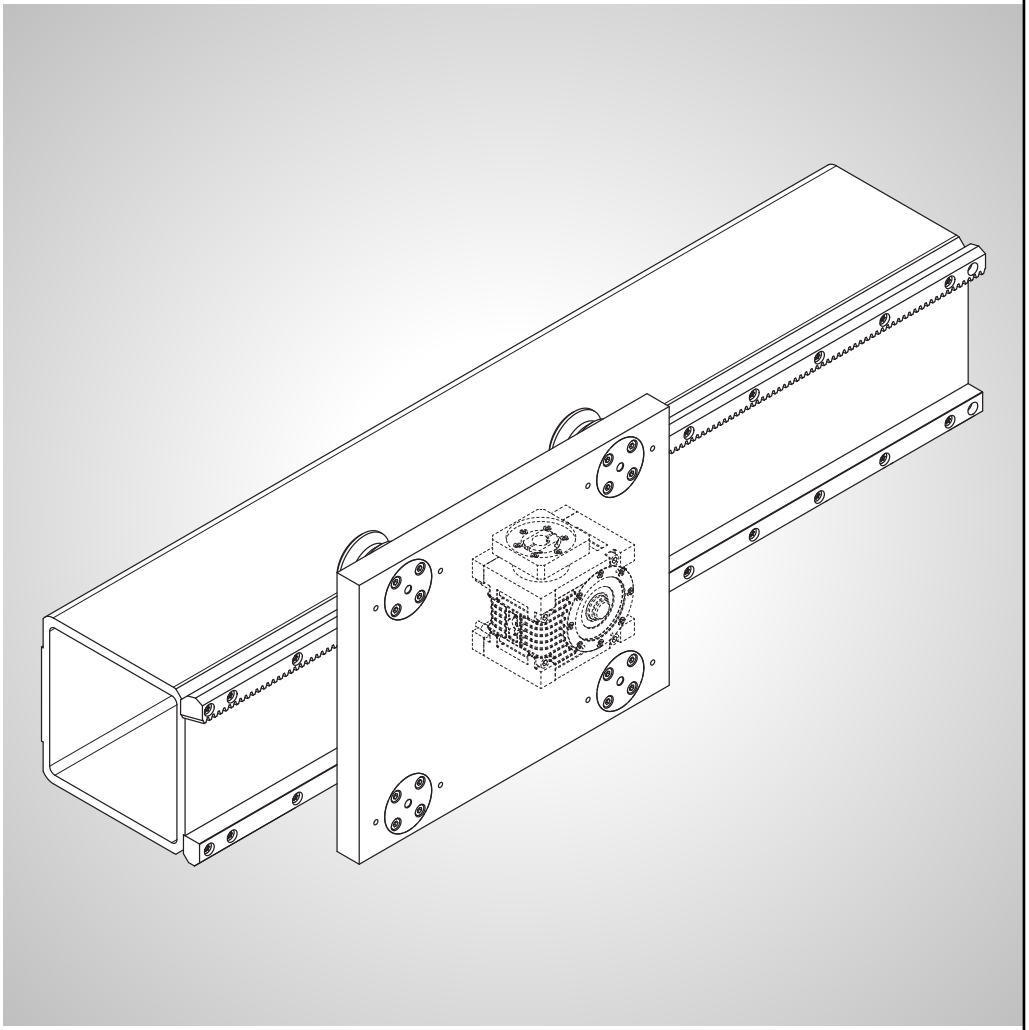
GÜDEL

SERVICE MANUAL

Guideway system for medium duty applications



Project / Order:
Bill of materials:
Serial number:
Year of manufacture:

GÜDEL

Translation of the original instructions

This manual contains standard illustrations that may deviate from the original. In the case of special models, options, or technical changes, the scope of delivery may differ from the descriptions here. Reprinting the instructions, in whole or in part, requires our permission. Subject to change due to technical improvements.

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Revision history

Version	Date	Description
1.0	06.04.2017	Basic version

Table -1 *Revision history*

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Table of contents

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1 General

Read the entire manual before working with the product. The manual contains important information for your personal safety. The manual must be read and understood by all persons who work on the product in any of the product life phases.

1.1 Purpose of the document

This manual describes the following product life phases of the product:

- Transport
- Assembly
- Maintenance
- Disposal

1.2 Explanation of symbols/abbreviations

The following symbols and abbreviations are used in this manual:

Symbol/Abbreviation	Use	Explanation
➲	For cross-reference	See
🗎	Possibly for cross-reference	Page
Fig.	Designation of graphics	Figure
Table	Designation of tables	Table
	In the tip	Information or tip

Table 1-1 Explanation of symbols/abbreviations

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2 Safety

2.1 General

Read the entire manual before working with the product. The manual contains important information for your personal safety. The manual must be read and understood by all persons who work on the product in any of the product life phases.

2.1.1 Personnel qualifications

⚠ WARNING

Lack of safety training

Incorrect behavior of untrained or insufficiently trained security staff can result in severe or fatal injuries!

Before technicians work on safety-related aspects of the product:

- Ensure that the technicians are trained with regard to safety
- Train and instruct the technicians specifically for their area of responsibility

Only appropriately trained and authorized technicians are allowed to work on the product.

Persons are authorized if:

- they are familiar with the relevant safety regulations for their area of responsibility
- they have read and understood this manual
- they meet the requirements for an area of responsibility
- they were assigned an area of responsibility by the operator

The technician is responsible to third parties in his area of responsibility.

During a training session or instruction, the technician may only work on the product under the supervision of an experienced manufacturer's technician.

2.1.1.1 Transport specialists

The transport specialist:

- is able to transport loads safely
- is able to use slings safely and properly
- is able to secure the load properly
- has experience in transportation

2.1.1.2 Fitters

The fitter:

- has very good mechanical and/or electrical knowledge
- is flexible
- has assembly experience

2.1.1.3 Manufacturer's technicians

The manufacturer's technician:

- is employed on site at the premises of the manufacturer or representative
- has very good mechanical and/or electrical knowledge
- has good software knowledge
- has maintenance, service and repair experience
- has experience with Güdel products

The manufacturer's technician is responsible for the following tasks:

- performing mechanical and electrical maintenance work in accordance with the manual
- performing mechanical and electrical service work in accordance with the manual
- cleaning the product
- replacing spare parts
- localizing and fixing malfunctions

2.1.1.4 Maintenance technicians

The maintenance technician:

- was trained by the operating company or the manufacturer
- has very good mechanical and/or electrical knowledge
- has software knowledge
- has maintenance experience
- bears responsibility for the safety of the cleaning staff

The maintenance technician is responsible for the following tasks:

- performing mechanical and electrical maintenance work in accordance with the manual
- cleaning the product
- replacing spare parts
- monitoring and instructing the cleaning staff in the safety zone during the cleaning process

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2.1.1.5 Service technicians

The service technician:

- was trained by the operating company or the manufacturer
- has very good mechanical and/or electrical knowledge
- has software knowledge
- has service and repair experience
- is flexible

The service technician is responsible for the following tasks:

- performing mechanical and electrical service work in accordance with the manual
- replacing spare parts

2.1.1.6 Disposal specialists

The disposal specialist:

- is able to separate waste
- is familiar with the country-specific disposal regulations
- has experience in environmentally-friendly disposal
- works carefully and safely

2.1.2 Disregarding safety regulations

⚠ DANGER

Disregarding safety regulations

Disregarding safety regulations can result in damage to property, severe or fatal injuries.

- Always comply with the safety regulations

Liability

Güdel shall not be held liable under any of the following circumstances:

- The installation regulations were disregarded
- Included protective equipment was not installed
- Included protective equipment was modified
- Included monitoring equipment was not installed
- Included monitoring equipment was modified
- The product was not used as intended

2.1.3 Installation instructions

Modifications

The product must never be modified or used in a manner contrary to its intended use. ➲ Chapter 3.1, 🗎 21

General rules for occupational safety

The generally accepted occupational safety rules must be observed and implemented.

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2.2 Hazard symbols in the manual

2.2.1 Hazard warnings

The hazard warnings are defined for the following four types of danger levels:

⚠ DANGER

DANGER

DANGER refers to hazards with a high risk of severe physical injury or immediate fatality.

⚠ WARNING

WARNING

WARNING refers to hazards with a moderate risk of severe physical injury or potential fatality.

⚠ CAUTION

CAUTION

CAUTION refers to hazards with a slight risk of moderate physical injury.

NOTE

NOTE

NOTE refers to hazards that can lead to property damage.

2.2.2 Explanation of warning symbol

Hazard warnings for personal injuries contain the symbol of the corresponding hazard.

Symbol	Explanation of symbols
	Hazards due to general causes
	Hazards resulting from automatic startup
	Hazards due to falling axles
	Hazards due to heavy components
	Hazards due to environmental pollution
	Hazards due to suspended loads
	Hazards due to sharp edges of the rack

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2.3 Fundamentals of safety

2.3.1 Product-specific hazards

⚠ WARNING

Heavy components

Components can be very heavy. Improper handling can cause severe or fatal injuries!

- Use appropriate lifting units
- Use suitable means to secure the components against tipping over
- Only remove the safety devices after the product has been completely assembled

⚠ WARNING

Suspended loads

Improper handling of suspended loads can lead to severe injuries or death!

- Use appropriate lifting units
- Wear appropriate protective clothing
- Always keep sufficient distance from suspended loads
- Never enter the area below a suspended load

⚠ WARNING

Ripping of lifting belts

The sharp edges of the rack cut the lifting belts. This can lead to severe or fatal injuries!

- Always protect the lifting belts with the guard plate

2.3.2 Material safety data sheets (MSDS)

Safety data sheets contain safety information about the materials. They are country-specific. Safety data sheets are issued, for example, for materials such as oils, greases, cleaning agents, etc. The operating company is responsible for obtaining safety data sheets for all materials used.

Safety data sheets can be obtained as follows:

- Suppliers of chemicals usually supply their substances together with safety data sheets
- Safety data sheets are available on the Internet.
  (Enter "msds" and the name of the material in a search engine. Safety information about the material will be displayed.)

Read the safety data sheets carefully. Follow all the instructions. We recommend that you store the safety data sheets for future reference.

The safety data sheet for Güdel H1 can be found in the download area of our company Web site http://www.gudel.com

3 Product description

3.1 Use

3.1.1 Intended use

The product is intended exclusively for transferring linear movements.

Any other or additional use is not considered to be intended use. The manufacturer assumes no liability for any resulting damage. All risks are borne solely by the user!

3.1.2 Non-intended use

The product is not intended:
- for operation outside of the specified performance data

Any use other than the specified intended use will be considered improper use and is prohibited!

The permissible performance data may not be exceeded. Güdel's design guidelines must be observed. The performance data can be found in the Güdel catalog http://www.gudel.com/products/linear-guideways.

Do not make any modifications to the product.

3.2 Technical data

This contains specific information on the product, depending on the order. Depending on the configuration, special operating conditions are to be observed.

Temperature ranges

The following ambient temperatures and air humidities apply:

Product life phase	Temperature range	Air humidity
Transport	-10 to +60 °C	
Operation	+5 to +40 °C	Up to and at 85%, condensation formation is not permissible
Storage	-10 to +40 °C	Up to 75%

Table 3-1 *Temperature ranges*

Low temperatures

At temperatures of 6°C and lower we recommend using Duralloy-coated guideways, racks, pinions and, where necessary, rollers, as well as blue zinc-plated or phosphate-coated screws.

4 Transport

The product is transported by air, land, or water. The packaging depends on the mode of transport.

Truck	=	Shipped on a transport pallet
Aircraft	=	Shipped in a crate
Ship	=	Shipped in a case or container

Only perform the tasks described in this chapter after you have read and understood the chapter "Safety". ➲ 13
It concerns your personal safety!

⚠ WARNING

Ripping of lifting belts

The sharp edges of the rack cut the lifting belts. This can lead to severe or fatal injuries!

- Always protect the lifting belts with the guard plate

⚠ WARNING

Suspended loads

Improper handling of suspended loads can lead to severe injuries or death!

- Use appropriate lifting units
- Wear appropriate protective clothing
- Always keep sufficient distance from suspended loads
- Never enter the area below a suspended load

NOTE

Improper transport

Improper handling of the containers can lead to transport damage!

- Do not tip over the containers
- Avoid heavy vibrations and shocks
- Observe the symbols on the packaging

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4.1 Packaging symbols

When moving the transport pallets / crates / cases, observe the following symbols:

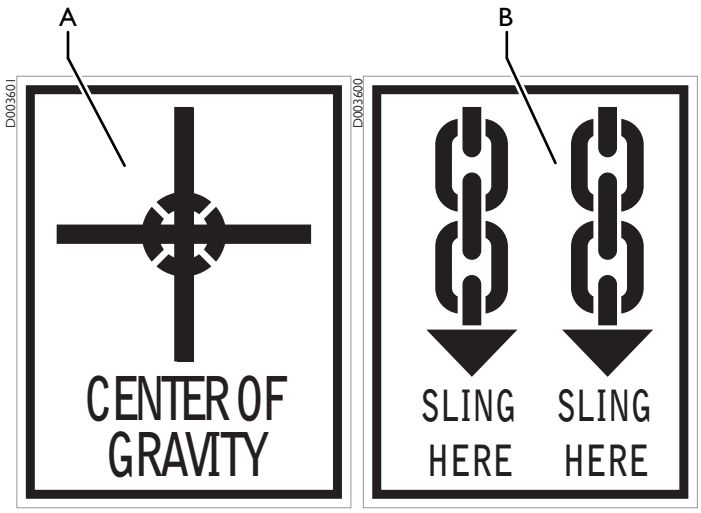

Fig. 4-1 *Attaching slings*

A *Center of gravity*

B *Fastening point*

Depending on the contents, the packaging units are marked with the symbols shown below. Observe these at all times.

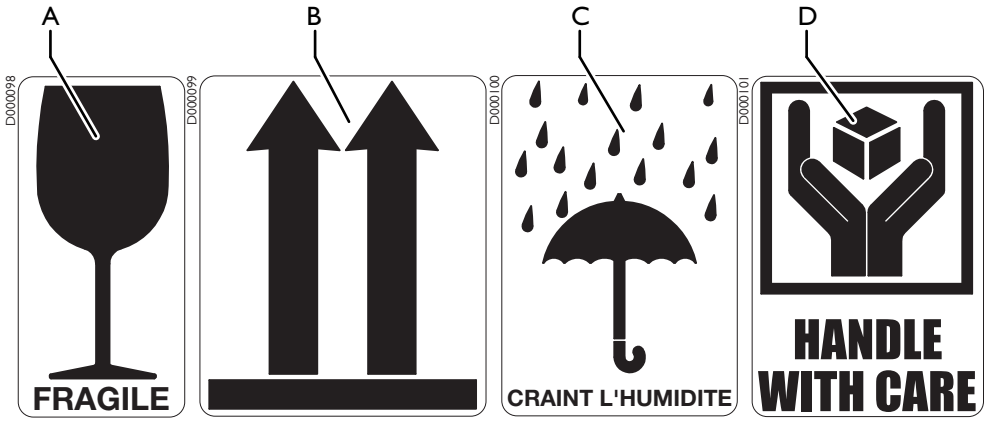

Fig. 4-2 *Packaging symbols*

A *Fragile*

B *This side up*

C *Keep dry*

D *Handle with care*

Remove the packaging only to the degree necessary for company-internal transport.

Transport the pallet, crate, or case to the intended installation location. Use appropriate transport devices.

4.2 Industrial trucks

Industrial trucks have to be capable of handling the size and weight of the container. The driver of the industrial truck must be authorized to drive the vehicle.

4.3 Slings

Slings, chains, ropes or belts must be suitable for the load of weight of the container. Fasten the slings to stable parts. Secure the slings against slipping. Make sure that no attachments are damaged by the slings.

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5 Commissioning

5.1 Introduction

5.1.1 Safety

Only perform the tasks described in this chapter after you have read and understood the chapter "Safety". ➲ 13
It concerns your personal safety!

⚠ WARNING

Ripping of lifting belts

The sharp edges of the rack cut the lifting belts. This can lead to severe or fatal injuries!

- Always protect the lifting belts with the guard plate

⚠ WARNING

Suspended loads

Improper handling of suspended loads can lead to severe injuries or death!

- Use appropriate lifting units
- Wear appropriate protective clothing
- Always keep sufficient distance from suspended loads
- Never enter the area below a suspended load

⚠ WARNING

Heavy components

Components can be very heavy. Improper handling can cause severe or fatal injuries!

- Use appropriate lifting units
- Use suitable means to secure the components against tipping over
- Only remove the safety devices after the product has been completely assembled

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5.1.2 Personnel qualifications

Only appropriately trained and authorized technicians are allowed to commission the product.

5.2 Intermediate storage

Observe the storage conditions if the product needs to be stored for a certain amount of time before assembly. ➲ 97

5.3 Unpacking

Accessories and small parts are packaged in a separate case or directly with the product itself.

The components have been treated with anti-rust oil (spray) and wrapped in oil paper. Remove packaging carefully.

The anti-rust oil protects the components. We recommend not removing the oil.

Dispose of the packaging in accordance with the local waste regulations. ➲ 99

Checking the delivery

Check the content of the delivery by comparing it with the accompanying documents. Check the product for damage. Report transport damage promptly.

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5.4 Special tools, testing and measuring instruments

Ensure that you have the following special tools, testing and measuring instruments at hand:

Tool	Use	Item number
Sharpening stone	Rubbing reference surfaces	0503016
Measurement bolt	Inspecting rack transition	
Mounting aid	Installing the guideway/rack: Module 1.5, helical	902280
Mounting aid	Installing the guideway/rack: Module 1.5915, straight toothed	902401
Mounting aid	Installing the guideway/rack: Module 2.3873, straight toothed	902402
Mounting aid	Installing the guideway/rack: Module 2.5, helical	902282
Mounting aid	Installing the guideway/rack: Module 3, helical	902283
Mounting aid	Installing the guideway/rack: Module 3.1831, straight toothed	902403
Screw clamps	Installing the racks	
Pin-type face wrench	Setting the rollers: Sizes 10, 15, 20	999756
Pin-type face wrench	Setting the rollers: Sizes 25, 35	999758

Table 5-1 Special tools, testing and measuring instruments

5.5 Installing

5.5.1 General

The following describes the steps for setting up and fastening the product.

⚠ WARNING

Heavy components

Components can be very heavy. Improper handling can cause severe or fatal injuries!

- Use appropriate lifting units
- Use suitable means to secure the components against tipping over
- Only remove the safety devices after the product has been completely assembled

Tightening torques

Unless otherwise indicated, adhere to the tightening torques of Güdel.
➲ Chapter 10, 🗎 103

Product versions

The product is available in numerous designs. Several of the available versions are described below.

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5.5.2 Prerequisites

Lifting units

Lifting units are required for setting up and installing the product. Make sure that appropriately dimensioned devices (crane, etc.) are available.

Opposing radius and abutment shoulder

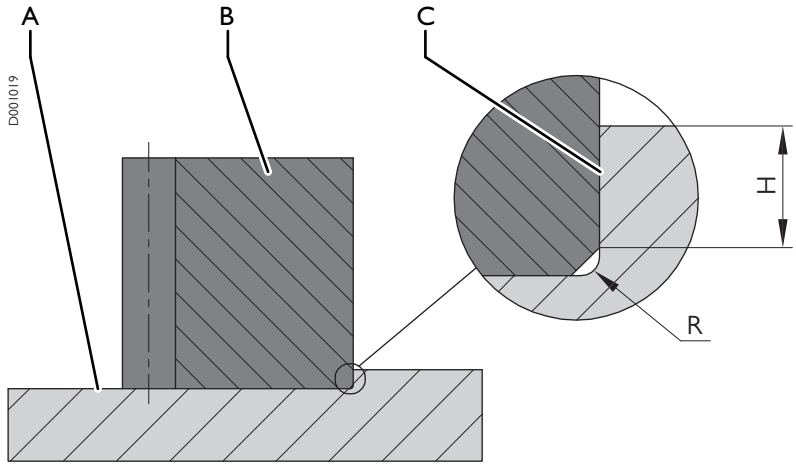

Fig. 5-1 *Opposing radius and abutment shoulder*

- *A* *Basal surface*
- *B* *Guideway/rack*
- *C* *Abutment shoulder*

The guideways and racks have a bevel of 0.5 mm or greater. The opposing radius R must not exceed 0.4 mm.

The minimum height H of the abutment shoulder can be found in the following table:

Size	min. height H [mm]
10	2
15	2
20	2.5
25	2.5
35	3

Table 5-2 *minimum height H of the abutment shoulder*

5.5.3 Guideway

5.5.3.1 Using the mounting aid: Installing the rack

The start and end of the rack each form half of a tooth gap. For precise and quiet transition, we recommend using a mounting aid toothed in the opposite direction. ➲ 29

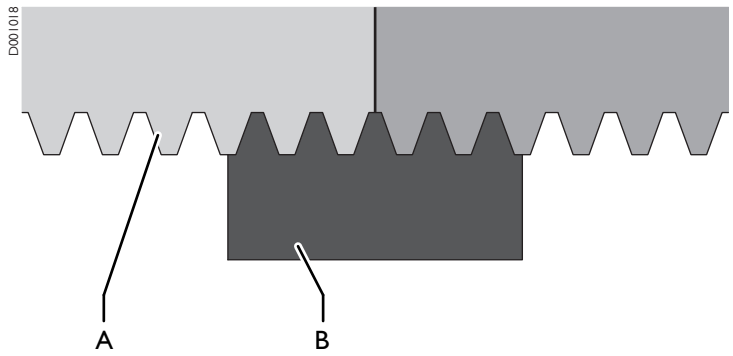

Fig. 5-2 *Mounting aid for rack installation*

A *Rack*

B *Mounting aid*

5.5.3.2 Installing the guideway

If you inspect the rack transition and cannot comply with the required values, the gap dimension takes priority.

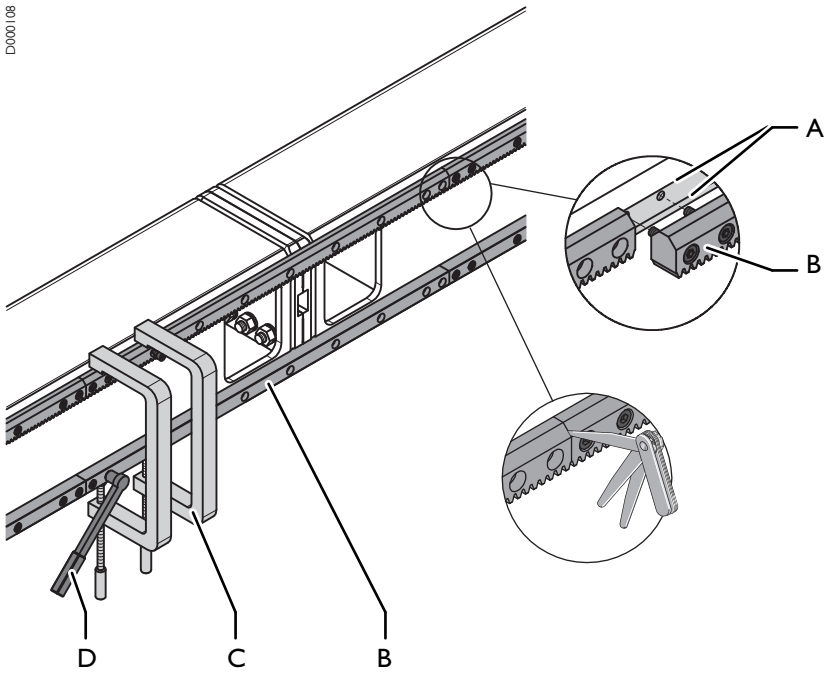

Fig. 5-3 *Installing the guideway*

A	*Reference surface*	*C*	*Screw clamp*
B	*Guideway*	*D*	*Torque wrench*

Cleaning agents
mild universal cleaner free from aromatic compounds (e.g. Motorex OPAL 5000)

Table 5-3 *Cleaning agents: Guideway, rack*

Install the guideway as follows:

1 Clean the reference surfaces and guideways thoroughly and rub a sharpening stone across them

2 Clamp guideways to reference surfaces with screw clamps

3 Tighten all screws

4 Check the transition: Gap dimension < 0.02 mm

5 Use a suitable measuring instrument to check that the guideways are parallel
(Tolerance: ±0.04 mm)

6 Move the carriage or axis across the entire length:
The drive pinion with correctly set tooth flank backlash should not jam at the transitions of the guideway

7 If deviations of the transition or parallelism occur:

7.1 Remove the screws and guideways

7.2 Repeat the procedure

The guideway has been installed.

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5.5.3.3 Inspecting rack transition

Rack quality and module ➲ 89

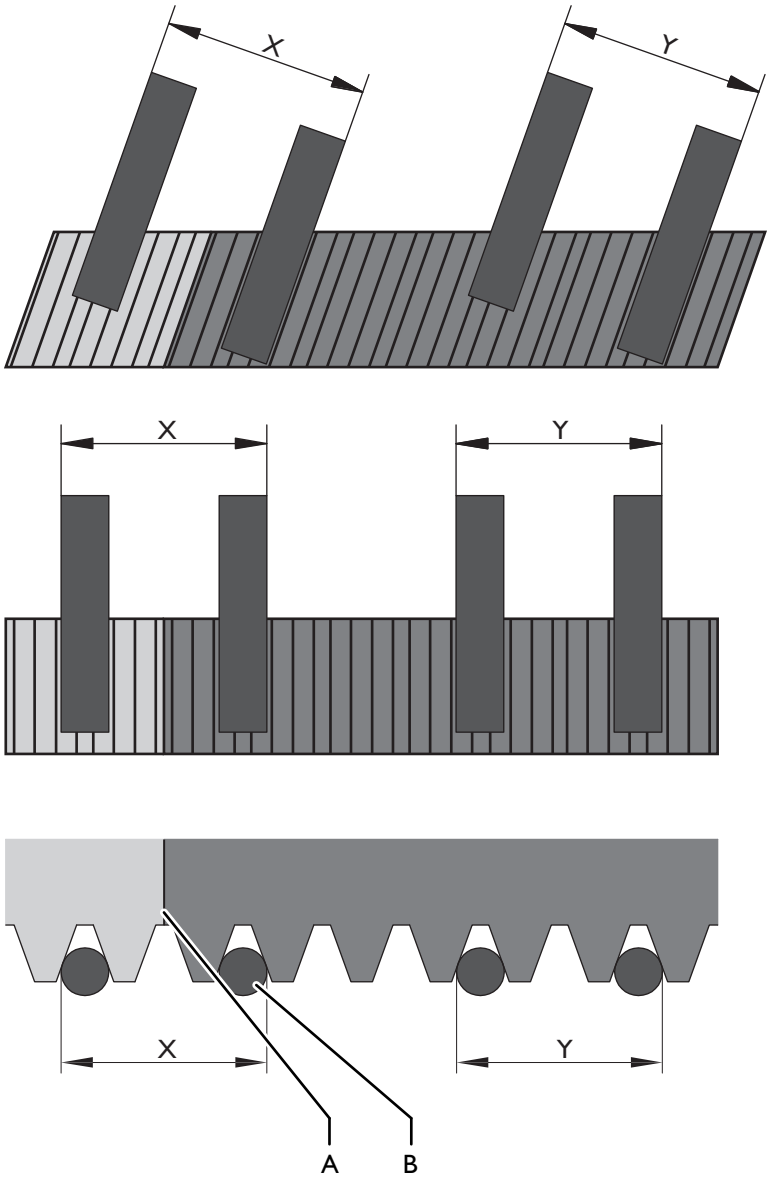

Fig. 5-4 *Inspecting rack transition*

A *Rack transition*

B *Measurement bolt (diameter D = 2 × m ; accuracy: tolerance class I acc. to DIN 2269)*

Rack quality	Permissible deviation [mm]	
	Module m ≤ 3	Module 3 < m ≤ 8
Q4 h21	0.006	0.010
Q5 h22	0.008	0.012
Q6 h23	0.012	0.012
Q7 h25	0.016	0.016
Q8 h27	0.016	0.016
Q9 h27	0.016	0.016

Table 5-4 *Permissible deviation, rack transition*

Inspect the rack transition as follows:

1 Position the measurement bolt as shown in the illustration

2 Check dimension X and Y (permissible deviation between value X and Y according to preceding table)

The rack transition has been inspected.

5.5.3.4 Checking the installed racks

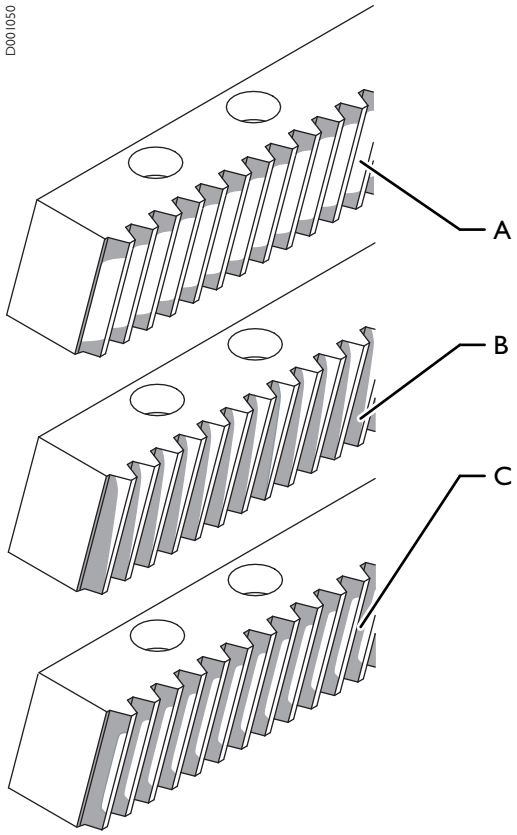

Fig. 5-5 *Checking the installed racks*

- *A* *Correct*
- *B* *Not parallel*
- *C* *Wrong axle spacing*

Cleaning agents
mild universal cleaner free from aromatic compounds (e.g. Motorex OPAL 5000)

Table 5-5 *Cleaning agents: Rack*

Check the installed racks as follows:

Prerequisite:The racks are highly loaded

1 Clean the tooth flanks of the rack thoroughly
2 Coat the tooth flanks with a paste or water-resistant felt pen
3 Move the components along the entire run length several times with the pinion
4 According to the illustration, evaluate the color (ink) that has been removed
5 If necessary, realign the components with the pinion

The installed racks have been checked.

5.5.4 Eccentric roller

5.5.4.1 Roller positions

The eccentric rollers have three home positions:

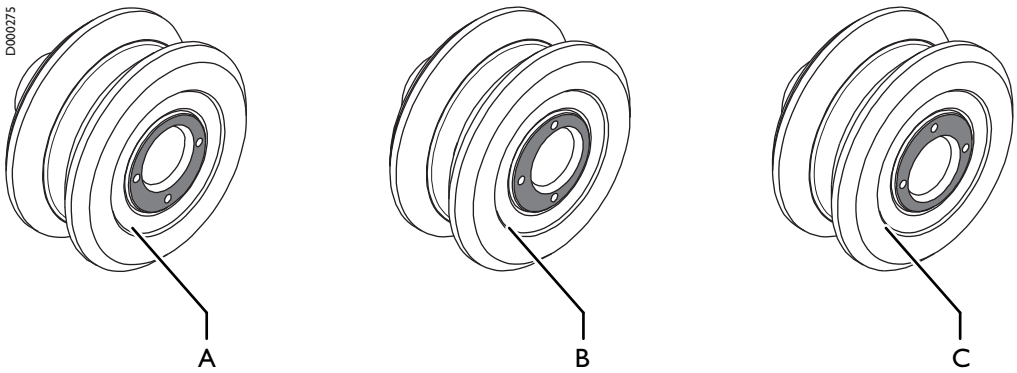

Fig. 5-6 *Roller positions*

A *Position -1*
B *Position 0*
C *Position +1*

5.5.4.2 Replacing the roller

Distinguishing characteristics of wear
• Excessive noise is audible • Discoloration due to heat present • Uneven running due to vibrations perceptible • Running surface worn • Notches on guide running surface

Table 5-6 *Distinguishing characteristics of wear: Roller*

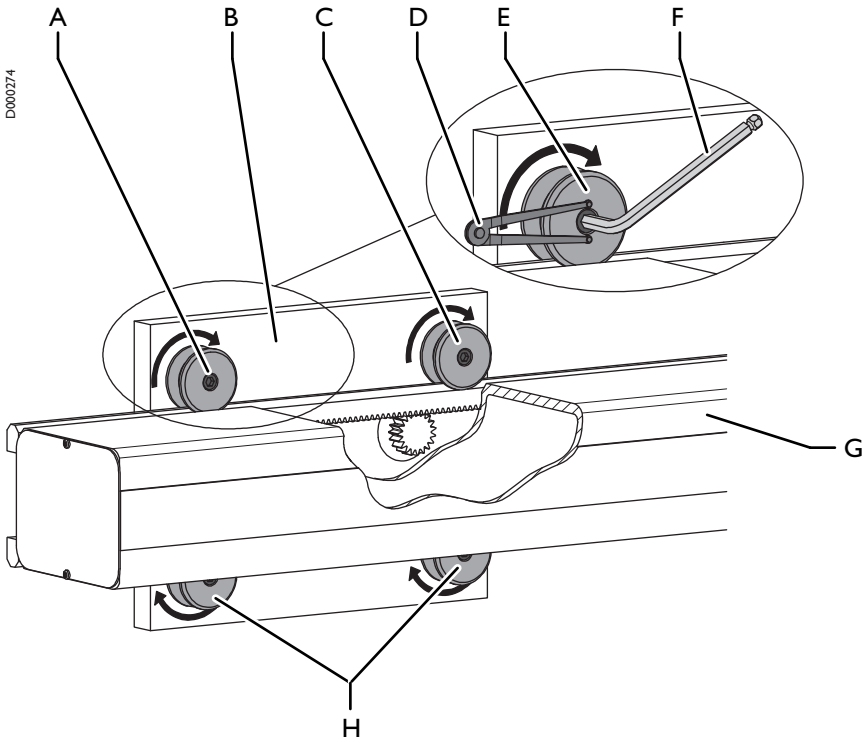

Fig. 5-7 *Replacing the roller*

A	*Screws*	*E*	*Supporting roller*
B	*Carriage*	*F*	*Hexagonal socket wrench*
C	*Supporting roller*	*G*	*Axis*
D	*Pin-type face wrench*	*H*	*Guideway rollers*

Replace the rollers as follows:

1 Switch off the system and padlock it to secure it against being switched on again
2 Attach the slings to the carriage or axis
3 Move the carriage off the axis or extend the axis
4 Remove the wiper and lubrication unit
5 Remove the screws
6 Replace the rollers
7 Slightly tighten the screws
8 Set the rollers: ➲ 38
   8.1 Supporting rollers: Position +1
   8.2 Guideway rollers: Position -1
9 Move carriage onto axis or insert the axis
10 Remove the slings
11 Set the rollers and the tooth flank backlash ➲ Chapter 6.3.7, 87

The rollers have been replaced.

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5.5.4.3 Centering and eccentric roller

Setting the rollers

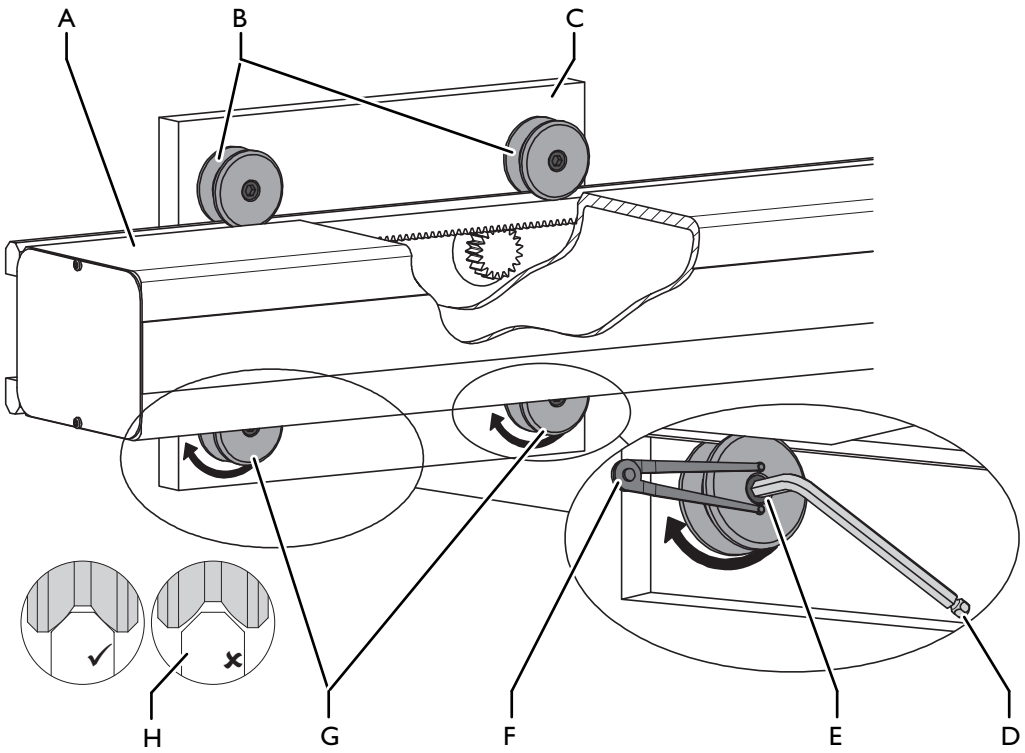

Fig. 5-8 *Setting the rollers: Prism guideway, centering and eccentric rollers*

A	*Axis*	*E*	*Screw*
B	*Supporting roller (concentric)*	*F*	*Pin-type face wrench*
C	*Carriage*	*G*	*Guideway roller (eccentric)*
D	*Hexagonal socket wrench*	*H*	*Guideway*

Adjust the rollers as follows:

Prerequisite:The wiper and lubrication units have been removed

Prerequisite:The maximum backlash has been set ➲ Chapter 6.3.7, 🗎 87

Prerequisite:Guideway rollers are set to position -1 ➲ 🗎 38

1. Switch off the plant and padlock it to secure it against being switched on again
2. Slightly loosen the screws
3. Move guideway rollers towards the guideway
4. Tighten the screws
   (block the rollers by means of a pin-type face wrench)
5. Check setting:
   The roller touches the guideway. The roller can still be turned by hand when a lot of force is applied
6. If there are deviations: Repeat process from step 2
7. Install the wiper and lubrication unit

The rollers have been set.

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5.5.4.4 Eccentric roller

Setting the rollers

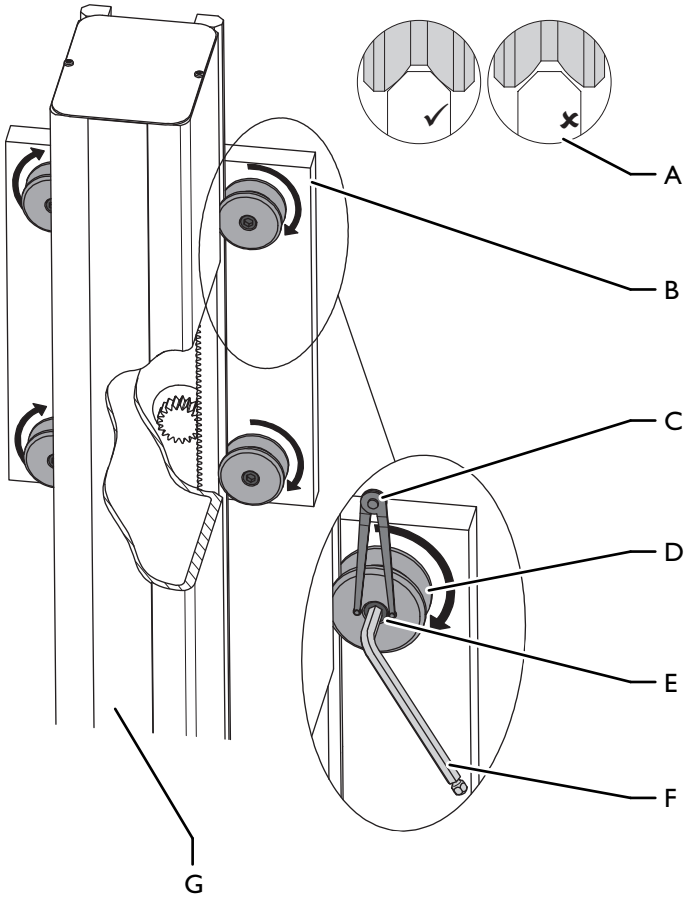

Fig. 5-9 *Setting the rollers: Prism guideway, eccentric rollers*

A	*Guideway*	*E*	*Screw*
B	*Carriage*	*F*	*Hexagonal socket wrench*
C	*Pin-type face wrench*	*G*	*Axis*
D	*Roller (eccentric)*		

Adjust the rollers as follows:

Prerequisite:The wiper and lubrication units have been removed

Prerequisite:The maximum backlash has been set ➲ Chapter 6.3.7, 🗎 87

Prerequisite:Right rollers are set to position +1 ➲ 🗎 38

Prerequisite:Left rollers are set to position -1 ➲ 🗎 38

1. Switch off the plant and padlock it to secure it against being switched on again
2. Slightly loosen the screws
3. Move right rollers in the direction of the arrow; check the parallelism between the carriage and axis
   (Tolerance: max. 0.05 mm)
4. Move left rollers towards the guideway
5. Tighten the screws
   (block the rollers by means of a pin-type face wrench)
6. Check setting:
   The roller touches the guideway. The roller can still be turned by hand when a lot of force is applied
7. If there are deviations: Repeat process from step 2
8. Install the wiper and lubrication unit

The rollers have been set.

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5.5.5 Eccentric flange

The installed gearbox should not cover eccentric flanges, as otherwise it is no longer possible to set the rollers.

5.5.5.1 Roller positions

The eccentric flanges have three different basic positions for setting the roller positions. Turn the flange between positions +1 and -1 in order to bring the roller closer (clockwise) or increase the distance (counterclockwise).

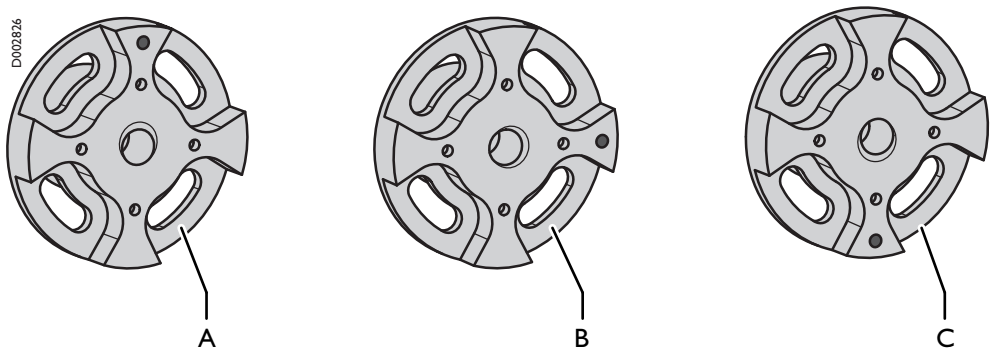

Fig. 5-10 *Eccentric flange / roller positions*

A *Position +1*

B *Position 0*

C *Position -1*

5.5.5.2 Replacing the roller

Distinguishing characteristics of wear
• Excessive noise is audible • Discoloration due to heat present • Uneven running due to vibrations perceptible • Running surface worn • Notches on guide running surface

Table 5-7 *Distinguishing characteristics of wear: Roller*

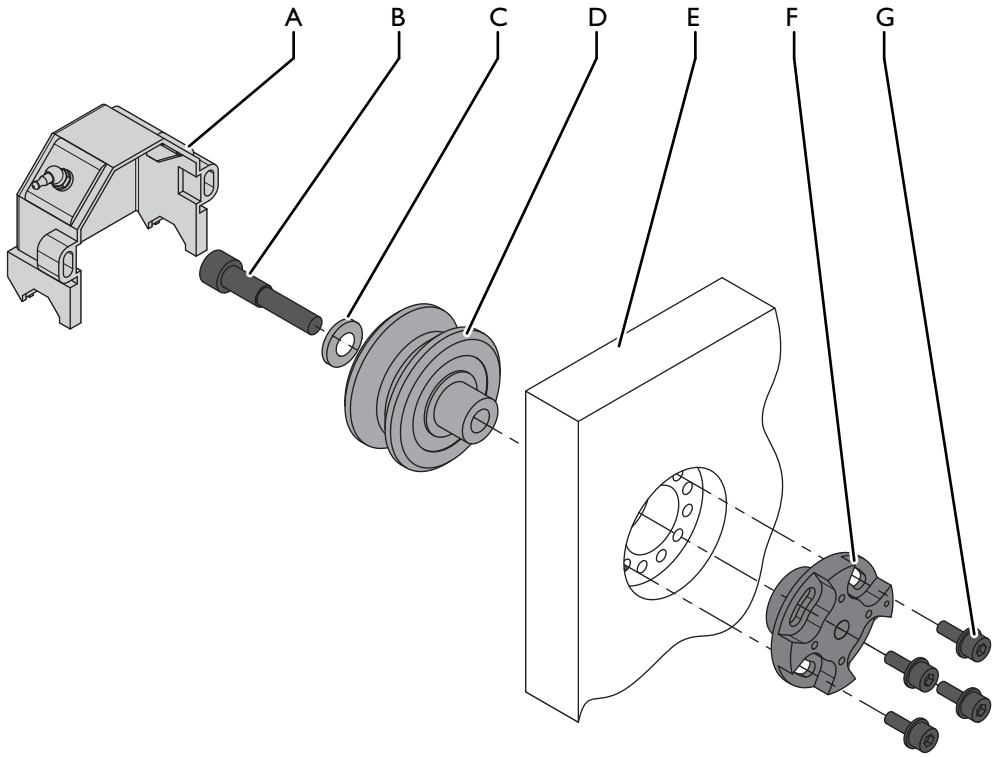

Fig. 5-11 *Replacing the roller*

A	*Wiper and lubrication unit*	*E*	*Carriage*
B	*Fastening screw*	*F*	*Eccentric flange*
C	*Serrated lock washer*	*G*	*Screw*
D	*Roller*		

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Replace the roller as follows:

1 Switch off the plant and padlock it to secure it against being switched on again
2 Attach the slings to the carriage
3 Move the carriage off the axis
4 Remove the wiper and lubrication units
5 Remove the fastening screw
6 Remove the serrated lock washer
7 Remove the screws
8 Replace the roller and serrated lock washer
9 Install the roller in the reverse order
10 Slightly tighten the screws
11 Move the rollers away from the guideway ➲ 45
12 Move carriage onto axis
13 Remove the slings
14 Set the rollers and the tooth flank backlash ➲ Chapter 6.3.7, 87

The roller has been replaced.

5.5.5.3 Setting the rollers

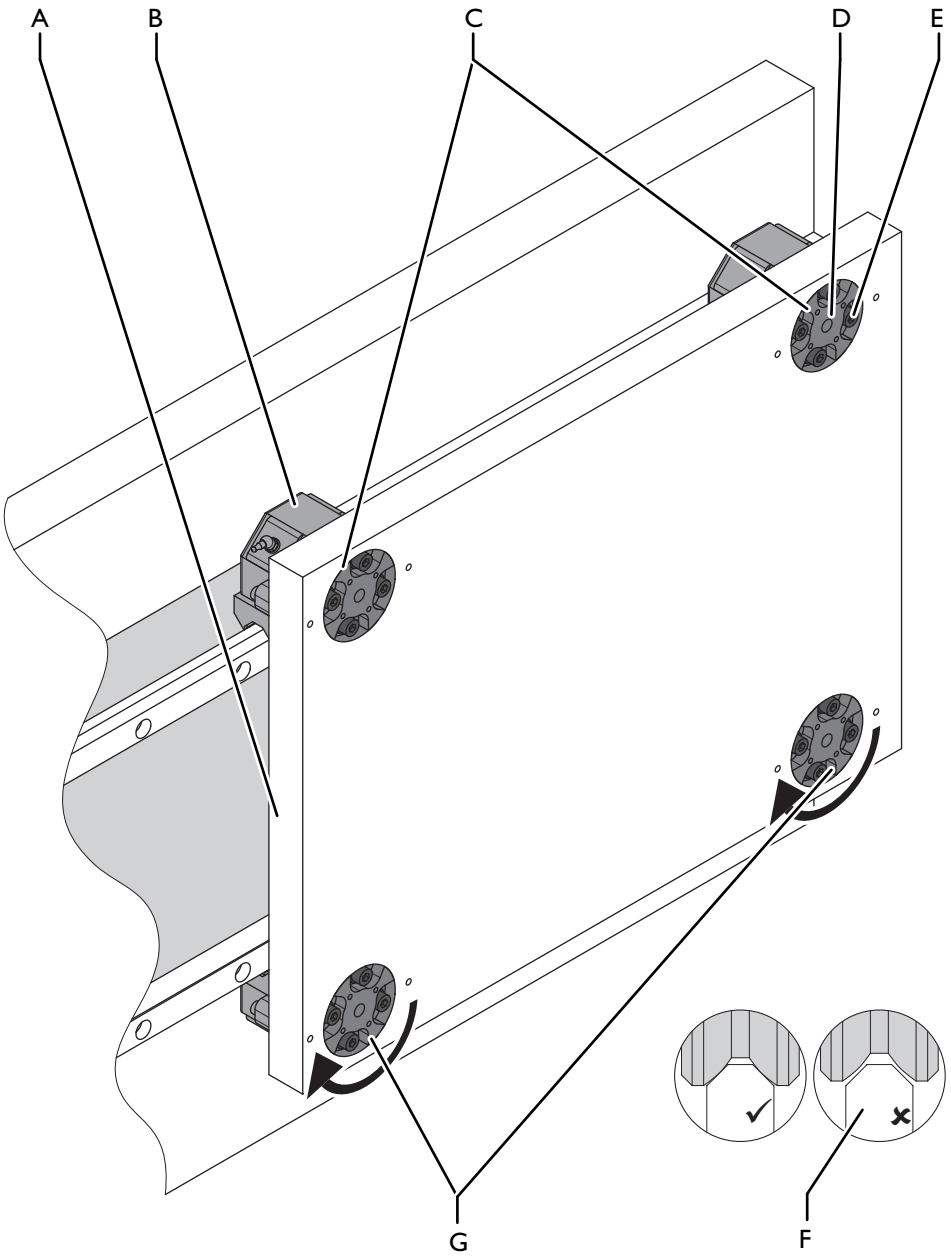

Fig. 5-12 *Setting the rollers: horizontal axis*

A	*Carriage*	*E*	*Screw*
B	*Wiper and lubrication unit*	*F*	*Guideway*
C	*Supporting roller*	*G*	*Guideway roller*
D	*Eccentric flange*		

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Adjust the rollers as follows:

Prerequisite:The wiper and lubrication units have been removed

Prerequisite:The maximum tooth flank backlash has been set
➲ Chapter 6.3.7, 🗎 87

Prerequisite:Supporting rollers have been set to position 0 ➲ 🗎 45

Prerequisite:Guideway rollers are set to position -1 ➲ 🗎 45

1 Switch off the plant and padlock it to secure it against being switched on again
2 Slightly loosen the screws
3 Move guideway rollers towards the guideway using the eccentric flange
4 Tighten the screws
5 Check setting:
The roller touches the guideway. The roller can still be turned by hand when a lot of force is applied
6 If there are deviations: Repeat process from step 2
7 Install the wiper and lubrication unit

The rollers have been set.

5.5.5.4 Setting the rollers

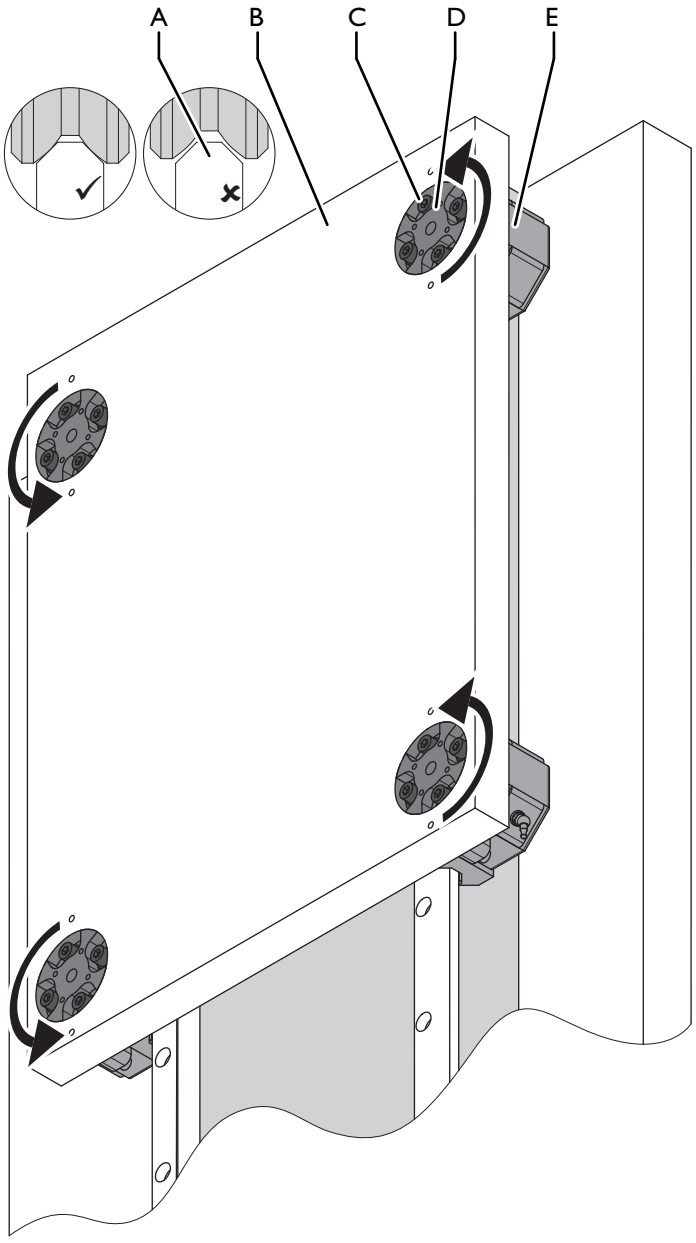

Fig. 5-13 *Setting the rollers: vertical axis*

A	*Guideway*	*D*	*Eccentric flange*
B	*Carriage*	*E*	*Wiper and lubrication unit*
C	*Screw*		

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Adjust the rollers as follows:

Prerequisite:The wiper and lubrication units have been removed

Prerequisite:The maximum tooth flank backlash has been set
➲ Chapter 6.3.7, 🗎 87

Prerequisite:Right rollers are set to position +1 ➲ 🗎 45

Prerequisite:Left rollers are set to position -1 ➲ 🗎 45

1. Switch off the plant and padlock it to secure it against being switched on again
2. Slightly loosen the screws
3. Move right rollers toward the guideway using the eccentric flange; check the parallelism between the carriage and axis
   (Tolerance: maximum 0.05 mm)
4. Move left rollers toward the guideway using the eccentric flange
5. Tighten the screws
6. Check setting:
   The roller touches the guideway. The roller can still be turned by hand when a lot of force is applied
7. If there are deviations: Repeat process from step 2
8. Install the wiper and lubrication unit

The rollers have been set.

5.5.6 Final tasks

Perform the following final tasks:

1. Set the tooth flank backlash ➲ Chapter 6.3.7, 🗎 87
2. Calibrate the reference plane of the motor (this procedure is described in the documentation for the complete system or the motor)

The final tasks have been performed.

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6 Maintenance

6.1 Introduction

Work sequences

Perform the work sequences in the order described. Perform the described tasks at the specified times. This ensures a long service life for your product.

Original spare parts

Only use original spare parts. ➲ 101

Tightening torques

Unless otherwise indicated, adhere to the tightening torques of Güdel.
➲ Chapter 10, 103

6.1.1 Safety

Only perform the tasks described in this chapter after you have read and understood the chapter "Safety". ➲ 13
It concerns your personal safety!

⚠ WARNING

Automatic startup

During work on the product, there is danger of the machine starting up automatically. This can lead to severe or fatal injuries!

Before working in the danger area:

- Secure vertical axes (if equipped) against falling.
- Switch off the superordinate main power supply. Secure it against being switched on again (main switch for the complete system)
- Before switching on the system again, make sure that no one is in the danger area

⚠ WARNING

Falling axes, workpieces

Falling axes or workpieces can cause physical damage, serious or fatal injuries!

- Set down any workpieces before working in the danger area
- Never enter the area below suspended axes and workpieces
- Secure suspended axes using the stipulated equipment
- Check the belts of the telescope axes for signs of breakage and tears

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⚠ WARNING

Heavy components

Components can be very heavy. Improper handling can cause severe or fatal injuries!

- Use appropriate lifting units
- Use suitable means to secure the components against tipping over
- Only remove the safety devices after the product has been completely assembled

6.1.2 Personnel qualifications

Only appropriately trained and authorized technicians are allowed to work on the product.

6.2 Consumables and auxiliary agents

6.2.1 Cleaning agents

Use a soft rag or cloth for cleaning tasks. Only use permissible cleaning agents.

6.2.1.1 Table of cleaning agents

Cleaning agents	Operation site
mild universal cleaner free from aromatic compounds (e.g. Motorex OPAL 5000)	Guideway, rack
	Rack

This table does not purport to be exhaustive.

Table 6-1 Table of cleaning agents

6.2.2 Lubricants

NOTE

Unsuitable lubricants

Using unsuitable lubricants can cause damage to the machine!

- Only use the lubricants listed
- If uncertain, please contact our service departments

For more information on the lubricants, refer to the tables below. For further information, refer to the chapter "Maintenance tasks" and the respective third party documentation.

Alternative manufacturers

The following tables show the specifications of the lubricants. Please inform your manufacturer accordingly. They will then suggest an alternative from their product range.

Low temperatures / food grade

Observe the application range limits of lubricants according to the safety data sheet.

6.2.2.1 Lubrication

Manual / automatic lubrication system

The guideways, racks and pinions of the product are lubricated either manually or automatically.

Oil / grease lubrication

There are differences between the wiper and lubrication units provided for oil and grease lubrication. Make sure to use the correct wiper and lubrication unit for your particular application.

Lubrication cycle

Güdel recommends a lubrication cycle of 150 h or 100 km, whichever occurs first. With automatic lubrication it may not be possible to set this lubrication cycle exactly. I In this case, select the nearest lubrication cycle. Perform lubrication work at soon as the first signs of tribocorrosion (reddish discoloration of the track) are visible.

Manual lubrication

The following lubrication systems and lubricants are intended for the manual lubrication of the product:

Fig. 6-1 *Lubricating manually with grease*

Lubrication ex works	Specification	Lubrication quantity	Operation site	Category
Mobil Mobilux EP 2	KP2K-30 in accordance with DIN 51502	As per instructions	Guideways, racks, and pinions	grease

Table 6-2 *Lubricants: Guideways, racks, and pinions*

Fig. 6-2 *Lubricating manually with oil*

Lubrication ex works	Specification	Lubrication quantity	Operation site	Category
Güdel H1 NSF no.146621	cannot be found	As per instructions	Guideways, racks, and pinions	oil

Table 6-3 *Lubricants: Guideways, racks, and pinions*

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Automatic lubrication system

The following lubrication systems and lubricants are provided for the automatic lubrication of the product:

Fig. 6-3 *Automatic lubrication system FlexxPump*

Lubrication ex works	Specification	Lubrication quantity	Operation site	Category
Güdel H1 NSF no.146621	cannot be found		Automatic lubrication system FlexxPump	oil

Table 6-4 *Lubricants: Automatic lubrication system FlexxPump*

Fig. 6-4 *Automatic lubrication system Memolub*

Lubrication ex works	Specification	Lubrication quantity	Operation site	Category
Castrol Longtime PD	2KP2K-30 in accordance with DIN 51502		Automatic lubrication system Memolub	grease

Table 6-5 *Lubricants: Automatic lubrication system Memolub*

Fig. 6-5 *Automatic lubrication system Memolub*

Lubrication ex works	Specification	Lubrication quantity	Operation site	Category
Mobil Glygoyle 460 NSF no.136467	CLP PG 460 in accordance with DIN 51502		Automatic lubrication system Memolub	oil

Table 6-6 *Lubricants: Automatic lubrication system Memolub*

Fig. 6-6 *SKF-Vogel automatic lubrication system*

Lubrication ex works	Specification	Lubrication quantity	Operation site	Category
Güdel H1 NSF no.146621	cannot be found	1000 ml	SKF-Vogel automatic lubrication system	oil

Table 6-7 *Lubricants: SKF-Vogel automatic lubrication system*

6.2.2.2 Lubricant table

Lubrication ex works	Specification	Lubrication quantity	Operation site	Category
Castrol Longtime PD	2KP2K-30 in accordance with DIN 51502		Automatic lubrication system Memolub	grease
Güdel H1 NSF no.146621	cannot be found		Automatic lubrication system FlexxPump	oil
	cannot be found		Guideways, racks, and pinions	oil
	cannot be found		SKF-Vogel automatic lubrication system	oil
Mobil Glygoyle 460 NSF no.136467	CLP PG 460 in accordance with DIN 51502		Automatic lubrication system Memolub	oil
Mobil Mobilux EP 2	KP2K-30 in accordance with DIN 51502	As per instructions	Guideways, racks, and pinions	grease

This table does not purport to be exhaustive.

Table 6-8 Lubricant table

6.3 Maintenance tasks

6.3.1 General prerequisites

Prior to performing repair and maintenance tasks, do the following:

- If vertical axes are present, secure them against falling
- Switch off the system and padlock it to secure it against being switched on again
- Make sure that all necessary spare parts and wearing parts are at hand ➲ 101

6.3.2 Maintenance intervals

The product is subject to natural wear and tear. It wears out. This can lead to operational downtime. Güdel specifies the service life and maintenance intervals so as to ensure safe and continuous operation. The maintenance intervals relate to the effective operating hours of the product at a power-on time of POT = 100%. Normal operating conditions are assumed. If they are more rough than assumed, products may fail earlier. Adjust the maintenance intervals to your operating conditions if necessary.

The definition is based on 5/7 working days per week.

Operating hours	1-shift operation	2-shift operation	3-shift operation
150	every 4 weeks	every 2 weeks	Weekly
2'250	yearly	every 6 months	every 4 months
6'750	every 3 years	every 1.5 years	yearly
11'250	every 5 years	every 2.5 years	every 20 months
13'500	every 6 years	every 3 years	every 2 years
22'500	every 10 years	every 5 years	every 3.3 years
31'500	every 14 years	every 7 years	every 4.5 years
54'000	every 24 years	every 12 years	every 8 years

Table 6-9 *Maintenance intervals in shift operation (5 days a week)*

Operating hours	1-shift operation	2-shift operation	3-shift operation
150	every 18 days	every 9 days	every 6 days
2'250	every 9 months	every 4.5 months	every 3 months
6'750	every 2.5 years	every 15 months	every 10 months
11'250	every 4 years	every 2 years	every 16 months
13'500	every 4.5 years	every 3 years	every 1.5 years
22'500	every 7.75 years	every 3.8 years	every 2.5 years
31'500	every 11 years	every 5.5 years	every 3.5 years
54'000	every 18.5 years	every 9.25 years	every 6.25 years

Table 6-10 Maintenance intervals in shift operation (7 days a week)

6.3.3 Special tools, testing and measuring instruments

Ensure that you have the following special tools, testing and measuring instruments at hand:

Tool	Use	Item number
Sharpening stone	Rubbing reference surfaces	0503016
Measurement bolt	Inspecting rack transition	
Mounting aid	Installing the guideway/rack: Module 1.5, helical	902280
Mounting aid	Installing the guideway/rack: Module 1.5915, straight toothed	902401
Mounting aid	Installing the guideway/rack: Module 2.3873, straight toothed	902402
Mounting aid	Installing the guideway/rack: Module 2.5, helical	902282
Mounting aid	Installing the guideway/rack: Module 3, helical	902283
Mounting aid	Installing the guideway/rack: Module 3.1831, straight toothed	902403
Screw clamps	Installing the racks	
Fastening device	Blocking the drive pinions: HPG/AE030	0917452
Fastening device	Blocking the drive pinions: HPG/AE045	0917453
Fastening device	Blocking the drive pinions: HPG/AE060	0917454

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Tool	Use	Item number
Fastening device	Blocking the drive pinions: HPG/AE090	0917447
Fastening device	Blocking the drive pinions: HPG/AE120	0917455
Fastening device	Blocking the drive pinions: HPG/AE180	0917456
Pin-type face wrench	Setting the rollers: Sizes 10, 15, 20	999756
Pin-type face wrench	Setting the rollers: Sizes 25, 35	999758

Table 6-11 Special tools, testing and measuring instruments

6.3.4 Maintenance tasks after 150 hours

6.3.4.1 Lubricating guideways, racks and pinions

Guideways are lubricated using the grease nipple of the wiper and lubrication unit or the roller supports.
Lubricate the racks and pinion using the lubricating nipple of the lubricating pinion.

NOTE

Incompatible lubricant!

Mixing different lubricants affects their properties!

- Never mix different types of lubricant
- Before using another type of lubricant, replace the following components:
  - ⇨ Wiper and lubrication unit
  - ⇨ Lubricating elements of the roller support
  - ⇨ Lubricating pinion
- Rinse the lines with fresh lubricant

A type plate is attached to roller supports. You will find the size of the roller on the type plate. In all other cases, the size of the roller can be found in the spare parts list.

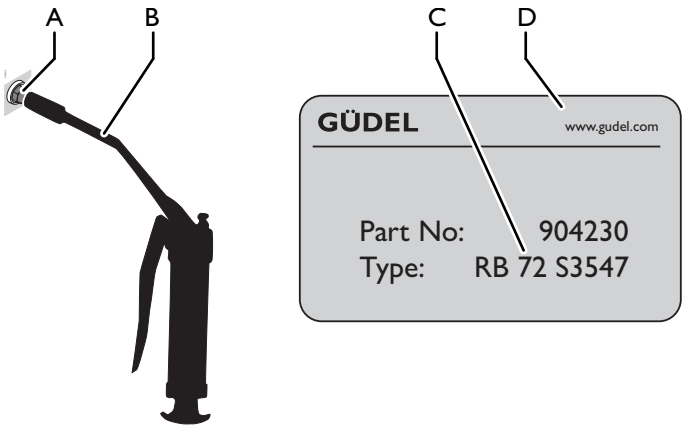

Fig. 6-7 *Lubricating components on the grease nipple*

A	*Grease nipple*	*C*	*Roller size*
B	*Grease gun*	*D*	*Type plate*

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Lubrication ex works	Specification	Lubrication quantity
➲ Chapter 6.2.2.1, 🗎 55	➲ Chapter 6.2.2.1, 🗎 55	Roller size 10-20: 4.5 cm³ Roller size 25-52: 7.5 cm³ Roller size 72-110: 12 cm³

Table 6-12 *Lubricants: Guideways, racks, and pinions*

Lubricate the guideways, racks, and pinions as follows:

Prerequisite:There is no automatic lubrication

1 Switch off the plant and padlock it to secure it against being switched on again

2 Press in the lubricant into the grease nipple using a grease gun

2.1 for all available wiper and lubrication units or roller supports: Lubrication quantity

2.2 for all available lubricating pinions: Double lubrication quantity

The guideways, racks and pinions are lubricated.

6.3.5 Maintenance tasks after 2,250 hours

6.3.5.1 General inspection

Performing a general inspection

For the general inspection, perform a rough check of the entire product.

Perform the general inspection as follows:

1 Switch off the system and padlock it to secure it against being switched on again

2 Check the inspection points as described in the inspection table

3 Take measures as described in the inspection table

The general inspection is complete.

Inspection point	Description	Measures
Contamination	Check all the components for contamination: • Rollers • Guideways • Racks • Wiper • Lubricating element, lubricating pinion	Immediately clean away any contamination
Loose components	Check the fit of the components: • Screws • Nuts • Attachments • Clamping sets	• Immediately tighten loose screws to the required torque • Align and fasten loose attachments
Components	Check the condition of the components: • Rollers • Guideways • Racks • Pinion • Wiper • Lubricating element, lubricating pinion	Replace worn and defective components
Setting	Check for correct setting in the components: • Pinions • Rollers	• Set the tooth flank backlash • Set the rollers

Table 6-13 Inspection table

6.3.6 Maintenance tasks after 22,500 hours

6.3.6.1 Replacing the roller

The components are designed for continuous use. Their wear depends on the duration of operation of the product and the ambient conditions. Güdel recommends preventatively replacing components as soon as their service life has been reached. Components may fail before expiry of the service life however. Replace worn components immediately.

Eccentric roller

Roller positions

The eccentric rollers have three home positions:

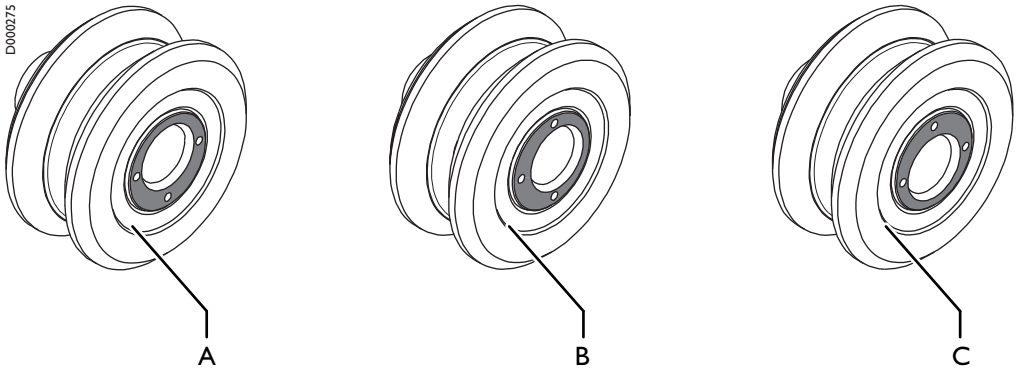

Fig. 6-8 *Roller positions*

A *Position -1*

B *Position 0*

C *Position +1*

Replacing the roller

Distinguishing characteristics of wear
• Excessive noise is audible • Discoloration due to heat present • Uneven running due to vibrations perceptible • Running surface worn • Notches on guide running surface

Table 6-14 *Distinguishing characteristics of wear: Roller*

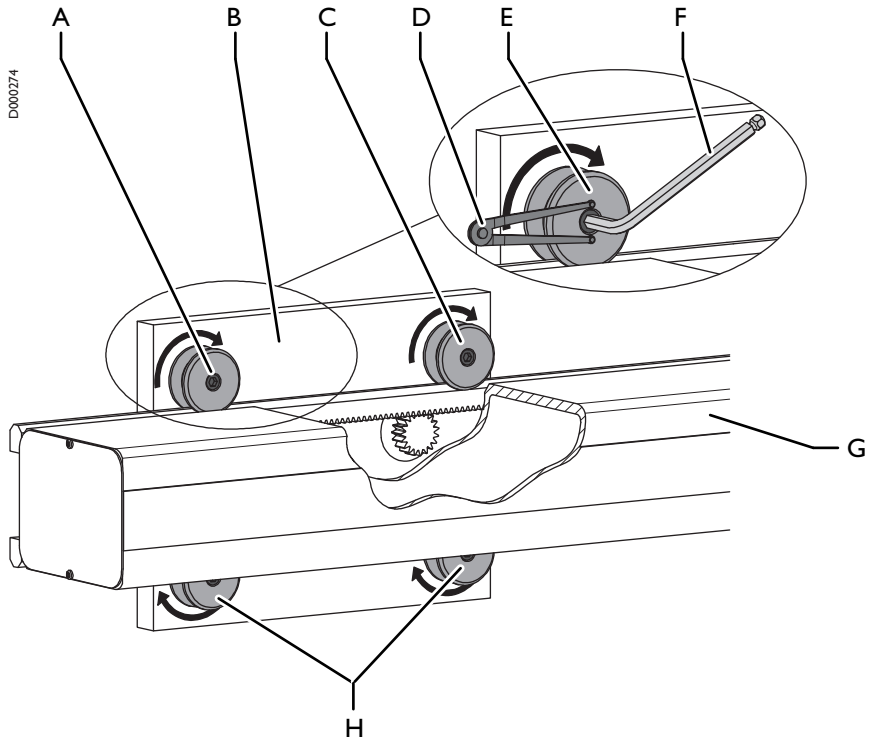

Fig. 6-9 *Replacing the roller*

A	*Screws*	*E*	*Supporting roller*
B	*Carriage*	*F*	*Hexagonal socket wrench*
C	*Supporting roller*	*G*	*Axis*
D	*Pin-type face wrench*	*H*	*Guideway rollers*

Replace the rollers as follows:

1 Switch off the system and padlock it to secure it against being switched on again
2 Attach the slings to the carriage or axis
3 Move the carriage off the axis or extend the axis
4 Remove the wiper and lubrication unit
5 Remove the screws
6 Replace the rollers
7 Slightly tighten the screws
8 Set the rollers: ➲ 67
   8.1 Supporting rollers: Position +1
   8.2 Guideway rollers: Position -1
9 Move carriage onto axis or insert the axis
10 Remove the slings
11 Set the rollers and the tooth flank backlash ➲ Chapter 6.3.7, 87

The rollers have been replaced.

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Centering and eccentric roller

Setting the rollers

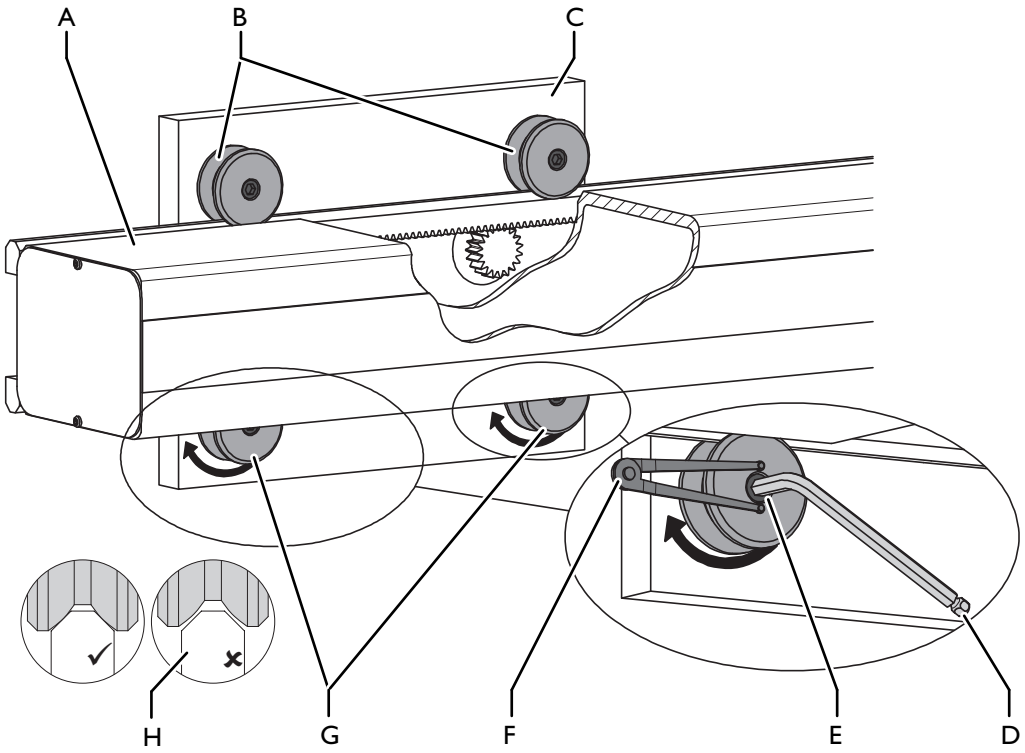

Fig. 6-10 *Setting the rollers: Prism guideway, centering and eccentric rollers*

A	*Axis*	*E*	*Screw*
B	*Supporting roller (concentric)*	*F*	*Pin-type face wrench*
C	*Carriage*	*G*	*Guideway roller (eccentric)*
D	*Hexagonal socket wrench*	*H*	*Guideway*

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Adjust the rollers as follows:

Prerequisite:The wiper and lubrication units have been removed

Prerequisite:The maximum backlash has been set ➲ Chapter 6.3.7, 🗎 87

Prerequisite:Guideway rollers are set to position -1 ➲ 🗎 67

1. Switch off the plant and padlock it to secure it against being switched on again
2. Slightly loosen the screws
3. Move guideway rollers towards the guideway
4. Tighten the screws
   (block the rollers by means of a pin-type face wrench)
5. Check setting:
   The roller touches the guideway. The roller can still be turned by hand when a lot of force is applied
6. If there are deviations: Repeat process from step 2
7. Install the wiper and lubrication unit

The rollers have been set.

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Eccentric roller

Setting the rollers

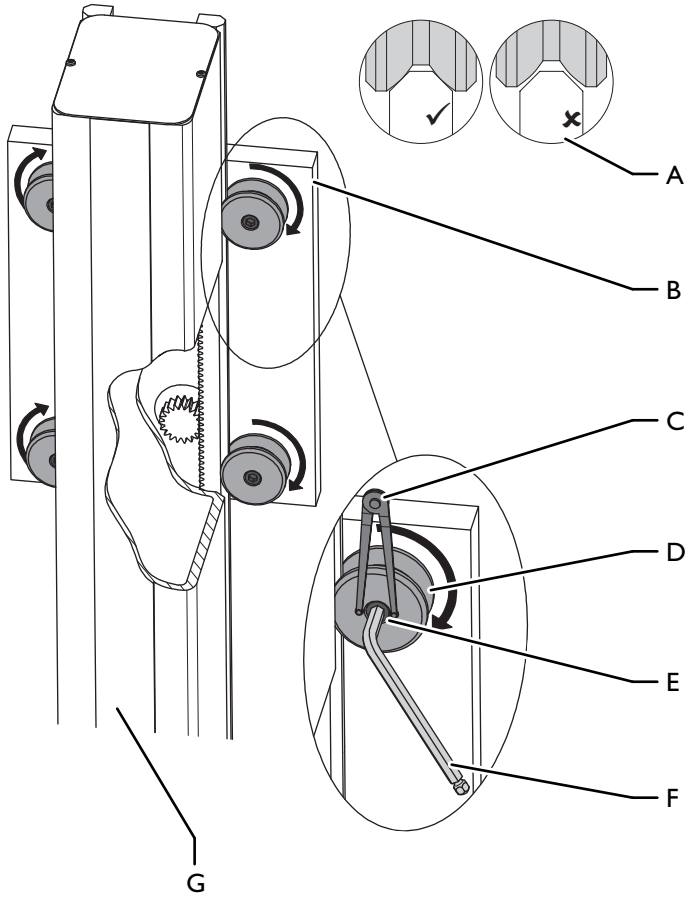

Fig. 6-11 *Setting the rollers: Prism guideway, eccentric rollers*

A	*Guideway*	*E*	*Screw*
B	*Carriage*	*F*	*Hexagonal socket wrench*
C	*Pin-type face wrench*	*G*	*Axis*
D	*Roller (eccentric)*		

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Adjust the rollers as follows:

Prerequisite:The wiper and lubrication units have been removed

Prerequisite:The maximum backlash has been set ➲ Chapter 6.3.7, 🗎 87

Prerequisite:Right rollers are set to position +1 ➲ 🗎 67

Prerequisite:Left rollers are set to position -1 ➲ 🗎 67

1. Switch off the plant and padlock it to secure it against being switched on again
2. Slightly loosen the screws
3. Move right rollers in the direction of the arrow; check the parallelism between the carriage and axis
   (Tolerance: max. 0.05 mm)
4. Move left rollers towards the guideway
5. Tighten the screws
   (block the rollers by means of a pin-type face wrench)
6. Check setting:
   The roller touches the guideway. The roller can still be turned by hand when a lot of force is applied
7. If there are deviations: Repeat process from step 2
8. Install the wiper and lubrication unit

The rollers have been set.

Eccentric flange

Roller positions

The eccentric flanges have three different basic positions for setting the roller positions. Turn the flange between positions +1 and -1 in order to bring the roller closer (clockwise) or increase the distance (counterclockwise).

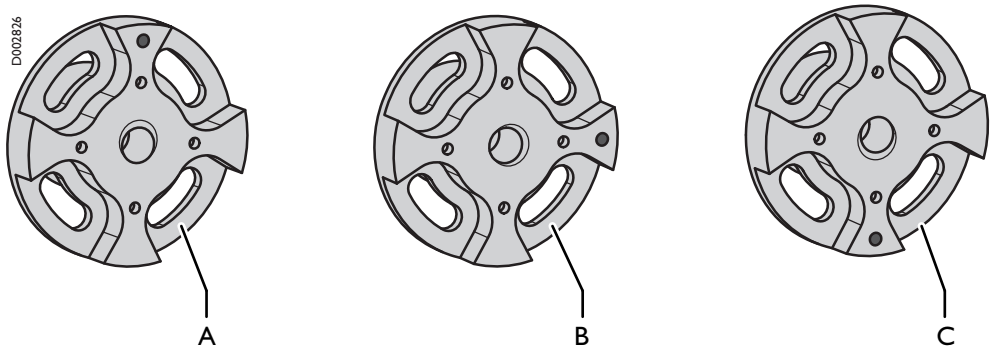

Fig. 6-12 *Eccentric flange / roller positions*

A *Position +1*

B *Position 0*

C *Position -1*

Replacing the roller

Distinguishing characteristics of wear
• Excessive noise is audible • Discoloration due to heat present • Uneven running due to vibrations perceptible • Running surface worn • Notches on guide running surface

Table 6-15 *Distinguishing characteristics of wear: Roller*

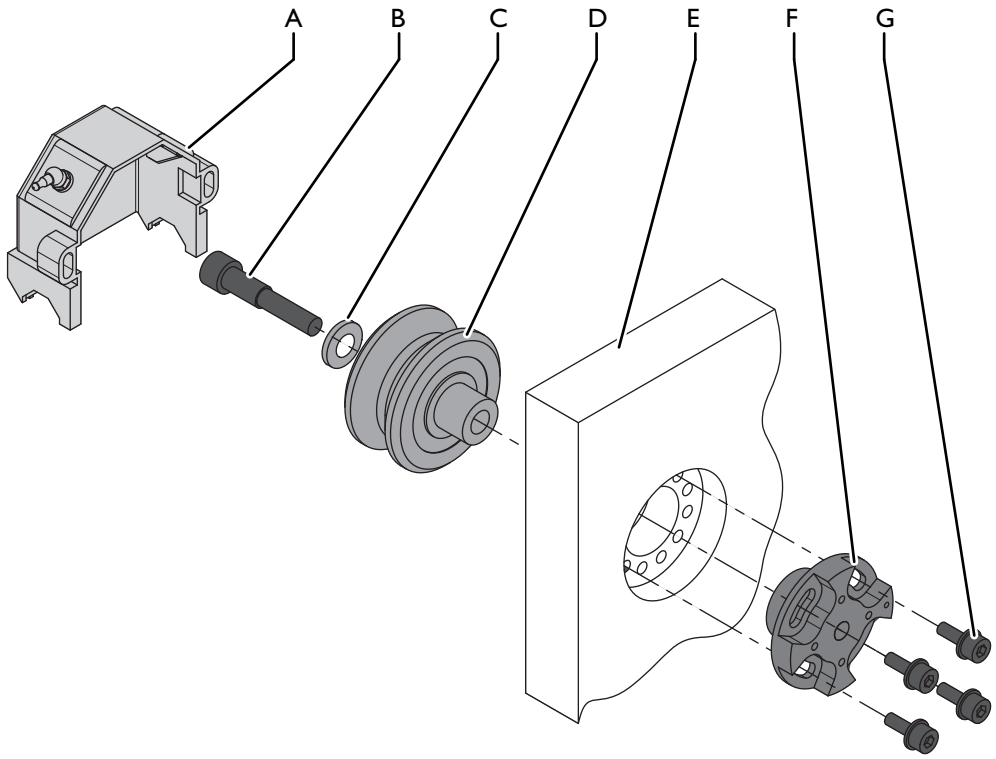

Fig. 6-13 *Replacing the roller*

A	*Wiper and lubrication unit*	*E*	*Carriage*
B	*Fastening screw*	*F*	*Eccentric flange*
C	*Serrated lock washer*	*G*	*Screw*
D	*Roller*		

Replace the roller as follows:

1 Switch off the plant and padlock it to secure it against being switched on again
2 Attach the slings to the carriage
3 Move the carriage off the axis
4 Remove the wiper and lubrication units
5 Remove the fastening screw
6 Remove the serrated lock washer
7 Remove the screws
8 Replace the roller and serrated lock washer
9 Install the roller in the reverse order
10 Slightly tighten the screws
11 Move the rollers away from the guideway ➲ 74
12 Move carriage onto axis
13 Remove the slings
14 Set the rollers and the tooth flank backlash ➲ Chapter 6.3.7, 87

The roller has been replaced.

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Horizontal axis

Setting the rollers

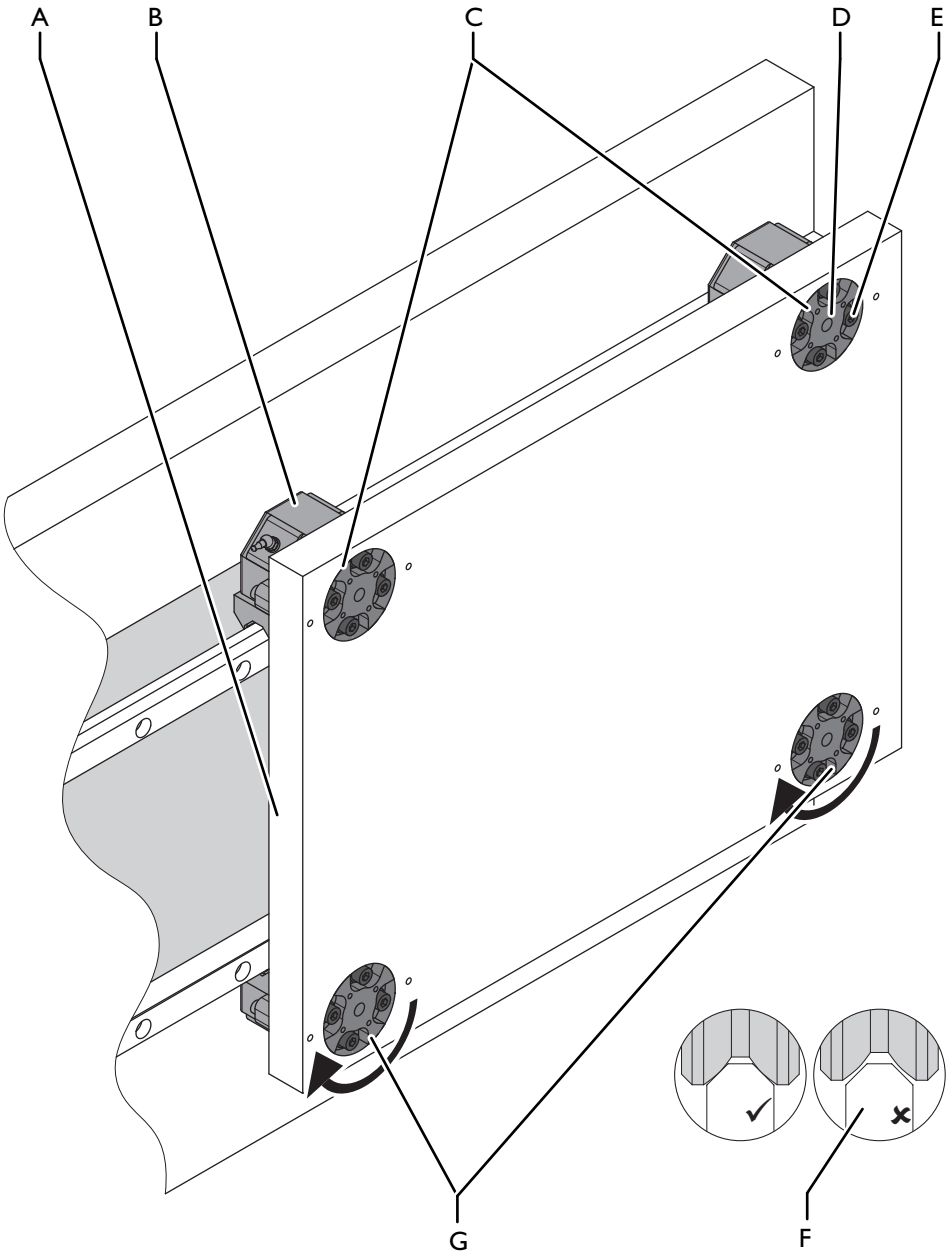

Fig. 6-14 *Setting the rollers: horizontal axis*

A	*Carriage*	*E*	*Screw*
B	*Wiper and lubrication unit*	*F*	*Guideway*
C	*Supporting roller*	*G*	*Guideway roller*
D	*Eccentric flange*		

Adjust the rollers as follows:

Prerequisite:The wiper and lubrication units have been removed

Prerequisite:The maximum tooth flank backlash has been set
➲ Chapter 6.3.7, 🗎 87

Prerequisite:Supporting rollers have been set to position 0 ➲ 🗎 74

Prerequisite:Guideway rollers are set to position -1 ➲ 🗎 74

1. Switch off the plant and padlock it to secure it against being switched on again
2. Slightly loosen the screws
3. Move guideway rollers towards the guideway using the eccentric flange
4. Tighten the screws
5. Check setting:
   The roller touches the guideway. The roller can still be turned by hand when a lot of force is applied
6. If there are deviations: Repeat process from step 2
7. Install the wiper and lubrication unit

The rollers have been set.

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Vertical axis

Setting the rollers

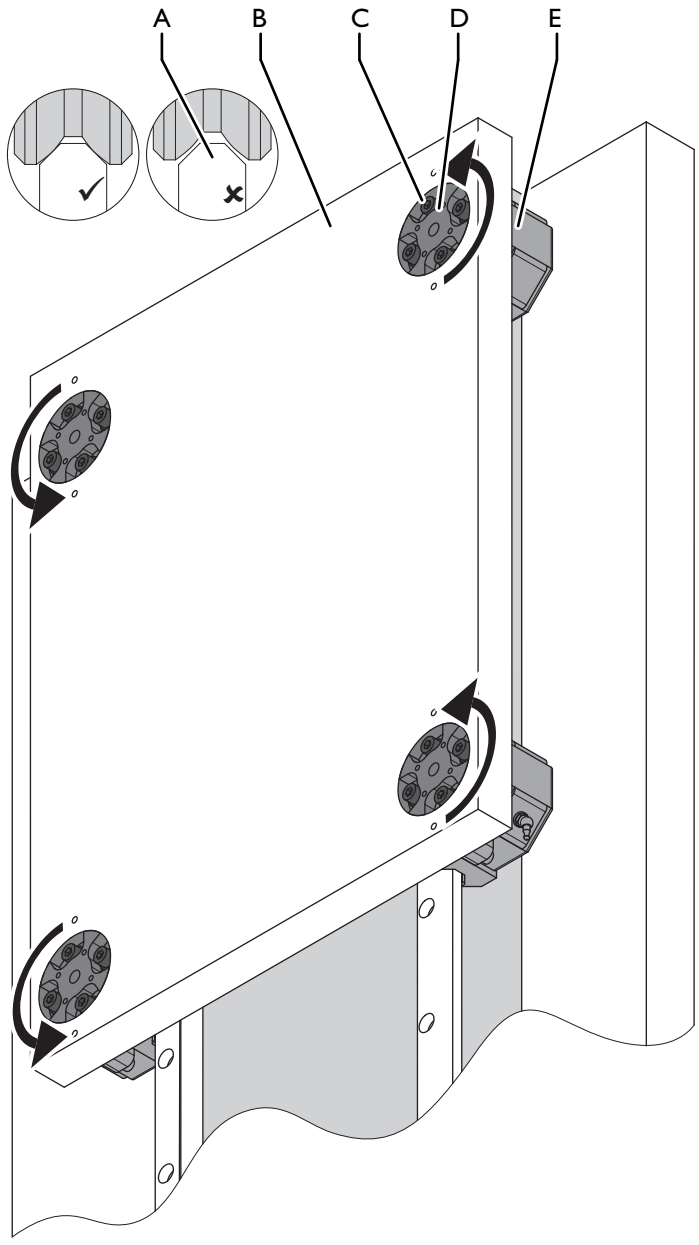

Fig. 6-15 *Setting the rollers: vertical axis*

A	*Guideway*	*D*	*Eccentric flange*
B	*Carriage*	*E*	*Wiper and lubrication unit*
C	*Screw*		

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Adjust the rollers as follows:

Prerequisite:The wiper and lubrication units have been removed

Prerequisite:The maximum tooth flank backlash has been set
➲ Chapter 6.3.7, 🗎 87

Prerequisite:Right rollers are set to position +1 ➲ 🗎 74

Prerequisite:Left rollers are set to position -1 ➲ 🗎 74

1 Switch off the plant and padlock it to secure it against being switched on again
2 Slightly loosen the screws
3 Move right rollers toward the guideway using the eccentric flange; check the parallelism between the carriage and axis
(Tolerance: maximum 0.05 mm)
4 Move left rollers toward the guideway using the eccentric flange
5 Tighten the screws
6 Check setting:
The roller touches the guideway. The roller can still be turned by hand when a lot of force is applied
7 If there are deviations: Repeat process from step 2
8 Install the wiper and lubrication unit

The rollers have been set.

Final tasks

Perform the following final tasks:

1 Set the tooth flank backlash ➲ Chapter 6.3.7, 🗎 87
2 Calibrate the reference plane of the motor (this procedure is described in the documentation for the complete system or the motor)

The final tasks have been performed.

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6.3.6.2 Replacing the guideway

Disassembling the guideway

Disassemble the guideway as follows:

1 Switch off the system and padlock it to secure it against being switched on again

2 Attach the slings to the carriage or axis

3 Expose guideway:

- **3.1** Move the carriage off the guideway or axis to be replaced, if necessary
- **3.2** Move out the vertical axis, if necessary

4 Remove all screws

5 Remove the guideway

The guideway has been disassembled.

Using the mounting aid: Installing the rack

The start and end of the rack each form half of a tooth gap. For precise and quiet transition, we recommend using a mounting aid toothed in the opposite direction. ➲ 62

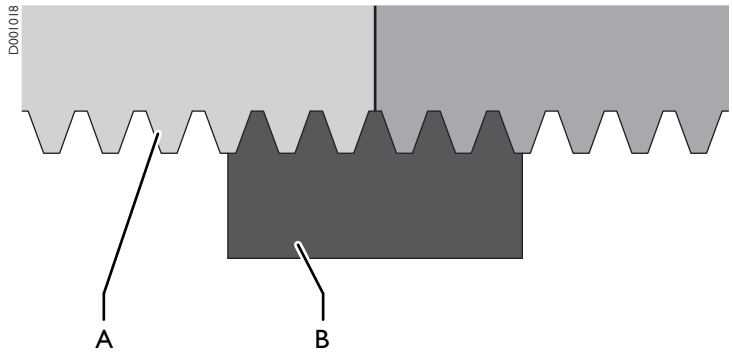

Fig. 6-16 *Mounting aid for rack installation*

A *Rack*

B *Mounting aid*

Installing the guideway

If you inspect the rack transition and cannot comply with the required values, the gap dimension takes priority.

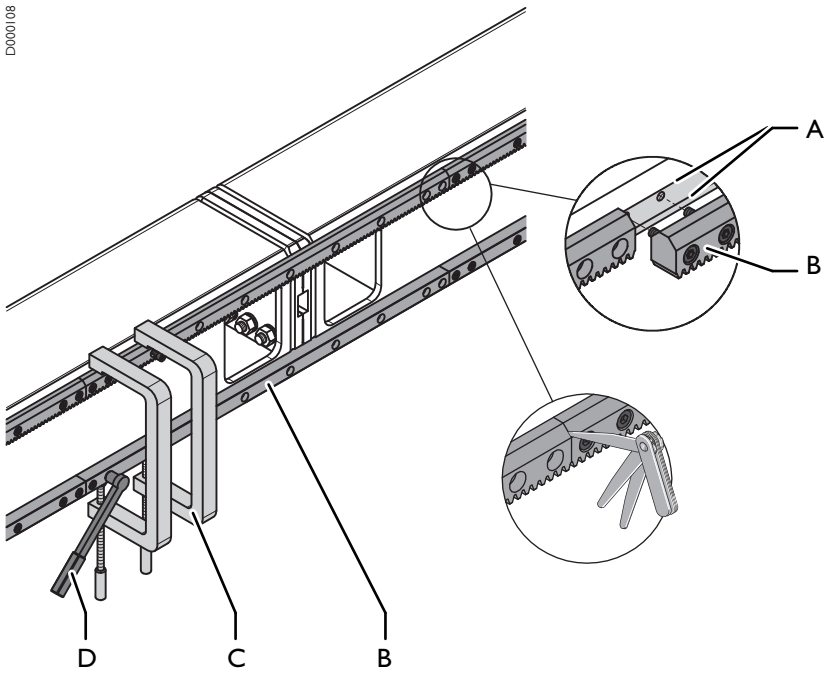

Fig. 6-17 *Installing the guideway*

A	*Reference surface*	*C*	*Screw clamp*
B	*Guideway*	*D*	*Torque wrench*

Cleaning agents
mild universal cleaner free from aromatic compounds (e.g. Motorex OPAL 5000)

Table 6-16 *Cleaning agents: Guideway, rack*

Install the guideway as follows:

1 Clean the reference surfaces and guideways thoroughly and rub a sharpening stone across them

2 Clamp guideways to reference surfaces with screw clamps

3 Tighten all screws

4 Check the transition: Gap dimension < 0.02 mm

5 Use a suitable measuring instrument to check that the guideways are parallel
(Tolerance: ±0.04 mm)

6 Move the carriage or axis across the entire length:
The drive pinion with correctly set tooth flank backlash should not jam at the transitions of the guideway

7 If deviations of the transition or parallelism occur:

7.1 Remove the screws and guideways

7.2 Repeat the procedure

The guideway has been installed.

Inspecting rack transition

Rack quality and module ➲ 89

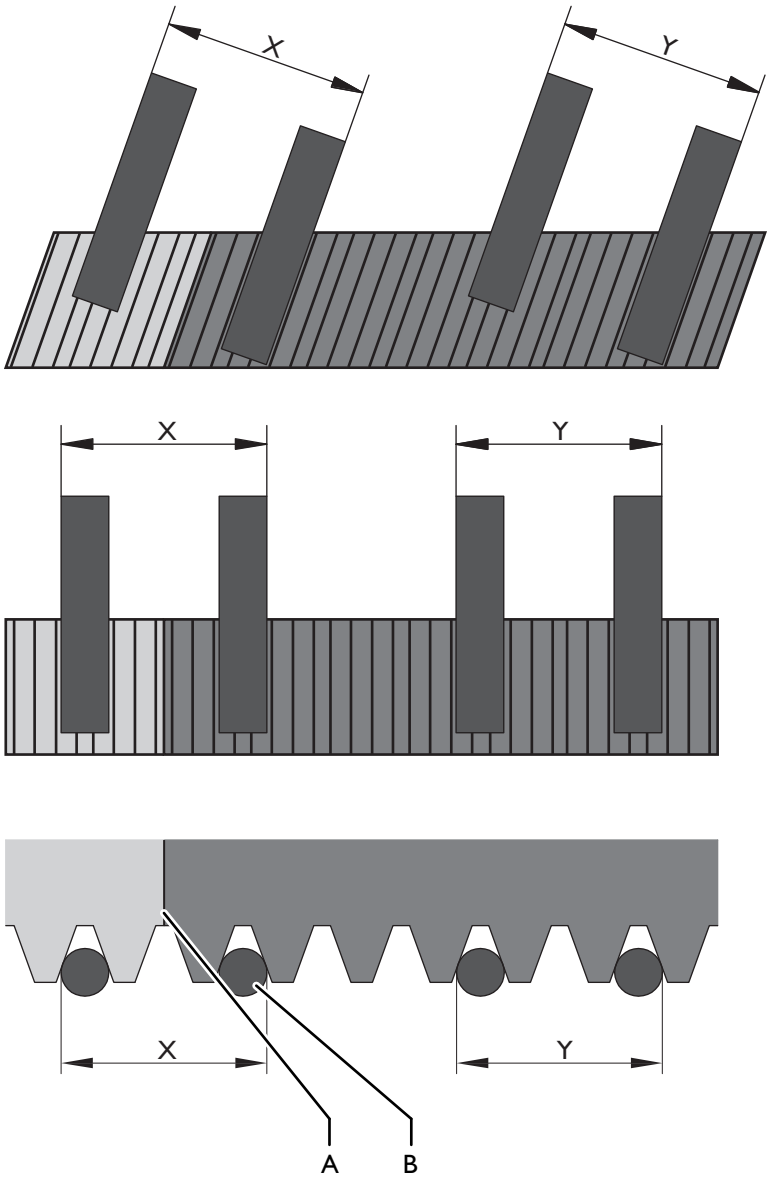

Fig. 6-18 *Inspecting rack transition*

A *Rack transition*

B *Measurement bolt (diameter D = 2 × m ; accuracy: tolerance class 1 acc. to DIN 2269)*

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Rack quality	Permissible deviation [mm]	
	Module m ≤ 3	Module 3 < m ≤ 8
Q4 h21	0.006	0.010
Q5 h22	0.008	0.012
Q6 h23	0.012	0.012
Q7 h25	0.016	0.016
Q8 h27	0.016	0.016
Q9 h27	0.016	0.016

Table 6-17 Permissible deviation, rack transition

Inspect the rack transition as follows:

1 Position the measurement bolt as shown in the illustration

2 Check dimension X and Y (permissible deviation between value X and Y according to preceding table)

The rack transition has been inspected.

Checking the installed racks

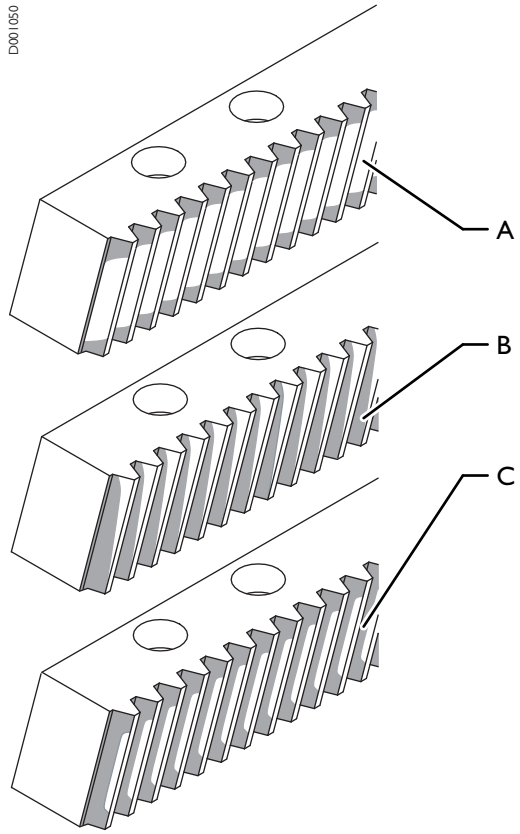

Fig. 6-19 *Checking the installed racks*

A *Correct*

B *Not parallel*

C *Wrong axle spacing*

Cleaning agents
mild universal cleaner free from aromatic compounds (e.g. Motorex OPAL 5000)

Table 6-18 *Cleaning agents: Rack*

Check the installed racks as follows:

Prerequisite:The racks are highly loaded

1 Clean the tooth flanks of the rack thoroughly
2 Coat the tooth flanks with a paste or water-resistant felt pen
3 Move the components along the entire run length several times with the pinion
4 According to the illustration, evaluate the color (ink) that has been removed
5 If necessary, realign the components with the pinion

The installed racks have been checked.

Final tasks

Perform these final tasks as follows:

1 Move the carriage onto the axis, if necessary
2 Retract the vertical axis, if necessary
3 Remove the slings
4 Set the rollers
5 Set the tooth flank backlash

The final tasks have been performed.

6.3.7 Setting the tooth flank backlash

NOTE

Wear of components

Incorrectly set rollers and tooth flank backlash increase the wear on the guideway, roller, rack and pinion.

- Always set the rollers and the tooth flank backlash with load attached and at operating temperature

Reset the rollers and the tooth flank backlash after each replacement of the following components:

- Roller
- Guideway
- Rack
- Pinion
- Gearbox

6.3.7.1 Checking the tooth flank backlash

If the axis is not driven with Güdel gearbox type, then use the procedure described in the operating manual of the relevant gearbox.

Blocking the drive pinions

Block the drive pinion to check the tooth flank backlash. Remove the block once you have completed the check. For this purpose, remove the fastening device and place the plug back onto the gearbox unit.

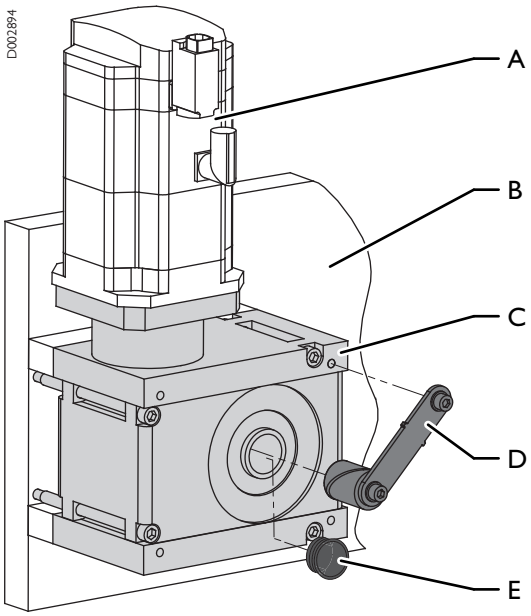

Fig. 6-20 *Blocking the drive pinions: Güdel gearbox unit*

A	*Motor*	*D*	*Fastening device*
B	*Carriage*	*E*	*Plug*
C	*Gearbox unit*		

Block the drive pinion as follows:

1. Switch off the system and padlock it to secure it against being switched on again
2. Remove the plug
3. Attach fastening device to gearbox unit

The drive pinion is blocked.

Rack quality and module

Hardened racks can be recognized by the engraved Güdel logo.

The quality and module are found in the following table:

Size	Rack quality		Module	Helix angle β [°]
	Hardened rack	Soft rack		
15, 20	6h23	7h25	1.5915	-
15, 20	6h23	7h25	1.5	19.5283
25	6h23	7h25	2.3873	-
25	6h23	7h25	2.5	19.5283
35	6h23	7h25	3.1831	-
35	6h23	7h25	3	19.5283

Table 6-19 *Rack quality and module*

Exact measuring method

Rack quality and module ➲ 🗎 89

Rack quality	Tooth flank backlash [mm]		
	Module m ≤ 3	Module 3 < m ≤ 8	Module 8 < m ≤ 12
Q4 h21	0.010	0.012	0.016
Q5 h22	0.016	0.019	0.025
Q6 h23	0.025	0.03	0.04
Q7 h25	0.059	0.079	0.099
Q8 h27	0.158	0.198	0.247
Q9 h27	0.158	0.198	0.247

Table 6-20 *Tooth flank backlash: Güdel gearbox unit*

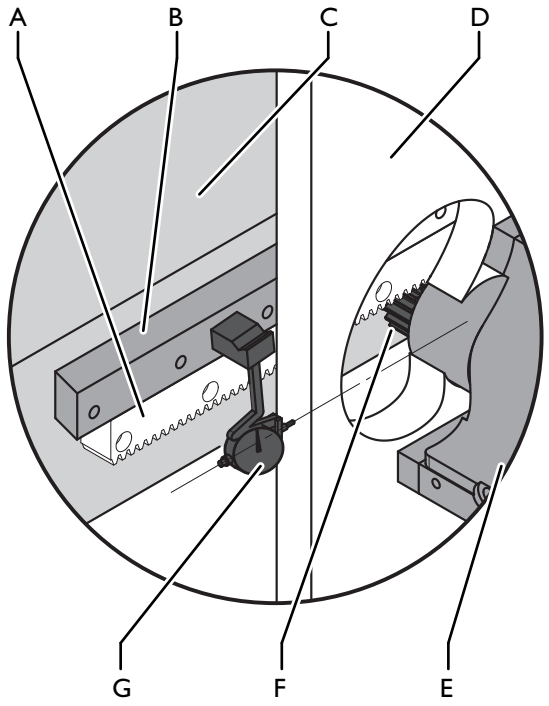

Fig. 6-21 *Checking the tooth flank backlash: Dial gauge (exact method)*

A	*Rack*	*E*	*Gearbox*
B	*Guideway*	*F*	*Drive pinion*
C	*Axle*	*G*	*Dial gauge*
D	*Carriage*		

Check the tooth flank backlash as follows:

Prerequisite:The drive pinion is blocked. ➲ 88

1. Switch off the system and padlock it to secure it against being switched on again
2. Mount the dial gauge to the guideway
3. Mount dial gauge in the direction of travel aligned with the center of the drive pinion
4. Zero the dial gauge
5. Move the carriage or axis in the direction of travel
6. Read tooth flank backlash on the dial gauge
7. Interpret tooth flank backlash according to the previous table

The tooth flank backlash has been checked.

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Inexact measuring method

NOTE

Damage resulting from inexact measuring method

The inexact measurement method described here can lead to incorrect interpretations and subsequent damage of every kind!

- Use it only when the exact method is not possible

Rack quality and module ➲ 89

Rack quality	Tooth flank backlash [mm]		
	Module m ≤ 3	Module 3 < m ≤ 8	Module 8 < m ≤ 12
Q4 h21	0.010	0.012	0.016
Q5 h22	0.016	0.019	0.025
Q6 h23	0.025	0.03	0.04
Q7 h25	0.059	0.079	0.099
Q8 h27	0.158	0.198	0.247
Q9 h27	0.158	0.198	0.247

Table 6-21 Tooth flank backlash: Paper strip (inexact method)

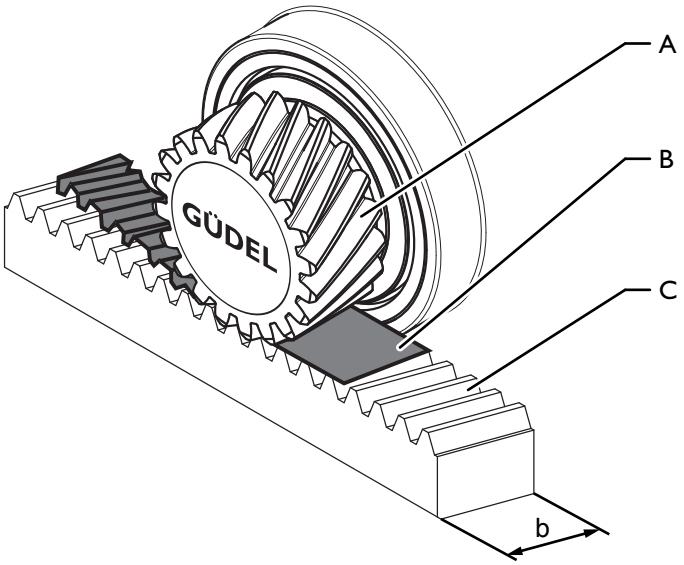

Fig. 6-22 *Checking the tooth flank backlash: Paper strip (inexact method)*

A *Drive pinion*

B *Paper strip*

C *Rack*

Check the tooth flank backlash as follows:

1 Switch off the system and padlock it to secure it against being switched on again

2 Insert paper strip from DIN A4 80 g/m2 with width b between drive pinion and rack

3 Move carriage or axis
(Paper strip is "turned through")

4 Paper strip worn:
Tooth flank backlash <0.05 mm

5 Paper strip cut, partially disconnected pieces:
Tooth flank backlash ~ 0.05 mm

6 Paper strips mildly cut, no disconnected pieces:
Tooth flank backlash ~ 0.07 mm

7 Paper strip wavy:
Tooth flank backlash ~ 0.1 mm

8 Paper strip undamaged:
Tooth flank backlash >0.1 mm

9 Interpret tooth flank backlash according to the previous table

The tooth flank backlash has been checked.

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6.3.7.2 Basics

The operating principle and calculation of the tooth flank backlash can be found in the standards DIN 3962-1:1978, DIN 3962-2:1978 and DIN 3962-3:1978.

NOTE

Wear of components

Incorrectly set rollers and tooth flank backlash increase the wear on the guideway, roller, rack, and pinion.

- The roller and pinion must regularly be run along the entire run length using several pushes

Select the tooth flank backlash of the application in accordance with the following:

Application	Tooth flank backlash [mm]
Hardened or soft racks, not ground	0.05
Hardened racks, ground	0.02

Table 6-22 Tooth flank backlash guide values

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6.4 Maintenance table

Maintenance work	Maintenance cycle [h]	Duration [min]	Target readership	Lubricants Cleaning agents	Further information
Lubricating guideways, racks and pinions	150		Service technicians Maintenance technicians The manufacturer's technicians	Mobil Mobilux EP 2 Güdel H1 NSF no.146621	➲ Chapter 6.3.4.1, 🗎 64
General inspection	2,250		Maintenance technicians The manufacturer's technicians		➲ Chapter 6.3.5.1, 🗎 65
Replacing the roller	22,500		Service technicians The manufacturer's technicians Maintenance technicians		➲ Chapter 6.3.6.1, 🗎 67
Replacing the roller			Maintenance technicians The manufacturer's technicians		➲ 🗎 75
Replacing the guideway			The manufacturer's technicians Maintenance technicians		➲ Chapter 6.3.6.2, 🗎 81

This table does not purport to be exhaustive.

Table 6-23 Maintenance table

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7 Decommissioning, storage

7.1 Introduction

Only perform the tasks described in this chapter after you have read and understood the chapter "Safety". ➲ 13
It concerns your personal safety!

7.1.1 Personnel qualifications

Only appropriately trained and authorized technicians are allowed to work on the product.

7.2 Storage conditions

⚠ CAUTION

Leaking fluids

During storage, substances that are hazardous to the environment can leak!

- Hazardous substances must be prevented from entering the drinking water supply. Take appropriate measures
- Observe the country-specific safety data sheets
- Oils and greases must be disposed of as hazardous waste, even if the total quantity is small

Room Store the product in a dry location. For information on the required space and the floor capacity, refer to the layout. Use a covering to protect the product against dust and dirt.

Temperature The ambient temperature must remain between -10 and +40 °C. Make sure that the product is not subjected to great temperature fluctuations.

Air humidity The air humidity must be below 75%.

7.3 Cleaning, rust-proofing

Clean away any dirt and dust from the product. Clean the product thoroughly. Dispose of any cloths soaked in oil or grease in an environmentally friendly manner. ➲ 99
Apply corrosion protection to all bright parts.

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8 Disposal

8.1 Introduction

Observe the following during disposal:

- Adhere to the country-specific regulations
- Separate the material groups
- Dispose of the materials in an environmentally friendly way
- Recycle waste if possible

8.1.1 Safety

Only perform the tasks described in this chapter after you have read and understood the chapter "Safety". ➲ 🗎 13
It concerns your personal safety!

⚠ WARNING

Heavy components

Components can be very heavy. Improper handling can cause severe or fatal injuries!

- Use appropriate lifting units
- Use suitable means to secure the components against tipping over
- Only remove the safety devices after the product has been completely assembled

⚠ WARNING

Suspended loads

Improper handling of suspended loads can lead to severe injuries or death!

- Use appropriate lifting units
- Wear appropriate protective clothing
- Always keep sufficient distance from suspended loads
- Never enter the area below a suspended load

⚠ WARNING

Ripping of lifting belts

The sharp edges of the rack cut the lifting belts. This can lead to severe or fatal injuries!

- Always protect the lifting belts with the guard plate

8.1.2 Personnel qualifications

Only appropriately trained and authorized technicians are allowed to work on the product.

8.2 Waste management compliant assemblies

8.2.1 Material groups

Dispose of the material groups in accordance with the following table:

Material	Disposal method
Contaminated materials / auxiliary agents	Hazardous waste
Wood	Municipal waste
Plastic	Collecting point or municipal waste
Lubricants	Collecting point disposal in accordance with the safety data sheets ➲ 20
Batteries	Battery collection
Metals	Scrap metal collection
Electrical material	Electrical waste

Table 8-1 Disposal: material groups

8.3 Disposal facilities, authorities

The disposal facilities and authorities differ from country to country. Observe the local laws and regulations concerning disposal.

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9 Spare parts supply

9.1 Service departments

For service queries, please use the service form at www.gudel.com or contact the offices in the appropriate country:

Austria:	+43 7226 20690-0
China:	+86 21 5055 0012
Czech Republic:	+420 602 309 593
Germany:	+49 6291 6446 792
France:	+33 1 30091545
India:	+91 20 6791 0221
Italy:	+39 02 9217021
South Korea:	+82 32 858 05 41
Mexico:	+52 81 8374 2500 x-103
Poland:	+48 33 819 01 25
Thailand:	+66 2 374 0709
United Kingdom:	+44 2476 695 444
USA:	+1 734 214 0000
Spain:	+34 93 476 0380
The Netherlands:	+31 541 66 22 50
Turkey:	+90 532 316 94 44
Russia:	+7 8482 735544
All other countries and Switzerland:	+41 62 916 91 70

Table 9-1 *National agencies*

For urgent service inquiries, our help desk provides after-hour assistance (24-hour support)

Europe/Asia:	+41 62 916 91 70	service@ch.gudel.com
USA:	+1 734 214 0000	service@us.gudel.com

Table 9-2 *24-hour Hotline*

Please have the following information at hand, as labeled on the type plate

- Product, type
- Project, sales order
- Serial number (parts list)
- Drawing number, if applicable

10 Torque tables

10.1 Tightening torques for screws

NOTE

Vibrations

Screws without screw lock become loose.

- Secure screw connections on moving parts Loctite medium strength 242.
- Apply the adhesive on the nut thread, not on the screw!

10.1.1 Zinc plated screws

Unless otherwise specified, the following tightening torques apply for zinc-plated screws lubricated with Molykote (MoS2) grease or secured with Loctite 242:

Thread size	Tightening torque [Nm]		
	8.8	10.9	12.9
M3	1.1	1.58	1.9
M4	2.6	3.9	4.5
M5	5.2	7.6	8.9
M6	9	13.2	15.4
M8	21.6	31.8	37.2
M10	43	63	73
M12	73	108	126
M14	117	172	201
M16	180	264	309
M20	363	517	605
M22	495	704	824
M24	625	890	1041
M27	915	1304	1526
M30	1246	1775	2077
M36	2164	3082	3607

Table 10-1 *Torque table for zinc-plated screws lubricated with Molykote (MoS2) grease*

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10.1.2 Black screws

Unless otherwise specified, the following tightening torques apply for black oiled and non-lubricated screws, or screws secured with Loctite 242:

Thread size	Tightening torque [Nm]		
	8.8	10.9	12.9
M4	3	4.6	5.1
M5	5.9	8.6	10
M6	10.1	14.9	17.4
M8	24.6	36.1	42.2
M10	48	71	83
M12	84	123	144
M14	133	195	229
M16	206	302	354
M20	415	592	692
M22	567	804	945
M24	714	1017	1190
M27	1050	1496	1750
M30	1420	2033	2380
M36	2482	3535	4136

Table 10-2 *Torque table for black oiled and non-lubricated screws*

10.1.3 Stainless steel screws

Unless otherwise specified, the following tightening torques apply for stainless steel screws lubricated with Molykote (MoS2) grease or secured with Loctite 242:

Thread size	Tightening torque [Nm]		
	50	70	80
M3	0.37	0.8	1.1
M4	0.86	1.85	2.4
M5	1.6	3.6	4.8
M6	2.9	6.3	8.4
M8	7.1	15.2	20.3
M10	14	30	39
M12	24	51	68
M14	38	82	109
M16	58	126	168
M20	115	247	330
M22	157	337	450
M24	198	426	568
M27	292	—	—
M30	397	—	—
M36	690	—	—

Table 10-3 *Torque table for stainless steel screws lubricated with Molykote (MoS2) grease*

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10.2 Thread rolling screws

Thread rolling screws are mainly used for guideways, mounting plates, and cable tray brackets.

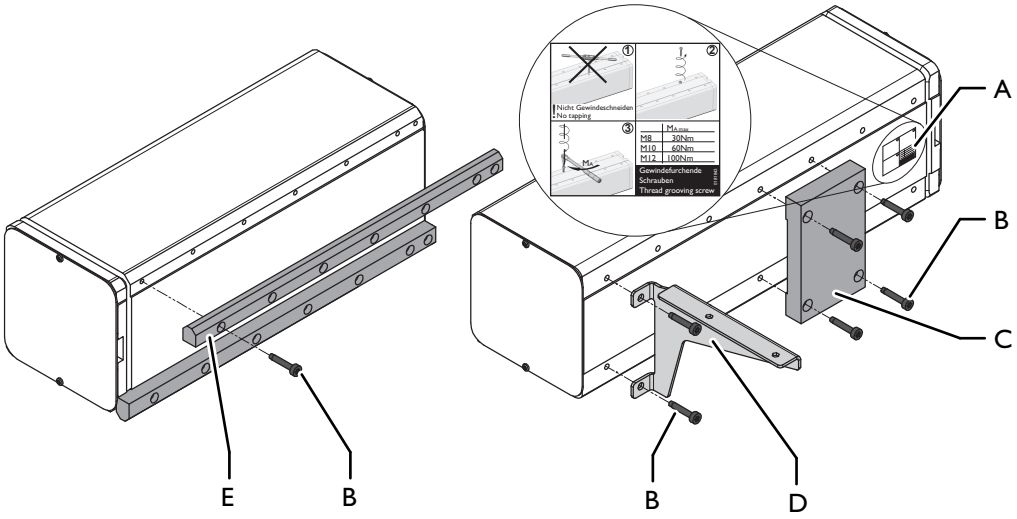

Fig. 10-1 *Use of thread rolling screws*

A	*Label*	*D*	*Cable tray bracket*
B	*Thread rolling screws*	*E*	*Cable tray bracket*
C	*Mounting plate*		

Thread rolling screws, the screws that are supplied by Güdel with a Torx drive, can be screwed directly into the core hole. It is not necessary to cut the thread in advance. After the first use of a thread-cutting screw, a metric screw can also be employed. Drill holes without a thread must be furrowed. Do not cut in the thread. This information can also be found on the label. The following tightening torques apply to thread rolling screws when screwed in for the first time:

Size	Tightening torque [Nm]	
	Steel S355J2	Aluminum
M8x30	30	35
M10x45	63	71
M12x40	108	123

Table 10-4 *Tightening torques for thread rolling screws*

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