Linear actuator with track roller guidance system and toothed belt drive

MLFI140-3ZR, MLFI200-3ZR
Fitting and maintenance manual

SCHAEFFLER GROUP
INDUSTRIAL

Safety guidelines and symbols

High product safety

Our products correspond to the current level of research and technology. If the bearing arrangement is correctly designed, if the products are handled and fitted correctly and as agreed and if they are maintained as instructed, they do not give rise to any immediate hazards.

Statements to be observed

This publication gives descriptions of standard products. Since these are used in numerous applications, we cannot make a judgement as to whether any malfunctions will cause harm to persons or property.

It is always and fundamentally the responsibility of the designer and user to ensure that all specifications are observed and that all necessary safety information is communicated to the end user. This applies in particular to applications in which product failure and malfunction may endanger persons.

Definition of guidelines and symbols

The warning and hazard symbols are defined along the lines of ANSI Z535.6-2006.

The meaning of the guidelines and symbols is as follows.

Warning  If they are not observed, death or serious injury may occur.

Caution  If they are not observed, minor or slight injury will occur.

 If they are not observed, damage or malfunctions in the product or the adjacent construction will occur.

Note! There follows additional or more detailed information that must be observed.

① Numbers within a circle are item numbers.

❑ Squares with a shaded border are placed in front of instructions.

✓ Tick marks indicate preconditions.

Contents

Contents

About this manual

The purpose of this manual

This fitting and maintenance manual is valid exclusively for the linear actuators stated on the title page.

It describes the secure fitting and maintenance of the linear actuators stated.

How to use the manual

- ❑ This manual should be read carefully in full before starting any fitting or maintenance work.
- ❑ The manual must be stored throughout the life of the linear actuator.
- ❑ Please ensure that the manual is accessible at all times to the target group.
- ❑ The manual must be forwarded to each subsequent owner or operator of the linear actuator or the machine or equipment in which the linear actuator is fitted.

Note!

The text and illustrations in this manual cover, by way of an example, the linear actuator MLFI140-3ZR.
For an explanation of the design, see page 10.

The information in this manual can be applied analogously to all variants of the linear actuators stated on the title page.

Target group

The target group of this manual comprises the operator and trained skilled personnel charged with the fitting and maintenance of the linear actuators described.

Safety guidelines for linear actuators

Use for the intended purpose

All the linear actuators named on the title page are intended exclusively for moving machine components connected to the carriage.

Any other use is not for the intended purpose and is therefore impermissible. The Schaeffler Group accepts no liability for any damage or loss arising therefrom.

General safety guidelines

- ❑ Any actions and methods that endanger the safety of human beings must not be carried out.
- ❑ In all fitting and maintenance work, the following must be observed:
  - all nationally valid and relevant specifications for the prevention of accidents
  - all generally recognised rules of safety practice and occupational medicine.

The linear actuators named on the title page are constructed in accordance with the current level of technology and the recognised rules of safety practice. Nevertheless, while they are being used the user or third parties may be put at risk or the linear actuator and other material assets may be impaired.

Risk reduction

Risks can be reduced by observing the following points:

- ❑ The linear actuator should only be operated if it is free from technical defects.
- ❑ The linear actuator should only be used for the intended purpose and with an awareness of safety and hazards.
- ❑ If any malfunctions occur that have safety implications, the linear actuator must be stopped immediately and the malfunction rectified by a person with appropriate responsibility.

Fundamental instructions

The assembly and fitting of the linear actuator as well as the fitting and dismantling of the individual components must only be carried out as described in this manual:

- ❑ Carry out the operations in the specified sequence.
- ❑ Use the listed tools and fitting accessories correctly. Tools and fitting accessories that are unsuitable, damaged or contaminated will impair the function of the linear actuator.
- ❑ Screws must only be tightened using a torque wrench and the specified torques must be observed.
- ❑ Use rubber hammers only, not metal hammers.
- ❑ Do not use pointed or sharp-edged tools.

Personnel selection and qualification

Persons charged with the fitting and maintenance of the linear actuator must have adequate qualification. They must receive appropriate training and instruction before carrying out fitting or maintenance work.

Providing information to personnel

The fitting and maintenance manual must be available in a suitable form to the nominated persons (for example as a printout).
This includes drawing explicit attention to the hazard and safety guidelines in this manual.

Disclaimer of liability

The Schaeffler Group does not accept any liability for harm to human beings, the linear actuator and the adjacent construction that can be attributed to:

- incorrect fitting
- incorrect or inadequate maintenance
- incorrect communication of the content to third parties or a failure to communicate the content.

Use of replacement parts

Special INA replacement parts have been developed for the linear actuators named on the title page. These ensure the reliable and long term function of linear actuators.

❑ Do not use replacement parts other than original replacement parts from INA, see page 46.

Use of products from other sources

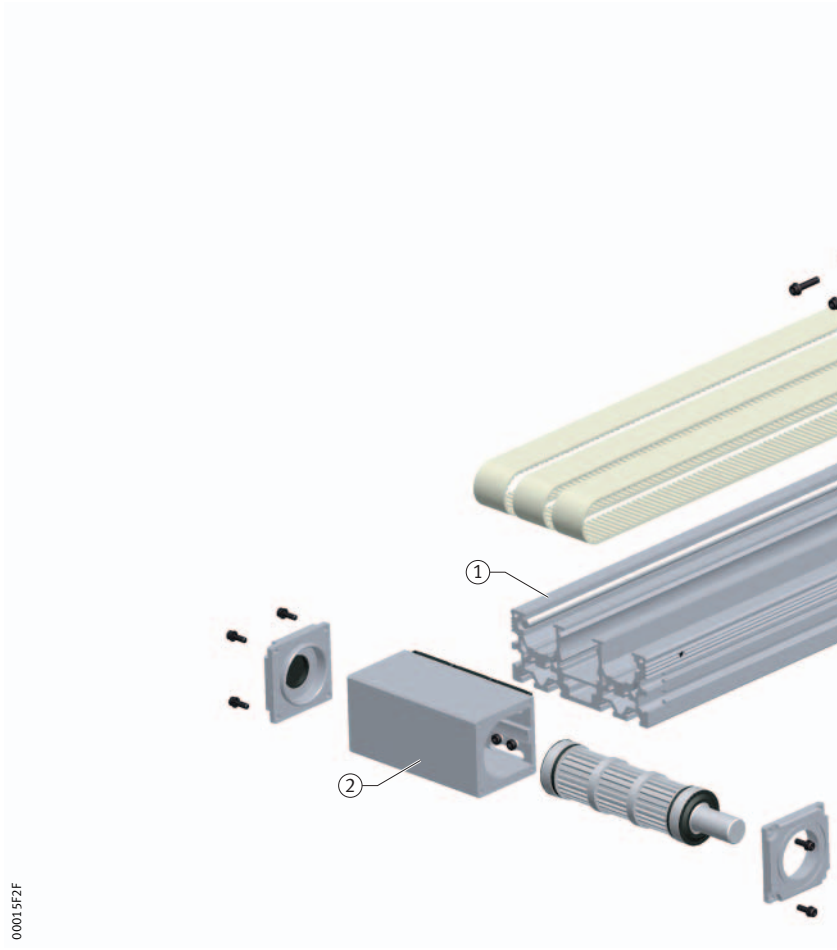
The use of products from other sources instead of INA replacement parts can:

- change the characteristics of the linear actuator in a negative manner
- endanger users or third parties
- cause impairment to the linear actuator and other material assets.

Disclaimer of liability

The Schaeffler Group accepts no liability for any damage or loss arising from the use of products from other sources.

Overview of the linear actuator

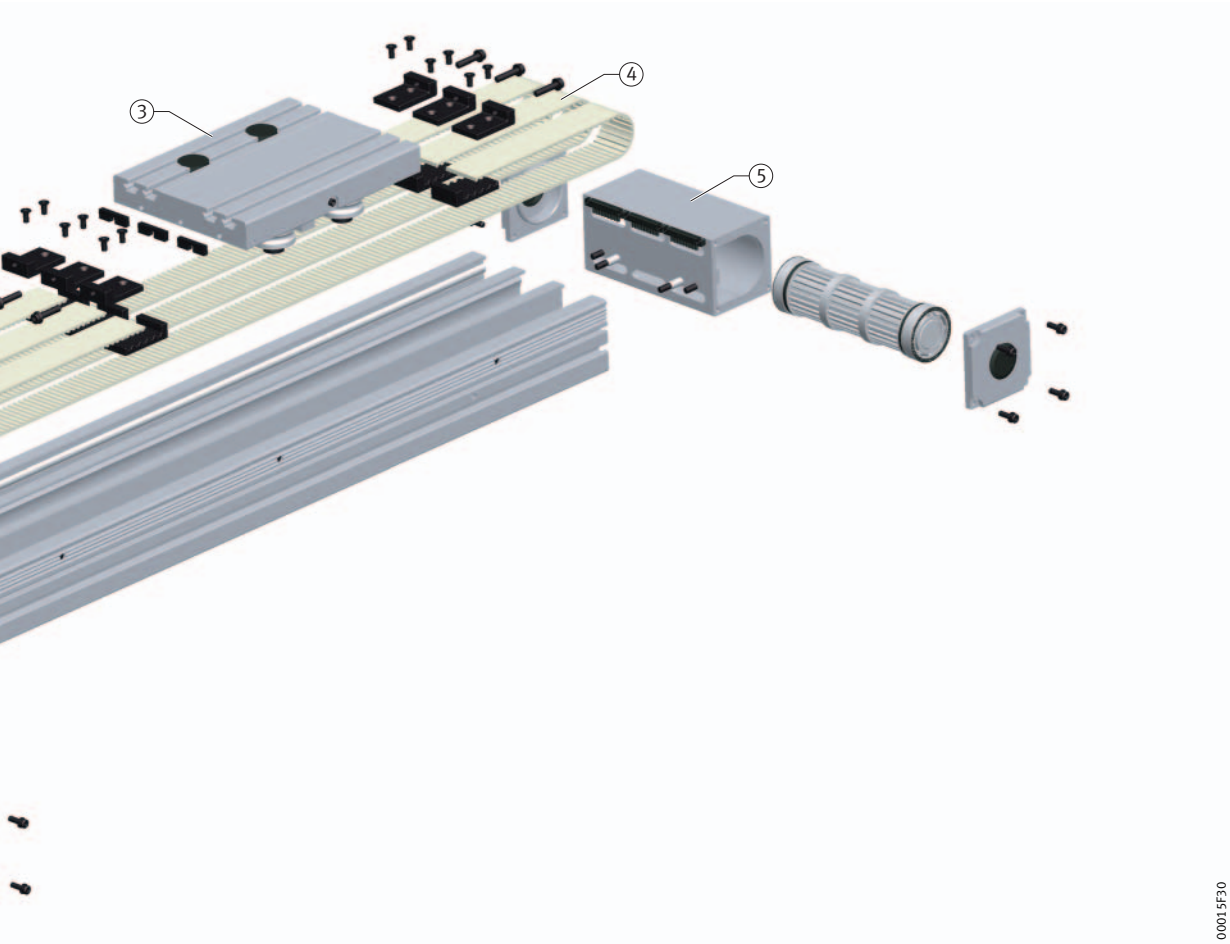


① Support rail with raceway shafts
② Drive unit
(return mechanism on drive side)
③ Carriage with profiled track rollers
④ Toothed belt unit
⑤ Return unit
(return mechanism on non-driven side)

Figure 1
Subassemblies
of linear actuator MLFI140-3ZR

Scope of delivery

- Support rail with raceway shafts ①.
  If supplied in several pieces, see section Variants, page 40.
- Drive unit ②.



Scope of delivery
– continued

- Carriage with profiled track rollers ③.
- Toothed belt unit ④.
  The toothed belt unit comprises three toothed belts and the clamping devices:
  The toothed belts are fixed to the carriage by means of the clamping devices.
- Return unit ⑤.

Available designs

The linear actuators are available in different designs.

Carriage

Carriage		Suffix in ordering designation
Number of driven carriages		
1		–
2		Variant, see page 42
Length		
MLFI140-3ZR	240 mm	–
MLFI200-3ZR	365 mm	–

Drive system

Drive system	Suffix in ordering designation
Without drive	OA
Drive shaft on right side	AR
Drive shaft on left side	AL
Drive shaft on both sides (right and left)	RL
Without drive shaft	OZ

Support rail

Support rail	Suffix in ordering designation
Single-piece	–
Multi-piece	Variant, see page 42

Note!

The text and illustrations in this manual cover, by way of an example, the following design of linear actuator:

- one driven carriage 240 mm long
- drive shaft on the left side (AL).

The information in this manual can be applied analogously to all variants of the linear actuators stated on the title page.

The precise design of your linear actuator is dependent on your order.

Ordering designation

The ordering number can be found engraved on the drive unit or return unit.

Ordering example

Design

Linear actuator with enclosed track roller guidance system	MLFI
Size	140
Length of carriage	240 mm
Drive type: triple toothed belt	3ZR
Drive shaft	AL
Number of carriages	1
Support rail	Single-piece
Total length of actuator	3 000 mm
Stroke length of actuator	2 546 mm

Ordering number **MLFI140-3ZR-AL/3 000-2 546**

Variants

Variants of the standard designs are shown in the section Variants, see page 42.

Fitting in the adjacent construction

The linear actuator is fitted in two steps:

- the support rail is fixed to the adjacent construction
- the carriage is fixed to the adjacent construction.

Note! Linear actuators more than 8 m long have a **multi-piece** support rail. They are supplied in several pieces.

❑ If the linear actuator is supplied in several pieces, please observe the section Variants, see page 40.

Location of the support rail on the adjacent construction

The support rail can be located on the adjacent construction using the following accessories:

- clamping lugs, see page 13
- fixing brackets, see page 13
- T-nuts to DIN 508, see page 14
- T-bolts to DIN 787, see page 14
- T-strips, see page 14
- hexagonal nuts to DIN 934, see page 14.

Note! Under normal loads, location by means of clamping lugs, fixing brackets **or** T-nuts, T-bolts etc. is normally sufficient.

INA connecting brackets

Multi-axis handling systems comprising INA linear actuators can be constructed using INA connecting brackets.

Detailed information on the connecting brackets can be found in INA publication Fasteners and connecting brackets for linear actuators (TPI 153).

If linear actuators are located incorrectly, this can damage the linear actuator itself and the adjacent construction.

❑ Note the maximum tightening torques for the fixing screws, see page 50.

❑ Note the maximum spacings for the fasteners.

❑ Ensure that the adjacent construction has adequate strength.

Location of the support rail using clamping lugs or fixing brackets

❑ If the support rail is fully in contact with the adjacent construction, clamping lugs or fixing brackets should be fitted on the left and right sides of the support rail at intervals of max. 333 mm.

MLFI140-3ZR:
A = 205 mm
B = 230 mm

MLFI200-3ZR:
A = 285 mm
B = 310 mm

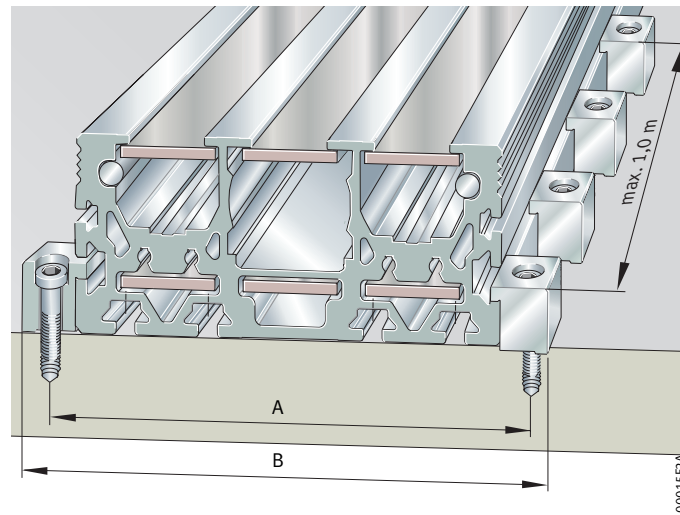


Figure 2
Location using clamping lugs

❑ Under high loads, the support rail should be fixed at shorter intervals or additionally by means of T-nuts or other accessories named on page 12.

Fixing the support rail by means of T-nuts

❑ If the support rail is fully in contact with the adjacent construction, T-nuts should be fitted in all profiled slots at intervals of max. 300 mm.

Note!

The following accessories can be used instead of T-nuts:

- T-bolts (MLFI140-3ZR only)
- T-strips with appropriate spacing of the screws
- hexagonal nuts.

MLFI140-3ZR:
B2 = 70 mm
B3 = 140 mm

MLFI200-3ZR:
B1 = 50 mm (not shown)
B2 = 110 mm
B3 = 210 mm

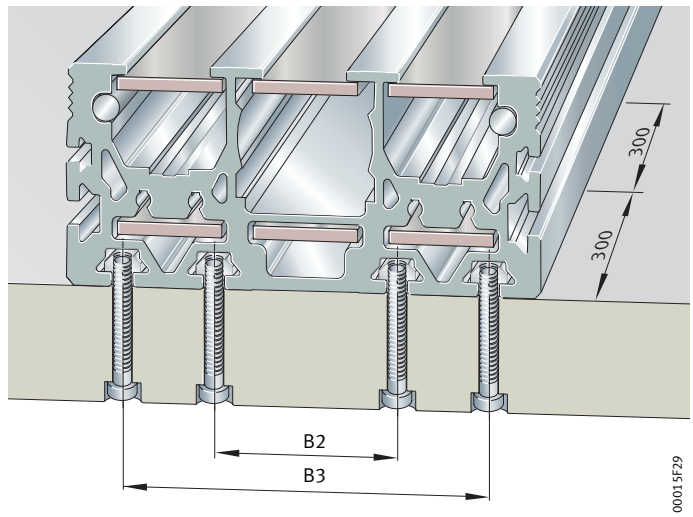


Figure 3
Fixing by means of T-nuts

❑ Under high loads, the support rail should be fixed at shorter intervals or additionally by means of clamping lugs or fixing brackets.

Fixing the carriage to the adjacent construction

A carriage with T-slots is located by means of:

- T-nuts to DIN 508
- T-bolts to DIN 787
- T-strips
- hexagonal nuts to DIN 934.

If linear actuators are located incorrectly, this can damage the linear actuator itself and the adjacent construction.

❑ Note the maximum tightening torques for the fixing screws.

❑ Ensure that the adjacent construction has adequate strength.

❑ Protect the raceway of the carriage against contamination.

Fixing the carriage

❑ Carriages must be fixed to the adjacent construction in accordance with the loads and the forces acting on them.

Fitting and mounting of accessories

For the linear actuators stated in the title, INA offers specially developed accessories, see section Appendix, page 48.

This chapter shows the fitting of the following accessories:

- coupling
- coupling housing.

Coupling

The following tools are required:

- torque wrench
- Allen key or hex key inserts.

Warning

Sudden start of the machine.

Crushing of fingers between the linear actuator and machine parts.

❑ Before starting work, disconnect the machine from the power supply.

❑ Secure the main switch of the machine against switching on.

Fitting the coupling

❑ Slide the coupling onto the drive shaft of the drive unit. There must be a gap of approx. 2 mm left between the coupling and the bearing cover.

❑ Fully tighten the fixing screw. The fixing screw and tightening torque will differ according to the coupling used, for information see INA publication ALE, Driven Linear Units.

Figure 4
Screw mounting of the coupling

Removing the coupling

✓ Coupling housing removed.

❑ Loosen the fixing screw.

❑ Remove the coupling in the direction of the drive shaft.

Coupling housing

The following tools are required:

- torque wrench
- Allen key or hex key inserts.

Warning

Sudden start of the machine.

Crushing of fingers between the linear actuator and machine parts.

❑ Before starting work, disconnect the machine from the power supply.

❑ Secure the main switch of the machine against switching on.

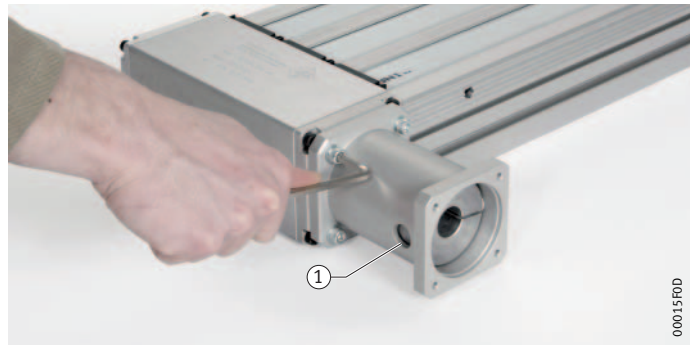
Fitting the coupling housing

✓ Coupling fitted.

❑ Slide the coupling housing over the coupling. The ring-shaped raised area on one end face must face towards the support rail.

❑ Screw mount the coupling housing to the drive unit by means of the fixing screws.

- MLFI140-3ZR: M6/9,5 Nm
- MLFI200-3ZR: M8/23 Nm.



① Hole in the coupling housing

Figure 5
Screw mounting of the coupling

Note!

The hole in the coupling housing is used to fix and loosen the drive shaft.

Removing the coupling housing

❑ Loosen the fixing screws.

❑ Remove the coupling housing in the direction of the drive shaft.

Maintenance

Maintenance requirements

Maintenance work is restricted to:

- relubrication
- cleaning.

Maintenance work may require the removal and refitting of components, see page 22 onwards.

Visual inspection

In order to ensure exact function and a long operating life of the linear actuator, it must be visually inspected for damage and contamination at regular intervals.

Maintenance intervals

Maintenance intervals, especially the intervals between relubrication, are influenced by:

- travel speed and drive torque
- load
- temperature
- stroke length
- environmental conditions (cleanliness etc.).

Maintenance according to operating conditions

It is not possible to calculate all the influences on maintenance intervals. The intervals can therefore only be determined precisely under operating conditions.

Note!

The interval lengths stated in the following sections are **maximum** maintenance intervals. They must be shortened for each individual case depending on the types of influences present.

Relubrication

Relubrication is necessary for:

- carriages.

When should relubrication be carried out?

The relubrication interval is dependent on the environmental conditions. Relubrication times and quantities can only be determined precisely under operating conditions.

Relubrication must be carried out:

- as a function of the application
  This must be determined in accordance with the operating conditions.
- as soon as fretting corrosion[1)] occurs.

Note!

If fretting corrosion occurs, the lubrication intervals should definitely be reduced.

What should be used for relubrication?

For relubrication of the carriage, oils CL and CLP to DIN 51 517 with a viscosity of ISO-VG 220 are recommended.

Note!

Detailed information on recommended lubricants can be found in the INA publication ALE, Driven Linear Units. The INA publication can be requested through info.linear@schaeffler.com.

What is the relubrication quantity?

Guide values for the required quantity of oil are shown in the table.

Relubrication quantity Carriage

Series	Relubrication quantity for carriage (guide values)
MLFI140-3ZR	approx. 2 ml to 3 ml
MLFI200-3ZR	approx. 4 ml to 5 ml

Note!

It is more advisable to carry out relubrication at several points during the maintenance interval, using partial quantities in each case, than relubrication at the end of the interval using the entire quantity.

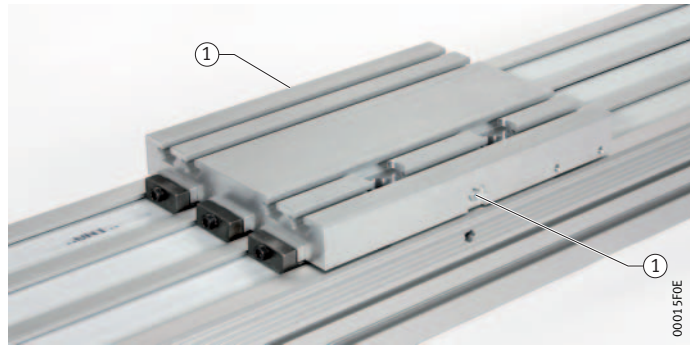
1) Fretting corrosion can be identified by a reddish discolouration of the raceway shafts or the outside surface of the track rollers.

Relubrication of carriages

Funnel type lubrication nipple

The carriage is relubricated via funnel type lubrication nipples to DIN 3 405-D6. These are located on the longitudinal sides of the carriage.

The lubrication connector can also be replaced in order to allow connection to a central lubrication system.



① Funnel type lubrication nipple

Figure 6
Funnel type lubrication nipple

Relubrication can be carried out from either the left or right side.

Warning

Sudden start of the machine.

Crushing of fingers between the carriage and machine parts.

- ❑ Before starting work, disconnect the machine from the power supply.
- ❑ Secure the main switch of the machine against switching on.

Relubrication of carriages

- ✓ Linear actuator warm from operation.
- ✓ Funnel type lubrication nipples clean and accessible.
- ❑ Pump the required lubricant quantity into one of the funnel type lubrication nipples.
- ❑ If possible, move the carriage by hand during lubrication in order to distribute the oil evenly.

Cleaning

When should cleaning be carried out?

Cleaning must be carried out if heavy contamination is present.

The cleaning requirements are dependent on the environmental and application conditions and can only be determined in the operational state.

Cleaning of components after removal

If components must be removed or the linear actuator must be dismantled, the components should be cleaned before refitting.

Damage due to unsuitable cleaning tools or cleaning agents.

- ❑ Do not use pointed, hard or abrasive objects.
- ❑ Do not dampen lubricated components during cleaning.
- ❑ Do not use abrasives, petroleum spirit, oil etc.

What should be used for cleaning?

Suitable cleaning tools are:

- paint brush
- soft brush
- soft cloths.

Linear actuator

The linear actuator is dismantled in the following sequence:

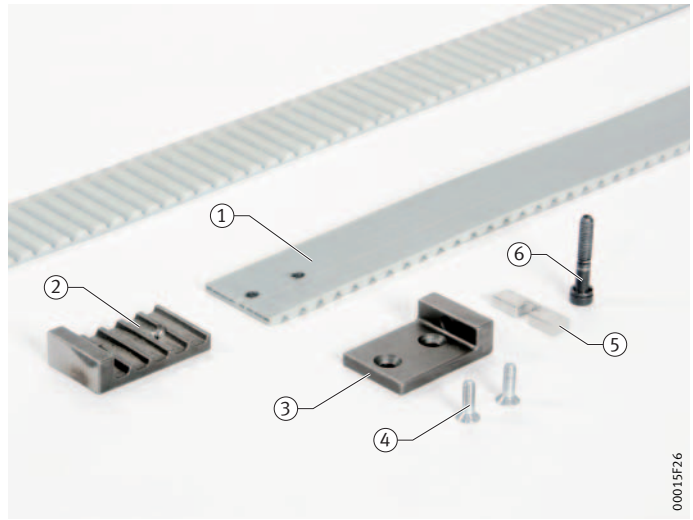
- remove the toothed belt, see page 23
- remove the drive unit or return unit, see page 25
- remove the carriage, see page 27.

Note!

It is only necessary in exceptional cases to completely disassemble the linear actuator.

Toothed belt unit

The toothed belt unit comprises three toothed belts and six clamping devices. The clamping devices connect the toothed belts to the carriage.



① Toothed belt

Clamping device:
② Lower clamping piece
③ Upper clamping piece
④ Fixing screws
⑤ Spacer
⑥ Adjusting screw

Figure 7
Overview of toothed belt unit

Warning

Sudden start of the machine.

Crushing of fingers between the carriage and machine parts.

❑ Before starting work, disconnect the machine from the power supply.

❑ Secure the main switch of the machine against switching on.

Removing the toothed belt

The following tools are required:

- torque wrench
- Allen key or hex key inserts.

Note!

The toothed belts are supplied with a factory-specified preload. If the toothed belts are refitted after removal, they must be set to the same preload as before removal, see page 36.

Detaching the clamping devices from the carriage (drive side)

❑ Loosen and remove the adjusting screws on the drive side of the carriage.

Figure 8
Loosening the adjusting screws

❑ Remove the clamping devices and the spacers from the carriage.

❑ If the same toothed belts are refitted: store the spacers carefully and reuse them when fitting the clamping device in order to achieve the original preload.

Detaching the clamping devices from the toothed belt

❑ Loosen and remove the fixing screws of the clamping devices.

Figure 9
Loosening the fixing screws

❑ Remove the upper and lower clamping pieces from the toothed belt.

Detaching the clamping devices on the return side

❑ Detach the clamping device from the carriage, but **do not** remove the clamping pieces from the toothed belt.

Note!

The clamping devices on the central toothed belt must only be removed from the toothed belt if the clamping device itself or the toothed belt must be replaced. Dismounting of these clamping devices is not necessary in order to remove the toothed belt unit.

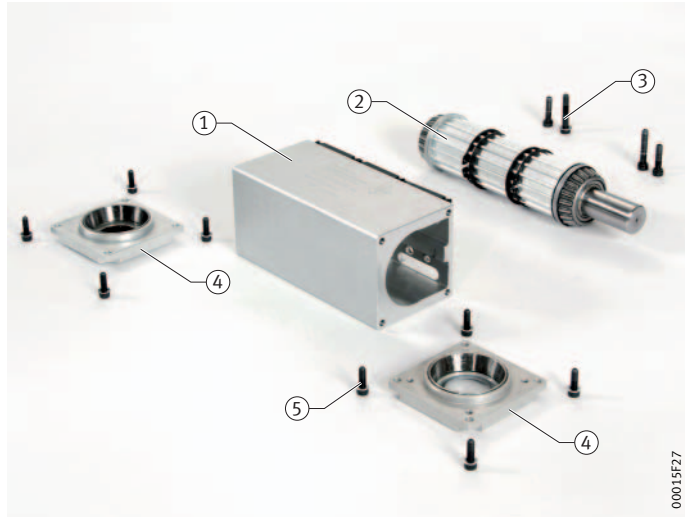
Removing the toothed belt

❑ Grip the end of each toothed belt consecutively and pull it out of the support rail.

Figure 10
Removing the toothed belt

Drive unit and return unit

The drive unit and return unit differ according to the design. However, both components are dismounted in the same way.



① Housing
② Toothed belt pulley with bearing
③ Fixing screws for housing
④ Bearing cover
⑤ Fixing screws for bearing cover

Figure 11
Overview of drive unit

Removing the drive unit or return unit

The following tools are required:

- torque wrench
- Allen key or hex key inserts.

✓ All toothed belts removed, see page 23.

✓ In the case of the drive unit:
motor, coupling and coupling housing removed,
see page 16 and page 17.

Removing the toothed belt pulley

❑ Loosen the fixing screws for one bearing cover on the drive unit or return unit as appropriate.

❑ Loosen the bearing cover from the housing and remove it in the direction of the shaft axis.

Figure 12
Removing the bearing cover

❑ Remove the toothed belt pulley together with the bearing from the housing.

Figure 13
Removing the toothed belt pulley

Removing the housing

❑ Remove the second bearing cover from the housing.

❑ Loosen the fixing screws on the housing.

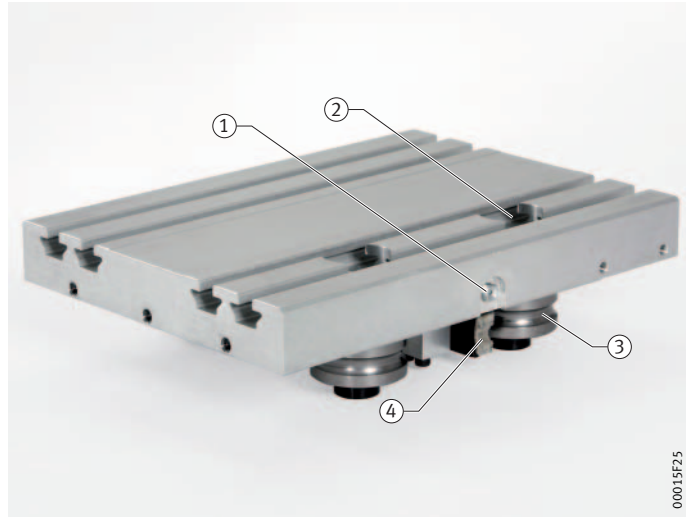
Figure 14
Unscrewing the housing

❑ Remove the housing from the support rail.

Figure 15
Removing the housing

Carriage

It is only necessary to remove the carriage if it is to be replaced by a new carriage.



① Funnel type lubrication nipple
② Eccentric bolt
③ Profiled track rollers
④ Felt inserts for relubrication

Figure 16
Overview of carriage

Damage due to contaminated lubricant.
The characteristics of oil may change due to contamination.
❑ The work area must be cleaned before removing the carriage.
❑ Elements with oil must be laid only on a clean, lint-free underlay.

Removal of carriage

✓ Drive unit or return unit removed, see page 25.

Damage due to incorrect removal.
❑ While removing the carriage, hold it concentric and parallel to the support rail.

Removing the carriage

❑ Remove the carriage carefully from the support rail.

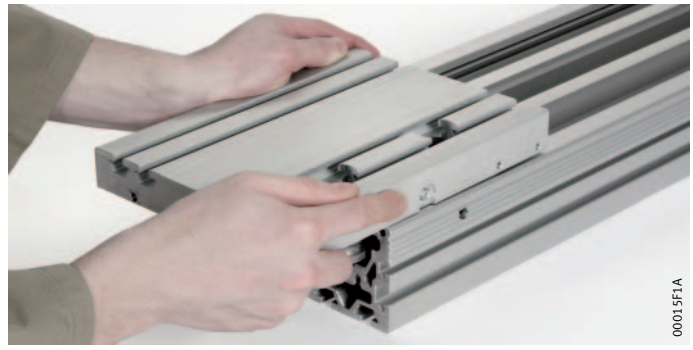


Figure 17
Removing the carriage

Linear actuator

A completely disassembled linear actuator is reassembled in the following sequence:

- fit the carriage, see page 29
- insert the toothed belt, see page 31
- fit the return unit, see page 32 to page 33
- fit the drive unit, see page 34 to page 35
- fix the toothed belt to the carriage, see page 35
- preload the toothed belt, see page 36 to page 37
- align the clamping device, see page 37.

Carriage

A component overview is shown in *Figure 16*, page 27.

The following tools are required:

- torque wrench
- Allen key or hex key inserts
- ring wrench
- screwdriver.

Damage due to incorrect fitting.

❑ Hold the profiled track rollers with the correct fit at the level of the raceway shafts.

❑ Hold the carriage concentric and parallel to the support rail.

❑ Ensure that the carriage runs without clearance over the whole length of the support rail.

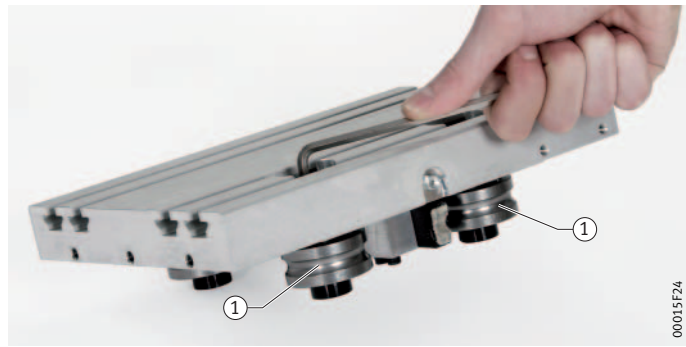
❑ After fitting, relubricate the raceway shafts.

Sliding the carriage onto the guideway

❑ Remove the black protective caps on the eccentric bolts.

❑ Loosen the nut marked in red on the eccentric bolt until the eccentric bolt can be turned.

❑ Turn the profiled track roller of the eccentric bolt towards the centre of the carriage.



① Profiled track rollers with eccentric bolts

Figure 18
Turning the profiled track rollers

❑ Slide the carriage carefully onto the raceway shafts. While doing this, carefully press the felt lubrication inserts inwards using a screwdriver.

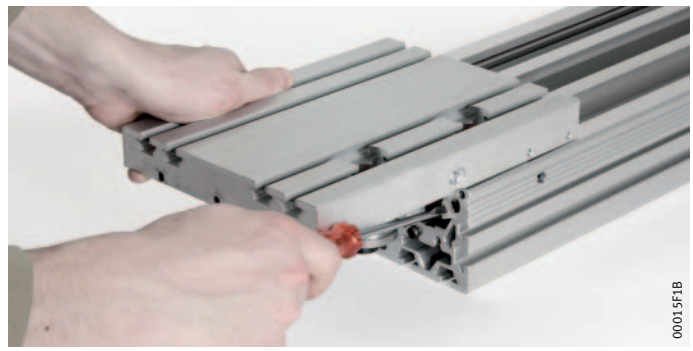


Figure 19
Sliding the carriage onto the raceway shafts

Setting the profiled track rollers clearance-free

❑ Turn the eccentric bolt until the carriage sits without clearance on the raceway shafts. While doing this, move the carriage by hand.

Figure 20
Turning the eccentric bolt

❑ Tighten the nuts on the eccentric bolts. Ensure that the eccentric bolt does not rotate as well:

- MLFI140-3ZR: 32 Nm
- MLFI200-3ZR: 50 Nm.

Figure 21
Tightening the nuts on the eccentric bolts

❑ Move the carriage by hand and check whether it can move without clearance over the whole length of the support rail.

Note!

If the carriage **cannot** move without clearance over the whole length of the support rail, please contact Application Engineering at the Linear Technology Division.

Toothed belt unit

A component overview is shown in *Figure 7*, page 22.

Overview of fitting

The toothed belts are fitted in 5 steps:

- insert the toothed belt
- fit the return unit
- fit the drive unit
- fix the toothed belt to the carriage
- preload the toothed belt.

The following tools are required:

- rubber hammer
- torque wrench
- Allen key or hex key inserts
- screwdriver.

Note!

If the toothed belts are refitted after removal, they must be set to the same preload as before removal, see page 36.

Starting point

The following instructions are based on the assumption that both the return unit and the drive unit have been removed, see page 25.

If only one of the two units has been removed, go directly to Fitting the drive unit housing, see page 34. In this case, the instructions also apply for fitting of the return unit.

✓ Carriage slid onto guideway, see page 29.

Inserting the toothed belt

❑ Insert all the toothed belts into the lower hollow sections at the open end of the support rail.
The teeth of the toothed belt must face upwards.

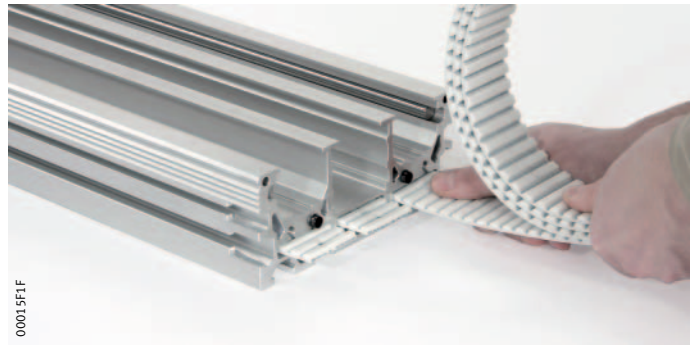
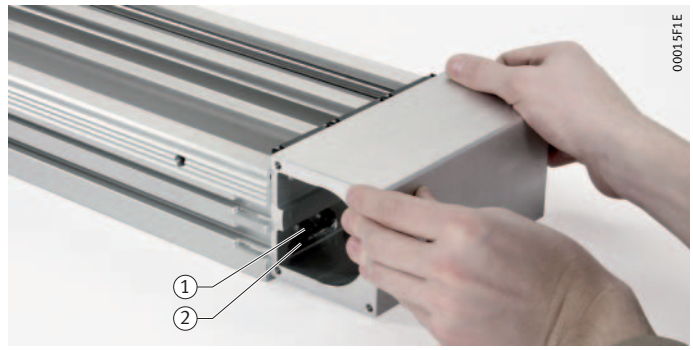


Figure 22
Inserting the toothed belt into the support rail

❑ Continue inserting the toothed belt until only 2 or 3 teeth protrude from the end of the support rail.

Fitting the return unit housing

❑ Locate the return unit housing on the two dowel pins and push it onto the support rail until it stops.
Ensure that the toothed belts slide through the lower openings into the housing.



① Outlying hole
② Opening for toothed belt

Figure 23
Locating the housing

❑ Screw mount the housing to the support rail using fixing screws:
– MLFI140-3ZR: M6/9,5 Nm
– MLFI200-3ZR: M8/23 Nm.

Note! Screw the shorter screws into the outlying holes.

Figure 24
Screw mounting of the housing

Inserting the toothed belt pulley

❑ Insert the toothed belt pulley into the housing and centre it.

Figure 25
Inserting the toothed belt pulley

Damage to the toothed belt and return unit due to unsuitable tools.
❑ Do not use pointed or sharp-edged tools.

Inserting the toothed belt

❑ Feed the central toothed belt onto the teeth of the toothed belt pulley with the aid of a screwdriver.
Hold the screwdriver flat between two teeth on the toothed belt.

Figure 26
Feeding the toothed belt onto the toothed belt pulley

❑ Guide the toothed belt over the toothed belt pulley and pull it approx. 200 mm out of the top of the return unit.

❑ Insert the two outer toothed belts and pull them approx. 200 mm out of the top of the drive unit.

Closing the housing

❑ Locate 1 bearing cover on the housing. Slide the toothed belt pulley into the cover.

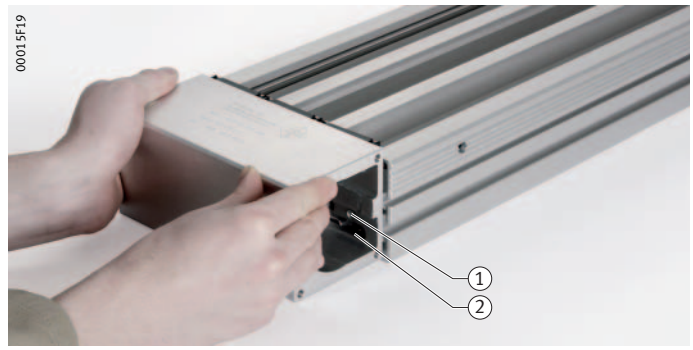
❑ Screw the bearing cover firmly to the housing:
- MLFI140-3ZR: M5/5,5 Nm
- MLFI200-3ZR: M6/9,5 Nm.

❑ Locate the second bearing cover and screw it firmly into place.

Fitting the drive unit housing

❑ Draw the toothed belts out of the return unit until their other ends protrude by 2 or 3 teeth from the open end of the support rail.

❑ Locate the drive unit housing on the dowel pins and push it onto the support rail until it stops. Ensure that the toothed belts slide through the lower opening into the housing.



① Outlying hole
② Opening for toothed belt

Figure 27
Locating the housing

❑ Screw mount the housing to the support rail using fixing screws:
- MLFI140-3ZR: M6/9,5 Nm
- MLFI200-3ZR: M8/23 Nm.

Note! Screw the two shorter screws into the outlying holes.

❑ Insert the toothed belt pulley into the housing.

Inserting the toothed belt

❑ Feed the central toothed belt onto the teeth of the toothed belt pulley.

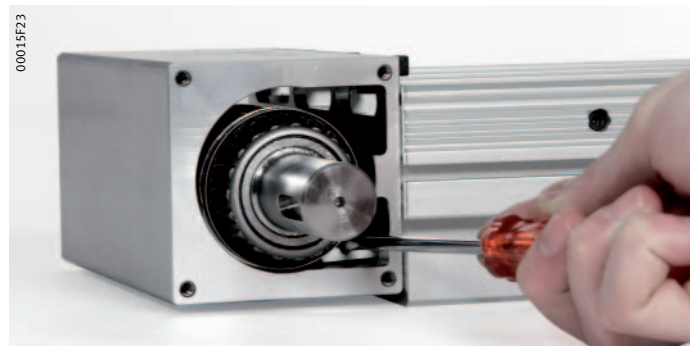


Figure 28
Feeding the toothed belt onto the toothed belt pulley

❑ Guide the toothed belt over the toothed belt pulley and pull it approx. 200 mm out of the top of the drive unit.

❑ Insert the two outer toothed belts and pull them approx. 200 mm out of the top of the drive unit.

Closing the drive unit housing

❑ Locate both bearing covers and slide them against the housing. If necessary, carefully knock the bearing cover into place using a rubber hammer.

❑ Screw the bearing cover firmly to the housing:
- MLFI140-3ZR: M5/5,5 Nm
- MLFI200-3ZR: M6/9,5 Nm.

Note! The inner holes on the bearing cover of the drive unit are intended for the coupling housing.

Attaching the toothed belt to the carriage

❑ Align the ends of the toothed belts parallel with each other in the upper channels of the support rail. The toothed belts must lie in the support rail over their whole length. Toothed belts with clamping devices fitted cannot be positioned in the support rail.

❑ Position the upper and lower clamping pieces of the clamping devices on the toothed belts and screw them firmly into place:
- MLFI140-3ZR: M5/5,5 Nm
- MLFI200-3ZR: M5/5,5 Nm.

Figure 29
Screw mounting the clamping device to the toothed belt

❑ Screw the clamping devices firmly into place on the return side of the carriage using the adjusting screws:
- MLFI140-3ZR: M6/9,5 Nm
- MLFI200-3ZR: M8/23 Nm.

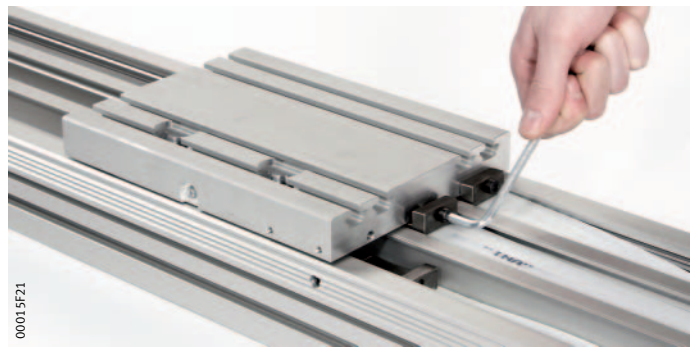


Figure 30
Screw mounting the clamping device to the carriage

❑ Screw mount the clamping device to the driven side of the carriage loosely enough so that the toothed belt is **not** yet tensioned.

Preloading the toothed belt during refitting

When refitting a toothed belt that has been removed:

❑ Reinsert the stored spacers between the clamping device and the carriage (driven side).

❑ Tighten the clamping device with a torque of M8/23 Nm to the hard stop.

Preloading a new toothed belt

When fitting a new toothed belt:

❑ Mark a measurement length of 1 000 mm on the untensioned toothed belt. In order to increase the measurement accuracy, the measurement length can be extended in the case of longer linear actuators (2 000 mm, 3 000 mm etc.).

Figure 31
Measurement length marked on central toothed belt

❑ Tighten the adjusting screws on the driven side of the carriage until the measurement lengths are extended by the preload elongation.
The elongation is as follows:

- MLFI140-3ZR: 1,1 mm/1 000 mm
- MLFI200-3ZR: 1,1 mm/1 000 mm.

Figure 32
Measurement length on preloaded central toothed belt

Inserting the spacers

- ❑ Measure the gap between the clamping device and carriage using a vernier.
- ❑ Select spacers corresponding to the width of the gap. If a single spacer is not sufficient, select 2 or more spacers that **together** correspond to the width of the gap.
- ❑ Insert the spacers between the carriage and the clamping device.
- ❑ Tighten the clamping device with a torque of M8/23 Nm to the hard stop.

Aligning the clamping devices

- ❑ Check on both sides of the carriage whether the upper edges of the clamping devices are aligned in parallel.
- ❑ If necessary, loosen the adjusting screws and align the clamping devices using a strip of wood or plastic and a rubber hammer.

Figure 33
Aligning the clamping devices

- ❑ Retighten the adjusting screws.

Drive unit and return unit

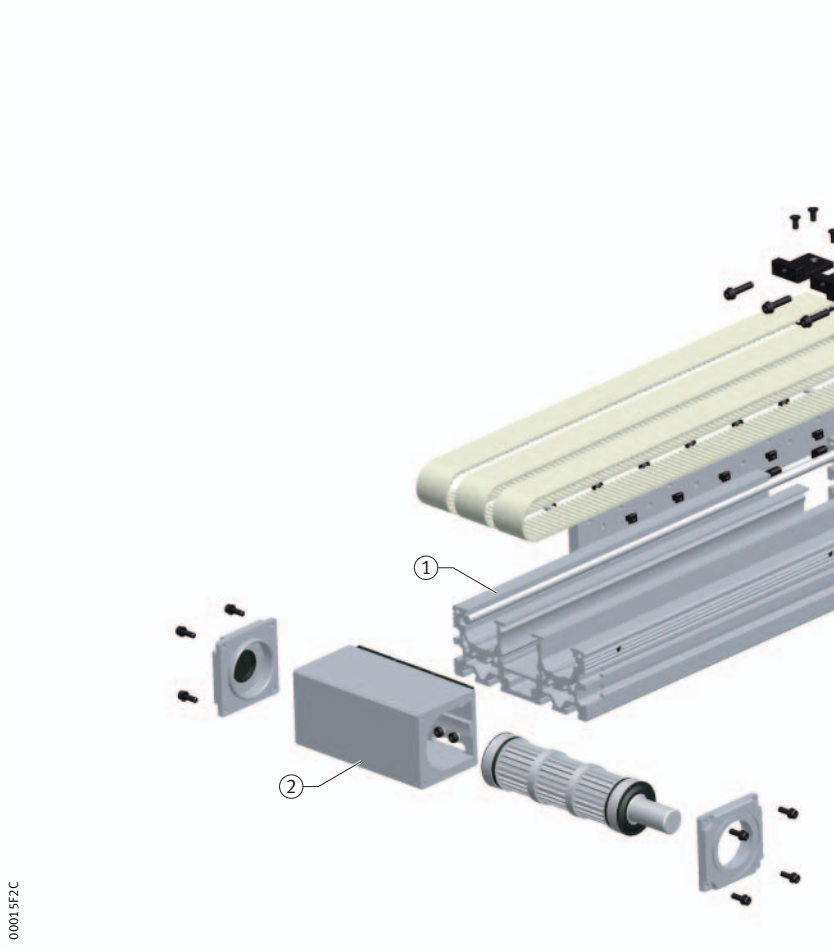
A component overview is shown in *Figure 11*, page 25.

The following tools are required:
- rubber hammer
- torque wrench
- Allen key or hex key inserts.

✓ Toothed belt inserted in the profiled section, see page 31.

Fitting the drive unit or return unit

❑ For fitting of the drive unit, see page 34.
❑ For fitting of the return unit, see page 32.

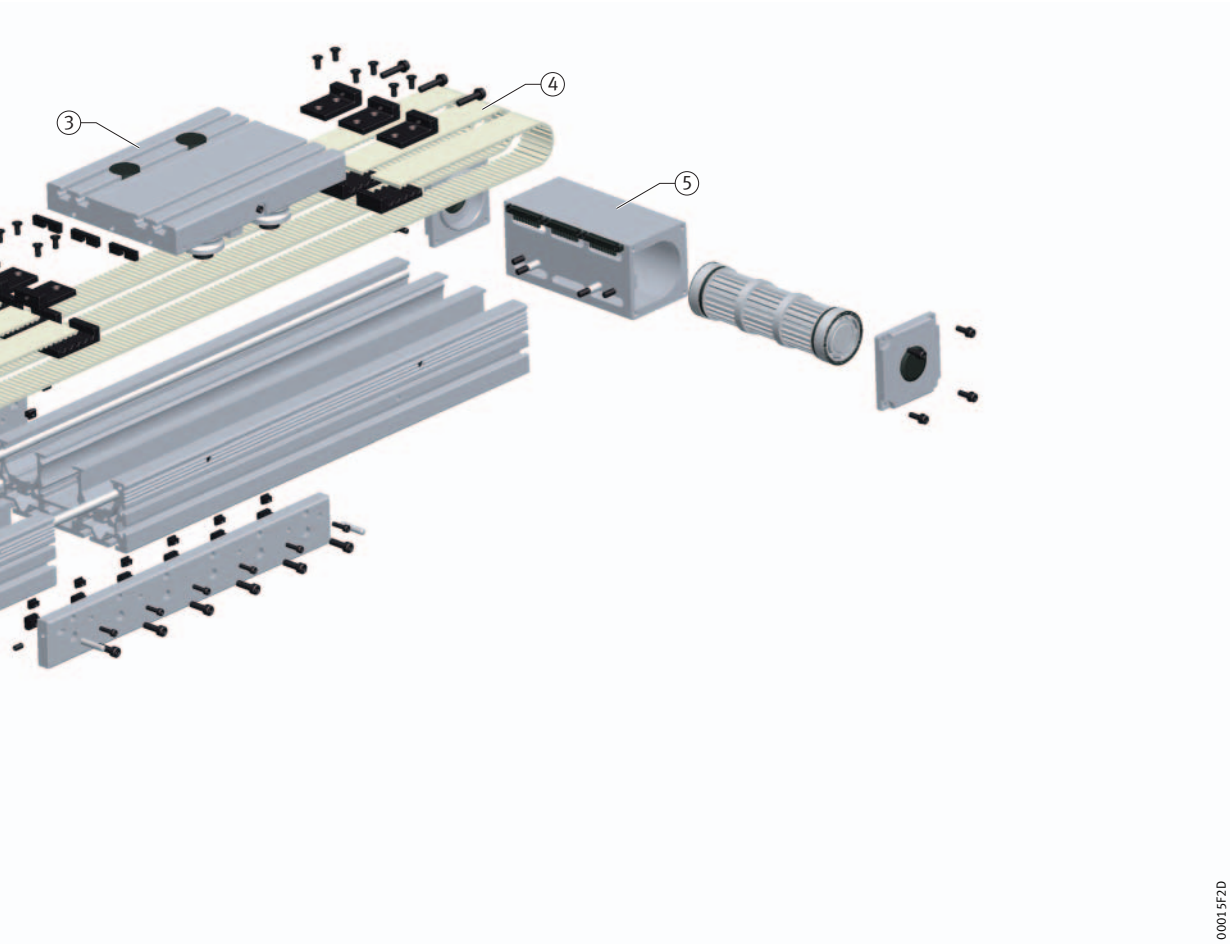


① Multi-piece support rail with raceway shafts and retaining plates
② Drive unit (return mechanism on drive side)
③ Carriage with profiled track rollers
④ Toothed belt unit
⑤ Return unit (return mechanism on non-driven side)

Figure 34
Subassemblies of linear actuator MLFI140-3ZR multi-piece design

Subassemblies

- Multi-piece support rail with raceway shafts and retaining plates ①, two retaining plates supplied per profile joint.
- Drive unit ②.



Subassemblies
– continued

- Carriage with profiled track rollers ③.
- Toothed belt unit ④.
  The toothed belt unit comprises three toothed belts and the clamping devices:
  The toothed belts are fixed to the carriage by means of the clamping devices.
- Return unit ⑤.

Variants

Available variants

Carriage	Suffix in ordering designation
2 driven carriages	W2

Support rail	Suffix in ordering designation
Multi-piece	FA517.X[1]

[1] X = number of support rail joints.

Ordering example

Design	
Linear actuator with enclosed track roller guidance system	MLFI
Size	200
Length of carriage	365 mm
Drive type: triple toothed belt	3ZR
Drive shaft	RL
Number of carriages	W2
Support rail	FA517.1
Total length of actuator	10 000 mm
Stroke length of actuator	8 686 mm

Ordering designation **MLFI200-3ZR-RL-W2-FA517.1/10 000-8 686**

Multi-piece support rail

Linear actuators more than 8 m long are supplied in several pieces. They must be assembled before fitting to the adjacent construction.

Note! If a delivery includes two or more multi-piece linear actuators, the individual pieces of each actuator are identified by the same letter on the joints of the profiled sections.

Example Linear actuator 1: A1, A2, A3, etc.
Linear actuator 2: B1, B2, B3, etc.

Assembling the support rail

The following tools are required:

- rubber hammer
- torque wrench
- Allen key or hex key inserts.

Caution

Risk of injury due to falling support rails.

❑ Ensure that support rails cannot drop from the working area.

Positioning of individual pieces

❑ The individual pieces of the support rail must be arranged consecutively in the correct sequence.
The combinations of letters and numbers at the profiled section joints must match, see *Figure 36*.

Example

Correct: profiled section joint A1 – A1

Incorrect: profiled section joint A1 – A2.

Figure 35
Arranging the support rails

❑ Slide the T-nuts for the retaining plates into the T-slots in the sides.

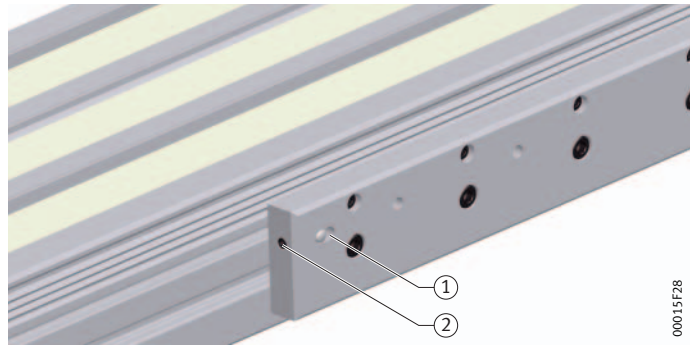
❑ Slide the individual pieces of the support rail together.

Figure 36
Example of letter and number combination for profiled section

Joining the individual pieces

- ❑ Locate the retaining plates at the centre of the profiled section joints using the fixing screws M6.
- ❑ Check whether the guideways in the individual sections abut each other. If necessary, correct the position of the individual pieces.
- ❑ Fix the retaining plates to the support rail by dowels using the two outermost dowel holes. Use the dowel holes in the support rail for this purpose.

Note! The dowel hole at one end of the retaining plate is designed as a slot.



① Slot
② Grub screw

Figure 37
Slot and grub screw

- ❑ Tighten the grub screws at the slots to the hard stop.
- ❑ Check the joint location again.
- ❑ Fasten the fixing screws in the retaining plates to a torque of 9,5 Nm.
- ❑ Drill through the remaining dowel holes in the retaining plates to a diameter 6 H7 approx. 20 mm deep.
- ❑ Knock in the dowel pins.

Fitting the components

- ❑ For fitting of further components, see chapter Fitting and mounting of components, page 28.

Multiple carriages

If the linear actuator has more than one carriage, these are linked by individual pieces of toothed belt.

Fitting of multiple carriages

The following tools are required:

- rubber hammer
- torque wrench
- Allen key or hex key inserts
- screwdriver.

✓ All carriages slid onto guideway, see page 29.

Fixing the toothed belt between carriages

❑ Fit short pieces of toothed belt with clamping devices and use these to link the carriages, see page 35.

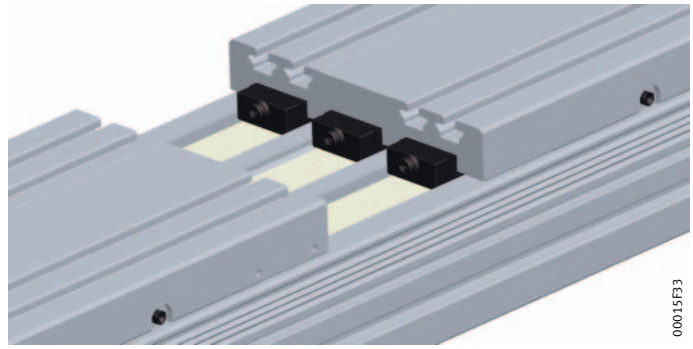


Figure 38

Linking carriages using separate pieces of toothed

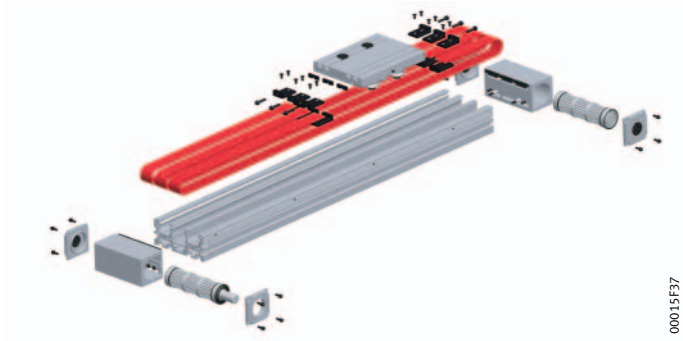
Fitting the toothed belt

❑ Fit the long pieces of toothed belt, see page 31 onwards.

Replacement parts

Note! The precise design of your linear actuator is dependent on your order. When ordering replacement parts, please indicate the ordering number of your linear actuator. The ordering number can be found engraved on the drive unit or return unit.

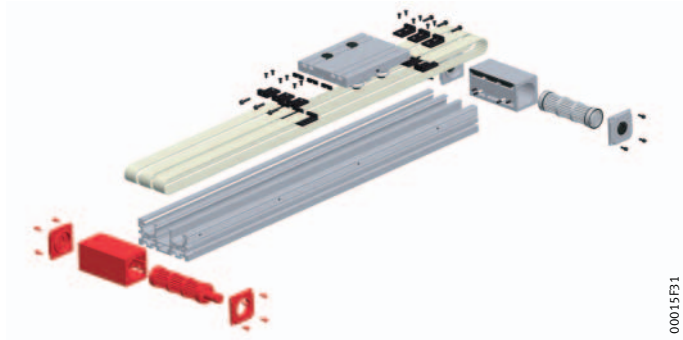
Toothed belt



Replacement parts list for toothed belt

Linear actuator	Designation	MATNR
MLFI140-3ZR	ZHRI40-AT-10	009634940-0000
MLFI200-3ZR	ZHRI50-AT-10	000255084-0000

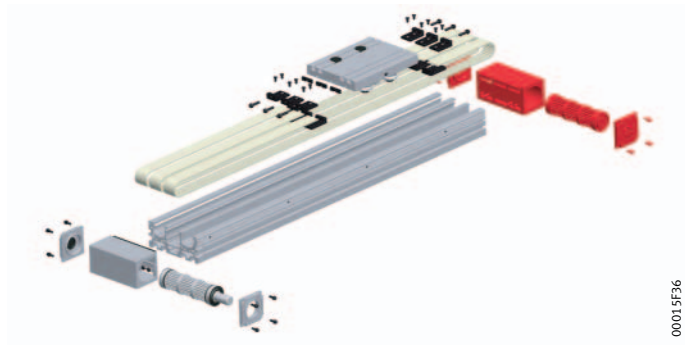
Drive unit



Replacement parts list for drive unit

Linear actuator	Designation	MATNR
Drive shaft on left or right side		
MLFI140-3ZR	UML.MDKUE15-ZR-AR-7500	009635181-0000
MLFI200-3ZR	UML.MDKUSE25-ZR-AR-7500	006984436-0000
Drive shaft on both sides		
MLFI140-3ZR	UML-MDKUE15-ZR-RL-7500	009774904-0000
MLFI200-3ZR	UML.MDKUSE25-ZR-RL-7500	006987265-0000

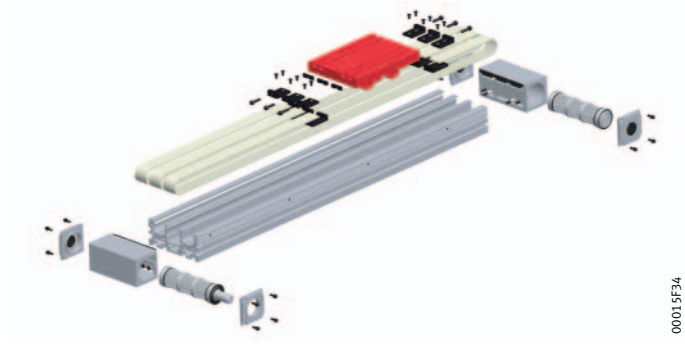
Return unit



Replacement parts list for return unit

Linear actuator	Designation	MATNR
MLFI140-3ZR	UML.MDKUE15-ZR-7500	009635270-0000
MLFI200-3ZR	UML.MDKUSE25-ZR-7500	009718230-0000

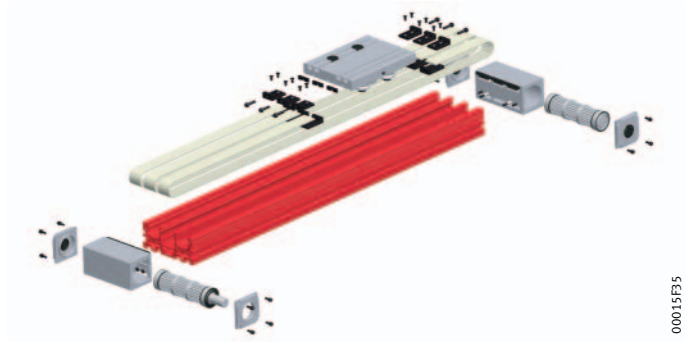
Carriage



Replacement parts list for carriage

Linear actuator	Designation	MATNR
MLFI140-3ZR	LAW.MLFI140-3ZR-4400	005413842-0000
MLFI200-3ZR	LAW.MLFI200-3ZR-4400	005424690-0000

Support rail



Replacement parts list for support rail

Linear actuator	Designation	MATNR
MLFI140-3ZR	LFS.MLFI140-3ZR-4700	005414008-0000
MLFI200-3ZR	LFS.MLFI200-3ZR-4700	005424712-0000

Appendix

Accessories

Special INA replacement parts have been developed for the linear actuators. These ensure the reliable and long term function of linear actuators.

Location

Accessory	Article number
Clamping lugs[1)]	SPPR28×30
Fixing brackets[1)]	WKL48×35
	WKL98×35
T-strips (steel)	Leis-M6-T-Nut
	Leis-M8-T-Nut
T-nuts	MU-DIN508-M4×8
	MU-DIN508-M6×8
	MU-M4×8-Rhombus
	MU-M6×8-POS
	MU-M6×8-Rhombus
	MU-M8×8-POS
T-bolts	SHR-DIN787-M8×8×32
Slot closing strips	NAD5×5,7
	NAD8×11,5
Connecting brackets	See INA publication Fasteners and connecting brackets for linear actuators (TPI 153)

1) Clamping lugs can support higher forces.
They should be used in preference over fixing brackets.

Coupling, gearbox, motor

As a system supplier, the Schaeffler Group also offers components including coupling housings, couplings, gearboxes and motors. These components are precisely matched to the linear actuators.

Possible combinations for MLFI140-3ZR

Coupling housing	Coupling	Gearbox	Motor
KGEH15/43100-MDKUVE-ZR	KUP-KM170-25H7-25H7	PL 115	MOT-SMH100 MOT-SMHA100-BR MOT-MH105 MOT-MHA105-BR
		PLE120/115	MOT-SMH100 MOT-SMHA100-BR MOT-MH105 MOT-MHA105-BR
KGEH15/43000-MDKUVE-ZR	KUP560-66-25H7-25H7	PL 115	MOT-SMH100 MOT-SMHA100-BR MOT-MH105 MOT-MHA105-BR
		PLE120/115	MOT-SMH100 MOT-SMHA100-BR MOT-MH105 MOT-MHA105-BR
KGEH32/43100-MLF-ZR	KUP560-56-20H7-25H7	PL 90	MOT-SMH82 MOT-SMHA82-BR
		PLE80/90	MOT-SMH82 MOT-SMHA82-BR

Possible combinations for MLFI200-3ZR

Coupling housing	Coupling	Gearbox	Motor
KGEH25/43100-MDKUE-ZR	KUP-KM400-32H7-25H7	PL 115	MOT-SMH100 MOT-SMHA100-BR MOT-MH105 MOT-MHA105-BR

Comprehensive information can be found in INA publication ALE, Driven Linear Units and on the Internet at www.schaeffler.com

Appendix

Tightening torques

The correct tightening torques are shown in the table.

Screw	Grade	Tightening torque Nm
M4	8.8	2,7
	10.9	4,3
	12.9	5,1
M5	8.8	5,5
	10.9	8,4
	12.9	10,2
M6	8.8	9,5
	10.9	14,7
	12.9	17,6
M8	8.8	23
	10.9	35,3
	12.9	42,2
M10	8.8	46
	10.9	67
	12.9	78
M12	8.8	80
	10.9	115
	12.9	135

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