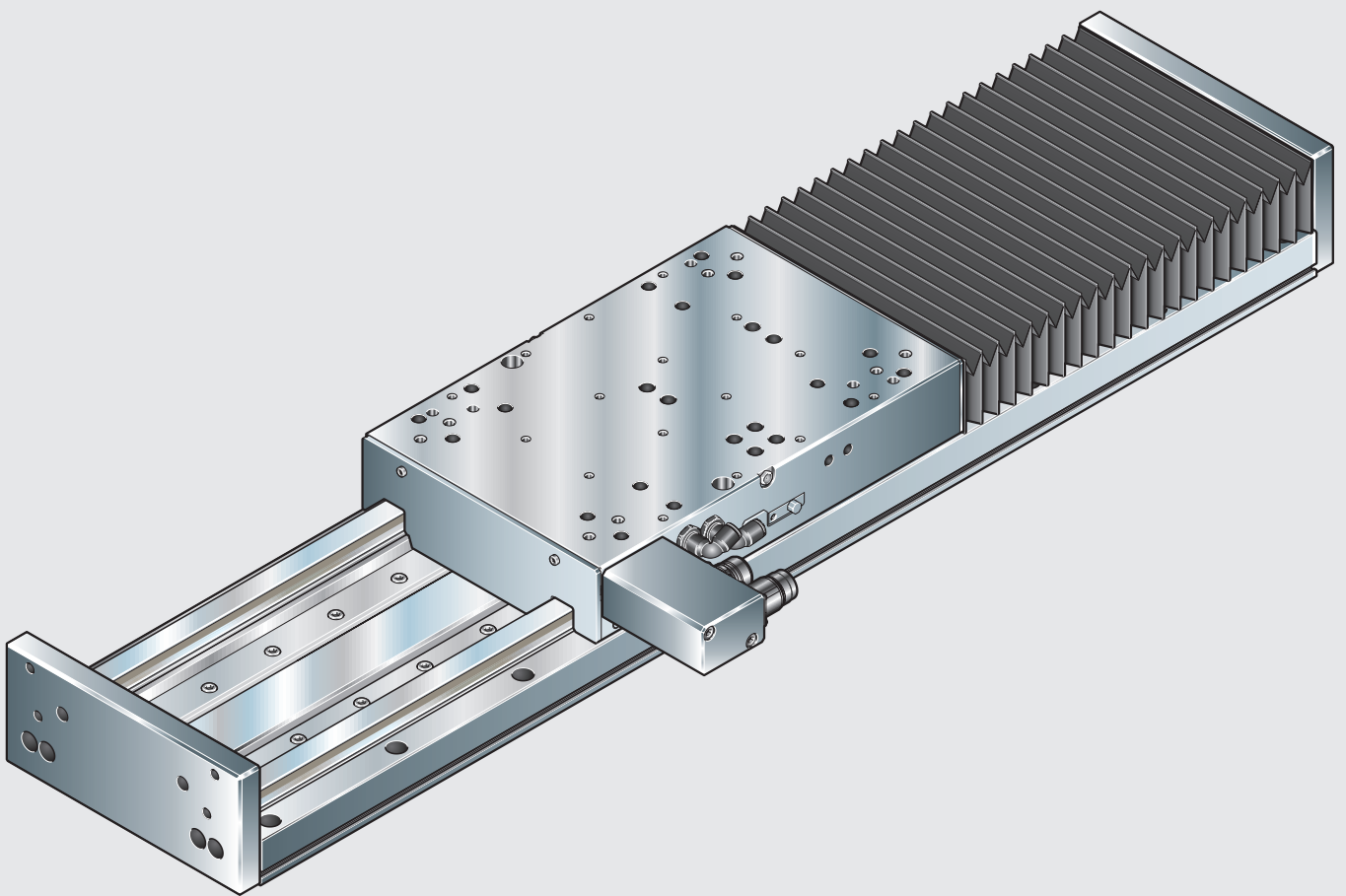


# Ball rail tables TKL

R320103154 (2017-05)  
EN

## Instructions

ENGLISH



This data has been provided solely for the purpose of product description. Any references to possible uses are provided merely as a convenience and shall be understood as sample applications or suggestions. Catalog data may not be construed as guaranteed characteristics. The information given does not release the user from the obligation of own judgment and verification. It should be noted that our products are subject to a natural process of aging and wear.

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The title page contains an illustration of a sample configuration. The product as delivered can differ from the illustration.

The original instructions are in German.

Any dissemination of the product must include these instructions.

This documentation is available in the following languages.

EN     English

Übersetzungen sind in Vorbereitung / Translations are under preparation

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# 1 About this documentation

## 1.1 Validity of the documentation

This documentation applies to the following products:


- Ball rail tables TKL according to "Ball rail tables TKL" catalog.

This documentation is intended for assembly/installation personnel, line operators and machinery/plant users or manufacturers.







This documentation contains important information for the proper and safe installation, operation, maintenance and disassembly of the product and for troubleshooting simple errors.

- Before commencing any work with the product, be sure to read these instructions, the "Safety Instructions for linear motion systems" and the "Safety instructions and instructions for use for Rexroth IndraDyn motors" carefully and completely.

## 1.2 Required and supplementary documentation

Documentation which is indicated by the book symbol  must be obtained before handling the product and must be observed:

**Table 1: Required documentation**

	Title	Document number	Document type
	Safety instructions for linear motion systems	R320103152	Safety instructions
	Safety instructions and instructions for use for Rexroth IndraDyn motors	R911338598	Safety instructions
	Ball rail tables TKL	R999001339	Catalog
	Rexroth IndraDyn L - Synchronous linear motor MLF	R911293634	Project planning
	Rexroth IndraDyn L - Synchronous linear motor MLF	R911337310	Instructions
	Rexroth connecting cable IndraDrive and IndraDyn	R911322948	Catalog
	Instructions for the drive controllers used		Instructions
	Safety data sheet for Dynalub 510	R320103160	Data sheet
	Product data sheet for Dynalub 510	R310DE2052	Data sheet
	Instructions of installed components (enclosed)		Instructions

The Rexroth documentation is available for download at [www.boschrexroth.com/mediadirectory](http://www.boschrexroth.com/mediadirectory).


## 1.3 Presentation of information

To enable users to work rapidly and safely with the product while following these instructions, this documentation uses standardized safety instructions, symbols, terms and definitions, and abbreviations. These are explained in the following sections.

### 1.3.1 Safety instructions in this document

This document contains safety instructions preceding any actions that involve a risk of personal injury or damage to property. The safety precautions described must be adhered to.




Safety instructions are structured as follows:

 <b>SIGNAL WORD</b>
<b>Type and source of hazard!</b> Consequences if ignored. ▶ Hazard prevention measure.

- **Warning sign:** draws attention to the hazard
- **Signal word:** indicates the severity of the hazard
- **Type and source of hazard:** indicates the type or source of the hazard
- **Consequences:** describes the consequences that may occur if precautions to avoid the hazard are not taken
- **Hazard prevention measure:** indicates how to avoid the hazard

The safety instructions cover the following hazard classes. The hazard class describes the risks involved if the safety instruction is not complied with.








**Table 2: Hazard levels per ANSI Z535.6 - 2006**

Warning sign, signal word	Meaning
 <b>DANGER</b>	Indicates a hazardous situation which will result in death or serious injury if not avoided.
 <b>WARNING</b>	Indicates a hazardous situation which may result in death or serious injury if not avoided.
 <b>CAUTION</b>	Indicates a hazardous situation which may result in minor or moderate injury if not avoided.
<b>NOTICE</b>	Property damage: The product or surroundings may be damaged

### 1.3.2 Symbols

The following symbols indicate notes which are not related to safety but make the documentation easier to understand.

**Table 3: Meaning of the symbols**

Symbol	Meaning
	If this information is not observed, the product will not be optimally used / operated.
	Single, independent work step
1.	Numbered work steps
2.	The numbers indicate the sequence of the work steps.
3.	
⇒ 7	see section 7
⇒  Fig. 7.1	see figure 7.1
	Screw with strength class ...
	Tightening torque
μ	Friction factor for screws
	Warning of dangerous magnetic and electromagnetic fields
	Hot surface warning

### 1.3.3 Abbreviations

The following abbreviations are used in this documentation:


**Table 4: Abbreviations and definitions**

Abbreviation	Meaning
TKL	Ball rail table TKL with ball rail systems and linear motor

## 2 Safety instructions

The general safety instructions for this product can be found in the documentation "Safety instructions for linear motion systems" and "Safety instructions and instructions for use for Rexroth IndraDyn motors" included in the scope of delivery. You must have read and understood these before handling the product.

Bosch Rexroth AG will not accept any liability for damage caused by non-compliance with our safety instructions.

 Only have ball rail tables TKL mounted, commissioned and maintained according to the specifications in these instructions and only by properly qualified personnel, e.g. mechatronics.

### 2.1 Protection from magnetic and electromagnetic fields

Magnetic and electromagnetic fields in the immediate vicinity of conductive cables or permanent magnets of electric motors can represent a serious hazard to people. The machine operator must reasonably protect the personnel working in these areas from injuries that might occur by taking suitable measures (e.g. warning notices, protective equipment, marking of the danger zone)

#### WARNING

**Health hazard for persons with pacemakers, metal implants and hearing aids in the immediate vicinity of motor components due to strong magnetic and electromagnetic fields!**

- ▶ Persons with pacemakers and metal implants must not get close to these motor parts or handle them.

**Risk of bruising for fingers and hands due to strong magnet attraction!**

- ▶ Keep movable ferromagnetic components (e.g. tools) away.
- ▶ Only use non-magnetic tools.

**Possible influencing of the plane electronics by magnetic fields**

- ▶ Compliance with the packaging and transport regulations (IATA 953)

#### NOTICE

**Risk of destruction of sensitive parts!**

- ▶ Keep watches, credit cards, bank cards and identity cards with magnetic strip as well as all ferromagnetic metal parts such as iron, nickel and cobalt away from the permanent magnets.

## 3 Scope of delivery

The following is included within the scope of delivery:

- Ball rail table TKL
- More accessories according to the configured options
- "Ball rail tables TKL" instructions
- Safety instructions for linear motion systems
- Safety instructions and instructions for use for Rexroth IndraDyn motors
- Instructions of installed components
- ▶ Upon receipt of the delivery, immediately check for completeness against the receipt.

### 3.1 Delivery condition

- Ball rail tables TKL are supplied fully assembled and greased.
- Switches and the related switch tabs included in the scope of supply are still to be mounted and adjusted before the TKL commissioning.
- Additional accessories (e.g. cable drag chain) must be attached by the customers themselves.

### 3.2 Accessories

For the accessories, see Ball rail tables TKL catalog:



Dimensions and material numbers of the accessories as well as additional fastening accessories ➡ "Ball rail tables TKL" catalog.

## 4 Product description

### 4.1 Performance description

Please refer to the notes, technical data, dimensions and descriptions in the Ball rail tables TKL catalog.

### 4.2 Device description

- 1 End block
- 2 Guide rails with integrated IMS measuring system
- 3 Guide rail
- 4 Linear motor secondary part
- 5 Linear motor primary part
- 6 Ball runner block (total of four or six pieces)
- 7 Probe integrated measuring system IMS
- 8 Carriage (aluminum)
- 9 Polyurethane protective bellows
- 10 Rubber buffer

#### Attachments:

- 11 Base plate (aluminum)
- 12 Plug holder for motor and length measuring system
- 13 Clamping unit
- 14 Glass scale
- 15 Mechanical switch (with attachments)
- 16 Cable channel (aluminum alloy)
- 17 Switch tab
- 18 Proximity switch (with attachments)

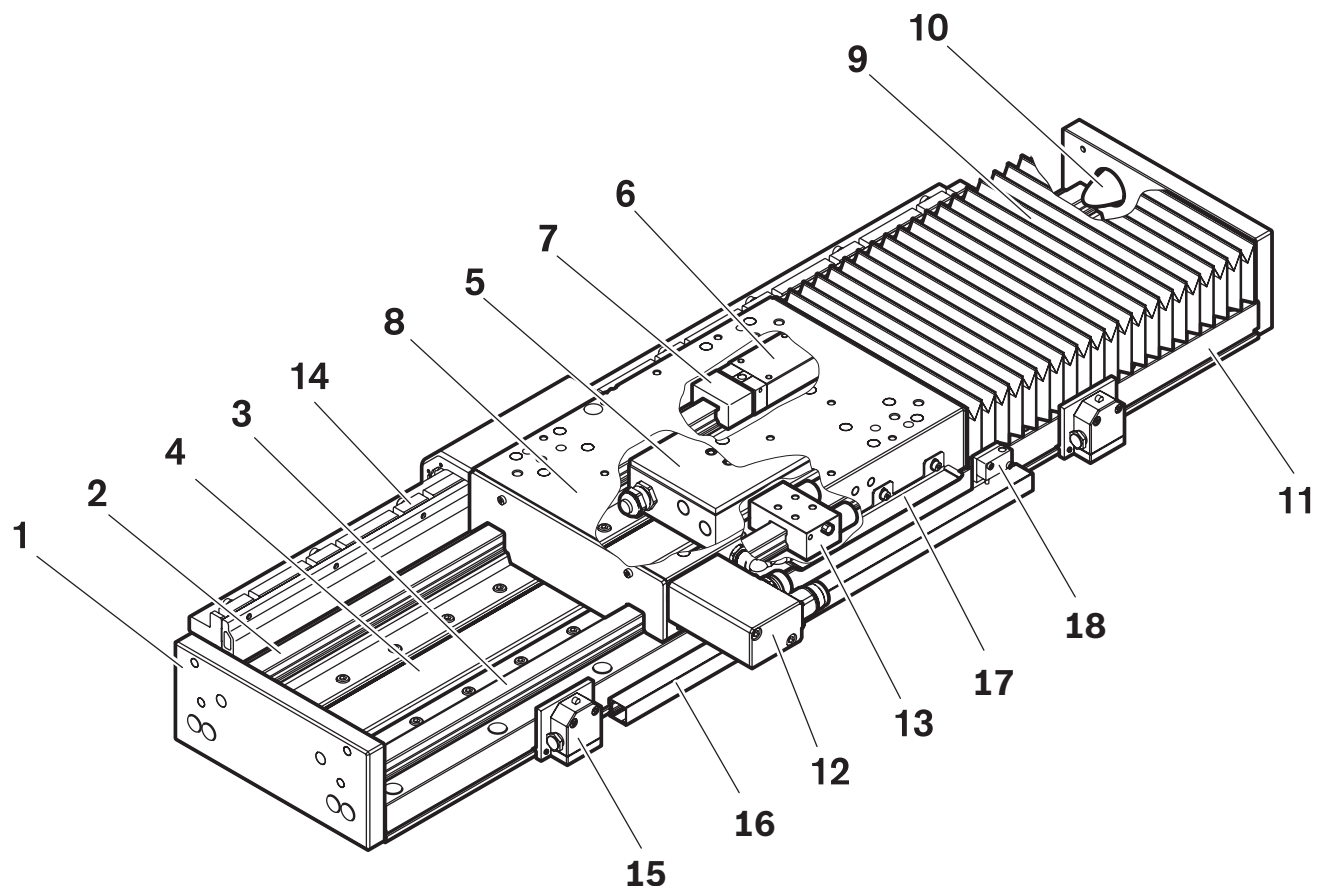


Fig. 1: TKL components



4.3 Identification

TKL nameplate

► When ordering wear parts, please always state all data given on the nameplate.

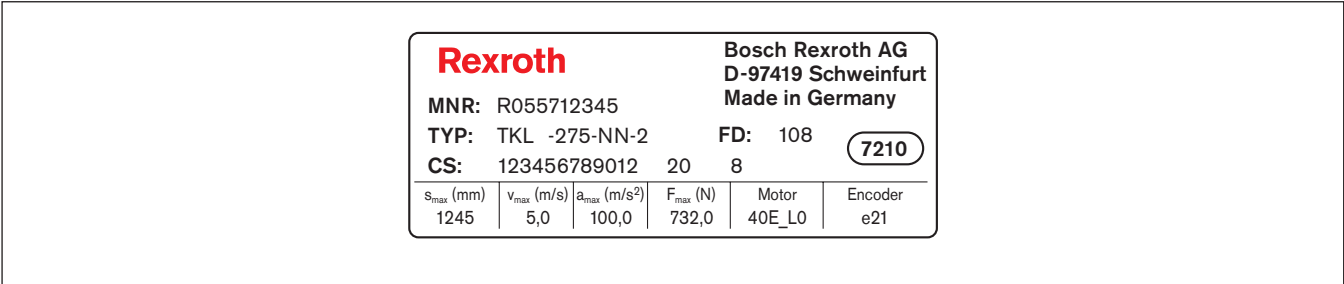


Fig. 2: TKL nameplate


The TKL nameplate bears the following information:

Table 5: Information on nameplate

Nameplate information	Meaning
MNR	Material number
TYP	Type designation and size
CS	Customer order number
FD	Date of manufacture
7210	Manufacturing location

The nameplate contains additional technical data for start-up. With these parameters, starting up the drives of linear motion systems becomes easier and faster ➡ 11.

Linear motor nameplate

 Here, the technical data refer to the primary part and may differ as compared to the TKL. The data of the TKL nameplate are decisive.

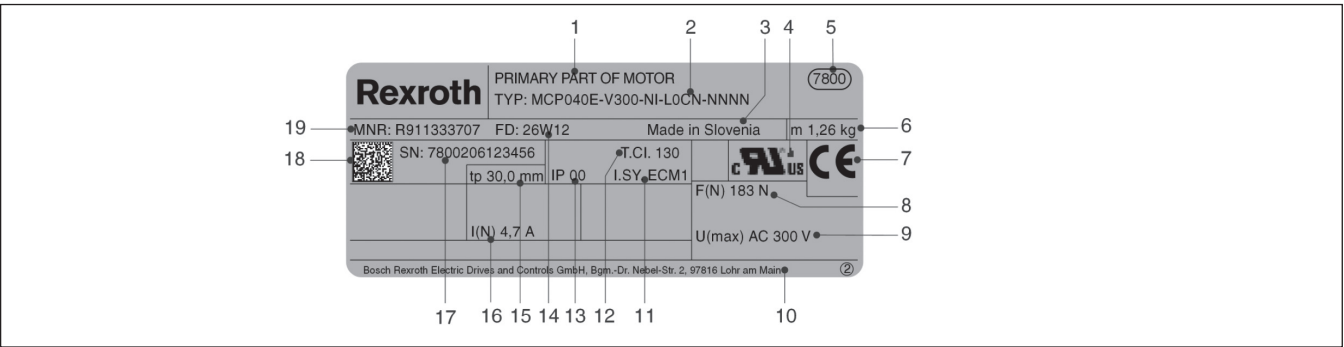


Fig. 3: Linear motor nameplate (primary part)

- 1 Motor type

2 Type designation

3 Designation of origin

4 UL mark

5 Factory number

6 Primary part weight
- 7 CE conformity marking

8 Rated force

9 Maximum input voltage

10 Company address

11 Insulation system

12 Thermal temperature class

13 Protection class, housing
- 14 Date of manufacture

15 Pole pitch

16 Rated current

17 Serial number

18 Rexroth bar code

19 Material number

## 5 Transport and storage

### WARNING

**Risk of product falling due to inadequate load handling equipment!**

Death or severe injury.

- ▶ Use only inspected and suitable load handling equipment.
- ▶ Attach load hoisting equipment carefully at the designated points only.
- ▶ Do not stand under suspended loads.
- ▶ Before hoisting the product, note the weight ➡ "TKL" catalog
- ▶ Do not remove the transport lock.

### NOTICE

**The TKL contains components subject to an electrostatic hazard. These components, e.g. the temperature sensors of the motor winding may be easily destroyed if improperly handled.**

- ▶ Avoid direct contact with the openly accessible contact pins in the electrical connection area of the carriage assembly without prior electrostatic discharge or grounding.
- ▶ Before handling endangered components, take suitable EEP protection measures (e.g. EEP protective clothing, wristband, conductive floor, earthed cabinets and working areas) to avoid damage.

**Risk of destruction of sensitive parts!**

- ▶ Keep watches, credit cards, bank cards and identity cards with magnetic strip as well as all ferromagnetic metal parts such as iron, nickel and cobalt away from the permanent magnets.

### 5.1 Transporting the product

#### NOTICE

**Damage due to transport under inappropriate environmental influence!**

Potential corrosion of product parts.

- ▶ Transport only in undamaged, unopened original packaging.
- ▶ Protect the product from humidity and corrosive agents.

Transport conditions: ➡ 16 General conditions of use

Hoisting the product:

1. Before hoisting the product, note the weight ➔ "TKL" catalog.
2. Hoist the product as shown in the figure using suitable load hoisting equipment.

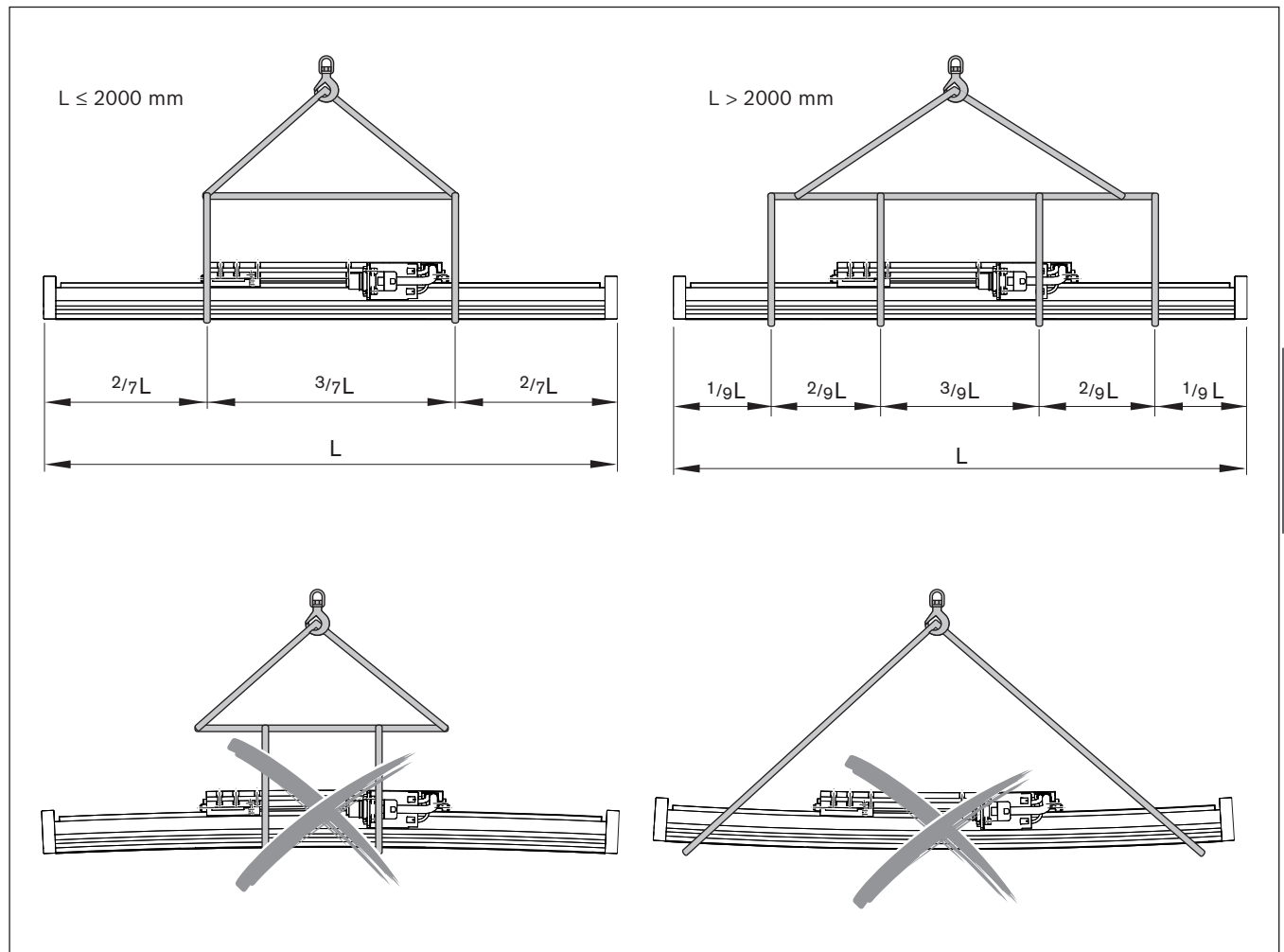


Fig. 4: Hoisting the TKL

## 5.2 Storing the product

### NOTICE

#### Damage due to storage under inappropriate environmental influence!

Potential corrosion of product parts.

- ▶ Storage only in undamaged, unopened original packaging.
- ▶ Only store the product in a roofed, dry area.
- ▶ Protect the product from humidity and corrosive agents.

Storage conditions: ➔ 16 General conditions of use

Storage periods:

- < 12 months: No measures required
- > 12 months: Check electric contacts for corrosion
- > 24 months: Please contact Bosch Rexroth.

## 6 Mounting

Dimensions and material numbers of the individual components ➡ "TKL" catalog.

### **WARNING**

**Danger to life or risk of injury caused by electric voltage!**

**During operation, the cables may wear due to the continuous mechanical load and reveal live conductors. Defective connection cables are to be replaced, the system must be decommissioned immediately. Do not perform provisional repairs at the connection cables.**

**Works at the electrical system may only be carried out by specialized electricians. Electrician tools (VDE tools) are absolutely necessary.**

**Before starting work:**

- ▶ 1. Disconnect.
- ▶ 2. Secure against reactivation.
- ▶ 3. Verify the de-energized condition.
- ▶ 4. Ground and short-circuit.
- ▶ 5. Cover or enclose any live components in the vicinity.

**After completion of the works, undo the measures in reverse order.**

**You are not permitted to operate the device, even for the purpose of taking brief measurements and tests, unless the grounding conductor is firmly connected to all the points provided for this purpose on the system.**

**If the carriage is moved manually, dangerous voltages may result at the connection pins for the power cable! Generator principle, synchronous motor: Conversion of mechanical energy into electric energy.**

### **NOTICE**

**The TKL contains components subject to an electrostatic hazard. These components, e.g. the temperature sensors of the motor winding may be easily destroyed if improperly handled.**

- ▶ Avoid direct contact with the openly accessible contact pins in the electrical connection area of the carriage assembly without prior electrostatic discharge or grounding.
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**Risk of destruction of sensitive parts!**

- ▶ Keep watches, credit cards, bank cards and identity cards with magnetic strip as well as all ferromagnetic metal parts such as iron, nickel and cobalt away from the permanent magnets.

## 6.1 Fastening the product to the adjoining structure

### NOTICE

#### Risk of product loosening or warping due to improper fastening.

Damage to the product.

- ▶ Fasten the product using the recommended fastening elements.
- ▶ Do not secure or support the product at the cross ties. The base plate is the load-bearing part!  
If possible, support it over the entire length!
- ▶ Observe the tightening torques ➡ 16.1

### 6.1.1 Preparing the fastening



The flatness of the underground must comply with the required accuracy.

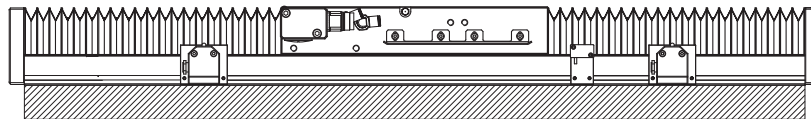


Fig. 5: Preparing the TKL fastening

1. For fastening the TKL, the bellows (if available) must be disassembled in advance. ➡ 13.1
2. Fasten accessible screws on the base plate first. ➡ 6.1.2
3. Remove the transport lock of the carriage. ➡ 11.1
4. Loosen the clamping element, if applicable. ➡ 10.2
5. Fasten the residual screws.

### 6.1.2 Fastening the TKL

The TKL is fastened from the top. At the base plate, there is a reference edge simplifying the alignment. The mounting hole plugs are included with the unit.

- 1 Mounting hole plug
- 2 Base plate
- 3 Reference edge

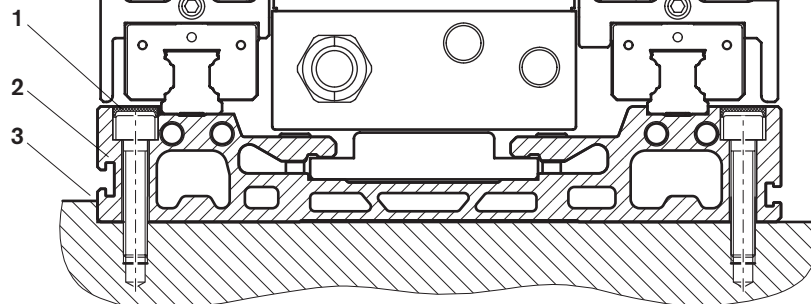


Fig. 6: Fastening the TKL

## 7 Cable drag chain

Put the cable drag chain underneath; dimensions and chain length calculation see "Ball rail tables TKL" catalog.

### 7.1 Installation space

The cable drag chain requires additional installation space; keep this required installation space clear.

- If the lower run (1) is supported, ensure continuous, smooth support. Do not allow cross webs!
- Keep dirt away from the cable drag chain. Accumulation of dirt is not allowed in the path of the cable drag chain either.

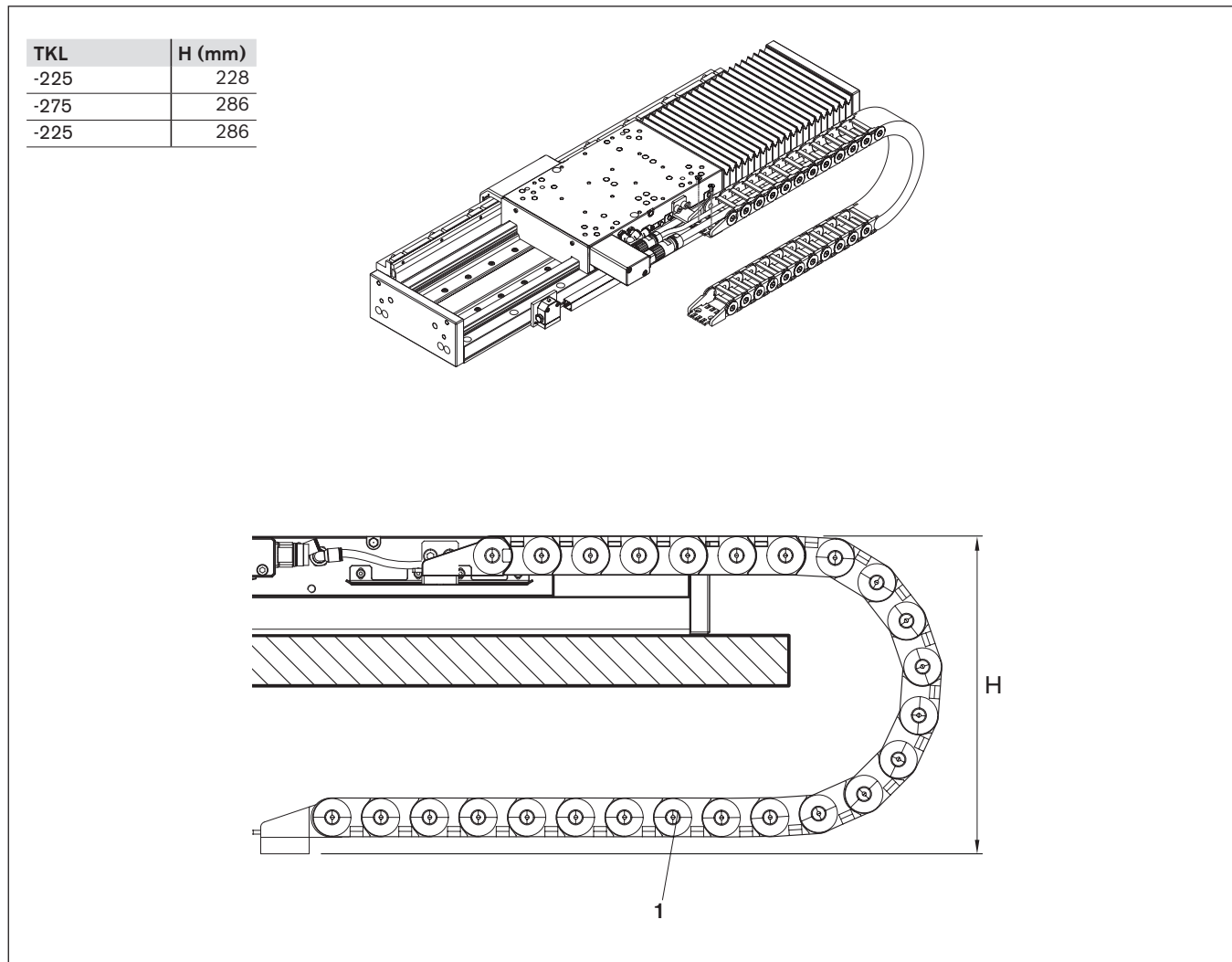


Fig. 7: Cable drag chain installation space

## 7.2 Assembling the cable drag chain

### NOTICE

#### Damaging of lines due to improper handling

Damage to the product.

- ▶ Do not twist/warp lines
- ▶ Lines must be able to move freely in the cable drag chain. Always make sure that the lines do not contact the insides/outside in the bend.

1. Calculate the chain length
2. Shorten or extend the cable drag chain (1 m pieces) ( ➡ 7.3) and lay down with the locking bracket facing upwards.
3. Fasten the connector with lugs on the inside journals at the chain with the mounting surface downwards.
4. Screw the angle to the carriage.
5. Screw the cable drag chain with connector and pull relief to the angle.
6. Lay out the cable drag chain straight, all closing brackets are at the upper side.
7. Clip all closing brackets open.
8. Connect the cable at the plug holder and at the lines and insert into the cable drag chain. Align the separators.
9. Fix the lines at the pull relief at the carriage using cable ties.
10. Attach the connector with lugs outside and holes at the end of the cable drag chain from the top and fix it using the flat-head screws (TKL-275 and TKL-325).
11. Close all closing brackets.
12. Bring the cable drag chain into its installation position and screw it to the connection construction.
13. Move the carriage and check the course of the cable drag chain.
14. Fix the lines at the pull relief using cable ties.

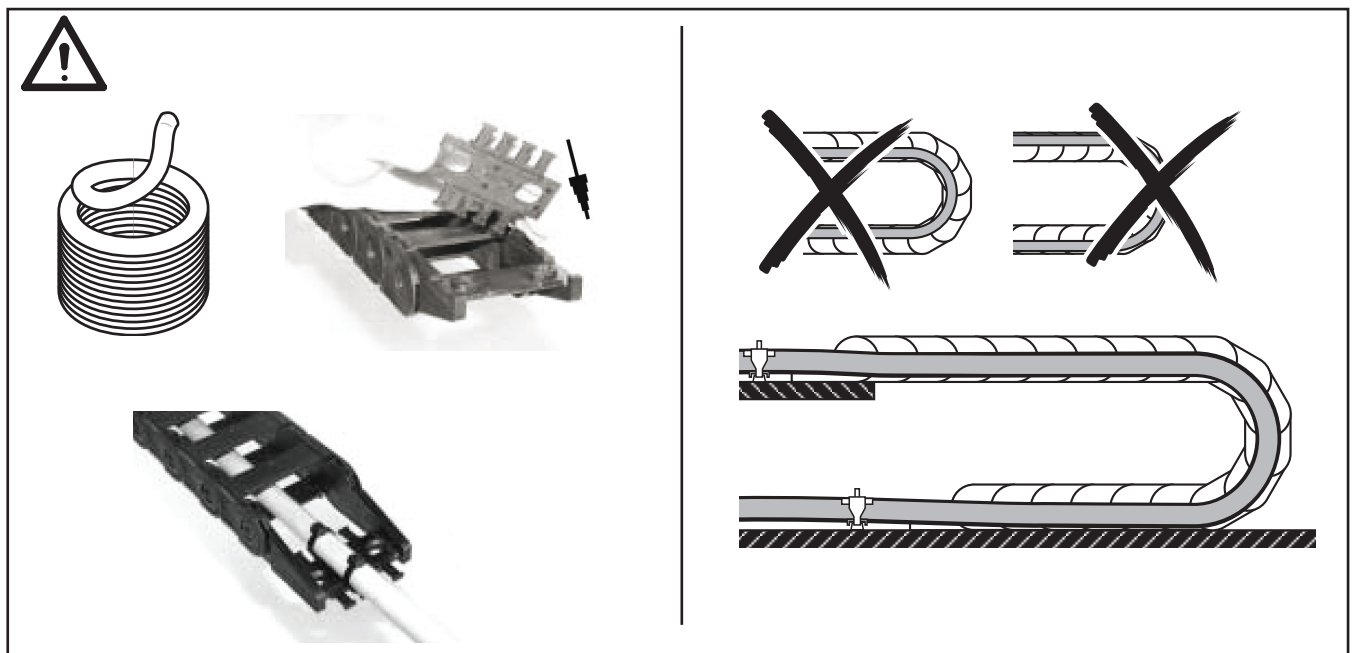


Fig. 8: Mounting the cable drag chain

## 7.3 Shortening or extending the cable drag chain

### ⚠ WARNING

#### Electric shock at damaged lines!

Death or severe injury.

- Before performing any works at the cable drag chain, always ensure that the voltage supply has been disconnected (observe the 5 safety rules).

### 7.3.1 Shortening the cable drag chain

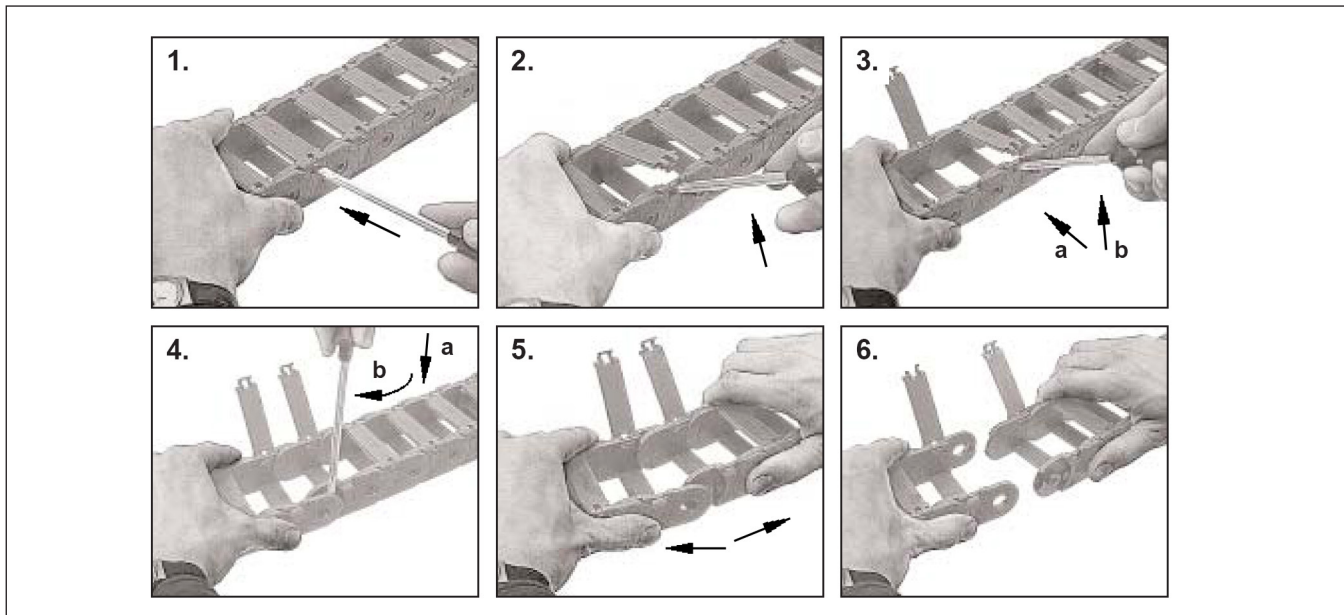


Fig. 9: Shortening the cable drag chain

### 7.3.2 Extending the cable drag chain

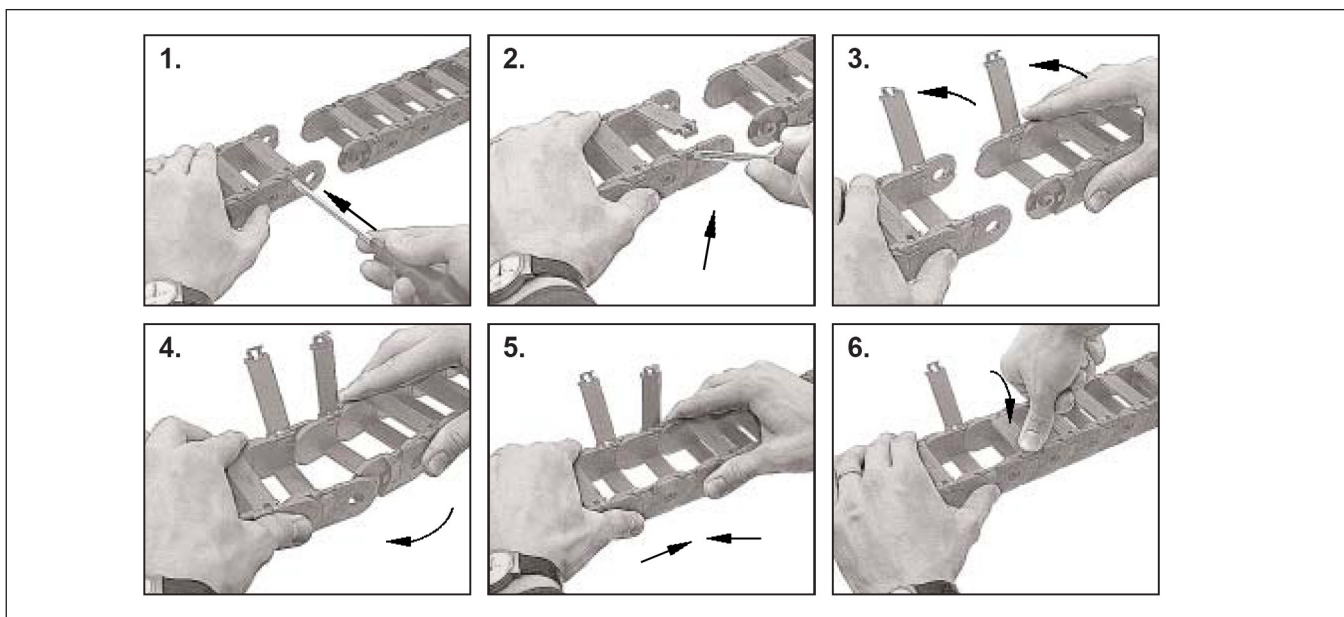


Fig. 10: Extending the cable drag chain



## 8 Disassembling / assembling the bellows

### NOTICE

#### Uncontrolled carriage movements

Death or severe injury.

- ▶ Before carrying out works at the bellows, always make sure that the carriage is secured against uncontrolled movements.
- ▶ Always disconnect the voltage supply when working at the axis (observe the 5 safety rules)

#### Disassembling the bellows

1. Screw the bellows off the cross tie (1)
2. Take out the internal frame (2)
3. Pull off the bellows upwards to the carriage.
4. Screw the bellows off the carriage (3)
5. Take out the other internal frame.

#### Assembling the bellows

1. Insert the internal frame (2) into the first and/or last pleat so that one stiffening fin of the bellows is in each case clamped as well.
2. Screw the bellows to the carriage (3). Tightening torque with M4: 2 Nm, with M5: 3.8 Nm.
3. Insert the bellows facing the fixed and/or floating bearing end.
4. Hold the internal frame (2) at the cross tie and screw it to the cross tie (1). Tightening torque with M4: 2 Nm, with M5: 3.8 Nm.

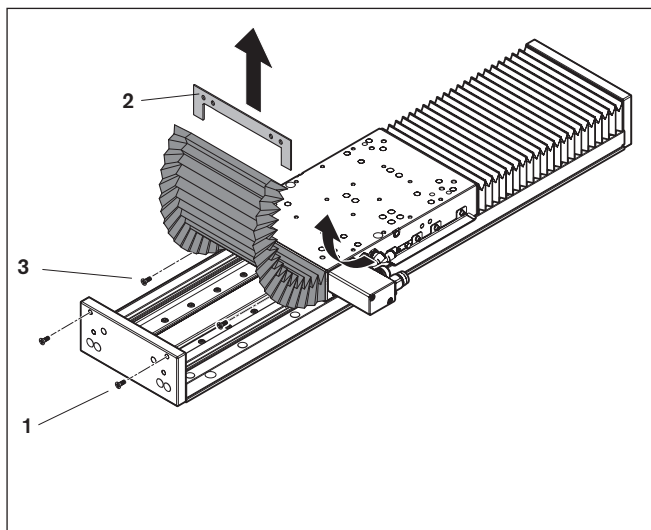


Fig. 11: Disassembling the bellows

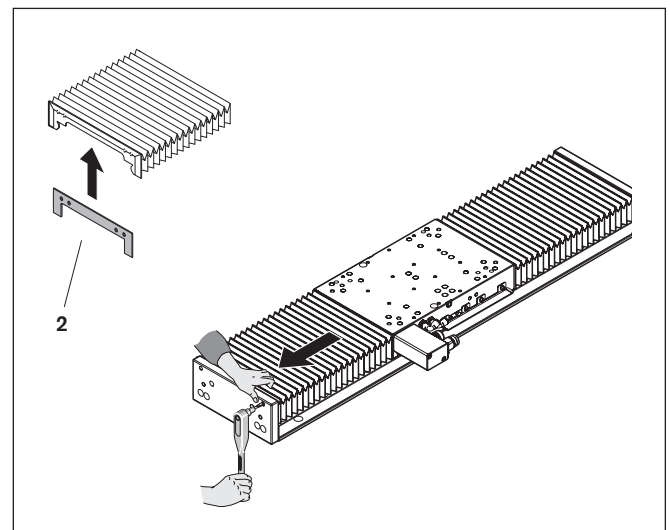


Fig. 12: Assembling the bellows



Tightening torques for fastening screws according to VDI 2230 with friction coefficient 0.125 and strength class 8.8

## 9 Electrical connection

### 9.1 Protection from electrical voltage

#### ⚠ WARNING

**Danger to life or risk of injury caused by electric voltage!**

During operation, the cables may wear due to the continuous mechanical load and reveal live conductors. Defective connection cables are to be replaced, the system must be decommissioned immediately. Do not perform provisional repairs at the connection cables.

Works at the electrical system may only be carried out by specialized electricians. Electrician tools (VDE tools) are absolutely necessary.

**Before starting work:**

- ▶ 1. Disconnect.
- ▶ 2. Secure against reactivation.
- ▶ 3. Verify the de-energized condition.
- ▶ 4. Ground and short-circuit.
- ▶ 5. Cover or enclose any live components in the vicinity.

**After completion of the works, undo the measures in reverse order.**

You are not permitted to operate the device, even for the purpose of taking brief measurements and tests, unless the grounding conductor is firmly connected to all the points provided for this purpose on the system.

If the carriage is moved manually, dangerous voltages may result at the connection pins for the power cable! Generator principle, synchronous motor: Conversion of mechanical energy into electric energy.

### 9.2 Pin assignment

#### 9.2.1 Motor flange socket pin assignment

Table 6: Motor flange socket pin assignment

Pin no.	
U1	A1
V1	A2
W1	A3
4	PE
5	SNM 150 DK +
6	SNM 150 DK -
7	n.c.
8	n.c.
9	n.c.

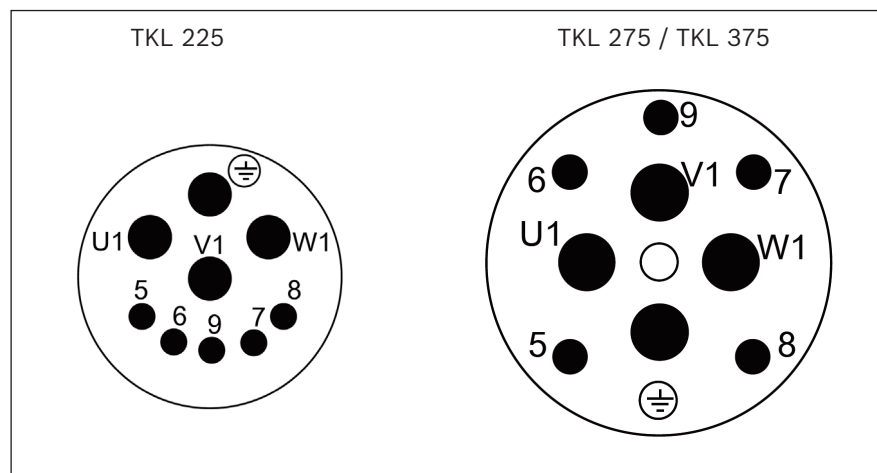


Fig. 13: Pin view contact side

**Table 7: Motor flange socket technical data**

Plug size	M23	M40
Protection type	IP67 (plugged)	
Temperature range	-40 ...+125 °C	
Ambient temperature during operation	40 °C	
Contact type	Pins	
Rated voltage	630V / 125V	
Rated current	23A	57A
Degree of contamination	3	
Overvoltage category	III (DIN VDE 0110)	
Corresponding wiring box	RLS1101	RLS1201

## 9.2.2 Encoder flange socket pin assignment

**Table 8: Encoder flange socket pin assignment**

Pin no.	IMS-A	IMS-I	Glass scale
1	Inner shield	Inner shield	n.c.
2	A +	A +	A +
3	A -	A -	A -
4	GND	GND	0V
5	B +	B +	B +
6	B -	B -	B -
7	Data +	Data + *	Data +
8	Data -	Data - *	Data -
9	n.c.	RI+	n.c.
10	n.c.	RI-	n.c.
11	VDD	VDD	VDD
12	n.c.	n.c.	n.c.
13	n.c.	n.c.	Clock +
14	n.c.	n.c.	Clock -
15	0V_Sense **	0V_Sense	0V_Sense
16	VDD_Sense **	5V_Sense	VDD_Sense
17	n.c.	n.c.	n.c.
Housing	Outer shield	Outer shield	Outer shield

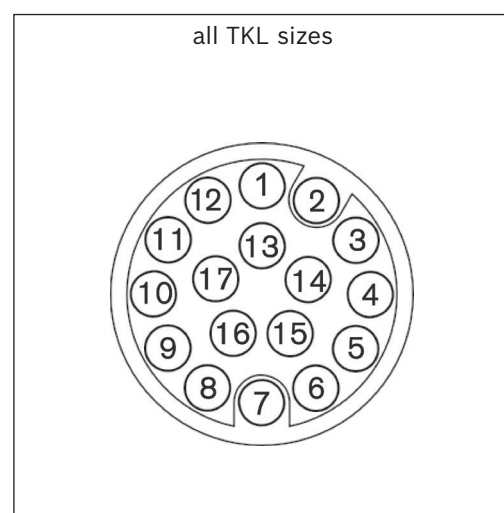
\* The IMS-I data lines cannot be used on the customer side

\*\* If there is no voltage adjustment via sense lines available, the sense lines can be switched parallel to the power supply lines

**Table 9: Encoder flange socket technical data**

Plug size	M17
Protection type	IP67 (plugged)
Temperature range	-40 ...+125 °C
Ambient temperature during operation	40 °C
Contact type	Pins
Rated voltage	60V
Rated current	3.6 A
Degree of contamination	3
Overvoltage category	III
Corresponding wiring box	RGS1711

**Lay power cable and encoder cable in a spatially separated form**

**Fig. 14: Pin view contact side**

## 10 Cooling circuit / clamping element connection

### 10.1 Cooling circuit connection

#### ⚠ CAUTION

**Risk of injury due to improper handling of pressurized lines!**

- ▶ Do not separate pressurized lines.
- ▶ Use suitable protective equipment

- Connect the cooling circuit at the TKL carriage
- Maximum pressure +10 bar must be observed
- The cooling lubricant inlet temperature must be max. 5 K below the ambient temperature.
- Only use suitable coolant additives (e.g. Aquaplus 22 / Petrofer)
- Observe the documentation for the motor and cooling unit

### 10.2 Clamping element connection

#### ⚠ WARNING

**Dangerous movements! Danger to life, risk of injury, serious physical injury or property damage!**  
**The clamping unit may not be used as a braking unit! For use only when the axis is at a standstill**

Serious injuries, damage to property.

- ▶ Use suitable braking / catching elements

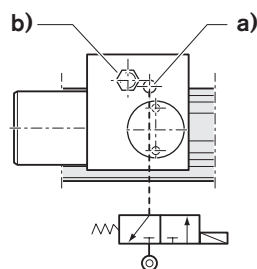


If the cylinder is bled, the clamping element is closed.

Observe the assembly and operating instructions of the clamping element!

- Minimum release pressure 5.5 bar
  - Maximum pneumatic operating pressure 6.5 bar
- Use only purified and lubricated air. The prescribed filter mesh size is 25 µm.

**Circuit type  
for standard air port**



- a) Air port M5
- b) Air filter

Fig. 15: Clamping element connection

## 10.3 Mounting the switching system

### 10.3.1 Overview of switching system

#### NOTICE

##### Risk of collision due to incorrect assembly of the switching system!

Damage to product, adjoining structure and workpieces.

- ▶ Mount the entire switching system on the same side of the electrical connections.
- ▶ Slowly move the carriage by hand over the entire working space to avoid possible collisions with workpiece or connection construction.

The following components can be retrofitted at any time

- 1 Mechanical switches external
- 2 Cable channel
- 3 Switch tab
- 4 Proximity switch external

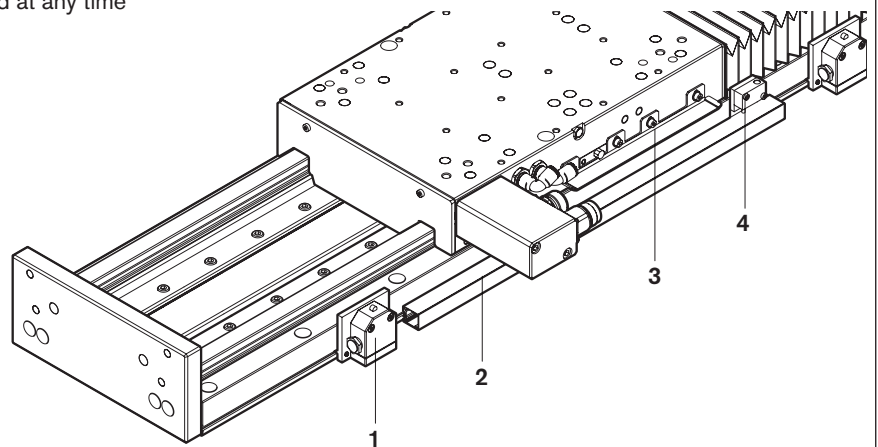


Fig. 16: Overview of switching system

### 10.3.2 Switch assembly

#### Mounting the switches

1. Connect the cable at the switch.
2. Screw the switch to the switch mounting plate.
3. Hang in the switch mounting plate.
4. Lock the switch mounting plate by means of the set screw.
5. Set the switching distances by adjusting the switching cam.

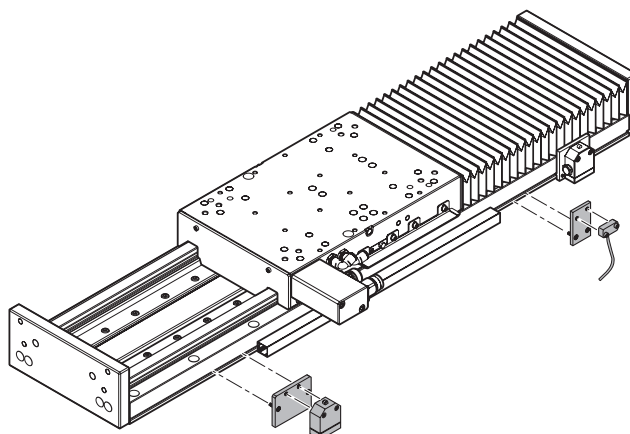


Fig. 17: Switch assembly

### 10.3.3 Moving switches

If switches are moved, the cable channel has to be changed or replaced.

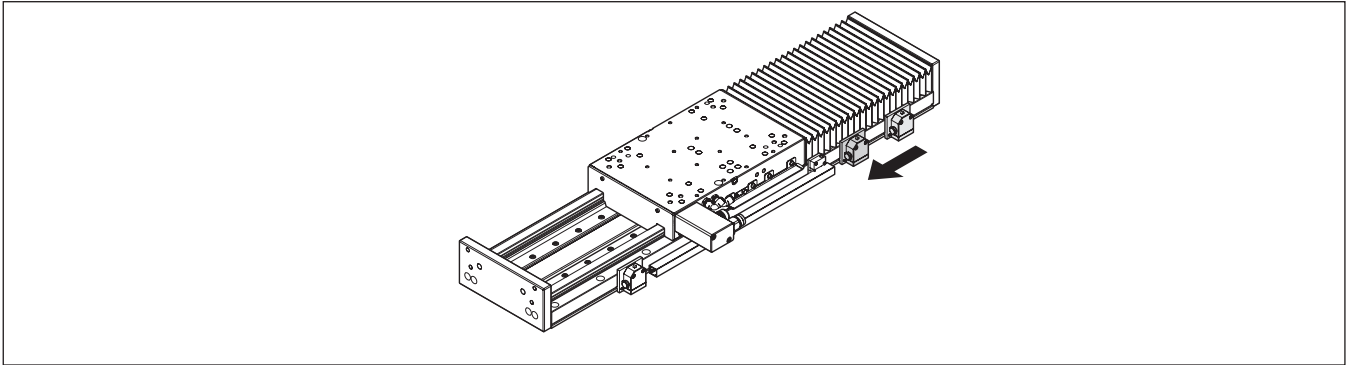


Fig. 18: Moving switches

### 10.3.4 Mounting the passive distributor

1. Mount the passive distributor on the retainer plate. 2 mounting orientations are possible.
2. Hang in the retainer plate at the TKL (analogously to switch).
3. Lock the retainer plate by means of the set screw.
4. Connect the plug at the distributor. Cover inputs that are not required with protective caps.



Fig. 19: Mounting the passive distributor

### 10.3.5 Mounting the T piece

1. Mount the T piece holder on the retainer plate.
2. Hang in the retainer plate at the TKL (analogously to switch).
3. Lock the retainer plate by means of the set screw.
4. Connect the plug at the T piece.
5. Snap the T piece into the T piece holder.
6. Snap the securing bracket on.

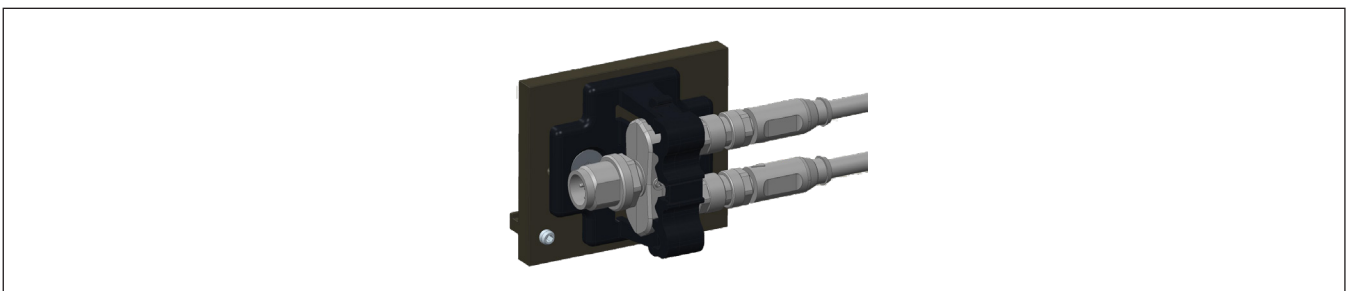


Fig. 20: Mounting the T piece

## 10.4 Mounting the cable channel



In addition to a maximum of 3 cables, the cable channel can also accommodate M8x1 plug-in connections.

1. Measure the length of the cable channel.
2. Saw off and deburr the cable channel.
3. Measure, punch and drill the holes for the cable outlets.
4. If the existing fastening bores are not sufficient, drill additional fastening holes into the cable channel bottom (2.5 deep,  $\varnothing$  3.1).
5. Clip the cable channel into the groove at the linear axis and fix it by means of the screws. Screws M3, 8 mm long, are included. If necessary, set screws M3, 8 mm long, enlarge the free space in the cable channel.
6. Cut the cable grommets **(1)** open according to the diameter of the cables and insert them. Five cable grommets are included.
7. Insert and lay the cables.

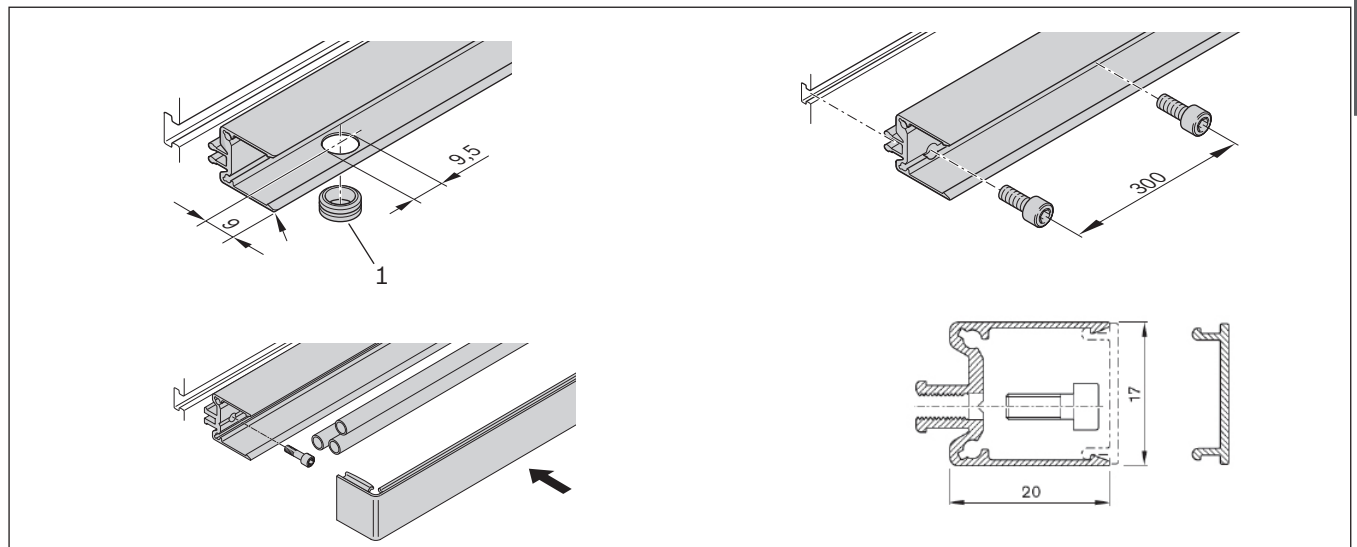


Fig. 21: Mounting the cable channel

### Mounting the cover strip with no cable channel end cover

1. Measure the cover of the cable channel, saw it off and deburr it.
2. Snap the cover in.

### Mounting the cover strip with cable channel end cover

1. Measure the cover of the cable channel.
2. Add 18 mm for every cover at the cable channel end.
3. Saw off and deburr the cover.
4. Remove the bars in the bending area and at the end.
5. Bend the cover and snap it in.

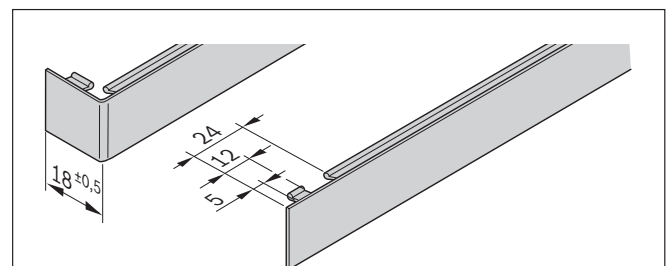


Fig. 22: Measuring the cover strip with cover

## 11 Commissioning and operation

### WARNING

**Dangerous movements! Danger to life, risk of injury, serious physical injury or property damage!**

**Do not stand in the TKL's range of movement.**

**Do not allow persons to inadvertently enter the danger area.**

**Never perform maintenance on running machines.**

**Secure the system against restart and unauthorized use during maintenance.**

**Securely fasten the TKL in the system or machine.**

**The TKL is not self-locking; this means that if it is used vertically or at an angle, it can drop or move uncontrollably.**

To prevent this, the manufacturer and/or vendor must take precautions when installing the machine in this manner. The Division Information Sheet on "Gravity-Loaded Axes" of DGUV Fachbereich Holz und Metall, the Woodworking and Metalworking Division of the German statutory accident assurance association (DGUV), and other sources offer further information on this topic.



### WARNING

**Risk of burns due to hot surfaces! Temperatures above 60 °C are possible.**

- ▶ Avoid touching the hot surface of the carriage assembly
- ▶ After switching off the product, let hot surfaces cool down before touching them.
- ▶ Temperature-sensitive components should not touch the surface of the carriage assembly.
- ▶ Pay attention to the clearance of the connecting cables from other components.

### 11.1 Checking the operating conditions

- ▶ For example take note of the permitted ambient temperature, load, linear travel speed and maximum travel of the TKL.
  - ➡ 15 and 16.
- ▶ For special operating conditions, please contact us.

### 11.2 Test run, running in

- ▶ Only start up the product after running successful tests under simulated production conditions.
- ▶ Move the thrust rod at low speed over the entire stroke. While doing so, be sure to check the settings and the function of the limit switches.
- ▶ If necessary, optimize the interaction of the mechanical equipment and the electronics.



### 11.3 Removing the transport lock

#### NOTICE

**Damage to the product!**

Damage to the product

- Before commissioning, remove the transport lock. If the product is installed vertically or diagonally, make sure that the carriage cannot move in an uncontrolled manner during/after removal of the transport lock.

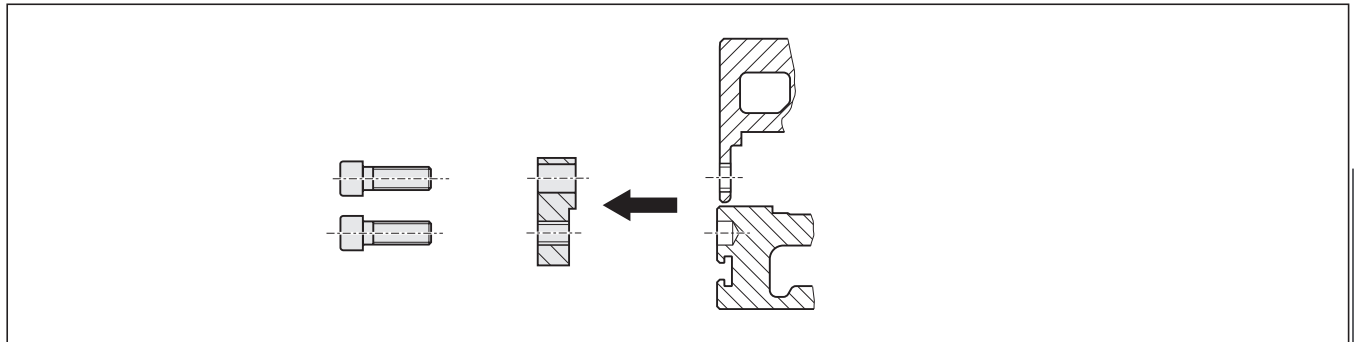


Fig. 21: Measuring the cover strip with cover

## 11.4 Commissioning in IndraWorks

### NOTICE

**If operated without liquid cooling, rated force and rated current of the motors must be reduced to approx. 40% of the specified value.**

► Reduce the current in parameter S-0-0111 accordingly! Risk of thermal overload of the motor.

#### Settings for commissioning with IndraWorks for IndraDrive drive controllers

- Motor data are loaded from the motor database (update to the latest version, if necessary)
- Motor category: Rexroth kit motor

**Table 10: Full motor designations**

Name plate information motor	Primary part	Secondary part
40A	MLP040A-0300-FS-N0-CN-NNNN	MLS040S-3A-150-NNNN
40B	MLP040B-0300-FS-N0-CN-NNNN	MLS040S-3A-150-NNNN
70A	MLP070A-0300-FS-N0-CN-NNNN	MLS070S-3A-150-NNNN
70B	MLP070B-0250-FS-N0-CN-NNNN	MLS070S-3A-150-NNNN
100A	MLP100A-0190-FS-N0-CN-NNNN	MLS100S-3A-150-NNNN
100B	MLP100B-0250-FS-N0-CN-NNNN	MLS100S-3A-150-NNNN
100C	MLP100C-0190-FS-N0-CN-NNNN	MLS100S-3A-150-NNNN

**Table 11: Parameterization for encoder IMS-A (nameplate information encoder: e13)**

Parameter	Value
Encoder type	Encoder with sine signals and HIPERFACE interface (1V <sub>pp</sub> , 12V vers.)
Resolution	0.040 mm
Encoder type	Linear encoder
Inverted direction of movement	yes

**Table 12: Parameterization for encoder glass scale IMS-I (nameplate information encoder: e12)**

Parameter	Value			
Encoder type	Encoder with sine signals (depending on connection 5V or 12V supply)			
Resolution	0.040 mm			
Encoder type	Linear encoder			
Inverted direction of movement	yes			
Encoder distance-coded	yes			
Counting direction	negative			
Reference dimension	TKL length L	T <sub>R</sub>	Reference dimension A	Reference dimension B
	up to 800 mm	40 mm	1025	1000
	up to 2400 mm	70 mm	1775	1750
	more than 2400 mm	90 mm	2275	2250

T<sub>R</sub> = reference dimension distance coding

**Table 13: Parameterization for encoder glass scale (nameplate information encoder: e11)**

Parameter	Value
Encoder type	Encoder with sine signals and EnDat 2.1 interface (depending on connection 5V or 12V supply)
Resolution	0.020 mm
Encoder type	Linear encoder
Inverted direction of movement	no

## 11.5 Test run, running in

### ! WARNING

**Uncontrolled carriage movements are possible in case of incorrect parameterization or control.**

**Personal injuries / damage to property**

- ▶ Keep the movement range free
- ▶ Do not allow persons to inadvertently enter the danger area, e.g. by putting up protective fences / screens

- ▶ Before the first test run, consider possible restrictions due to system-inherent interfering contours.
- ▶ During the first test run, move at low speed over the entire stroke. While doing so, check particularly the setting and function of the reference switch, the reference mark and the limit switches (if available)
- ▶ If necessary, optimize the interaction of the mechanical equipment and the electronics.

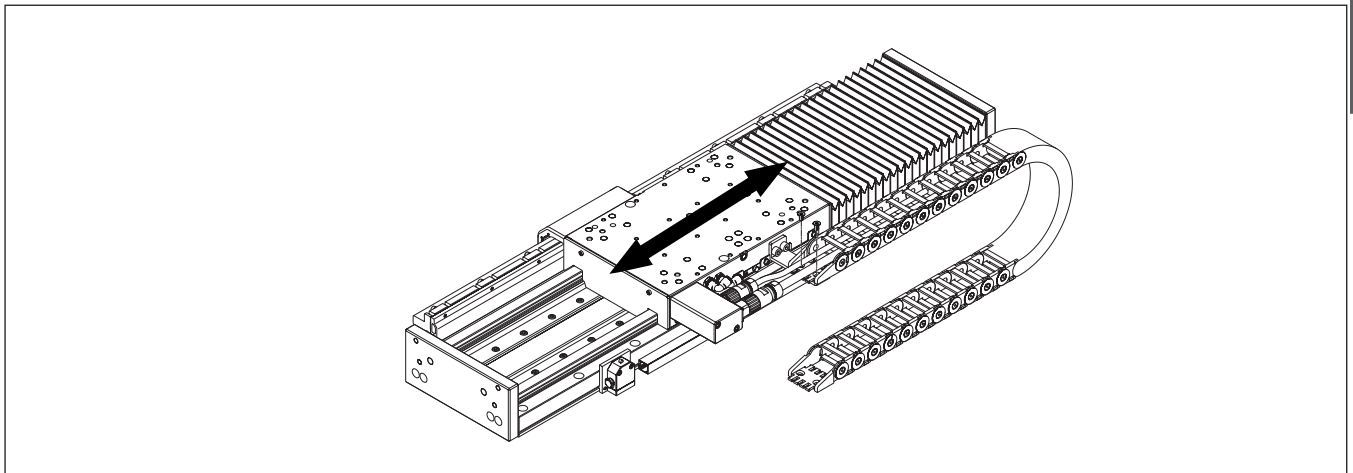


Fig. 22: Moving the carriage

## 11.6 Operation

During operation, the specified conditions of use and technical data must be complied with.

Controls during operation:

- Look out for unusual noises.
- Look out for increased vibrations.
- Check the monitoring equipment and the diagnosis / error messages of the control units.
- Check the cabling for wear at regular intervals

### NOTICE

**Immediately decommission the drive if there are any deviations from normal operation!**

Damage to the product.

- ▶ For the further procedure, refer to chapter 17 "Service and support"

## 12 Maintenance and repair

### 12.1 Visual inspection and cleaning

- ▶ Excessive dirt, dust or chips may have negative influence on the function of the motors; in extreme cases, this may even lead to failure of the motors.
- ▶ Check connection cables for damage at regular intervals and exchange them, if necessary.
- ▶ Check cable drag chains (drag chains) that may optionally be available for defects.

### 12.2 Lubrication

- ▶ Before using lubricants, read and observe the appropriate safety data sheets.
- ▶ For lubricating the ball runner blocks, a commercially available manual grease gun is to be used.
- ▶ Basic lubrication with Dynalub 510 is carried out by the manufacturer.

#### NOTICE

##### **Risk of property damage due to insufficient lubrication!**

Loss of performance and corrosion as well as early failure of the guideways.

- ▶ Lubricate the product every 500 operating hours or when the travel distance has been covered – whichever limit is reached first ➡ Tabelle 15/16.

##### **Risk of insufficient lubrication due to use of improper lubricants!**

Damage to the product, reduced relubrication intervals, loss of performance in short-stroke applications and under load; possible chemical interactions between plastic materials and lubricants.

- ▶ Do not use lubricants containing solid particles (e.g. graphite or MoS<sub>2</sub>)!
- ▶ Use only the recommended lubricants ➡ Tabelle 14.

##### **Reduced lubrication intervals in special environmental conditions (contamination, vibrations, impact loads, etc.)!**

Inadequate lubrication.

- ▶ Reduce the recommended relubrication intervals to suit the given environmental conditions.
- ▶ Even under normal operating conditions, the system must be relubricated **at least every 2 years** due to aging of the grease.

##### **Performance altered by special operating conditions!**

Damage to the product.

- ▶ Before commissioning the product under special operating conditions (➡ 16), please consult Bosch Rexroth AG. This applies especially to environments with glass fiber or wood dust, solvents and extreme temperatures.

**Table 14: Recommended lubricants**

TKL	Grease DIN 51825	Consistency class DIN 51818	Recommended grease	Material number
225 / 275 / 325	KP2K	NLGI 2	Dynalub 510	Cartridge R3416 037 00, bucket (25 kg) R341603500

Can still be used:

- Elkalub GLS 135 / N2 (company Chemie-Technik)
- Castrol Longtime PD2 (company Castrol)

## Relubrication of the ball runner blocks

### Normal stroke ( $\geq$ stroke according to table 15)

- Once the relubrication interval (travel distance) according to table 15 has been reached, relubricate the amount stated in table 15.

**Table 15: Normal stroke / relubrication quantities / relubrication interval**

TKL	Stroke (mm)	Primary part	Relubrication quantity Dynalub 510		Relubrication interval	
			(cm <sup>3</sup> )	(g)	$F_{\text{comb}} / C \leq 0.12$ (km)	$0.12 < F_{\text{comb}} / C \leq 0.12$ (km)
TKL-225-NN-2	131	A + B	5.6	5.2	5,000	2,200
TKL-275-NN-2	159	A + B	11.2	10.4	10,000	4,300
TKL-325-NN-2	179	A + B	17.6	16.4	10,000	4,300
	179	C	26.4	24.6	10,000	4,300

### Short stroke ( $<$ stroke according to table 16)

- Once the relubrication interval (travel distance) according to table 16 has been reached, relubricate the amount stated in table 16.
- Lubrication cycle: insert half the relubrication quantity. Move with a double stroke of 2 strokes according to the table. Repeat the process once again.  
As minimum stroke, half the stroke according to table 16 has to be moved.

**Table 16: Short stroke / relubrication quantities / relubrication interval**

TKL	Stroke (mm)	Primary part	Relubrication quantity Dynalub 510		Relubrication interval	
			(cm <sup>3</sup> )	(g)	$F_{\text{comb}} / C \leq 0.12$ (km)	$0.12 < F_{\text{comb}} / C \leq 0.12$ (km)
TKL-225-NN-2	131	A + B	11.2	10.4	5,000	2,200
TKL-275-NN-2	159	A + B	22.4	20.8	10,000	4,300
TKL-325-NN-2	179	A + B	35.2	32.7	10,000	4,300
	179	C	52.8	49.1	10,000	4,300

This applies to the following conditions:

- No exposure to media
- Ambient temperature:  $T = 10 - 40^\circ \text{C}$
- Normal operating conditions
- With a load ratio of  $F_{\text{comb}} / C > 0.2$ , please consult us

### Definition $F_{\text{comb}}/C$

The load ratio  $F_{\text{comb}}/C$  is the quotient of the equivalent dynamic combined load on the bearing  $F_{\text{comb}}$  (considering the internal preload force  $F_{\text{pr}}$ ) and the dynamic load capacity  $C$ .

### Key

- C = Dynamic load capacity (N)
- F = Equivalent dynamic load (N)

## Relubrication

For the relubrication intervals under normal operating conditions, see table 15/16

- For lubrication using the grease gun, the grease quantity must be weighted per stroke.
- After every relubrication, move some strokes over the entire travel distance (3).

### 12.2.1 Lubricating ball rail tables TKL through the carriage

The lube nipples are located on both sides of the carriage. Lubrication from one side is sufficient.

1. Check that the operating conditions are normal ➔ 16.
2. Lubricate the ball rail tables TKL using a manual grease gun. While doing so, measure the grease quantity per stroke ➔ Table 15/16.
3. Move the carriage at least by the prescribed stroke according to table 14/15 to ensure even greasing of the runner blocks.

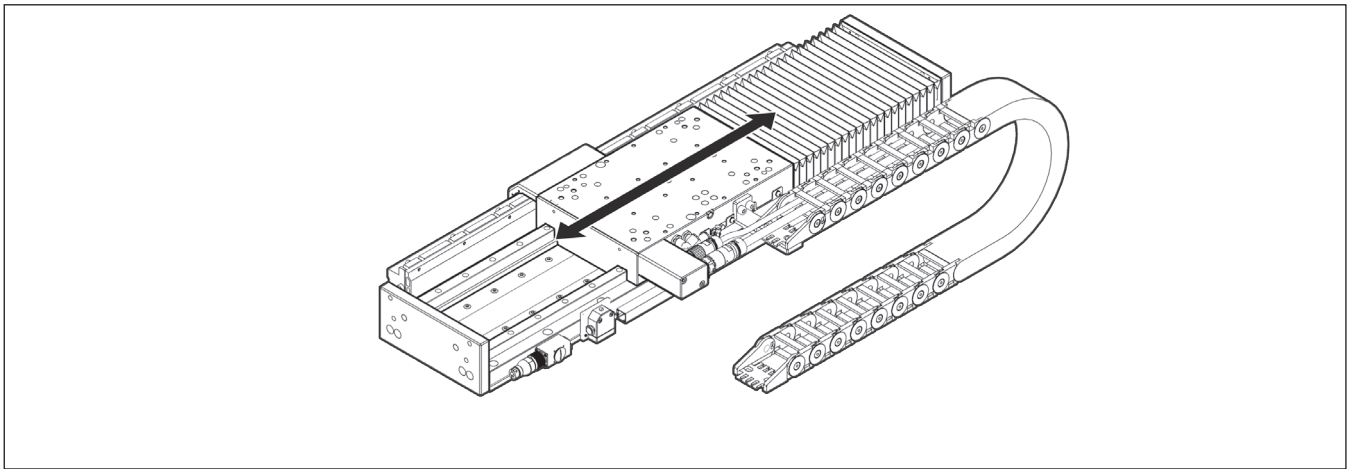


Fig. 23: Lubricating the TKL

## 12.3 Maintenance

### Cleaning cycle

Dirt can settle and encrust on ball guide rails, especially when these are not enclosed.

To ensure that seals and cover strips retain their functionality, this dirt must be removed at regular intervals.

It is advisable to perform at least one full cleaning cycle over the entire stroke at least twice a day or every 8 hours at the latest.

Before shutting down the machine, always perform a cleaning cycle.

Shorter maintenance intervals in case of exposure to cooling lubricants.

### Maintenance of accessories

All accessories used for scraping the ball guide rail shall be subject to regular maintenance.

In environments with heavy contamination, it is advisable to replace all the parts directly exposed to such contamination.

We recommend annual maintenance.

## 12.4 Repair

Repairs to the product may only be carried out by Bosch Rexroth.

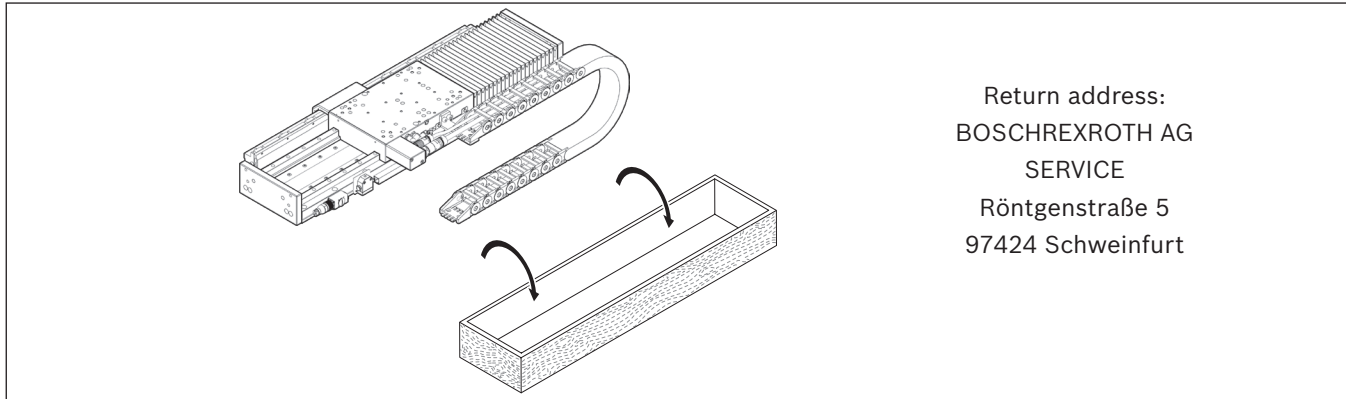


Fig. 24: Returning the product to Bosch Rexroth

## 13 Removal and replacement

To ensure the accuracy and function of the product after replacement of assemblies (e.g. linear motor, ball rail systems, carriage, frame, etc.), such assemblies may only be removed and replaced by Rexroth. The only exceptions to this rule are the work steps described in this section.

### 13.1 Mounting the transport lock

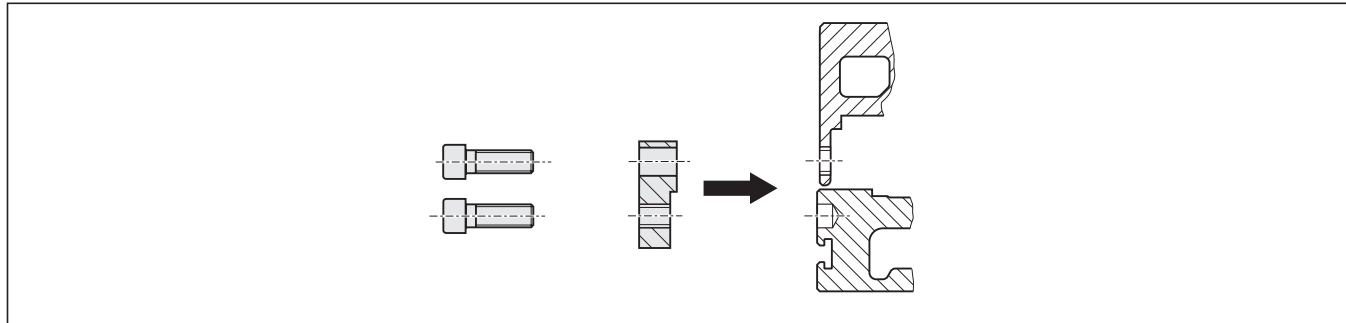


Fig. 21: Measuring the cover strip with cover

### 13.2 Removing the cable channel

► Disassemble the cable channel in the reverse order as during assembly. ➡ 6.6

### 13.3 Removing the switching system

► Disassemble the switching system in the reverse order as during assembly. ➡ 6.4

### 13.4 Removing the cable drag chain

► Disassemble the cable drag chain in the reverse order as during assembly. ➡ 6.3



## 14 Environmental protection and disposal

### NOTICE

#### **Environmentally hazardous materials can pollute the environment if not disposed of properly.**

Environmental pollution.

- ▶ Collect any leaking lubricant and recycle it correctly.
- ▶ The product and its components must be recycled correctly and in compliance with all applicable national and international guidelines and regulations.
- ▶ The permanent magnets at the secondary part must be demagnetized before disposal to prevent injuries and damage to property.

#### **Recycling:**

- ▶ Due to the high metal content, the products can mostly be recycled. To achieve an optimum metal recovery, dismantling into individual assemblies is required. Metals contained in the electric and electronic assemblies can also be recycled using special separating procedures.

#### **The TKL primarily consists of the following components:**

- ▶ Steel, aluminum, copper, brass
- ▶ Plastics, insulation and combined materials
- ▶ Electronic components
- ▶ Permanent magnets
- ▶ Lubricants

#### **Demagnetizing the magnets:**

- ▶ The magnets at the secondary part are demagnetized by means of a special thermal treatment. In this connection, the duration of the treatment is influenced by the size. The secondary part must remain in the oven for at least 30 minutes, starting at the time at which the magnet surface has reached a temperature of 300 °C. In case of successful demagnetization, the magnets can be separated from the carrying plate without force after the secondary part has cooled down.

#### **Packaging:**

- ▶ Our packaging materials do not contain any problematic materials and can be recycled without problems. The following is used as packaging materials: wood, cardboard and plastics.

#### **Disposal by the manufacturer:**

- ▶ Products manufactured by us can be returned to us for disposal. Please make sure that no foreign substances or foreign components are contained. In case of air transport, observe the hazardous materials regulations (IATA) for the secondary part, if applicable.

#### **Please send the products carriage paid to the following address:**

- ▶ BOSCHREXROTH AG  
SERVICE  
Röntgenstraße 5  
97424 Schweinfurt



## 17 Service and support

Service Germany.

The service helpdesk & hotline is available at:

- Phone: +49 9352 40 50 60
- Email: [servicelt@boschrexroth.de](mailto:servicelt@boschrexroth.de)

Worldwide service.

If you are located outside of Germany, please contact your contact person first.

Hotline numbers can be found with the sales addresses in the Internet.

- Internet: <http://www.boschrexroth.com>

Information preparation

We will be able to help you quickly and efficiently if you have the following information ready:

- Detailed description of the malfunction and conditions
- Information on the nameplate of the affected product
  - Material number, type designation, TKL customer order number
  - Material number, type designation, drive controller serial number
- More far-reaching information on the control periphery, if possible (e.g. control type, firmware, bus system)
- Your contact data (contact person, telephone number and email address)

### 17.1 Troubleshooting and fault clearance

**Table 19: Troubleshooting and fault clearance**

Fault	Error cause	Remedy
Motor is not running	Controller enable missing	Activate controller enable
	Control error	Fault clearance according to the control unit documentation
	Voltage supply missing	
Vibrations	Fixing screws loose	Check the screw connection
	Unsuitable control circuit parameterization	Check the control circuit settings
Running noises	Foreign matter in the motor	Stop motor --> Repair by manufacturer
	Ball rail systems	Stop motor --> Repair by manufacturer
High motor temperature, motor monitoring responds	Operation outside the nominal data	Reduce load, check dimensioning, if applicable; check liquid cooling
TKL is stiff or blocked	Improper assembly, tension due to the fastening, service life end, ...	Check the mechanical system
Incorrect or faulty temperature display	Temperature sensor not connected	Connect the temperature sensor
	Temperature sensor defective	Stop motor --> Repair by manufacturer
Encoder signal interference or faulty, reference mark detection not successful	Defective encoder cable	Check encoder cable

The Drive & Control Company

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