assembly.

## Tool

Assembly Set KLE LR (0.0.612.72) is used to support assembly and maintenance of both sizes of system. It consists of the following parts:

- Drilling Jig KLE 8 80x80 LR 0.0.611.21
- Drilling Jig KLE 6 60x60 LR 0.0.611.53
- Pin Spanner KLE 0.0.611.82
- Torque Spanner 0.0.612.73
- Mounting Aid KLE 0.0.610.91
- Shaft Assembly Lever KLE 0.0.610.92

Also available:

- Track Oil 0.0.612.75
- Oil Can with Tip for KLE 0.0.612.74

The various tools and how they are used are described on the following pages.

## Shaft and profile machining

Cutting to size of Profile 6 60x60 KLE 0.0. 603.83
Profile 8 80x80 KLE 0.0.600.42

Determining the profile lengths while factoring in the various system geometries and variable stroke length H, where:

KLE 6 60x60: $L_{Profile} = 2 \times S + H + 198$ mm

KLE 8 80x80: $L_{Profile} = 2 \times S + H + 273$ mm

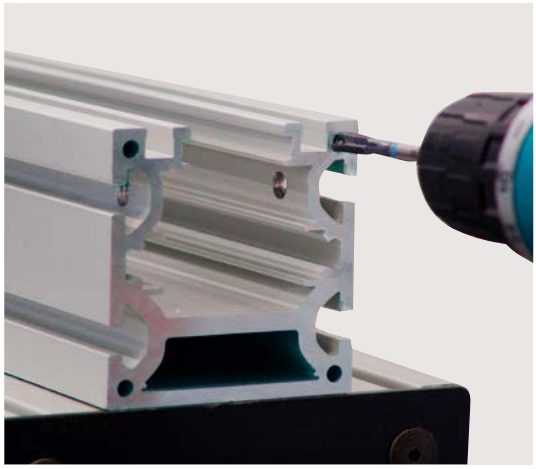
Safety distance S of KLE 6 60x60: $S_{min} = 26.0$ mm
KLE 8 80x80: $S_{min} = 63.5$ mm

Cutting Shaft D10 (KLE 6 60x60) / D14 (KLE 8 80x80) approx. 5 mm shorter than profile length:

KLE 6 60x60: $L_{Shaft} = L_{Profile} - 5$ mm
KLE 8 80x80: $L_{Shaft} = L_{Profile} - 5$ mm

Next, tap threads into the core bores of the profile end faces.

Threaded bore: KLE 6 60x60: M5x15
KLE 8 80x80: M6x20

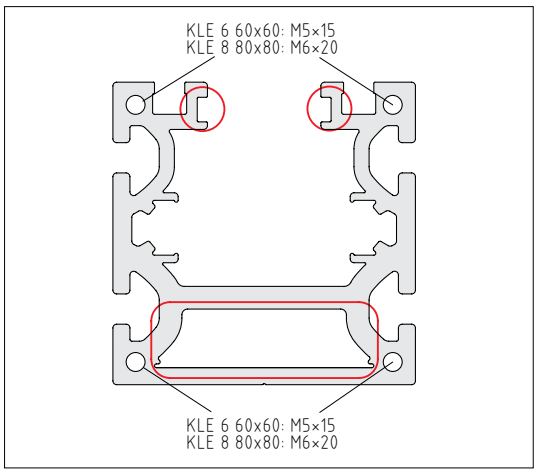


The ends of the profiles in the areas marked red must be free of burrs in order to prevent damage to the Timing Belt. The cut edges must be machined accordingly!

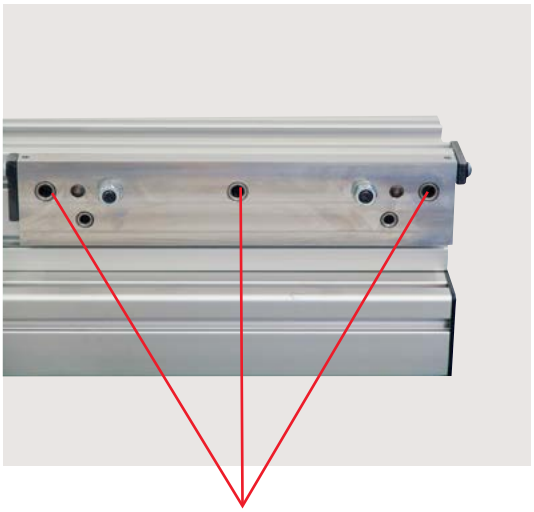
Maintenance holes are then drilled into the profile.

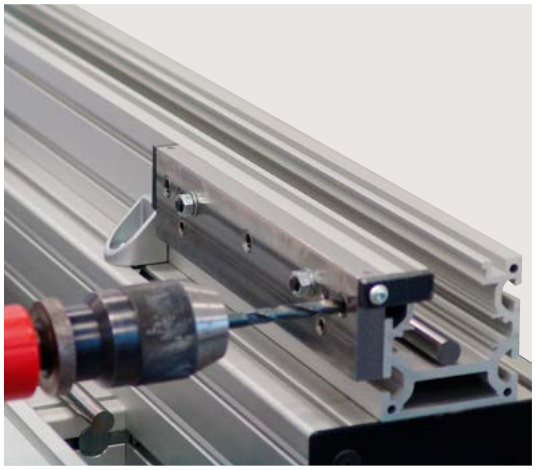
Assembly Set KLE-LR (0.0.612.72) contains a Drilling Jig for this purpose. This maps out the precise gauge for holes.

The Drilling Jig is fitted with a stop that ensures the minimum dimension required between the maintenance holes and the end of the profile.



The maintenance holes can be cut at any accessible point as long as the gauge for the holes is adhered to.
A pillar drill is recommended.

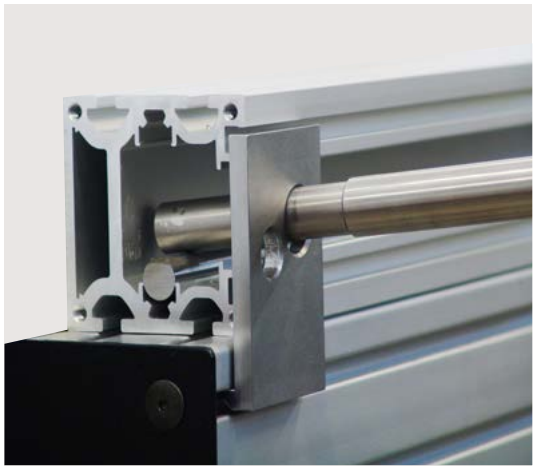


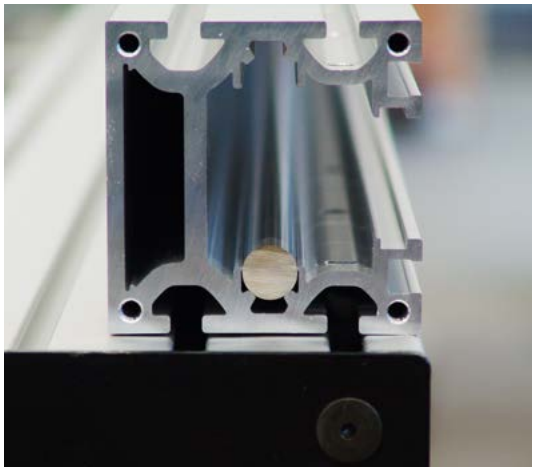


Distance between maintenance holes: w [mm]
KLE 6 60x60: w = 85.5 mm ∅ 6 mm
KLE 8 80x80: w = 119 mm ∅ 8 mm

The maintenance holes need only be cut into the profile from one side so that the carriage grease nipples can be accessed.

## Press-fitting the Shafts





Press Shafts D10 (KLE 6 60x60) / D14 (KLE 8 80x80) into the profile geometry using the Mounting Aid, Shaft Assembly Lever (part of Assembly Set KLE-LR, 0.0.612.72) and a suitable second Line 8 profile.

With the profile laid on its side, insert the Shafts into the profile geometry and arrange them so that both ends of each Shaft are approx. 2.5 mm shorter than the profile.

Next, use the Shaft Assembly Lever to press the Shafts, every 100 mm or so (the width of a hand), into the profile geometry until you can clearly feel or hear them engage.

The Shaft should be greased lightly to make it easier to press in.

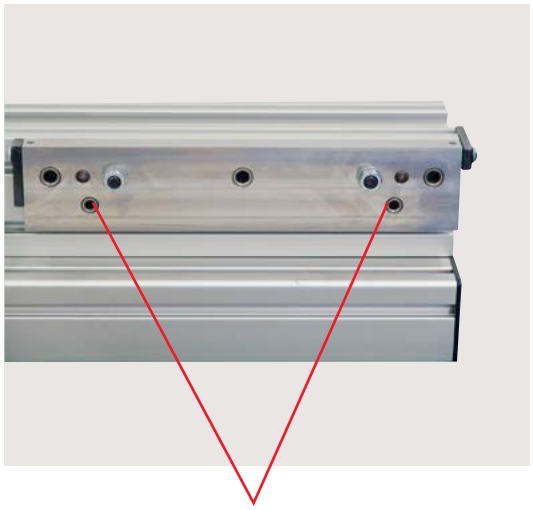
Next, pin the Shafts at one end using the drill template that is part of Assembly Set KLE-LR (0.0.612.72).

To do this, suitable drill bushes are provided in the Drilling Jig at a distance of 30 mm (KLE 60) / 40 mm (KLE 80) from the profile edge.

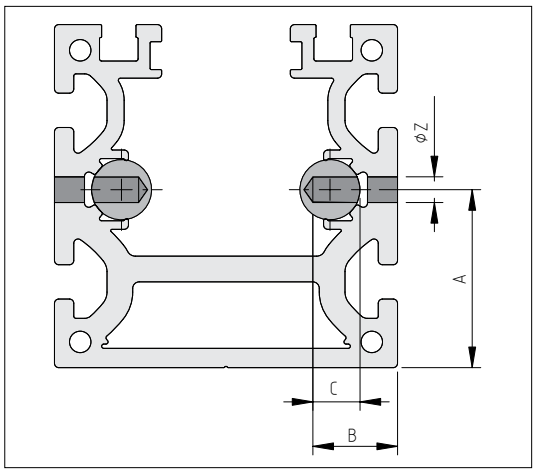
As the Shaft is hardened, lay the profile on its side and cut a hole from above on a pillar drill.

| | |
|---|---|
| KLE 6 60x60: | Carbide spiral drill ∅ 4 mm<br>Recommended speed 3000 rpm |
| KLE 8 80x80: | Carbide spiral drill ∅ 6 mm<br>Recommended speed 2000 rp |

Next, remove all the shavings and clean the profile and Shafts of all residual material.



Drilling aid for pinning the Shaft

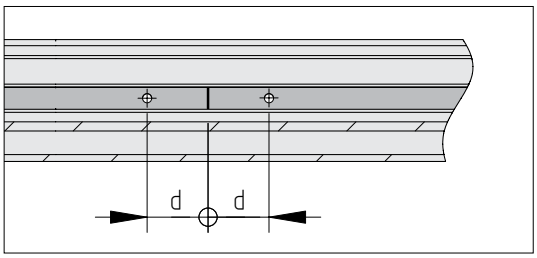



| | KLE 6 60x60 | KLE 8 80x80 |
|---|---|---|
| A [mm] | 31.0 | 41.5 |
| B [mm] | 15.8 | 19.8 |
| C [mm] | 8.0 | 11.0 |
| ∅ Z [mm] | 4.0 | 6.0 |

Table 6 Geometry for pinning

We recommend the following dowel for pinning purposes:

KLE 6 60x60 Dowel Pin DIN 6325-4x14
KLE 8 80x80 Dowel Pin DIN 6325-6x18




For KLE units with Shaft lengths in excess of 3 m, Shafts D10 (KLE 6 60x60) / Shaft D14 (KLE 8 80x80) must be butt-joined. There must be no more than one butt joint. The recommended minimum Shaft length is
LShaft min = 300 mm

The butt joints thus created on the Shafts can be opposite each other, i.e. they do not have to be offset to each other, since the rollers of the Carriage are offset.

The ends of the Shafts must be clean and free of burrs and chamfered edges.

Use the Drilling Jig (part of Assembly Set KLE-LR 0.0.612.72) to pin the butt-jointed Shafts at the joints but not at the ends of the profiles too. The recommended distance d from the fixing bore to the butt joint is:

KLE 6 60x60: d = 30 mm
KLE 8 80x80: d = 40 mm

## Timing Belt, Strip

The length of the Timing Belt and Strip is calculated as follows:

1. Timing Belt: KLE 6 60x60: LTB = 2 x $L_{profile}$ + 162 mm
KLE 8 80x80: LTB = 2 x $L_{profile}$ + 246 mm

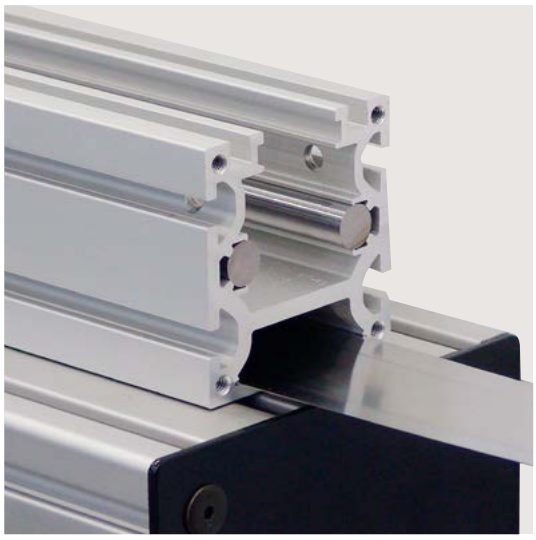
The formula already factors in an additional tooth as a safety factor
plus a tooth of Timing Belt R25 AT5 PAR: + 5 mm
plus a tooth of Timing Belt R34 AT10 PAR: + 10 mm

2. Strip: $L_{Strip} = L_{profile} - 2$ mm

The Strip at the bottom of the profile reduces the frictional losses of the moving Timing Belt.

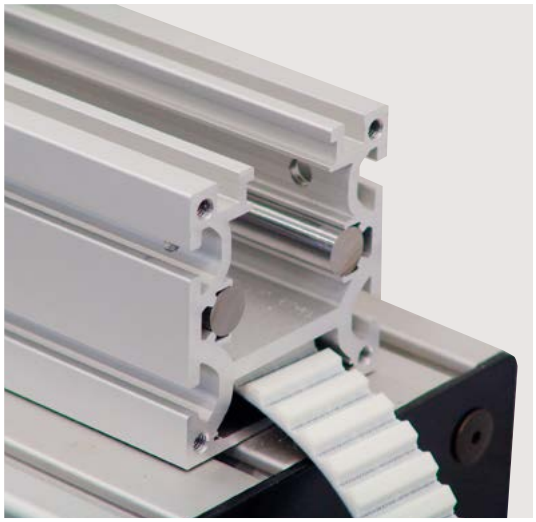
The ends of the Strip must be free of burrs.

Insert the Strip all the way into the bottom of the profile (with the curved side facing down).



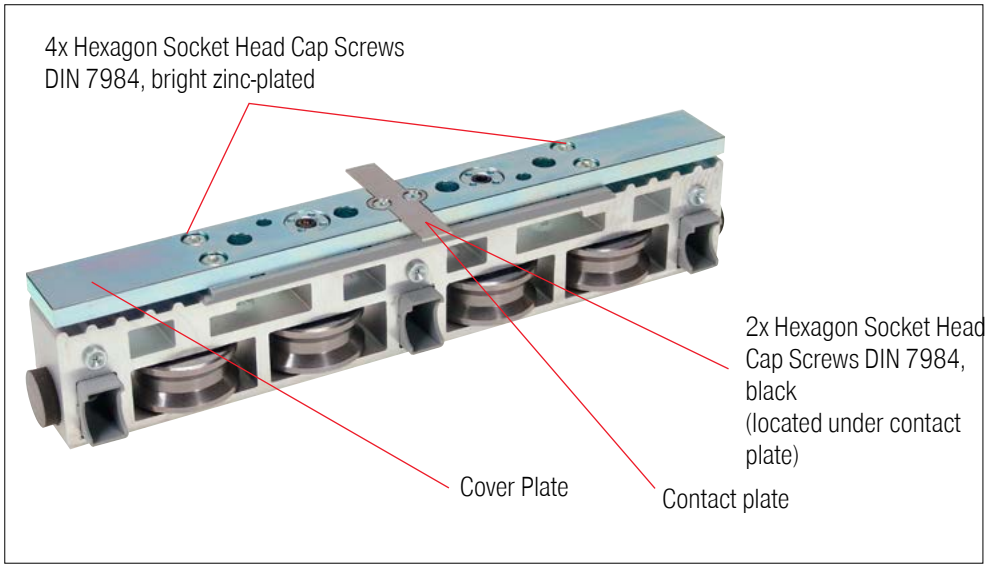
The Timing Belt can be cut with conventional metal shears.

After it has been cut, slide the Timing Belt over the Strip in the bottom of the profile so that it projects at both sides.



## Carriage

Carriage KLE 6 60x60 / Carriage KLE 8 80x80 is supplied pre-assembled.




Disassemble the contact plate. Do this by removing the two Countersunk Screws DIN 7997.

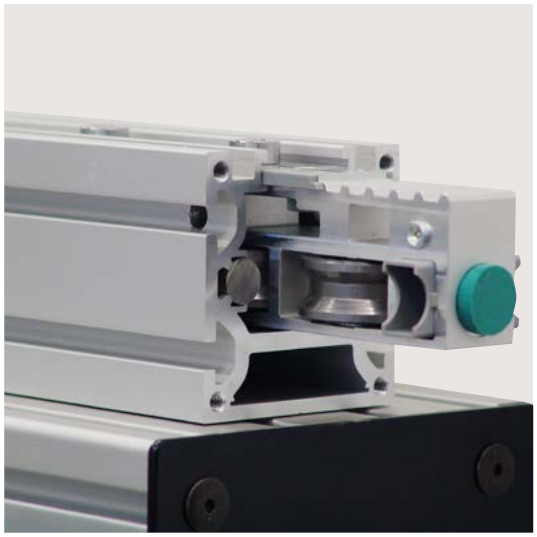
Remove the Cover Plate from the Carriage. To do this, remove the four Hexagon Socket Head Cap Screws DIN 7984 (bright zinc-plated) on the outside and the two Hexagon Socket Head Cap Screws DIN 7984 (black) under the contact plate.

Next, push the Carriage without the lubricating felt inserts into the track between the Shafts.

Use the two (central) eccentrically adjustable pins to set the rollers, eliminating play and applying a gentle preload over the entire length of travel.

To do this, push the Carriage along the profile to check it is running smoothly and to adjust the play.

It is important to check that the Carriage runs easily and quietly.



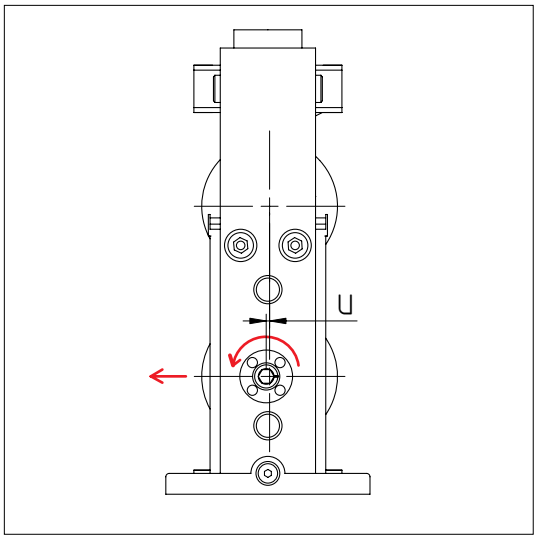
When pushing in the Carriage, the two central rollers are adjusted with an Allan key A/F 4 so that the Carriage can be slid into the Profile with ease.

When adjusting the Carriage in the profile, the hexagon sockets bolts of the rollers may only be moved in anti-clockwise direction.

A small mark on the hexagon socket defines the position of the roller between the Shafts and thus axial offset. During the adjustment process, this mark moves anti-clockwise in a circular arc that must be smaller than 360°.

The result is the maximum possible axial offset (u) of the outer roller relative to the inner Roller of:

KLE 6 60x60: $u_{max}$ = 1 mm
KLE 8 80x80: $u_{max}$ = 2 mm



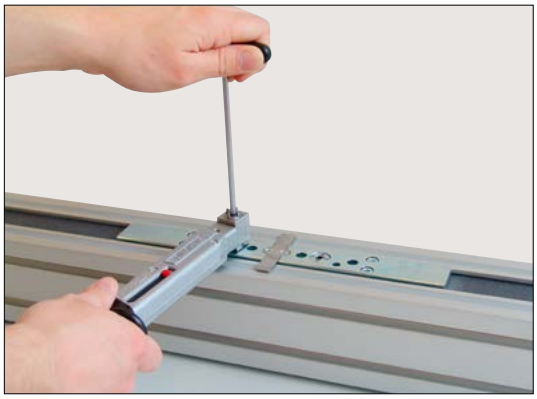

Caution! If you exert too much pressure on the rollers, the roller bearings may be damaged.

When running without play, the rollers are secured in position using a special pin torque spanner (part of Assembly Set KLE-LR 0.0.612.72).

To secure the lock nut, turn the pin torque spanner clockwise and, at the same time, turn the Allan key anti-clockwise.

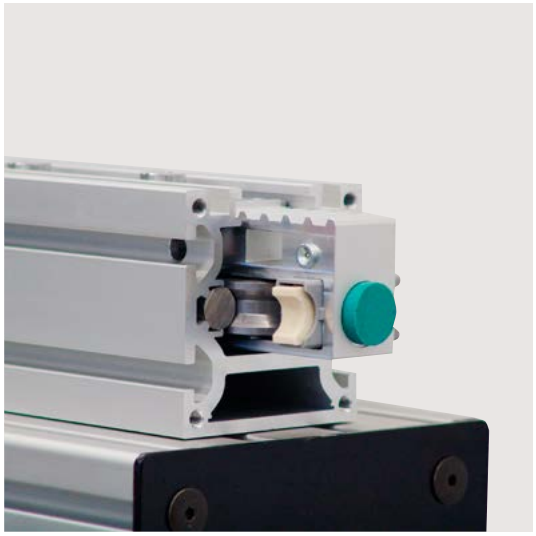
Tightening torque applied by torque spanner:

KLE 6 60x60: T = 10 Nm
KLE 8 80x80: T = 20 Nm



Remove the Carriage from the guide track and fit the springs and felt inserts of the End Cap and Lubricating System into the positions provided for this purpose on the Carriage.

Before the Carriage is inserted into place, the maintenance lines should be completely filled from both sides in a one-off step.



The lines of the central lubrication system must be charged by the person commissioning it.

Insert the lubricating felt inserts in pairs into the plastic housings. Insert a compression spring between the felt pieces.

When subsequently inserting the Carriage into place, press the felts together to prevent them from being damaged.

The plastic element must be correctly positioned before the Carriage is slotted on.

The plastic element is used to cover the gap and must be assembled with the tooth-shaped ends pointing downwards.

Ends of the plastic element pointing downwards in line with tooth shape

## Timing-Belt Reverse Unit, Timing-belt drive

The rerouting units for the Timing Belt of the KLE-LR differ in design – one is a Drive Unit and the other a Reverse Unit.

A Drive Unit KLE is fitted to one end of Profile KLE and a Reverse Unit KLE to the other.

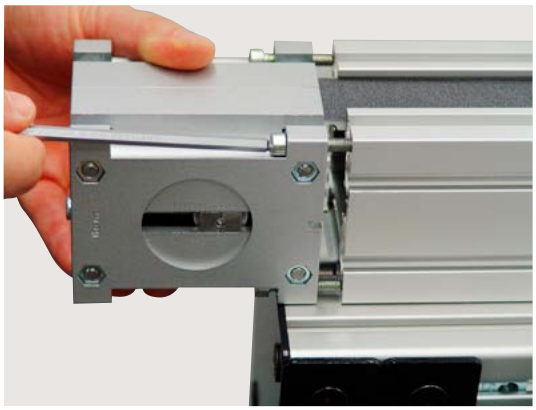
A motor can only be connected to a Drive Unit.

The ends of the Timing Belt emerging from the lower profile are routed through the two rerouting units and, in cases where these units are unsecured and have not been dismantled, are run into the profile's upper guide groove.

The tensioning axle at the Reverse Unit end makes it easier to introduce the Timing Belt.

Align the Reverse Units with the end faces of Profile KLE and secure them in place:

Tightening torque KLE 6 60x60 (M5): 6 Nm
Tightening torque KLE 8 80x80 (M6): 10 Nm



Lift the Timing Belt up out of the guide groove and press it onto the toothing on the end of the Carriage.

It is important to ensure that the Timing Belt is located centrally on the Carriage. The Carriage has a marking to indicate this. The fitter must mark the centre of the Timing Belt.

All teeth of the Timing Belt must mesh into the toothing on the Carriage.

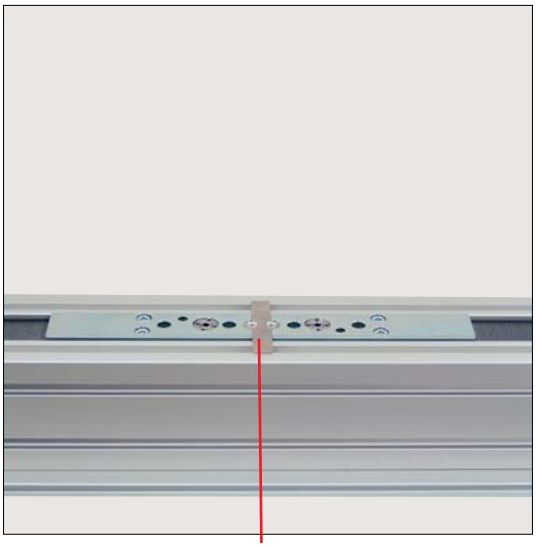
Screw six Hexagon Socket Head Cap Screws DIN 7984 into the Cover Plate again:

KLE 60: 4 x M4x12 (bright zinc-plated) and 2 x M4x8 (black)
KLE 80: 4 x M5x14 (bright zinc-plated) and 2 x M5x12 (black)

Tightening torque M4: 3 Nm
Tightening torque M5: 6 Nm

The Cover Plate of the Carriage can only be secured in one position! It is important to ensure that the holes in the Cover Plate coincide with the threads in the Carriage and that the gap is symmetrical.

4x Hexagon Socket Head Cap Screws
DIN 7984 bright zinc-plated



2x Hexagon Socket Head Cap Screws
DIN 7984 black (under contact plate)

To correct (shorten) the length of a Timing Belt, move the Carriage backwards and forwards several times so that the belt teeth can align correctly in the pulleys of the Reverse Units.

If the Carriage is difficult to move, the teeth are not yet positioned correctly in the pulley of the Reverse Unit.

You can shorten the Timing Belt if necessary by unscrewing the Cover Plate, shortening the Timing Belt and refitting it. Next, screw the Cover Plate back in place.

## Calculating and setting timing-belt tension

If the KLE has been supplied fully preassembled, you will need to adjust the pre-tensioning or check it against the order specifications.

To increase tension, use the tensioning screw at the rear of the Timing-Belt Reverse Unit to pull back the movable tensioning axle. How far you need to pull back the tensioning axle in the Reverse Unit varies according to the operating load of the KLE.

Conventional calculation:

Following applies: $F_P + F_X < F_{Bperm}$
and: $F_P > F_X$
Where: $F_X = m \times a + m \times g + F_F$
Where: $\Delta L = (L_B \times F_P) / (C_{spez})$
Where: $\Delta T = ½ \Delta L$
$F_P$ = Pre-tensioning force for Timing Belt [N]
$F_X$ = operating load [N]
$F_{Bperm}$ = Permissible force for Timing Belt R10 T5 [N] = 300N
$F_F$ = Frictional force, loss of friction when running light (for Linear Unit KLE 8 80x80 [N]: 75N
Linear Unit KLE 6 60x60 [N]: 40,5N
$\Delta L$ = Necessary elongation of the overall Timing Belt length [mm]

$L_B$ = Overall Timing Belt length when not under tension [mm]
$K = C_{spez}$ = Constant of elongation [N] :
KLE 6 = 0,35 x 106N
KLE 8 = 1,13 x 106N
$\Delta T$ = Necessary adjustment on tensioning axle [mm]

Use the tensioning screw to adjust the movable tensioning axle in the Timing-Belt Reverse Unit. Moving this axle makes the Timing Belt tighter or slacker, pulling the tensioning axle back by 1 mm elongates the Timing Belt by 2 mm. There are various ways to check the calculated tensioning adjustment. Typical tools for this purpose include frequency analysis tools, strain gauges and other length measuring devices.

- e.g.:
  $L_B$ = 1250 mm
  $F_X$ = m x a + m x g + FF = 100N
- item recommends increasing pre-tensioning force by 20%: $F_P = 1.2 \times F_X$ = 120N
- $\Delta L = (F_P \times L_B) / (C_{spez})$ = 2 mm
- $\Delta T$ = ½ $\Delta L$ = 1 mm

Test: $F_P + F_X < F_{Bperm}$

- 120N + 100N = 220N < 300N

and: $F_P > F_X$

- 120N > 100N

When setting the timing-belt tension based on a tensioning axle adjustment that has been derived from a calculation, you must first identify the exact position at which the tensioning axle starts to elongate the Timing Belt.

## Tightening the Timing Belt

You can tighten the Timing Belt using Reverse Unit KLE 6 60x60 or Reverse Unit KLE 8 80x80.

Two Hexagon Socket Head Cap Screws DIN 912 are provided for this purpose on the end of the Reverse Unit.

The first step when tightening the Timing Belt is to find the zero point at which the untightened belt has no sag at all and pre-tensioning begins.

To do this, pull back the movable tensioning axle in the Reverse Unit and then fix it in position using the screws.

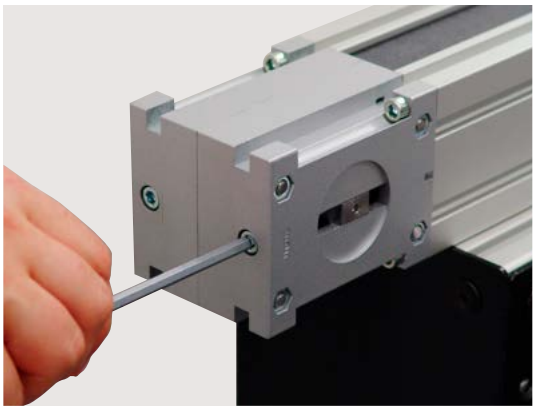
A scale on the Reverse Unit can be used to adjust the tensioning axle travel from this reference position.

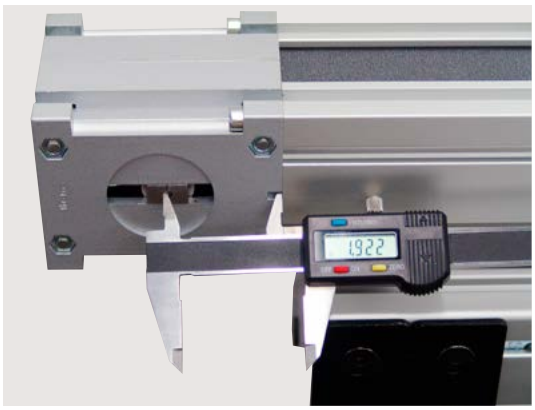
A calliper between the end of the profile and the marking on the tensioning axle enables precise pre-tensioning on both sides of the Reverse Unit.

Tighten the Timing Belt by tightening the two screws alternately and evenly.

It is vital that the tightening is not uneven, i.e. that the tensioning axle is not skew by > 0.05 mm!

The tensioning screws are secured (micro-encapsulated) to prevent them from being adjusted or working themselves loose unintentionally.





Tip:

Instead of measuring the movement of the tensioning axle, it is advisable to measure the actual elongation of the Timing Belt. When using this approach, the exact position of the tensioning axle before you make any adjustments is irrelevant and measurement errors can be minimised.

This approach uses the fact that the entire Timing Belt elongates evenly as tension is applied.
This means, for example, that when a timing belt that is 10,000 mm long is elongated by 10 mm, each 1,000 mm section of the belt is stretched to a length of 1001 mm. The ten sections, each measuring 1001 mm in length, add up to the overall length of 10 x 1001 mm = 10,010 mm.

To measure the actual elongation of any timing belt, first select and mark a section of the belt that is freely accessible, making sure the section is as large as possible and that the timing belt is not under any tension. Now calculate the relative elongation L' for the belt section you marked and move the tensioning axle back until the marked section has stretched by the right amount for this partial belt length.

Example:

A steel ruler was used to make marks 300 mm apart on the timing belt in our example while it was not under any tension.

Calculating the elongation for this section of the belt:

- $\Delta L$ = 2 mm based on the overall length of the timing belt, which is 1250 mm

This means that the measurable elongation on a 300 mm section of the belt will be:

- $\Delta L' = (\Delta L / 1250) \times 300 = 0.48 \text{ mm} \approx 0.5 \text{ mm}$

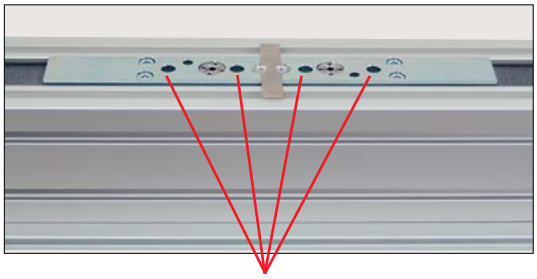
If we now pull back the tensioning axle in the Reverse Unit, the timing belt begins to elongate at a certain point and the marks move further apart.

We continue to pull back the tensioning axle until the marks have moved 0.5 mm further apart or, to put it another way, until the gap between the marks has increased from 300 mm to 300.5 mm. At this point, the elongation on the timing belt as a whole is correct and the calculated pre-tensioning force has been applied.

## Support system, Carriage Plate

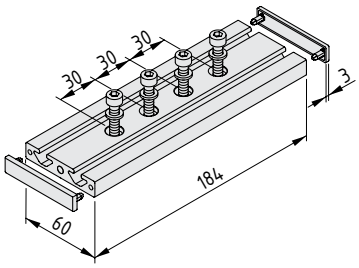
The assembled KLE can be used to secure preconfigured and self-designed Carriage systems.

To do this, there are 4 mounting bores in the cover plate of the Carriage for securing a support plate. Depending on the system sizes Carriage Plate KLE 6 60x60 (0.0.609.25) and Carriage Plate KLE 8 80x80 (0.0.609.24) are available as preconfigured support plates.

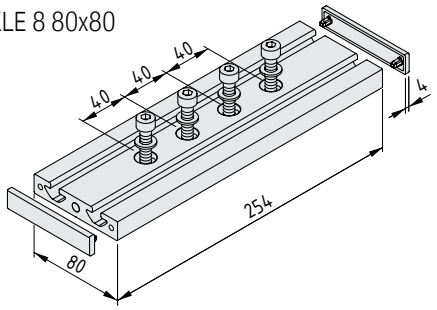


Mounting bores prepared:
KLE 6 60x60 for M6
KLE 8 80x80 for M8

KLE 6 60x60

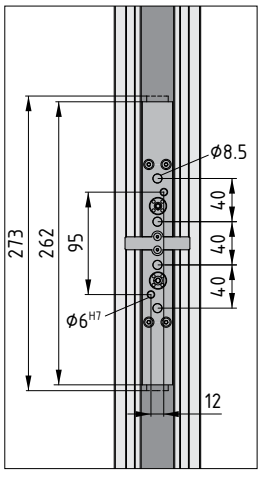


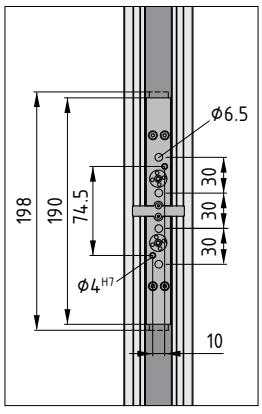

KLE 8 80x80




The carriage plate of the KLE 6 60x60 and the carriage plate KLE 8 80x80 each have two holes which are used for pinning the carriage plate to the cover plate of the carriage.

The pinning of the carriage plate to the cover plate is necessary to support the loads and to ensure a safe transfer of the load to the roller guide.




Two ø6H7 pin holes are provided in the cover plate of the KLE 8 80x80 and two ø4H7 pin holes in the cover plate of the KLE 6 60x60.
We recommend using the dowel pins supplied with the carriage set in conjunction with the carriage plates.
KLE 6 60x60: straight pin ISO2338 4h8x30
KLE 8 80x80: straight pin ISO2338 6h8x40

If the original slide plates are not used, the hole layout must be taken from the drawings and transferred to the slide designs.

## Drive Synchronization

The basic element of a KLE unit is now fully assembled; the next step consists of attaching a

- Drive Unit and any required
- synchronisation with a second Drive Unit

## The drive

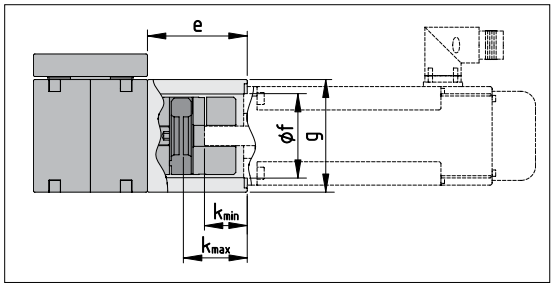
The Drive Set contains all the components needed for connecting a motor or gearbox.

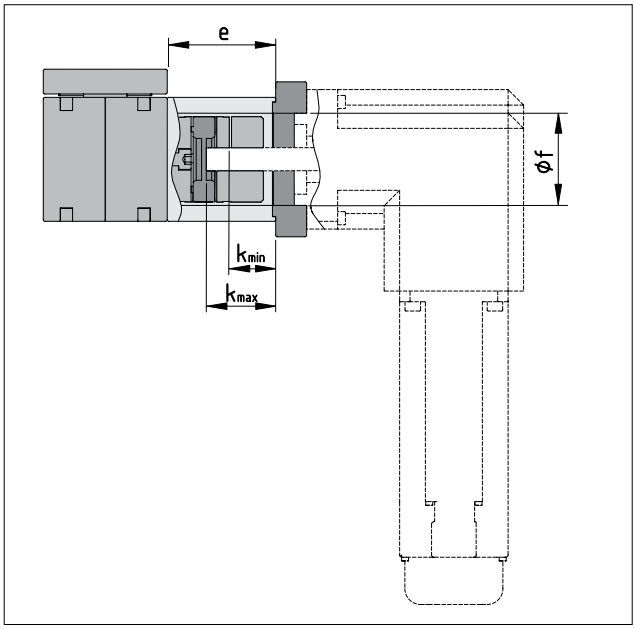
- The Drive Set consists of:
- Coupling Housing, Drive KLE
- Coupling Half KLE
- Coupling Half (unmachined)
- Coupling Insert
- Centring Piece KLE
- Adapter Plate KLE
- Hexagon Socket Head Cap Screws DIN 912, St, bright zinc-plated

Both the Drive Set and Synchronising Set can be assembled only from the drive side of the KLE!

Depending on the requirements of the motor or gearbox used, the drive casing or Adapter Plate KLE is machined and screwed to the motor or gearbox.

The connection processing parameters are the depth of insertion of drive shaft k, the gauge of the holes for fastening the motor/gearbox and the Centring Piece (Table 8).



| | [mm] | KLE 6 60x60 | KLE 8 80x80 |
|---|---|---|---|
| Coupling Housing depth | e | 62 | 70 |
| Centring Piece | ∅ $f_{min}$ | 47 | 59.5 |
| Coupling Housing height | g | 60 | 80 |
| Depth of insertion of drive shaft | $k_{min}$ | 34 | 30 |
| | $k_{max}$ | 38 | 44 |

Table 8 Preparing the drive

If force is transferred from the coupling to the drive shaft using frictional resistance, the Coupling Half to be connected to the drive shaft must be provided with a hole the size of the shaft and then connected with the latter.

The Shaft and the hole in the coupling hub must be degreased and cleaned to ensure the frictional resistance is effective.

The torques transferred by the clamp connection factor in the maximum mating play for the shaft fits: Shaft k6 / hole H7 (Table 9).

| Clamping connection between motor shaft and coupling | KLE 6 60x60 | KLE 8 80x80 |
|---|---|---|
| Clamping screw | M6 | M6 |
| Tightening torque [Nm] | 10.5 | 10.5 |
| Hole diameter D[mm] for motor shaft | D6-D20 | D8-D28 |
| Transmissible drive torque $T_{D\,max}$ [Nm] | 12 | 30 |

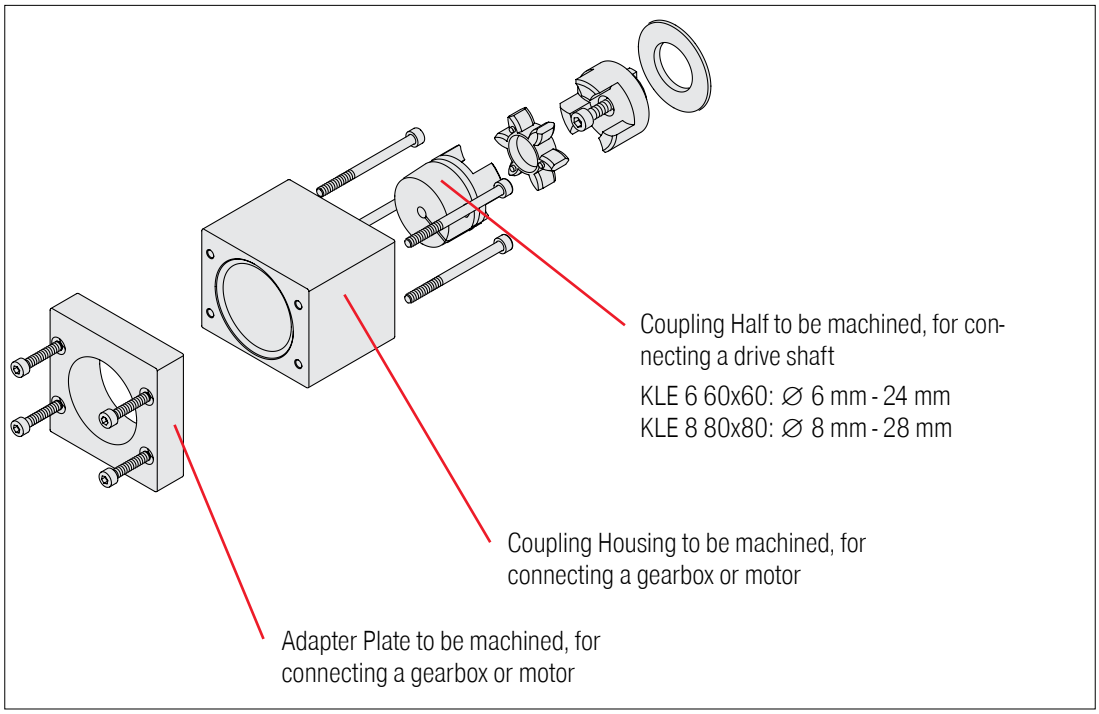
| Permissible operating load of drive unit at vmedium = 1.5 m/s | KLE 6 60x60 | KLE 8 80x80 |
|---|---|---|
| $F_{x\,max}$ [N] | 500 | 1,500 |

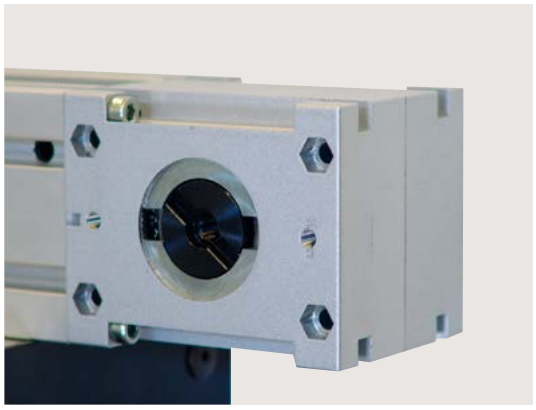
Tabelle 9 Antriebsmomente

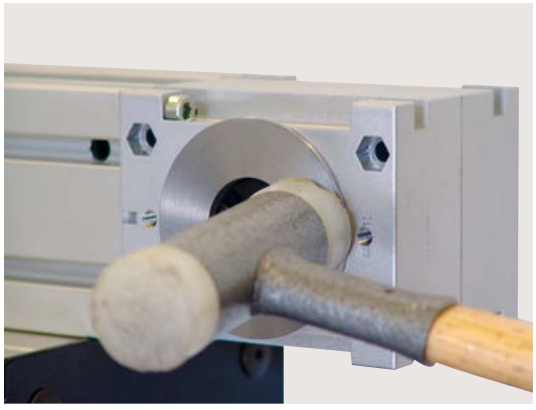
| Rigid connection of motor shaft to Coupling (e.g. with key) | KLE 6 60x60 | KLE 8 80x80 |
|---|---|---|
| Transmissible drive torque TD max [Nm] | 12 | 50 |

If the drive shaft requires a rigid connection to the Coupling Half, this must be machined in accordance with the specifications of the motor or gearbox manufacturer.

Hexagon Socket Head Cap Screws must be secured against working loose.

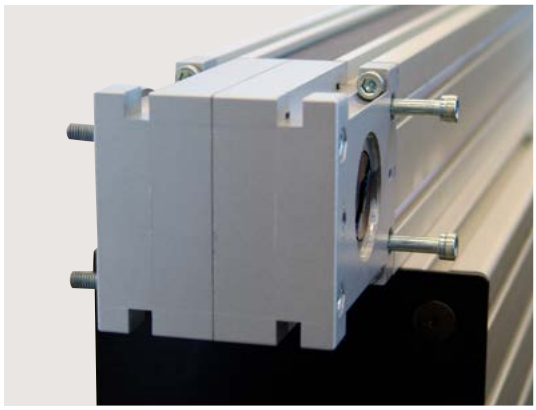


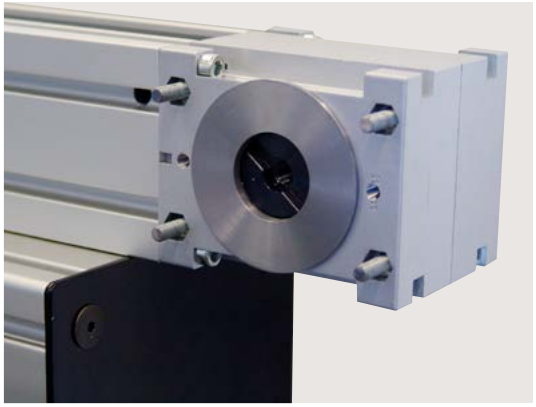


To assemble the Drive Set, first carefully position the Centring Piece KLE on the motor side of Drive Unit KLE using a rubber hammer.

Next, use the longer Hexagon Socket Head Cap Screws DIN 912 from Drive Set KLE to replace the fastening screws and inserted nuts for the two halves of the Drive Unit.



The longer screws can be used to screw on Coupling Housing KLE.

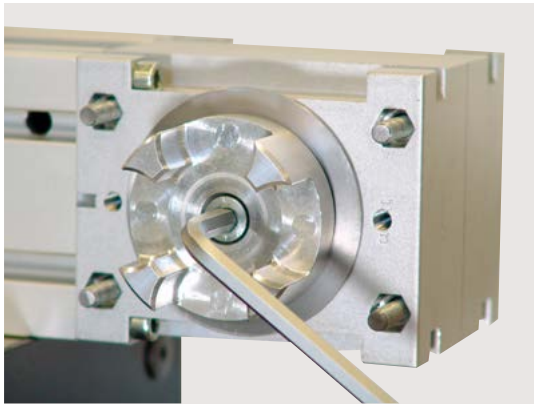


Insert Coupling Half KLE centrally into Drive Unit KLE and screw it into place.

When doing so, the Coupling Half must be secured to prevent it from turning.

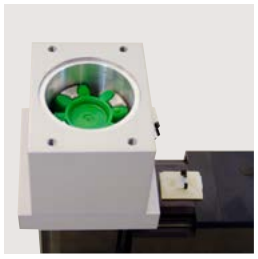
Tightening torque for the fastening screw in the Coupling Half:

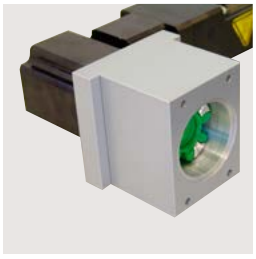
KLE 6 60x60: M6 = 10 Nm
KLE 8 80x80: M8 = 20 Nm



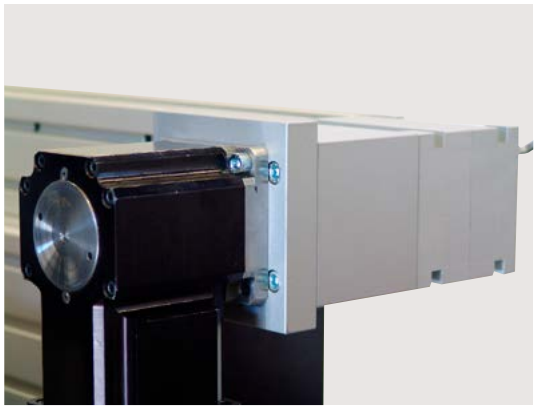
Press the Coupling Insert into place.

Next, screw the Coupling Housing to the Drive Unit KLE.





The question of whether a machined Coupling Housing or a machined adapter plate is used for connecting the motor depends on the geometry of the gearbox or motor (Table 8).



## Synchronising two Linear Units KLE

Two KLEs are synchronised by connecting Drive Units KLE using a Synchronising Set and the corresponding tube.

The Synchronising Sets include all components required for connecting two Compact Linear Units.

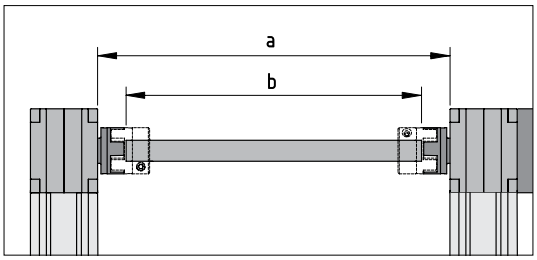
- The Synchronising Set contains:
- 2 Coupling Halves KLE Al
- 2 Coupling Halves for tube clamping
- 2 Coupling Inserts
- Hexagon Socket Head Cap Screws St, bright zinc-plated

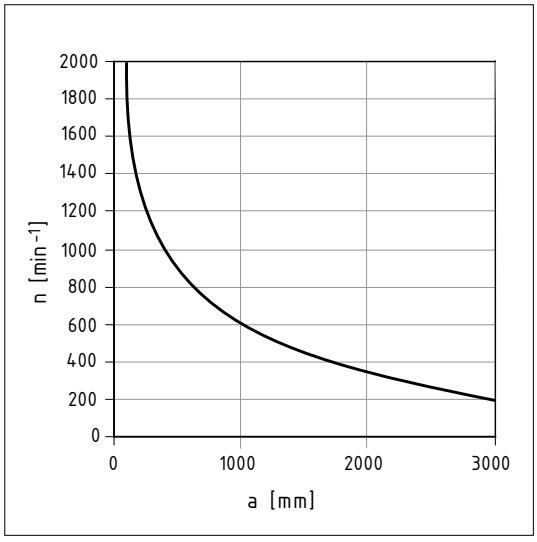
When designing the synchronised Linear Units, the drive speed and distance between the Linear Units are key criteria.

The length of Synchroniser Shaft (b) is defined as follows:

| | KLE 6 60x60 | KLE 8 80x80 |
|---|---|---|
| Tube | D20x3 St | D25x3 St |
| b | a - 65 mm | a - 70 mm |
| a | Distance between Linear Units | |

Table 10 Synchronisation



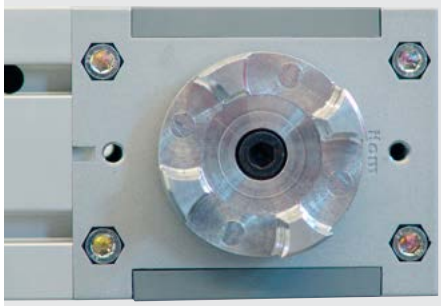

n = Rotary speed of the Synchroniser Shaft
a = Distance between Linear Units

To assemble the system, first connect Coupling Half KLE to the Drive Unit of the KLE. The Coupling Half is used to create a rigid mechanically locked connection with the timing pulley of the KLE Drive Unit (see page 20).

There are two options for the next step of the assembly operation:

1. If a cover (using a Synchroniser Shaft Cover Set and cable conduit) is required to provide protection against the rotating Synchroniser Shaft, secure the synchroniser adapter plates to the two Drive Units of the KLEs.
2. If no cover is required to protect against the rotating Synchroniser Shaft, the Synchroniser Shaft Cover Sets are not required.

Fall 1



Fall 2

Scenario 1:

Cut the Synchroniser Shaft (tube) to size b and push the clamping Coupling Halves from the Synchronising Set onto the Synchroniser Shaft to a point beyond their operating position (Table 10).

Use a rubber hammer to carefully drive the Coupling Insert into Coupling Half KLE.

Next, hold the prepared Synchroniser Shaft with the two Coupling Halves right and left in the installation position and use a rubber hammer to carefully drive the Coupling Halves onto the assembled Coupling Half of the KLE 6 60x60 or KLE 8 80x80.

The Carriage position and the appropriate angle must be set before clamping the Synchroniser Shaft (tube).

Clamping screw M6
Tightening torque: 10.5 Nm

Scenario 2:

If a guard is fitted to provide protection against the rotating Shaft, the cable conduit required is first sawn to the correct length and then machined.

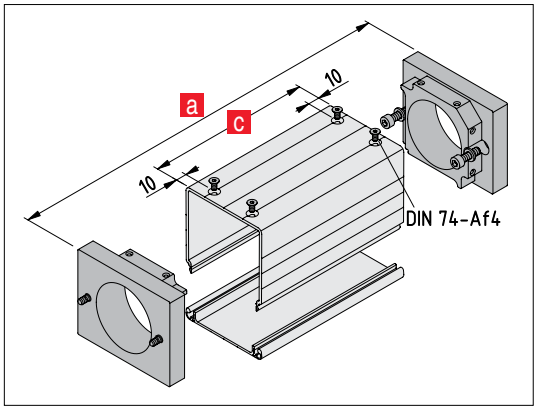
The rotating parts of the Synchroniser Shaft are covered
by a Conduit Profile U 60x60 E with Lid Profile D 60 E or a Conduit Profile U 80x80 E with Lid Profile D 80 E.

a Distance between Linear Units

c Length of conduit elements for covering the Synchroniser Shaft

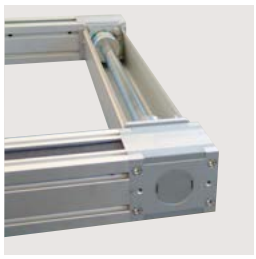
KLE 6 60x60: c = a - 24 mm

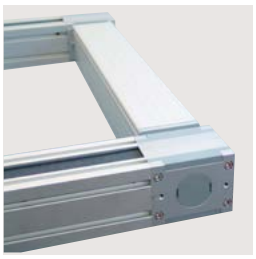
KLE 8 80x80: c = a - 32 mm



Afterwards, slot the cable conduit section into position between the synchroniser Adapter Plates at a slight angle.

By carefully selecting the position of the screw-attached Adapter Plate, you can screw the cable conduit in place to ensure an optimum position for opening the Lid.

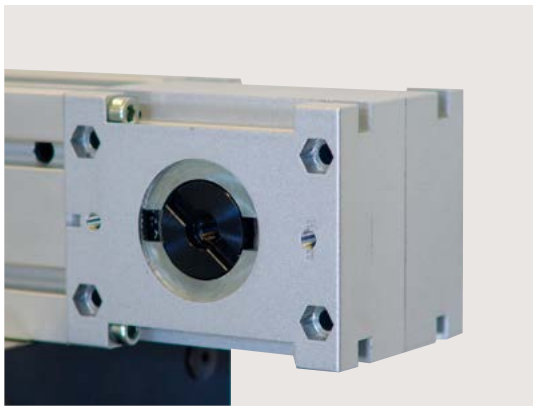


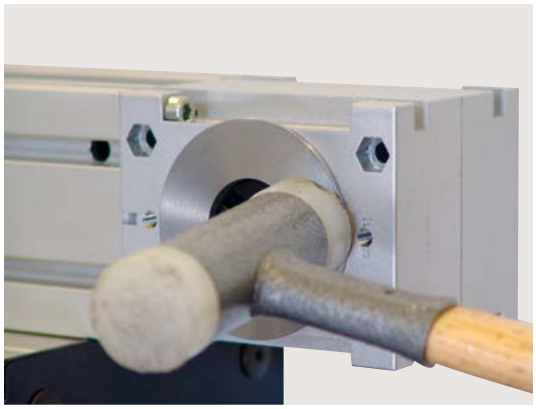


## Prepared KLE Drive Set

Assembling Drive Set KLE 6 60x60 AP/WP 40 – 0.0.673.29
Assembling Drive Set KLE 6 60x60 AP/WP 60 – 0.0.673.28
Assembling Drive Set KLE 8 80x80 AP/WP 60 – 0.0.673.26
Assembling Drive Set KLE 8 80x80 AP/WP 80 – 0.0.673.27

This section describes the assembly of the Drive Sets of the KLE 8 80x80 and KLE 6 60x60, which are prepared for item drive components, gearboxes and motors. Due to the performance range of the KLE 8 80x80 and KLE 6 60x60, two motors and two gearboxes with different output ranges are available and can be connected with the linear axis using Drive Sets that have been prepared appropriately.

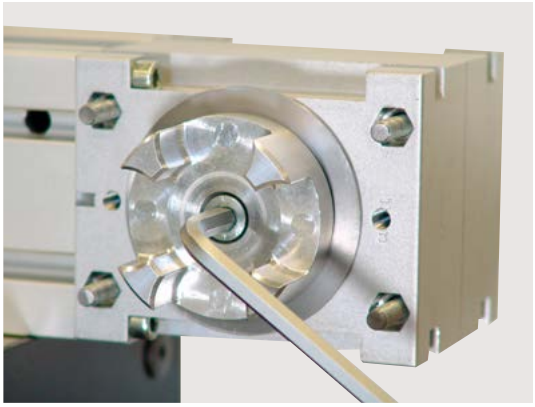




First, use a rubber mallet to carefully position the centring disc on the motor side of the drive Reverse Unit. Next, use the longer Hexagon Socket Head Cap Screws DIN 912 from the pre-prepared Drive Set to replace the fastening screws and inserted nuts for the two halves of the Drive Unit.

The longer screws enable connection of the Coupling Housing. Next, insert Coupling Half KLE centrally into Drive Unit KLE and screw it into place. When doing so, the Coupling Half must be secured to prevent it from turning.
Tightening torque for the fastening screw in the Coupling Half:

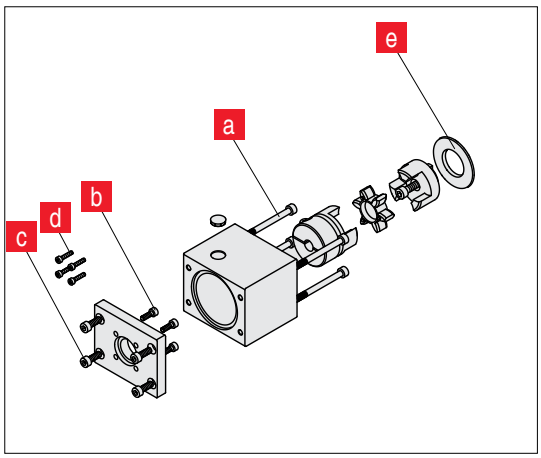
KLE 6 60x60: TT = 10 Nm
KLE 8 80x80: TT = 20 Nm

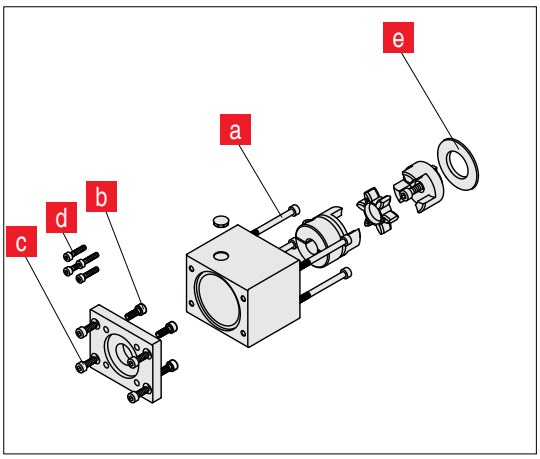


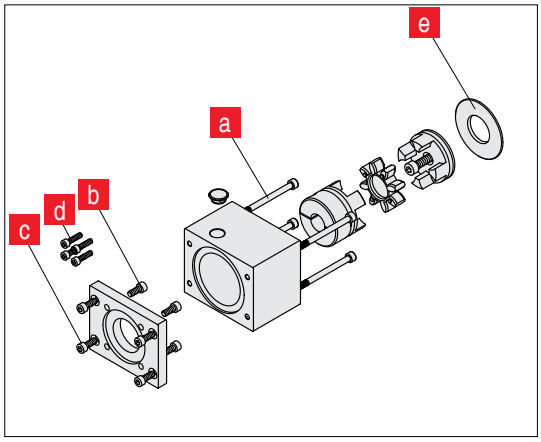
Next, press the Coupling Insert into place and screw the Coupling Housing to the Drive Unit.
Use the Hexagon Socket Head Cap Screws M4x18 [d] included with the Drive Set to secure the motor to the gearbox of the Linear Unit. Use the Hexagon Socket Head Cap Screws M5x1 [b] included with the Drive Set to secure the gearbox to the Adapter Plate of the Drive Set.

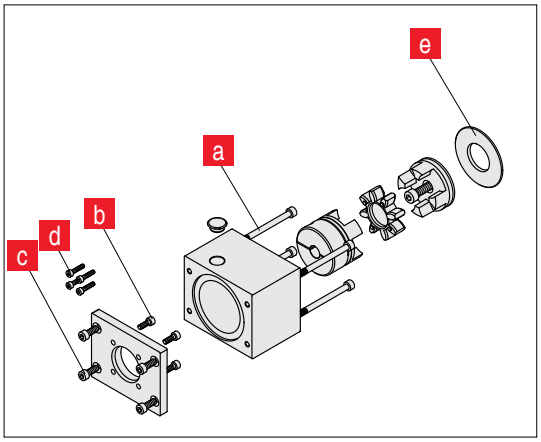
Working through the Coupling Housing, create a friction-based connection between the clamping hub screw (T = 9.6Nm) of the clamp coupling half and the drive shaft.

a Hexagon Socket Head Cap Screw M5x65, $T_T$ = 10 Nm
b Hexagon Socket Head Cap Screw M4x12, $T_T$ = 6 Nm
c Hexagon Socket Head Cap Screw M5x14, $T_T$ = 10 Nm
d Hexagon Socket Head Cap Screw M3x14, $T_T$ = 4 Nm
e Centring Piece D40 KLE 60x60




a Hexagon Socket Head Cap Screw M6x85, $T_T$ = 13 Nm
b Hexagon Socket Head Cap Screw M6x15, $T_T$ = 13 Nm
c Hexagon Socket Head Cap Screw M6x19, $T_T$ = 13 Nm
d Hexagon Socket Head Cap Screw M5x20, $T_T$ = 10 Nm
e Centring Piece D55 KLE 80x80

a Hexagon Socket Head Cap Screw M6x85, $T_T$ = 13 Nm
b Hexagon Socket Head Cap Screw M6x14, $T_T$ = 13 Nm
c Hexagon Socket Head Cap Screw M6x16, $T_T$ = 13 Nm
d Hexagon Socket Head Cap Screw M4x18, $T_T$ = 6 Nm
e Centring Piece D55 KLE 80x80

## Proximity Switches

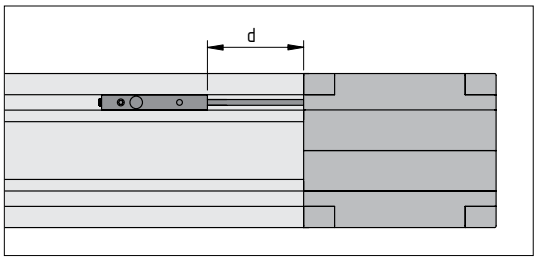
Proximity Switches KLE are part of the system and are fitted into the profile grooves where they are secured using a grub screw, which locks the switch in the groove.

The Proximity Switch cables run inside the groove and through the Reverse Units. The cable is run out to the outside at a suitable point (by removing the Caps of the Reverse Units).

The minimum distance is determined by the Carriage geometry and the contact plate located on it:

KLE 6 60x60: dmin = 80 mm + S

KLE 8 80x80: dmin = 100 mm + S




This does not factor in the Carriage braking distance.

The Proximity Switch cables cannot be routed past a further Proximity Switch in the groove! Consequently, a maximum of 4 Proximity Switches can be used for each KLE.

Two different inductive Proximity Switches are available for each system size (1 NO, normally open switch, 1 NC, normally closed switch).

The groove is closed using Cover Profile 6 60x60 or 8 80x80. The Cover Profile is pressed over the cable to protect it from damage. There are gaps in the Cover Profile at the locations of the Proximity Switches.

## Commissioning

It is important prior to start-up to ensure that the rollers are lubricated (see Section 6 - Maintenance).

The homing run serves as a final quality check.

The following factors must be checked:

- Are the conditions okay?
  - Ambient temperature (10 °C–40 °C)
  - Load
  - Travel speed
  - Travel distance
- Have all relevant elements been lubricated (see Section 6 - Maintenance)?
- Is there sufficient protection on all rotating parts, live electrical parts and points where parts of the body may become trapped?
- Have all screws been tightened in line with requirements?
- Are all possible caps and covers, particularly over rotating parts, being used and have they been locked in place.

A trial run must be carried out at low speed that takes in the entire travel path and checks that the Compact Linear Unit is functioning correctly.Possible faults may present as smoke or noise!

## Maintenance

Basic lubrication for the guide is applied by the operator under normal operating conditions.

The service life for the initial lubrication applies to normal operating conditions.

A special oil press can be used to provide additional lubrication to the guide system.

To do this, move the Carriage to the “maintenance position” defined by the position of the lubrication holes and lubricate it through the three holes with the same spacing as the grease nipples (see Section 4.2).

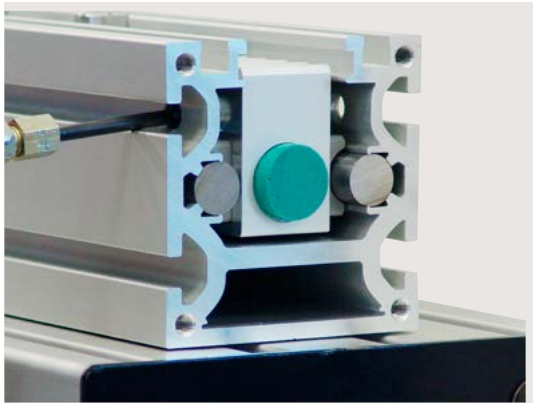
To apply the oil, insert the long tip of the oil press through the maintenance holes onto the Carriage grease nipples and apply the oil.

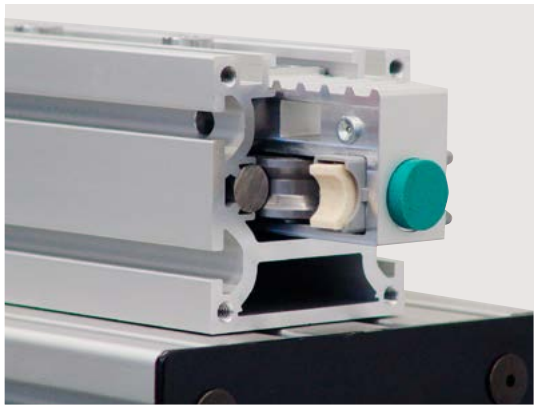
The End Cap and Lubricating Systems need to be re-lubricated with the required amount from one side only.

Normal operating conditions:

Ambient temperature: 10 °C–40 °C

50% of max. load





Under special operating conditions such as a special installation type, dust, short travel distance, influence from solvents, etc. the lubrication intervals will need to be adapted to suit the relevant application scenario.

**Recommended oil:**
Track Oil for Linear Guides
(recommended: Klüber Oil 4 UH1-460), Art. No. 0.0.612.75

**Auxiliary tool:**
Pressol oil can KLE-LR, 0.0.612.74

**Fill quantity:**
Approx. 1 ml per maintenance hole per maintenance interval (1 ml is equivalent to one actuation of the Pressol oil can)

**Maintenance interval:**
Every 6 months or every 2,500 km

Greases containing solid particles (e.g. graphite and MoS2 additives) must not be used!

## Disposal

The possibility of reuse or further use (if necessary after refurbishment and replacement of components) is provided for. Recyclability is ensured by appropriate material selection and by dismantling capability. Careless

Careless disposal of the KLE linear thrust units can lead to environmental pollution.
Therefore, dispose of the Linear Units KLE in accordance with the national regulations of your country.
Incorrect disposal endangers our environment.

Transport packaging:
The packaging must be returned to the available return and collection systems.

## Product development and documentation

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