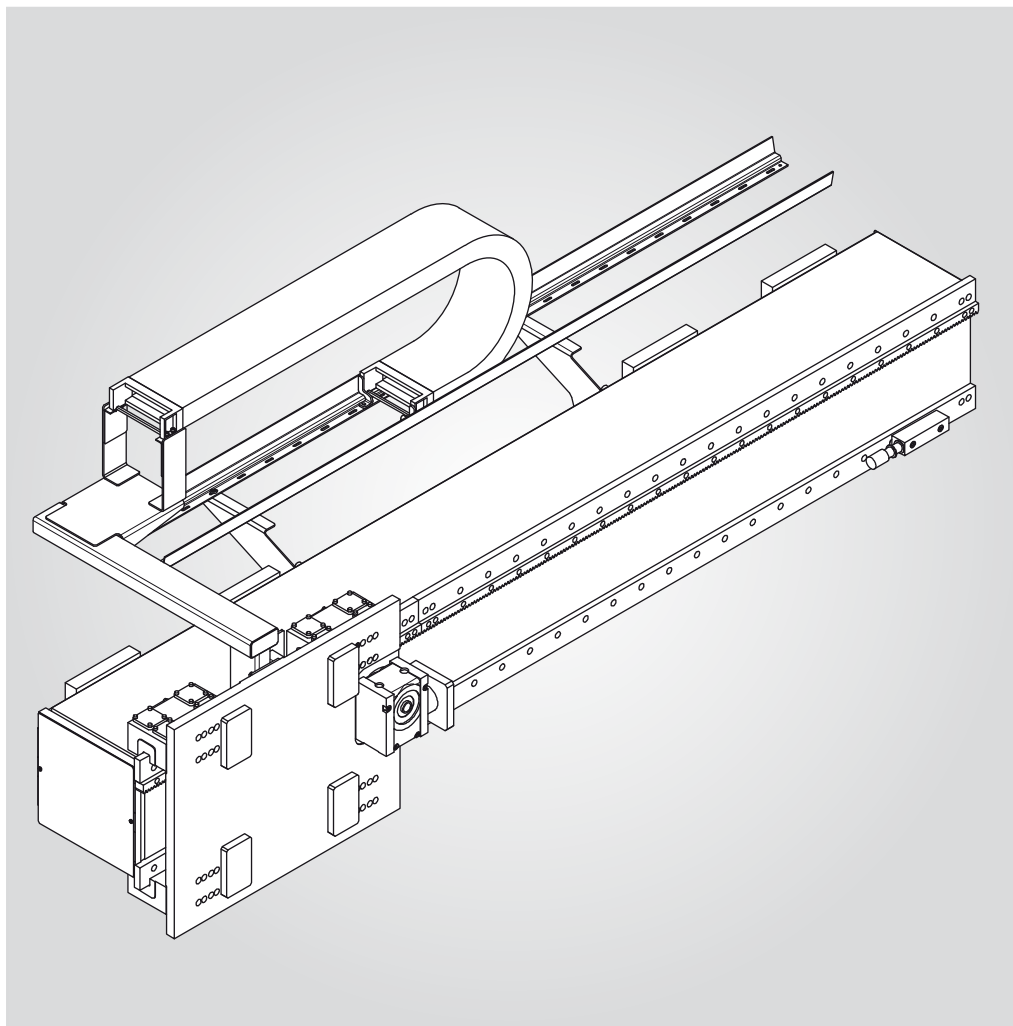


## OPERATING MANUAL

### TM-O Sizes 40-90



Project: Axxxxxxx-xx  
Bill of materials: 09xxxxxx  
Date of manufacture: xx/xxxx

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Version                      b

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# I General

## I.1 Purpose of the document

This operating manual describes all product life phases of the product TM-O:

- Transport
- Repairs
- Commissioning
- Operation
- Maintenance
- Disposal

The operating manual contains the required information on how to operate the product in the intended manner. It is an important component of the product TM-O.

The operating manual must be available at the product site throughout its entire service life. If the product is sold, it has to be transferred to the new owner with the machine.

### NOTE



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


## I.2 Target readership

This operating manual is aimed at the following target readership:

- Specialists
  - Technicians
  - Forwarding agents
- Operating companies
- Operating personnel
- Service personnel

## I.3 Characters / Explanation of abbreviations

The following symbols and abbreviations are used in this operating manual:

Sym- bol/Abbre- viation	Use	Explanation
	For cross-reference	Page
Fig.	Designates drawings	Figure
Tab.	Designates tables	Table

Tab. I-1 Explanation of symbols/abbreviations



## **I.4 Torque tables**

### **I.4.1 Tightening torques for screws**

If no other specifications have been made, the following tightening torques apply for oiled and unlubricated screws:

<b>Thread size</b>	<b>Tightening torque [Nm]</b>		
	<b>8.8</b>	<b>10.9</b>	<b>12.9</b>
M4	3	4.6	5.1
M5	5.9	8.6	10.0
M6	10.1	14.9	17.4
M8	24.6	36.1	42.2
M10	48.0	71.0	83.0
M12	84.0	123.0	144.0
M14	133.0	195.0	229.0
M16	206.0	302.0	354.0
M20	415.0	592.0	692.0
M22	567.0	804.0	945.0
M24	714.0	1017.0	1190.0
M27	1050.0	1496.0	1750.0
M30	1420.0	2033.0	2380.0
M36	2482.0	3535.0	4136.0

Tab. I-2 Torque table: oiled and unlubricated screws

If no other specifications have been made, the following tightening torques apply for screws lubricated with moly grease:

Thread size	Tightening torque [Nm]		
	8.8	10.9	12.9
M4	2.6	3.9	4.5
M5	5.2	7.6	8.9
M6	9.0	13.2	15.4
M8	21.6	31.8	37.2
M10	43.0	63.0	73.0
M12	73.0	108.0	126.0
M14	117.0	172.0	201.0
M16	180.0	264.0	309.0
M20	363.0	517.0	605.0
M22	495.0	704.0	824.0
M24	625.0	890.0	1041.0
M27	915.0	1304.0	1526.0
M30	1246.0	1775.0	2077.0
M36	2164.0	3082.0	3607.0

Tab. I-3 Torque table: screws lubricated with moly grease

## I.4.2 Tightening torques for HV sets

The following tightening torques apply to DIN6914/15/16-10.9 HV sets:

Thread size	Tightening torque [Nm]	
	Lubricated with moly grease	Slightly oiled
M12	100	120
M16	250	350
M20	450	600
M22	650	900
M24	800	1100
M27	1250	1650
M30	1650	2200
M36	2800	3800

Tab. I-4 Tightening torques: HV sets

**I.4.3     Tightening torques for roller holders**

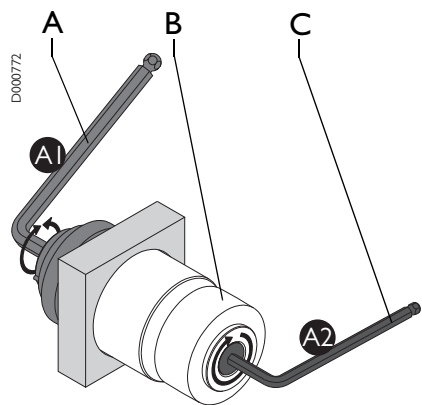


Fig. I-1     Tightening torques for roller holders

- A Move roller with hexagonal socket wrench (tightening torque A1)
- B Roller holder
- C Tighten screw with hexagonal socket wrench (tightening torque A2)

The following tightening torques apply to roller holders:

Size	Tightening torque [Nm]	
	A1	A2
40	1.5	4
52	2	4
62	3	15
72	4.5	15
90	7	15

Tab. I-5     Tightening torques: Roller holders

## I.4.4 Tightening torques for roller supports

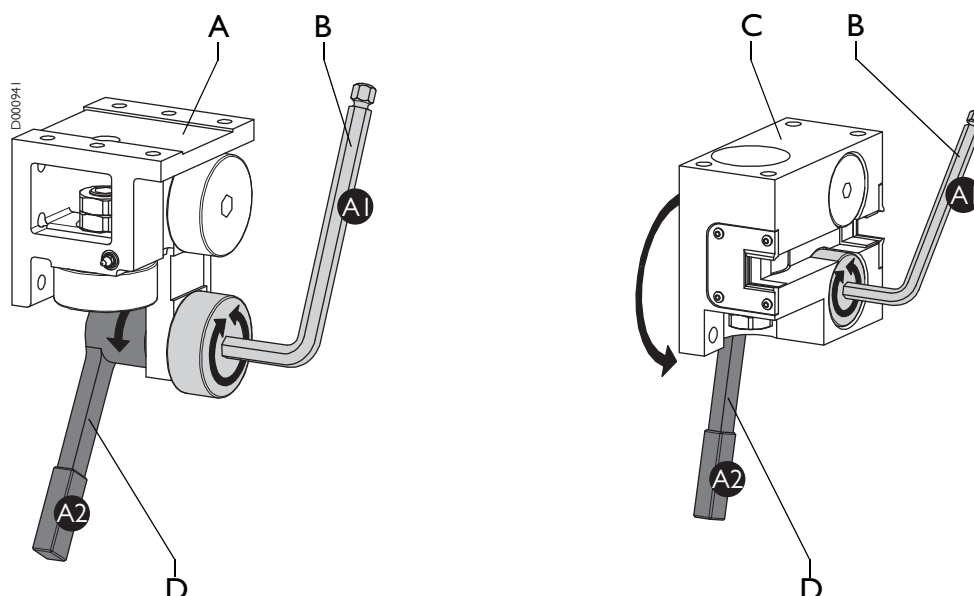


Fig. I-2 Tightening torques for roller supports

- A Roller supports size 72 and 90
- B Move roller with hexagonal socket wrench (tightening torque A1)
- C Roller supports size 40 and 52
- D Tighten nut and locknut with hexagonal key (tightening torque A2)

The following tightening torques apply to roller supports:

Size	Tightening torque [Nm]	
	A1	A2
40	1	87
52	2	120
72	3	220
90	5.5	450

Tab. I-6 Tightening torques: Roller supports

## **2 Product description**

### **2.1 Purpose**

#### **2.1.1 Intended use**

The TM-O product is intended exclusively for moving and positioning of robots.

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

#### **2.1.2 Non-intended use**

The TM-O product is not intended for:

- Movement of poisonous goods
- Movement of explosive goods
- Operation in explosive areas

Any other use shall be considered improper use and is forbidden!

Do not modify the product in any way.

## 2.2 Product designation

Each product has a type plate. It contains the following information:

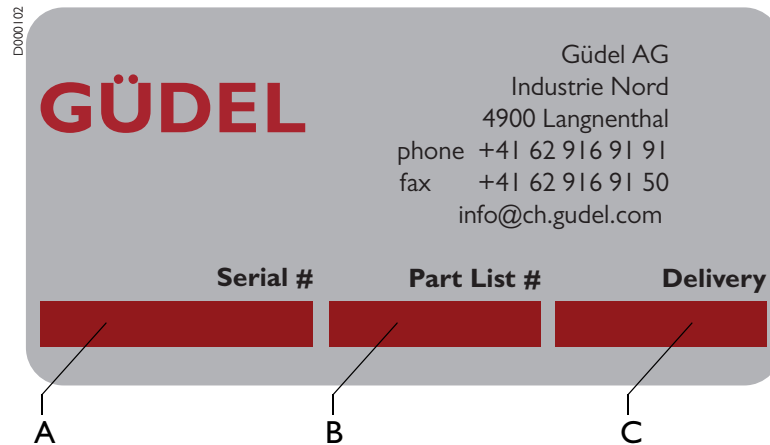


Fig. 2-1

Type plate

- A Order number
- B Part list number
- C Delivery date

## 2.3 Technical data

The technical data is valid for temperatures between +25 and +30 °C.

The emitted sound pressure level depends on how the product is used.

For the following data, refer to the layout(s) in chapter 13 'Appendix', 97:

- Dimensions
- Weight
- Strokes of the individual axes
- Gearbox type
- Gearbox ratios
- Motors

*Temperature ranges*    The following temperature ranges apply:

Transport	-10 to +60°C
Operation	+12 to +40°C
Storage	-10 to +40°C

## **2.4      Options**

The following options are supplied with separate documentation:

- Automatic lubrication system, battery or external 24 V DC, oil or grease
- Manual lifting and safety unit: vertical axis
- Holding brake
- Rotary axis
- Telescope axis
- Pneumatic load balance

This documentation can be found in chapter 13 'Appendix',  97.



## 3 Safety

### 3.1 General

#### Note




**Read this chapter prior to working with the product! It contains important information for your personal safety. This chapter must be read and understood by all persons who work on the product in any of the product life phases.**

#### 3.1.1 Product safety

*Residual danger* The TM-O product corresponds to the state of the art. It was designed and constructed according to the recognized safety regulations. However, some residual danger remains during its operation.

There is danger to the personal safety of the operator, as well as to the TM-O product and other property.

*Operation* Always adhere to the instructions in this manual when operating the TM-O product, and ensure that it is always in perfect working order.

The product must never be modified or used in a manner contrary to its intended use. Intended use and non-intended use is described in chapter 2 'Product description',  14.

#### 3.1.2 Operating personnel

Persons who work with the TM-O product must be technically qualified and trained. They must be familiar with all hazards associated with using the TM-O product.

### 3.1.3 Failure to comply with safety regulations

#### DANGER



##### **Disregarding safety regulations**

Disregarding the safety regulations can be very hazardous for personnel and the surroundings!

Always comply with the safety regulations!

##### *Protective measures*

The operator is responsible for ensuring safe conditions in the vicinity of the TM-O product. In particular, it is mandatory to comply with all general safety regulations. This includes implementing all of the safety measures before commissioning the system. These must cover all hazards. This is the only way to ensure that operation of the product conforms with CE regulations.

As stipulated by the machinery directive, the safety measures must:

- Correspond to the state of the art
- Comply with the required safety category

##### *Liability*

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

- Failure to implement safety measures
- Included protective equipment was not installed
- Included protective equipment was modified

## 3.2 Hazard symbols and instructions

### 3.2.1 Hazard symbols in the operating manual

#### Hazard warnings

The hazard warnings are defined for the four following hazard 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 a hazard that can lead to property damage.








#### **NOTE**

Note refers to helpful information and tips for users.


## Warning symbols

Symbol	Use
	Danger, warning, caution, note Refers to hazards resulting from automatic operation of the plant
	Danger, note Refers to electrical hazards
	Danger, warning Refers to hazards from falling beams
	Warning, caution Refers to crushing hazards from gears
	Danger, warning, caution, note Refers to hazards from industrial trucks
	Warning, caution Refers to hand injury hazards
	Warning, caution Refers to hazards from heavy components
	Danger, warning, caution, note Refers to environmental pollution hazards

Symbol	Use
	Danger, warning, caution, note Refers to hazards from suspended loads
	Danger, note Refers to hazards from electromagnetic fields
	Danger, warning, caution, note Refers to hazards from crushing
	Danger Refers to hazards from explosion
	Danger, warning, caution, note Refers to hazardous locations

Tab. 3-1 Warning symbols

### Special symbols

Symbol	Use
	Note Helpful information and other tips

Tab. 3-2 Special symbols

### 3.2.2 Hazard symbols on the product

The following labels are attached to the product:

The „Danger sign“ label warns against the possibility of axes falling after the transport securing device is removed.

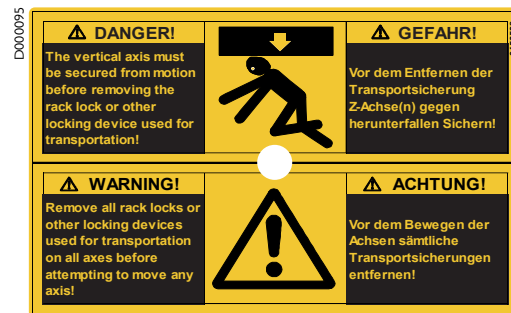


Fig. 3-1 Danger sign label


The „Transport information“ label provides information on correctly attaching transport equipment.



Fig. 3-2 Transport information label

## 3.3 Fundamentals of safety

### 3.3.1 Intended use

The intended use is described in chapter 2.1.1 'Intended use',  14.

### 3.3.2 Safety and monitoring equipment



#### NOTE

**Never remove or modify any of the safety and monitoring equipment! Be sure to close all of the protective equipment during operation!**

For information on the safety and monitoring equipment, refer to the documentation on the complete system. More details can be found in the supplied risk analysis.

### 3.3.3 Product-specific hazards

#### Danger due to electric current

#### DANGER

##### Hazardous voltage



The product contains components that are energized with hazardous voltages. Touching these components will cause an electric shock. Electric shocks can be fatal.

Before working in the danger area:

- Switch off the main power supply and secure it against being switched on again (main switch of complete plant)
- Ground the equipment
- Before switching on the product again, make sure that no one is located in the danger area

## Danger due to falling axes/workpieces

### ⚠ WARNING

#### Falling axes/workpieces



Falling axes or workpieces can cause severe or fatal injuries!

Observe the following:

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

### 3.3.4 Safety data sheets (MSDS)

Safety data sheets contain safety information about the materials. The operator is responsible for obtaining safety data sheets for all materials used, such as oils, greases, cleaning agents etc.

Safety data sheets can be obtained as follows:

- Chemical vendors usually deliver their substances with safety data sheets.
- Safety data sheets are available on the Internet  
Example: Enter "msds" plus the name of the material to find safety information for the material.

Read the safety data sheets closely and follow all instructions. We recommend that you store the safety data sheets for future reference.



## 4 Design and function

### 4.1 Design

In the standard configuration, the TM-O product consists of the following assemblies:

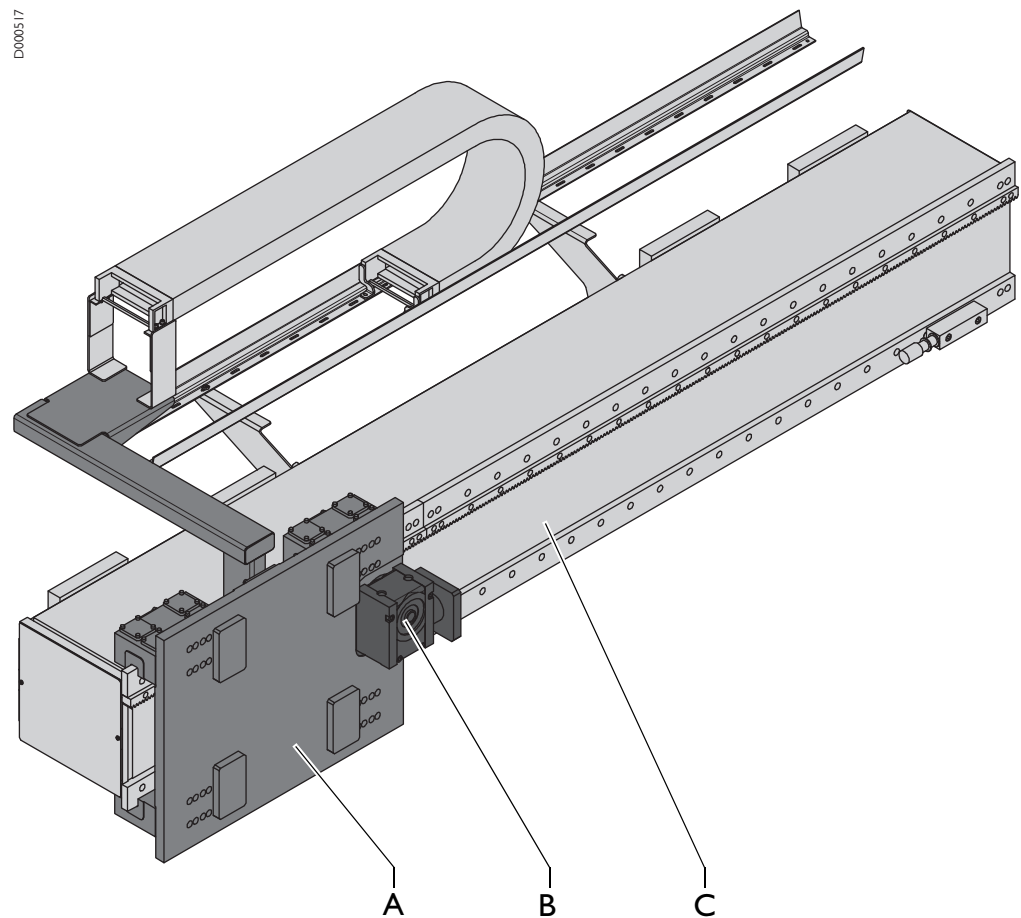


Fig. 4-1

Design

- A Carriage
- B Drive
- C Y-axis

The TM-O product is available in the following fastening versions:

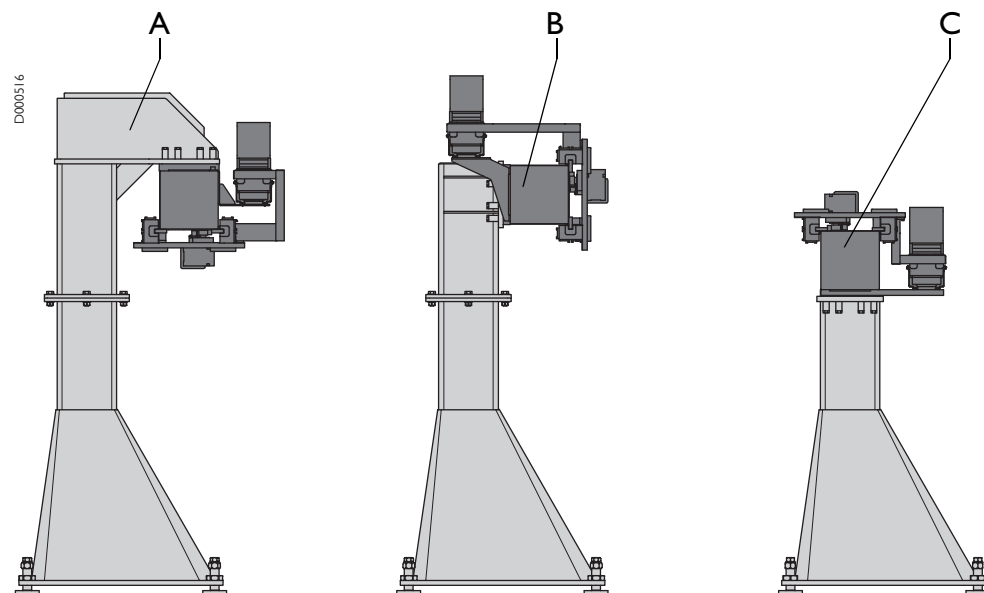


Fig. 4-2 Fastening type TM-O

- A Overhead Trackmotion ceiling mounting TM-X-xx<sup>l)</sup>-C
- B Overhead Trackmotion wall mounting TM-X-xx-W
- C Overhead Trackmotion elevated mounting TM-O-xx-E

The Overhead Trackmotion wall mounting is shown in this operating manual. In some special cases, all three types are described.

## 4.2 Functional description

The TM-O product can move along the following axes:

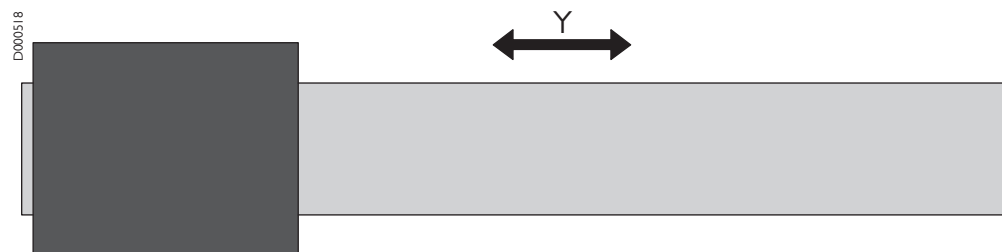


Fig. 4-3 Axis names


l)xx stands for the size 40, 52, 72, 90

## 5 Commissioning

### 5.1 Introduction

Various options are available for your product. This chapter provides information on several available options. It therefore describes components with which your product is not equipped.

#### 5.1.1 Safety

Only perform the tasks described in this chapter after you have read and understood chapter 3 'Safety',  17. It concerns your personal safety!

#### WARNING

##### Suspended loads



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

Observe the following:

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

#### 5.1.2 Personnel qualifications

Only appropriately trained and authorized personnel are allowed to commission the TM-O product.

## 5.2 Transport

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

Truck = Shipped on a transport pallet

Aircraft = Shipped in a crate

Ship = Shipped in a case or container

### Note



#### Improper transport

Improper handling of the package can lead to transport damage!

Do not tip over the package. Avoid heavy vibrations and shocks. Observe the symbols on the packaging.

#### Packaging symbols

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

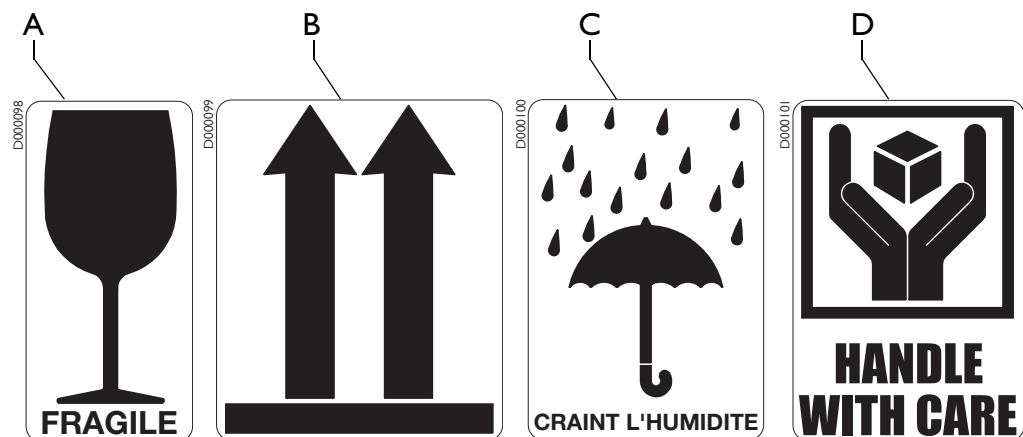


Fig. 5-1

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 planned installation location. Use appropriate transport devices.

## 5.3 Positioning, assembly

### 5.3.1 Prerequisites

- Base* The base has to fulfill the requirements of the application. For information on the load per surface and the surface properties, please refer to the layout or the documentation of the complete system.
- Lines* The supply lines have to meet the requirements of the application. For information on the required capacities, please consult the documentation of the complete system.
- Lifting unit* Lifting units are required for positioning and assembling the product or plant. Make sure that appropriately dimensioned devices (crane etc.) are available.

### 5.3.2 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.



#### Note

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

Dispose of the packaging in accordance with the local disposal regulations. For more information on disposal, refer to chapter 10 'Disposal', 87.

- DeliveryChecking* Check the content of the delivery by comparing it with the accompanying papers.  
Check the product for damage. Report transport damage immediately.

### 5.3.3 Positioning, fastening

This chapter describes the steps for positioning and fastening the TM-O product.

If no other specifications have been made, the tightening torques as per chapter 1.4.1 'Tightening torques for screws', 9 apply.

Before you position the product at the installation site, the requirements as per chapter 5.3.1 'Prerequisites', 29 have to be fulfilled.

#### **⚠ WARNING**

##### **Heavy components**



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

Use suitable means to secure the components against tipping over. Only remove the tip-over protection after the product has been completely assembled.

*Slings Attaching* This section describes the steps for attaching the slings.

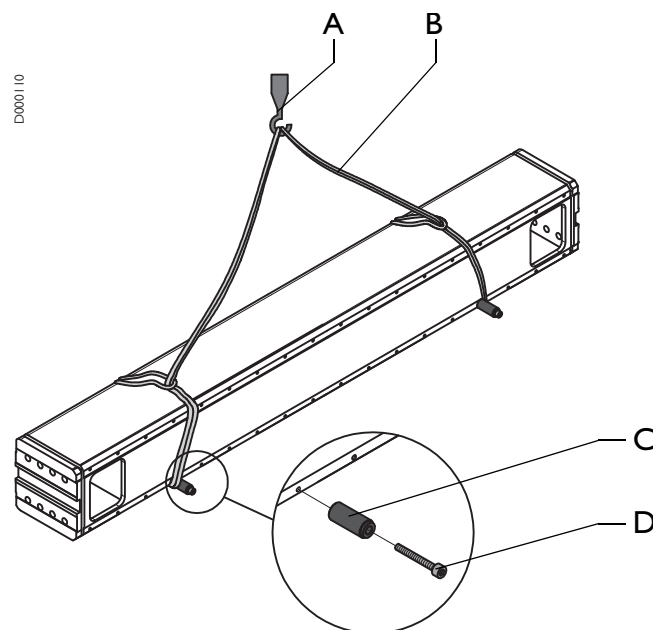


Fig. 5-2 Attaching the slings

- A Hook
- B Lifting belts
- C Transport aids
- D Screws

Attach the slings as follows:

- 1 Fasten the transport aid by means of the screw  
(Symmetric arrangement according to the figure)
- 2 Position the lifting belts as shown in the drawing
- 3 Hang the ends of the lifting belts into the hooks

The slings are in place.

*Setting up a column* For the TM-O product, the following fastening methods are possible:

- Güdel columns
- Other columns
- Directly at a machine
- Directly at a steel beam construction

Güdel offers the following columns for the various fastening options of the TM-O product:

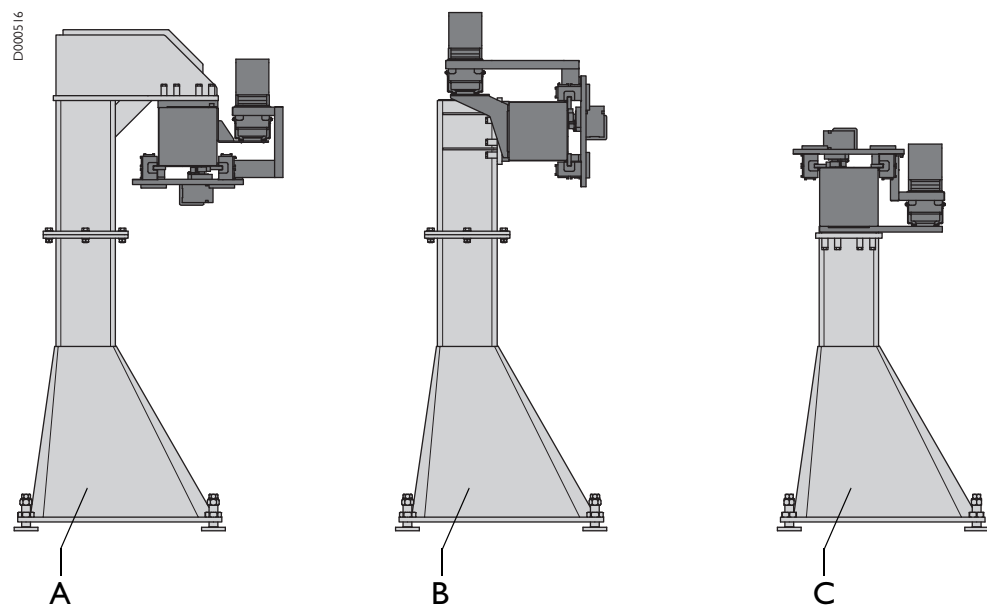


Fig. 5-3

*Fastening types*

- A Column for ceiling mounting
- B Column for wall mounting
- C Column for elevated mounting

If you are not using Güdel columns, contact the respective manufacturer.

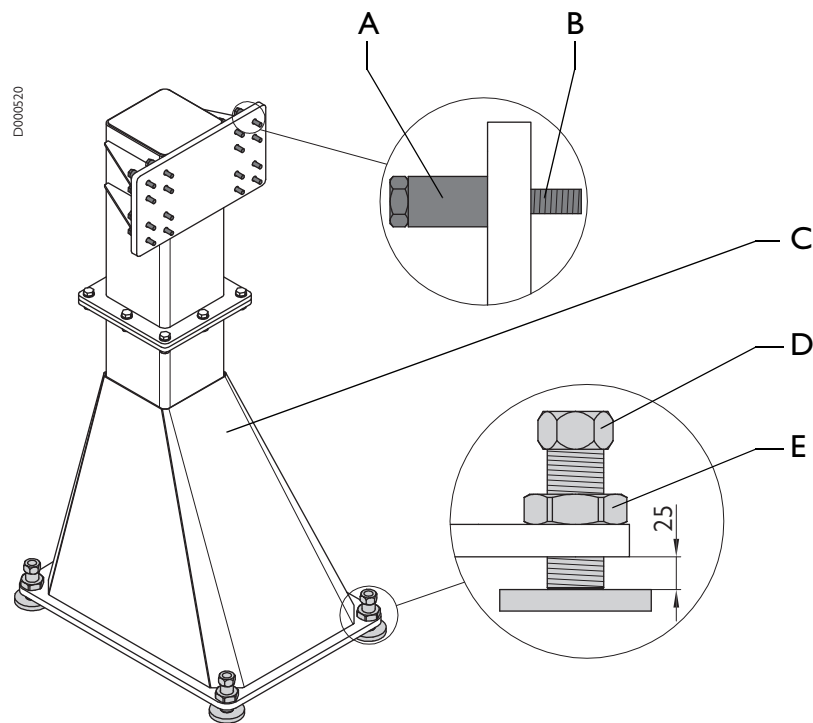


Fig. 5-4 Setting up a column

- A Spacer sleeves
- B Screws
- C Column
- D Floor levelling screws
- E Locknuts

Set up the column as follows:

- 1 Set floor levelling screws to the specified mass
- 2 Set up the column as shown in the layout
- 3 Align the column horizontally and vertically by means of floor levelling screws
- 4 Lock the floor levelling screws
- 5 Secure the column against falling over
- 6 Attach spacer sleeves and screws

The column has been completely set up and aligned.



**Mounting beams** This section describes the steps for mounting beams to the Güdel supports. For other models, please contact the respective manufacturer.

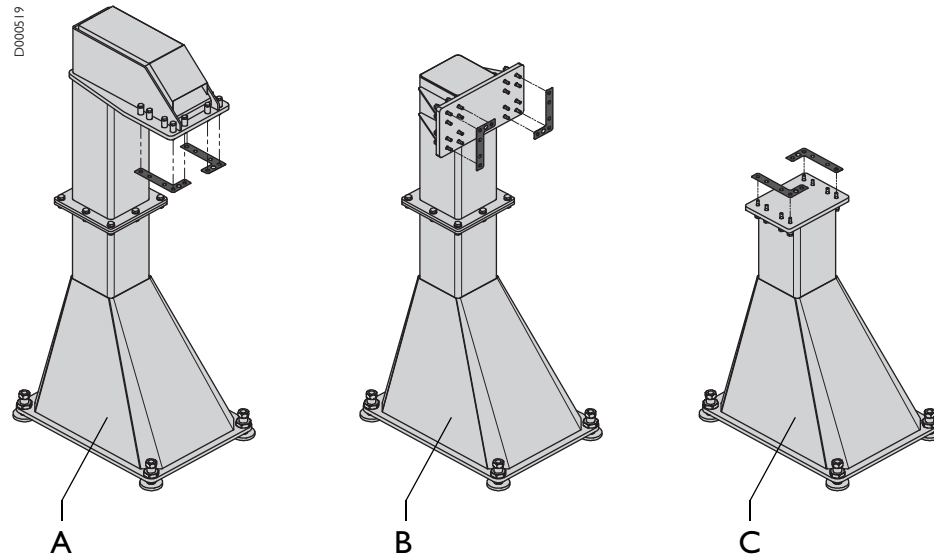


Fig. 5-5 Mounting spacer sheet metal

- A Spacer sheet metal for columns for ceiling mounting
- B Spacer sheet metal for columns for wall mounting
- C Spacer sheet metal for columns for elevated mounting

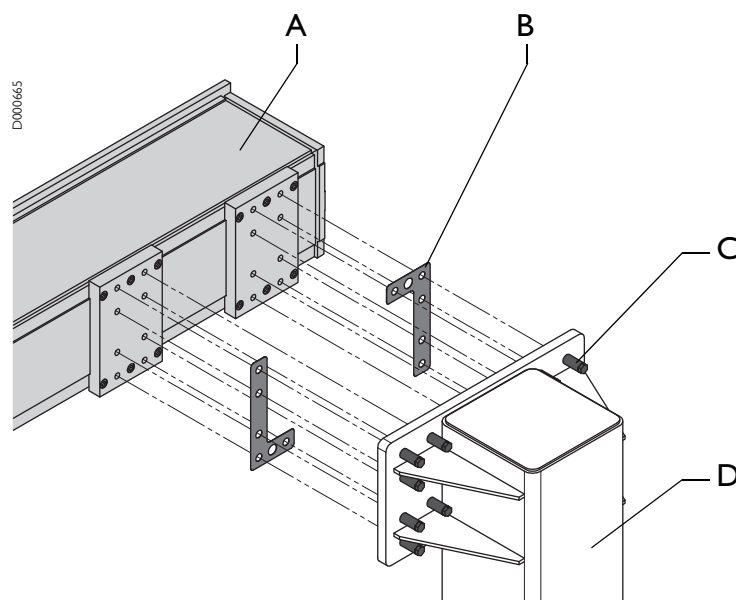


Fig. 5-6 Mounting beams

- A Beam
- B Spacer sheet metal
- C Screws and spacer sleeves
- D Column

Mount the beams as follows:

- 1 Lift beam to column height
- 2 Mount spacer sheet metal as per Fig. 5-5, 33
- 3 Mount beam to column using screws

The beam has been mounted.

*Connecting beams* This section describes the steps for connecting and aligning the beams.

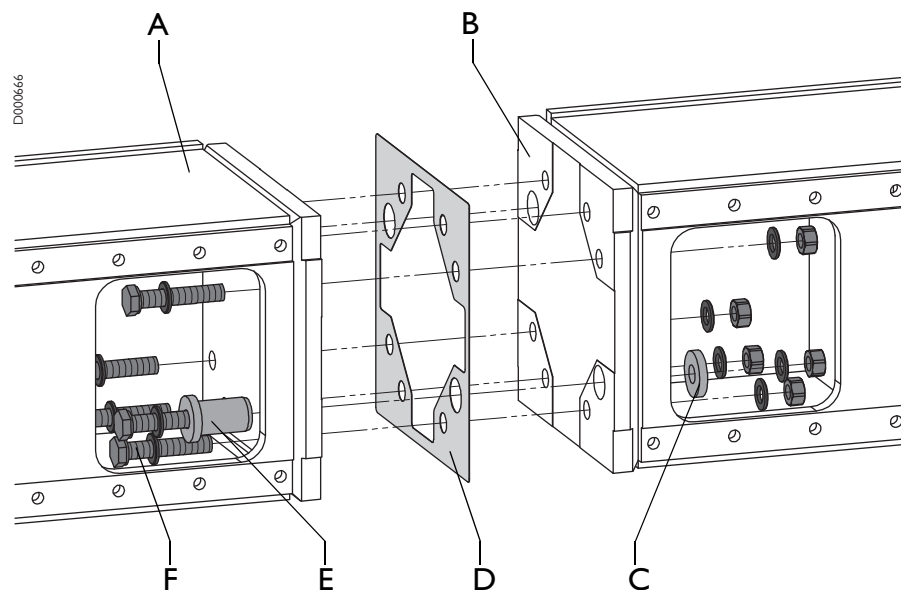


Fig. 5-7

*Connecting beams*

- A Fixed beam
- B Loose beam
- C Washers
- D Spacer sheet metal
- E Center bolt
- F HV sets


Connect beams as follows:

- 1 Lift the loose beam to the height of the fixed beam (the beams have to be flush)
- 2 Insert spacer sheet metal
- 3 Insert center bolt and washer
- 4 Connect the beam with the HV set (For the tightening torque, refer to Tab. I-4, 11)
- 5 Connect the loose beam with the column

- 6 Realign the machine horizontally and vertically, by means of the floor levelling screws

The beams are connected and aligned.

*Base fixing* The base can be fastened either with adhesive anchors or with a welded joint.

You can find the corresponding anchor type in the layout in chapter 13 'Appendix',  97.

## Note



**Only anchor the product after it has been correctly positioned and aligned!**

**Only use anchors approved by Güdel!**

## Base fixing with adhesive anchor

This section describes the base fixing with adhesive anchor.

This fastening requires uncracked concrete with a quality of at least C20/25 (ENV 206). The minimum concrete thickness and edge distance can be found in the table below.

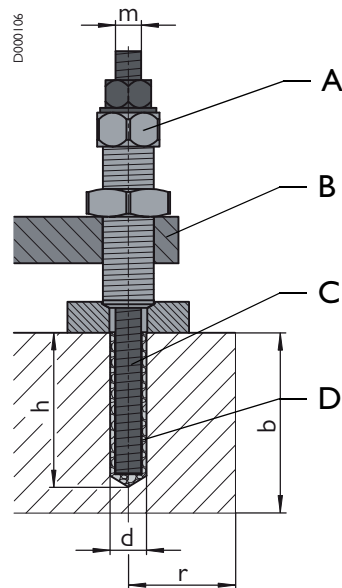


Fig. 5-8 Anchored base fixing

- A Floor levelling screw
- B Column/frame
- C Anchor
- D Adhesive capsule

m (anchor size)	M12	M20	M27	M30
b (concrete thickness) [mm]	140	220	300	340
r (edge distance) [mm]	110	180	240	270
d (drill diameter) [mm]	ø14	ø24	ø30	ø35
h (drilling depth) [mm]	110	170	240	270
Tightening torque [Nm]	50	160	270	300

Tab. 5-1 Anchored base fixing

Anchor the column as follows:

- 1 Make a bore hole as per the table above
- 2 Clean the bore hole
- 3 Insert the adhesive capsule
- 4 Screw in the anchor rod with the hammer drill
- 5 Wait until the hardening period specified by the manufacturer has passed
- 6 Screw the column tight  
(For the tightening torque, refer to the table above.)
- 7 Remove the safety devices

The column is anchored.

### Base fixing with welded joint

This section describes the base fixing with welded joint.

Prior to welding the joint, you have to fasten the base plate to the floor. This fastening requires cracked concrete with a quality of at least C20/25 (ENV 206). The minimum concrete thickness and edge distance can be found in the table below.



#### Note

**The welding work described below may only be performed by certified personnel!**

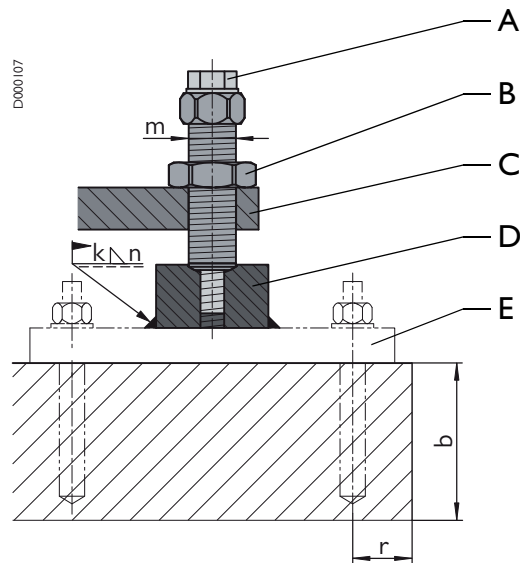


Fig. 5-9 Welded base fixing

- A Screw
- B Floor levelling screw
- C Column/frame
- D Bottom plate
- E Base plate

m (floor levelling screw)	M24x2	M36x2	M48x3	M56x3
b (concrete thickness) [mm]	120	160	250	340
r (edge distance) [mm]	90	130	185	255
k (throat dimension) [mm]	a 4	a 4	a 5	a 5
n (joint length) [mm]	140	190	190	330

Tab. 5-2 Welded base fixing

Perform the weld joint as follows:

- 1** Connect the floor levelling screw and bottom plate by means of the screw
- 2** Weld the bottom plate to the base plate  
(weld joint in acc. with the table above)
- 3** Tighten the screw
- 4** Remove the safety devices

The weld joint has been applied.

The product is anchored to the floor.

### 5.3.4 Assembly

*Installing the  
guideway*

This section describes the steps for installing the guideway.

*Mounting aid*

The start and end of the rack form a half tooth gap. For precise and low-noise transition, we recommend using a mounting aid geared in the opposite direction (see chapter 8.2 'Special tools, testing and measuring instruments', 64).

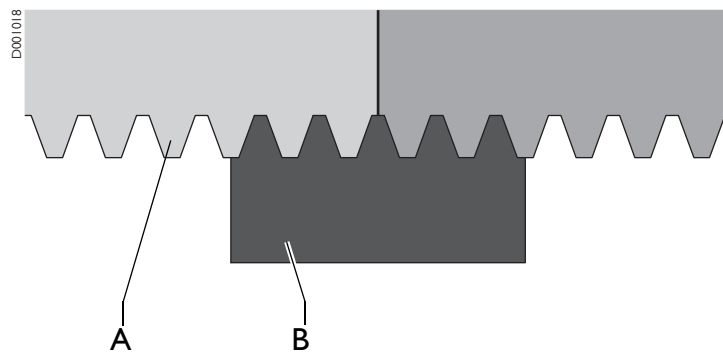


Fig. 5-10 Mounting aid for rack assembly

- A Rack
- B Mounting aid

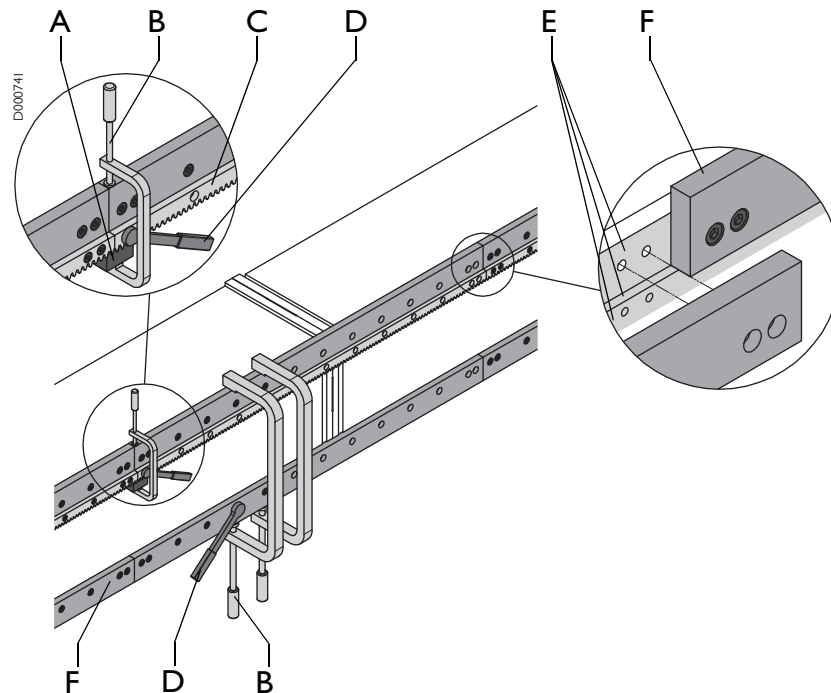


Fig. 5-11 Guideway installation

- A Mounting aid
- B Screw clamps
- C Racks
- D Torque wrench
- E Reference surfaces
- F Guideways

Install the guideway as follows:

- 1 Clean the reference surfaces, guideway and racks thoroughly and rub an oil stone across them
- 2 Use clamp screws to clamp the guideway against the reference surfaces
- 3 Tighten all screws
- 4 Inspect the guideway transition  
(gap dimension  $< 0.02 \text{ mm}$ )
- 5 Use a suitable measuring device to check that the guideways are parallel  
(Tolerance:  $\pm 0.04 \text{ mm}$ )
- 6 Clamp rack to guideway with screw clamp and mounting aid
- 7 Tighten all screws
- 8 Inspect transition according to section ", 39
- 9 If deviations occur (transition/parallelism):



**9.1** Remove screws and guideway

**9.2** Repeat the procedure

The guideway has been installed.

*Inspecting the rack transition*

This section describes the inspection of the rack transition.

The racks correspond to the qualities in the following table:

Axle	Rack quality	
	Hardened rack	Soft rack
Y	9	-

Tab. 5-3 Rack quality

Hardened racks can be recognized by the engraved Güdel logo.

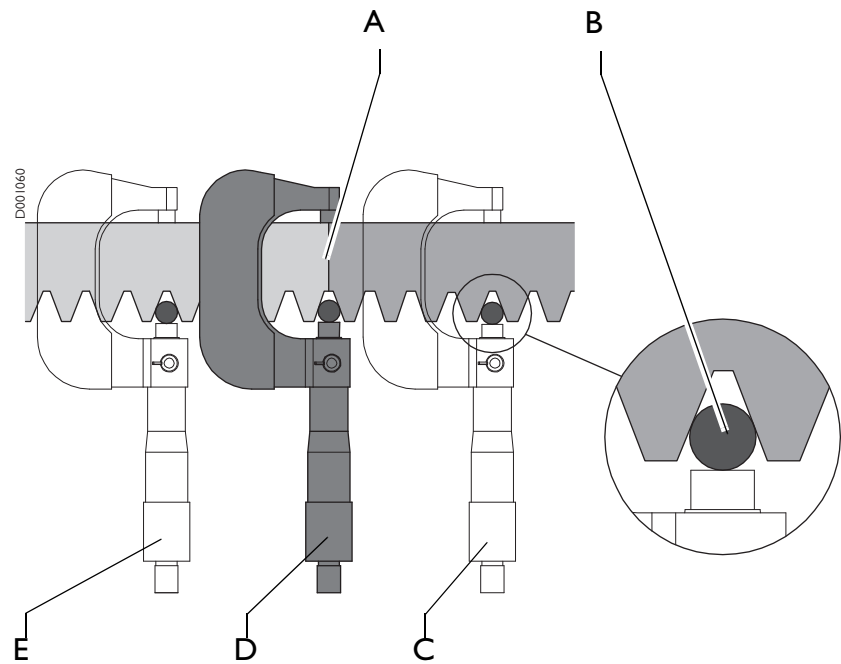


Fig. 5-12 Inspect rack transition with micrometer

- A Rack transition
- B Measurement bolt
- C Micrometer position C
- D Micrometer position D
- E Micrometer position E

Rack quality	Permissible deviation [mm]
4	0.01
6	0.03
7	0.08
8	0.20
9	0.20

Tab. 5-4 Deviation method I

Inspect the rack transition as follows:

- 1 Position the measurement bolt as shown in the illustration
- 2 Inspect the deviations in the height of positions C and E to micrometer position D  
(Permissible deviation of position C and E to D, refer to table above)

## Installing the motor and coupling

This section describes the steps for installing the coupling and the motor.

Depending on the type of transport securing device used, you have to remove the device before installing the motor for the first time (see section 'Transport securing device at the gearbox', 45).

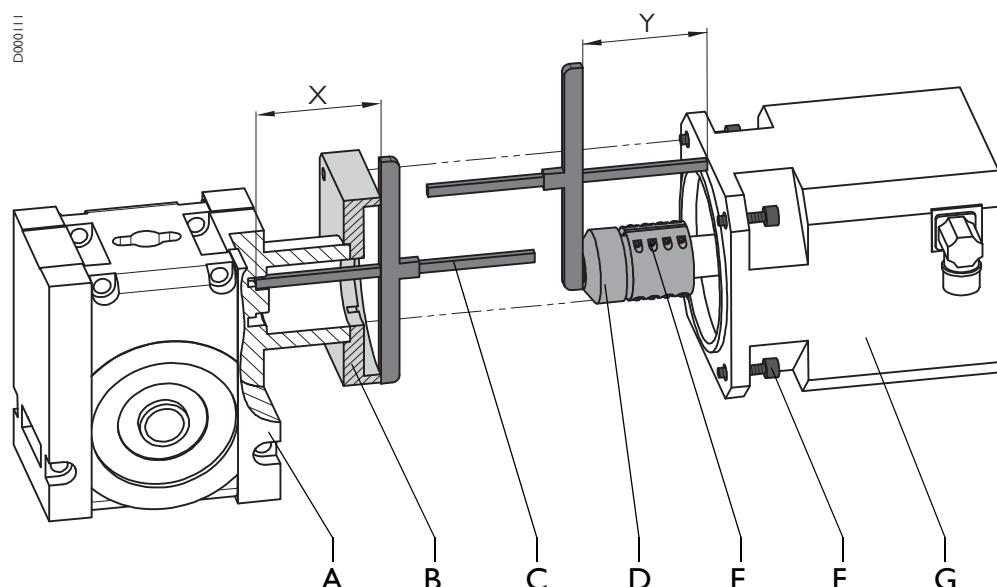


Fig. 5-13


Installing the motor and coupling

- A Gearbox
- B Motor flange
- C Measuring instrument
- D Coupling
- E Coupling screws
- F Motor screws
- G Motor

Install the motor and the coupling as follows:

- 1 Clean the coupling and motor shaft to ensure that they are free of grease
- 2 Measure distance X
- 3 Push the coupling onto the motor shaft  
(Dimension Y has to match dimension X, tolerance -0.2 to -0.4 mm)
- 4 Tighten the coupling screws
- 5 Grease the gear rim of the coupling  
(For grease types, see 7.2 'Consumables and auxiliary agents', 48)
- 6 Push the motor, with the mounted coupling, onto the gearbox
- 7 Tighten the motor screws

The motor and the coupling have been installed.

- Attaching options* If equipped, attach the following optional components as per the separate documentation:
- Automatic lubrication system, battery or external 24 V DC, oil or grease
  - Manual lifting and safety unit: vertical axis
  - Holding brake
  - Rotary axis
  - Telescope axis
  - Pneumatic load balance
- Attaching the load* Attach the load (gripper, robot, etc.) to TM-O machine. Set the roller and tooth flank backlash again. This procedure is described in chapter 8.3.5 'Setting the roller and tooth flank backlash',  74.
- Integrating the product* Integrate the TM-O product into the complete plant. Connect the product with the supply lines for energy and consumables. For this procedure, refer to the documentation of the complete system.

## 5.3.5 Transport securing device

At delivery, a transport securing device is in effect at the gearbox. This has to be removed prior to assembling the motor.

### **WARNING**



#### **Danger of being crushed**

After removing the transport securing devices, the carriage will move off to the side. This can cause severe or fatal injuries!

Secure the carriage before removing the transport securing device!

*Transport securing  
device at the  
gearbox*

This section describes the removal of the transport securing device at the gearbox.

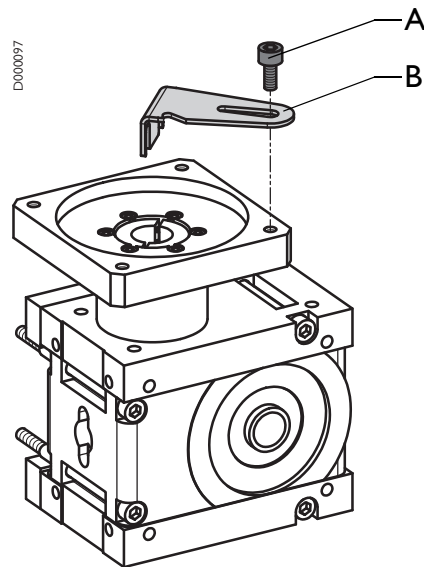


Fig. 5-14

*Transport securing device at the gearbox*

A Screws

B Transport securing device

Remove the transport securing device at the gearbox as follows:

- 1 Fixate the carriage
- 2 Loosen the screw
- 3 Remove the transport securing device

Transport securing device has been removed.

## 5.4 Function check

Prior to the functional check, ensure that:

- The product is anchored to the floor
- The safety equipment has been attached and closed
- No persons are present in the danger area

The procedure for the functional check is described in the documentation of the complete system.

## **6      Operation**

For information on operating the TM-O, refer to the appropriate chapter of the documentation of the complete product.

## 7 Maintenance

### 7.1 Introduction

This chapter describes all maintenance tasks.

<i>Work sequences</i>	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.
<i>Original spare parts</i>	Use only original spare parts. For information on spare parts and wear items, refer to chapter 11 'Spare part supply', 91.
<i>Options and third-party products</i>	For information on maintenance of options and third-party products, read the appropriate documents in the appendix.
<i>Lubrication</i>	This chapter describes the steps for manually lubricating the machine. If your product is equipped with an automatic lubrication system, these tasks do not have to be performed.
<i>Tightening torques</i>	If no other specifications have been made, the tightening torques as per chapter 1.4.1 'Tightening torques for screws', 9 apply

#### 7.1.1 Safety

Only perform the tasks described in this chapter after you have read and understood chapter 3 'Safety', 17. It concerns your personal safety!

#### WARNING

##### Falling axles/workpieces

Falling axles or workpieces can cause severe or fatal injuries!

Observe the following:

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



**⚠ WARNING**



**Heavy components**

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

Use appropriate lifting units!

## 7.1.2 Personnel qualifications

Only appropriately trained and authorized personnel are allowed to work on the TM-O product.

## 7.2 Consumables and auxiliary agents

**NOTE**



**Unsuitable lubricants**

Using unsuitable lubricants can lead to machine damage!

Only use the lubricants listed below. If uncertain, please contact our service departments!

### 7.2.1 Cleaning agents

For cleaning tasks, have a grease-dissolving cleaning agent (e.g. acetone) at hand.

### 7.2.2 Lubricants

**Markings at the lubricating points**

The marking disc below the grease nipple shows the type of lubricant.



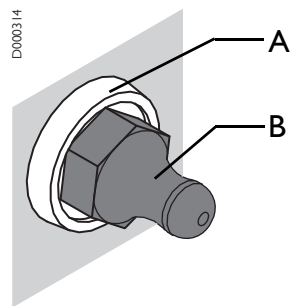


Fig. 7-1 Markings at the lubricating points

A Marking disc

B Grease nipple

Yellow marking disc Grease

Red marking disc Oil

## Oils

*Oil types* The following oil is used ex works by default:

Mobil Glygoyl 460

Information on deviating cases is contained in the spare parts list in the appendix.

The following types of oil can be used alternatively:

Aral	Degol	GS 460
BP	Energol	SG-XP-460
Texaco	Pinnacle	460
Shell	Tivela	S 460
Klüber	Klübersynth	GH6-220

*Oil quantities* Refer to the table below for the required oil quantities for the gearbox.

Type	Quantity [cm <sup>3</sup> ]
AE030	40
AE045	100
AE060	250
AE090	700
AE120	1400
AE180	as per type plate

Tab. 7-1 Oil quantity for gearbox

## Greases

*Grease types for gearbox coupling and teeth*

The following grease is used ex works for the gearbox coupling and the teeth (for manual lubrication):

Mobil Mobilux EP 2

Information on deviating cases is contained in the spare parts list in the appendix.

The following grease types can be used alternatively:

Aral	Aralup	HLP 2
BP	Energol	LS-EP 2
Texaco	Multifak	EP 2
Shell	Alvania	EP-2
Klüber	Centoplex	EP-2

For automatic grease lubrication, the following grease is used ex works for the teeth:

Castrol Longtime PD2

*Grease type for  
bearings of the  
rollers*

Always use the following grease for the rollers:

INA

Lithium soap  
grease  
Arcanol

LOAD I 50  
DIN 51825-KP2N-20

**7.3 Maintenance schedule**

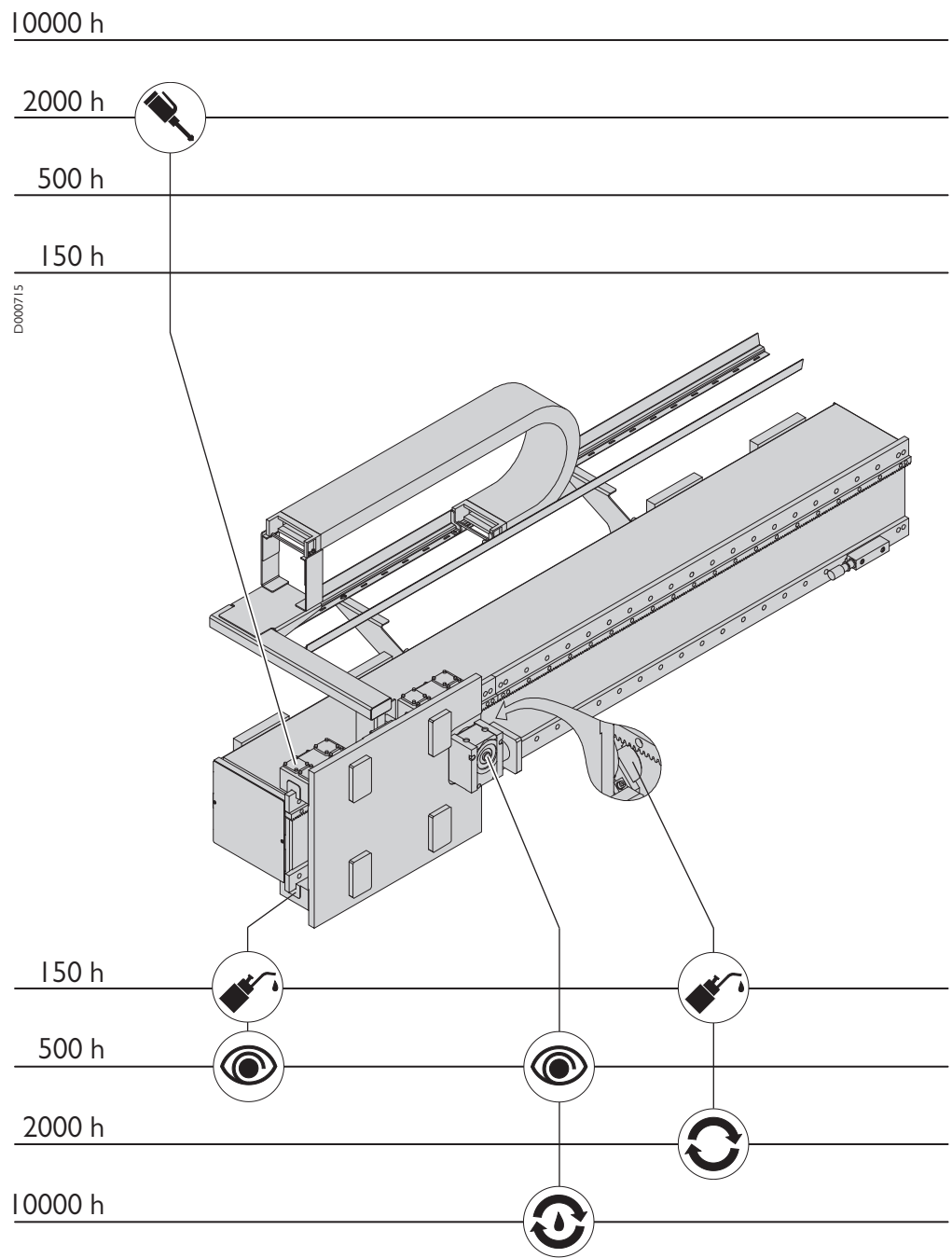
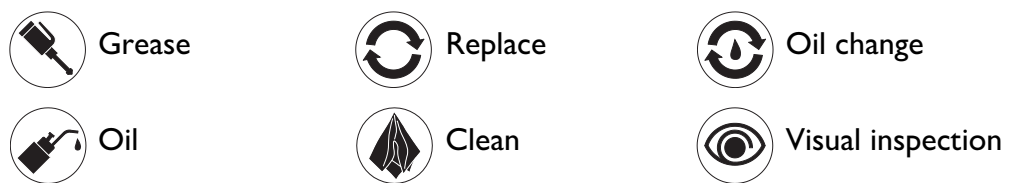



Fig. 7-2 Maintenance schedule




## 7.4 Maintenance tasks

### 7.4.1 General prerequisites

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

- If vertical axles are present, secure them against falling
- Switch off the plant and padlock it to secure it against being switched on again
- Make sure that all spare parts and wear items are at hand.  
(For information on spare parts and wear items, refer to chapter 11 'Spare part supply',  91.)

### 7.4.2 Maintenance tasks every 150 hours

For more information on the lubricants, refer to chapter 7.2 'Consumables and auxiliary agents',  48.

#### Guideways, Racks and Lubricating the pinions

Lubricate all guideways, racks and pinions every 150 hours.

#### Note



##### Incompatible lubricant!

Mixing different lubricants affects their properties.

Never mix different types of lubricant!

Before using another type of lubricant, exchange the wiper and lubrication units and the lubricating pinions!

Product size				Roller size	Number of shots with the grease gun (1 shot = 1.5 cm <sup>3</sup> )
EP ZP FP	CP CPP	TM TMO	MLB		
1-3	1		1-3	10-20	3-4
4-5	2-4	40-52		25-52	5-6
6-7	5	72-90		62-90	8-10

Tab. 7-2 Number of shots with the grease gun

Lubricate the guideways, racks and pinions as follows:

- 1 Switch off the plant and padlock it to secure it against being switched on again
- 2 Use a grease gun to manually inject full shots of lubricant at the lubricating point of all wiper and lubrication units and all lubricating pinions (Number of shots according to table above)

The guideways, racks and pinions are lubricated.

### 7.4.3 Maintenance tasks every 500 hours

#### General inspection

During the general inspection, the entire product is subjected to an overall check.

Check the following points:

Inspection criterion	Description	Measures
Dirt	Check the components for dirt: <ul style="list-style-type: none"> <li>• Wiper</li> <li>• Rollers</li> <li>• Guideways</li> </ul>	Immediately clean away any dirt
Damage	Check the plant for damage: <ul style="list-style-type: none"> <li>• Paint damage</li> <li>• Bent attachments (e.g. cover plates)</li> <li>• Cracks in the cast parts</li> <li>• Cracks at welding seams</li> </ul>	Immediately remedy all discovered damage
Loose components	Check the seating of the components: <ul style="list-style-type: none"> <li>• Screws</li> <li>• Nuts</li> <li>• Attachments</li> </ul>	<ul style="list-style-type: none"> <li>• Immediately tighten loose screws to the required torque</li> <li>• Align and fasten loose attachments</li> </ul>
Loss of oil	Check the plant and its surroundings for signs of the following: <ul style="list-style-type: none"> <li>• Puddles of oil and oil spills on the floor or in the drip sheets</li> <li>• Leaks, torn or pinched lines</li> <li>• Leakage at the gearbox</li> </ul>	<ul style="list-style-type: none"> <li>• Replace defective and pinched lines</li> <li>• Repair or replace the gearbox</li> <li>• Remove puddles of oil and oil spills on the floor or in the drip sheets</li> </ul>

Inspection criterion	Description	Measures
Components	Check the condition of the components: <ul style="list-style-type: none"> <li>• Carriage</li> <li>• Rollers</li> <li>• Guideways</li> <li>• Racks</li> <li>• Cog belt</li> </ul>	Replace worn components
Backlash	Check for correct amount of backlash in the components: <ul style="list-style-type: none"> <li>• Pinions</li> <li>• Rollers</li> </ul>	Correct the backlash
Tension	Correct cog belts for correct tension	Correct the tension
Energy chain and cable	Check the energy chain: <ul style="list-style-type: none"> <li>• Mobility</li> <li>• Wear</li> <li>• Damage</li> <li>• Position of the cables and lines</li> <li>• Condition of the cables and lines</li> </ul>	<ul style="list-style-type: none"> <li>• Look for cause</li> <li>• Replace defective or worn energy chains</li> <li>• Correct the position of cables and lines</li> <li>• Replace worn or defective cables</li> </ul>

Tab. 7-3 Inspection table



## 7.4.4 Maintenance tasks every 2000 hours

### Replacing the lubricating pinions

A pinion soaked in lubrication runs along next to the drive pinion. It ensures a continuous lubrication of the rack and the drive pinions.

Replace the lubricating pinion to ensure uniform lubrication.

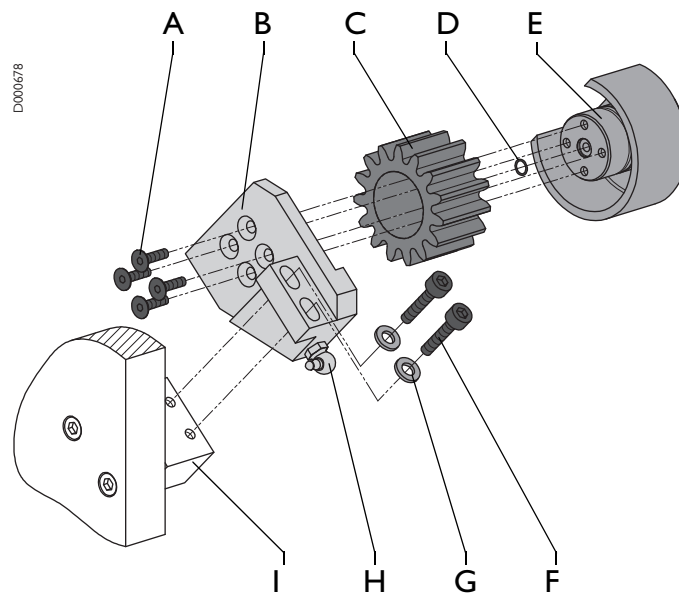


Fig. 7-3 Replacing the lubricating pinion

- A Screws
- B Intermediate piece
- C Lubricating pinion
- D O-ring
- E Housing
- F Fastening screws
- G Washers
- H Grease nipple
- I Carriage

Replace the lubricating pinion as follows:

- 1 Switch off the plant and padlock it to secure it against being switched on again
- 2 If there is an automatic lubrication, disconnect the supply
- 3 Remove the fastening screws and washers
- 4 Remove the lubricating pinion unit

- 5 Remove the screws
- 6 Remove housing, O-ring and lubricating pinion
- 7 For oil lubrication, submerge the new lubricating pinion in oil for several minutes  
(Oil quality, see chapter 7.2 'Consumables and auxiliary agents', 48)
- 8 Replace O-ring
- 9 To assemble the lubricating pinion unit, reverse the disassembly steps
- 10 Only for manual lubrication:  
Lubricate lubricating pinion  
(See chapter 'Guideways, Racks and Lubricating the pinions', 53)
- 11 Only for automatic lubrication:  
Connect lubrication line, start lubrication procedure  
(See separate operating manual on automatic lubrication)

The lubricating pinion has been replaced.

## Greasing the roller

The roller holders are equipped with lubrication channels for relubrication of the bearings.

For more information on the grease qualities, refer to chapter 7.2 'Consumables and auxiliary agents', 48.

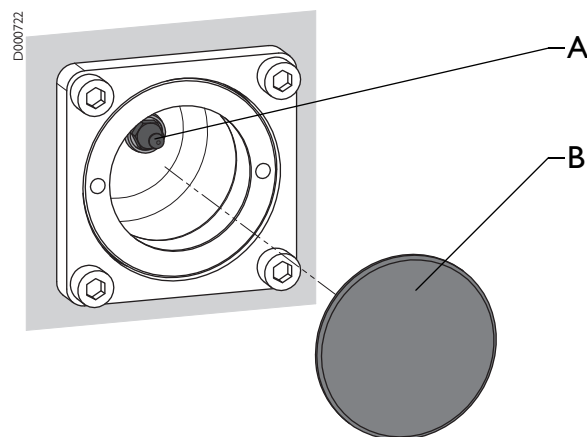


Fig. 7-4 Greasing the roller

- A Grease nipple  
B Covering

Product size	Roller size	Relubrication quantity [g]
40	40	1.1
52	52	2.4
62 - 90	62 - 90	7.3

Tab. 7-4 Roller relubrication quantity

Grease the roller as follows:

- I2** Switch off the plant and padlock it to secure it against being switched on again
- I3** Remove the covering
- I4** Use a grease gun to press in the grease  
(Relubrication quantity according to table above)

The roller has been greased.

## 7.4.5 Maintenance tasks every 10000 hours

### Oil change in type NA / NH / FA / FH / AE gearboxes

Always replace the gearbox oil within the specified intervals.

For more information on the oil qualities, refer to chapter 7.2 'Consumables and auxiliary agents', 48.

Perform the oil change as follows:

*Disassembling a drive with pinion*

This section describes the steps for disassembling the drive.



## Note

**Do not change the position of the coupling on the motor shaft!**

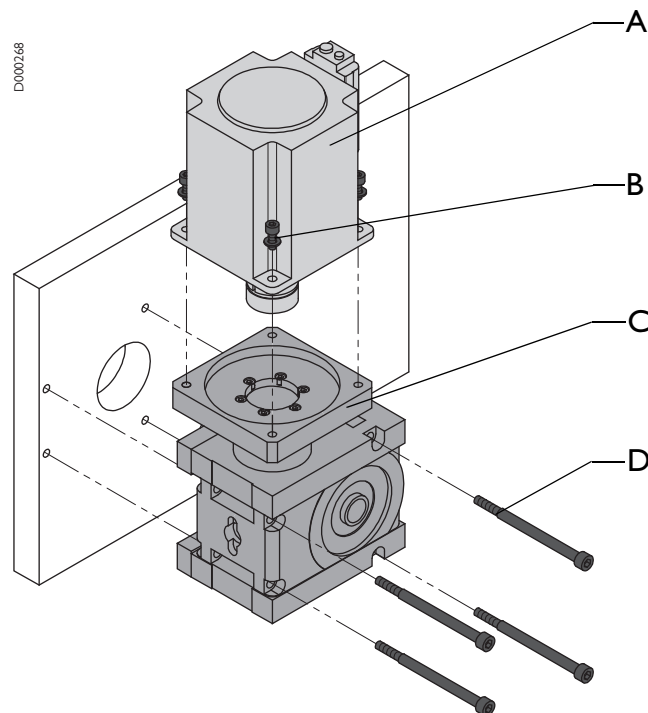


Fig. 7-5

*Disassembling the drive*

- A Motor
- B Motor screws
- C Gearbox
- D Gearbox screws

Disassemble the drive as follows:

- 1 Switch off the plant and padlock it to secure it against being switched on again
- 2 Secure carriage or axle with transport securing device or lifting device
- 3 Remove the motor screws
- 4 Pull the motor, together with the coupling, off the gearbox
- 5 Remove the gearbox screws

## 6 Remove the gearbox

The drive has been disassembled.

Changing the  
gearbox oil

This section describes the steps for changing the gearbox oil.

### ⚠ CAUTION

#### Oils/greases

Oils and greases are harmful to the environment!

The oils and greases may not get into 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.

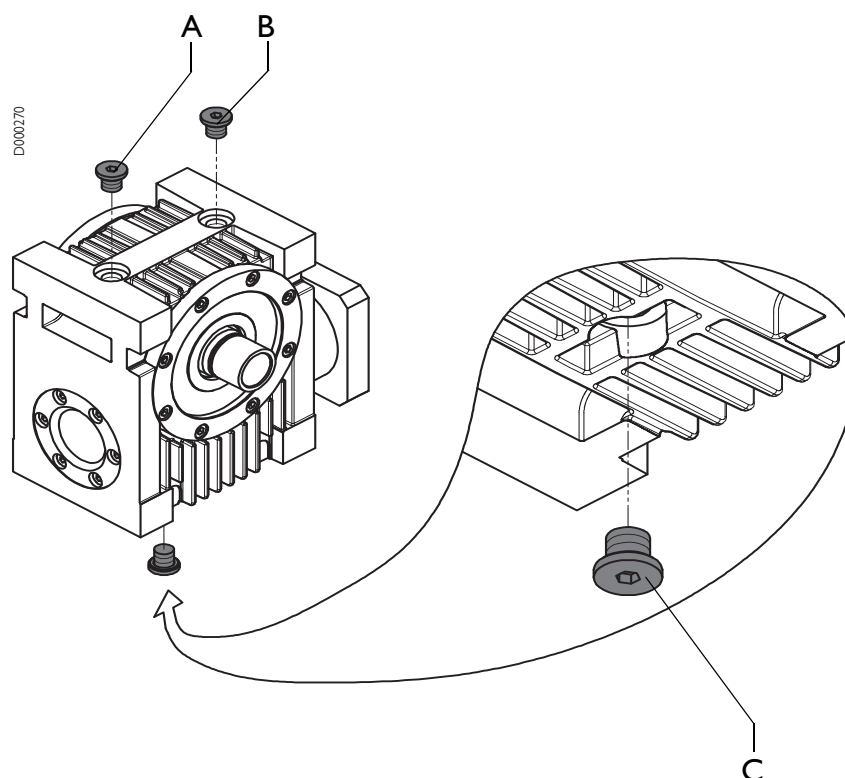


Fig. 7-6

Oil change

A Bleed screw

B Filler screw

C Drain screw

Change the gearbox oil as follows:

- 1 Position the gearbox:  
Drain screw at the bottom  
Filler and bleed screw at the top
- 2 Position a suitable container below the drain screw
- 3 Remove the bleed, filler and drain screw
- 4 Drain the oil
- 5 Rinse the gearbox with fresh oil  
(for oil types, see the Oils chapter)
- 6 Allow the gearbox to drain
- 7 Screw in the drain screw
- 8 Fill up the gearbox through the filler screw  
(for oil types and quantity, see the Oils chapter)
- 9 Screw in the bleed and filler screws

The gearbox oil has been changed.

*Assembling the drive* This section describes the steps for assembling the drive.

## Note



**Calibrate the measurement reference plane after each drive assembly.**

**This procedure is described in the documentation of the complete plant or of the motor!**

Assemble the drive as follows:

- 1 To assemble the drive, reverse the disassembly steps in section 'Disassembling a drive with pinion', 60
- 2 Set the tooth flank backlash according to Chapter 8.3.5, 74
- 3 Calibrate the measurement reference plane of the motor  
(This procedure is described in the documentation of the complete plant or of the motor)

The drive has been assembled.

The oil change has been completed

## 8 Repairs

### 8.1 Introduction

This chapter describes all repair tasks.

*Work sequences* Perform the work sequences in the order described.

*Original spare parts* Use only original spare parts. For information on spare parts and wear items, refer to chapter 11 'Spare part supply', § 91.

*Tightening torques* If no other specifications have been made, the tightening torques as per chapter 1.4.1 'Tightening torques for screws', § 9 apply

#### 8.1.1 Safety

Only perform the tasks described in this chapter after you have read and understood chapter 3 'Safety', § 17. It concerns your personal safety!

#### **WARNING**

##### **Falling axles/workpieces**



Falling axles or workpieces can cause severe or fatal injuries!

Observe the following:

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

#### **WARNING**

##### **Heavy components**



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

Use appropriate lifting units!

## 8.1.2 Personnel qualifications

Only appropriately trained and authorized personnel are allowed to work on the TM-O product.

## 8.2 Special tools, testing and measuring instruments

For repairs, ensure that you have the following special tools, testing and measuring instruments at hand:

Tool	Use	Item number
Adjusting tool	Adjusting the rollers Size 40, 52	0919690
	Adjusting the rollers Size 72, 90	0915289
Mounting aid	Assembly of the racks Size 40, 52	902403
	Assembly of the racks Size 72	902404
	Assembly of the racks Size 90	902405
Micrometer	Checking parallelism at the guideways	
Screw clamps	Installing the guideways	


Tab. 8-1 Special tools, testing and measuring instruments



## 8.3 Repairs

### 8.3.1 General prerequisites

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

- If vertical axles are present, secure them against falling
- Switch off the plant and padlock it to secure it against being switched on again
- Make sure that all spare parts and wear items are at hand.  
(For information on spare parts and wear items, refer to chapter 11 'Spare part supply',  91.)

### 8.3.2 Replacing the bumper unit

The bumper unit is a safety component.  
Replace the entire bumper unit after a crash has occurred.

#### **WARNING**

##### **Weak safety component**



After a crash, it is not immediately apparent whether bumper unit elements have been weakened or are defective. Another crash can cause severe or fatal injuries.

Always replace the entire bumper unit!

The bumper unit consists of the following components:

- Bumper
- Bumper block or bumper bracket
- Screws
- Sleeves and/or heavy-duty spring tension pins

### 8.3.3 Replacing the wiper and felt insert

Continuous lubrication of the guideways at operating temperatures under 0 °C or with grease requires a modification to the wiper and felt insert. This procedure is described in the sections:

- 'Preparing the wiper', 67
- 'Preparing the felt insert', 68.

#### Replacing wiper and felt insert

This section describes the steps for replacing the wiper and the felt insert.

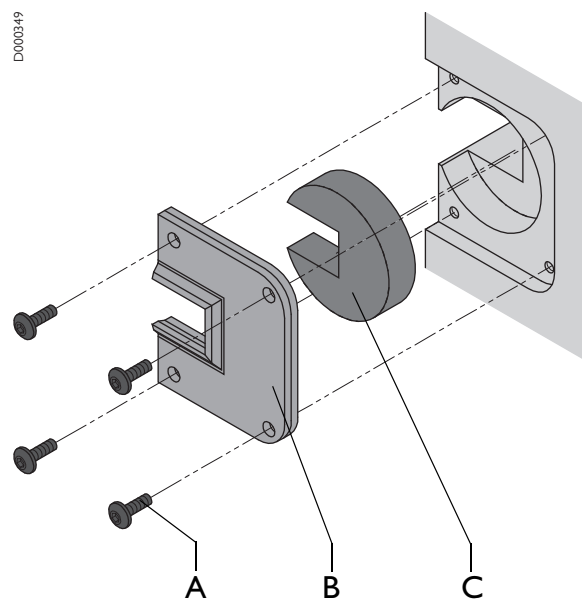


Fig. 8-1

Wiper and felt insert

- A Screws  
B Wiper  
C Felt insert

Replace the wiper and felt insert as follows:

- 1 Switch off the plant and padlock it to secure it against being switched on again
- 2 If there is an automatic lubrication, disconnect the supply
- 3 Remove the screws
- 4 Replace wiper
- 5 Replace felt insert

- 6** Only for oil lubrication:  
Submerge new felt insert in oil for several minutes  
(Oil quality, see chapter 7.2 'Consumables and auxiliary agents', 48)
- 7** To assemble the wiper and felt insert, reverse the disassembly steps
- 8** Only for manual lubrication:  
Lubricate guideways  
(See chapter 'Guideways, Racks and Lubricating the pinions', 53)
- 9** Only for automatic lubrication:  
(See separate operating manual on automatic lubrication)
  - 9.1** Connect lubrication line
  - 9.2** Start lubrication procedure  
(See separate operating manual on automatic lubrication)

The wiper and felt insert have been replaced.

*Preparing the wiper* This section describes the steps for preparing the wiper. This applies for oil lubrication, operating temperature under 0 °C or grease lubrication.

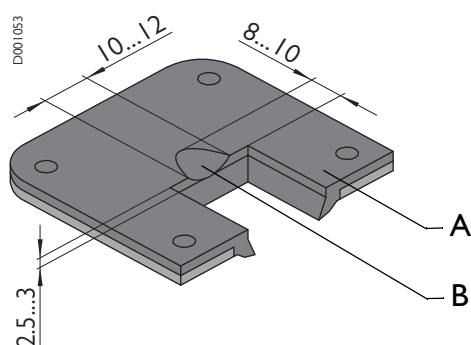


Fig. 8-2

*Preparing the wiper*

- A Wiper
- B Recess

Prepare the wiper as follows:

- I** Attach recess  
(Mass according to figure)

The wiper has been prepared.

*Preparing the felt insert* This section describes the steps for preparing the felt insert. This applies for oil lubrication, operating temperature under 0 °C or grease lubrication.

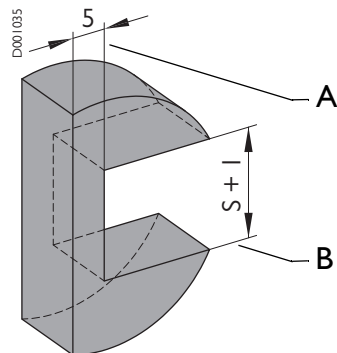


Fig. 8-3 *Preparing the felt insert*

A Reduction  
B Slot

Prepare the felt insert as follows:

- 1 Shorten the felt insert to the 5 mm dimension
- 2 Increase dimension S by 1 mm  
(Only for oil lubrication, operating temperature below 0 °C)

The felt insert has been prepared.

### 8.3.4 Replacing the rollers and guideways

The rollers, guideways and racks are designed for continuous use. Certain ambient conditions can increase the wear on these components.

Replacing the rollers, guideways and racks involves a considerable amount of work. Always replace these components simultaneously.

## Roller holder installation types

The roller holders have installation types for setting the roller backlash and tooth flank backlash.

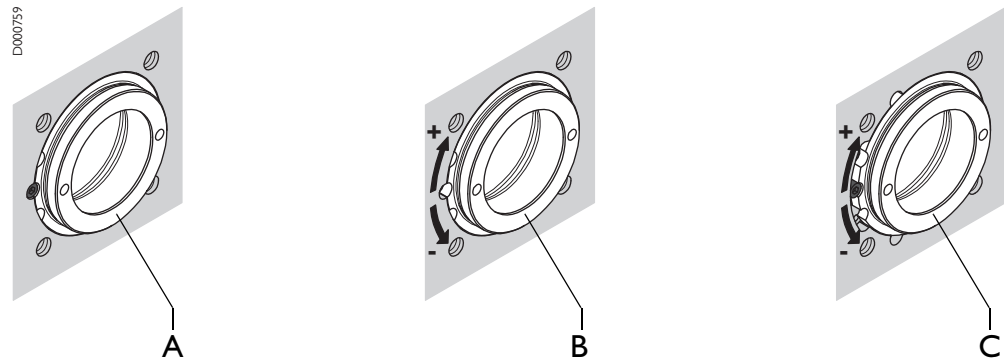


Fig. 8-4 Roller holder installation types

- A Installation type (E1): Eccentric zero position, fixed with positioning screw
- B Installation type (E2): Eccentric infinitely adjustable, fixed with flange
- C Installation type (E3): Eccentric adjustable in increments, fixed with positioning screw

The roller holders are to be arranged according to the following figure. The installation types are shown for the various models of the TM-O product.

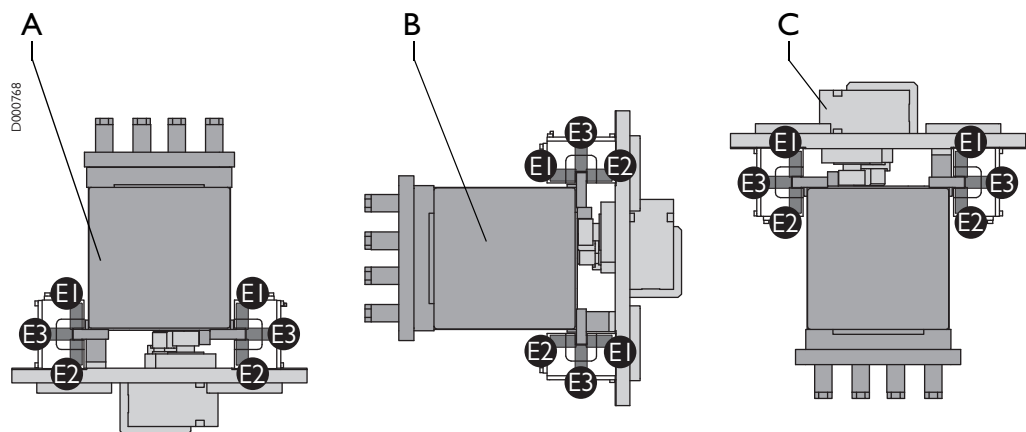


Fig. 8-5 Roller holder arrangement

- A Ceiling mounting
- B Wall mounting
- C Elevated mounting

## Replacing the roller

This chapter describes the steps for replacing roller.

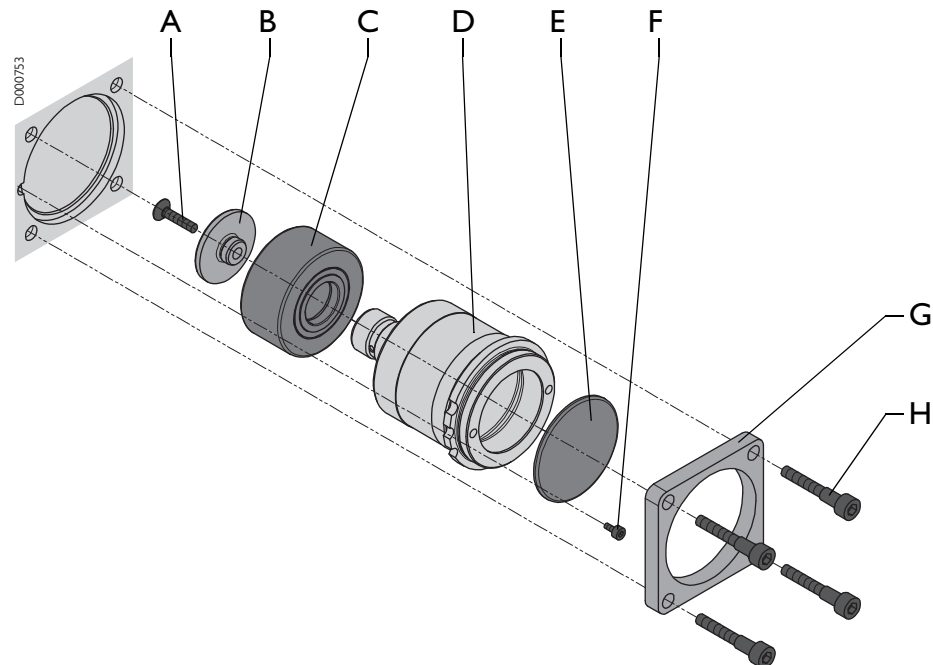





Fig. 8-6 Replacing the roller

- A Screw
- B Peg
- C Supporting roller
- D Roller holder
- E Covering
- F Positioning screw
- G Flange
- H Fastening screws

Replace the roller as follows:

- 1 Switch off the plant and padlock it to secure it against being switched on again
- 2 Support the carriage or secure it to a lifting device
- 3 Remove fastening screws and flange
- 4 If there is a positioning screw, remove it
- 5 Remove the covering
- 6 Remove the entire roller holder
  - 6.1 Remove screw and peg
  - 6.2 Replace the roller

- 6.3 To assemble the roller holder, reverse the disassembly steps (Secure screw with ERGO 4052, tightening torque according to Tab. I-4,  11)
- 7 Install E1 roller holder:  
(Type and arrangement of installation, see chapter 'Roller holder installation types',  69)
  - 7.1 Fix roller holder in eccentric zero position with positioning screw
  - 7.2 Mount flange
  - 7.3 Tighten fastening screws
- 8 Install E2 roller holder:
  - 8.1 Turn roller holder to eccentric minimum setting
  - 8.2 Mount flange
  - 8.3 Move fastening screws slightly
- 9 Turn E3 roller holder to eccentric minimum setting
- 10 Remove support or lifting device
- 11 Set roller and tooth flank backlash as per Chapter 8.3.5,  74

The roller has been replaced


## Replacing the guideways

Replace the guideways as soon as the surfaces show signs of wear.

The term "guideway" includes:

- Guideway
- Rack

Replace the guideways as follows:

*Guideway removal* The designations refer to Fig. 8-8,  73.

Remove the guideway as follows:

- 1 Switch off the plant and padlock it to secure it against being switched on again
- 2 Attach the carriage to a lifting device
- 3 Move the carriage off the guideway or axle to be replaced

**4** Remove all screws  
(See Fig. 8-8, 63 73)

**5** Remove the guideways

The guideway has been removed.

*Installing the  
guideway*

This section describes the steps for installing the guideway.

*Mounting aid*

The start and end of the rack form a half tooth gap. For precise and low-noise transition, we recommend using a mounting aid geared in the opposite direction (see chapter 8.2 'Special tools, testing and measuring instruments', 64).

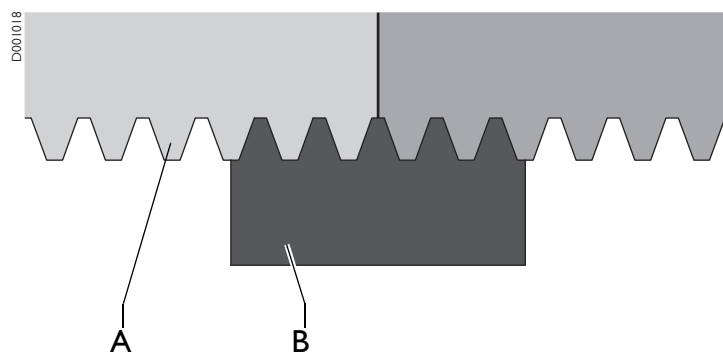


Fig. 8-7 Mounting aid for rack assembly

A Rack

B Mounting aid



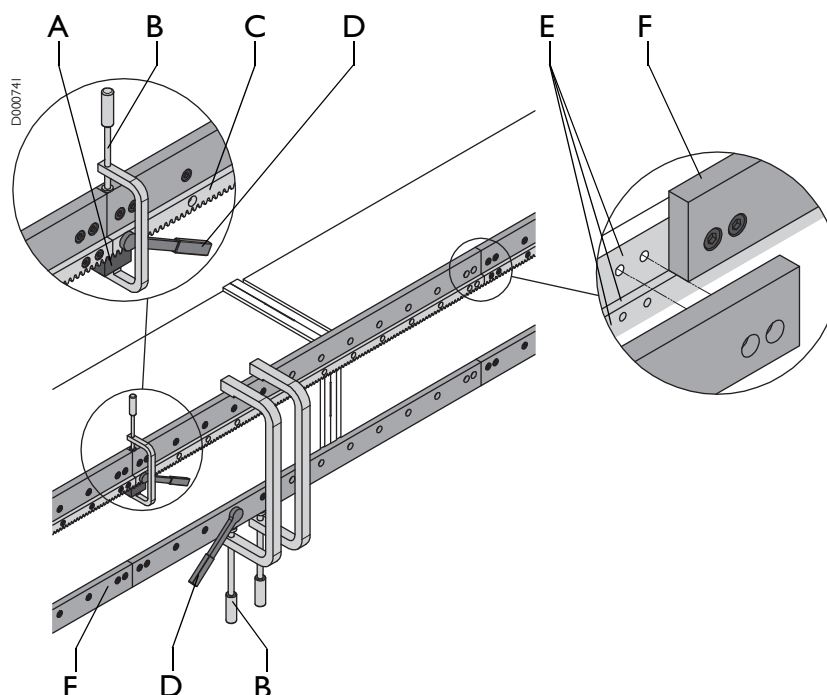


Fig. 8-8

Guideway installation

- A Mounting aid
- B Screw clamps
- C Racks
- D Torque wrench
- E Reference surfaces
- F Guideways

Install the guideway as follows:

- 1 Clean the reference surfaces, guideway and racks thoroughly and rub an oil stone across them
- 2 Use clamp screws to clamp the guideway against the reference surfaces
- 3 Tighten all screws
- 4 Inspect the guideway transition  
(gap dimension  $< 0.02 \text{ mm}$ )
- 5 Use a suitable measuring device to check that the guideways are parallel  
(Tolerance:  $\pm 0.04 \text{ mm}$ )
- 6 Clamp rack to guideway with screw clamp and mounting aid
- 7 Tighten all screws
- 8 Inspect transition according to section 'Inspecting the rack transition',  
41
- 9 If deviations occur (transition/parallelism):

**9.1** Remove screws and guideway

**9.2** Repeat the procedure

The guideway has been installed.

*Final tasks* The following tasks must be performed after assembly of the guideway.

Perform these final tasks as follows:

- 1** Move the carriage onto the axle if necessary
- 2** Insert the Z-axis, if required
- 3** Remove the lifting device
- 4** If necessary, adjust the rollers

The final tasks have been performed.

The guideway has been replaced.

The guideways have been replaced.


### 8.3.5 Setting the roller and tooth flank backlash


Set the roller and tooth flank backlash after each roller, guideway or gearbox change.



#### Note

**Always set the roller backlash and tooth flank backlash with load attached and at operating temperature!**

When tightening the roller holders, the maximum tightening torques apply, refer to Tab. I-5,  12.

Type and arrangement of installation, see chapter 'Roller holder installation types',  69.

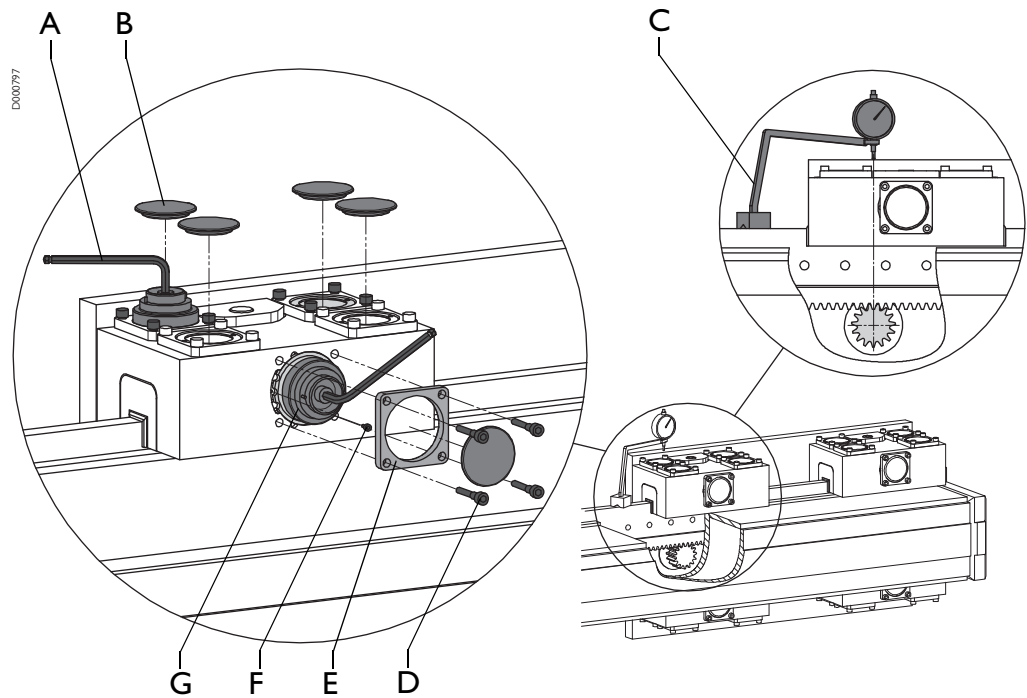


Fig. 8-9      *Setting the roller and tooth flank backlash*


- A Hexagonal socket wrench
- B Coverings
- C Dial gauge
- D Fastening screws
- E Flanges
- F Positioning screws
- G Adjusting tools

Product size	Roller size	Value [mm]
40	40	0.05
52	52	0.06
72	72	0.08
90	90	0.1

Tab. 8-2      *Roller and tooth flank backlash*

D000679

Set the roller and tooth flank backlash as follows:

(For descriptions, see also chapter 8.3.4 'Replacing the rollers and guideways',  
 68)

- 1** You may need to make the following preparations:
  - 1.1** Remove coverings
  - 1.2** Lightly loosen the fastening screws of the E2 roller holders
  - 1.3** Turn E2 roller holders to eccentric minimum setting
  - 1.4** Remove fastening screws and flanges of the E3 roller holders
  - 1.5** Turn E3 roller holders to eccentric minimum setting
- 2** Block drive pinions
- 3** Move the E2 roller holders closer by rotating them clockwise uniformly
- 4** Fix the position with the flange and the securing screws
- 5** Move E3 roller holders on the gearbox side uniformly until the rack and the drive pinions engage without play
- 6** Check the parallelism between the carriage and axle  
(Value:  $\pm 0.1$  mm)
- 7** Set the tooth flank backlash:
  - 7.1** Attach dial gauge as shown in the figure above
  - 7.2** Zero the dial gauge
  - 7.3** Move E3 roller holders on the gearbox side away until the dial gauge shows the specified value  
(Value according to table above)
- 8** Fix E3 roller holders on gearbox side with positioning screws
- 9** Move remaining E3 roller holders and fix with positioning screw
- 10** Mount flange, fastening screws and all coverings
- 11** Unblock the drive pinions

The roller and tooth flank backlash has been set.

## 8.3.6 Replacing the gearbox

This section describes the steps for replacing the gearbox.

Disassemble the drive to replace the gearbox.

*Disassembling a drive with pinion*

This section describes the steps for disassembling the drive.



### Note

**Do not change the position of the coupling on the motor shaft!**

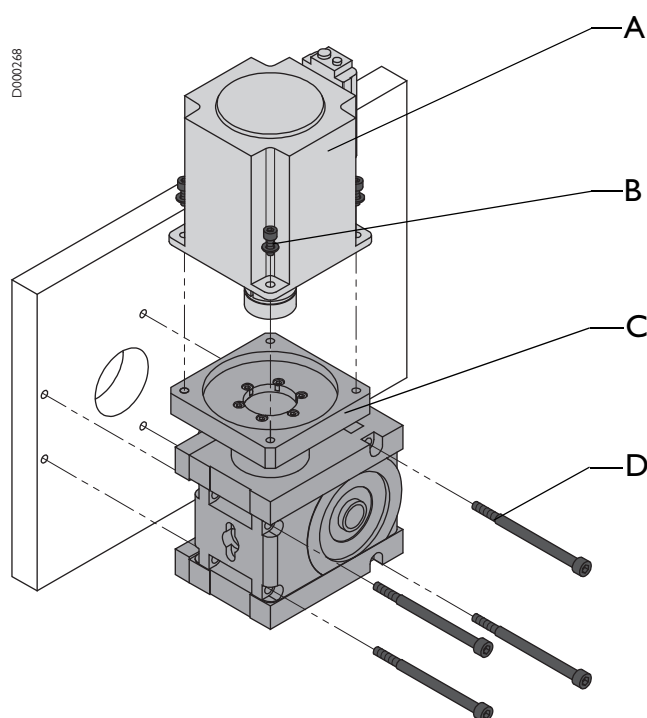


Fig. 8-10 Disassembling the drive

- A Motor
- B Motor screws
- C Gearbox
- D Gearbox screws

Disassemble the drive as follows:

- 1 Switch off the plant and padlock it to secure it against being switched on again
- 2 Secure carriage or axle with transport securing device or lifting device
- 3 Remove the motor screws
- 4 Pull the motor, together with the coupling, off the gearbox
- 5 Remove the gearbox screws
- 6 Remove the gearbox

The drive has been disassembled.

*Replace the gearbox* This section describes the steps for replacing and installing the new gearbox.


### Note



**Calibrate the measurement reference plane after each drive assembly.**

**This procedure is described in the documentation of the complete plant or of the motor!**

Replace and install the gearbox as follows:

- 1 Replace the gearbox
- 2 To assemble the drive, reverse the disassembly steps
- 3 Set the tooth flank backlash according to Chapter 8.3.5,  74
- 4 Calibrate the measurement reference plane of the motor  
(This procedure is described in the documentation of the complete plant or of the motor)

The gearbox has been replaced and installed.

### 8.3.7 Setting the gear backlash

Ex works, the gear backlash is set to a value lower than 6'. If the backlash increases, it has to be readjusted.

#### Note



- **Do not remove the casing cover, else the gearbox oil will leak out!**
- **Always align both casing covers in the identical position!**

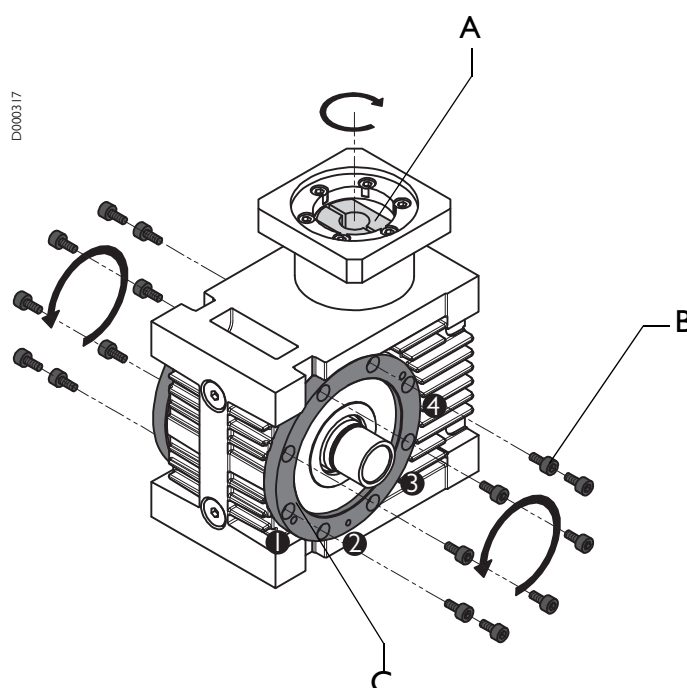


Fig. 8-11 Setting the gear backlash

- A Worm shaft  
B Screws  
C Casing cover

Set the gear backlash as follows:

- 1 Switch off the plant and padlock it to secure it against being switched on again
- 2 Disassemble the drive according to section 8.3.6 'Replacing the gearbox',  
77
- 3 Remove all screws on both sides
- 4 Rotate both covers to the next higher, cast-in number

- 5 Tighten two screws on each of the two sides
- 6 Check the gear backlash:  
Rotate the worm shaft 360° by hand
  - 6.1 The shaft does not resist rotation:  
Repeat from step 3
  - 6.2 The shaft resists rotation:  
Remove the screws, set both gearbox covers one level lower
- 7 Insert all screws on both sides and tighten crosswise
- 8 Check the backlash again, as described in step 6.

The gear backlash has been set

### 8.3.8 Replacing the motor and coupling

This chapter describes the steps for replacing the motor and the coupling

#### Note



**Calibrate the measurement reference plane after each drive assembly.**  
**This procedure is described in the documentation of the complete plant or of the motor!**

Replace the motor and coupling as follows (for descriptions, see Fig. 8-12, 81):

#### Removing the motor and coupling

This section describes the steps for removing the coupling and the motor.

Remove the motor and the coupling as follows:

- 1 Switch off the plant and padlock it to secure it against being switched on again
- 2 Loosen the motor screws
- 3 Pull the motor, together with the coupling, off the gearbox
- 4 Loosen the coupling screws
- 5 Pull the coupling off the motor shaft

The motor and the coupling have been removed



## Installing the motor and coupling

This section describes the steps for installing the coupling and the motor.

Depending on the type of transport securing device used, you have to remove the device before installing the motor for the first time (see section 'Transport securing device at the gearbox', 45).

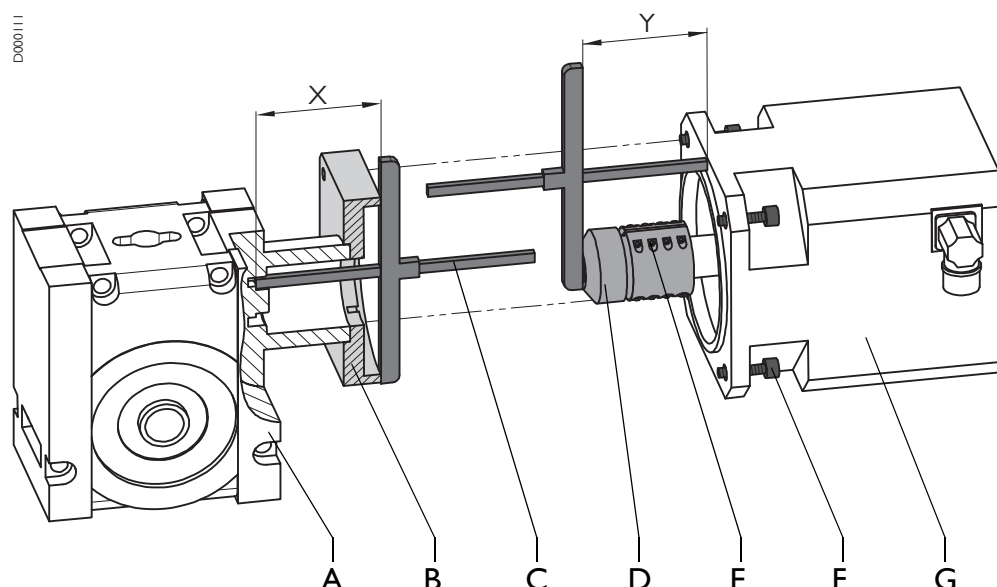


Fig. 8-12

Installing the motor and coupling

- A Gearbox
- B Motor flange
- C Measuring instrument
- D Coupling
- E Coupling screws
- F Motor screws
- G Motor

Install the motor and the coupling as follows:

- 1 Clean the coupling and motor shaft to ensure that they are free of grease
- 2 Measure distance X
- 3 Push the coupling onto the motor shaft  
(Dimension Y has to match dimension X, tolerance -0.2 to -0.4 mm)
- 4 Tighten the coupling screws
- 5 Grease the gear rim of the coupling  
(For grease types, see 7.2.2 'Lubricants', 48)
- 6 Push the motor, with the mounted coupling, onto the gearbox
- 7 Tighten the motor screws


The motor and the coupling have been installed.

The motor and the coupling have been replaced.

## **8.4 Other documents**

For information on the available options, read the appropriate documents in the appendix.

## **8.5 Service departments**

If you have questions, please contact the service departments. For a list with their contact information, see chapter 11.2 'Service departments',  92.

## 9 Decommissioning, storage

### 9.1 Introduction

#### 9.1.1 Safety

Only perform the tasks described in this chapter after you have read and understood chapter 3 'Safety', § 17. It concerns your personal safety!

#### 9.1.2 Personnel qualifications

Only appropriately trained and authorized personnel are allowed to work on the TM-O product.

### 9.2 Storage conditions

#### ⚠ CAUTION

##### Leaking fluids



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

Hazardous substances may not get into the drinking water supply:

- Take appropriate measures.
- Observe the country-specific safety data sheets.
- Fluids 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 machine layout or general layout.

Use a covering to protect the product against dust and dirt.

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

*Air humidity* The air humidity must be below 75%.

## 9.3 Decommissioning

### 9.3.1 Shutdown

This chapter provides information on shutting down the product.

#### **WARNING**

##### **Falling axles/workpieces**



Falling axles or workpieces can cause severe or fatal injuries!

Observe the following:

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

#### **NOTE**



**Do not empty the lubrication lines and the gearbox when shutting down the product!**

To shut down the product, proceed as follows:

- 1 Fixate the axles
- 2 Shut down the plant  
(main switch of complete system)
- 3 Disconnect the supply lines for energy and consumables
- 4 Automatic lubrication system (optional): Unscrew the lubricator and remove the batteries

The product has been decommissioned.

### 9.3.2 Cleaning / rust-proofing

Prior to performing rust-proofing, clean away any dirt and dust from the product. Clean the product thoroughly.



#### NOTE

**Dispose of any cloths soaked in oils and/or greases in an environmentally friendly manner! For more information on disposal, refer to chapter 10 'Disposal', 87.**

Apply corrosion protection to all parts.

### 9.3.3 Transport securing device

On unbraked motors, mount the transport securing devices.


### 9.3.4 Labeling

Label the product with the following data:

- Date of decommissioning
- Internal machine number/name
- Further data as per internal guidelines

## **9.4      Recommissioning**

For recommissioning, follow the steps described for commissioning.

Prior to recommissioning, perform the general inspection as set out in chapter 7.4 'Maintenance tasks',  53. Perform the required maintenance tasks and repairs.

If the machine has been standing still for more than one year, perform the following tasks:

- Change the gearbox oil
- Rinse the lubrication lines with fresh lubricant
- Replace the felt inserts and lubricating pinions
- Check the gaskets and replace if necessary


## **I0 Disposal**

### **I0.1 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

#### **I0.1.1 Safety**

Only perform the tasks described in this chapter after you have read and understood chapter 3 'Safety',  17. It concerns your personal safety!

#### **I0.1.2 Personnel qualifications**

Only appropriately trained and authorized personnel are allowed to work on the TM-O product.

### **I0.2 Disposal**


Your product consists of the following units:

- Packaging
  - Contaminated materials /auxiliary agents (oil paper)
  - Wood
  - Plastic (film)
- Consumables
  - Lubricants (oils/greases)
  - Batteries
- Base unit
  - Metals (steel/aluminum)
  - Plastics (thermoplasts/duroplasts)
  - Contaminated materials/auxiliary agents (felt/cleaning cloths)
  - Electrical material (cables)

## 10.3 Waste management compliant assemblies

### 10.3.1 Disassembly

This chapter describes how to disassemble the product.

Prior to disassembly, shut down product as described in chapter 9.3.1 'Shut-down',  84.

#### WARNING

##### Suspended loads



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

Observe the following:

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

#### CAUTION

##### Oils/greases



Oils and greases are harmful to the environment!

The oils and greases may not get into 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.



Disassemble the product as follows:

- 1** Remove connecting elements  
(cables / energy chains)
- 2** Dismount mobile axes
- 3** Remove the gearbox and drain the oil
- 4** Dismount the carriage
- 5** Dismount fixed assemblies  
(axes/columns)
- 6** Take the assemblies apart and separate the different materials.

The product has been disassembled.

### 10.3.2 Material groups

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

Material	Disposal route
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 3.3.4 'Safety data sheets (MSDS)', 24
Batteries	Battery collection
Metals	Scrap metal collection
Electrical material	Electrical rubbish

Tab. 10-1 Disposal: material groups

## **10.4 Disposal facilities, authorities**

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

## II Spare part supply

### II.1 Explanations regarding the spare parts list

The spare parts list can be found in chapter 13 'Appendix', 97. It contains position drawings and the complete parts list of your product.

#### II.1.1 Positioning drawings

The positions of the spare parts can be seen on the drawings. These are standard drawings. Individual positions or images might differ from your product.

#### II.1.2 Parts list

The parts list contains all parts of your product. The spare parts and wear items are indicated as described in the explanation of symbols.

Explanation of  
symbols

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<p>Güdel AG Industrie Nord CH-4900 Langenthal phone +41 62 916 91 91 fax +41 62 916 91 50 info@ch.gudel.com</p>				<p><b>GÜDEL</b></p> <p>14.07.2008 / Page 1 of 1</p>			
<b>BCH034580 VS0035</b>		<b>2-Amod ZP-4 M MO mec 3.10</b>		<b>10947-001A</b>			
Position	Item number	Text	Drawing	Quantity	Unit	E	W
300	V000134	Y-Axis LP220/220-25 V L=9200	8523-032	1	Stk		
302	0141004	Energy chain 390.17.200.0 IGUS	390.17.200.0	77	Stk	E	A
400	0916667	Y-Carriage ZP-4	8523-030	2	Stk		
900	406015-10.00	Worm gear unit AE060/L left	AE060	2	Stk	E	B
		Ratio i=10.00					
910	406089	Motor flange 060 18x116x116 ø130/110	8030-018a	2	Stk	E	C
1000	0910499	Mechanical multi limit switch accessories 750 Y	8523-024	2	Stk		
1100	230803	Felt pinion for lubrication	8102-039d	1	Stk	V	A
		ø40.6x20, Modul m=2.387 pitch P=7.5, Z=15					

A  
B

Fig. 11-1 Explanation of symbols

- A Spare part status  
B Availability

Spare part status (column E):  
 E = Spare part  
 V = Wear item

Availability (column W):  
 A = Available from stock  
 B = Delivery time approx. 2 - 3 weeks  
 C = Delivery time upon request

The information on availability is given without warranty. The delivery times might in some cases differ.

## 11.2 Service departments

If you have questions on service, please use the service form at [www.gudel.com](http://www.gudel.com) or contact the offices in the appropriate country:

Germany:	+49 6291 6446 41
Great Britain:	+44 24 7669 5444
India:	+91 20 5622 7165
Italy:	+39 0292 170920
South Korea:	+82 2168 98 00
Taiwan:	+88 635 97 8808
USA:	+1 734 214 0000
All other countries and Switzerland:	+41 62 916 91 91

For urgent service requests, our Helpdesk provides after-hour assistance (24-hour support):

Europe/Asia:	+41 62 916 9170
USA:	+1 248 456 0440

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

- Serial no.
- Part list no.
- Drawing number (if applicable)

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## **I3      Appendix**

The appendix of this operating manual contains the following documents:

- Declaration of manufacturer
- Layout
- Options
- Third-party products
- Spare parts list

## Declaration of manufacturer

**Layout**

## Options

## Third-party products

**Spare parts list**