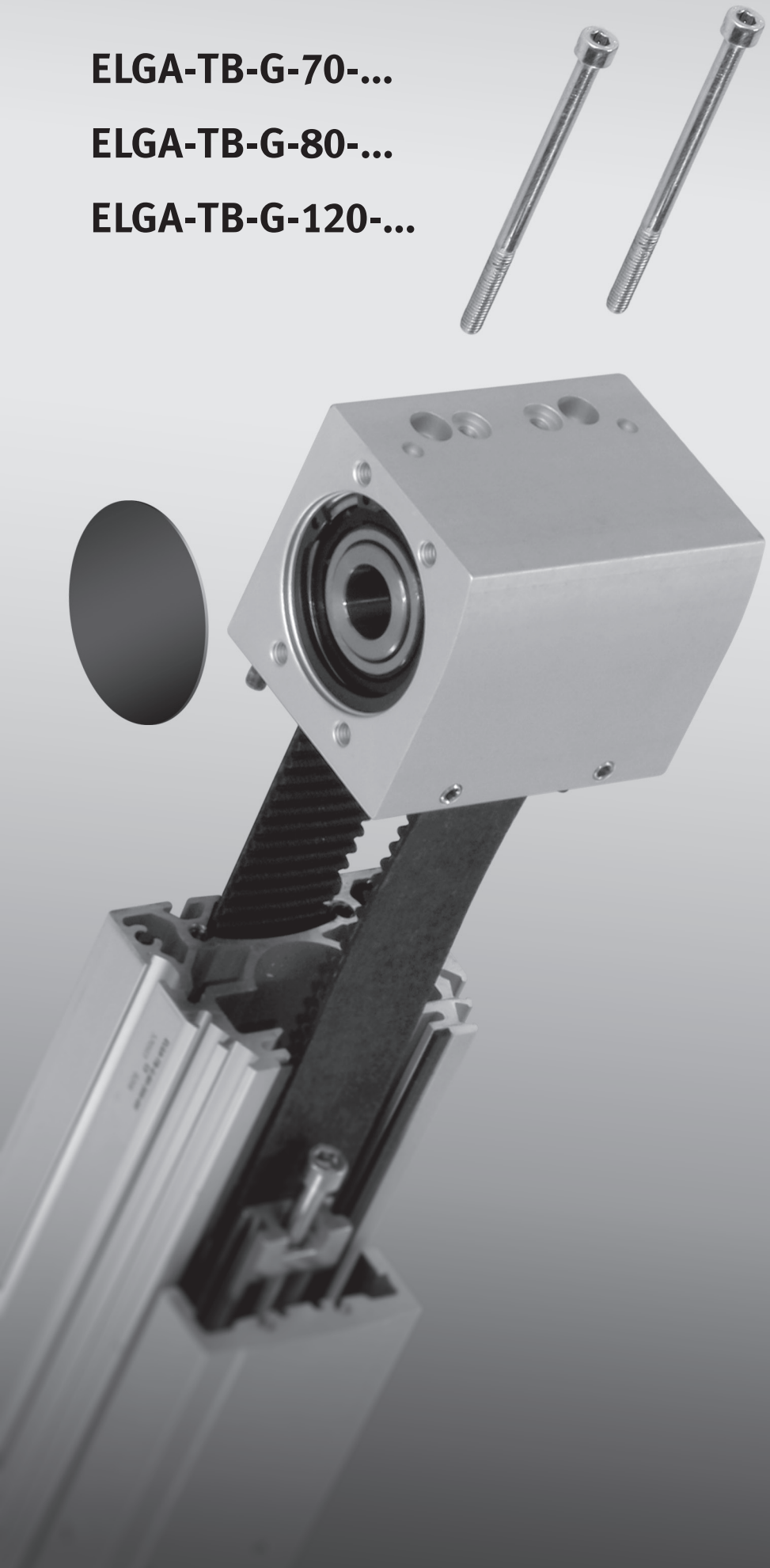
Toothed belt axis

ELGA-TB-G-70-...

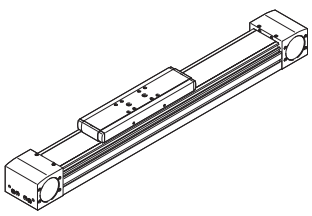
ELGA-TB-G-80-...

ELGA-TB-G-120-...



FESTO

Repair instructions (en)



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Ruiter Straße 82
73726 Esslingen
Germany

Editorial team:
Spare Part Documentation and
Support

Phone:
+49 / 711 / 347-0

E-mail:
service_international@festo.com

Internet:

Internet:
www.festo.com

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 34.

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.

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Table of Contents

1 Important information

1.1 About these repair instructions

This document contains important information about proper repair of the products listed on the title page.

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.

The toothed belt axis Type ELGA-TB-G-... is also called the product in these repair instructions.

For reasons of clarity, these repair instructions do not contain all detailed information. The following documents should therefore also be available while carrying out repair work:

- **Toothed belt axis ELGA-TB-G-... operating instructions**

  Contains information on the product's peripherals as well as its function, structure, application, installation, commissioning, maintenance and care, etc. (➔ www.festo.com).
- **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).
- **"Tools and repair accessories" information brochure**

  Contains an overview of available assembly aids (e.g. lubricants, locking agent), special tools, schematic diagrams, fixtures, measuring devices, etc. The information 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 Symbols used in these repair instructions

- Activities that can be carried out in any order.
1. Activities which should be carried out in the specified order.
– 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 always be carried out in conjunction with these repair instructions as well as the respective operating instructions for the device, and 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.

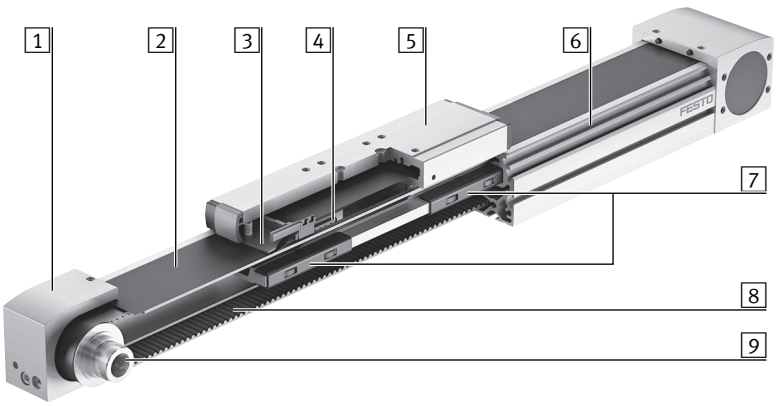
1.6 Standards and test values

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-G-... 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 a linear motion in a toothed belt with a pulley at both ends of the axis that is then transmitted to the slide with plain-bearing guide attached to the toothed belt.
By minimising the moving dead weight, a high dynamic response and shorter cycle times can be achieved. The ELGA-TB-G-... 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 Slide elements
8 Toothed belt
9 Toothed belt pulley with deep-groove ball bearing

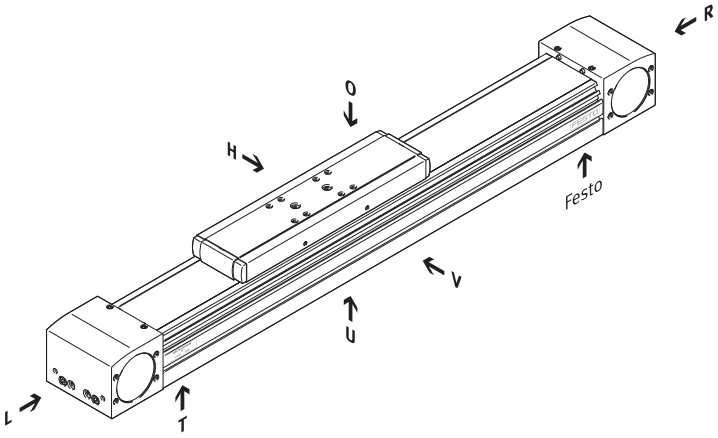
2.2 Types and part numbers

Type	Part number
ELGA-TB-G-70-...	570502
ELGA-TB-G-80-...	570503
ELGA-TB-G-120-...	570504

The complete overview of features, accessories, type codes, technical data and dimensions for the ELGA-TB-G 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.

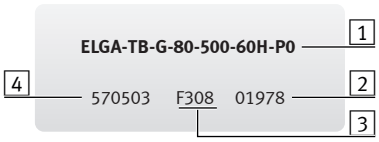


Festo=reference point (logo)
T = Rating plate
O = top
U = bottom
R = right
L = left
V = front
H = rear

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

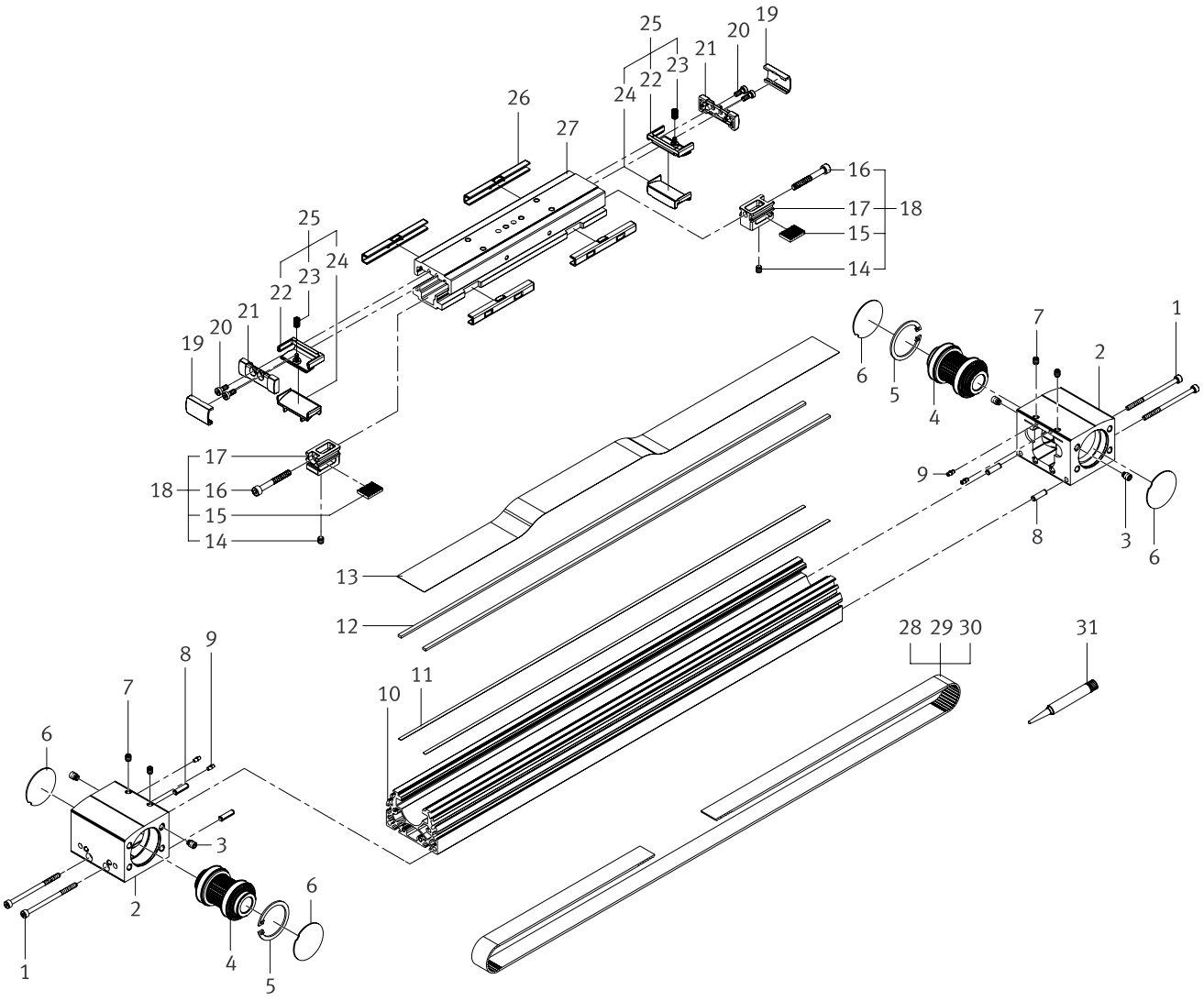
The type designation on these rating plates provides the following information:

ELGA	Toothed belt axis of the type ELGA
TB	Toothed belt
G	Plain-bearing guide
80	Size
500	Stroke [mm]
60H	Stroke reserve [mm]
P0	without strip cover

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

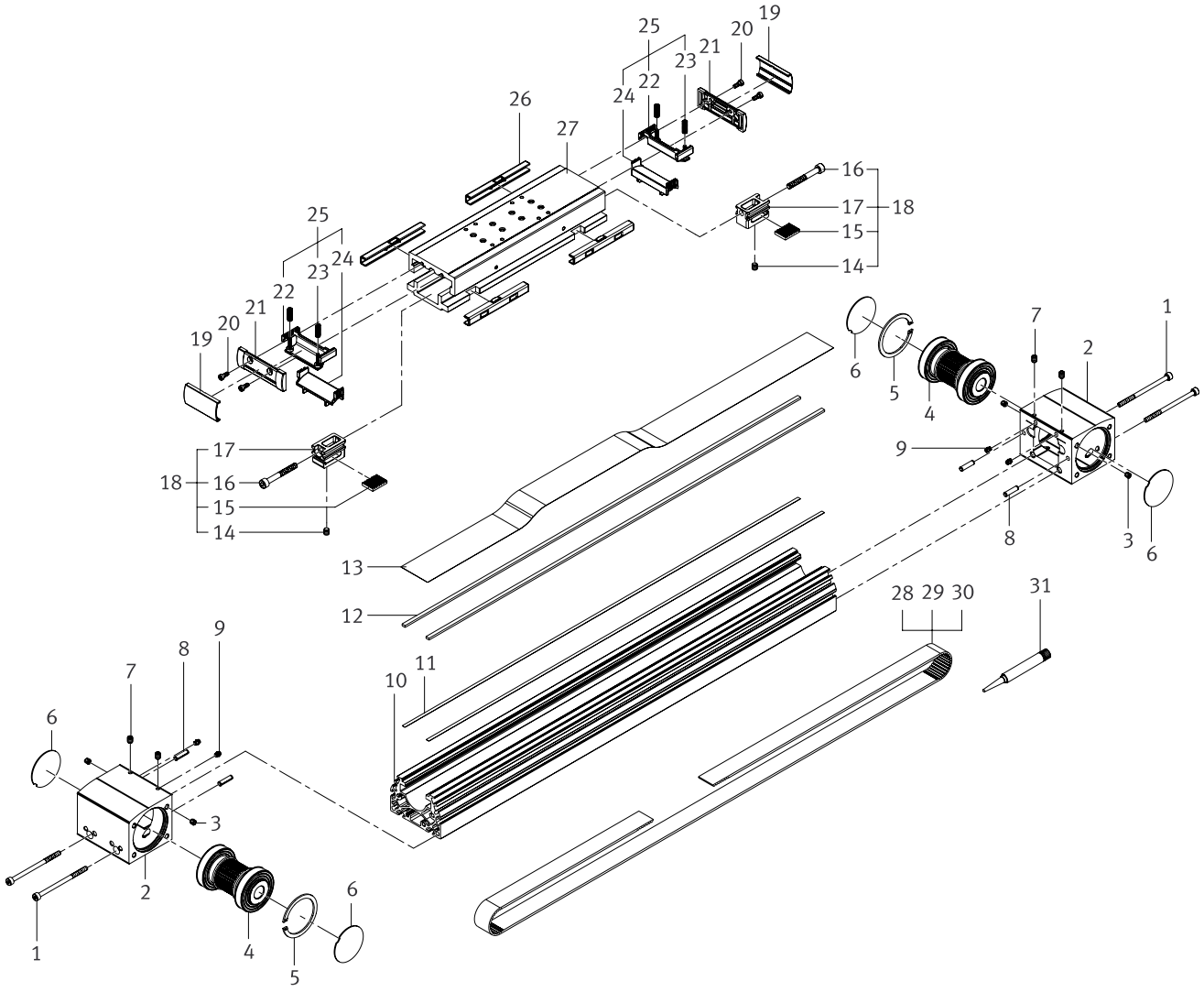
3.1 ELGA-TB-G-70 / 80



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-G-70	ELGA-TB-G-80
No.	Designation	Type	Type
1	Socket head screw	ISO 4762-M4X65-8.8	ISO 4762-M5X70-8.8
2	Drive cover		
3	Threaded pin	ISO 4028-M6X8-45H	ISO 4028-M6X8-45H
4	Toothed belt pulley module		
5	Retaining ring	DIN 472-37×1,5	DIN 472-47X1,75
6	Sealing washer		
7	Threaded pin	ISO 4026-M5X6-45H	ISO 4028-M6X8-45H
8	Spring pin	DIN 7346-4,5×16	DIN 7346-4,5X16
9	Buffer element		
10	Cylinder barrel		
11	Adhesive tape		
12	Magnetic tape		
13	Cover strip		
14	Threaded pin	ISO 4026-M5X6-45H	ISO 4026-M8X8-45H
15	Clamping plate		
16	Socket head screw	ISO 4762-M5X40-10.9	ISO 4762-M6X55-10.9
17	Clamping part		
18	Clamping		
19	Clip		
20	Socket head screw	DIN 6912-M4X6-A2-70	DIN 6912-M4X6-A2-70
21	Cover		
22	Belt reversal, top		
23	Compression spring		
24	Belt reversal, bottom		
25	Belt reversal		
26	Slide element		
27	Slide module		
28	Toothed belt		
29	Toothed belt []	5m piece	5m piece
30	Toothed belt [PU2]	5m piece	5m piece
31	Locking agent (threadlocker)		

3.2 ELGA-TB-G-120



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-G-120
No.	Designation	Type
1	Socket head screw	ISO 4762-M8X110-8.8
2	Drive cover	
3	Threaded pin	ISO 4026-M8X8-45H
4	Toothed belt pulley module	
5	Retaining ring	DIN 472-75X2,5
6	Sealing washer	
7	Threaded pin	ISO 4028-M6X12-45H
8	Spring pin	DIN 7346-7X28
9	Buffer element	
10	Cylinder barrel	
11	Adhesive tape	
12	Magnetic tape	
13	Cover strip	
14	Threaded pin	ISO 4026-M8X8-45H
15	Clamping plate	
16	Socket head screw	ISO 4762-M8X50-10.9
17	Clamping part	
18	Clamping	
19	Clip	
20	Socket head screw	DIN 6912-M5X6-A2-70
21	Cover	
22	Belt reversal, top	
23	Compression springs	
24	Belt reversal, bottom	
25	Belt reversal	
26	Slide element	
27	Slide module	
28	Toothed belt	
29	Toothed belt []	5m piece
30	Toothed belt [PU2]	5m piece
31	Locking agent (threadlocker)	

4 Repair steps

This chapter describes how to dismantle, repair and assemble the toothed belt axis ELGA-TB-G-.... 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 as major dents in the guide groove of the slide elements. 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 (➔ www.festo.com/spareparts) using the relevant part number (dependent on the size and version of the toothed belt axis).

The part number is a module number and depends on the size of the toothed belt axis. In addition to the part number, you must also specify the stroke and type of slide of your toothed belt axis when ordering. The information required can is given in the type code on the nameplate of the toothed belt axis (➔ Chapter 2.4 on page 9). You can use this information to calculate the necessary toothed belt length.

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-G-70	Neoprene NP	11 mm
ELGA-TB-G-80 / 120	Neoprene NP	23 mm
ELGA-TB-G-70-...-PU2	Polyurethane PU2, coated	25 mm
ELGA-TB-G-80 / 120-...-PU2	Polyurethane PU2, coated	32 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).

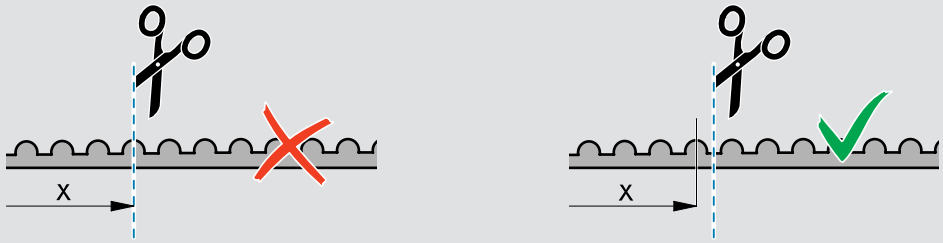
Ordering a precise fitting toothed belt:

The part number of the cantilever 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”, depending on the stroke		Value “B”	Pitch “C”
ELGA-70	all strokes	1,996	296	3
ELGA-70-...-PU2		2,0		
ELGA-80		1,996	347	5
ELGA-80-...-PU2		2,0		
ELGA-120		1,996	452,5	
ELGA-120-...-PU2		2,0		

Example: **ELGA - TB - G -** ↓ **80** Size **-** ↓ **375** Stroke **-** ↓ **30H** Stroke reserve **- PU2**

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

L = 2,0 × (375 + 2 × 30 + 347) mm

L = 1564 mm

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

L = 1560 mm

The toothed belt can be renewed with the toothed belt axis still installed if it is not torn or if the location of the tear is visible, as it is not necessary to remove the slide unit and drive cover in such cases (➔ Chapter 4.3.3 on page 36). If the location of the tear is in the drive covers or the cylinder barrel, then the drive covers must be removed (➔ Chapter 4.4.1 on page 43).

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 4.4.2 on page 26.

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).

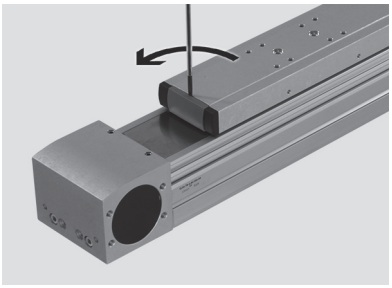
  Block-shaped acceleration and deceleration profiles (no jerk limitation) cause high peaks in the drive force that can lead to overloading of the drive. Positions outside of the permissible range can also occur. An acceleration and deceleration specification with jerk limitation reduces oscillations in 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.

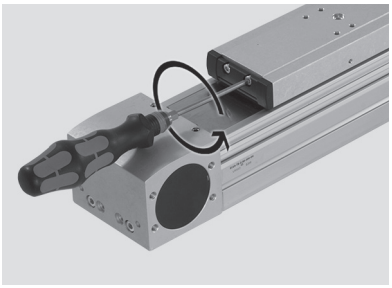
- **Ambient conditions/material resistance**
  - Check whether the ambient temperature is within the permissible range.
  - Check the chemical and physical ambient conditions for harmful substances, such as dust, abrasive particles, cooling lubricants, solvents, ozone, radiation, water-soluble substances,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

4.3.1 Removing the cover strip

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



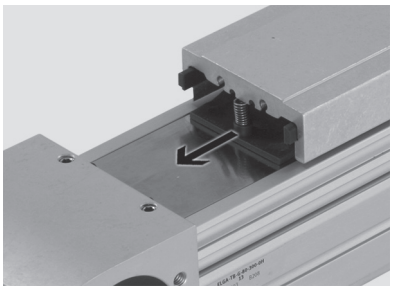
After the covers have been removed, the top belt reversal can come out of the slide when the slide is moved. If this happens, the compression springs of the belt reversal may be lost.



2. Unscrew the socket head screws at both ends of the slide.
3. Remove the cover.

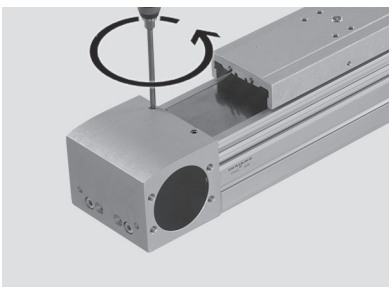
Secure the compression springs against springing out to the side on pulling out the top belt reversal.

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

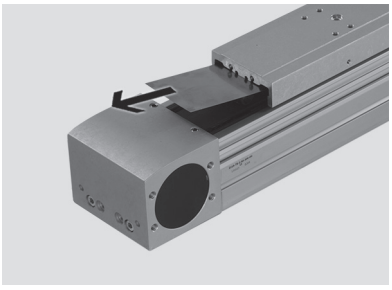


4. Pull out the top belt reversals on both sides of the slide.

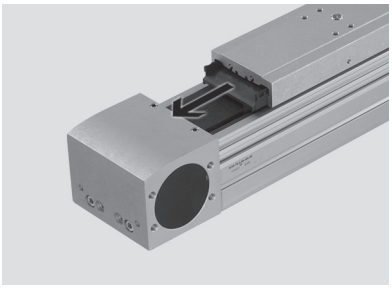
5. Unscrew the grub screws in both actuator end caps.
6. Remove any locking agent residue from the thread.



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



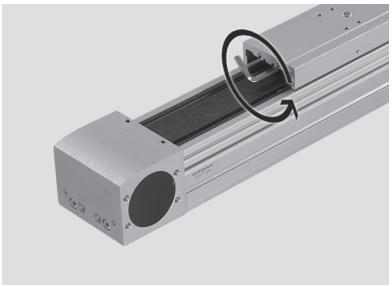
8. Pull out the bottom belt reversals on both sides of the slide.



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.

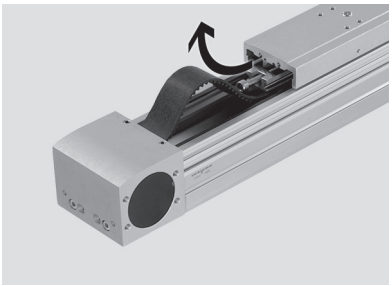
4.3.2 Removing clamping components

1. Unscrew the socket head screws in the clamping components on both sides of the slide.



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.

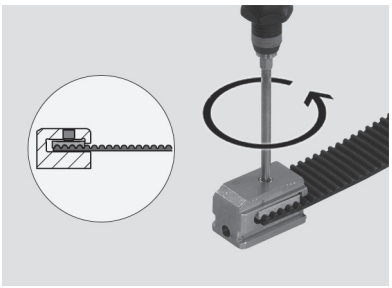


Note

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).

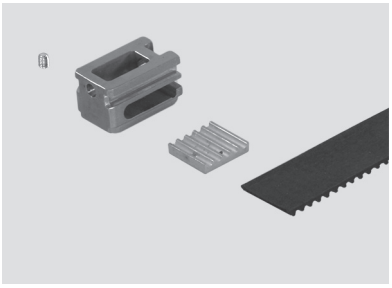
2. Pull the clamping components out of the slide using the toothed belt.



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.

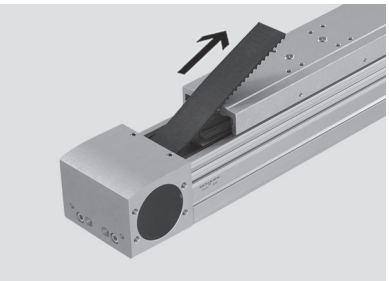


4.3.3 Replacing the toothed belt

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 on page 14.

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.



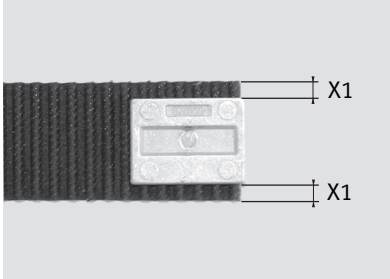
4.3.4 Attaching clamping components

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.

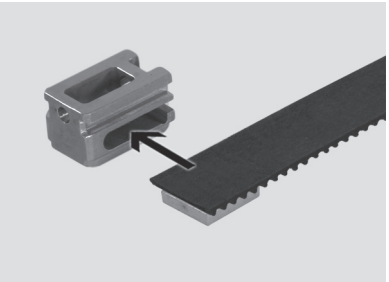
2. Position the clamping plates centrally widthways on the toothed belt.



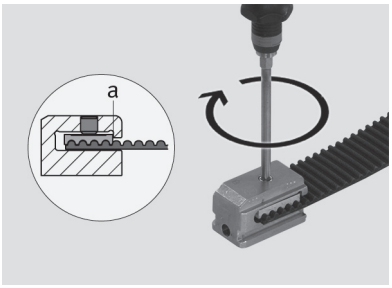
Note

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 threadlocker.
6. Screw the grub screws into the clamping components.
7. 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.

8. Tighten the grub screws to the appropriate torque.

Note

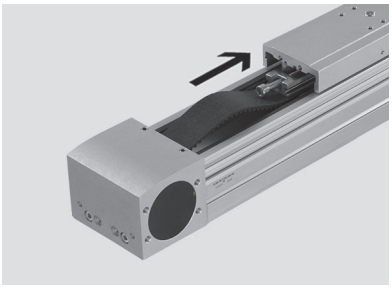
It is critical that the tightening torques be observed. Excessive tightening torques will bend the clamping component.

Type	Tightening torque
ELGA-TB-G-70	0.5 Nm
ELGA-TB-G-80	4.0 Nm
ELGA-TB-G-120	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).

9. 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

Overstretching the toothed belt shortens its service life. Slowly increase the toothed belt pretension up to the correct value.

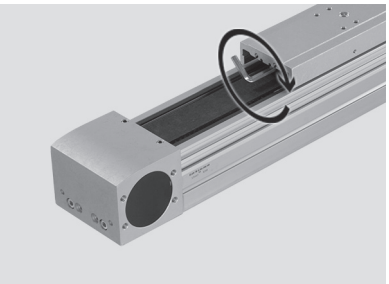
If the toothed belt is cut to the correct length, the clamping components should be at least flush with the cut-out in the slide.

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 4.3.6 on page 22.

10. Insert the socket head screw into the clamping component.
11. Screw the socket head screw a few turns into the slide.
12. Repeat the steps at the other end of the axis to insert the second clamping component.

13. Screw the socket head screws evenly through the clamping components and into the slide.
14. 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

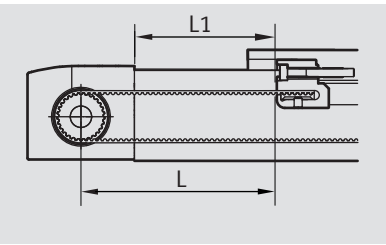
Correct toothed belt pretension is essential for the service life of the toothed belt as well as the positioning accuracy and operating performance of the toothed belt axis. The toothed belt pretension must therefore be checked extremely carefully.

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_P
ELGA-TB-G-70	0,0459 kg / m	30 mm + L1[1)]	358 - 390 N
ELGA-TB-G-70-...-PU2	0,0567 kg / m	30 mm + L1[1)]	357 - 393 N
ELGA-TB-G-80	0,1140 kg / m	34 mm + L1[1)]	809 - 885 N
ELGA-TB-G-80-...-PU2	0,1384 kg / m	34 mm + L1[1)]	823 - 908 N
ELGA-TB-G-120	0,1500 kg / m	50 mm + L1[1)]	1321 - 1438 N
ELGA-TB-G-120-...-PU2	0,1917 kg / m	50 mm + L1[1)]	1341 - 1475 N

[1)] → Chapter 4.3.6 on page 22

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

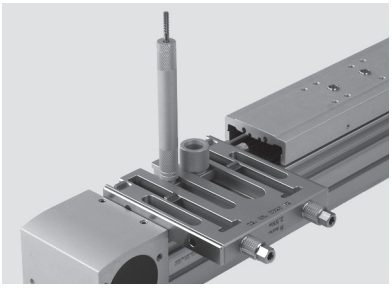
Before the toothed belt pretension can be measured, the slide must be moved back and forth several times so that the toothed belt can fully settle and differences in tension can be levelled out.

The easiest way to check the toothed belt pretension is to use a test device. (➔ Chapter 6.3 on page 33).

Measuring the toothed belt pretension using a test device

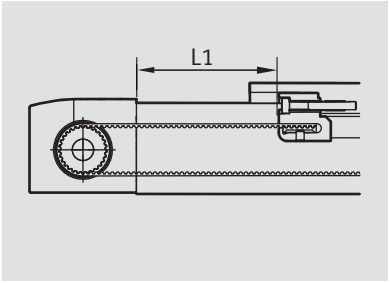
The distance between the actuator end cap and clamping component does not need to be set if the toothed belt pretension is measured using a test device (➔ Chapter 6.3 on page 33). The correct strand length is achieved using the supplied spacers.

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

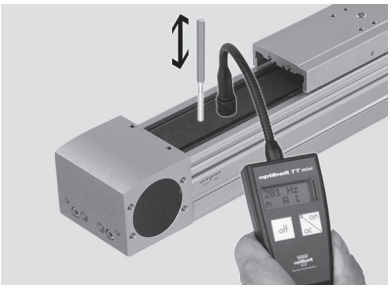
1. Set the distance between the actuator end cap and clamping component (L1) as given in the table.



Type	Distance L1
ELGA-TB-G-70	290 mm / 100 mm[1)]
ELGA-TB-G-70-...-PU2	290 mm / 100 mm[1)]
ELGA-TB-G-80	290 mm / 100 mm[1)]
ELGA-TB-G-80-...-PU2	290 mm / 100 mm[1)]
ELGA-TB-G-120	290 mm / 100 mm[1)]
ELGA-TB-G-120-...-PU2	290 mm / 100 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 measured values with the specified value (➔ table).

For strokes ≥290mm

Type	Minimum frequency (f)	Maximum frequency (f)
ELGA-TB-KF-70	138 Hz	144 Hz
ELGA-TB-KF-70-...-PU2	124 Hz	130 Hz
ELGA-TB-KF-80	130 Hz	136 Hz
ELGA-TB-KF-80-...-PU2	119 Hz	125 Hz
ELGA-TB-KF-120	138 Hz	144 Hz
ELGA-TB-KF-120-...-PU2	123 Hz	129 Hz

For short strokes ‹290mm

Type	Minimum frequency (f)	Maximum frequency (f)
ELGA-TB-KF-70	340 Hz	352 Hz
ELGA-TB-KF-70-...-PU2	305 Hz	317 Hz
ELGA-TB-KF-80	314 Hz	326 Hz
ELGA-TB-KF-80-...-PU2	287 Hz	299 Hz
ELGA-TB-KF-120	316 Hz	326 Hz
ELGA-TB-KF-120-...-PU2	279 Hz	289 Hz

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.

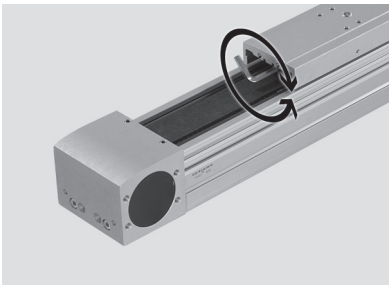
The toothed belt pretension must therefore only be set after renewing the toothed belt.

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.

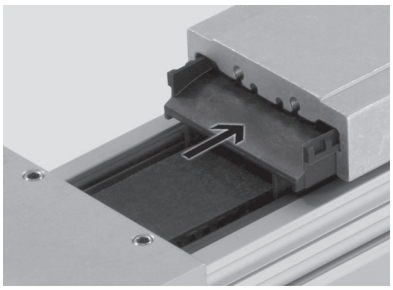


Turning the socket head screw clockwise increases the tension of the toothed belt, and thus its oscillation frequency.

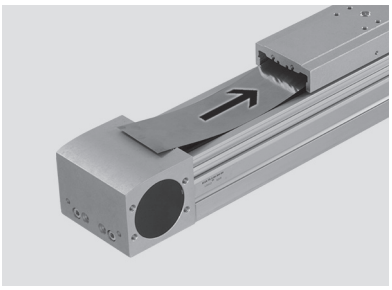
Turning the socket head screw anticlockwise decreases the tension of the toothed belt, and thus its oscillation frequency.

4.3.8 Installing the cover strip

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



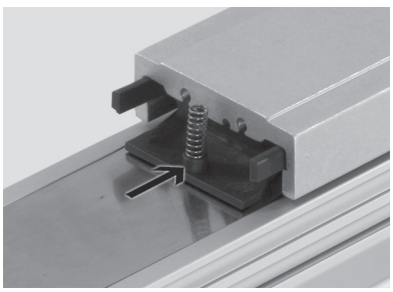
2. Guide the cover strip through the slide over the belt reversals.



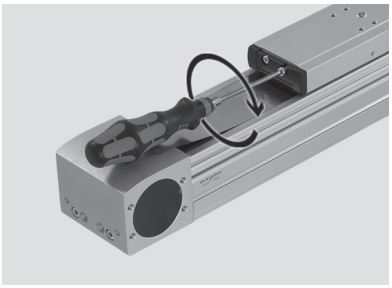
At the top belt reversals:

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

3. Insert the top belt reversals together with the compression springs in both sides of the slide.

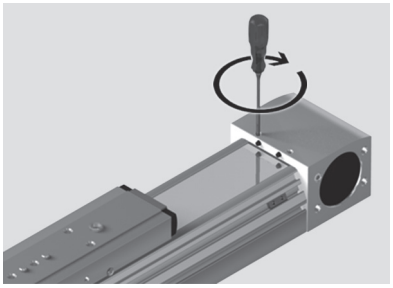


4. Place the cover on both sides of the slide.
5. Wet the socket head screws for the cover with locking agent.
6. Screw the socket head screws into the slide through the covers on both sides of the slide and tighten using the appropriate torque (➔ table).



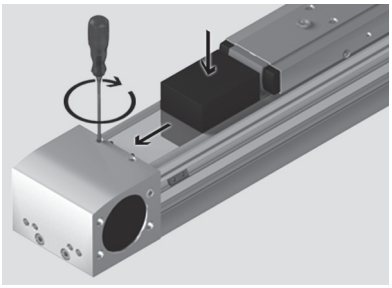
Type	Tightening torque
ELGA-TB-G-70	1.2 Nm
ELGA-TB-G-80	1.2 Nm
ELGA-TB-G-120	2.0 Nm

7. Insert the cover strip into both actuator end caps.
8. Screw the grub screws into the right-hand actuator end cap and tighten them to the appropriate tightening torque (➔ table).



Type	Tightening torque
ELGA-TB-G-70	2.0 Nm
ELGA-TB-G-80	2.0 Nm
ELGA-TB-G-120	2.0 Nm

9. Screw grub screws loosely into the left-hand actuator end cap - do not tighten yet. The cover strip must not be fixed in place.
10. Select suitable clamping element depending on the axis size (➔ table and Chapter 6.2 on page 32).

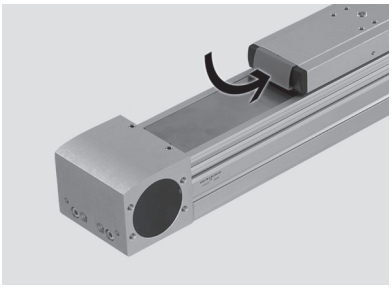


Type	Clamping element
ELGA-TB-G-70	EADT-S-L5-70 (use lengthwise)
ELGA-TB-G-80	EADT-S-L5-70 (use crosswise)
ELGA-TB-G-120	EADT-S-L5-120 (use lengthwise)

11. Place the clamping element on the cover strip.
12. 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.
13. Tighten the grub screws to the appropriate tightening torque (➔ table).

Type	Tightening torque
ELGA-TB-G-70	2.0 Nm
ELGA-TB-G-80	2.0 Nm
ELGA-TB-G-120	2.0 Nm

14. 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.
15. Clip the clips onto the covers on both sides of the slide.



4.4 Dismantling the toothed belt axis

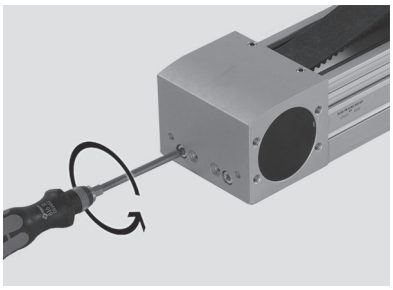
The toothed belt axis ELGA-TB-G-... is made up of the following modules:

– 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 supported on plain-bearings with cover strip guide, driven via clamping component on the toothed belt.

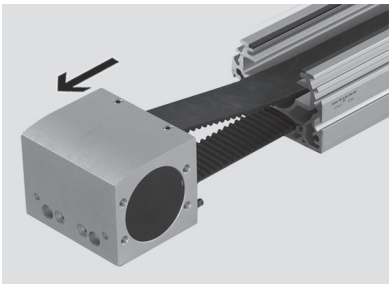
4.4.1 Removing the actuator end caps

Note
The steps described in Chapter 4.3.1 on page 17 and Chapter 4.3.2 on page 18 must be carried out before dismantling the actuator end caps.

1. Unscrew the socket head screws in both actuator end caps.



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

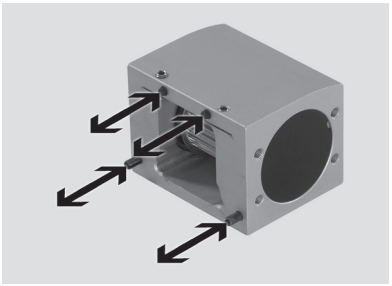


2. Pull the actuator end caps off the cylinder barrel.
3. Pull the toothed belt out of the cylinder barrel.

4.4.2 Repairing the actuator end cap

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.

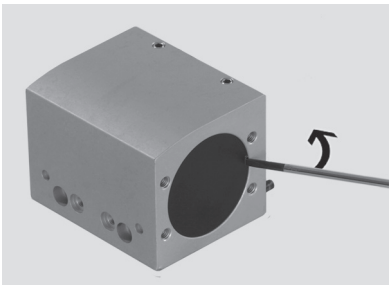


Toothed belt pulley module

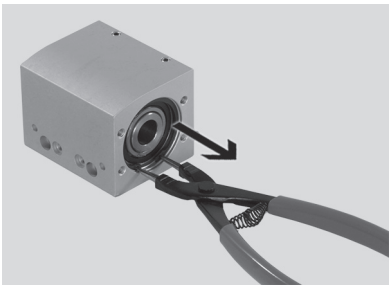
The toothed belt pulley module sits with clearance fit of the actuator end cap with two pressed-on deep-groove ball bearings, and is clamped axially by a retaining ring.

Removing the toothed belt pulley module

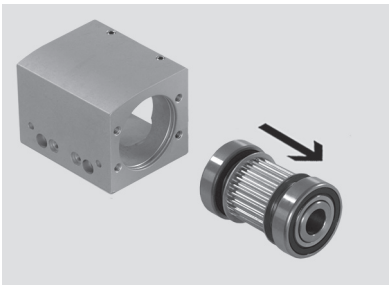
1. Lever the sealing discs, if present, out of the actuator end cap.



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 components.

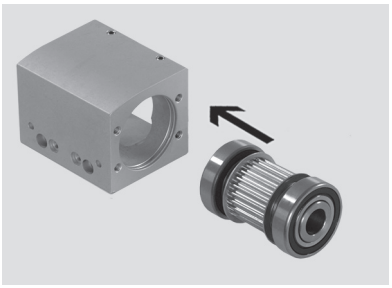


You do not need to pull off the deep-groove ball bearings, as the spare part includes both bearings and the shaft.

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.

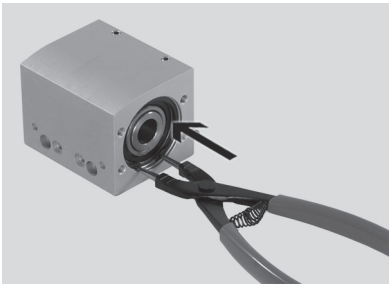
Installing the toothed belt pulley module

1. Apply a light coating of grease to the outside of the deep-groove ball bearings.
2. 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.

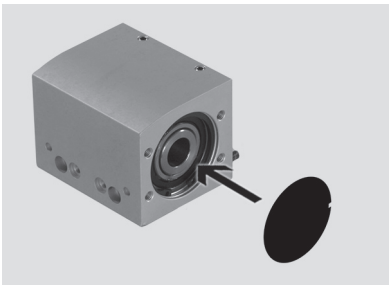
3. Insert the retaining ring.



Note

Check that the retaining ring is positioned correctly.

4. Press the sealing discs into the actuator end caps so that the deep-groove ball bearings have extra protection from contamination.

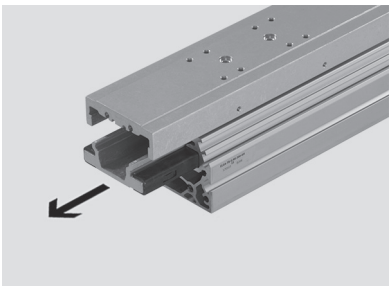


4.4.3 Repairing the plain-bearing guide

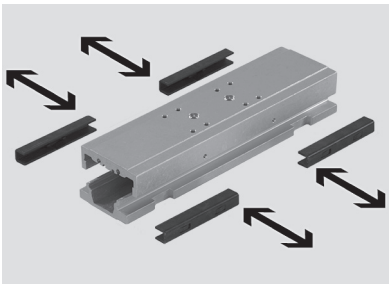
Requirement for all work on the slide:

1. the cover strip must be dismantled (➔ Chapter 4.3.1 on page 17),
2. the two clamping components must be unscrewed out of the slide (➔ Chapter 4.3.2 on page 18) and
3. one actuator end cap must be dismantled (➔ Chapter 4.4.1 on page 26).

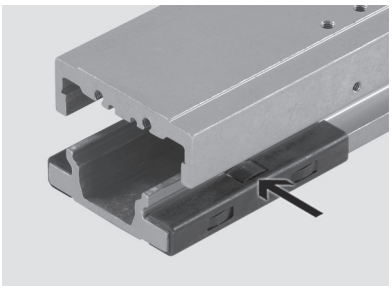
4. Push the slide out of the cylinder barrel.



5. Remove the slide elements from the slide.
6. Clean the slide and slide elements.
7. If necessary, replace the slide elements.



8. Assemble the slide elements with the tabs facing upwards.



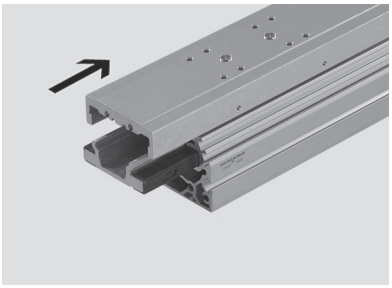
4.5 Assembling the toothed belt axis

4.5.1 Preparing the cylinder barrel

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

4.5.2 Inserting the slide

- Push the slide carefully into the cylinder barrel.



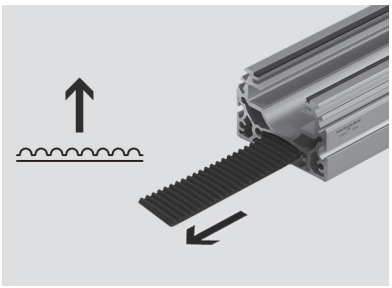
4.5.3 Installing the actuator end caps

Note

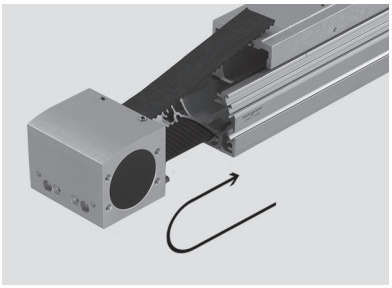
Do not bend or fold the toothed belt, as this can result in damage to the tensile members and shorten its service life by cracking it.

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.

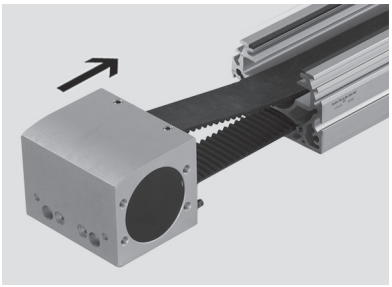


2. Guide the ends of the toothed belt through both of the prepared actuator end caps as shown.



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

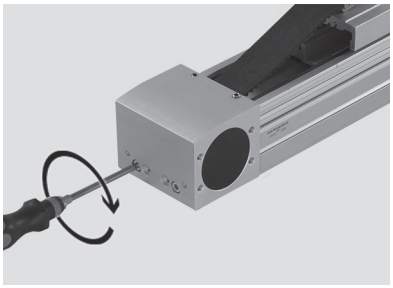
3. Place both actuator end caps on the cylinder barrel and push against the cylinder barrel.



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 threadlocker.
5. Screw the socket head screws through the actuator end cap and into the cylinder barrel and tighten with the appropriate tightening torque.

Type	Tightening torque
ELGA-TB-G-70	2.5 Nm
ELGA-TB-G-80	5.0 Nm
ELGA-TB-G-120	11 Nm



4.5.4 Attaching clamping components

➔ Chapter 4.3.4 on page 19.

4.5.5 Checking and adjusting the toothed belt presstressing

➔ Chapter 4.3.6 on page 22 and Chapter 4.3.7 on page 23.

4.5.6 Installing the cover strip

➔ Chapter 4.3.8 on page 24.

4.6 Assembly and functional test

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

4.6.1 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-G-70	ELGA-TB-G-80	ELGA-TB-G-120
Max. no-load torque with cover strip	0.5 Nm	1.0 Nm	3.0 Nm
Max. no-load torque without cover strip	0.4 Nm	0.75 Nm	2.5 Nm
Max. displacement resistance with cover strip	35 N	50 N	114 N
Max. displacement resistance without cover strip	28 N	38 N	95 N

4.6.2 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 and greasing the toothed belt axis

For ELGA-TB-G-...-P0: Check the cavity between the guide and toothed belt for foreign objects and remove them.

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

Lubricants for assembly of the toothed belt axis

Application	Designation
Assembly	Festo LUB-KC1[1)]

[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).

5.2 Toothed belt pretensioning

Note

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

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

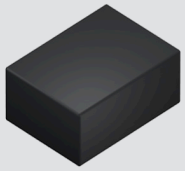
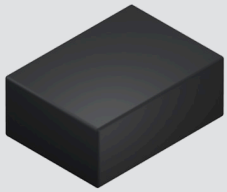
6.1 Standard tools

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
- Thread cutter
- Flat pliers
- Ruler
- Sturdy general purpose scissors or metal shears

6.2 Special tools

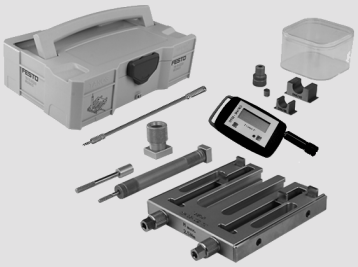
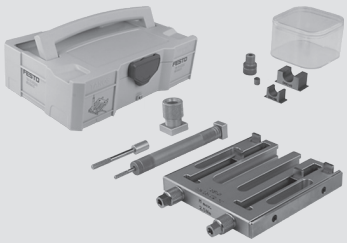
The following special tools are required for repair and maintenance of the toothed belt axis:

Designation	Additional information	Festo order no.	Figure
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	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	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**.

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