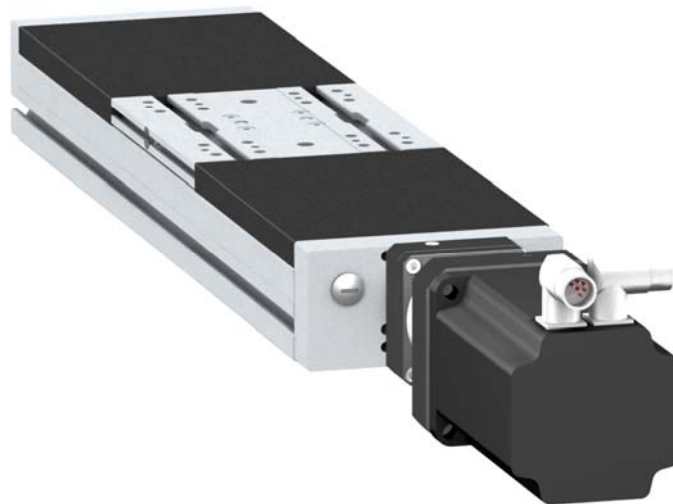




Motion Control & Systems

# Installation Instruction

KT4 Linear Table



## **Important information**

This manual is part of the product.

Carefully read this manual and observe all instructions.

Keep this manual for future reference.

Hand this manual and all other pertinent product documentation over to all users of the product.

Carefully read and observe all safety instructions and the chapter "Before you begin - safety information".

Some products are not available in all countries. For information on the availability of products, please consult the catalog.

Subject to technical modifications without notice.

All details provided are technical data which do not constitute warranted qualities.

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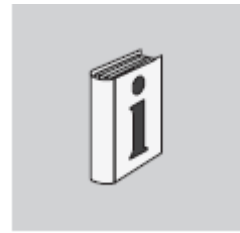
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## Writing conventions and symbols



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This manual is valid for KT4x standard products. Chapter 1 "Introduction" lists the type code for this product. The type code allows you to identify whether your product is a standard product or a customized version.

*Source manuals* The latest versions of the manuals can be downloaded from the at.

<http://www.hiwin.de>

*Source CAD drawings* For easier engineering, CAD drawings and product master data are available for download from the Internet at:

<http://www.hiwin.de>

*Corrections and suggestions* We always try to further optimize our manuals. We welcome your suggestions and corrections:  
Please get in touch with us by e-mail

[info@hiwin.de](mailto:info@hiwin.de).

*Work steps* If work steps must be performed consecutively, this sequence of steps is represented as follows:

- Special prerequisites for the following work steps
- ▶ Step 1
- Specific response to this work step
- ▶ Step 2

If a response to a work step is indicated, this allows you to verify that the work step has been performed correctly.

Unless otherwise stated, the individual steps must be performed in the specified sequence.

*Making work easier* Information on making work easier is highlighted by this symbol:



*Sections highlighted this way provide supplementary information on making work easier.*

*SI units* SI units are the original values. Converted units are shown in brackets behind the original value; they may be rounded.

Example:

Minimum conductor cross section: 1.5 mm<sup>2</sup> (AWG 14)

*Glossary* Explanations of special technical terms and abbreviations.

*Index* List of keywords with references to the corresponding page numbers.

## **1. Introduction**

### **1.1 Overview of product properties**

The linear tables are based on specially developed and particularly torsion-resistant aluminium profiles. They excel with their ability to position heavy loads at changing torques with high feed forces and high accuracy.

The ball screw drive is not self-locking.

#### **1.1.1 Product family**

The linear axes product family consists of the following sizes:

- KT41SB (cross section axis body 100x40 mm)
- KT42SB (cross section axis body 150x70 mm)
- KT43SB (cross section axis body 200x80 mm)

The sizes differ in terms of outer dimensions, drive data, payload capacities and maximum stroke.

#### **1.1.2 Features and options of the linear tables**

The linear axis excels with the following features and options:

- Easy integration into systems and machines due to axis bodies with T slots
- Different strokes lengths available
- Mounting thread with counterbores for locating dowels at the carriage for reproducible mounting of the payload
- Grease nipples at the side of the carriage for external lubrication
- with bellows
- Motor mounting via compact coupling system
- Sensors adjustable in T slots

### 1.1.3 Characteristics of the linear guide

#### *Recirculating ball bearing guide*

- High acceleration
- High load capacity
- High accuracy
- High torque capacity
- optimal power flow to the profile

### 1.1.4 Motor mounting

The motor or the gearbox are coupled by means of a torsionally stiff coupling

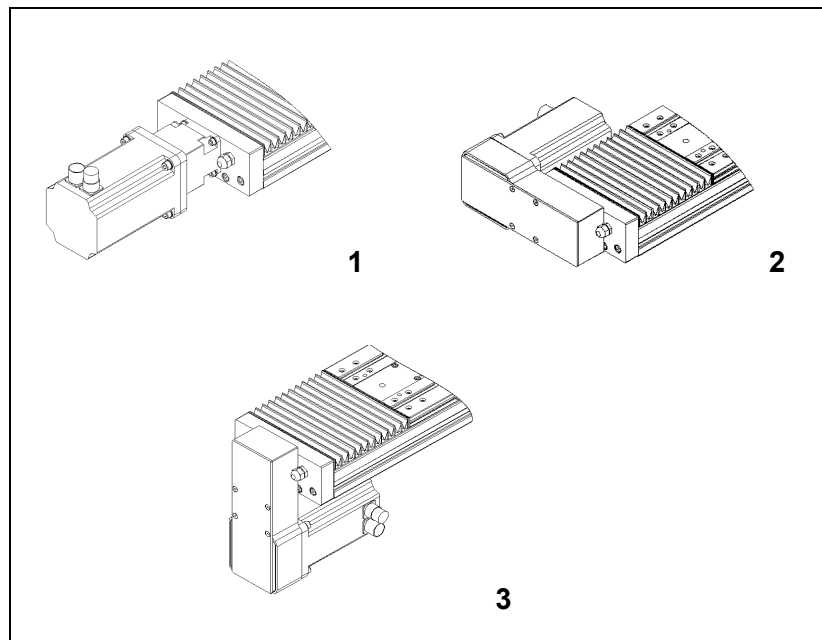


Figure 1.1 Options of motor mounting

- (1) Motor mounting straight
- (2) Horizontal belt drive, motor left inside
- (3) Vertical belt drive, motor down inside



## 1.2 Product overview

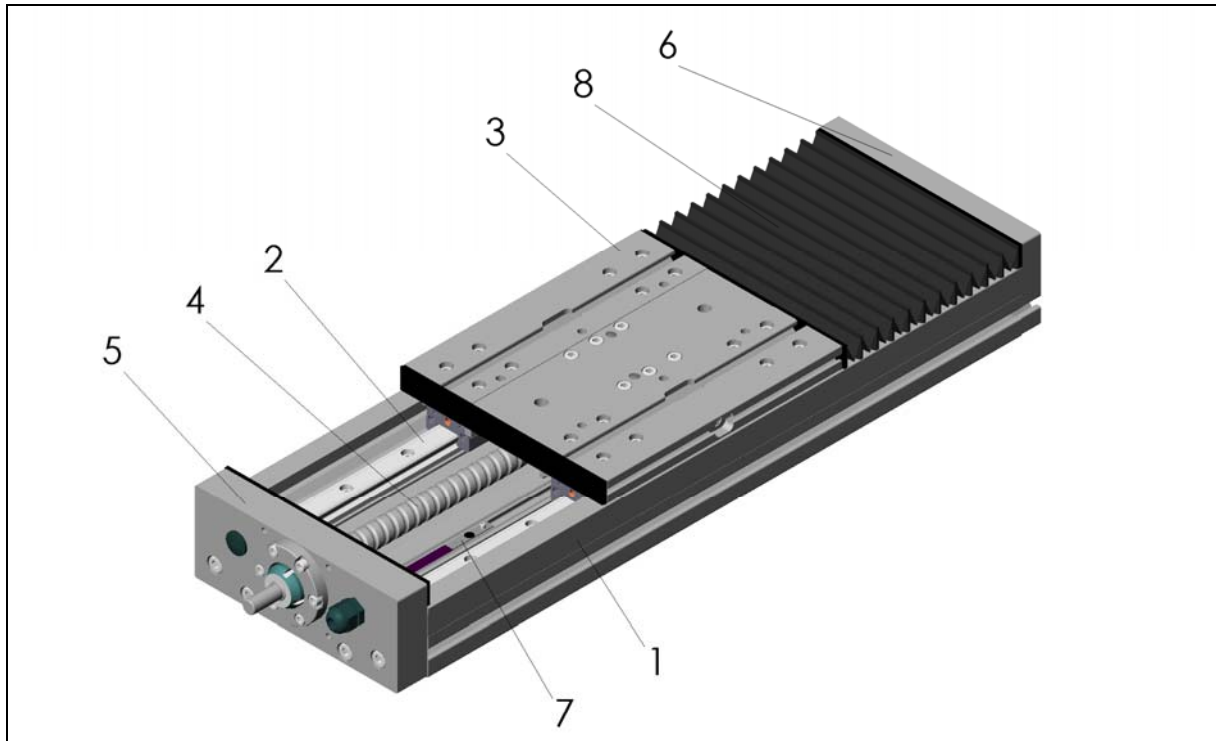


Figure 1.2 Product overview linear table

1. Axis body
2. Recirculating ball bearing guide
3. Carriage
4. Ball screw shaft with backlash nut
5. Front plate for motor mounting
6. End plate with loose screw bearing
7. Sensor
8. Bellows

### 1.3 Declaration of Incorporation

Declaration of Incorporation:

By Messrs. HIWIN GmbH  
Brücklesbünd 2  
77654 Offenburg  
Tel.: +49 (0)781 932 78 0

Person responsible for documentation: Werner Mäurer  
Brücklesbünd 2  
77654 Offenburg

Product designation: KT41..., KT42..., KT43...  
Year of manufacture: from 2011 onwards

The manufacturer herewith declares that the partly completed machine conforms to the requirements of the Machine Directive (2006/42/EG).

In addition to the above mentioned directive, the product conforms to the following European standards:

- Electromagnetic Compatibility Directive (2004/108/EG)
- Electrical Equipment Directive (Low-Voltage Directive 2006/95/EG)

The manufacturer herewith agrees to transfer (e.g. electronically) special documentation for the partly completed machine to individual public authorities upon request.

The special technical documents belonging to the machine, according to Annex VII, part B, have been drawn up.

The partly completed machine must not be put into service until it has been determined that the machine, into which the partly completed machine is to be incorporated, conforms to the requirements of the Machinery Directive 2006/42/EG.

Offenburg, 18.11.2011

Management



Werner Mäurer

## **2. Before you begin - safety information**

### **2.1 Qualification of personnel**

Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product. In addition, these persons must have received safety training to recognize and avoid hazards involved. These persons must have sufficient technical training, knowledge and experience and be able to foresee and detect potential hazards that may be caused by using the product, by changing the settings and by the mechanical, electrical and electronic equipment of the entire system in which the product is used.

All persons working on and with the product must be fully familiar with all applicable standards, directives, and accident prevention regulations when performing such work.

### **2.2 Intended use**

This product is a linear table and intended for industrial use according to this manual.

The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements and the technical data.

Prior to using the product, you must perform a risk assessment in view of the planned application. Based on the results, the appropriate safety measures must be implemented.

Since the product is used as a component in an entire system, you must ensure the safety of persons by means of the design of this entire system (for example, machine design).

Operate the product only with the specified cables and accessories. use only genuine accessories and spare parts.

The product must NEVER be operated in explosive atmospheres (hazardous locations, Ex areas).

Any use other than the use explicitly permitted is prohibited and can result in hazards.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel.

### 2.3 Hazard categories

Safety instructions to the user are highlighted by safety alert symbols in the manual. In addition, labels with symbols and/or instructions are attached to the product that alert you to potential hazards.

Depending on the seriousness of the hazard, the safety instructions are divided into 4 hazard categories

<b>⚠ DANGER</b>
DANGER indicates an imminently hazardous situation, which, if not avoided, <b>will result</b> in death or serious injury.
<b>⚠ WARNING</b>
WARNING indicates a potentially hazardous situation, which, if not avoided, <b>can result</b> in death, serious injury, or equipment damage.
<b>⚠ CAUTION</b>
CAUTION indicates a potentially hazardous situation, which, if not avoided, <b>can result</b> in injury or equipment damage.
<b>CAUTION</b>
CAUTION used without the safety alert symbol, is used to address practices not related to personal injury (e.g. <b>can result</b> in equipment damage).

## 2.4 Basic informations

### DANGER

#### **ELECTRIC SHOCK**

High voltages at the motor connection may occur unexpectedly.

- Verify that no voltage is present (this includes the DC bus) prior to taking up work on the drive system.
- AC voltage can couple voltage to unused conductors in the motor cable. Insulate both ends of unused conductors in the motor cable.
- The motor generates voltage when the shaft is rotated. Prior to performing any type of work on the drive system, block the motor shaft to prevent rotation.

**Failure to follow these instructions will result in death or serious injury.**

### WARNING

#### **GREAT MASS OR FALLING PARTS**

- Consider the mass of the parts when mounting them. It may be necessary to use a crane.
- Mount the parts in such a way (tightening torque, securing screws) that they cannot come loose even in the case of fast acceleration or continuous vibration.
- Take into consideration that axes installed in vertical or tilted positions may move unexpectedly.

**Failure to follow these instructions can result in death, serious injury or equipment damage.**

<b>⚠ WARNING</b>
<p><b>LOSS OF CONTROL</b></p> <ul style="list-style-type: none"> <li>• The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop, overtravel stop, power outage and restart.</li> <li>• Separate or redundant control paths must be provided for critical functions.</li> <li>• System control paths may include communication links. Consideration must be given to the implication of unanticipated transmission delays or failures of the link.</li> <li>• Observe all accident prevention regulations and local safety guidelines.<sup>1)</sup></li> <li>• Each implementation of the product must be individually and thoroughly tested for proper operation before being placed into service.</li> </ul> <p><b>Failure to follow these instructions can result in death or serious injury.</b></p>

1) For USA: Additional information, refer to NEMA ICS 1.1 (latest edition), "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control" and to NEMA ICS 7.1 (latest edition), "Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems".

## 2.5 Standards and terminology

Technical terms, terminology and the corresponding descriptions in this manual are intended to use the terms or definitions of the pertinent standards.

In the area of drive systems, this includes, but is not limited to, terms such as "safety function", "safe state", "fault", "fault reset", "failure", "error", "error message", "warning", "warning message", etc.

Among others, these standards include:

- IEC 61800 series: "Adjustable speed electrical power drive systems"
- IEC 61158 series: "Industrial communication networks - Fieldbus specifications "
- IEC 61784 series: "Industrial communication networks- Profiles"
- IEC 61508 series: "Functional safety of electrical/electronic/programmable electronic safety-related systems"

Also see the glossary at the end of this manual.

### 3. Technical Data

See chapter 9 "Glossary" for definitions and explanations of terms.

#### 3.1 Ambient conditions

*Ambient temperature during operation*

Temperature	[°C]	0 ... +50
-------------	------	-----------

*Ambient conditions transportation and storage*

The environment during transportation and storage must be dry and free from dust. The maximum vibration and shock load must be within the specified limits.

Temperature	[°C]	-25 ... +70
-------------	------	-------------

*Relative humidity*

The following relative humidity is permissible during operation.

Relative humidity		As per IEC60721-3-3, Class 3K3, no condensation
-------------------	--	---

*Installation altitude*

Installation altitude above sea level for linear axis without motor	[m]	<1500
---	-----	-------

*Schutzart*

Degree of protection		IP 20 1)
----------------------	--	----------

1) without bellows IP 00

*Vacuum*

Operation in vacuum is not permissible.

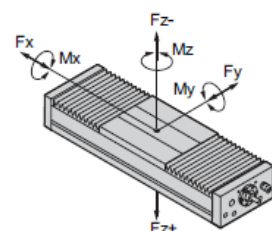
*Lubricants and lubrications*

See chapters 8.4.2 "Lubrication" and 8.4.3 "Lubricating the linear guide and the drive elements"

### 3.2 KT41SB

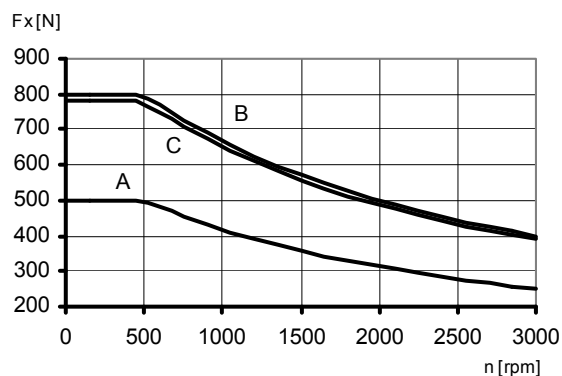
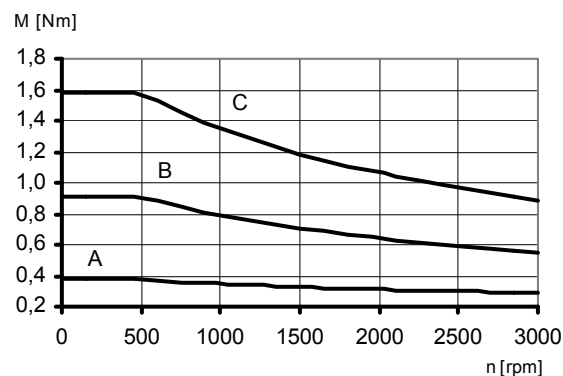
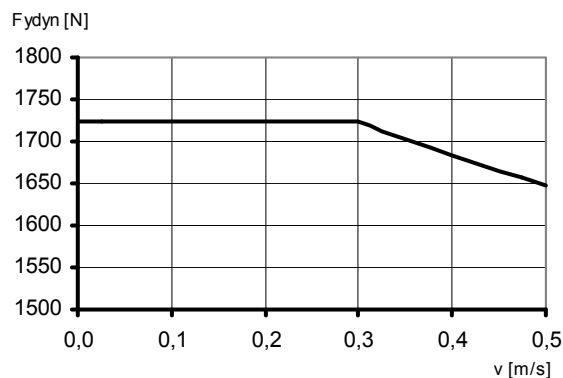
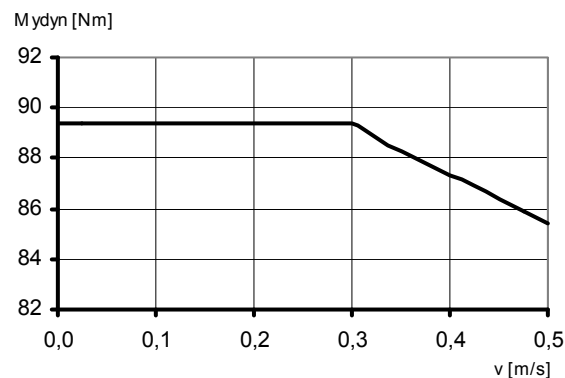
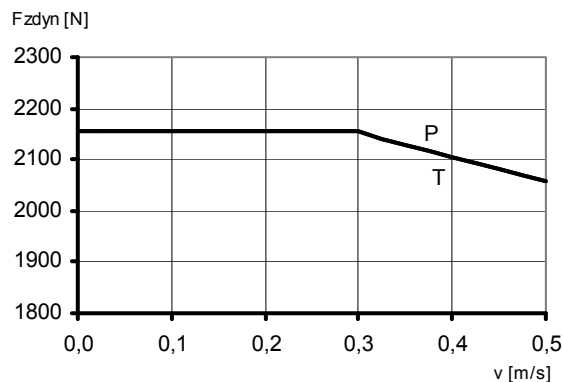
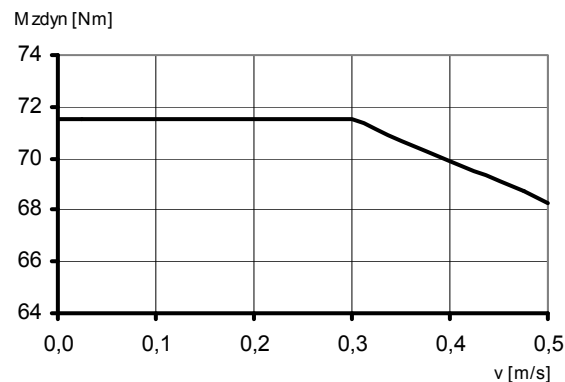
Technical data portal axes		KT41SB		
Drive element		Ball screw drive (P7 as per DIN 69051 part 3)		
Guide type		Recirculating ball bearing guide (size 12)		
Payload	kg	20		
Carriage type		Typ1		
Carriage length	mm	120		
Ball screw pitch	mm	2	5	10
Diameter ball screw shaft	mm	12		
Backlash of the ball screw drive	mm	0		
Maximum feed force $F_{x\max 1}$	N	500	800	780
Maximum speed of rotation of ball screw shaft	$\text{min}^{-1}$	3000		
Maximum velocity 2)	m/s	0,10	0,25	0,50
Maximum acceleration 2)	$\text{m/s}^2$	0,8	2,0	4,0
Maximum driving torque $M_{\max 1}$	Nm	0,4	0,9	1,6
Breakaway torque 0 stroke axis 3)	Nm	0,21	0,21	0,22
Moment of inertia 0 stroke axis without belt gear	$\text{kgcm}^2$	0,18	0,19	0,2
Moment of inertia 0 stroke axis with belt gear	$\text{kgcm}^2$	0,22	0,23	0,24
Moment of inertia per 1 m of stroke	$\text{kgcm}^2/\text{m}$	0,29	0,30	0,33
Moment of inertia per 1 kg of payload	$\text{kgcm}^2/\text{kg}$	0,001	0,006	0,025
Maximum force $F_{\text{dyn}\max 1}$	N	1720		
Maximum force $F_{\text{zdyn}\max (+F_z / -F_z)^{1)}$	N	2155 / 2155		
Maximum torque $M_{\text{dyn}\max 1}$	Nm	90		
Maximum torque $M_{\text{zdyn}\max 1}$	Nm	72		
Maximum torque $M_{\text{xdyn}\max 1}$	Nm	48		
Mass 0 stroke axis	kg	2,4		
Mass per 1 m of stroke	kg/m	8,4		
Moving mass carriage	kg	0,7		
Maximum stroke 4)	mm	600		
Minimum stroke 5)	mm	7		
Repeatability 2)	mm	$\pm 0,02$		
Diameter motor shaft	mm	6 ... 14		
Cross section axis body (W x H)	mm	100 x 50		
Axial area moment of inertia ( $I_x / I_y$ )	$\text{mm}^4$	111.840 / 1.511.700		
Modulus of elasticity (aluminium) E	$\text{N/mm}^2$	72000		
Load rating linear guide Cstat	N	3530		
Load rating linear guide Cdyn	N	4000		
Load rating ball screw drive Cstat	N	3200	4900	4800
Load rating ball screw drive Cdyn	N	2500	4000	3900
Service life 6)	km	5000		

- 1) The maximum permissible dynamic forces and torques decrease at increasing velocities (see characteristic curves)
- 2) Load- and stroke-dependent
- 3) The carriage closest to the motor is driven
- 4) Please inquire for greater stroke
- 5) Minimum stroke required for lubrication of the linear guide
- 6) Forces and torques relate to the service life

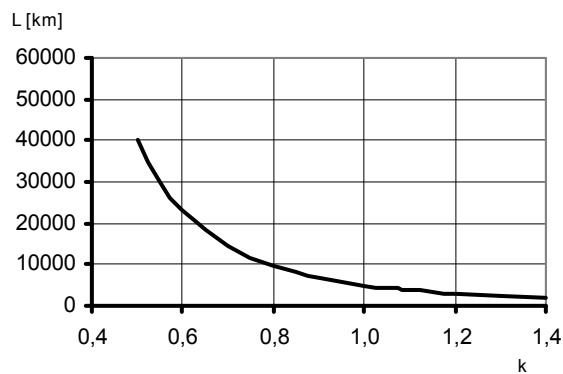
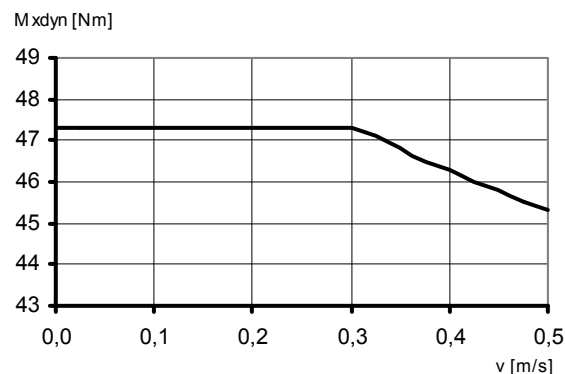




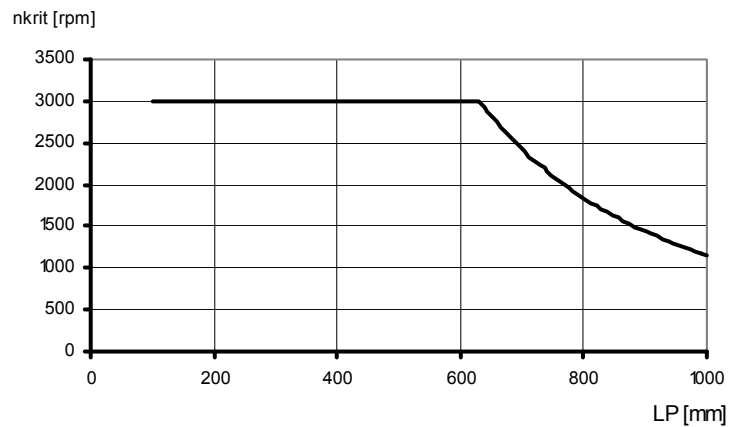
## Characteristic curves KT41SB

Max. feed force  $F_x$ 

Max. driving torque  $M_{max}$ 

Max. force  $F_{y_{dynmax}}$ 

Max. torque carriage  $M_{y_{dynmax}}$ 

Max. force  $F_{z_{dynmax}}$ 

Max. torque carriage  $M_{z_{dynmax}}$ 


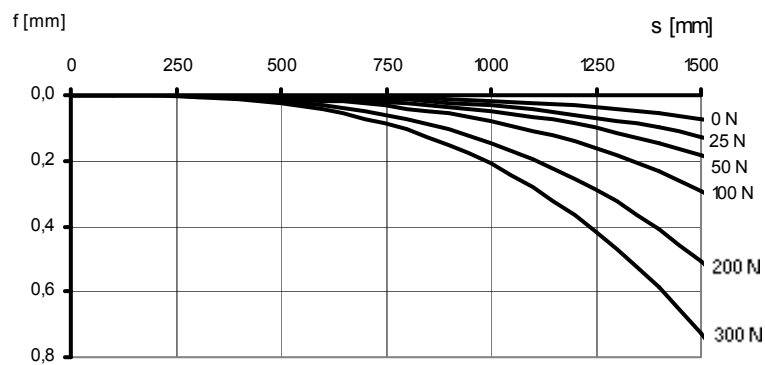
## Service life


Max. torque carriage  $M_{x_{dynmax}}$ 


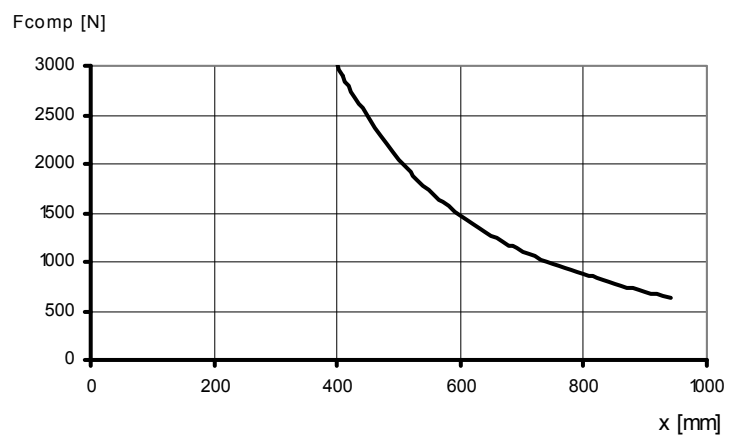
- (A) Ball screw pitch 2 mm  
(B) Ball screw pitch 5 mm  
(C) Ball screw pitch 10 mm



**A**



**B**

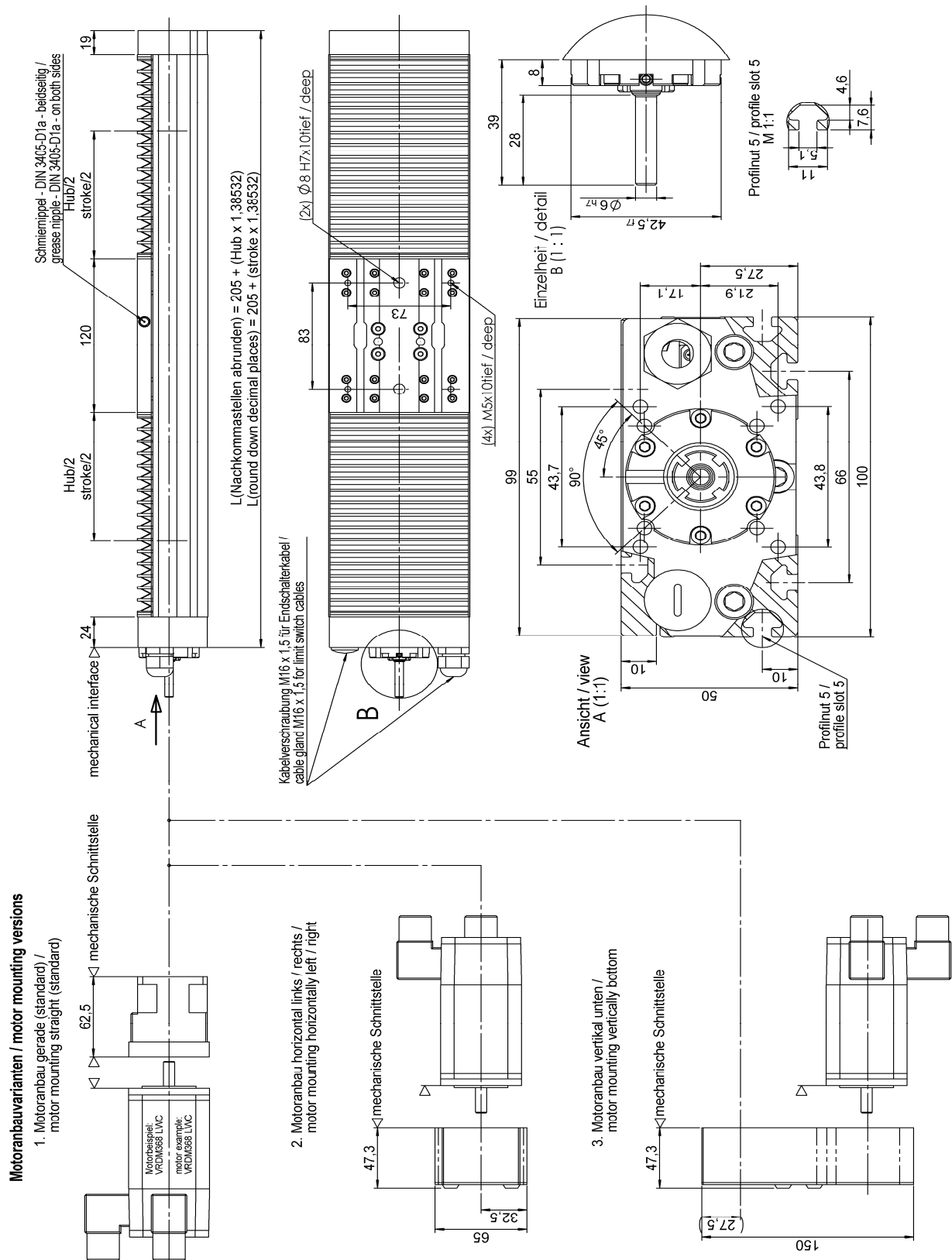


**C**

Figure 3.1 Speed of rotation of ball screw, deflection, buckling strength

- ( A ) Speed of rotation ball screw shaft
- ( B ) deflection
- ( C ) buckling strength

Figure 3.1 Dimensional drawings KT41SB



How to calculate the total length:

**L = 205+ (stroke x 1.38532) --> round down the result to a whole number**

### 3.3 KT42SB

Technical data portal axes		KT42SB		
Drive element		Ball screw drive (P7 as per DIN 69051 part 3)		
Guide type		Recirculating ball bearing guide (size 15)		
Payload	kg	80		
Carriage type		<b>Typ1</b>		
Carriage length	mm	180		
Ball screw pitch	mm	<b>5</b>	<b>10</b>	<b>16</b>
Diameter ball screw shaft	mm	16		
Backlash of the ball screw drive	mm	0		
Maximum feed force $F_{x\max}$ 1)	N	2200	1120	1080
Maximum speed of rotation of ball screw shaft	$\text{min}^{-1}$	3000		
Maximum velocity 2)	m/s	0,25	0,50	0,80
Maximum acceleration 2)	$\text{m/s}^2$	2,0	4,0	6,4
Maximum driving torque $M_{\max}$ 1)	Nm	2,2	2,3	3,4
Breakaway torque 0 stroke axis 3)	Nm	0,33	0,35	0,38
Moment of inertia 0 stroke axis without belt gear	$\text{kgcm}^2$	1,47	1,51	1,6
Moment of inertia 0 stroke axis with belt gear	$\text{kgcm}^2$	1,83	1,87	1,96
Moment of inertia per 1 m of stroke	$\text{kgcm}^2/\text{m}$	0,42	0,54	0,61
Moment of inertia per 1 kg of payload	$\text{kgcm}^2/\text{kg}$	0,006	0,025	0,065
Maximum force $F_{\text{dynmax}}$ 1)	N	2660		
Maximum force $F_{\text{zdynmax}}$ (+ $F_z$ / - $F_z$ ) <sup>1)</sup>	N	6285 / 3140		
Maximum torque $M_{\text{dynmax}}$ 1)	Nm	190		
Maximum torque $M_{\text{zdynmax}}$ 1)	Nm	160		
Maximum torque $M_{\text{xdynmax}}$ 1)	Nm	110		
Mass 0 stroke axis	kg	6,4		
Mass per 1 m of stroke	kg/m	13,7		
Moving mass carriage	kg	2,2		
Maximum stroke 4)	mm	1000		
Minimum stroke 5)	mm	9		
Repeatability 2)	mm	$\pm 0,02$		
Diameter motor shaft	mm	9 ... 20		
Cross section axis body (W x H)	mm	150 x 70		
Axial area moment of inertia ( $I_x$ / $I_y$ )	$\text{mm}^4$	363.230 / 5.885.270		
Modulus of elasticity (aluminium) E	$\text{N/mm}^2$	72000		
Load rating linear guide Cstat	N	16500		
Load rating linear guide Cdyn	N	14700		
Load rating ball screw drive Cstat	N	33000	8400	8200
Load rating ball screw drive Cdyn	N	11000	5600	5400
Service life 6)	km	10000		

1) The maximum permissible dynamic forces and torques decrease at increasing velocities (see characteristic curves)

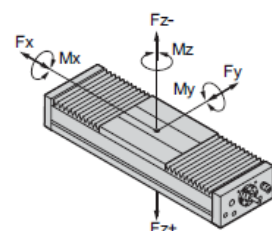
2) Load- and stroke-dependent

3) The carriage closest to the motor is driven

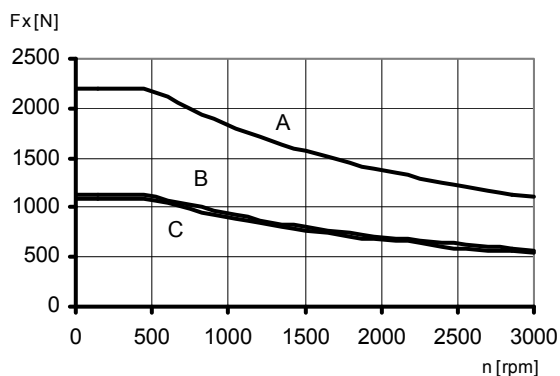
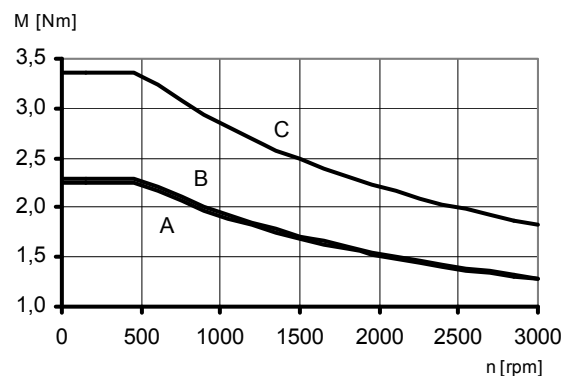
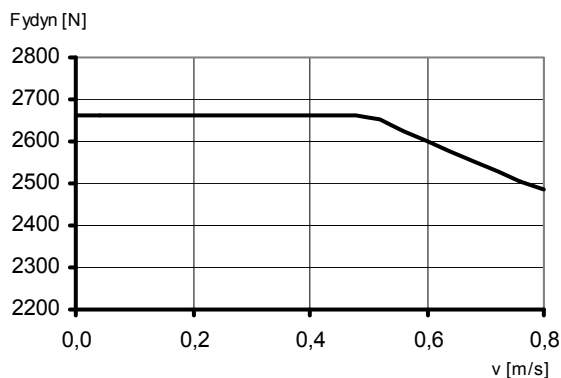
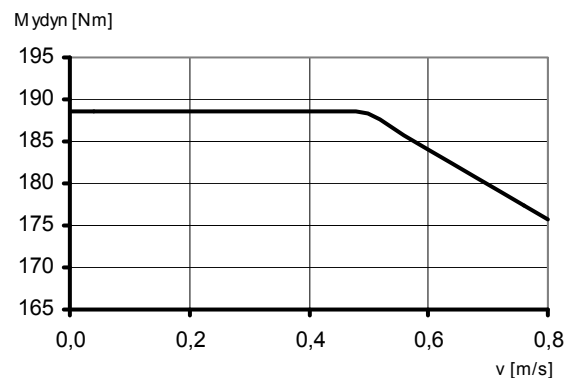
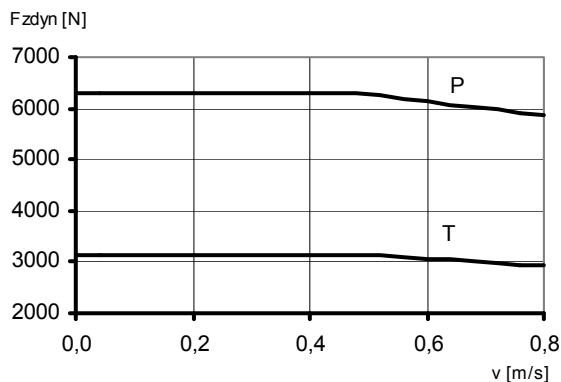
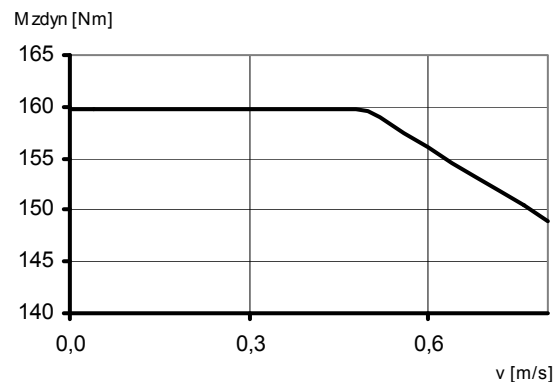
4) Please inquire for greater stroke

5) Minimum stroke required for lubrication of the linear guide

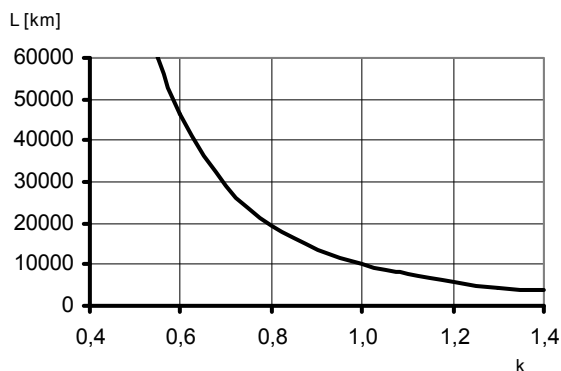
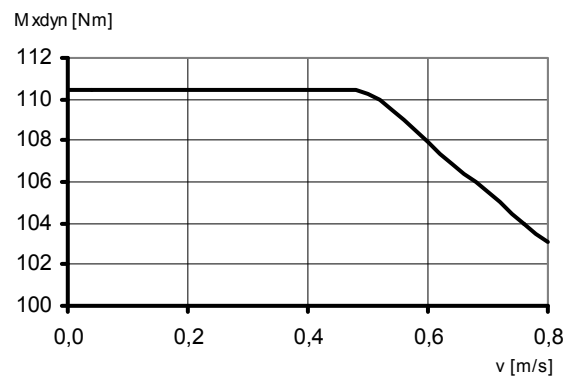
6) Forces and torques relate to the service life



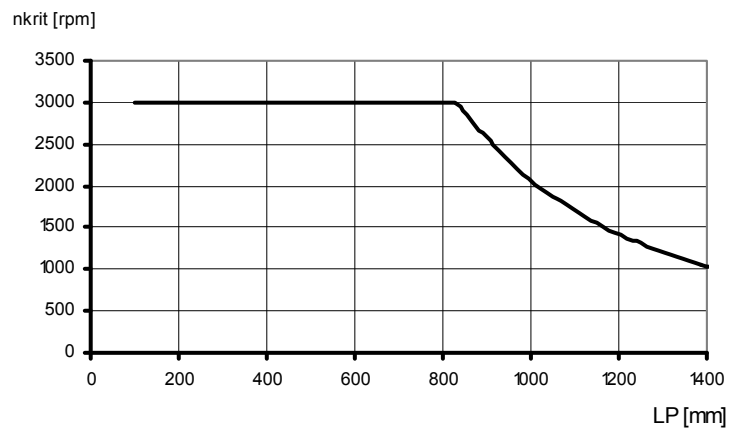
## Characteristic curves KT42SB

Max. feed force  $F_x$ 

Max. driving torque  $M_{max}$ 

Max. force  $F_{y_{dynmax}}$ 

Max. torque carriage  $M_{y_{dynmax}}$ 

Max. force  $F_{z_{dynmax}}$ 

Max. torque carriage  $M_{z_{dynmax}}$ 


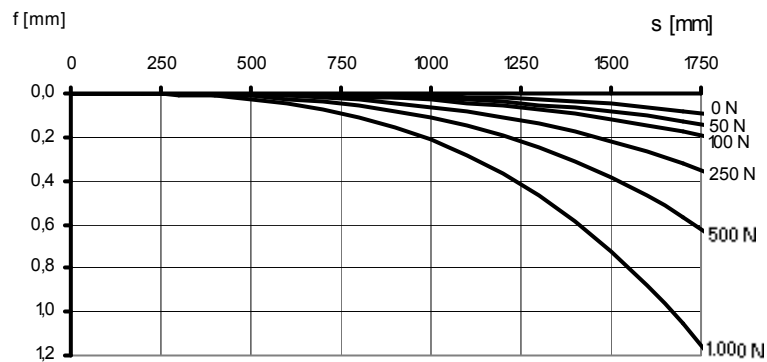
## Service life


Max. torque carriage  $M_{x_{dynmax}}$ 


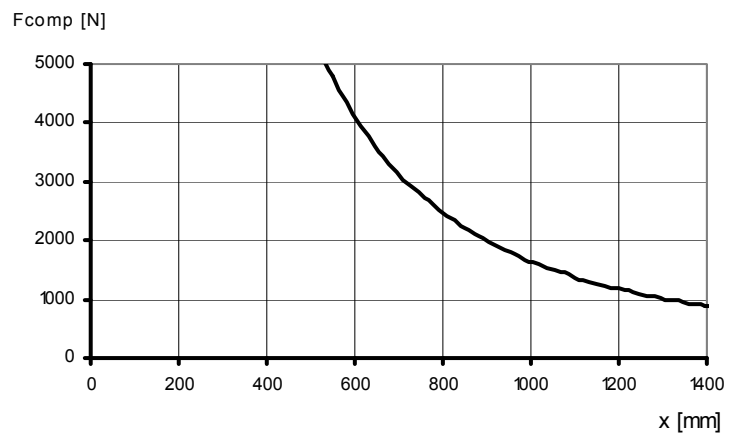
- (A) Ball screw pitch 5 mm  
 (B) Ball screw pitch 10 mm  
 (C) Ball screw pitch 16 mm



A



B

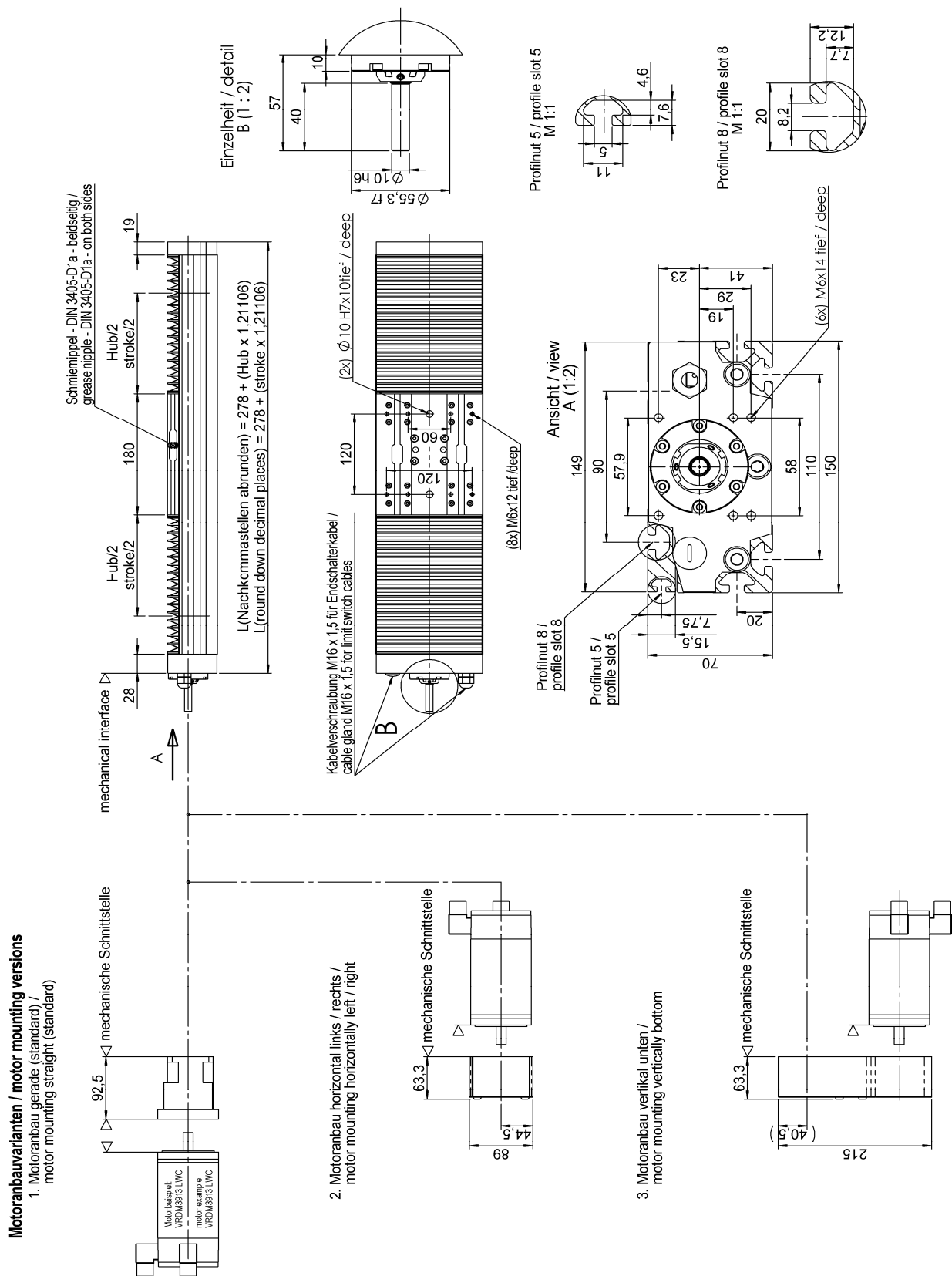


C

Figure 3.2 Speed of rotation of ball screw, deflection, buckling strength

- ( A ) Speed of rotation ball screw shaft
- ( B ) deflection
- ( C ) buckling strength

Figure 3.2 Dimensional drawings KT42SB



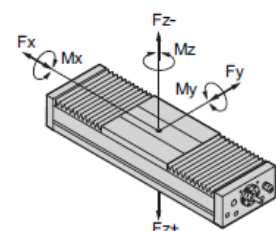
How to calculate the total length:

**L = 278 + (stroke x 1.21106) --> round down the result to a whole number**

### 3.4 KT43SB

Technical data portal axes		KT43SB		
Drive element		Ball screw drive (P7 as per DIN 69051 part 3)		
Guide type		Recirculating ball bearing guide (size 20)		
Payload	kg	150		
Carriage type		<b>Typ1</b>		
Carriage length	mm	230		
Ball screw pitch	mm	<b>5</b>	<b>10</b>	<b>20</b>
Diameter ball screw shaft	mm	20		
Backlash of the ball screw drive	mm	0		
Maximum feed force $F_{x\max}$ 1)	N	2580	1760	1700
Maximum speed of rotation of ball screw shaft	$\text{min}^{-1}$	3000		
Maximum velocity 2)	m/s	0,25	0,50	1,00
Maximum acceleration 2)	$\text{m/s}^2$	2,0	4,0	8,0
Maximum driving torque $M_{\max}$ 1)	Nm	2,7	3,5	6,4
Breakaway torque 0 stroke axis 3)	Nm	0,44	0,47	0,53
Moment of inertia 0 stroke axis without belt gear	$\text{kgcm}^2$	3,6	3,78	3,99
Moment of inertia 0 stroke axis with belt gear	$\text{kgcm}^2$	2,7	2,8	3,11
Moment of inertia per 1 m of stroke	$\text{kgcm}^2/\text{m}$	1,09	1,27	1,32
Moment of inertia per 1 kg of payload	$\text{kgcm}^2/\text{kg}$	0,006	0,025	0,101
Maximum force $F_{y\text{dynmax}}$ 1)	N	3550		
Maximum force $F_{z\text{dynmax}}$ ( $+F_z / -F_z$ ) <sup>1)</sup>	N	8380 / 4190		
Maximum torque $M_{y\text{dynmax}}$ 1)	Nm	335		
Maximum torque $M_{z\text{dynmax}}$ 1)	Nm	285		
Maximum torque $M_{x\text{dynmax}}$ 1)	Nm	205		
Mass 0 stroke axis	kg	11,7		
Mass per 1 m of stroke	kg/m	20,4		
Moving mass carriage	kg	4,1		
Maximum stroke 4)	mm	1500		
Minimum stroke 5)	mm	11		
Repeatability 2)	mm	$\pm 0,02$		
Diameter motor shaft	mm	12 ... 25		
Cross section axis body (W x H)	mm	200 x 80		
Axial area moment of inertia ( $I_x / I_y$ )	$\text{mm}^4$	654.170 / 15.702.590		
Modulus of elasticity (aluminium) E	$\text{N/mm}^2$	72000		
Load rating linear guide $C_{\text{stat}}$	N	23400		
Load rating linear guide $C_{\text{dyn}}$	N	19600		
Load rating ball screw drive $C_{\text{stat}}$	N	38700	12000	11600
Load rating ball screw drive $C_{\text{dyn}}$	N	12900	8800	8500
Service life 6)	km	10000		

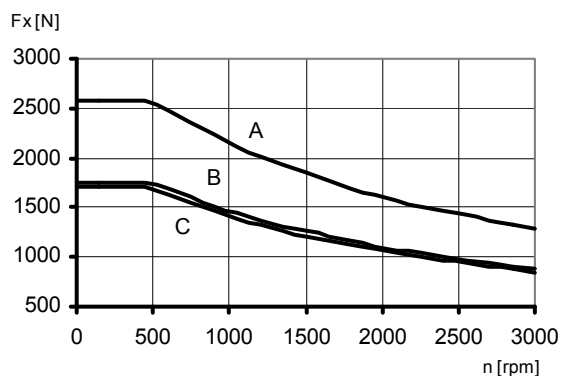
- 1) The maximum permissible dynamic forces and torques decrease at increasing velocities (see characteristic curves)  
2) Load- and stroke-dependent  
3) The carriage closest to the motor is driven  
4) Please inquire for greater stroke  
5) Minimum stroke required for lubrication of the linear guide  
6) Forces and torques relate to the service life



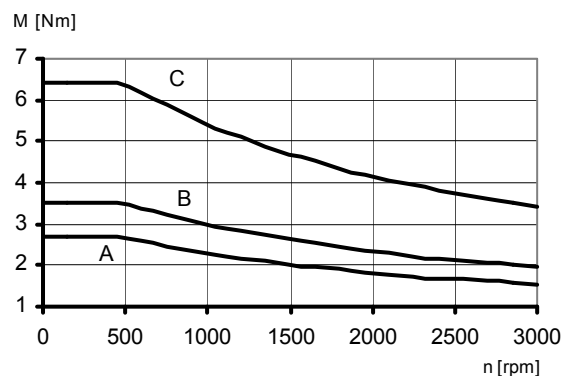


Characteristic curves KT43SB

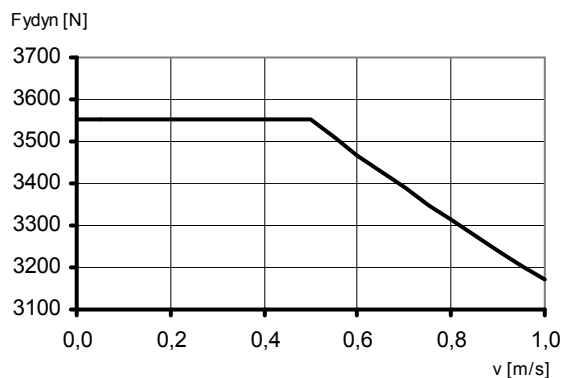
Max. feed force  $F_x$



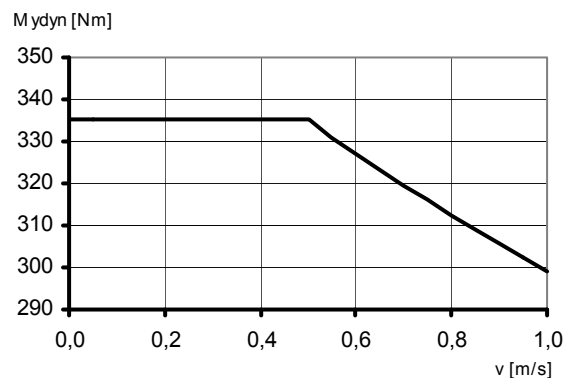
Max. driving torque  $M_{max}$



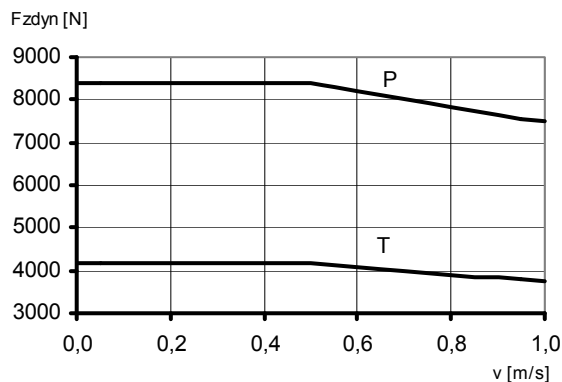
Max. force  $F_{y_{dynmax}}$



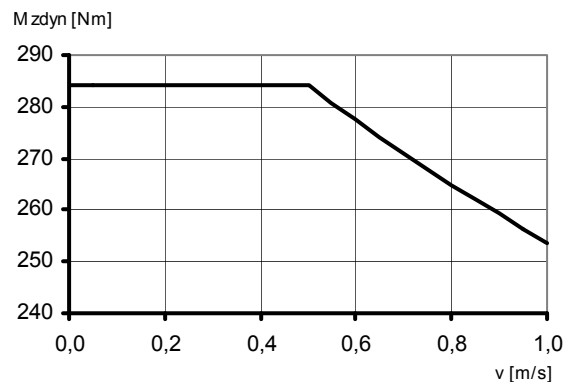
Max. torque carriage  $M_{y_{dynmax}}$



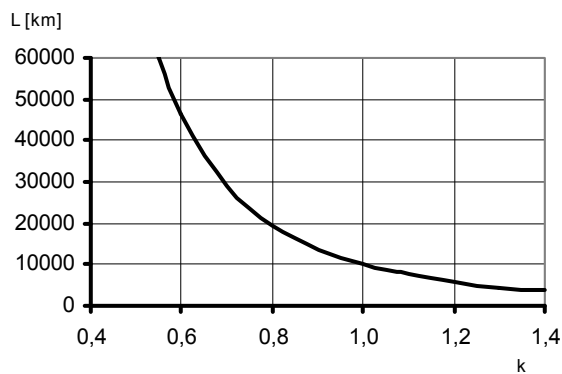
Max. force  $F_{z_{dynmax}}$



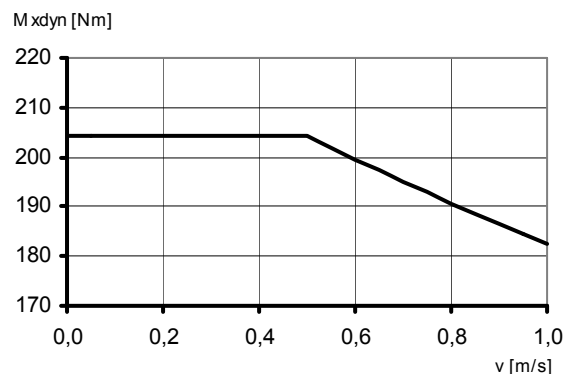
Max. torque carriage  $M_{z_{dynmax}}$



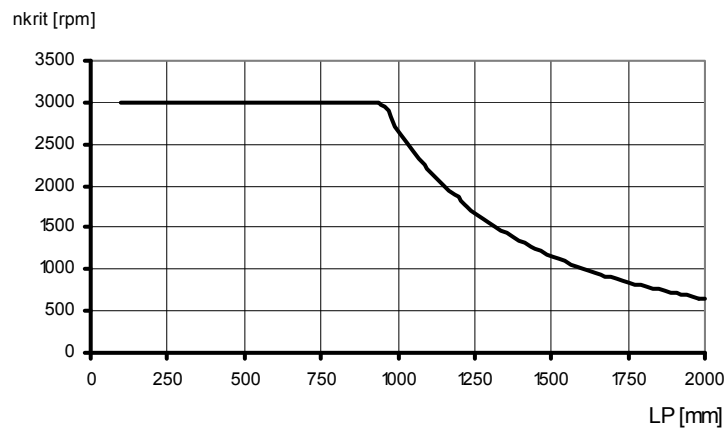
Service life



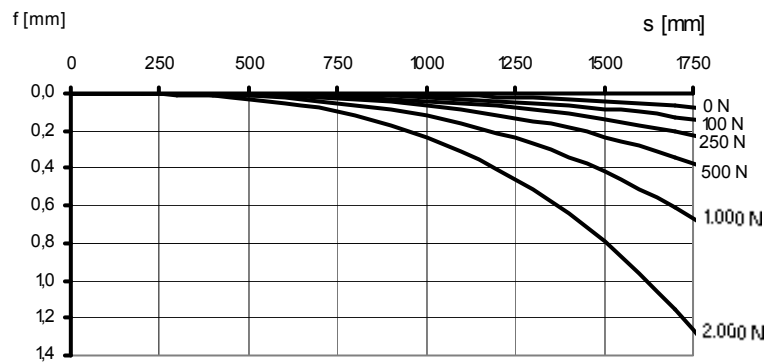
Max. torque carriage  $M_{x_{dynmax}}$



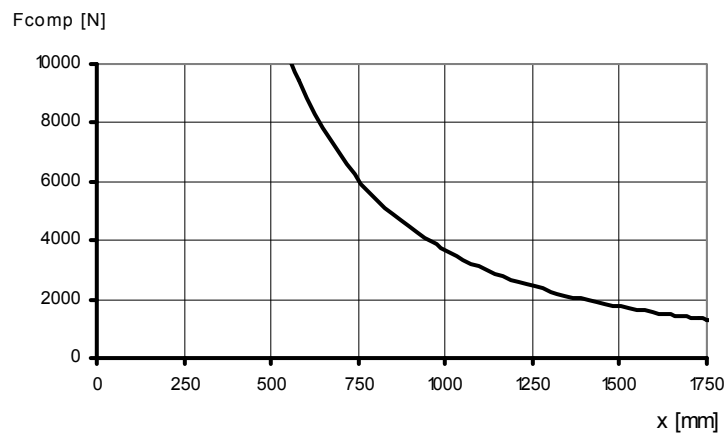
- ( A ) Ball screw pitch 5 mm  
 ( B ) Ball screw pitch 10 mm  
 ( C ) Ball screw pitch 20 mm



A



B

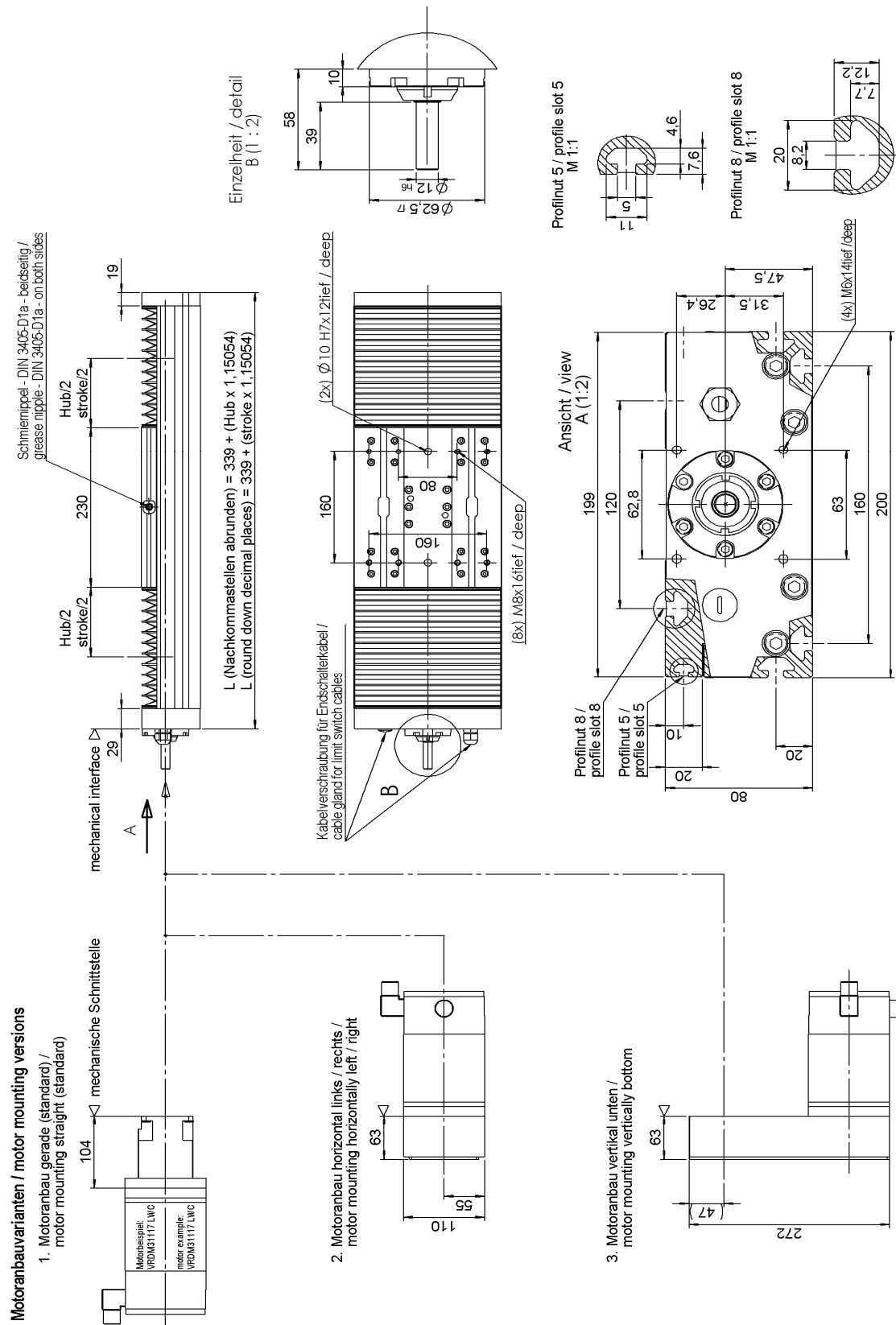


C

Figure 3.2 Speed of rotation of ball screw, deflection, buckling strength

- ( A ) Speed of rotation ball screw shaft
- ( B ) deflection
- ( C ) buckling strength

Figure 3.3 Dimensional drawings KT43SB



How to calculate the total length:

**L = 339 + (stroke x 1.15054) --> round down the result to a whole number**

### 3.5 Service life

The service life of the product is a function of the mean forces and torques that act in the system. If multiple forces and torques act simultaneously, use the following formula to calculate the load k.

$$\frac{F_y}{F_{y_{\text{dynmax}}}} + \frac{F_z}{F_{z_{\text{dynmax}}}} + \frac{M_x}{M_{x_{\text{dynmax}}}} + \frac{M_y}{M_{y_{\text{dynmax}}}} + \frac{M_z}{M_{z_{\text{dynmax}}}} = k$$

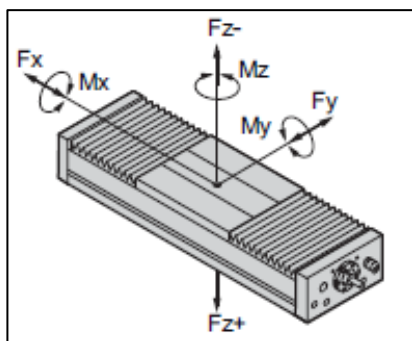


Figure 3.4 Forces and torques

The service life of the axis (in km) can be approximated using the load factor and the service life - load characteristic curve.

The application-specific load values appear in the numerator.

The numerator contains the maximum permissible forces and torques. These forces and torques decrease at increasing velocities, see characteristic curves in chapter 3

### 3.6 Positioning accuracy and repeatability

#### 3.6.1 Positioning accuracy

The positioning accuracy describes the positioning deviation of the linear unit that is allowed for a positioning move to a set position.

The positioning accuracy is influenced by the following factors:

- The mechanics – manufacturing tolerances, ball screw, pitch, ..
- The drive – motor resolution, closed loop circuit, ..
- The motion profile – steep deceleration ramps, high speed, ..
- Heat – environmental heat, internal friction heat

### 3.6.2 Repeatability

The repeatability describes the positioning deviation of the linear unit that is allowed for repeat positioning moves to the same position.

The repeatability is influenced by the following factors:

- Load change
- External temperature changes
- Internal temperature changes, at continuous operation the ball screw heats up through friction and expands.
- Change of the motion profile (deceleration ramp, speed,.)
- Accuracy of the trigger position of the inductive limit switch (signal evaluation)

### 3.7 Stroke reserve

The linear tables are manufactured customized for stroke.

The stroke is the distance that the carriage moves between the trigger points of the negative and positive limit switches. Beyond that, there is a safety distance, that is available to compress the bellows.

The safety distances vary depending on the stroke and total length of the linear table:

Stroke reserve	KT41	KT42	KT43
[mm]	7 - 10	12 - 15	17 - 20

Table 3.1 Distance between limit switch and mechanical stop

### 3.8 Motor

See the motor manual for details on the motor.

## 4. Installation

### WARNING

#### **GREAT MASS OR FALLING PARTS**

- Consider the mass of the parts when mounting them. It may be necessary to use a crane.
- Mount the parts in such a way (tightening torque, securing screws) that they cannot come loose even in the case of fast acceleration or continuous vibration.
- Take into consideration that axes installed in vertical or tilted positions may move unexpectedly.

**Failure to follow these instructions can result in death, serious injury or equipment damage.**

### WARNING

#### **MOTOR WITHOUT BRAKING EFFECT**

If power outage, functions or errors cause the power stage to be switched off, the motor is no longer decelerated in a controlled way and may cause damage.

- Verify the mechanical situation.
- If necessary, use a cushioned mechanical stop or a suitable holding brake.

**Failure to follow these instructions can result in death, serious injury or equipment damage.**

### WARNING

#### **HOT SURFACES**

The heat sink at the product may heat up to over 100°C (212°F) during operation.

- Avoid contact with the hot heat sink.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity.
- Consider the measures for heat dissipation described.

**Failure to follow these instructions can result in death or serious injury.**

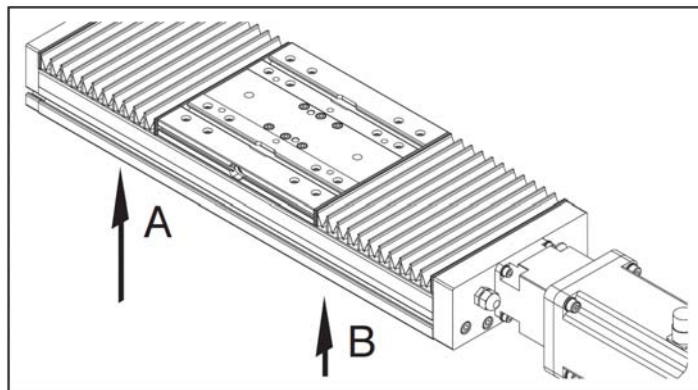
## 4.1 Preparing installation

The linear table is a precision product and must be handled with care. Shocks and impacts may damage the guides and the ball screw drive.

They may lead to reduced running accuracy and reduced service life.

Transport the product in its packaging as close as possible to the installation site. Do not remove the packaging until the product is at the installation site.

The linear table may only be lifted at points A and B (see figure). The distance between the end plate and point A and between the end plate and point B should be one fourth of the total length of the linear axis. If an axis with a mounted motor is lifted, points A and B are to be moved to balance the load. The motor must not be used to lift the load. Support the motor when lifting the axis.



## **4.2 Mechanical Installation**

### *Accessibility for servicing*

When mounting the linear table, the motor and the sensors, keep in mind that they may have to be accessed for servicing.

### *Mounting position*

The linear table can be installed in any position.

However, all external forces and torques must be within the ranges of permissible values.

If a linear table with a mounted motor is mounted in a vertical or tilted position, the motor should be at the top. This way, the ball screw is under tension and there is no buckling stress.

### **4.2.1 Standard tightening torques**

Special tightening torques are applicable for mounting sensors, couplings and tensioning elements; these tightening torques are listed in the appropriate chapters.

The following, generally applicable tightening torques apply to mounting the payload and fastening slot nuts, clamping claws and motor with hex socket screws.

<b>Thread</b>	<b>Wrench size in mm</b>	<b>Maximum tightening torque in Nm (lb in)</b>
M3	2,5	1,1 (9.74)
M4	3	2,5 (22.13)
M5	4	5 (44.25)
M6	5	8,5 (75.23)
M8	6	21 (185.87)
M10	8	42 (371.73)
M12	10	70 (619.55)

Table 4.1 Standard tightening torques for screws, ISO 4762 – 8.8



## 4.2.2 Mounting the linear axis

Only mount the linear axis using the T slots at the axis body. To do so, use clamping claws (lateral fastening) or slot nuts (bottom or lateral fastening).

A selection of suitable clamping claws and slot nuts can be found in chapter 7 "Accessories and spare parts".

Note the following:

- If motors with a cross section greater than the cross section of the axis body are used, the axis must be supported or the mounting surface must be cut out as required.
- The end blocks protrude beyond the axis body at the ends. The end blocks must not be the only parts supported by the mounting surface.

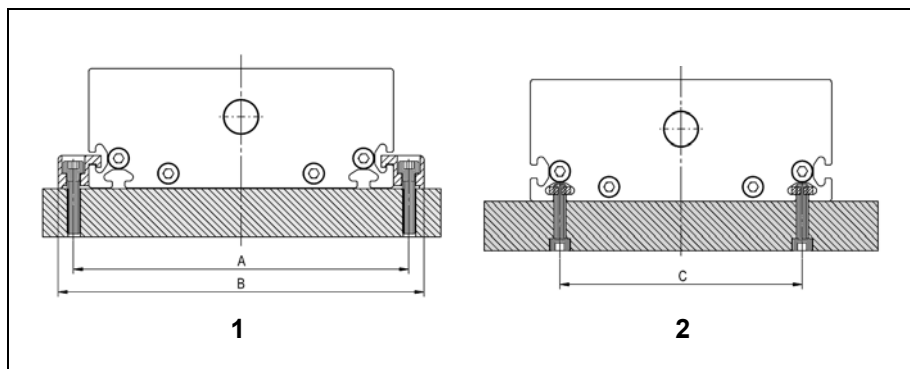


Figure 4.1 Fastening by means of clamping claws (1) and slot nuts from the bottom (2)

Tapped hole distance		KT41SB	KT42SB	KT43SB
A	[mm]	114	170	220
B	[mm]	128	190	240
C	[mm]	66	110	160

Maximum distance 1)		KT41SB	KT42SB	KT43SB
Clamping claws	[mm]	150	250	250
Slot nuts	[mm]	100	150	150

1) Recommended values per side at medium loads

The greater the load or the demands on the running accuracy, the shorter the distance between the slot nuts or the clamping claws must be.

### 4.2.3 Alignment for running accuracy

Due to the manufacturing process of the extruded profiles, a linear axis has a certain tolerance in terms in straightness and twist. The deviations are generally well within the specifications of EN 12020-2 in the case of the product.

The run off tolerance of the linear tables depends of the quality of the mounting surface.

Perform the following lateral alignment procedure for running accuracy.

- The mounting surface must be machined smooth and flat.
- ▶ Start by tightening the fastening screws of the slot nut or clamping claws with a low tightening torque.
- ▶ Provide a reference plane alongside the linear axis.
- ▶ Place a dial gauge onto the carriage.
- ▶ Move the carriage and record the deviation with reference to the reference plane over the entire stroke.
- ▶ Correct the deviations by lateral alignment of the linear axis and by tightening the screws appropriately.  
Observe the standard tightening torques on page 32.

### 4.2.4 Mounting the motor

The motor or the belt gear drive can be mounted in different arrangements (turned in increments of  $4 \times 90^\circ$ ).

NOTE: Third-party motors:

Note when choosing a motor, that the maximum drive torque of the toothed belt is not exceeded.

The ball toothed belt could be damaged or destroyed.



*Adaptations for straight motor mounting or mounting motor belt gear can be produced on request. Contact your local sales office.*



*Unless otherwise specified, the standard tightening torques indicated on page 32 apply.*

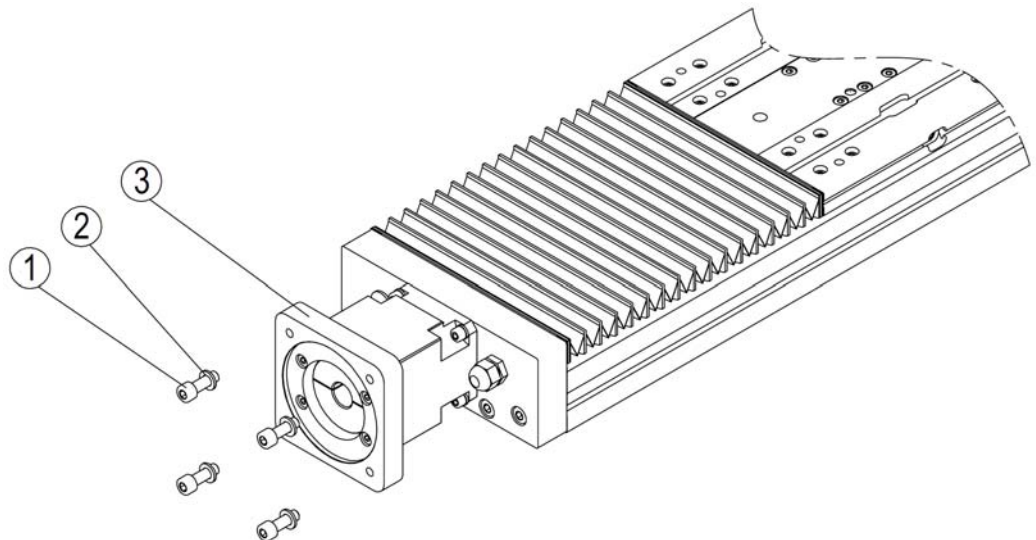
*Before mounting*

See chapter 7 "Accessories and spare parts" for suitable couplings"

You need a set of hex keys and a torque wrench with hexagon socket.

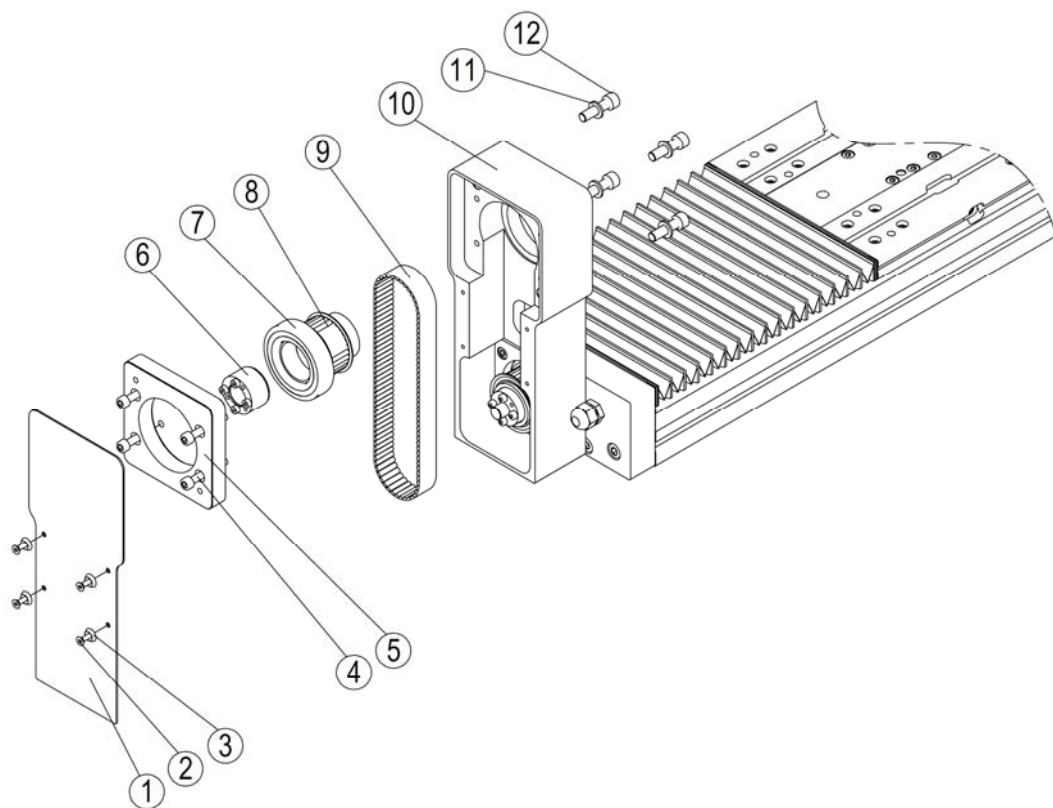
NOTE: Do not use ball head hex keys. Excessive torque may cause the ball head to tear off. A torn off ball head is difficult to remove from the screw.

- ▶ Clean all parts you will use.
- ▶ Check all parts for damage.

*Motor mounting, straight motor*

- ▶ Remove the 4 Screws (1) with the washers (2) from the motor adapter plate (3).
- ▶ Mount the motor as described in Chapter 8.3.3 "Motor mounting, (straight motor)".

### *Motor mounting, belt gear*



- ▶ Remove the screws (12) with the washers (11) from the housing of the toothed belt gear (10).
- ▶ Loosen the screws (2) on cover (1) and remove it including the washers (3).
- ▶ Remove the cover (1) of the belt gear.
- ▶ Loosen and remove the screws (4) of the counter bearing plate (5).
- ▶ Press the counter bearing plate (5) with 2 screws (4) out of the housing (10) of the belt gear.
- ▶ Remove the toothed belt (9) and the toothed belt pulley (8).
- ▶ Let the tensioning element (6) in the toothed belt pulley (8).
- ▶ Mount the motor as described in Chapter 8.3.4 “Motor mounting, (belt gear)“.

#### 4.2.5 Mounting the payload



*Unless otherwise specified, the standard tightening torques indicated on page 32 apply.*

**NOTE:**

The installation material must be clean and be planar manufactured, so the carriage is not tensioned.

Tensions in the carriages are additional forces and moments and reduce the life time of the ball guide and of the ball screw drive.

Mounting threads on the carriage allow you to fasten the payload.

For reproducible mounting of the payload are 2 dowel holes exist.

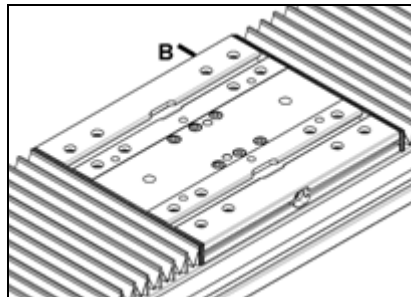


Figure 4.2 Carriage

Carriage		KT41SB	KT42SB	KT43SB
Thread	[mm]	M5	M6	M8
Depth	[mm]	10	12	16
diameter dowel holes	[mm]	8 H7	10 H7	10 H7
Depth	[mm]	10	10	12

Table 4.2 Carriage

## 4.3 Electrical installation

### 4.3.1 Connecting the sensors



Figure 4.3 Connecting the sensors

The cable ends of the mounted inductive sensors are routed to the outside through a strain relief at the front plate. The sensors either have a plug M8 x 1 or an open cable end.

The contacts of the plugs are clamped and can simply be disconnected without special tools. The plug pin out is marked according to the limit switch cable conductors (brown/black/blue).

The free cable length at the plug exit is 200mm. At the open cable end, the free cable length is independent of the stroke, but at least 3000mm. The sensors are coded as follows at the cable end:

- negative Sensor (Motorseite): -
- positive Sensor: +
- Reference sensor: Ref

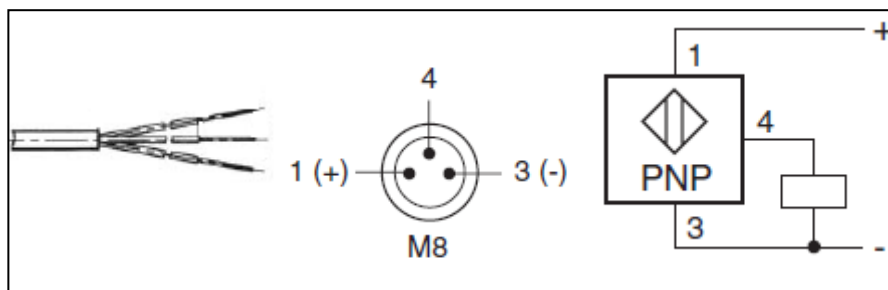


Bild 4.4 Connection assignment sensors PNP/NC (opener)

PIN	Description	Color
1	PELV supply voltage (+)	BN (brown)
3	PELV supply voltage (-)	BU (blue)
4	Output	BK (black)

Extension cables are available in various lengths as accessories, see chapter 7 "Accessories and spare parts"

#### **4.3.2 Motor connection**

See the motor manual for details on connecting the motor.

#### **4.4 Checking installation**

Verify that you have correctly installed the product after having performed the above steps.

- Verify correct mounting and cabling of the product. In particular, check the mains connection and the 24V connection.

Check the following:

- Did you connect all protective ground conductors?
- Do you use correct fuses?
- Did you isolate all unused cable ends?
- Did you properly install and connect all cables and connectors?
- Did you properly install the sensors?
- Do the sensors function as required?
- Are all mechanical parts bolted?

## 5. Commission

### **WARNING**

#### **UNEXPECTED MOVEMENT**

When the axis is operated for the first time, there is a risk of unexpected movements caused by possible wiring errors or unsuitable parameters.

- Verify that the axis is properly fastened so it cannot come loose even in the case of fast acceleration.
- The carriage of linear axes in vertical or tilted positions may move unexpectedly.
- Verify that a functioning button for emergency stop is within reach.
- Verify that the system is free and ready for the movement before switching it on.
- Run initial tests at reduced velocity.

**Failure to follow these instructions can result in death, serious injury or equipment damage.**



## 5.1 Commissioning procedure



*You must also re-commission an already configured product if you want to use it under changed operating conditions.*

- Verify proper installation, see chapter 4.4 "Checking installation".
- For commissioning, note the information provided in the manual of the motor used and the manual of the drive used
- Verify that the actual loads conform to the required and engineering data prior to operating the product.
- Verify the function of the sensors. The integrated LED must indicate the switching state correctly.
- Check the distance between the sensors and the mechanical stops. The movement must be stopped by the sensors before the carriage reaches a mechanical stop.
- Perform initial tests at reduced velocity. During these tests, verify that the controller responds correctly to the sensors in both directions of movement
- Please note that the maximum torque of servo motors is significantly higher than the nominal torque. The maximum torque of the motors must not exceed the permissible torque of the linear axis.

If necessary the maximum torque must be limited.

Because of the high feed forces that the linear axis generates in combination with the servo motor, it is likely that the ball screw drive is damaged at a high acceleration or at a collision.

- Run the entire motion profile multiple times with low speed to guarantee a safe operation.
- Verify that the ambient conditions and actual loads conform to The required and engineering data. See chapter 3.1 "Ambient conditions".

## 6. Diagnostics and troubleshooting

### 6.1 Troubleshooting

Problem	Cause	Troubleshooting
Sensor over traveled	Sensor	Adjust or replace sensors, see page 52
	Controller	Check controller
Motor load increases, controller switches off because of overload.	Guides and/or ball screw drive under mechanical tension or excessive friction caused by poor lubrication.	Contact service
Noise and vibrations at high speed of rotation of the ball screw drive.	Speed of rotation too high	Reduce speed of rotation
	Poor lubrication (in the case of noise)	Lubricate, see page 67
	Run-out of the ball screw shaft caused by impact or shock	The ball screw must be replaced. Contact service
Running inaccuracy and noise of the guides	Poor lubrication	Lubricate, see page 67
	Damage to the guides, for example by shock or impact on the carriage	Replace guides, contact service
Carriage has backlash and positions inaccurately	Backlash in ball screw drive or guides after a collision or poor lubrication	Contact service

## 7. Accessories and spare parts



Contact your local sales office if you have questions concerning required spare parts that are not listed.

### 7.1 Clamping claws

Order data


	Description		Order no.
	For mounting the axis body to a mounting surface.  Contains 10 piece	For axis ...	
		KT41	8-50-0209
		KT42	8-50-0210
		KT43	8-50-0210

Dimensional drawings

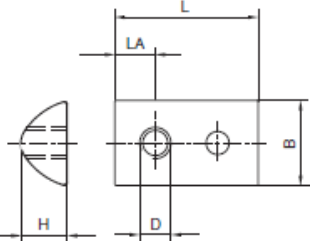
	For axis ...	A	B	B1	B2	D1	D2	H	H1	L	LA1
		mm	mm	mm	mm	[mm]	mm	mm	mm	mm	mm
	KT41	8	18	14	7	10	5.5	11.2	5.4	36	20
	KT42	18	28	20	10	15	9	22	12	76	40
	KT43	18	28	20	10	15	9	22	12	76	40

## 7.2 T-slot nuts

### Order data

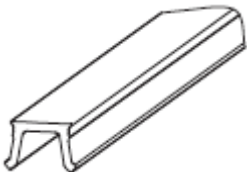
	Description			Order no.
	The slot nuts are inserted into the T-slots of the axis body to fasten the axis or parts of the axis.  Contains 10 piece	For axis ...	Slot nut typ	
		KT41	5 Steel M5	<b>8-50-0202</b>
		KT42	8 Steel M6	<b>8-50-0204</b>
			8 Steel M8	<b>8-50-0205</b>
		KT43	8 Steel M6	<b>8-50-0204</b>
			8 Steel M8	<b>8-50-0205</b>

### Dimensional drawings

	For axis ...	Slot nut typ	B [mm]	D [mm]	H [mm]	L [mm]	LA [mm]
	KT41	5 Steel M5	8	5	4	11.5	4
	KT42	8 Steel M6	13.8	6	7.3	23	6.5
		8 Steel M8	13.8	8	7.3	23	7.5
	KT43	8 Steel M6	13.8	6	7.3	23	6.5
		8 Steel M8	13.8	8	7.3	23	7.5


## 7.3 T-slot covers

### Order data

	Description			Order no.
	Length 2 m  Contains:5 piece	For axis ...	T slot size	
		KT41	5	<b>8-50-0211</b>
		KT42	8	<b>8-50-0214</b>
		KT43	8	<b>8-50-0214</b>

## 7.4 Sensors

*Order data*

	Description		Order no.
	With signal state indicator, with 5 m cable and second cable end open  Contains 1 piece	PNP, normally closed contact	<b>0000052060001</b>

### Dimensional drawings

Total length	Thread length	Cable length
<b>A</b>	<b>B</b>	<b>L</b>
[mm]	[mm]	[m]
40	10	5

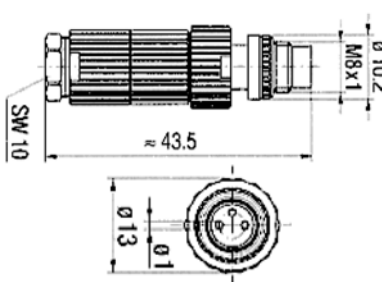
See chapter 4.3.1 "Connecting the sensors" for the connection assignment

### Technical data

Model		special
Approvals		CE
Electrical connection (PUR-cable)	[m]	5
Nominal switching distance Sn(in the case of aluminium)	[mm]	0,7 +/-10%
Nominal switching distance Sn(in the case of steel)	[mm]	1,6 +/-10%
Hysteresis		< 15% of the real switching distance
Degree of protection as per IEC 60529		IP67
Temperature (storage)	[°C]	-25 ... +95
Temperature (operation)	[°C]	-25 ... +70
Housing material		Aluminium
Cable material		PUR-Kabel HK-SO-Li12y11y-HF
Function indicator output		red LED
Function indicator supply voltage		no
Supply voltage (PELV)	[Vdc]	10 ... 30 with reverse polarity protection
Supply voltage (including residual ripple)	[Vdc]	< 15% of 24 VDC
Switching current (overload and short-circuit protection)	[mA]	150
Voltage drop, output conducting	[V]	< 3
No-load current	[mA]	< 10
Maximum switching frequency	[Hz]	1000
Switch-on time	[ms]	< 10
Switch-off time	[ms]	< 10

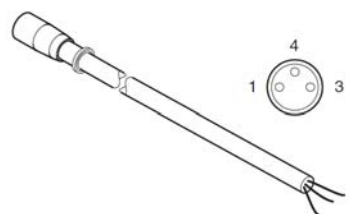
## 7.5 Sensor connectors

Order data

	Description	Order no.
	sensor connector with 3-pin M8 circular connector  Contains 2 piece	<b>VW3L50200</b>

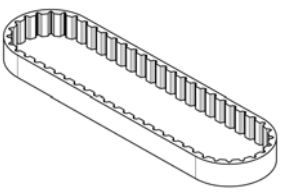
## 7.6 Sensor extension cable

Order data

	Description	Order no.	
	Suitable for drag chain applications; sensor side end 3-pin M8 circular connector, second cable end open  Contains 2 piece	5 m	<b>8-10-0276</b>
		10 m	<b>8-10-0278</b>
		15 m	<b>8-10-0279</b>

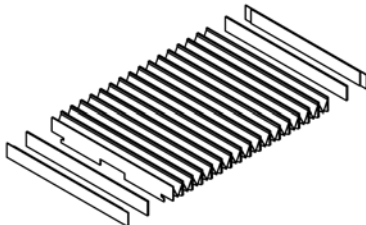
## 7.7 Toothed belt for belt gear

Order data

	Description				Order no.
	For axis ...	Toothed belt	Width [mm]	pitch [mm]	
	KT41	B10AT5 -225	10	5	<b>0000033550049</b>
	KT42	B20AT5 -420	10	5	<b>0000033550070</b>
	KT43	B20AT5 -500	20	5	<b>0000033550071</b>

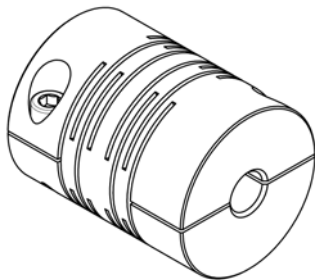
## 7.8 Bellows

Order data

	Description		Order no.
	A bellows protects the linear guide and ball screw shaft from dirt and foreign particles.  Contains 1 piece bellows 2 piece adhesive tape 2 piece textile coated tape	<b>For axis ...</b>	<b>reference number of your linear table.</b>
		KT41	
		KT42	
		KT43	

## 7.9 Coupling

Order data

	Description				Order no.
	Torsionally stiff coupling				
	Contains 1 piece				
	For axis ...	D1 [mm] Please inquire for other diameters	D2 [mm] Ball Screw shaft 1)	Mmax [Nm] Maximum torque that can be transmitted	
	KT41	6,35	6	8	0000019720161
		8	6	8	0000033550064
		9	6	8	0000033550065
		11	6	8	0000019856799
		12	6	8	0000019720159
	KT42	11	10	30	0000019720166
		12	10	30	0000033550066
		14	10	30	0000033550067
		16	10	30	0000019853215
		19	10	30	0000019720167
	KT43	9	12	65	0000019851130
		11	12	65	0000019851131
		12	12	65	0000019858154
14		12	65	0000019720139	
19		12	65	0000033550068	
20		12	65	0000019720170	
24		12	65	0000019854422	

1) see dimensional drawings linear tables in chapter 3 "Technical Data"

**7.10 Grease guns**

Grease guns are available in two different sizes:

Article number: 5-12-0009  
Designation: GN-080M grease gun for 70g bellows cartridge  
Quantity per stroke: 0.5 cm<sup>3</sup>  
Article number: 5-12-0010  
Designation: GN-400C grease gun for 400g cartridge  
Quantity per stroke: 0.8 cm<sup>3</sup>

These grease guns are delivered with a set of nozzles that were designed to grease profiled guide rails

Article number for set of nozzles without grease gun: 5-12-0035

**HIWIN Greases**

HIWIN offers the following greases in various packages. The properties and areas of application are described in the chapter "Accessories".

Article Number	Package Designation	Grease Type Designation	Area of Application of the Grease
5-12-0012	70g cartridge	G01	Heavy duty application
5-12-0013	400g cartridge	G01	Heavy duty application
5-12-0014	1kg tin	G01	Heavy duty application
5-12-0015	70g cartridge	G02	Clean room
5-12-0016	400g cartridge	G02	Clean room
5-12-0017	1kg tin	G02	Clean room
5-12-0018	70g cartridge	G03	Clean room v > 1 m/s
5-12-0019	400g cartridge	G03	Clean room v > 1 m/s
5-12-0020	1kg tin	G03	Clean room v > 1 m/s
5-12-0021	70g cartridge	G04	High-speed v > 1 m/s
5-12-0022	400g cartridge	G04	High-speed v > 1 m/s
5-12-0023	1kg tin	G04	High-speed v > 1 m/s
5-12-0024	70g cartridge	G05	Standard applications
5-12-0025	400g cartridge	G05	Standard applications
5-12-0026	1kg tin	G05	Standard applications



## 8. Service, maintenance and disposal

### **⚠ WARNING**

#### **GREAT MASS OR FALLING PARTS**

- Consider the mass of the parts when mounting them. It may be necessary to use a crane.
- Mount the parts in such a way (tightening torque, securing screws) that they cannot come loose even in the case of fast acceleration or continuous vibration.
- Take into consideration that axes installed in vertical or tilted positions may move unexpectedly.

**Failure to follow these instructions can result in death, serious injury or equipment damage.**

### 8.1 Service address

If you cannot resolve an error yourself please contact your sales office. Have the following details available:

- Nameplate (type, identification number, serial number, DOM, ...)
- Type of error (such as LED flash code or error number)
- Previous and concomitant circumstances
- Your own assumptions concerning the cause of the error

Also include this information if you return the product for inspection or repair.



*If you have any questions please contact your sales office. Your sales office staff will be happy to give you the name of a customer service office in your area.*

<http://www.hiwin.de>

### 8.2 Checks after collisions

Components of the linear axis may be damaged or destroyed as a result of a collision.

- After a collision, inspect the drive elements, the linear guide and The elastomer coupling for damage according to the instructions in the following chapters

#### 8.2.1 Ball screw drive

- Check the linear axis for unusual noise and vibrations
- Perform a visual inspection of the ball screw drive for damage do so, remove the bellows as described in chapter 8.3.2 "Replacing the bellows"



*A damaged ball screw drive must be replaced. Contact your local sales office.*

#### 8.2.2 Ball screw bearing

- Check the linear axis for unusual noise and vibrations.



*A damaged ball screw bearing must be replaced. Contact your local sales office.*

#### 8.2.3 Linear guide

The linear guide consists of the guide carriage and the recirculating ball bearing guide.

- Check the guide carriage for play. If the guide carriage has, the pretension has been changed. The pre-tension of the guide carriage can only be adjusted by the manufacture. Note the serial number of the linear table and contact your local sales office
- Perform a visual inspection of the linear guide for damage. To do so, remove the bellows as described in chapter 8.3.2 "Replacing the bellows"
- Check for irregular noise or vibration. Irregular noise or vibration indicates a deformation in the linear guide. Deformation will cause rapid wear.



*A damaged linear guide must be replaced. Contact your local sales office.*

#### 8.2.4 Coupling

- ▶ Perform a visual inspection of the elastomer coupling for damage.  
To do so, remove the motor or the gearbox as described in chapter 8.3.2 "Replacing the motor or the gearbox".

NOTE: A damaged coupling must be replaced. See chapter 8.3.3 "Replacing the coupling" for the procedure

#### 8.2.5 Toothed belt

- ▶ Perform a visual inspection of the toothed belt for damage to the teeth and abrasion at the sides.  
To do so, remove the cover of the belt drive housing. Exchange the toothed belt as described in chapter 8.3.6 "Replacing the toothed belt".

NOTE: A damaged toothed belt must be replaced.

### 8.3 Replacing parts

Only replace the parts described. Any other parts may only be replaced by technicians trained by the manufacturer.

To replace the entire axis, install the new axis as per see chapter 4 "Installation".

Adjust and check the linear axis as per chapter 4.4 "Checking installation" after replacing parts.

#### 8.3.1 Replacing a sensor

##### **WARNING**

###### **LOSS OF CONTROL**

If unsuitable sensors are installed, ground faults or line interruptions will be detected as an On state and will cause the function to become inoperable.

- If possible, use normally closed contacts as limit switches so that a wire break can be signaled as an error.

**Failure to follow these instructions can result in death, serious injury or equipment damage.**



*Unless otherwise specified, the standard tightening torques indicated on page 32 apply.*

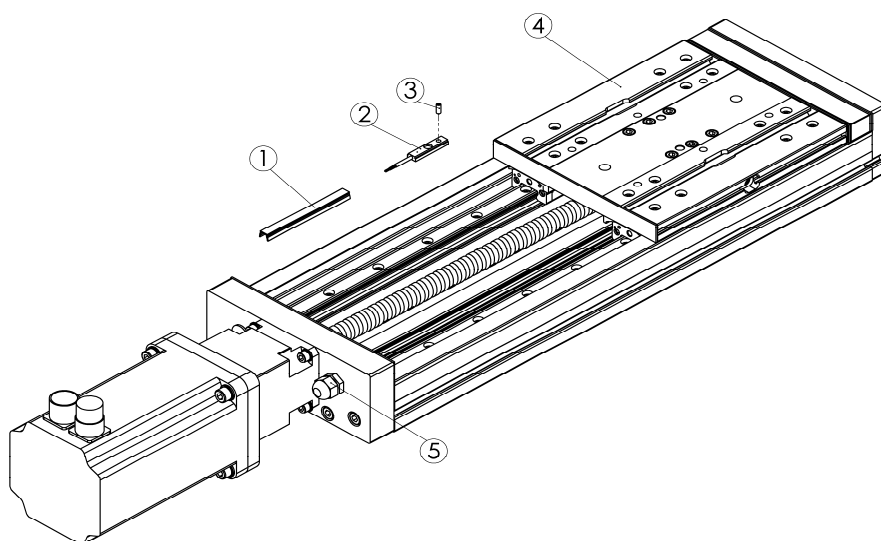
**Prerequisites** See chapter 7 "Accessories and spare parts" for suitable spare parts.

You need a set of hex keys and torque wrench with hexagon socket.

**Procedure** The limit switches are mounted protected in the T-slots on the inside of the base profile. The sensor cables are covered in the groove with a plastic profile.

The cable ends exit at the front plate via a strain relief.

The switching points of the sensors are adjusted for that the carriage travel to the end position is  $\frac{1}{2}$  stroke from the center of the linear table.



1. Move the carriage (4) to the opposite end position of the sensor (2).
2. Disconnect the electrical connection of the limit switch (2) from the drive control.
3. Remove the bellows (see Chapter 8.3.2 Exchange of bellows“)
4. Remove the plastic cover (1) of the limit switch cables from the groove.
5. Mark position of the limit switch (2) at the base profile.
6. Loosen the attachment screw (3) of the limit switch (2) and remove completely from the limit switch housing.
7. Tilt the limit switch (2) and swivel it out of the base profile groove.
8. Loosen the strain relief (5) at the front plate.
9. Pull the limit switch cable out of the strain relief (5).
10. Remove the limit switch (2).
11. Route the cable of the new limit switch (2) through the strain relief (5) to the outside.
12. Tilt the limit switch (2) and insert into the groove of the base profile
13. Mount the limit switch (2) in the previously marked position with the attachment screw (3). Tightening torque: 0,3Nm (2,66 lb-in)
14. Route the limit switch cable in the groove to the front plate.
15. Pull the extra cable through the strain relief (5)
16. Tighten the strain relief (5).
17. Cover the limit switch cable in the groove again with the plastic profile (1).
18. Mount the bellows (see Chapter 8.3.2 Exchange of bellows“)
19. Electrical reconnection of the limit switch (2) to the drive control.
20. Check function of the new limit switch.

### 8.3.2 Replacing bellows

When wear of the bellows, it is recommended that you replace both bellows.

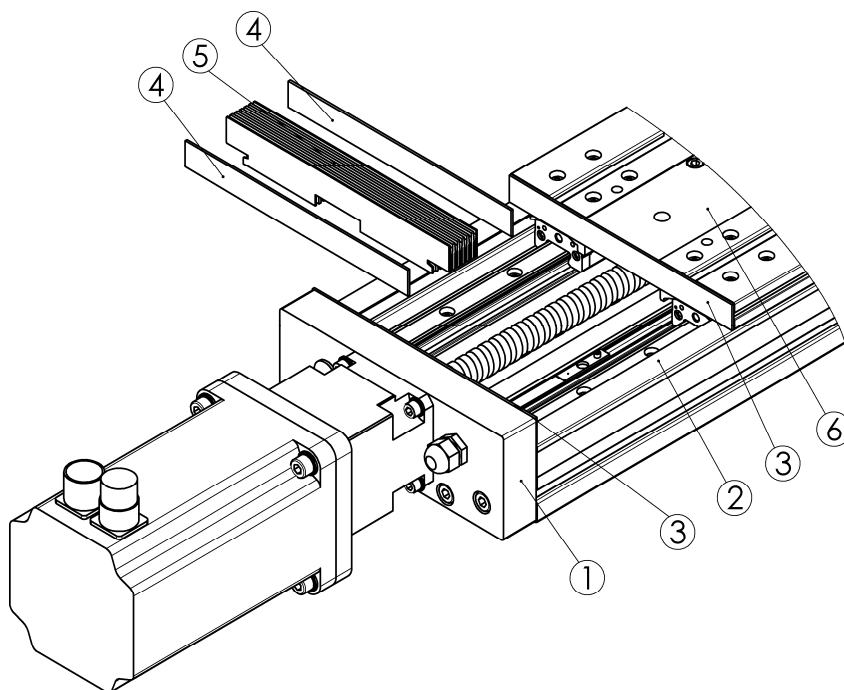


*Unless otherwise specified, the standard tightening torques indicated on page 32 apply.*

**Prerequisites** See chapter 7 "Accessories and spare parts" for suitable spare parts.

You need a set of hex keys and torque wrench with hexagon socket.

**Procedure** Carry out the following steps on both ends of the carriage / Linear table



In general the used bellows are maintenance free. However, if an exchange is necessary it must be carried out (order must be kept) as follows

1. Move the carriage (6) of the linear table over to the opposite end position.
2. Loosen the adhesive tapes (4) of the bellows (5) from the textile-coated tapes (3) of the carriage (6) and the front plate (1).
3. Manually compress the bellows (5) to solid length.
4. Rotate the bellows (5) in the compressed state across the base profile (2) until the guide notches in the support frame of the bellows (5) are bare.
5. Remove the bellows (5) from the base profile (2).
6. Remove the textile-coated tapes (3) from the front plate (1) and the front surface of the carriage (6).
7. Clean the adhesive surfaces of the front plate (1) and the carriage (6). The adhesive surface must be free of oil.
8. Place the new textile-coated tapes (3) according to the previous location on the inside of the front plate (1) and on the front surface of the carriage (6).
9. Use the bellows (5) of the same count.
10. Press the adhesive tapes (4) of the bellows (5) on to the textile-coated tapes of the front plate (1) and the carriage (6).
11. Check the bellows for proper run in the base profile.  
The bellows must not be moved jerkily.

### 8.3.3 Replacing the motor (straight mounted)

<b>⚠ WARNING</b>
<b>UNEXPECTED MOVEMENTS DUE TO DISMOUNTING</b> Dismounting parts can cause unexpected movements. <ul style="list-style-type: none"> <li>In the case of a linear axis installed in a vertical or tilted position, secure the moving parts to keep them from moving unexpectedly.</li> </ul> <b>Failure to follow these instructions can result in death, serious injury or equipment damage.</b>

The motor or the gearbox are coupled by means of a torsionally stiff coupling.



*Unless otherwise specified, the standard tightening torques indicated on page 32 apply.*

#### *Special tightening torques*

Coupling		KT41SB	KT42SB	KT43SB
Screw ISO 4762 - 8.8		M4 x 12	M6 x 16	M8 x 20
Wrench size	[mm]	3	5	6
Tightening torque	[Nm] (lb-in)	4,3 (38.05)	14,5 (123.91)	35 (309.78)

Table 12.1 Tightening torque for couplings

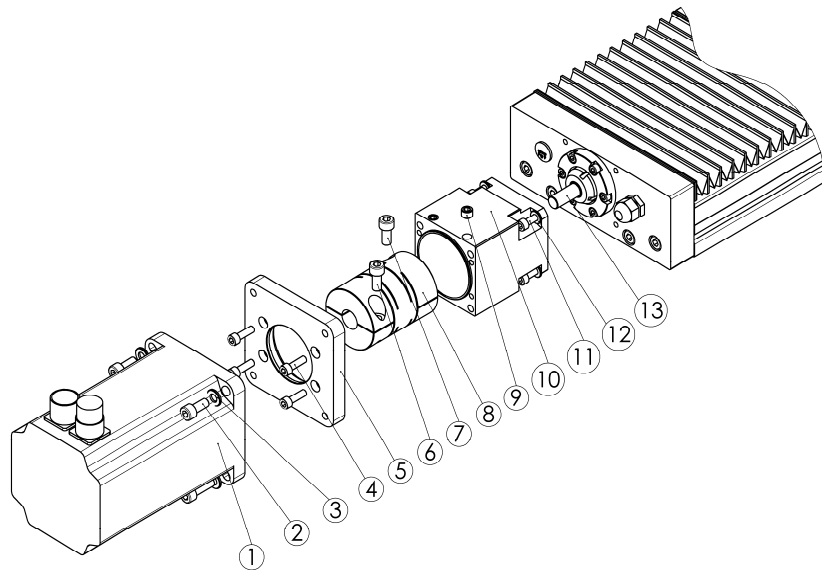
*Prerequisites* See chapter 7 "Accessories and spare parts" for suitable spare parts.

You need a set of hex keys and torque wrench with hexagon socket

**NOTE:** Do not use ball head hex keys. Excessive torque may cause the ball head to tear off. A torn off ball head is difficult to remove from the screw.



## Procedure



### Motor dismounting

1. Remove the screw plug (9) from the housing of the coupling (10).
2. Loosen the attachment screw (6) of the coupling (8). It might be necessary to rotate the ball screw shaft to line up the attachment screw and the service hole.
3. Secure the motor (1) that it can not fall down and remove the mounting screws (2) including the washers (3).
4. Carefully pull the motor (1) in axial direction out of the coupling (8) and the motor adapter plate (5) without jamming.

This requires a greater force of up to 450 N

### Motor mounting

5. Clean the flange and the shaft of the new motor and remove damages.
6. Place the motor onto the motor adapter plate with even contact. Secure the motor to keep it from falling down.

Fasten the motor (1) to the motor adapter plate (5) with the screws (2) and the washers (3)

7. Tighten the attachment screws (6) of the coupling (8) with the tightening torque how specified in table 12.1.
8. Close the hole in the housing of the coupling (10) with the screw plug (9).

### 8.3.4 Replacing the motor (with belt gear)

<b>⚠ WARNING</b>
<b>UNEXPECTED MOVEMENTS DUE TO DISMOUNTING</b> Dismounting parts can cause unexpected movements. <ul style="list-style-type: none"> <li>In the case of a linear axis installed in a vertical or tilted position, secure the moving parts to keep them from moving unexpectedly.</li> </ul> <b>Failure to follow these instructions can result in death, serious injury or equipment damage.</b>



Unless otherwise specified, the standard tightening torques indicated on page 32 apply.

#### Special tightening torques

Tensioning element		KT41SB		KT42SB		KT43SB		
Shaft diameter	[mm]	8	9	12	14	12	14	19
Screw ISO 4762-8.8		M2,5 x 12		M3 x 16		M4 x 20		
Wrench size	[mm]	2		2,5		3		
Tightening torque	[Nm] (lb-in)	1,2 10.6	1,2 10.6	1,2 10.6	2,1 18.6	4,9 43.4	4,9 43.4	4,9 43.4

Table 12.2 Tightening torque for tensioning element

Toothed belt pre tensioning		KT41SB	KT42SB	KT43SB
Width / pitch				
Belt tensioning force per span ( $F_v$ )	[N]	60	85	150
Pre-tensioning distance	[mm]	0,1	0,1	0,2
Screw revolutions		1/8	1/8	1/4

Table 12.3 Toothed belt pre tensioning

Tension plate		KT41SB	KT42SB	KT43SB
Screw ISO 4762-8.8		M5 x 20	M6 x 20	M6 x 25
Wrench size	[mm]	4	5	5
Tightening torque	[Nm] (lb-in)	4 35.4	8,5 75.23	8,5 75.23

Tabelle 12.4 Tightening torque for tensioning plate

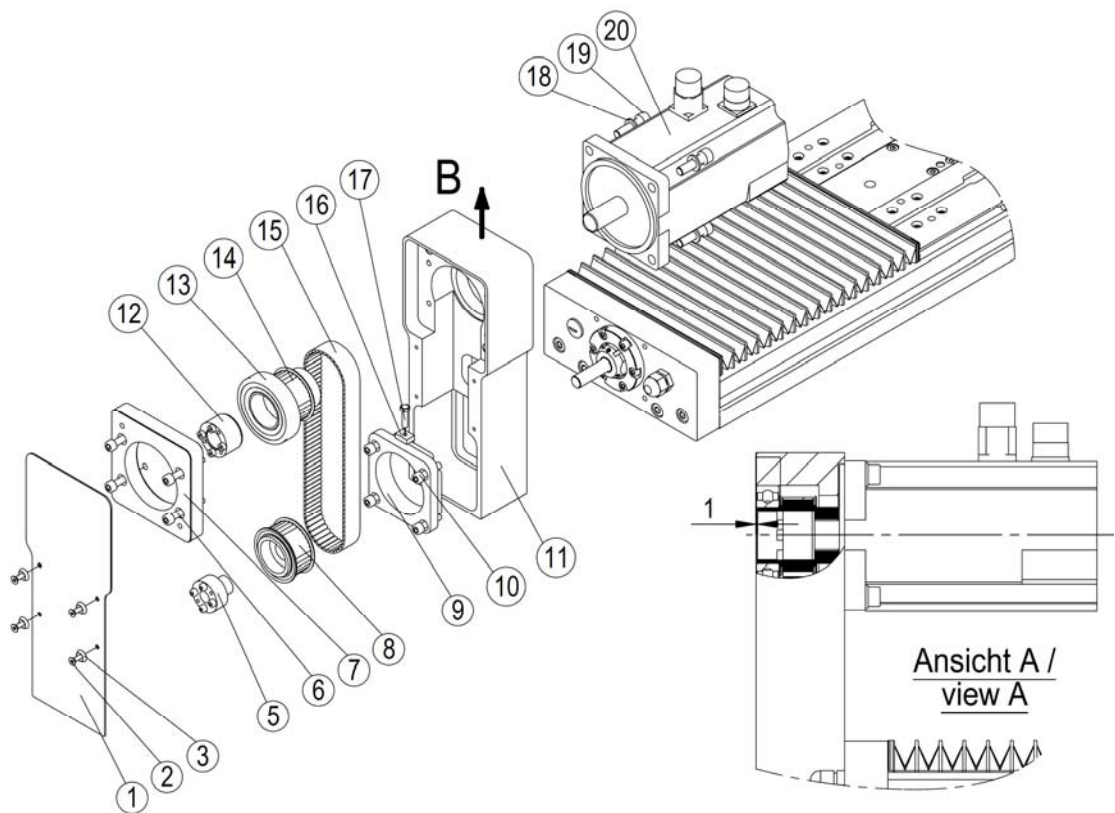
*Prerequisites* See chapter 7 "Accessories and spare parts" for suitable spare parts.

You need a set of hex keys and torque wrench with hexagon socket and medium strength threadlocker.

NOTE: Do not use ball head hex keys. Excessive torque may cause the ball head to tear off. A torn off ball head is difficult to remove from the screw.

Normally the toothed belt is maintenance free. The toothed belts are correctly pre tensioned at the factory to 30% of the maximum operating force. Only with a special belt tension measuring device the belt tension can be adjusted optimally. Measuring the pre tensioning distance and counting the tensioning screw revolutions can achieve a setting sufficient for practical use

### Procedure



### Motor dismounting

1. Loosen the screws (2) on cover (1) and remove it including the washers (3).
2. Remove the cover (1) of the toothed belt gear.
3. Loosen only the screws of the tensioning element (12)
4. Relax the toothed belt (15) by loosening the tensioning screw (17).
5. Loosen and remove the screws (6) of the counter bearing plate (7).
6. Press the counter bearing plate (7) with 2 screws (6) out of the housing (11) of the belt gear.
7. Loosen only the screws (10) of the tension plate (9).
8. Secure the motor (20) that it can not fall down and remove the mounting screws (19) including the washers (18).
9. Pull the motor (20) from the belt gear housing (11) and from the toothed belt pulley (14).

This requires a greater force of up to 450 N

### *Motor mounting*

10. Clean the flange and the shaft of the new motor and remove damages.
11. Place the motor (20) on to belt gear housing (11) with even contact  
Secure the motor to keep it from falling down.
12. Fasten the motor (20) to the belt gear housing (11) with the screws (19) and the washers (18).
13. Press the tensioning element (12) to stop in the toothed belt pulley (14).
14. Put the toothed belt (15) outside of the housing (11) on the toothed belt pulley (14).
15. Put the toothed belt (15) with the toothed belt pulley (14) in the Housing (11) and put the toothed belt on the pulley (8).
16. Push the toothed belt pulley (14) on to the motor shaft.
17. Tighten slightly the screws on the tensioning element (12)
18. Check the distance between the belt gear housing (11) and toothed belt pulley (14). See detail view (A), Normally distance is 0,8- 1 mm.
19. Tighten the screws of the tensioning element (12). with the tightening torque how specified in table 12.2
20. Check the distance between the belt gear housing (11) and the toothed belt pulley (14) again.
21. Push the counter bearing plate (7) on to counter bearing (13) and mount with the screws (6).
22. Remove only one of the screws (10) from the tension plate,  
Apply a thin layer of medium strength threadlocker to the the screw and tighten slightly the screw to 1 Nm (8,85 lb-in).
23. Press the gear belt housing (11) by hand slightly in the tensioning direction (B). to eliminate belt slack.  
  
Previously make sure the 4 screws (10) of the tension plate are loosed.
24. Tighten slightly the tensioning screw (17) on the tension plate (9).

### *Toothed belt pre tensioning*

25. Tension the toothed belt (15) by tightening the tensioning screw (17). For tensioning distance see table 12.3 toothed belt pre tensioning
26. Tighten the screws (10) of the tension plate (9). with the tightening torque how specified in table 12.4.
27. Attach the cover (1) to the belt gear housing (11) with screws (2) including the washers (3).

### 8.3.5 Replacing the coupling



*Unless otherwise specified, the standard tightening torques indicated on page 32 apply.*

#### *Special tightening torques*

Coupling		KT41SB	KT42SB	KT43SB
Screw ISO 4762 - 8.8		M4 x 12	M6 x 16	M8 x 20
Wrench size	[mm]	3	5	6
Tightening torque	[Nm] (lb-in)	4,3 (38.05)	14,5 (123.91)	35 (309.78)

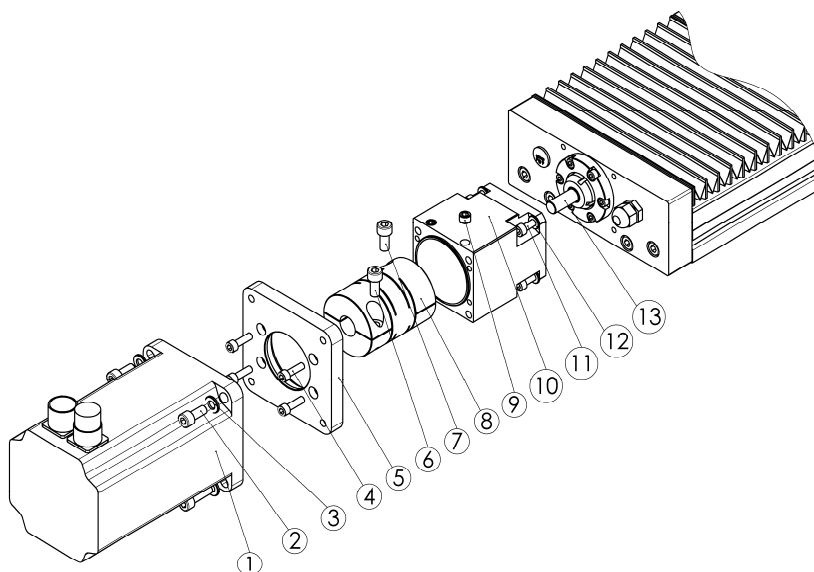
Table 12.1 Tightening torque for couplings

**Prerequisites** See chapter 7 "Accessories and spare parts" for suitable spare parts.

You need a set of hex keys and torque wrench with hexagon socket

**NOTE:** Do not use ball head hex keys. Excessive torque may cause the ball head to tear off. A torn off ball head is difficult to remove from the screw.

#### *Procedure*



1. Remove the motor as described in the Chapter 8.3.3.
2. Remove the screws (4) and take off the motor adapter plate (5).
3. Remove the screws (11) including the washers (12) and take off housing of the coupling (10).
4. Loosen the second attachment screw (7) of the coupling (8) and pull coupling from the ball screw shaft (13).
5. Slide the new, cleaned coupling (8) to the stop of the ball screw shaft (13).
6. Tighten the attachment screws (7) of the coupling (8) with the tightening torque specified in table 12.1“
7. Mount the housing of the coupling (10) with screws (11) and the washers (12).
8. Rotate the coupling (8) until the screw (6) is under the hole (9) in the coupling housing (10).
9. Place back the motor adapter plate (5) on housing of the coupling (10) and mount it with the screws (4).
10. Mount the motor back as described in Chapter 8.3.3.

### 8.3.6 Replacing the toothed belt (at belt drive KT41)



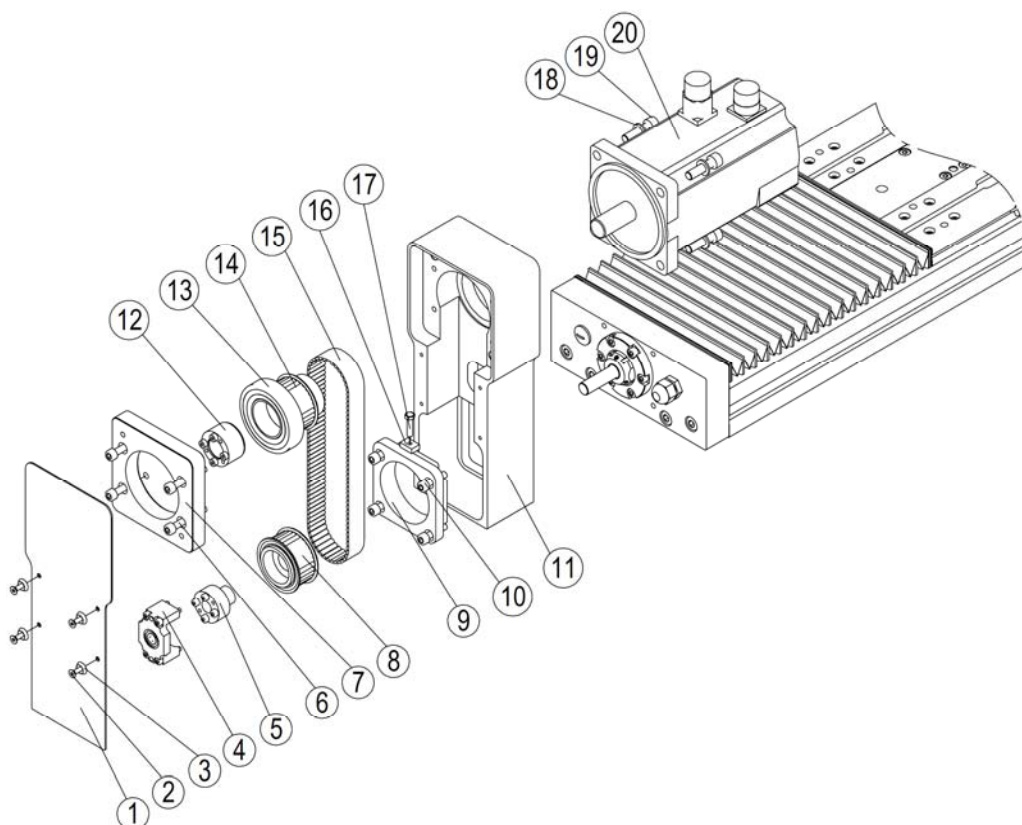
*Unless otherwise specified, the standard tightening torques indicated on page 32 apply.*

**Prerequisites** See chapter 7 "Accessories and spare parts" for suitable spare parts.

You need a set of hex keys and torque wrench with hexagon socket

**NOTE:** Do not use ball head hex keys. Excessive torque may cause the ball head to tear off. A torn off ball head is difficult to remove from the screw.

#### *Procedure*



1. Remove motor as described in Chapter 8.3.4. "motor dismounting"
2. Loosen and remove the screws of the bearing block (4).
3. Remove bearing block (4).
4. Exchange toothed belt (15).
5. Put the bearing block (4) on to the tension plate (9) and mount with the screws. Tighten the screws to 2 Nm (17,7 lb-in).
6. Mount motor again as described in Chapter 8.3.4. "motor mounting"



### 8.3.7 Replacing the toothed belt (at belt drive KT42 /KT43)



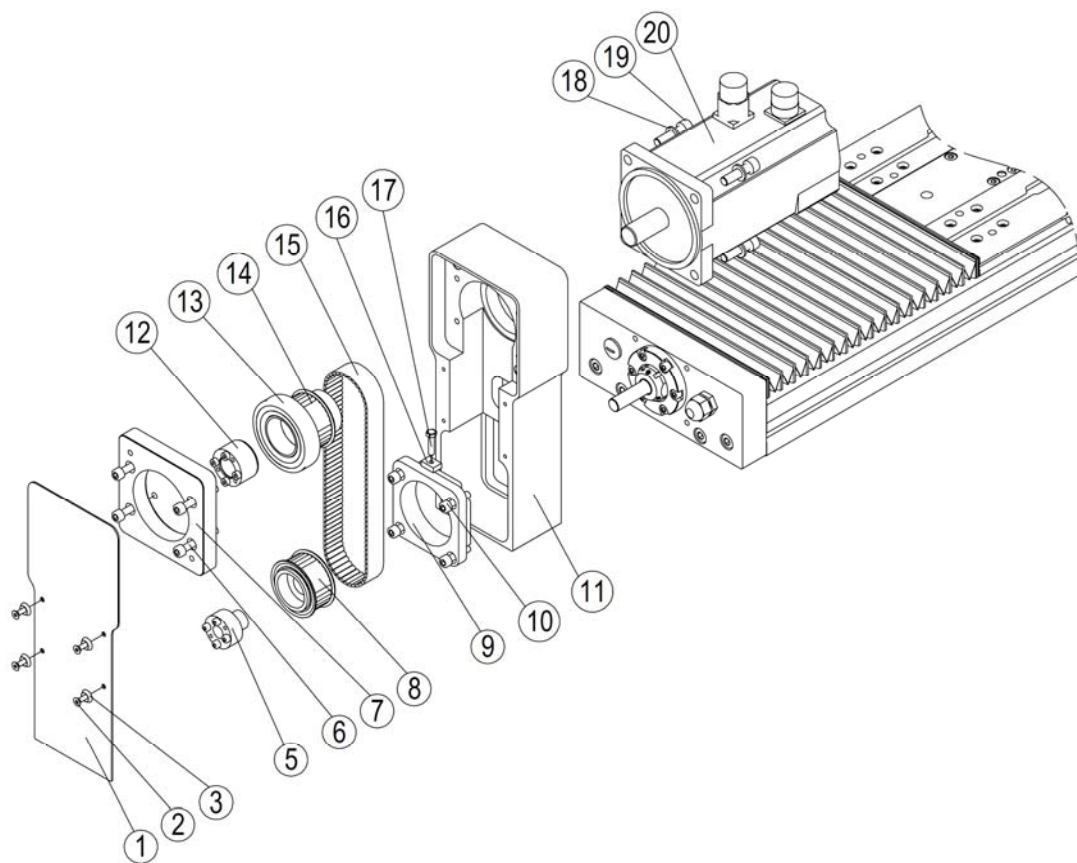
*Unless otherwise specified, the standard tightening torques indicated on page 32 apply.*

**Prerequisites** See chapter 7 "Accessories and spare parts" for suitable spare parts.

You need a set of hex keys and torque wrench with hexagon socket

**NOTE:** Do not use ball head hex keys. Excessive torque may cause the ball head to tear off. A torn off ball head is difficult to remove from the screw.

**Procedure**



1. Remove motor as described in Chapter 8.3.4.
2. Exchange toothed belt (15).
3. Mount motor again as described in Chapter 8.3.4.

### 8.4 Maintenance

The maintenance intervals for cleaning and lubrication must be adhered to:

- ▶ Include the maintenance intervals in your maintenance schedule.

#### 8.4.1 Cleaning

Due to its design, the product is not susceptible to the ingress of contaminants and external objects.  
The used guides and drive elements are sealed and protected by bellows from the outside environment.

The product must be checked and cleaned at regular intervals.

- ▶ Do not use compressed air for cleaning.
- ▶ Remove large particles and dirt from the surface at regular intervals.
- ▶ The anodized surface only has a limited resistance to alkaline cleaning agents. Therefore, use only neutral cleaning agents for cleaning.
- ▶ Use only damp, soft and lint-free cleaning cloths to wipe the surface.

#### *Bellows*

The bellows are non-sealing covers over the mechanics of the linear tables. They consist of polyester fabric coated with polyurethane on both sides and are resistant to humidity, emulsion, oil, mechanical wears as well as limited to chemicals. Excessive pollution can impair the bellows in their functionality or damage them.

- ▶ Remove large particles and dirt regularly from the surface of the bellows.
- ▶ Check the bellows regularly from damages.  
Damaged bellows must be replaced immediately.
- ▶ Assure before and while in operation, that the bellows can be compressed unhindered.
- ▶ The bellows are only limited resistant against alkaline detergents.  
We recommend to use exclusively neutral detergents for cleaning.

## 8.4.2 Lubrication

CAUTION
<b>DAMAGE DUE TO INCORRECT LUBRICANT</b> Incorrect lubricants may damage the product. <ul style="list-style-type: none"><li>• Use the correct type of lubricant (grease, oil) as specified.</li></ul> <b>Failure to follow these instructions can result in equipment damage.</b>

Lubricant is consumed continuously during operation of the linear axis. The product must be lubricated at regular intervals.

The lubrication system is not completely tight. Therefore, small amounts of lubricants may escape.

Insufficient lubrication or incorrect lubricants increase wear and reduce the service life.

The following factors influence the lubrication intervals:

- Dust and dirty particles
- High operating temperatures
- Heavy loads
- Heavy vibration
- Permanent short-distance positioning
- High speed of rotation

**8.4.3 Lubricating the linear guide and the drive elements**

The Linear table is lubricated with grease from an internal reservoir.  
The reservoir is factory-prefilled.

The carriage features 1 grease nipples at each side for relubrication.

- Both, the ball screw drive and the linear guide can be lubricated at one grease nipple location, depending on the accessibility.

The lubrication interval depends on the load, the velocity, the cycle time and the ambient conditions.

The following recommended values apply to lubrication intervals.

*Linear guide and  
ball screw drive*

40 km at a screw pitch of 2 mm  
100 km at a screw pitch of 5 mm  
200 km at a screw pitch of 10 mm  
300 km at a screw pitch of 16 mm  
400 km at a screw pitch of 20 mm

Size	Lubricant 1)	Relubrication volume	Strokes
KT41SB	Microlube GL 261	1,5 cm <sup>3</sup>	2
KT42SB		2,0 cm <sup>3</sup>	4
KT43SB		2,5 cm <sup>3</sup>	5

1) Alternative grease K1N-30 as per DIN51825

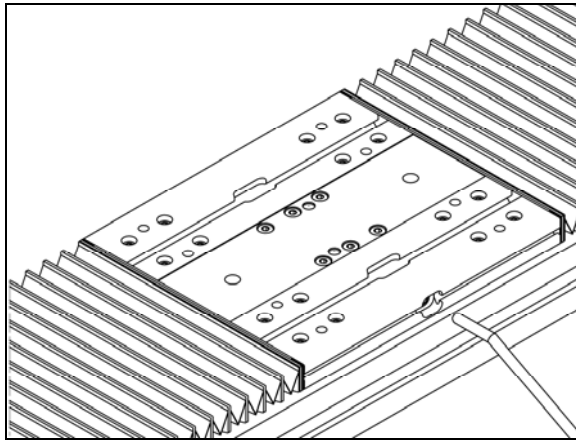
See chapter 7 "Accessories and spare parts" for grease guns, nozzles and lubricants:

*Notes on greasing*

When applying the lubricant, you must not exceed a maximum flow rate. Therefore, the minimum injection time of 3 seconds per grease gun stroke must be adhered to.

The carriage must be moved between strokes of the grease gun to allow the grease to distribute evenly in the lubricant reservoirs.

### Procedure



Lubricating the linear guide and the Ball screw drive.

1. Inject the correct type and volume of grease into the the center grease nipple at one side of the carriage.

## 8.5 Shipping, storage, disposal

Note the ambient conditions in chapter 3.1

### *Shipping*

The product must be protected against shocks during transportation. If possible, use the original packaging for shipping.

### *Storage*

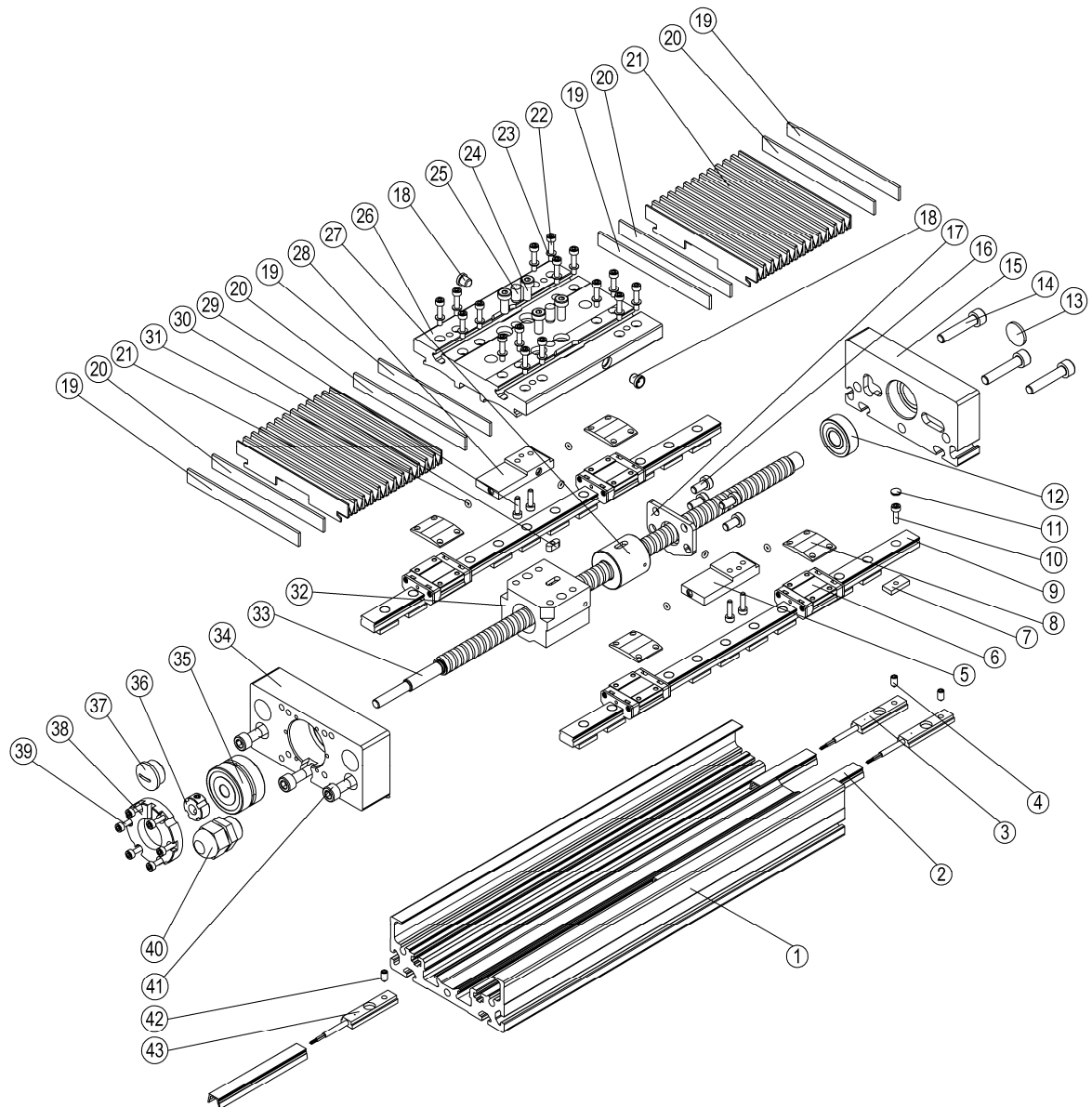
The product may only be stored in spaces where the specified permissible ambient conditions are met.  
Protect the product from dust and dirt.

### *Disposal*

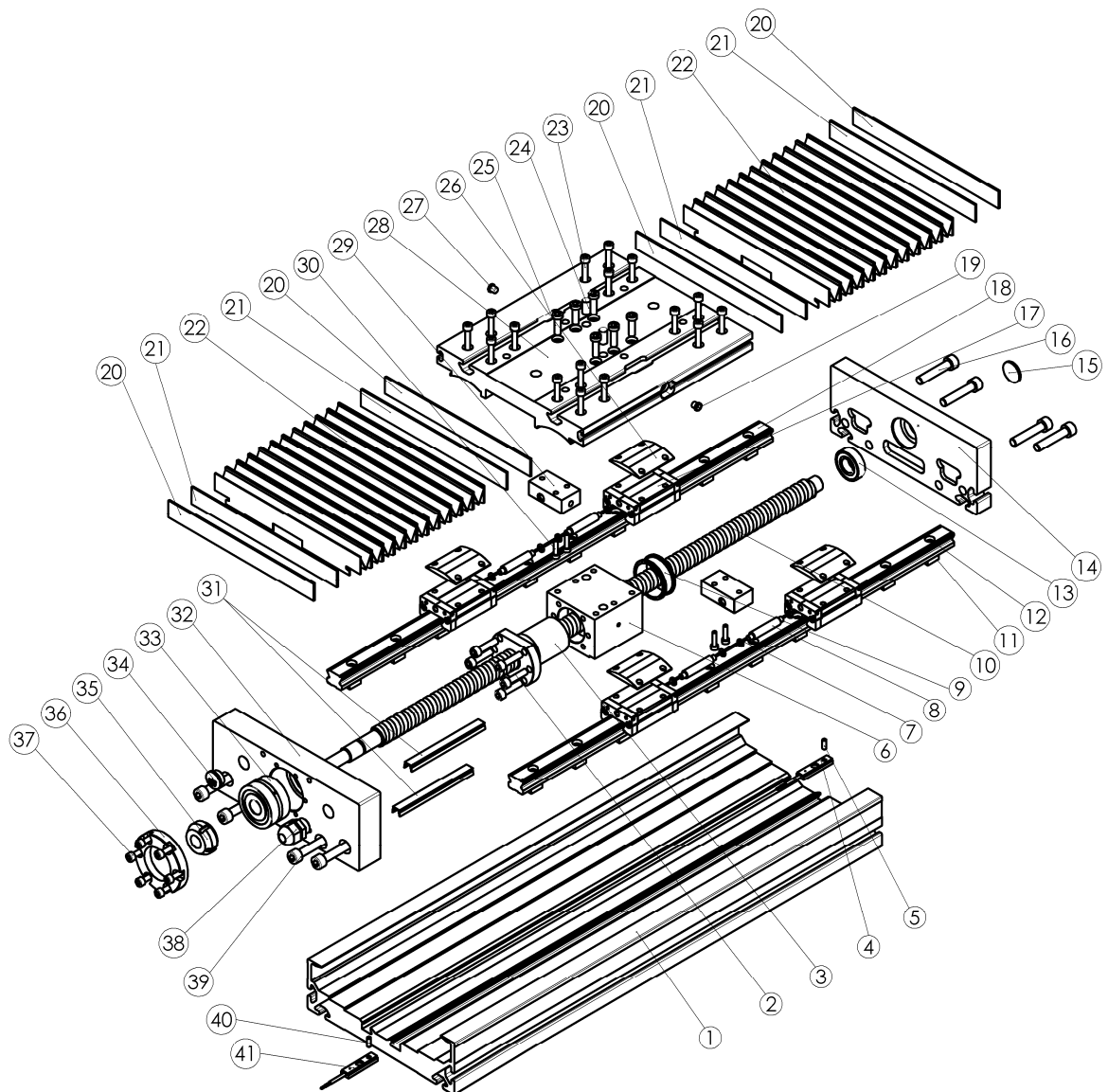
The product consists of various materials that can be recycled be and must disposed of separately. Dispose of the product in accordance with local regulations.

## 8.6 Exploded Drawings

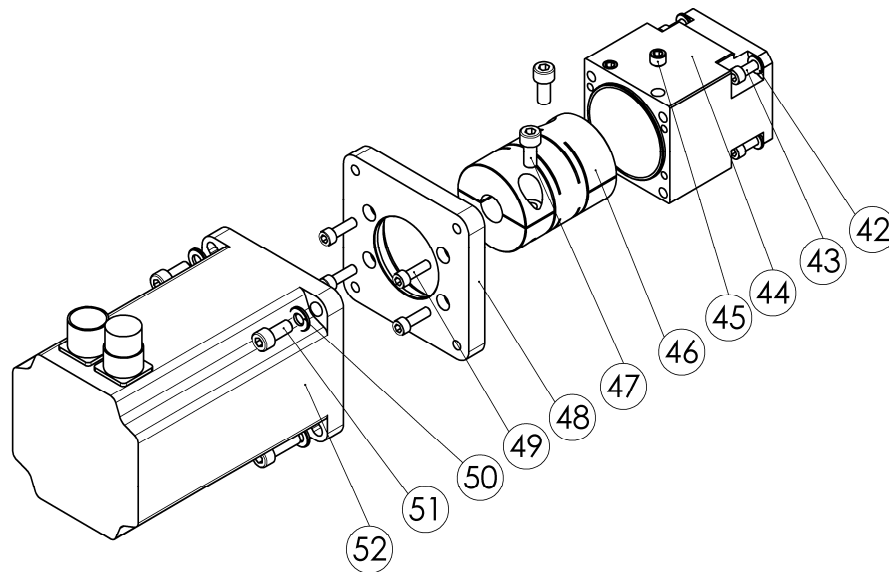
### 8.6.1 Exploded view of a linear table KT41SB



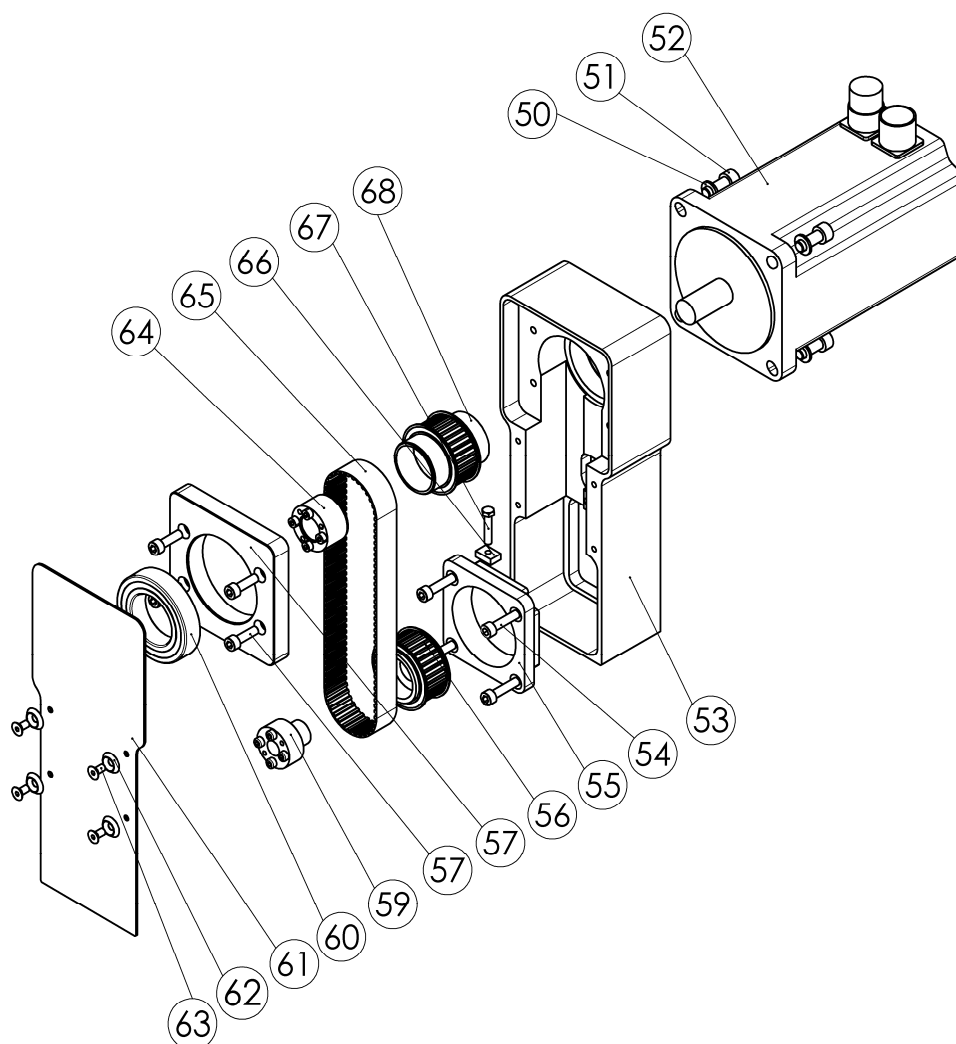
### 8.6.2 Exploded view of a linear table KT42SB / KT43SB



### 8.6.3 Exploded view with motor straight mounted



### 8.6.4 Exploded view with belt gear mounted





## 9. Glossary

### 9.1 Terms and Abbreviations

See chapter 2.5 "Standards and terminology" for information on the pertinent standards on which many terms are based. Some terms and abbreviations may have specific meanings with regard to the standards.

<i>Axis body</i>	The axis body is a aluminum precision profile.
<i>Ball screw drive</i>	The ball screw drive converts a rotary movement into a linear movement. It consists of a ball screw, a ball nut with the ball recirculating elements and the bearing balls. A ball screw drive has a very high efficiency. It allows for high-precision, stiff feed movements and generates high feed forces at high positioning accuracy and repeatability.
<i>Ball screw pitch</i>	<p>The pitch of the ball screw shaft relates to the distance covered by the carriage per revolution of the ball screw. The greater the pitch the higher the maximum velocity.</p> <p>The following applies to the ball screw pitch:</p> <ul style="list-style-type: none"> <li>• High pitch requires high driving torque</li> <li>• High pitch results in high velocity</li> <li>• High pitch causes high inaccuracy</li> </ul>
<i>Breakaway torque</i>	The breakaway torque describes the driving torque required to overcome the static friction and that initiates the transition to sliding friction.
<i>Buckling stress</i>	Buckling is the loss of stability of the ball screw shaft when the maximum permissible thrust forces whose line of application is along the axis of the ball screw axis is exceeded. Excessive buckling stress results in a rapidly increasing deformation and deflection of the ball screw shaft.
<i>Cantilever axis</i>	In the case of a cantilever axis, the carriage is stationary while the axis body moves. Portal axes work the other way round.
<i>Critical speed of the ball screw shaft</i>	If the critical speed of the ball screw shaft is exceeded, deflection of the ball screw and resonance will occur. This will seriously affect the service life of the ball screw drive. Ball screw supports are installed in longer linear axes to increase the critical speed of the ball screw shaft speed and thus the performance data.
<i>DOM</i>	<p>(Date of manufacture). The nameplate of the product shows the date of manufacture in the format DD.MM.YY or in the format DD.MM.YYYY. Example:</p> <p>31.12.09 corresponds to December 31, 2009</p> <p>31.12.2009 corresponds to December 31, 2009</p>

<i>Degree of protection</i>	The degree of protection is a standardized specification for electrical equipment that describes the protection against the ingress of foreign objects and water (for example: IP 20).
<i>Direction of rotation</i>	Rotation of the motor shaft in a positive or negative direction of rotation. Positive direction of rotation is when the motor shaft rotates clockwise as you look at the end of the protruding motor shaft.
<i>Drive element</i>	The drive element of the linear axis is a ball screw drive.
<i>Error class</i>	Classification of errors into groups. The different error classes allow for specific responses to errors, for example by severity.
<i>Fatal Error</i>	In the case of fatal error, the product is no longer able to control the motor so that the power stage must be immediately disabled.
<i>Fault</i>	Fault is a state that can be caused by an error. Further information can be found in the pertinent standards such as IEC 61800-7, ODVA Common Industrial Protocol (CIP).
<i>Fault reset</i>	A function used to restore the drive to an operational state after a detected error is cleared by removing the cause of the error so that the error is no longer active.
<i>Feed per revolution</i>	The feed per revolution is the distance the carriage covers per motor revolution.
<i>Linear guide</i>	The linear guide consists of the guide carriage and the recirculating ball bearing guide.
<i>Load torque</i>	The permissible load torques are calculated based on the service life of the carriage guide. If the load torque exceeds the specified values, the service life of the axis will be reduced.
<i>Modulus of elasticity</i>	The modulus of elasticity is used to describe the tendency of a material to deform along an axis when opposing forces are applied along this axis; it is the ratio of tensile strain and tensile stress. The higher the value, the stiffer the material.
<i>Mounting position</i>	The linear axis can be installed in any desired position. However, all external forces and torques must be within the ranges of permissible values.
<i>Portal axis</i>	In the case of a portal axis, the axis body is stationary while the carriage moves. Cantilever axes work the other way round.
<i>Positioning accuracy</i>	Positioning accuracy is the tolerance between the specified position and actual position.
<i>Recirculating ball bearing</i>	The axis axis body absorbs the forces and torques applied at the carriage via the recirculating ball bearing guide. The recirculating ball bearing guide can absorb high forces and torques.
<i>Repeatability</i>	Repeatability is the accuracy with which it is possible to move to a previous position again under the same conditions.
<i>Running accuracy</i>	Due to the manufacturing process, the extruded aluminium profiles have a certain tolerance in terms in straightness and twist. The tolerances are specified in EN 12020-2. To reach the desired running accuracy, the linear axis must be mounted on a precision-machined surface.

<i>Sensor</i>	Inductive proximity switches are used as sensors for limit switches or reference switches. These switches are not a safety function.
<i>Service life</i>	The service life is the distance in kilometers before the first signs of material fatigue can be seen on the guides, the drive elements and the bearings. Service life specifications (kilometers covered) relate to the nominal values specified in the data sheet. If the nominal values are exceeded, the service life decreases accordingly.
<i>Stiffness</i>	Stiffness is a measure of the ability to move and hold with high position accuracy a part to be positioned even when the load changes.
<i>Stroke reserve</i>	The stroke reserve is the distance between a limit switch and the mechanical stop.
<i>Stroke</i>	Stroke is the maximum travel of the carriage between the switching points of the limit switches.
<i>Support axis</i>	A support axis has linear guides, but no drive elements. A support axis carries loads that are applied asymmetrically to the carriage and improves the stability and service life of the system.
<i>Warning</i>	If the term is used outside the context of safety instructions, a warning alerts to a potential problem that was detected by a monitoring function. A warning is not an error and does not cause a transition of the operating state.