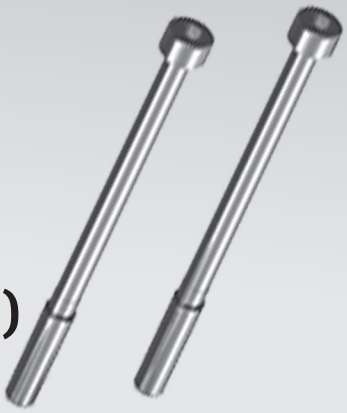
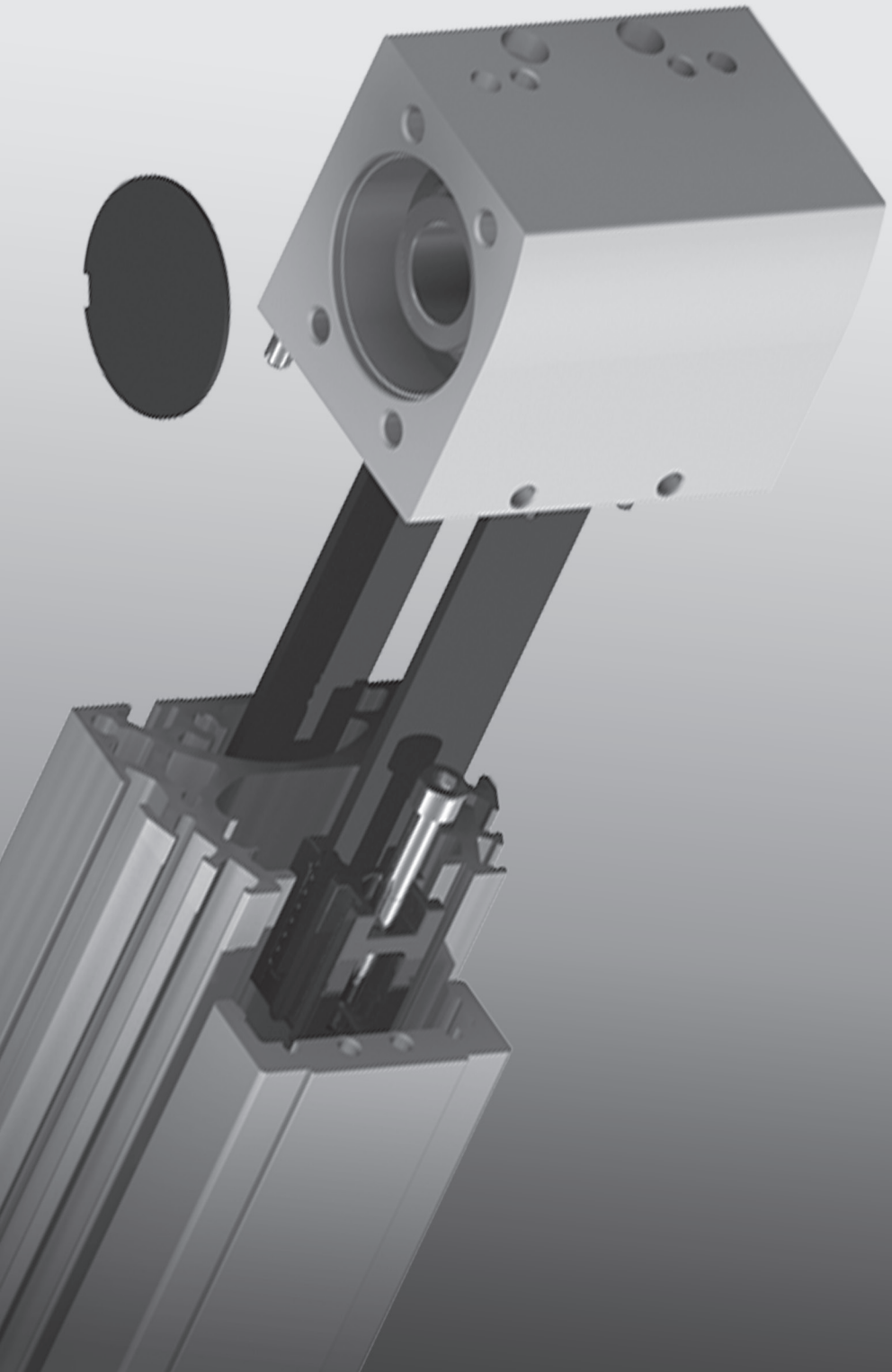
Toothed belt axis

ELGA-TB-RF-70-...(-F1)

ELGA-TB-RF-80-...(-F1)

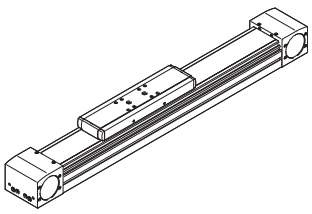
ELGA-TB-RF-120-...(-F1)





FESTO

Repair instructions (en)



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Foreword

These repair instructions are valid for the toothed belt axis listed on the title page to the exclusion of any liability claims.

Deviations compared to the descriptions in these repair instructions may arise depending on the version and/or modification status of the toothed belt axis. The user must check this prior to carrying out the repair and take the deviations into consideration if necessary.

These repair instructions have been prepared with care.

Festo SE & Co. KG does not, however, accept liability for any errors in these repair instructions or their consequences. Likewise, no liability is accepted for direct or consequential damage resulting from incorrect use of the products.

Further information is given in Chapter 7 on page 45.

The relevant regulations on occupational safety, safety engineering, and interference suppression as well as the stipulations contained in these repair instructions must be observed when working on the products.

FESTO

Table of Contents

1 Important information

1.1 About these repair instructions

This document contains important information about professional repair of the toothed belt axis of the type ELGA-TB-RF-...

However, the costs of carrying out a repair must be considered in the case of larger defects.

Before carrying out a repair, the relevant chapter in these instructions must be read in full and followed consistently.

For reasons of clarity, these repair instructions do not contain all detailed information. The following documents should therefore also be available while performing repair work on the linear drive:

- **Operating instructions**

  Contain information about the installation and removal of the motor, motor flange, coupling and coupling housing of the ELGA-TB-RF-... toothed belt axis as well as its function, structure, use, installation, commissioning, maintenance and care, etc. They can be found on the Festo website (➔ www.festo.com/sp).
- **Spare parts documentation**

  Contains an overview of the spare and wearing parts as well as information on their installation. This can be found in the online spare parts catalogue on the Festo website (➔ www.festo.com/spareparts).
- **Information brochure – Tools and repair accessories**

  Contains an overview of the available installation resources, e.g. lubricating greases, threadlocking agents, maintenance tools, etc. (resources for installation and maintenance). The brochure can be found in the online spare parts catalogue on the Festo website (➔ Tools and repair accessories.pdf).

1.2 Symbols used in these repair instructions

Danger categories

The following symbols identify text passages which draw attention to specific hazards.

Warning

Caution

Marking special information

The following symbols identify text passages which contain special information.

Note

Information

Environment

1.3 Text designations used in these repair instructions

- Indicates activities that can be carried out in any sequence.

1. Indicates activities that should be carried out in the specified sequence.

– Indicates a general list.

➔ Reference to further information.

Underlined, blue text indicates a cross-reference or hyperlink that you can click on in the PDF.

1.4 General safety information

Warning

Risk of fatal injury due to electric shock and uncontrolled movement of components.

– The toothed belt axis must be de-energised, depressurised and reliably secured against unauthorised switching back on again before the maintenance and repair work begins.

Caution

The toothed belt axis may only be repaired by authorised and trained persons in accordance with the specifications in the technical documentation and using original spare parts.

Installation and repair by unauthorised and untrained persons, repairs using non-original spare parts or without the technical documentation required for installation and/or repair are dangerous and therefore not permitted.

Repairs must only be carried out in conjunction with these repair instructions and the respective device-specific operating instructions.

Caution

Lifting large loads can lead to permanent injury.

– The toothed belt axis must be lifted by several people or with suitable lifting gear, depending on its size and weight.

Caution

Unintended switching on can trigger unexpected movements and cause bruises.

– Ensure that the plant is protected against restarting before any modification or maintenance work or inspections are carried out. Loosened parts can make unexpected movements or fall off.

– Secure parts against accidental movements or move them into a safe end position.

Note

Carrying out repair work without the respective necessary technical documentation is dangerous, and therefore not permissible. Repairs must only be carried out in conjunction with these repair instructions and the respective operating instructions for the device, as well as the documents listed in Chapter 1.1 on page 6.

In the event of damage caused by unauthorised manipulation, improper use or use of non-original spare parts, all warranty and liability claims against the manufacturer expire.

Instead of carrying out the repair yourself, your local Festo sales office offers the option of having the repair carried out by Festo.

Components and equipment replaced during repair must be disposed of in accordance with the relevant local environmental protection regulations.

1.5 Technical requirements

Note

The following instructions for safe and proper use must be observed:

- Observe the connection and ambient conditions specified in the technical data of the products and all the connected components. The product can only be operated in compliance with the relevant safety guidelines if you comply with the limit values and load limits (see enclosed documentation).
- The toothed belt axis must be in perfect technical condition.
- The toothed belt axis may only be operated in its original condition and without unauthorised modifications.
- The toothed belt axis is designed for industrial use.

1.6 Standards and test values

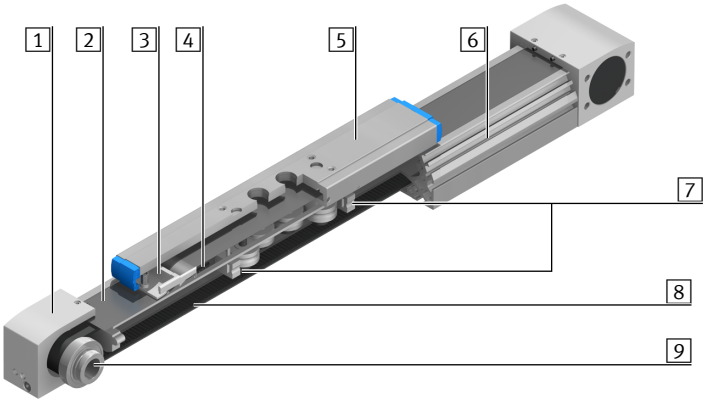
Standards and test values which products comply with and fulfil can be found in the “Technical data” sections of the enclosed documentation.

2 General product description

2.1 Functional description

The ELGA-TB-RF-... is a toothed belt axis based on the operational principle of a circulating toothed belt for power transmission. The rotary motion of a drive motor produces linear motion in a toothed belt with a pulley at both ends of the axis that is then transmitted to the slide fixed onto the toothed belt. The slide is mounted on roller bearings.

By minimising the dead weight moved, a high dynamic response and shorter cycle times can be achieved. The ELGA-TB-RF-... is approved for slide operating mode.



1 Actuator end cap with corner pulley
2 Cover band
3 Belt reverser
4 Clamping component
5 Slide
6 Sensor slots
7 Oil scraper
8 Toothed belt
9 Toothed belt pulley with deep-groove ball bearing

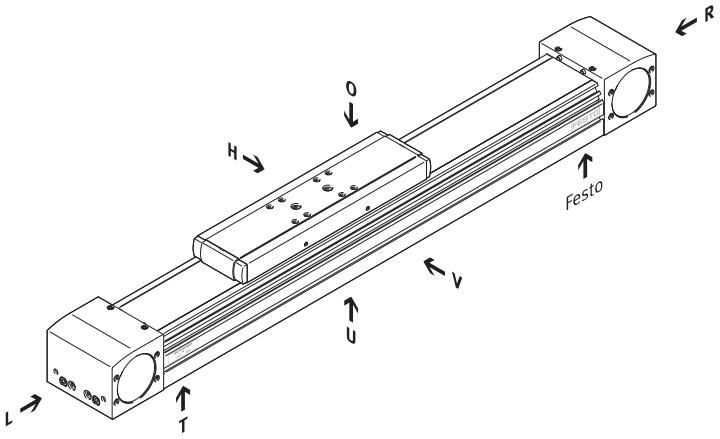
2.2 Types and part numbers

Type	Part number
ELGA-TB-RF-70-...(-F1)	1371245
ELGA-TB-RF-80-...(-F1)	1371246
ELGA-TB-RF-120-...(-F1)	1371247

The complete overview of features, accessories, type codes, technical data and dimensions for the ELGA-TB-RF toothed belt axes can be found in the product catalogue or on the Festo website (➔ www.festo.com).

2.3 Orientation designations

This illustration provides an overview of the mounting directions for the toothed belt axis.



Festo=reference point (logo)
T = Rating plate
O = top
U = bottom
R = right
L = left
V = front
H = rear

2.4 Type code

The precise features of a toothed belt axis can be determined with the help of its nameplate. The type designation describes the features of the toothed belt axis, separated by a hyphen (-).

Example:

1 Type designation
2 Serial number
3 Serial number
4 Part number

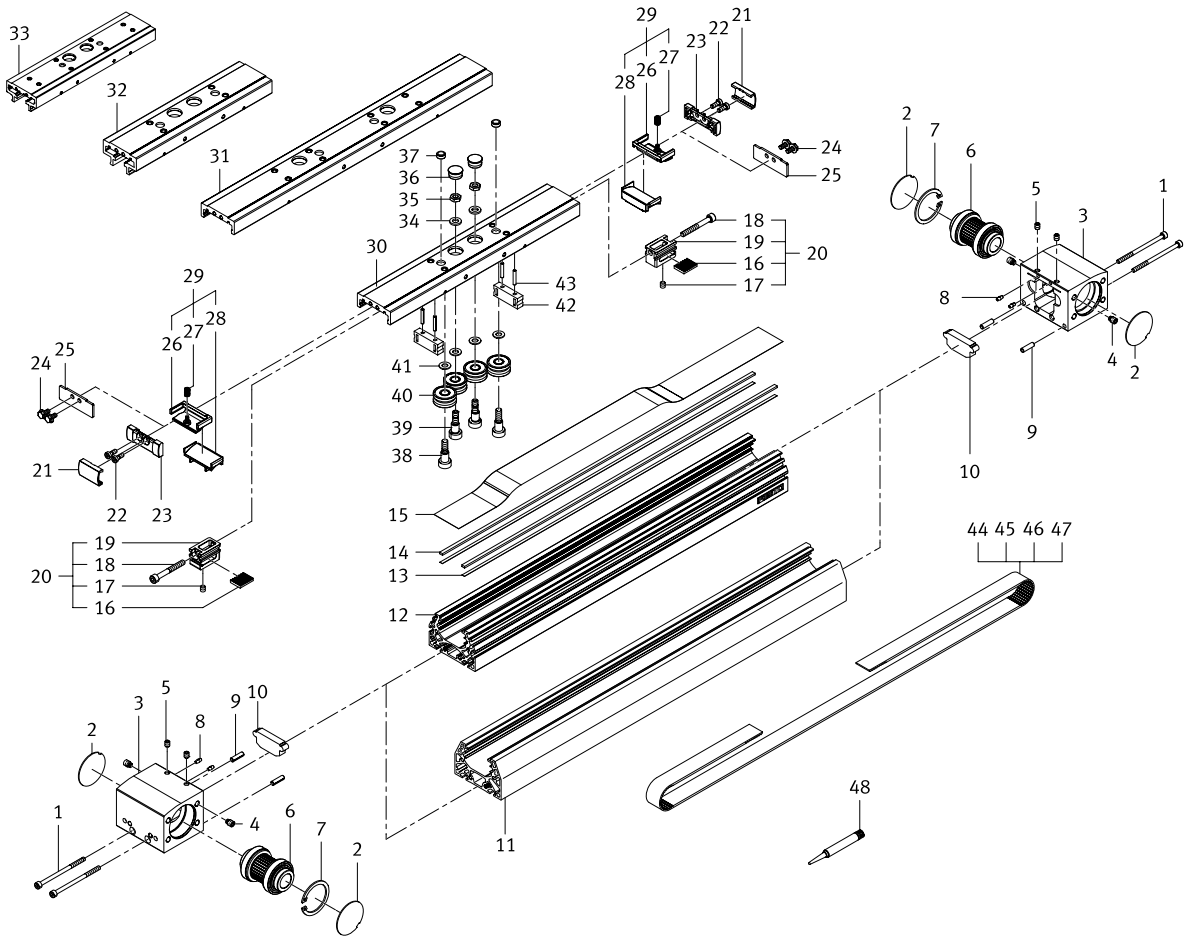
The type designation on these rating plates provides the following information:

ELGA	Toothed belt axis of the type ELGA
TB	Toothed belt
RF	Roller bearing guide
120	Size
500	Stroke [mm]
20H	Stroke reserve [mm]
L	Slide, long

A list and description of all possible equipment features of the toothed belt axis can be found in the data sheet. It is available on the Festo website (➔ www.festo.com).

3 Components list

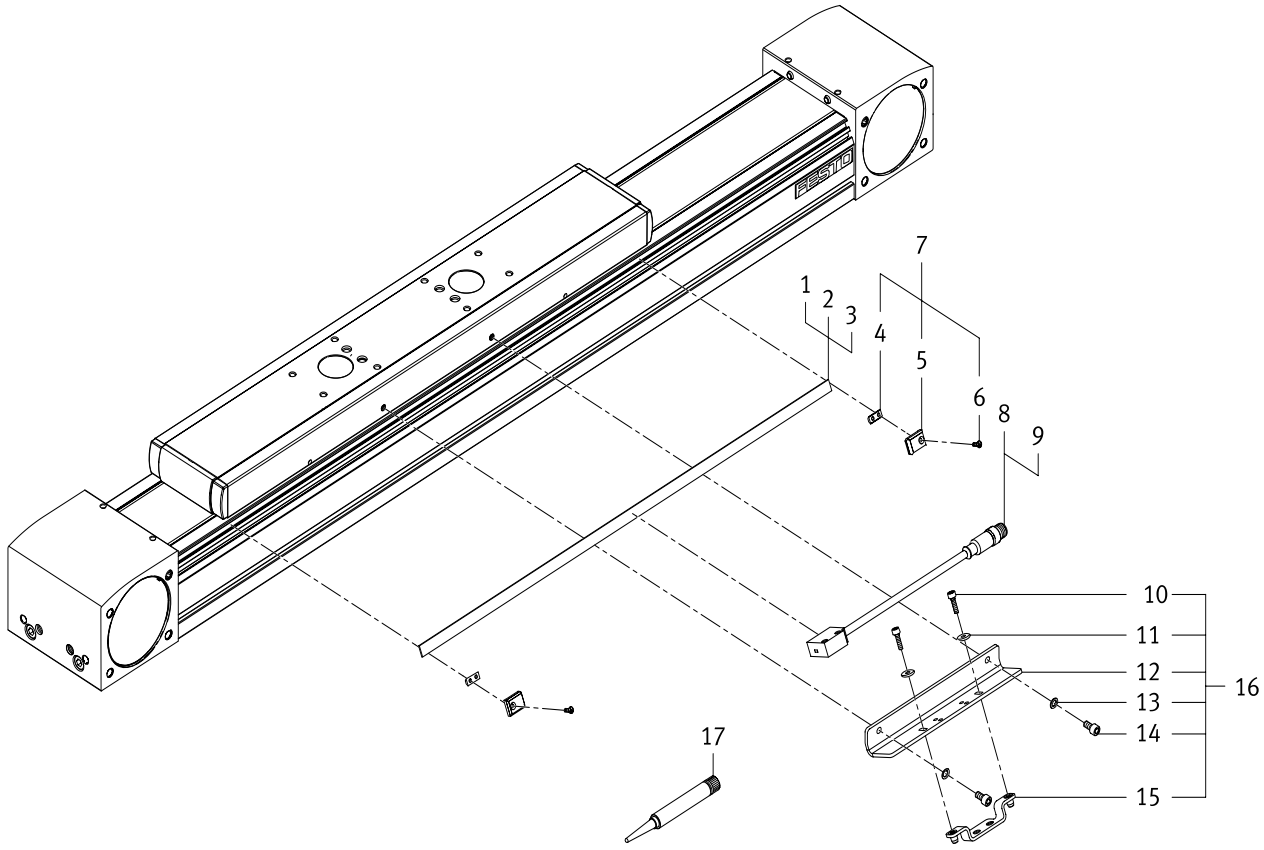
3.1 ELGA-TB-RF-70 / 80 / 120-...(-F1)



This diagram is intended only to provide an overview of the individual components. To order spare and wearing parts, please use the online spare parts catalogue on the Festo website (➔ www.festo.com/spareparts).

Item	Designation	ELGA-TB-RF-70-...(-F1)	ELGA-TB-RF-80-...(-F1)	ELGA-TB-RF-120-...(-F1)
1	Socket head screw	DIN 912-M4×65-8.8	DIN 912-M5×70-8.8	DIN 912-M8×110-8.8
		DIN 912-M4×65-A2-70	DIN 912-M5×70-A2-70	DIN 912-M8×110-A2-70
		F1 variant only	**F1 variant only**	**F1 variant only**
2	Sealing disc			
3	Grub screw	DIN 915-M6×8-45H	DIN 915-M6×8-45H	DIN 913-M8×8-45H
4	Actuator end cap assembly			
5	Grub screw	DIN 913-M5×6-45H	DIN 915-M6×8-45H	DIN 915-M6×12-45H
6	Toothed belt pulley assembly			
7	Retaining ring	DIN 472-37×1.5	DIN 472-47×1.75	DIN 472-75×2.5
8	Buffer element			
9	Spring pin	DIN 7346-4.5×16	DIN 7346-4.5×16	DIN 7346-7×28
10	Scraper			
11	Cylinder barrel module	**F1 variant only**	**F1 variant only**	**F1 variant only**
12	Cylinder barrel module			
13	Adhesive tape			
14	Magnetic strip			
15	Cover band			
16	Clamping plate			
17	Grub screw	DIN 913-M5×6-45H	DIN 913-M8×8-45H	DIN 913-M8×8-45H
18	Socket head screw	DIN 912-M5×40-10.9	DIN 912-M6×55-10.9	DIN 912-M8×50-10.9
19	Clamping component			
20	Clamping			
21	Clip			
22	Socket head screw	DIN 6912-M4×10-8.8	DIN 6912-M4×10-8.8	DIN 6912-M5×6-A2-70
23	End cap			
24	Hexagon head screw	F-M4×8-A2-70	F-M4×8-A2-70	CR-M5×10-A2-70
		F1 variant only	**F1 variant only**	**F1 variant only**
25	Cover plate	**F1 variant only**	**F1 variant only**	**F1 variant only**
26	Belt reversal			
27	Compression spring			
28	Belt reversal			
29	Belt reversal			
30	Slide module			
31	Slide module (L), long			
32	Slide module (S), short			
33	Slide module (XS), very short	**Component not available**		
34	Washer	DIN 125-A-6.4-1.4301	DIN 125-A-8.4-A2	DIN 125-A-13-A2
35	Hex nut	DIN 439-B-M6-04	DIN 934-B-M8-08	DIN 439-B-M12-04
36	Cover cap			
37	Centring sleeve			
38	Fitting bolt			
39	Eccentric cam			
40	Track roller			
41	Washer			
42	Scraper			
43	Spring pin	DIN 1481-3×18	DIN 1481-3×24	DIN 1481-3×24
44	Toothed belt			
45	Toothed belt [], 5m piece			
46	Toothed belt [PU1], 5m piece	**F1 variant only**	**F1 variant only**	**F1 variant only**
47	Toothed belt [PU2], 5m piece			
48	Screw locking agent			

3.2 ELGA-TB-RF-...-M...-



This illustration serves as an order overview as well as an overview of the individual components. Use the online spare parts catalog on the Festo website for a detailed overview of assemblies (➔ www.festo.com/spareparts).

Toothed belt axis		ELGA-TB-RF-70-...-M...-	ELGA-TB-RF-80-...-M...-	ELGA-TB-RF-120-...-M...-
No.	Designation	Type	Type	Type
1	Tape measure	2m piece	2m piece	2m piece
2	Tape measure	5m piece	5m piece	5m piece
3	Tape measure	10m piece	10m piece	10m piece
4	Slot nut			
5	Cap			
6	Countersunk screw	DIN 965-M3X8-4.8-H	DIN 965-M3X8-4.8-H	DIN 965-M3X8-4.8-H
7	Cap			
8	Measuring unit	M1	M1	M1
9	Measuring unit	M2	M2	M2
10	Socket head screw	ISO 4762-M4X14-10.9	ISO 4762-M4X14-10.9	ISO 4762-M4X14-10.9
11	Disc	DIN 7349-4,3	DIN 7349-4,3	DIN 7349-4,3
12	Sensor bracket			
13	Retaining washer	S-4	S-4	S-5
14	Socket head screw	ISO 4762-M4X8-8.8	ISO 4762-M4X8-8.8	ISO 4762-M5X10-10.9
15	Sensor mounting			
16	Sensor bracket			
17	Screw locking agent			

4 Repair steps

This chapter describes how to dismantle, repair and assemble the toothed belt axis ELGA-TB-RF-.... Note that the axis does not need to be completely dismantled for all repair work.

Where possible, it is advisable to dismantle the toothed belt axis from the system entirely before carrying out the repair.

Before starting the repair, dismantle any attachments in accordance with the instructions in the accompanying operating instructions.

Keep your working environment clean and tidy.

Depending on the cause of the defect to be eliminated, it may be necessary to replace several components. The cause of a defect must therefore always be determined before starting a repair.

Note

The repair should preferably be carried out on a stable and flat work surface with storage for small parts.

To prevent damage to the guide rail and other components, do not use pointed or sharp-edged assembly tools.

4.1 Preparatory steps

Warning

Risk of fatal injury from electric shock.

The control of the drive motors is still charged after the voltage has been switched off (capacitor voltage). As such, you must wait approx. 3 minutes after switching off the voltage before the motor cables can be removed. The capacitors discharge their voltage during this time.

4.2 Visual inspection

Check the toothed belt axis for visible damage that can impair its function, such a defects in the profiled roller track guide. The complete toothed belt axis must be replaced if significant damage exists.

4.3 Replacing the toothed belt

The toothed belt is ordered from the online spare parts catalogue using the appropriate part number (depending on the size and version of the product) or it is ordered by the metre (5 m roll) (➔ www.festo.com/spareparts).

Note

Do not bend or fold the toothed belt, as this can result in damage to the tensile members and shorten its service life by cracking it. Note the minimum bending radius for assembly and storage:

Type	Toothed belt material	Minimum bending radius R_{min}
ELGA-TB-RF-70	Neoprene NP	11 mm
ELGA-TB-RF-80 / 120	Neoprene NP	23 mm
ELGA-TB-RF-70-...-F1	Polyurethan PU1	25 mm
ELGA-TB-RF-80 / 120-...-F1	Polyurethan PU1	32 mm
ELGA-TB-RF-70-PU2	Polyurethan PU2, coated	25 mm
ELGA-TB-RF-80 / 120-PU2	Polyurethan PU2, coated	32 mm

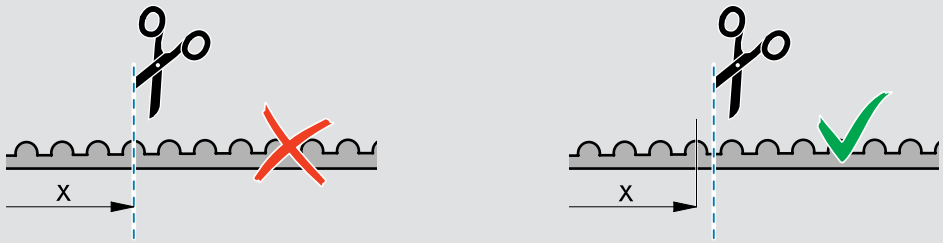
Ordering a precise fitting toothed belt:

The part number of the toothed belt axis is a module number and is dependent on the size of the product. When ordering the toothed belt, in addition to the part number, the stroke and stroke reserve of the product must also be stated. The necessary information is given in the order code in the product labelling (➔ Chapter 2.4 on page 9).

Cutting the toothed belt to size if ordered by the metre

Note

- Use sturdy general-purpose scissors or metal shears to cut through the toothed belt.
- Round down the cut length (L) to an integer multiple of the pitch “C” (➔ table) to ensure that the belt can always be cut to size in a gap.



The precise length of the toothed belt is calculated as follows:

L (length of toothed belt in mm) = Multiplier “A” × (stroke + 2 × stroke reserve + value “B”)

Values for multiplier “A” and value “B” ➔ table

Type	Multiplier “A”	Value “B”, depending on the slide type				Pitch “C”
		Standard	L[2)]	S[3)]	XS[4)]	
ELGA-TB-RF-70	1,996	332,3	382,3	254,3	-	3
ELGA-TB-RF-70-...-F1[1)]/-PU2	2,0					
ELGA-TB-RF-80	1,996	442,8	512,8	358,8	314	5
ELGA-TB-RF-80-...-F1[1)]/-PU2	2,0					
ELGA-TB-RF-120	1,996	568,2	683,2	466,2	404	
ELGA-TB-RF-120-...-F1[1)]/-PU2	2,0					

[1)] Feature F1 = PU1 toothed belt

[2)] L = long slide; [3)] S = short slide; [4)] XS = very short slide (not ELGA-70)

Example: **ELGA - TB - RF -** **80** Size **-** **5000** Stroke **-** **30H** Stroke reserve **-** **L** Slide type

L (length of toothed belt in mm) = Multiplier “A” × (stroke + 2 × stroke reserve + value “B”)

L = 1.996 × (5000 + 2 × 30 + 512,8) mm

L = 11.123,31 mm

rounded down to an integer multiple of the pitch “C” (in this example: 5)

L = 11.120 mm

If the toothed belt is not cracked, or if the crack location is underneath the cover strip, it can be replaced with the toothed belt axis installed, as the actuator end caps then do not have to be dismantled (➔ Chapter 4.3.3 on page 19). If the location of the crack is in the actuator end caps or in the bottom part of the cylinder barrel, then the actuator end caps must be dismantled (➔ Chapter 4.4.1 on page 26).

If it is necessary to change the toothed belt, always investigate the cause of the failure in order to prevent premature and repeated failure. A toothed belt axis that has been used as intended and designed correctly will not normally exhibit any premature signs of failure.

This investigation is not necessary in the case of non-premature failure (fatigue time). However, the condition of the toothed belt pulley module (wear of the tooth surface/tooth geometry, radial clearance between bearing inner raceway and the bearing seat: interference fit when new) and also the condition of the deep-groove ball bearings (e.g. perceptible bearing clearance, disrupted, non-smooth rolling behaviour and increased running noise, etc.) should always be evaluated too. In case of uncertainty, we recommend replacing all the components mentioned to rule out reciprocal effects during later operation.

Possible visible signs of wear of the toothed belt:

- Cracks on the back of the toothed belt are signs of wear. For example, these can be caused by operation outside the permitted temperature range, impermissible chemical effects or possibly reaching the end of its fatigue life.
- Wear of the nylon fabric (fabric cover) on the tooth side of the belt. This is indicated by lint and pilling, for example, and constitutes primary wear (abrasion of the fabric).
- Visible individual glass fibre cords in the tooth gullet are secondary signs of wear due to primary wear of the nylon fabric. In this case, the toothed belt pulley module must be examined very carefully for wear, as visible glass fibre cords may have caused severe abrasive damage to the sides of the tooth tip of the toothed belt pulleys.

A description of how to replace the toothed belt pulley module together with the corresponding deep-groove ball bearings can be found in Chapter 4.3.1 on page 16.

If the toothed belt suffers premature failure, the operating conditions should be observed more closely.

The following possibilities should be considered, among other things:

- **Overloading**

  Incorrect set values of the braking ramp for STOP statuses (e.g. EMERGENCY OFF, quick stop) result in overloading of the toothed belt axis and can irreparably damage it or reduce its service life drastically.

  The elasticity of the toothed belt delays the acceleration and braking behaviour of the toothed belt axis and results in greater acceleration and deceleration than set in the controller (spring effect).

  Block-shaped acceleration and deceleration profiles (no jerk limitation) cause high peaks in the drive force that can lead to overloading of the drive. Positions outside of the permissible range can also occur. An acceleration and deceleration specification with jerk limitation reduces oscillations in the entire system and has a positive effect on the stresses to which the mechanical system is subjected.

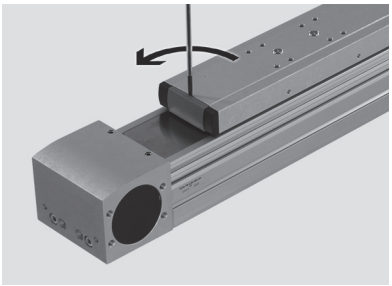
  - Check which closed-loop controller settings can be adjusted (e.g. jerk limitation, smoothing of the acceleration profile).
  - Check the settings for all braking ramps in your controller or the higher-order control system (deceleration values and jerk).
  - Make sure that the deceleration values (braking deceleration, deceleration times) for the speed, the load to be moved and the installation position (horizontal/vertical) as well as the specified maximum drive torque or the feed force correspond to the permissible values for the toothed belt axis used.
  - Use the Festo “PositioningDrives” design software, available via the Festo website (➔ www.festo.com), to design the toothed belt axis.

- **Ambient conditions/material resistance**
  - Check whether the ambient temperature is within the permissible range.
  - Check the chemical and physical ambient conditions for harmful substances, such as dust, abrasive particles, cooling lubricants, solvents, ozone, radiation, water-soluble substances, greases and oils, etc.

4.3.1 Removing the cover strip

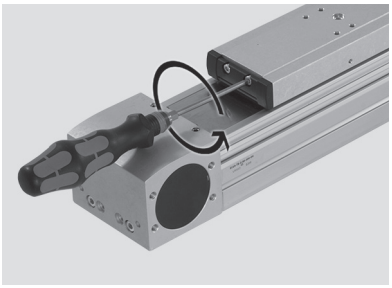
ELGA-TB-RF-...- not F1

1. Lever off the cover at both ends of the slide.



After the covers have been removed, the top belt reversal can come out of the slide when the slide is moved. If this happens, the compression springs of the belt reversal may be lost.

2. Unscrew the socket head screws at both ends of the slide and remove the covers.

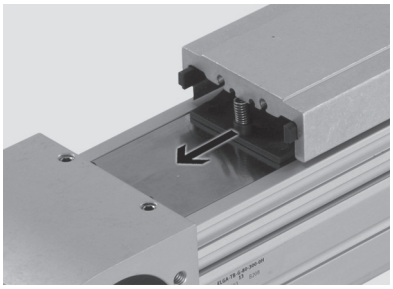


ELGA-TB-RF-...-F1 (PU1 toothed belt)

- Unscrew the socket head screws at both ends of the slide and remove the cover plates.

All variants with cover strip

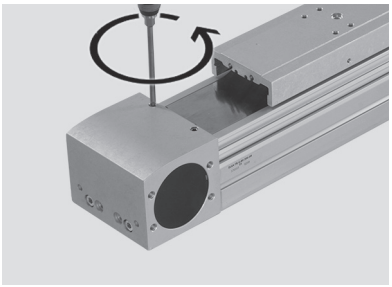
There is no belt reversal on the short and very short slide variant. This work step can therefore be skipped.



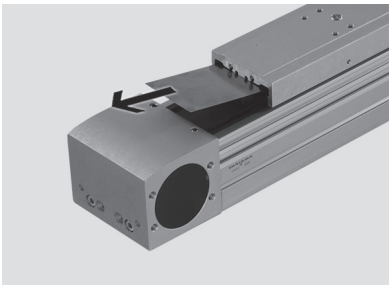
Secure the compression springs against springing out to the side on pulling out the top belt reversal.

– The ELGA-TB-RF-70 / 80 has **one** compression spring mounted on each upper belt reversal.
– The ELGA-TB-RF-120 has **two** compression springs mounted on each upper belt reversal.

1. Pull out the top belt reversals on both sides of the slide.
2. Pull out the top belt reversals on both sides of the slide.
3. Unscrew the grub screws in both actuator end caps.
4. Remove any locking agent residue from the thread.

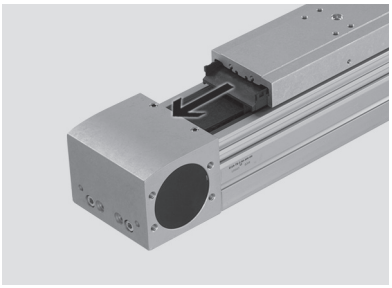


5. Pull the cover strip out of the actuator end caps and slide.



There is no belt reversal on the short and very short slide variant. This work step can therefore be skipped.

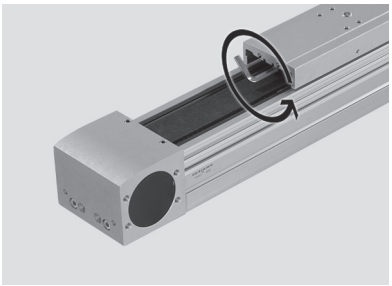
6. Pull out the bottom belt reversals on both sides of the slide.



The short part of an Allen key, e.g. A/F 3 mm, can be used to pull the belt reversal out of the slide.

4.3.2 Removing clamping components

1. Loosen the socket head screws in the clamping components on both sides of the slide and unscrew them.



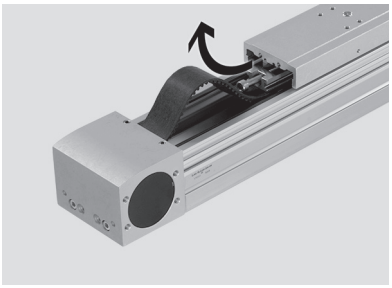
The heads of the socket head screws are filled with threadlocker. This can make it difficult to fully insert an Allen key. Remove the threadlocker, for example, by positioning an Allen key on it and tapping the key gently with a hammer.

The use of threaded inserts with SCREWLOCK makes unscrewing the socket head screws difficult. Screwdriver bits (long type) with an extension piece and ratchet can be used to achieve the appropriate loosening torque.

Note

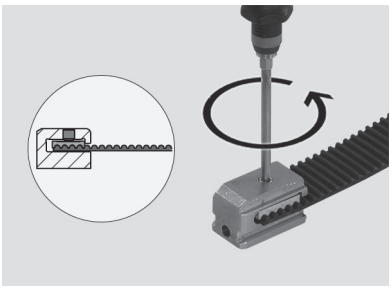
Do not bend or fold the toothed belt, as this can result in damage to the tensile members and shorten its service life by cracking it.

Note the minimum bending radius for assembly and storage. (➔ Chapter 4.3 on page 14)



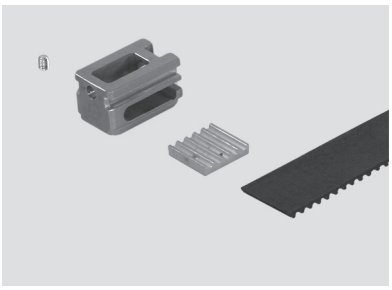
2. Pull the clamping components out of the slide using the toothed belt.

After the grub screw has been loosened, the clamping plate sits loosely in the clamping component and can fall out.



3. Loosen the grub screws in the clamping components at both ends of the toothed belt and unscrew them.
4. Remove any locking agent residue from the thread.

5. Pull the clamping components sideways off the toothed belt.
6. Remove the clamping plates from the toothed belt.

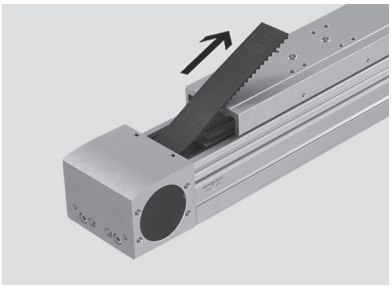


4.3.3 Replacing the toothed belt

Do not pull the old toothed belt out of the axis before you have joined it to the new toothed belt. Otherwise the actuator end caps must be removed.

A description of how to determine the correct toothed belt length can be found in Chapter 4.3.8 on page 24.

1. Use adhesive tape to join the old and new toothed belts at one end.
2. Pull the old toothed belt carefully out of the axis until the new toothed belt is pulled through the axis.
3. Separate the old toothed belt from the new one.



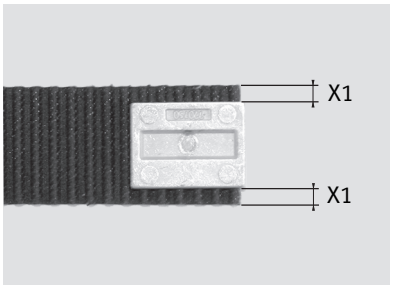
4.3.4 Attaching clamping components

1. Place the clamping plates on the ends of the new toothed belt.

Note

The clamping plate must be positioned centrally widthways on the toothed belt to prevent damage to the toothed belt during operation.

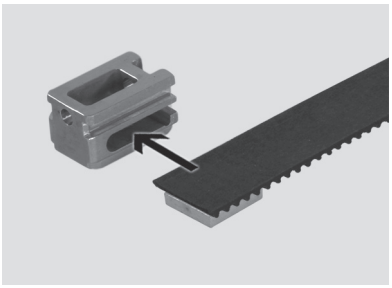
2. Position the clamping plates centrally widthways on the toothed belt.



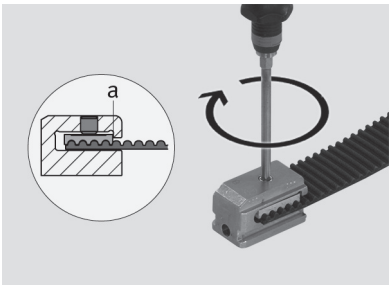
Note

The threads of the clamping components must be recut before the grub screws are screwed in. Residues of the old locking agent in the thread result in non-uniform and increased tightening torques of grub screws, and correct tightening is thus not ensured.

3. Insert the ends of the toothed belt together with the clamping plates into the clamping components.
4. Align the toothed belt widthways with the centre of the clamping body.



5. Wet the grub screws with locking agent screw them into the clamping components.
6. Push the clamping plates against the stop (a) on the clamping component.



Note

The clamping plates must make contact with the stop as otherwise the toothed belt pretension will diminish during operation.

7. Tighten the grub screws to the appropriate torque.

Note

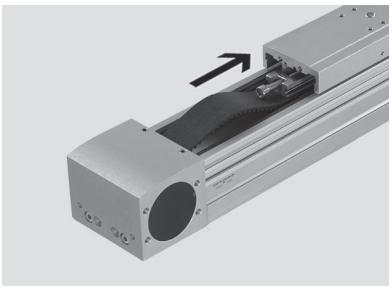
It is critical that the tightening torques be observed. Excessive tightening torques will bend the clamping component.

Type	Tightening torque
ELGA-TB-RF-70-...(-F1)	0.5 Nm
ELGA-TB-RF-80-...(-F1)	4.0 Nm
ELGA-TB-RF-120-...(-F1)	4.0 Nm

Note

Do not bend or fold the toothed belt, as this can result in damage to the tensile members and shorten its service life by cracking it. Note the minimum bending radius for assembly and storage. (➔ Chapter 4.3 on page 14)

8. Insert the clamping components into the slide.



Threaded inserts with SCREWLOCK® are screwed into the slides. These have an incorporated screw-clamping area that serves as a screw lock. Multiple windings have a clamping effect on the edges of the screwed-in adjusting screws for the toothed belt pretension. The result is flexible frictional locking. This stops the adjusting screw from becoming loose and prevents adjustment of the set toothed belt pretension during operation.

Note

The clamping effect can damage the thread profile of the adjusting screw. As such, the use of new adjusting screws for assembly is recommended.

The use of the threaded inserts with SCREWLOCK® and the dynamic load on the adjusting screw call for the use of only original spare parts from Festo with the appropriate strength class. Otherwise, the screws can break prematurely.

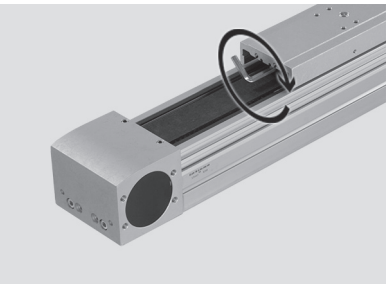
The Clamping parts must not touch the slide when they are being screwed in as otherwise the toothed belt could become overstretched and the service life of the toothed belt would be reduced. Slowly increase the toothed belt pretension up to the correct value.

If the toothed belt is cut to the correct length, the clamping components should be at least flush with the cut-out in the slide.

If the clamping components protrude, the socket head screws will not reach the minimum length of engagement and could be pulled out. In addition, the belt reversal cannot be correctly mounted.

Set the toothed belt pretension as described in Chapter 4.3.7 on page 24.

9. Insert the socket head screw into the clamping component and screw it a few turns into the slide.
10. Repeat the steps at the other end of the axis to insert the second clamping component.
11. Screw the socket head screws uniformly through the clamping components and into the slide.
12. Pretension the toothed belt by uniformly tightening the socket head screws by feel.



4.3.5 General information on the toothed belt pretension

A pulse is applied to the toothed belt to make it oscillate. The resulting natural frequency of the toothed belt is recorded using a measuring device and displayed as a frequency value in hertz.

Note

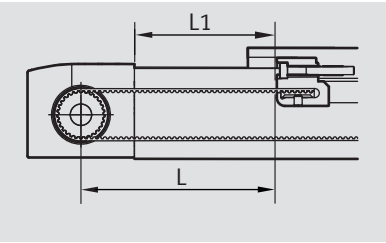
Correct toothed belt pretension is essential for the service life of the toothed belt as well as the positioning accuracy and operating performance of the toothed belt axis. The toothed belt pretension must therefore be checked extremely carefully.

A conventional method for measuring the toothed belt pretension using the deflection force is too inaccurate, and therefore cannot be used. Accurate results are achieved by measuring the oscillation frequency. The natural frequency of a belt is based on its tension (strand force), mass and strand length.

The strand length is the oscillating length of a belt.

As the freely oscillating strand length (L) cannot be measured directly, the distance between the clamping component and one of the actuator end caps (L1) is set alternatively by moving the slide.

The toothed belt pretension is therefore determined by measuring the fundamental component (natural frequency) of the toothed belt with a fixed and freely oscillating strand length (L).



The frequency value is calculated using the specified values for strand force (pretension force), belt mass and length of the free belt strand according to the following formula:

$$f = \frac{1}{2 \cdot L} \cdot \sqrt{\frac{F_V}{m}}$$

f	Natural frequency of the freely oscillating strand [Hz]
L	Strand length [m]
F_v	Pretension force (N)
m	Weight per metre of the toothed belt [kg / m]

The frequency that needs to be set can be calculated using the data from the following table:

Type	Weight per metre m	Freely oscillating strand length L	Pretension force F_v
ELGA-TB-RF-70	0,0459 kg / m	30 mm + L1[2)]	358 - 390 N
ELGA-TB-RF-70-...-F1[1)]	0,0567 kg / m	30 mm + L1[2)]	357 - 393 N
ELGA-TB-RF-70-PU2	0,0567 kg / m	30 mm + L1[2)]	357 - 393 N
ELGA-TB-RF-80	0,1140 kg / m	34 mm + L1[2)]	809 - 885 N
ELGA-TB-RF-80-...-F1[1)]	0,1384 kg / m	34 mm + L1[2)]	823 - 908 N
ELGA-TB-RF-80-PU2	0,1384 kg / m	34 mm + L1[2)]	823 - 908 N
ELGA-TB-RF-120	0,1500 kg / m	50 mm + L1[2)]	1321 - 1438 N
ELGA-TB-RF-120-...-F1[1)]	0,1917 kg / m	50 mm + L1[2)]	1341 - 1475 N
ELGA-TB-RF-120-PU2	0,1917 kg / m	50 mm + L1[2)]	1341 - 1475 N

[1)] Feature F1 = PU1 toothed belt

[2)] ➔ Chapter 4.3.1 on page 16.

Note on measurement using the acoustic frequency measuring device:

If the toothed belt is excited by means of a force pulse, the strand oscillates with its natural frequency; this decays more or less quickly depending on damping.

The frequency measuring device measures the natural frequency generated (transverse oscillation) using the acoustic operating principle. In addition to the fundamental frequency (natural frequency), harmonics can also occur. From experience it is always the 1st harmonic. In other words, a further node is generated and therefore, in addition to the fundamental frequency, values that are twice the natural frequency can also be measured.

For this reason, several measurements should always be taken in order to differentiate between the necessary fundamental (natural frequency) and the harmonic. Only this frequency can be used to conclude the force acting in the strand.

4.3.6 Checking the toothed belt pretension

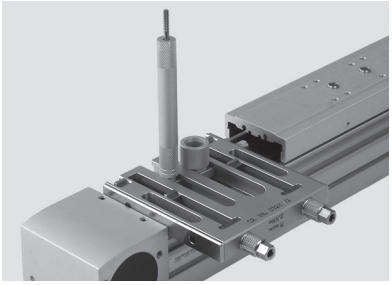
Before the toothed belt pretension can be measured, the slide must be moved back and forth several times so that the toothed belt can fully settle and differences in tension can be levelled out.

The easiest way to check the toothed belt pretension is to use a test device. (➔ Chapter 6.3 on page 44)

Measuring the toothed belt pretension using a test device

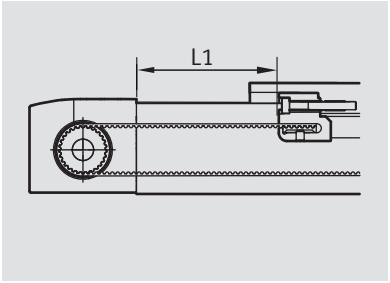
If the toothed belt pretension is to be measured using one of the test devices (➔ Chapter 6.3 on page 44), the distance between the actuator end cap and clamping components does not have to be set. The correct strand length is achieved using the supplied spacers.

The exact procedures for checking the toothed belt pretension are given in the operating instructions **“Test device for toothed belt pretension TB-TE-EQ12”** (➔ TB-TE-EQ12_en.pdf) or **“Test device for toothed belt pretension TB-TE-EQ02”** (➔ TB-TE-EQ02_en.pdf).



Measuring the toothed belt pretension without a test device

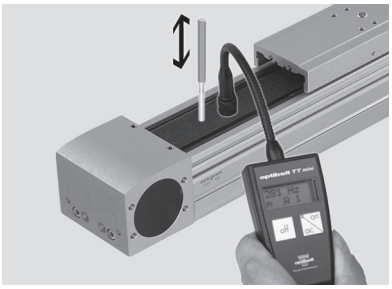
1. Set the distance between the actuator end cap and clamping component (L1) as given in the table.



Type	Distance L1
ELGA-TB-RF-70-...(-F1)	290 mm / 70 mm[1]
ELGA-TB-RF-80-...(-F1)	290 mm / 70 mm[1]
ELGA-TB-RF-120-...(-F1)	290 mm / 70 mm[1]

[1] Alternatives for toothed belt axes with short strokes

2. Align the acoustic frequency measuring device towards the centre of the toothed belt as described in the corresponding operating instructions.
3. Make the toothed belt oscillate by hitting it, for example, with an Allen key or punch.



Several measurements should be taken to compensate for measurement tolerances.

The belt must be able to oscillate freely.

4. Compare the measurement with the specified value (➔ table).

For strokes ≥290mm

Type	Minimum frequency (f)	Maximum frequency (f)
ELGA-TB-RF-70	138 Hz	144 Hz
ELGA-TB-RF-70-...-F1[1]	124 Hz	130 Hz
ELGA-TB-RF-70-PU2	124 Hz	130 Hz
ELGA-TB-RF-80	130 Hz	136 Hz
ELGA-TB-RF-80-...-F1[1]	119 Hz	125 Hz
ELGA-TB-RF-80-PU2	119 Hz	125 Hz
ELGA-TB-RF-120	138 Hz	144 Hz
ELGA-TB-RF-120-...-F1[1]	123 Hz	129 Hz
ELGA-TB-RF-120-PU1	123 Hz	129 Hz

[1] Feature F1 = PU1 toothed belt

For short strokes ‹290mm

Type	Minimum frequency (f)	Maximum frequency (f)
ELGA-TB-RF-70	441 Hz	453 Hz
ELGA-TB-RF-70-...-F1[1]	397 Hz	409 Hz
ELGA-TB-RF-70-PU2	397 Hz	409 Hz
ELGA-TB-RF-80	407 Hz	419 Hz
ELGA-TB-RF-80-...-F1[1]	370 Hz	382 Hz
ELGA-TB-RF-80-PU2	370 Hz	382 Hz
ELGA-TB-RF-120	392 Hz	402 Hz
ELGA-TB-RF-120-...-F1[1]	348 Hz	358 Hz
ELGA-TB-RF-120-PU1	348 Hz	358 Hz

[1] Feature F1 = PU1 toothed belt

4.3.7 Setting the toothed belt pretension

Note

The pretension of the toothed belt is not an indicator of wear!

The values specified here are relate to a new toothed belt.

The toothed belt is set to the specified value in the factory, and is thus maintenance-free for its entire service life.

The pretension of the toothed belt reduces due to storage time and operation. This is not an indication of wear; it is a normal process that must not be changed by retensioning the toothed belt.

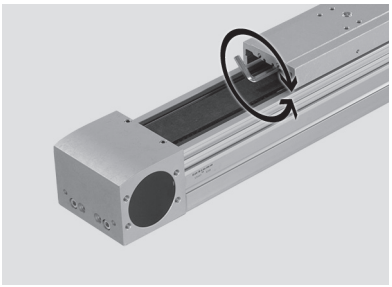
The toothed belt pretension must therefore only be set after renewing the toothed belt.

The socket head screws must be screwed in at least far enough that the clamping components are flush with the cut-outs in the slide.

If both clamping components are touching the inside of the slide but the measured frequency is still below the setpoint frequency, the toothed belt must be shortened by one tooth on one side. Sturdy general purpose scissors or metal shears are best for cutting the toothed belt. This process must be repeated until the setpoint frequency can be set.

If the measured natural frequency of the toothed belt is outside the specified range, the toothed belt pretension must be adjusted as follows:

1. Adjust the toothed belt pretension by turning the socket head screws.
2. Before you measure the toothed belt pretension again, the slide must be moved back and forth a number of times so that the toothed belt can fully settle and differences in tension are equalised.



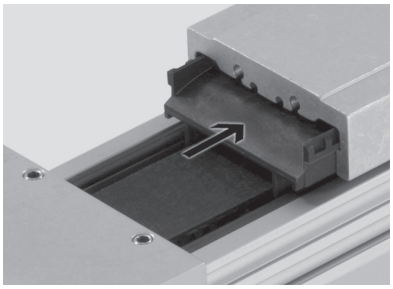
Turning the socket head screw clockwise increases the tension of the toothed belt, and thus its oscillation frequency.

Turning the socket head screw anticlockwise decreases the tension of the toothed belt, and thus its oscillation frequency.

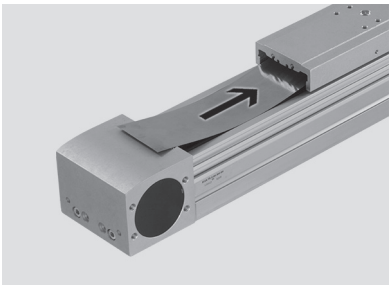
4.3.8 Installing the cover strip

There is no belt reversal on the short and very short slide variant. This work step can therefore be skipped.

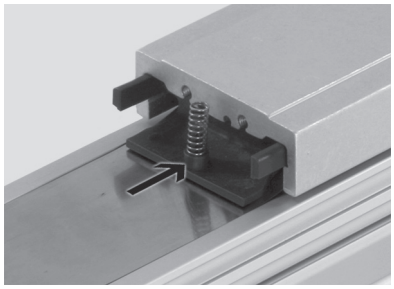
1. Place the bottom belt reversals in the correct position on both sides of the slide.



2. Guide the cover strip through the slide over the belt reversals.



There is no belt reversal on the short and very short slide variant. This work step can therefore be skipped.

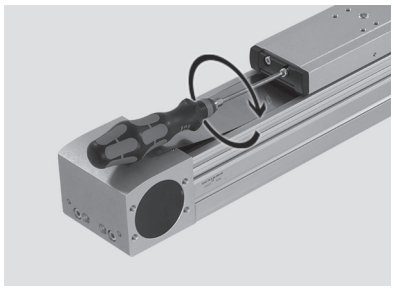


At the top belt reversals:

– the ELGA-TB-RF-70 / 80 has **one** compression spring mounted on each.
– the ELGA-TB-RF-120 has **two** compression springs mounted on each.

3. Insert the top band reversals together with the compression springs on both sides of the slide.

ELGA-TB-RF-...- not F1



1. Place the cover on both sides of the slide.
2. Wet the socket head screws for the cover with locking agent.
3. Screw the socket head screws into the slide through the cover on both sides of the slide and tighten using the appropriate torque. (see table).

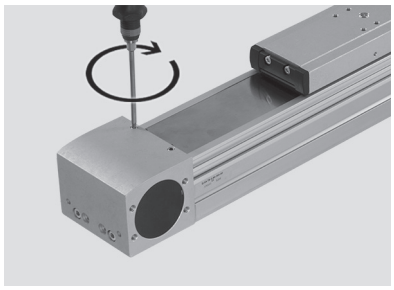
Type	Tightening torque
ELGA-TB-RF-70	1.2 Nm
ELGA-TB-RF-80	1.2 Nm
ELGA-TB-RF-120	2.0 Nm

ELGA-TB-RF-...-F1 (PU1 toothed belt)

1. Position the cover plates on both sides of the slide.
2. Screw the socket head screws through the cover plate and into the slide on both sides of the slide and tighten using the appropriate tightening torque. (see table).

Type	Tightening torque
ELGA-TB-RF-70-...-F1	1.2 Nm
ELGA-TB-RF-80-...-F1	1.2 Nm
ELGA-TB-RF-120-...-F1	2.0 Nm

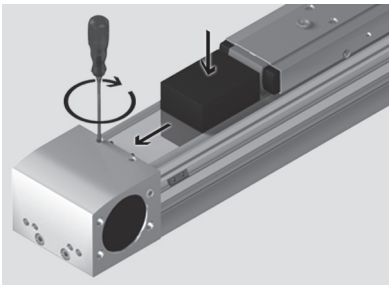
All variants with cover strip



4. Push the cover strip into the slots of the two actuator end caps.
5. Screw the grub screws into the right-hand actuator end cap and tighten them to the appropriate tightening torque (see table).

Type	Tightening torque
ELGA-TB-RF-70-...(-F1)	2.0 Nm
ELGA-TB-RF-80-...(-F1)	2.0 Nm
ELGA-TB-RF-120-...(-F1)	2.0 Nm

6. Screw grub screws loosely into the left-hand actuator end cap - do not tighten yet. The cover strip must not be fixed in place.
7. Select suitable clamping element depending on the axis size (➔ table and Chapter 6.2 on page 43).

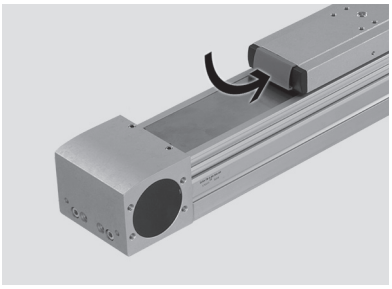


Type	Clamping element
ELGA-TB-RF-70-...(-F1)	EADT-S-L5-70 (use lengthwise)
ELGA-TB-RF-80-...(-F1)	EADT-S-L5-70 (use crosswise)
ELGA-TB-RF-120-...(-F1)	EADT-S-L5-120 (use lengthwise)

8. Place the clamping element on the cover strip.
9. Press the clamping element onto the cover strip and at the same time push the cover strip into the slot in the actuator end cap.
10. Tighten the grub screws to the appropriate tightening torque (see table).

Type	Tightening torque
ELGA-TB-RF-70-...(-F1)	2.0 Nm
ELGA-TB-RF-80-...(-F1)	2.0 Nm
ELGA-TB-RF-120-...(-F1)	2.0 Nm

11. Check whether the cover strip is firmly in place by moving the slide. If the cover strip ripples, it must be pushed further into the actuator end caps.
12. Clip the cover caps onto the covers on both ends of the slide.



This step is omitted for the ELGA-TB-RF-...-**F1** (PU1 toothed belt).

4.4 Dismantling the toothed belt axis

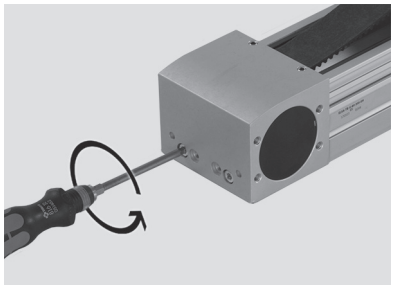
The toothed belt axis ELGA-TB-RF-... is made up of the following modules:

– Cylinder barrel with integrated slide guide and bonded-on magnetic strip for attaching the cover strip.
– Actuator end cap with toothed belt pulley and drive as well as clamp for the cover strip.
– Slide with roller bearing guide and cover strip guide, driven by clamping components on the toothed belt.
– Incremental displacement encoder for checking the slide position in relation to the cylinder barrel (optional).

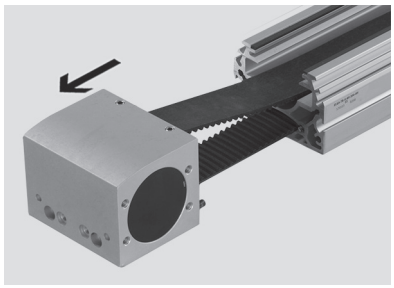
4.4.1 Removing the actuator end caps

The steps described in Chapter 4.3.1 on page 16 and Chapter 4.3.2 on page 18 must be carried out before dismantling the actuator end caps.

1. Loosen the socket head screws in the two actuator end caps and unscrew them.



The actuator end caps are connected to the cylinder barrel by spring pins. A certain amount of force is required to pull them off.

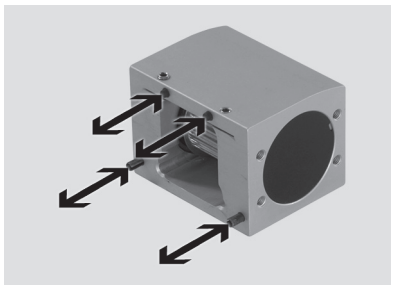


2. Pull the actuator end caps off the cylinder barrel.
3. Pull the toothed belt out of the cylinder barrel.

4.4.2 Repairing the actuator end caps

Spring pins and elastomer buffers

- The spring pins and elastomer buffers are inserted into the actuator end caps. However, the spring pins may also be located in the cylinder barrel after dismantling the actuator end caps. Pull out the parts and replace them.

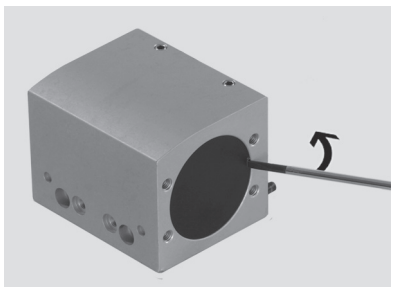


Toothed belt pulley assembly

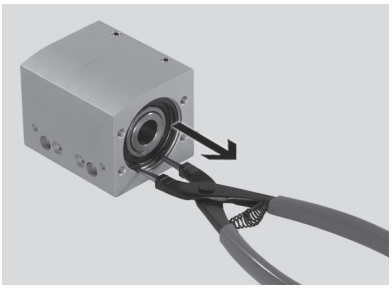
The toothed belt pulley module sits with clearance fit of the actuator end cap with two pressed-on deep-groove ball bearings, and is clamped axially by a retaining ring.

Removing the toothed belt pulley module

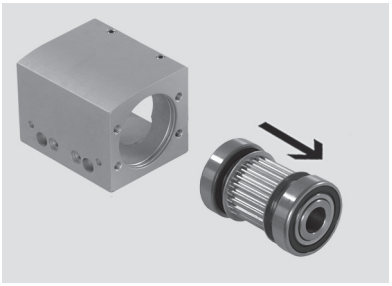
1. Lever the sealing discs, if present, out of the actuator end cap.



2. Remove the retaining ring.



3. Push the toothed belt pulley module with the two deep-groove ball bearings out of the actuator end cap.
4. Clean the components by removing any abraded particles.

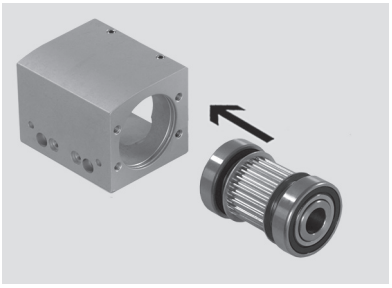


You do not need to pull off the deep-groove ball bearings, as the spare part includes both bearings and the shaft.

5. Check the inner raceways of the deep-groove ball bearings for secure fit on the toothed belt pulley module. If a bearing does not fit tightly, replace the module.
6. Check the tooth geometry for damage. If there is any damage, replace the module.

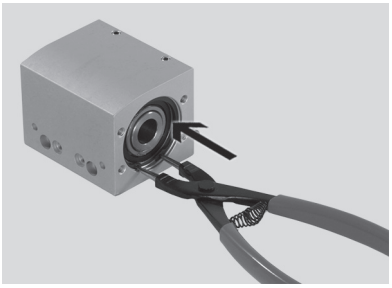
Installing the toothed belt pulley module

7. Apply a light coating of grease to the outside of the deep-groove ball bearings.
8. Push the toothed belt pulley module into the actuator end cap.



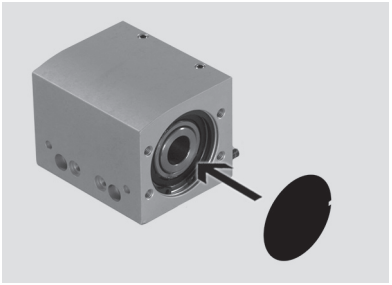
If necessary, use a plastic hammer to carefully drive it into the actuator end cap.

9. Insert the retaining ring.



Check that the retaining ring is positioned correctly.

10. Insert the sealing discs into the actuator end cap so that the deep-groove ball bearings have extra protection against contamination.

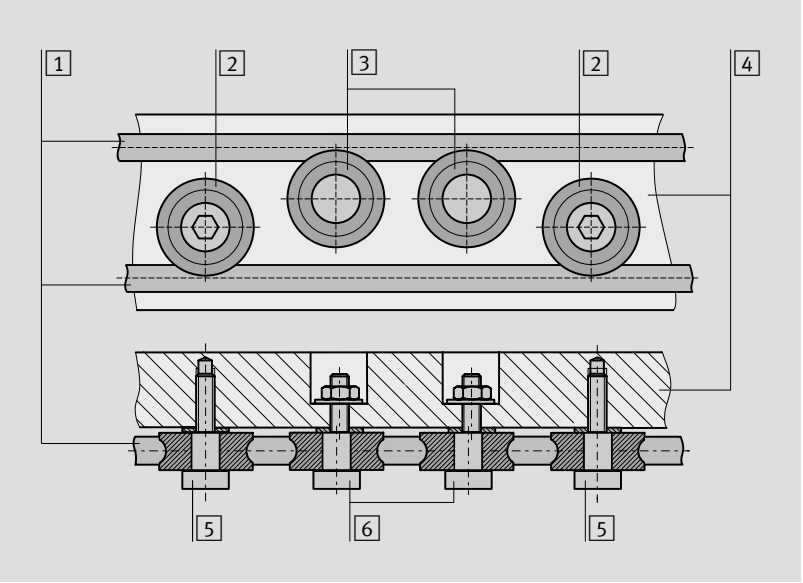


4.5 Track roller guiding system

The track roller guiding system consists of two guide rods, also called intermediate shafts, and four profiled track rollers (roller bearings). The two guide rods are surface-hardened and are roller burnished with positive locking in the cylinder barrel. This means that it is not technically possible to replace the guide rods. If a defect occurs in the guide rods, the entire toothed belt axis must be replaced.

The guiding system has negative operating clearance, i.e. it is pretensioned and therefore has no mechanical play. This results in a load bearing capacity in all system directions, as well as more precise guiding. The guiding system is adjusted without backlash and pretensioned at two of the four roller bearings using eccentric cams. The specified pretension is achieved via an adjustment torque on the two eccentric cams.

Felt scrapers fastened to both of the outer roller bearings are used to lubricate the bearing surface of the outer ring of the roller bearings and the guide rods. These are impregnated with oil and their semicircular profiles press against the guide rods (➔ Chapter 5.2 on page 41). This lubricates the guide rods and wipes off any contamination.



1 Guide rods
2 Non-adjustable track rollers
3 Adjustable track rollers
4 Slide
5 Fitting bolts
6 Eccentric cam

Festo recommends that the entire drive always be replaced if a defect occurs in the profiled track roller guide.
Replacement of the roller bearings is undertaken by users at their own risk.

Replacement of the toothed belt axis may be necessary under the following circumstances, for example:

The end of the profile track roller guide's useful life has been reached as a result of material fatigue and wear. Signs of fatigue appear on the areas of material that are rolled over. Fine cracks, pores and pits (depending on the wear condition) appear on the bearing surfaces. There is visible pitting on the bearing surfaces of the guide rods and the roller bearings or the bearing surface is noticeably uneven. This can result in perceptible bearing clearance, impaired rolling and increased operating noise, etc.

The application must be checked for the following causes in the event of premature failure due to increased wear:

- Poor lubrication; lubrication intervals not adhered to (unlubricated operation).
- Using an oil not included in the specification.
- Dirty and corrosive ambient conditions (dust, etc.).
- Impact and vibration.
- Technical limit data exceeded (torques, forces, speed, temperature range, etc.)
- Flatness of the attachments screwed onto the slide, setpoint value < 0.01 mm (strain).

Note

Incorrect set values of the braking ramp for STOP statuses (e.g. EMERGENCY OFF, quick stop) result in overloading of the toothed belt axis and can irreparably damage it or reduce its service life drastically.

- Check the settings for all braking ramps in your controller or the higher-order control system (deceleration values and jerk).
- Make sure that the deceleration values (braking deceleration, deceleration times) for the speed, the load to be moved and the installation position (horizontal/vertical) as well as the specified maximum drive torque or the feed force correspond to the permissible values for the toothed belt axis used.
- Use the Festo “PositioningDrives” design software, available via the Festo website (➔ www.festo.com), to design the toothed belt axis.

Block-shaped acceleration profiles (without jerk limitation) cause high peaks in the drive force that can lead to overloading of the drive. Positions outside of the permissible range can also occur.

An acceleration specification with jerk limitation reduces vibrations in the entire system and has a positive effect on the stresses in the mechanical system.

- Check which closed-loop controller settings can be adjusted (e.g. jerk limitation, smoothing of the acceleration profile).

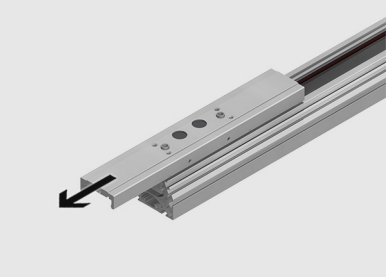
The track rollers should at least be replaced in pairs, but it is best to replace all four track rollers at the same time.

Before replacing the track rollers, check the guide rails for damage. Defective guide rails cannot be replaced.

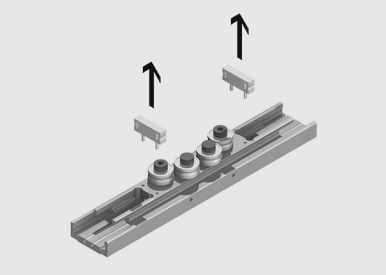
4.5.1 Replacing the track rollers

An actuator end cap must be removed to renew the track rollers. Carry out the steps described for dismantling actuator end cap.

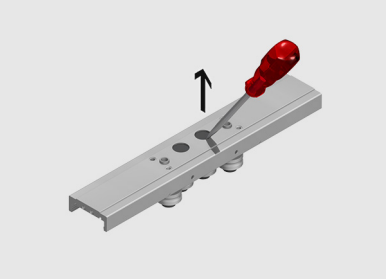
1. Push the slide out of the axis.



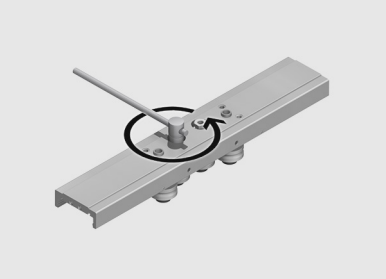
2. Remove both oil scrapers.



3. Lever both covers out of the slide.



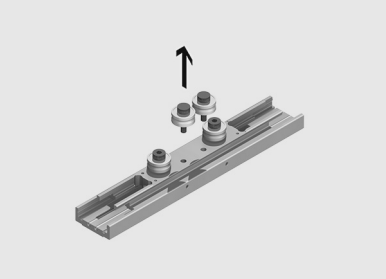
4. Loosen the two hex nuts and unscrew them.



You may need to hold the eccentric screw from underneath. Alternatively, you can use an Allen socket and a socket with a milled spanner flat. (➔ Chapter 6.1 on page 42 and Chapter 6.3 on page 44)

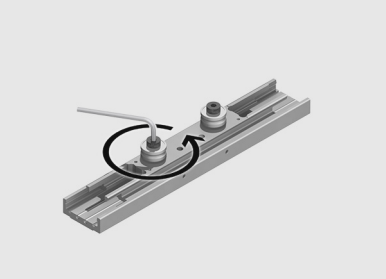
5. Remove the washers from the hole.

6. Pull the eccentric cams with the track rollers out of the slide holes.



7. Remove the shims and track rollers from the eccentric cams.

8. Unscrew both fitting bolts.



9. Remove the shims and track rollers from the fitting bolts.
10. Clean the fitting holes in the slide and the eccentric cams.

The eccentric cams must be easy to turn in the fitting holes in the slide so that the adjustment torque is not distorted when setting the roller pretension.

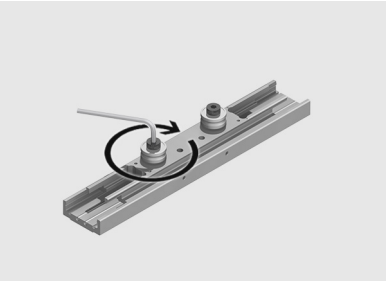
Do **not** mix up the shims and washers.

It is not necessary to ensure specific mounting orientation as the track rollers are symmetrical.

11. Push the new track rollers and then the shims onto the fitting bolts.

12. Wet the fitting bolts with locking agent and screw them into the slide.
13. Tighten the fitting bolts to the appropriate tightening torque.

Type	Tightening torque
ELGA-TB-RF-70-...(-F1)	9.9 Nm
ELGA-TB-RF-80-...(-F1)	24 Nm
ELGA-TB-RF-120-...(-F1)	80 Nm

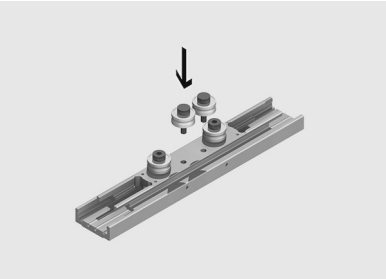


Do **not** mix up the shims and washers.

It is not necessary to ensure specific mounting orientation as the track rollers are symmetrical.

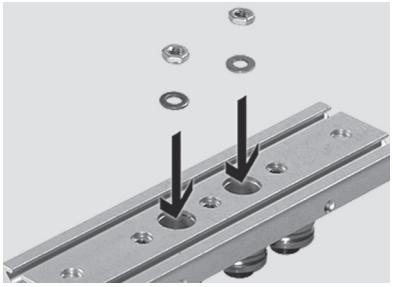
14. Push the new track rollers followed by the shims onto the eccentric cams.

15. Insert the eccentric cams into the fitting holes in the slide.

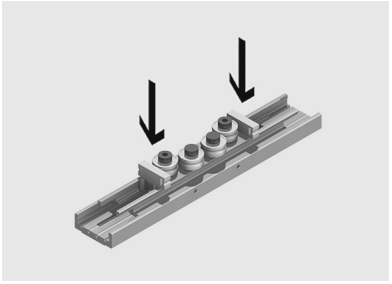


Wet the eccentric cam with locking agent. This is done just before the roller pretension is set.

16. Place the washer and hex nut on the eccentric cams and hand tighten the hex nut.



17. Press the scrapers onto the outer track rollers.

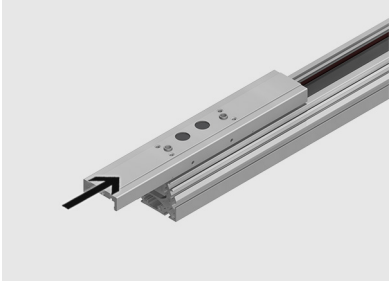


Note

The oil-soaked scrapers are important for the running performance of the roller bearing guide, and must not be omitted. Without them, the wear on the roller guide will be increased and the toothed belt axis will suffer premature failure. Impregnate the scrapers with oil as in Chapter 5.2 on page 41.

18. Clean the cylinder barrel and guide rails with compressed air and a cloth.

19. Carefully push the slide onto the guide rails in the cylinder barrel.



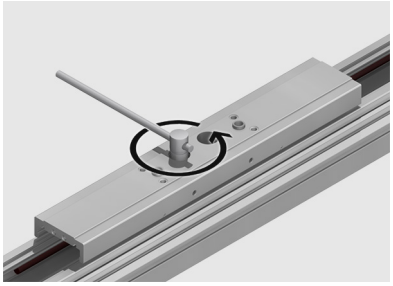
4.5.2 Setting the track rollers

The roller bearings must be set using the eccentric cams so that the displacement resistance for the slide is as low as possible and it can move without backlash.

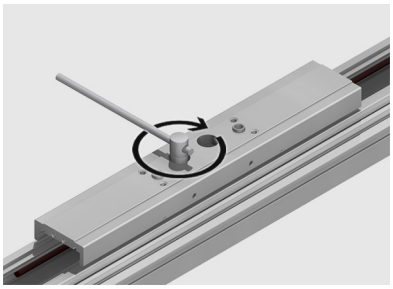
The track roller pretension is set using the two inner track rollers via eccentric cams. It requires a high degree of mechanical awareness.

The setting is made set without the toothed belt attached.

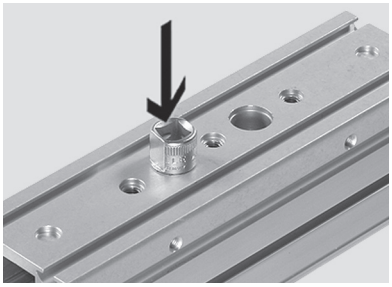
1. Unscrew the hex nuts of the eccentric cams and wet with locking agent.



2. Screw back in the hex nuts of the eccentric cams, but do not tighten them yet.



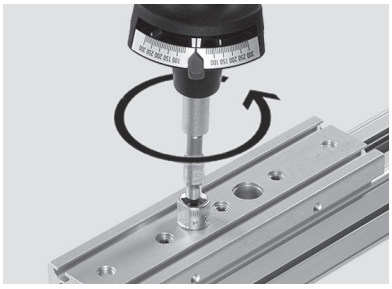
The two track rollers are set one after the other.



3. Place the socket with the milled spanner flat on the hex nut. (➔ Chapter 6.3 on page 44)

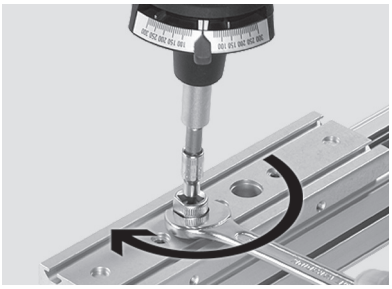
4. Place the Allen socket through the socket on the eccentric cams.
5. Pretension the eccentric cams to the relevant tightening torque by turning anticlockwise using a torque wrench with scale pointer.

Type	Tightening torque
ELGA-TB-RF-70-...(-F1)	0.5 Nm
ELGA-TB-RF-80-...(-F1)	2 Nm
ELGA-TB-RF-120-...(-F1)	5 Nm



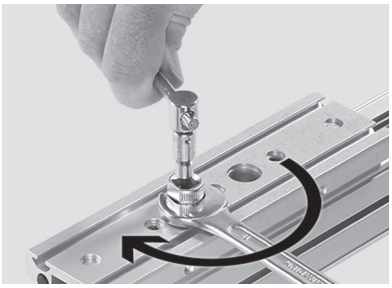
6. Tighten the hex nuts slightly so that the pretension of the eccentric cam is maintained.

The pretension is changed if the hex nuts are overtightened.



7. Place a rigid Allen key in the eccentric cam and hold it in position.
8. Tighten the hex nuts to the appropriate torque.

Type	Tightening torque
ELGA-TB-RF-70-...(-F1)	2.9 Nm
ELGA-TB-RF-80-...(-F1)	20 Nm
ELGA-TB-RF-120-...(-F1)	40 Nm



9. Repeat the setting process on the second track roller.
10. Check the pretension setting by measuring the displacement force of the slide. (➔ Chapter 4.5.3 on page 35)

4.5.3 Measuring the displacement force of the slide

The displacement force is measured across the entire stroke without the toothed belt attached.

1. Check the guide backlash and the displacement force by moving the slide a number of times. The displacement force should remain between the minimum value of 5 N and the maximum value of 12 N.
2. The slide must move on the guide rail uniformly and without jerking.

The displacement force can be determined using an electronic, hand-held force-measuring device (compression and tensile force meter).

The mechanical sensitivity of the user is key when setting the linear guide. Poor operating behaviour manifests itself through operating noise. Excessive pretensioning manifests itself through harsh, increased operating noise.

3. If necessary, adjust the track roller pretension until the operating behaviour is perfect. (➔ Chapter 4.5.2 on page 33)

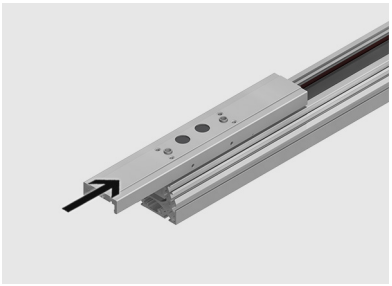
4.6 Assembling the toothed belt axis

4.6.1 Preparing the cylinder barrel

- Clean the cylinder barrel with compressed air and a soft cloth.

4.6.2 Inserting the slide

- Push the slide carefully into the cylinder barrel.



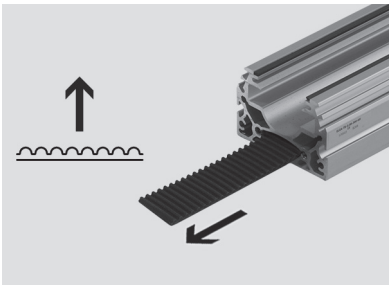
4.6.3 Installing the actuator end caps

Note

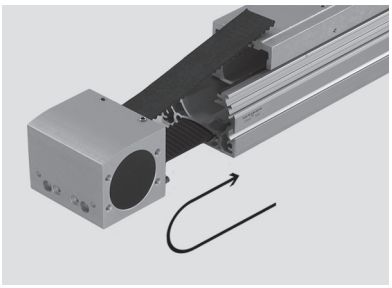
Do not bend or fold the toothed belt, as this can result in damage to the tensile members and shorten its service life by cracking it.

Note the minimum bending radius for assembly and storage (➔ Chapter 4.3 on page 14).

1. Guide the toothed belt through the toothed belt guide in the cylinder barrel as shown. The toothed profile must be facing upwards.

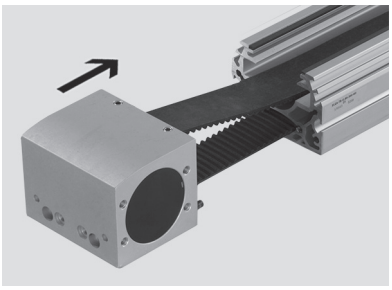


2. Guide the ends of the toothed belt through both of the prepared actuator end caps as shown.



The actuator end cap is centred by means of two spring pins. A certain amount of force may need to be applied for assembly.

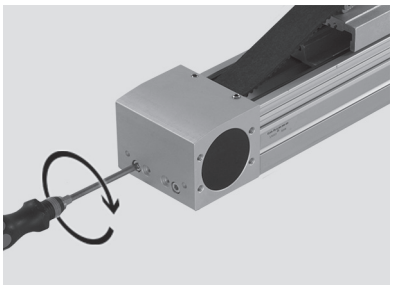
3. Place the two actuator end caps on the cylinder barrel and press them against the cylinder barrel.



If necessary, tap the actuator end caps gently with a plastic hammer to insert the spring pins into the drill holes.

4. Wet the socket head screws with locking agent and screw them through the actuator end cap and into the cylinder barrel.
5. Tighten the socket head screws to the appropriate torque.

Type	Tightening torque
ELGA-TB-RF-70-...(-F1)	2.5 Nm
ELGA-TB-RF-80-...(-F1)	5 Nm
ELGA-TB-RF-120-...(-F1)	11 Nm



4.6.4 Attaching clamping components

➔ Chapter 4.3.4 on page 19.

4.6.5 Checking and adjusting the toothed belt presstressing

➔ Chapter 4.3.6 on page 22 and Chapter 4.3.7 on page 24.

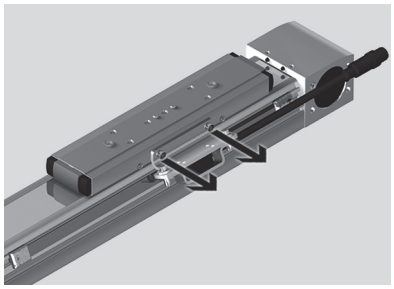
4.6.6 Installing the cover strip

➔ Chapter 4.3.8 on page 24.

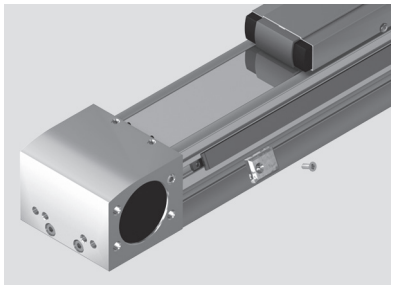
4.7 Replacing the measuring tape of the incremental displacement encoder

4.7.1 Remove the old measuring tape

1. Dismantle the sensor bracket the measuring unit.



2. Unscrew the countersunk screws of the caps at both ends of the magnetic strip.
3. Remove the caps.



4. Remove the measuring tape carefully from the cylinder barrel, do **not** use any sharp-edged auxiliary means.
5. Clean the cylinder barrel to remove adhesive residues.

Festo recommends LOCTITE 7063 and LOCTITE 7070 for cleaning.

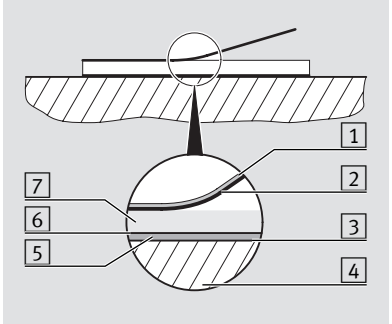
4.7.2 Sticking on the new measuring tape

Note

To prevent stresses in the magnetic strip, it must not be pinned, twisted or supported or handled with the magnetised plastic strip facing inwards (min. radius of curvature 150 mm).

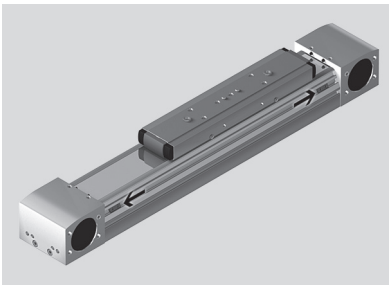
When sticking on the magnetic strip note the markings on the magnetic strip and on the sensor head. Incorrect assembly produces incorrect values. A magnetic strip that is already stuck on is irreparably damaged on removal and cannot be reused.

Structure of the measuring tape

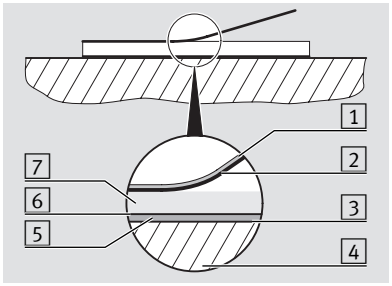


1 Cover strip
2 Adhesive tape
3 Adhesive tape
4 Cylinder barrel
5 Steel strip
6 Adhesive tape
7 Magnetic strip
5, 6 and 7 are connected to each other in the factory

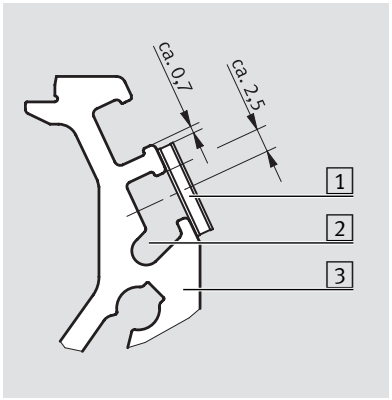
1. Push the slot nuts onto the two actuator end caps.



The magnetic strip [7] is joined with a steel strip [5] and adhesive tape [3] (= carrier side) in the factory.



2. Adjust the magnetic strip with the steel strip [1] so that it is centred with the middle of the cylinder barrel. A distance of 20 mm from each actuator end cap must be maintained.
3. Stick the magnetic strip with the steel strip [1] over the slot [2] on the cylinder barrel [3].

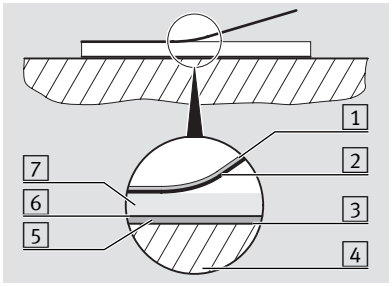


The easiest way is to stick on the magnetic strip in two steps:

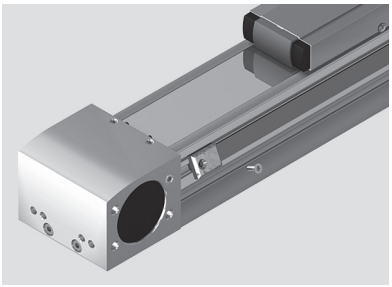
1. Remove half the protective film of the adhesive film.
2. Stick on the magnetic strip corresponding to the removed film.
3. Remove the remaining length of protective film from the adhesive film.
4. Stick on the whole length of magnetic strip.

The cover strip [1] is joined with a adhesive tape [2] in the factory.

4. Stick the cover strip [1] with adhesive tape [2] onto the magnetic strip [7].

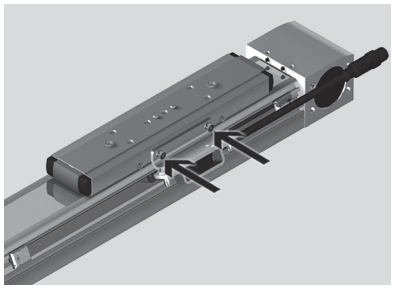


5. Place the caps on both ends of the measuring tape. A distance of 5 mm from each actuator end cap must be maintained.
6. Wet the countersunk screws locking agent.
7. Screw countersunk screws through the caps and into the slot nuts and tighten with a tightening torque of 0.15 Nm.



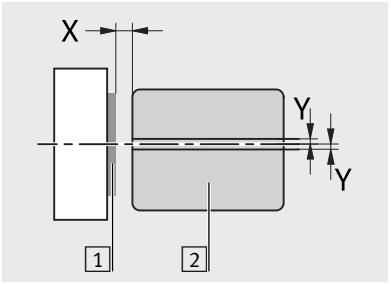
8. Use two cheesehead screws to screw the sensor bracket with measuring unit on to the slide and tighten with the appropriate tightening torque.

Type	Tightening torque
ELGA-TB-RF-70	5 Nm
ELGA-TB-RF-80	5 Nm
ELGA-TB-RF-120	5.9 Nm

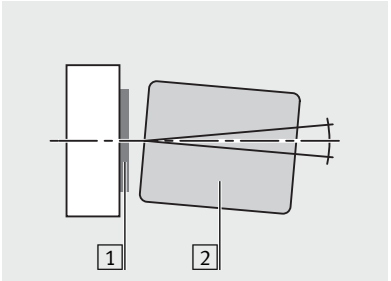


9. To obtain precise position information, the measuring unit must comply with the tolerances listed in the following for the distance and angle between the measuring unit and the measuring tape:

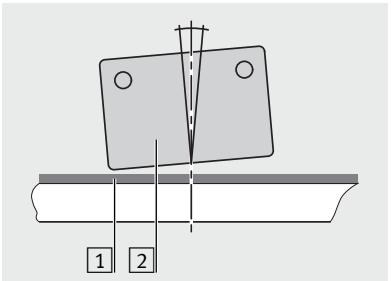
– The measuring unit [2] must be set on attachment with a distance **X** of 0.1 mm to 2 mm from the magnetic strip [1].
– The offset between the measuring unit and the horizontal middle axis of the magnetic strip [1] must not exceed Y = 2.5 mm.



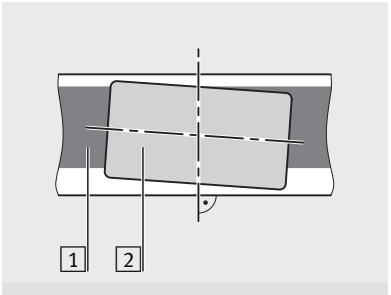
– The inclination between the measuring unit [2] and the magnetic strip [1] must not exceed ±5°.



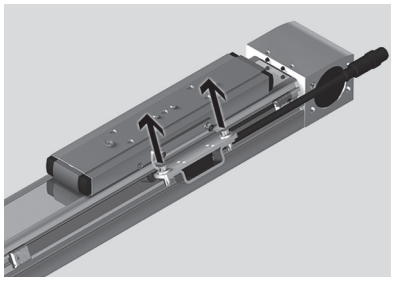
– The deviation in the parallelism between the measuring unit [2] and the magnetic strip [1] must not exceed ±5°.



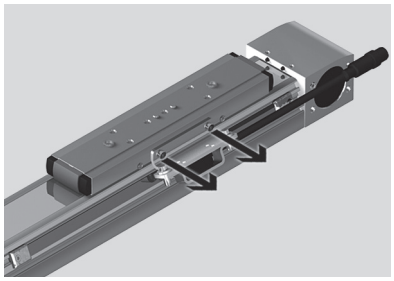
– The deviation in the parallelism between the measuring unit [2] and the magnetic strip [1] must not exceed ± 1.5°.



10. If these tolerances are not complied with, the measuring unit must be readjusted.
11. Undo the cheesehead screws of the sensor mounting.
12. Align measuring unit correctly.

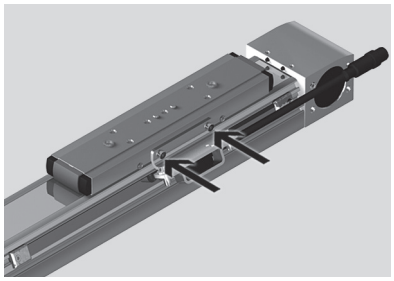


13. Undo the cheesehead screws of the sensor bracket.
14. Align measuring unit correctly.

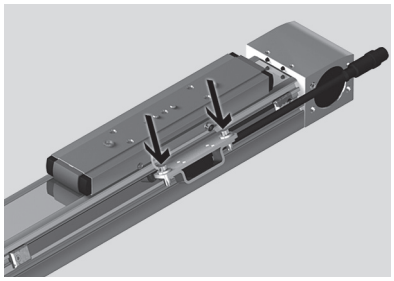


15. Use two cheesehead screws to screw the sensor bracket with measuring unit on to the slide and tighten with the appropriate tightening torque.

Type	Tightening torque
ELGA-TB-RF-70	5 Nm
ELGA-TB-RF-80	5 Nm
ELGA-TB-RF-120	5.9 Nm



16. Tighten the socket head screws of the sensor mounting with a tightening torque of 3.5 Nm.



4.8 Assembly and functional test

After completing the assembly work on the toothed belt axis, check that it function correctly.

4.8.1 No-load torque

It must be possible to move the slide in idling mode, without drive (motor) attached and without a coupled load without any large resistance and without jerking.

The following values can be used for the quantitative check. The no-load torque and displacement resistance are dependent on the speed. The following values are based on a speed of v=0.2 m/s.

	ELGA-TB-RF-70-...(-F1)		ELGA-TB-RF-80-...(-F1)		ELGA-TB-RF-120-...(-F1)	
	Neoprene toothed belt	Polyurethane toothed belt	Neoprene toothed belt	Polyurethane toothed belt	Neoprene toothed belt	Polyurethane toothed belt
Max. no-load torque with cover strip	0.66 Nm	1.03 Nm	1.35 Nm	1.93 Nm	3.0 Nm	5.67 Nm

	ELGA-TB-RF-70-...(-F1)		ELGA-TB-RF-80-...(-F1)		ELGA-TB-RF-120-...(-F1)	
	Neoprene toothed belt	Polyurethane toothed belt	Neoprene toothed belt	Polyurethane toothed belt	Neoprene toothed belt	Polyurethane toothed belt
Max. no-load torque without cover strip	0.53 Nm	0.88 Nm	0.97 Nm	1.55 Nm	2.25 Nm	4.95 Nm
Max. displacement resistance with cover strip	46 N	72 N	68 N	97 N	114 N	216 N
Max. displacement resistance without cover strip	37 N	62 N	49 N	78 N	86 N	189 N

4.8.2 Start-up

Start-up the repaired toothed belt axis as described in the operating instructions (enclosed with the toothed belt axis or available on the Festo website (➔ www.festo.com)).

5 Maintenance

This chapter contains the most important technical information about the maintenance work to be carried out on the toothed belt axis. A precise description of the care and maintenance steps is given in the operating instructions (➔ www.festo.com). Further information on the assembly aids and lubricants is given on the Festo website (➔ Tools and repair accessories.pdf).

5.1 Cleaning the toothed belt axis

Clean the toothed belt axis if necessary using a soft cloth and a gentle cleaning product.

5.2 Relubricating the roller track guide

Check whether the roller track guide is set free from backlash and stress during each maintenance operation.

The track rollers are lubricated for life. They do not need to be relubricated.

The roller track guide must be relubricated at certain intervals using a grease gun to apply the grease via the **two** lubrication nipples on the front of the slide. Relubricate with the same lubricant used to lubricate the roller track guide on delivery.

Recommended oil	Manufacturer / source
ELKALUB VP 916	Chemie-Technik, Vöhringen (➔ http://www.elkalub.com) Purchased as AZLO-H1-C-10 cartridge with 10 ml Elkalub VP 916 for AZTP-S-L grease gun through Festo [1] (➔ also Chapter 6.2 on page 43).

[1] See the information brochure “Tools and repair accessories”. The brochure can be found in the online spare parts catalogue on the Festo website (➔ Tools and repair accessories.pdf).

The guide rods of the roller bearings are lubricated during operation by oil-soaked felt scrapers. The maximum capacity of the scrapers is approx. 5 ml.

The roller track guide should be relubricated after a load-dependent lubrication interval. To determine the lubrication interval S_{int} the load comparison factor f_v must be calculated using the formula for combined loads, see operating instructions **Toothed belt axis ELGA-TB-G / -KF / -RF** (➔ www.festo.com).

Note

The lubrication interval S_{int} depends on the load acting on the product.

Load factors:

- dusty and contaminated environment
- Nominal stroke > 2000 mm or < 300 mm
- Speed > 2 m/s
- Travel profile ≙ triangular operation (frequent acceleration and braking)
- Ambient temperature > +40 °C
- Product's time in operation > 3 years

- If **one** of these factors applies, halve the lubrication interval S_{int}.
- If **several** factors apply at the same time, divide the lubrication interval by four.

The following quantities (per lubrication nipple) are recommended for relubricating the guide:

	ELGA-TB-RF-70-...(-F1)	ELGA-TB-RF-80-...(-F1)	ELGA-TB-RF-120-...(-F1)
Quantity of oil per lubrication nipple	1.0 – 1.5 ml	1.5 – 2.5 ml	2.5 – 4.5 ml

If the relubrication quantity is exceeded a limited quantity of surplus oil is absorbed by integrated felt oil absorbers. The felt oil absorbers must be replaced if their capacity is exhausted.

5.3 Toothed belt pretensioning

The toothed belt is set to the specified value in the factory, and is thus maintenance-free for its entire service life.

The pretension of the toothed belt reduces due to storage time and operation. **This is a normal process and not an indication of wear.**

6 Tools and equipment

This chapter provides an overview of the tools and aids required to repair and maintain the toothed belt axis.

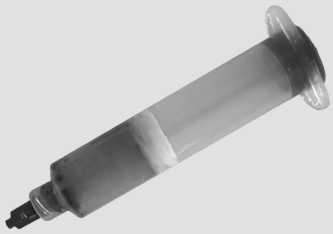
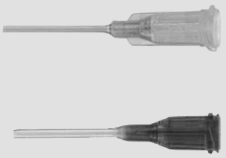
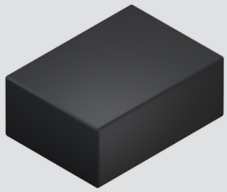
6.1 Standard tools

The following standard tools are required for repair and maintenance of the toothed belt axis:

- Plastic hammer
- Pliers for retaining rings (inner retainer for bore)
- Internal hexagon socket screwdriver (allen key)
- Torque spanner/torque screwdriver
- Screwdriver set
- Flat pliers
- Ruler
- Tensile and pressure force meter
- Sturdy general purpose scissors or metal shears

6.2 Special tools

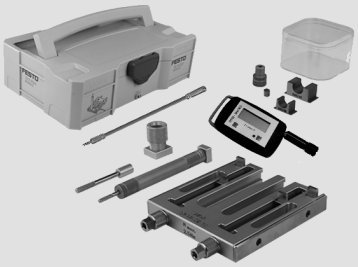
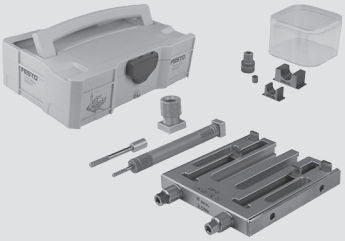
The following special tools are required for repair and maintenance of the toothed belt axis:

Designation	Additional information	Festo order no.	Figure
Oil gun AZTP-S-L	Oil gun for manual relubrication with cartridges of the type AZLO-H1-C-10. Cartridge and dosing needles are **not** included in the scope of delivery.	8041022	
Cartridge AZLO-H1-C-10	Cartridge for oil gun AZTP-S-L. Cartridge contains 10 ml Elkalub VP 916 (oil for the food industry). Dosing needles are **not** included in the scope of delivery.	8086576	
Dosing needle set AZTN-DS	Dosing needle set contains: 1× dosing needle size 18, (green) for ELGA-RF-70 1× dosing needle size 15, (amber-coloured) for ELGA-RF-80 / 120	8086577	
Clamping element EADT-S-L5-70	suitable for ELGA-TB-70 / 80-...(-F1)	8058451	
Clamping element EADT-S-L5-120	suitable for ELGA-TB-120-...(-F1) ELGA-TB-150	8058450	

Further information on the equipment and measuring devices can be found in the information brochure **"Tools and repair accessories"**. The brochure can be found in the online spare parts catalogue on the Festo website (➔ Tools and repair accessories.pdf).

6.3 Equipment and measuring devices

The following test devices and measuring devices can be used to check checking the toothed belt pretension:

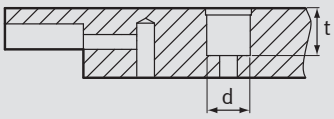
Designation Order No.	Description	Figure
TB-TE-EQ10	Content: – Test device for checking the toothed belt pretension in the Systainer with foam insert. Suitable for the following toothed belt axes: – DGE-25 / 40 / 63-ZR(-KF) – DGE-25 / 40 / 63-ZR-RF – EGC-50 / 70 / 80 / 120 / 185-TB-KF – EGC-HD-125 / 160 / 220-...-TB-...(-GP) – ELGA-TB-G-70 / 80 / 120 – ELGA-TB-RF / KF-70 / 80 / 120-...(-F1) – ELGA-TB-KF-150 – DGEA-18 / 25 / 40-ZR – Acoustic frequency meter type TB-TE-EQ13 – Extension cable for acoustic frequency meter TB-TE-EQ13 – Clamping component for DGE-25-ZR-RF – Clamping component for DGE-40-ZR-RF – Round magnet (L = 6 mm) for DGE-63 – Plastic box for small parts The exact procedure for checking the toothed belt pretension can be found in the operating instructions **“Test device for toothed belt pretension TB-TE-EQ12”** (➔ TB-TE-EQ12_en.pdf).	
TB-TE-EQ12	Content: – Test device for checking the toothed belt pretension in the Systainer with foam insert. Suitable for the following toothed belt axes: – DGE-25 / 40 / 63-ZR(-KF) – DGE-25 / 40 / 63-ZR-RF – EGC-50 / 70 / 80 / 120 / 185-TB-KF – EGC-HD-125 / 160 / 220-...-TB-...(-GP) – ELGA-TB-G-70 / 80 / 120 – ELGA-TB-RF / KF-70 / 80 / 120-...(-F1) – ELGA-TB-KF-150 – DGEA-18 / 25 / 40-ZR – Clamping component for DGE-25-ZR-RF – Clamping component for DGE-40-ZR-RF – Round magnet (L = 6 mm) for DGE-63 – Plastic box for small parts The exact procedure for checking the toothed belt pretension can be found in the operating instructions **“Test device for toothed belt pretension TB-TE-EQ12”** (➔ TB-TE-EQ12_en.pdf).	

Designation Order No.	Description	Figure
TB-TE-EQ13	Acoustic frequency meter for measurement with and without a test device. An extension cable that can be installed between the frecuency meter and the acoustic test probe is included in the scope of delivery.	
O-ring 10x1 Order No. 200926	Mounts the acoustic test probe in the test device by means of clamping friction. Included in the scope of delivery of the frequency meter TB-TE-EQ13.	

Further information on the equipment and measuring devices can be found in the information brochure **“Tools and repair accessories”**. The brochure can be found in the online spare parts catalogue on the Festo website (➔ Tools and repair accessories.pdf).

To order the Test device TB-TE-EQ10 / -EQ12, Frequency meter TB-TE-EQ13, please **contact** your **local support**.

6.4 Devices for in-house assembly

Designation	Dimensions ELGA-TB-RF-70	Dimensions ELGA-TB-RF-80	Dimensions ELGA-TB-RF-120	Figure
Socket with milled spanner flat For tightening the hex nuts of the eccentric cams	WAF 10 with 1/4" square drive Max. outer diameter 14.5 mm Spanner flat 10 mm	WAF 13 with 3/8" square drive Max. outer diameter 18.6 mm Spanner flat 10 mm	WAF 19 with 3/8" square drive Max. outer diameter 31.4 mm Spanner flat 10 mm	
Hole dimensions of the slide for manufacturing the socket	d = 14.7 -0.1 mm t = 18.5 mm	d = 18.8 +0.1 mm t = 23.5 mm	d = 31.6 +0.1 mm t = 30.5 mm	

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