

alpha Linear System
Rack & Pinion
Operating Manual



alpha

Ein Unternehmen der **WITTENSTEIN AG**



1 Contents

1 Contents	2		
1.1 Service contact	2		
2 General information	3		
2.1 Description, designations	3		
2.2 Who is this manual addressed to?	3		
2.3 Which signs and symbols are referred to in this manual?	3		
2.4 Exclusion of liability	3		
2.5 Modifications, reconstructions	3		
2.6 EC Machinery Directive	3		
2.7 Technical modifications	3		
2.8 Copyright	3		
3 Safety	4		
3.1 Intended use	4		
3.2 Improper use	4		
3.3 Safety instructions	4		
3.3.1 General safety instructions	5		
4 Technical Specifications	6		
4.1 Design	6		
4.1.1 PRECISION ⁺ SYSTEM	6		
4.1.2 PRECISION SYSTEM	6		
4.1.3 ECONOMY ⁺ SYSTEM	6		
4.1.4 ECONOMY SYSTEM	7		
4.1.5 SMART SYSTEM	7		
4.2 Weight	7		
4.3 Lubricant	8		
4.4 Performance statistics	8		
4.5 Ordering code	9		
5 Delivery Status, Transport, Storage	11		
5.1 Delivery status	11		
5.2 Transport	11		
5.2.1 Transport using hoisting equipment	11		
5.3 Storage	11		
6 Mounting, Initial operation	11		
6.1 Racks mounting	12		
6.1.1 General information	12		
6.1.2 Preparing mounting	13		
6.1.3 Cleaning	15		
		6.1.4 Mount first rack	16
		6.1.5 Mount following racks	18
		6.1.6 Checking during assembly	20
		6.1.7 Pinning	22
		6.2 Mounting the gear reducer	23
		6.2.1 Check the running characteristic after the assembly	27
		6.3 Mount lubricator	28
		7 Operating conditions rack & pinion	29
		8 Maintenance	30
		8.1 Shutdown, preparation	30
		8.2 Inspection schedule	30
		8.3 Maintenance work	30
		8.3.1 Visual inspection	30
		8.3.2 Lubrication system inspection	30
		8.4 Startup after maintenance work	31
		8.5 Malfunction list (troubleshooting)	31
		9 Dismantling	31
		9.1 Preparation	31
		9.2 Remove rack	32
		10 Disposal	32
		10.1 Lubricants	32
		10.2 Sealing rings	32
		10.3 Metal	32
		11 Appendix	33
		11.1 Operating manual lubricator	33
		11.1.1 Safety	33
		11.1.2 Safe handling of lubricating grease	33
		11.1.3 Assembly preparations	34
		11.1.4 Synchronisation with machine runtime	35
		11.1.5 Pressure build-up times	36
		11.1.6 Lubrication guide	37
		11.1.7 End-position detection at electronically controlled lubricator	41

1.1 Service contact

Please contact our technical service department if you have any technical questions:

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2 General information

2.1 Description, designations

The Rack & Pinion drive (hereafter simply named drive system) is designed and constructed for feed drives.

2.2 Who is this manual addressed to?

This manual concerns all persons who install, operate, or maintain this drive system. They may only carry out work on the drive system, if they have read and understood this operating manual. Please pass the safety instructions on to other persons as well.

2.3 Which signs and symbols are referred to in this manual?

- ➔ An “action instruction”, which requires you to carry out an action.
- ▽ With a “check” you can determine whether the device is ready for the next work stage.
- ☺ A “usage tip” shows you an option of facilitating or improving operations.

The safety instructions symbols are described in Chapter 3 [“Safety”](#).

2.4 Exclusion of liability

The manufacturer does not accept liability for damage or injury ensuing from improper handling of the drive system.

2.5 Modifications, reconstructions

Modifications or reconstructions of the drive system may only be carried out with the express written authorisation of **alpha getriebebau**. Use only original parts when you maintain or retrofit the lift machine (e.g. rack). **alpha getriebebau** does not accept any liability for damage or injury resulting from the use of third-party parts.

2.6 EC Machinery Directive

Within terms of the EC Machinery Directive 98/37 EC, the drive system is not considered an autonomous machine, but as a component to install in machines. Operation is prohibited within the area of validity of the EC directive until it has been determined that the machine in which this product is installed corresponds to the regulations within this directive.

2.7 Technical modifications

alpha getriebebau reserves the right of carrying out technical modifications to improve the product.

2.8 Copyright

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3 Safety

3.1 Intended use

The drive system is designed and constructed for feed drives that do not fall under article 2 of the Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Please refer to our catalogue or our Internet site for the maximum permitted forces and torques: <http://www.alphagetriebe.de/en>.

- ➔ Please consult our technical service department (see 1.1) if your drive system is older than one year. In this way you receive valid data.

3.2 Improper use

Any use transgressing the above-named restrictions (especially higher forces and torques) is not compliant with the regulations, and is thus prohibited.

The operation of the drive system is prohibited if:

- it was not installed according to regulations (e.g., aligning the gearhead to the rack),
- it is not properly maintained (i.e. using the wrong lubricant) or
- the splash guard is insufficient.

3.3 Safety instructions

The following symbols are used in this operating manual to warn you of hazards:



DANGER

The signal word "DANGER" warns you about an increased risk of injury.





WARNING

The signal word "WARNING" warns you about a possible risk of injury.



CAUTION

The signal word "CAUTION" warns you about a small risk or injury damage.

For special situations the general warning symbol  is replaced by the appropriate warning symbol (e.g. "electrical voltage" .



Dangerous for the environment

The signal word "Dangerous for the environment" warns you about an environmental risk.

3.3.1 General safety instructions

Working on the drive system



WARNING

Improperly executed work can lead to injury and damage.

- ➔ Make sure that the drive system is only installed, maintained, and dismantled by trained technicians.



WARNING

Debris flung through the air can cause grave injury.

- ➔ Before putting the drive system into operation, check that there are no impurities or tools near the drive system.



CAUTION

Loose or overloaded screw connections can cause damage.

- ➔ Always use a calibrated torque wrench to tighten and check all screw connections for which a tightening torque has been specified.

Operation



WARNING

Moving machinery may cause injury. There is danger of being trapped or pulled in!

- ➔ Keep a sufficient distance to rotating machinery.

Maintenance



WARNING

An unintentional start of the machine during maintenance work can lead to serious accidents.

- ➔ Ensure that no one can start the machine while you are working on it.



WARNING

Even only briefly running the machine during maintenance work can lead to accidents if the safety devices have been put out of function.

- ➔ Check that all safety devices are mounted and activated.

Lubricants



Dangerous for the environment

Lubricants (oils and greases) are hazardous substances that can contaminate soil and water.

- ➔ Collect drained lubricant into suitable receptacles and dispose of it according to the valid national guidelines.

4 Technical Specifications

4.1 Design

The drive system consists of a gearhead with a pinion at the gear output as well as the respective racks for mounting onto a customer construction. Please refer to our catalogue or our Internet site for the assembly dimensions: <http://www.alphagetriebe.de/en>.

4.1.1 PRECISION⁺ SYSTEM

PREMIUM CLASS⁺ pinion

The pinion for the SP/TP drive is noted for their utmost linear stiffness and dynamics. This is caused by a small effective diameter and the high true running accuracy. The pinion is suited for high-end applications with utmost dynamics and position accuracy.

PREMIUM CLASS rack

The racks of the PREMIUM CLASS are suited for high dynamic and precise position accuracies. An alignment edge in the engine bed allows for easy assembly. Due to the high precision the drive system (rack & pinion) can be adjusted to be backlash-free upon consultation with **alpha getriebebau**.

☺ Furthermore a sorting of the racks is possible whereby the glass scale for rotational position sensing can be omitted. For further information, please consult **alpha getriebebau**.

4.1.2 PRECISION SYSTEM

PREMIUM CLASS RTP pinion

The pinion for the TP gear output features a medium linear dynamic stiffness with very good position accuracy because of its large effective diameter.

PREMIUM CLASS rack

The racks of the PREMIUM CLASS are suited for high dynamic and precise position accuracies. An alignment edge in the engine bed allows for easy assembly. Due to the high precision the drive system (rack & pinion) can be adjusted to be backlash-free upon consultation with **alpha getriebebau**.

☺ Furthermore a sorting of the racks is possible whereby the glass scale for rotational position sensing can be omitted. For further information, please consult **alpha getriebebau**.

4.1.3 ECONOMY⁺ SYSTEM

STANDARD CLASS RSP pinion

The pinion for the SP involute drive is noted for its high linear stiffness and dynamics. This is caused by a small effective diameter and the medium true running accuracy. The pinion is suited for mid-range applications with high dynamics and position accuracy.

VALUE CLASS rack

The VALUE CLASS racks are suited for low-cost applications. The alignment edge in the engine bed makes the assembly easy.



4.1.4 **ECONOMY SYSTEM**

VALUE CLASS pinion

The pinion for the LP/(SP) gear output features low positioning accuracy in connection with a low linear stiffness. High movement speeds are possible with only a low eccentricity error. The pinion is suited for low-cost applications.

VALUE CLASS rack

The VALUE CLASS racks are suited for low-cost applications. The alignment edge in the engine bed makes the assembly easy.

4.1.5 **SMART SYSTEM**

SMART CLASS rack

The SMART CLASS racks are suited, due to their dynamic positioning accuracy and the freely flexible mounting without alignment edge, for all applications with most flexible assembly requirements and modular design. This rack can be optimally aligned to the guide rails. The applications range from low-cost to high-end depending on the pinion.

4.2 **Weight**

The total mass of the drive system is a combination of the mass of the gearhead with pinion and the respective racks.

- ☺ The mass of the gearhead can be found in the operating manual of the gearhead.
- ☺ The weights of the individual racks can be found in [Table 4.1](#).

Weights [kg] of the racks					
Module	2.0	3.0	4.0	5.0	6.0
Length [mm]					
167	0.7	-	-	-	-
250	-	1.5	-	-	-
333	1.4	-	-	-	-
480	1.9	2.7	4.7	-	-
500	2.1	3.0	-	6.5	9.9
506	-	-	5.4	-	-
1000	4.1	5.9	10.7	13.1	19.9

Table 4.1

4.3 Lubricant

Rack & Pinion



CAUTION

Too little lubrication damages then gearing.

- ➔ Make sure there always is enough lubrication and replace the greaser in time.

The lubrication of the pinion or the rack is always done from a greaser by a lubricating felt pinion. The greaser is available in two sizes (125 and 475 cm³) and is factory-filled with “Klüber Microlube GB 0”.

Information on alternative greases or oil can be obtained from **alpha getriebebau**.

☺ The recommended lubricant quantity at a movement speed of 90 m/min is for example with module 2 0.175 - 0.35 cm³/day.

☺ Further information on setting the automatic lubrication can be found in the instructions for the lubricator in the appendix (Chapter 11.1) of this operating manual.

The ambient temperature may not be under –10 °C and not over +40 °C.

Operating temperature may not exceed +90 °C.

Gearhead

The gearhead is filled by the manufacturer with synthetic gear oil (polyglycols) of viscosity class ISO VG 220 or with a high-performance lubricant.

☺ The further information can be found in the operating manual of the gearhead.

4.4 Performance statistics

Please refer to our catalogue or our Internet site for the maximum permitted forces and torques of the gearhead: <http://www.alphagetriebe.de/en>.

- ➔ Please consult our technical service department (see 1.1) if your gearhead is older than a year.

4.5 Ordering code

The ordering code (A) is located on the racks.

The identification plate for the gearhead is located on the housing.

☺ Further information on the identification plate can be found in the instructions for the gearhead.

Rack

The ordering code (e.g.: ZST 200-SB6-480-030-R1) provides the following information:

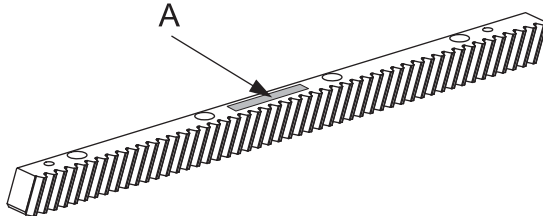


Fig. 4.1

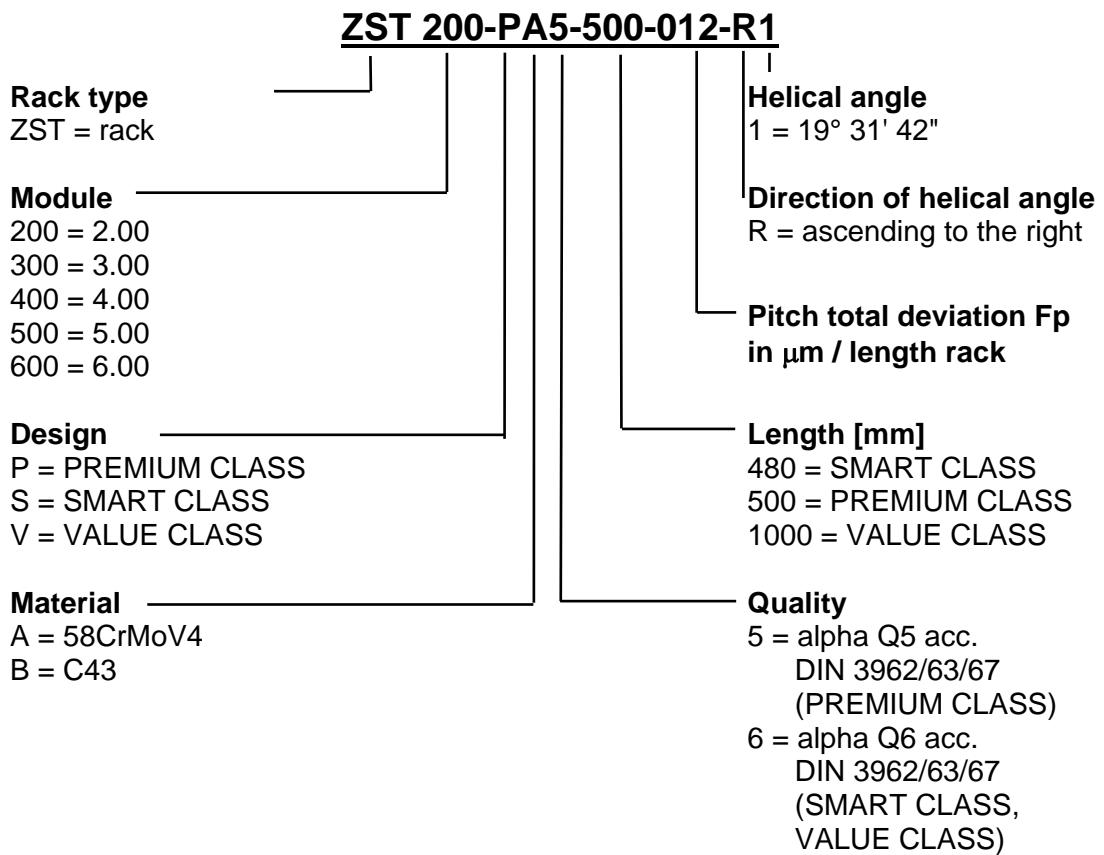


Fig. 4.2: Ordering code



PREMIUM CLASS⁺ and VALUE CLASS pinion

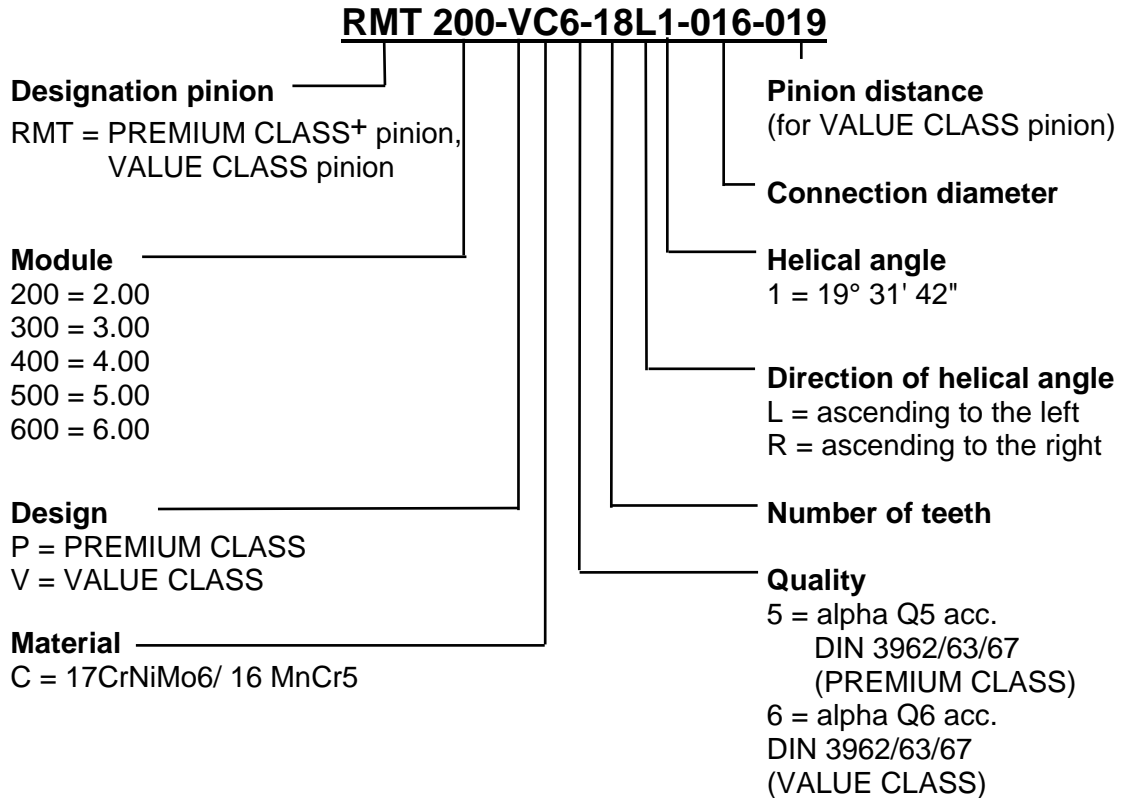


Fig. 4.3: Ordering code

STANDARD CLASS RSP and PREMIUM CLASS RTP pinion

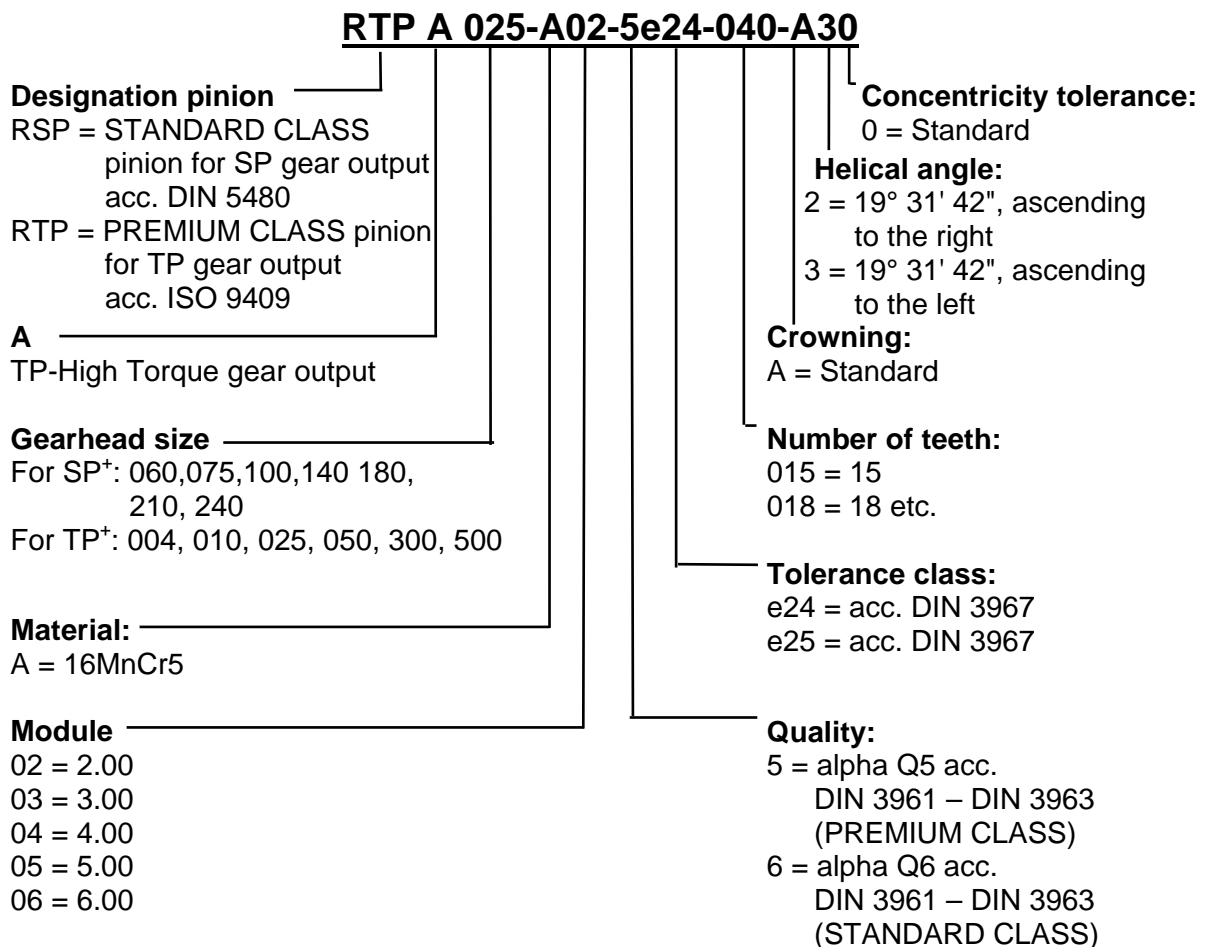


Fig. 4.4: Ordering code

5 Delivery Status, Transport, Storage

5.1 Delivery status

Each rack is conserved all around and put into packaging.

The gearheads are treated with an anti-corrosion agent at the gear input and the factory-mounted pinion and are packed in foils and cartons. The foils and boxes can be recycled.

All gearheads are filled with lubricant during manufacture.

5.2 Transport

No special direction or position is prescribed to transport the drive systems.

The total mass of the drive system is a combination of the mass of the gearhead with pinion and the racks. You can find an assignment to the rack sizes in [Table 4.1](#) in

Chapter 4.2 "Weight".

5.2.1 Transport using hoisting equipment



WARNING

Falling loads or breakage of sling equipment (e.g. ropes, chains, cables) may cause injury.

- ➔ Do not stand under suspended loads.
- ➔ Keep as safe a distance as possible from sling equipment.



CAUTION

Falling or hard placement can damage the drive system.

- ➔ Only use hoisting and securing equipment (e.g. ropes, chains, cables) that is permitted for the size/weight of your drive system.
- ➔ Ensure that the load is handled and placed slowly and carefully.

5.3 Storage

The drive systems can be stored dry and in a horizontal position in the original packing for a maximum of 2 years at a temperature between 0 °C and +30 °C. For storage logistics we recommend the "first in - first out"– principle.

6 Mounting, Initial operation

- ➔ Please observe the instructions in Chapter 3.3.1 "[General safety instructions](#)".



WARNING

Touching sharp edges or hot surfaces can cause injuries or burns respectively.

- ➔ Use suitable protective equipment during assembly (such as protective gloves).



CAUTION

Avoid a heat transfer to the rack during assembly.

- ➔ Use suitable protective equipment during assembly (such as protective gloves).

6.1 Racks mounting

6.1.1 General information



CAUTION

The improper use of clamping fixtures such as screw clamp can damage the tothing of the racks.

➡ Always use pads made of plastic or brass.

PREMIUM CLASS / VALUE CLASS

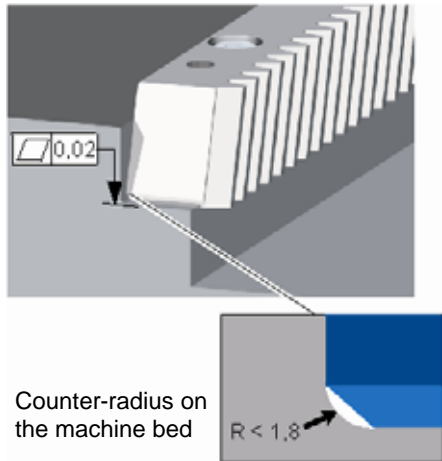


Fig. 6.1

The rack has a bevelled corner of $2 \times 45^\circ$ at the alignment edge (Fig. 6.1). The engine bed should be constructed so that an assembly friendly clamping of the rack is possible. The threaded bores for the fastening bolts need to feature a sufficient screw-in depth depending on the material of the machine bed. Depending application the mounting surfaces in the machine bed have to have a parallelism between 20 and 40 μm towards the carriage guide (parallelism should be within the required parallelism tolerance of the manufacturer of the rail guide)

SMART CLASS

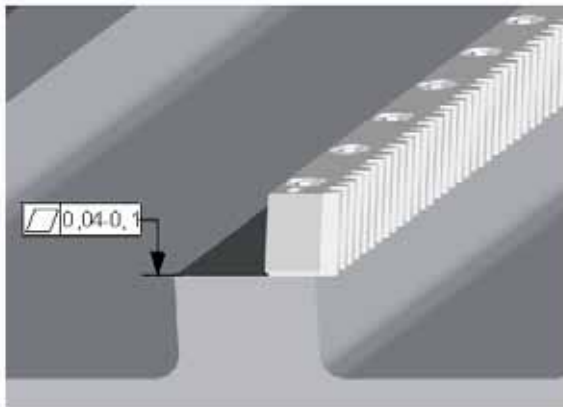


Fig. 6.2

The engine bed should be constructed so that the rack can be attached in an assembly friendly manner. An alignment edge is not necessary for the SMART CLASS design because of the higher attachment type of the rack. The threaded bores for the fastening bolts need to feature a sufficient screw-in depth depending on the material of the machine bed.

Depending on the application the fitting surface should have a levelness between 0.04 mm (machine bed cast of made of steel) and 0.1 mm (machine bed made of aluminium) for the rack mounting surface.

The parallelism between 20 μm and 40 μm to the carriage guide is achieved by a spacer (see Fig. 6.3) during assembly (the parallelism should be ideally within the prescribed parallelism tolerance of the manufacturer of rail guides).

6.1.2 Preparing mounting

For fastening the racks you need screws and pins per rack according to the Table 6.1 below. The lengths of the bolts and pins depend on the design of the machine bed (not included in the **alpha** scope of delivery!).

Module	Length	CLASS			Bolt DIN EN ISO 4762–12.9 (quantity x thread)	Tightening torque [Nm]	Number x cylinder pin DIN EN ISO 2338 / Cylinder pin with inner thread DIN7979/DIN EN ISO 8735 form A
		PREMIUM	SMART	VALUE			
2	1000			X	8 x M6	16.5	2 x 6 m6
2	500	X			4 x M6	16.5	2 x 6 m6
2	480		X		8 x M8	40	2 x 8 m6
2	333	X			4 x M6	16.5	2 x 6 m6
2	167	X			2 x M6	16.5	2 x 6 m6
3	1000			X	8 x M8	40	2 x 8 m6
3	500	X			4 x M8	40	2 x 8 m6
3	480		X		8 x M10	81	2 x 10 m6
3	250	X			2 x M8	40	2 x 8 m6
4	1000			X	8 x M8	40	2 x 8 m6
4	507	X			4 x M10	81	2 x 10 m6
4	480		X		8 x M12	140	2 x 10 m6
5	1000			X	8 x M12	140	2 x 12 m6
5	500	X			4 x M12	140	2 x 12 m6
6	1000			X	8 x M14	220	2 x 16 m6
6	500	X			4 x M14	220	2 x 16 m6

Table 6.1

- ➔ Check the ordering code (see Chapter 4.5) of all racks. Use only racks with the same ordering codes for the same application. Make especially sure that the helical angle and the height tolerance have the same identification.
- ☺ Always provide the ordering code when ordering spare parts so that you receive precisely matching racks and pinions.

Through-holes are available in the housing for bolting it onto the customer's construction.
 ☺ The attachment of the gearhead can be found in the instructions for the gearhead.

You need an assembling jig for aligning the transfers between the individual racks. For the final check by a dial gauge you need a needle roller (measuring roller).

☺ Please refer to our catalogue or our Internet site for the order numbers of the assembling jig and the needle roller: <http://www.alphagetriebe.de/en>.

SMART CLASS

The bores in the machine bed should have a tolerance of ± 0.2 (absolute measure).

➔ Make a spacer customised to your machine (possible design see Fig. 6.3).

Spacer without assembling jig

Spacer with assembling jig

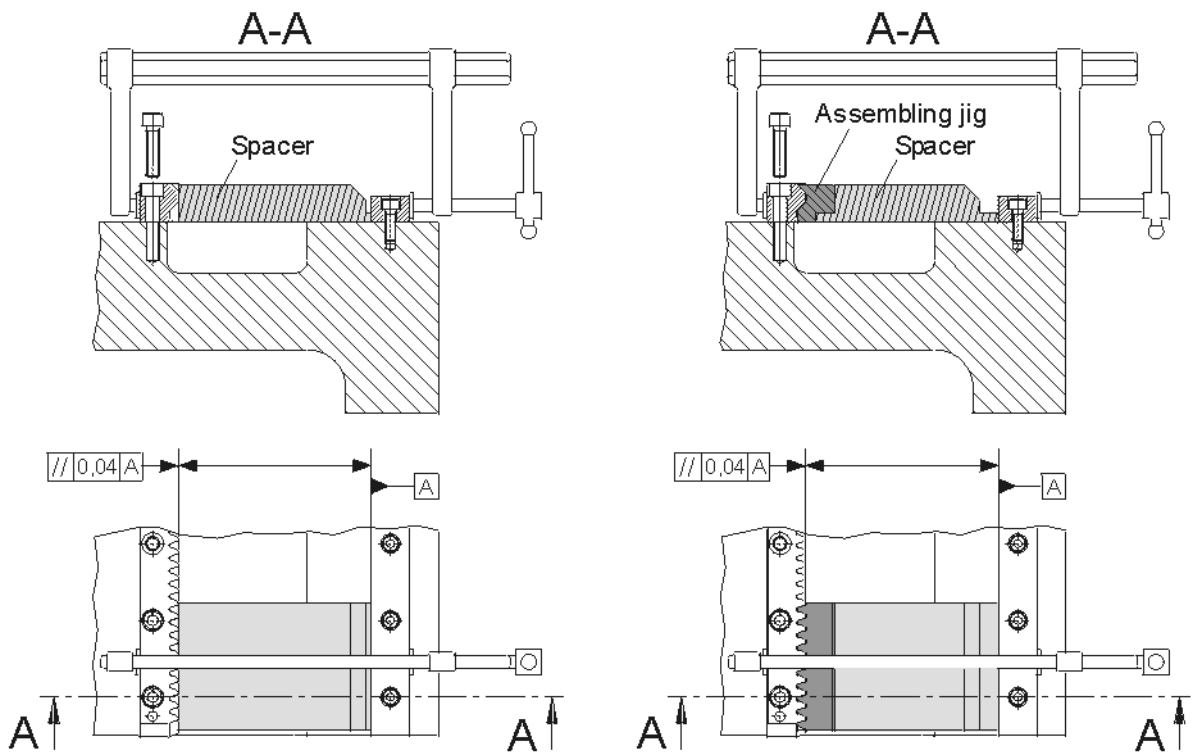


Fig. 6.3

6.1.3 Cleaning

- ➔ Before mounting the racks, remove any trace of anti-corrosion agent. Use a clean cloth moistened with a suitable cleaning agent (fat dissolving but non-aggressive, e.g. petroleum, [Fig. 6.4](#)).
- ➔ Clean the spacer (for SMART CLASS).
- ➔ Thoroughly clean the alignment edges or mounting surfaces of the guide bed and hone them with an oil stone.
- ➔ Oil or grease the contact surfaces with a cloth against corrosion.

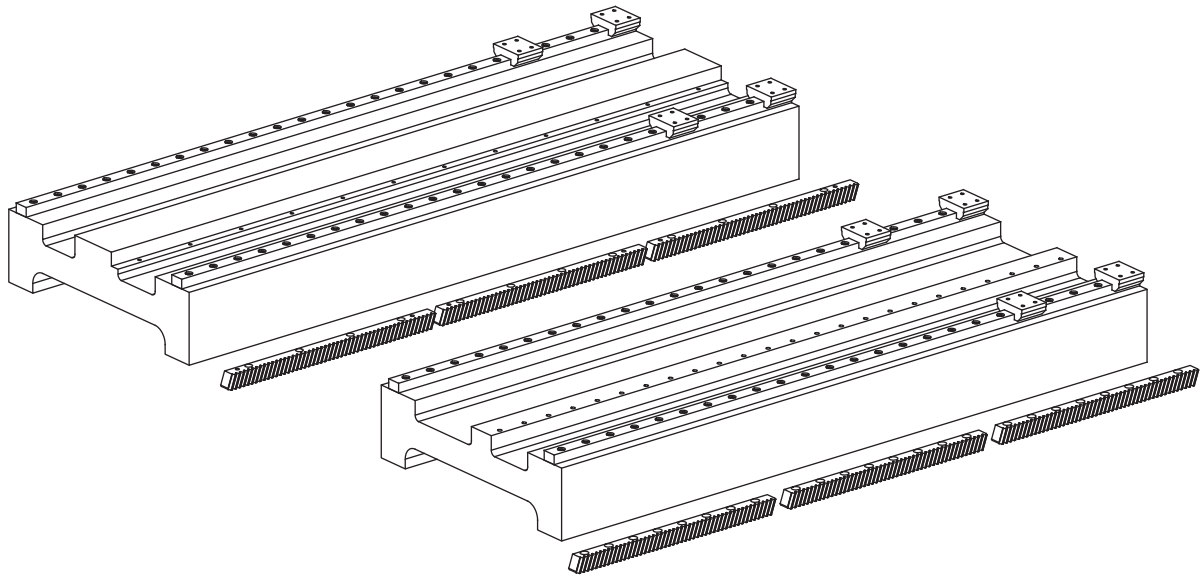
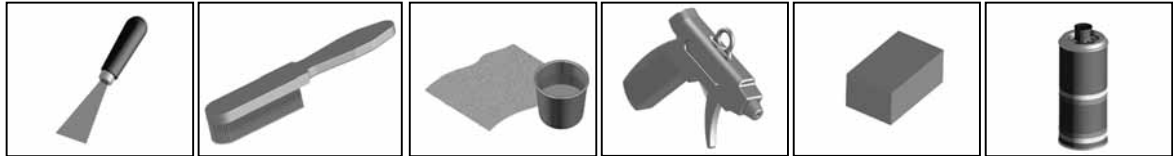


Fig. 6.4

After the cleaning

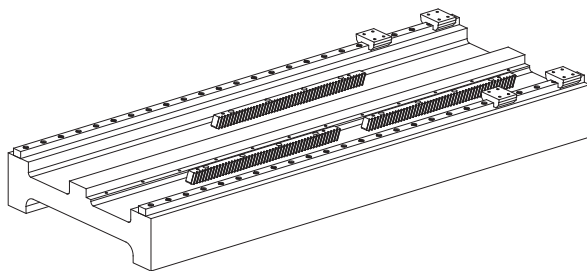


Fig. 6.5

- ➔ Place the racks on the machine bed for at least 4 hours so that the temperatures can adapt.

6.1.4 **Mount first rack**

▽ Optimal alignment can be reached by first aligning the mounting rails to the guide carriages.

PREMIUM CLASS / VALUE CLASS

- ➔ Place the first rack and position it centrally in the machine bed over the respective threaded bores.
- ➔ Clamp the rack in the area of the fastening bores to the machine bed (e.g. with clamping fixtures).
- ➔ Insert the first cylinder head screw.
- ➔ Tighten the cylinder head screw with the specified tightening torque (see [Table 6.1](#) in Chapter 6.1.2), while the clamping fixture (simply called screw clamp below) holds the position.
- ➔ Repeat the previous steps for the remaining cylinder head screws (see [Table 6.1](#) in Chapter 6.1.2).
- ➔ Remove the screw clamps.

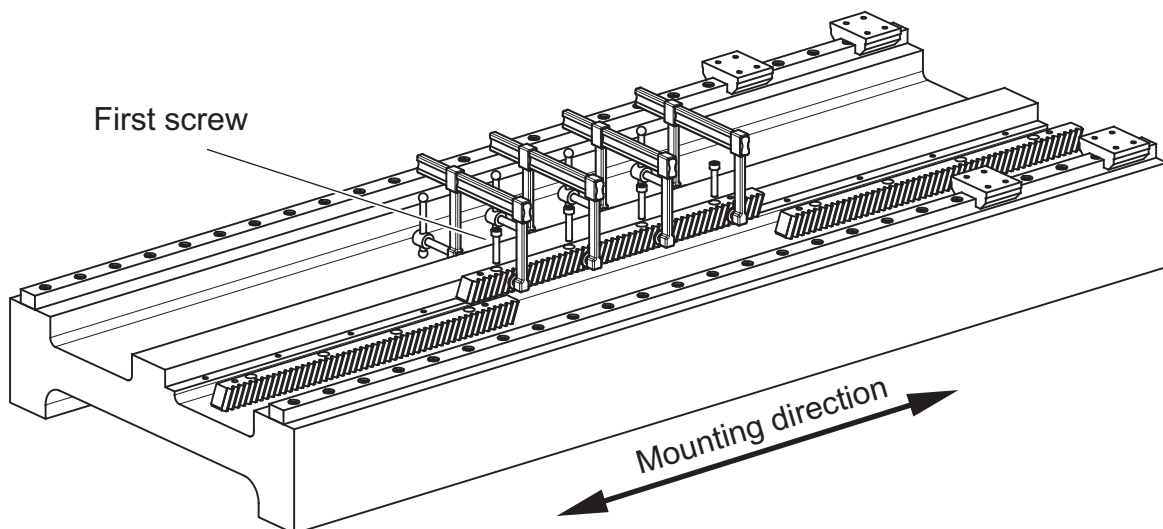


Fig. 6.6

SMART CLASS

- ➔ Place the first rack and position it centrally in the machine bed over the respective threaded bores.
- ☺ For more precise positioning clamp an assembling jig with spacer (see [Fig. 6.3](#) in Chapter 6.1.2) between rack and guide rail.
- ➔ Lightly clamp (e.g. with screw clamps) the rack in the area of the fastening bores to the home rail edge (guide rail).
- ➔ Insert the first cylinder head screw.
- ➔ Tighten the cylinder head screw with the specified tightening torque (see [Table 6.1](#) in Chapter 6.1.2), while the clamping fixture (simply called screw clamp below) holds the position.
- ➔ Repeat the previous steps for the remaining cylinder head screws (see [Table 6.1](#) in Chapter 6.1.2).
- ➔ Remove the screw clamps.

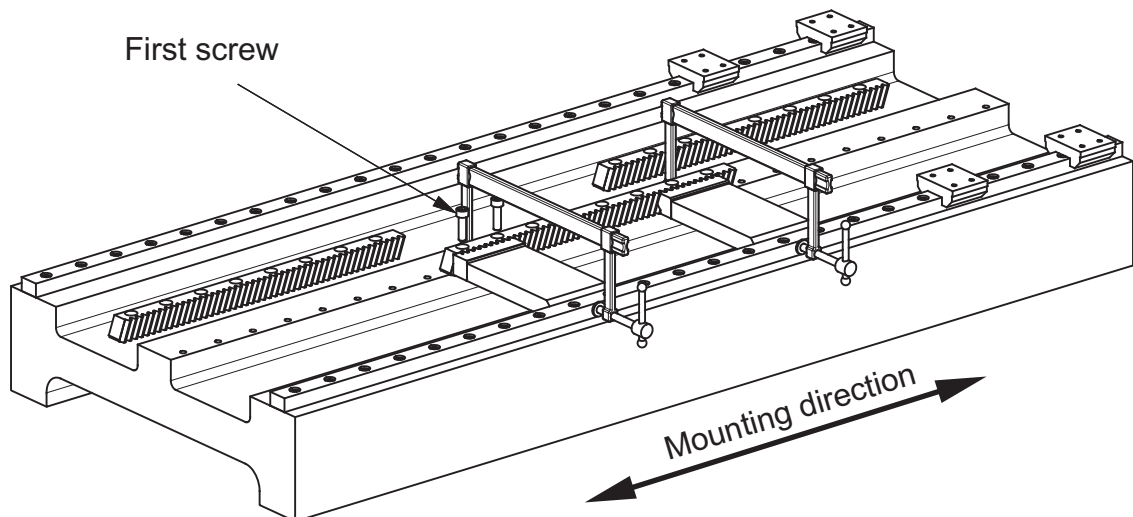


Fig. 6.7

6.1.5 Mount following racks

- ▽ If the pressing force of the assembling jig is too great for the connection of two racks, the rack gap may widen. The assembling jig should only serve as an adaptor between two racks.

PREMIUM CLASS / VALUE CLASS

- ➔ Place the next rack and position it over the respective threaded bores.
- ➔ Place the assembling jig and clamp it lightly.
- ➔ Clamp the rack in the area of the fastening bores to the machine bed.
- ➔ Insert the first cylinder head screw in mounting direction.
- ➔ Tighten the cylinder head screw in mounting direction with half the specified tightening torque (see [Table 6.1](#) in Chapter 6.1.2).
- ➔ Repeat the previous steps for the remaining cylinder head screws.
- ➔ Loosen all screw clamps and the assembling jig.
- ▽ Do a check by holding the assembling jig in the transfer point of the two racks. The racks are optimally aligned to each other when the assembling jig can be placed flush and backlash-free.
- ▽ Check the evenness of the joint as described in [Chapter 6.1.6](#) before mounting the next rack.

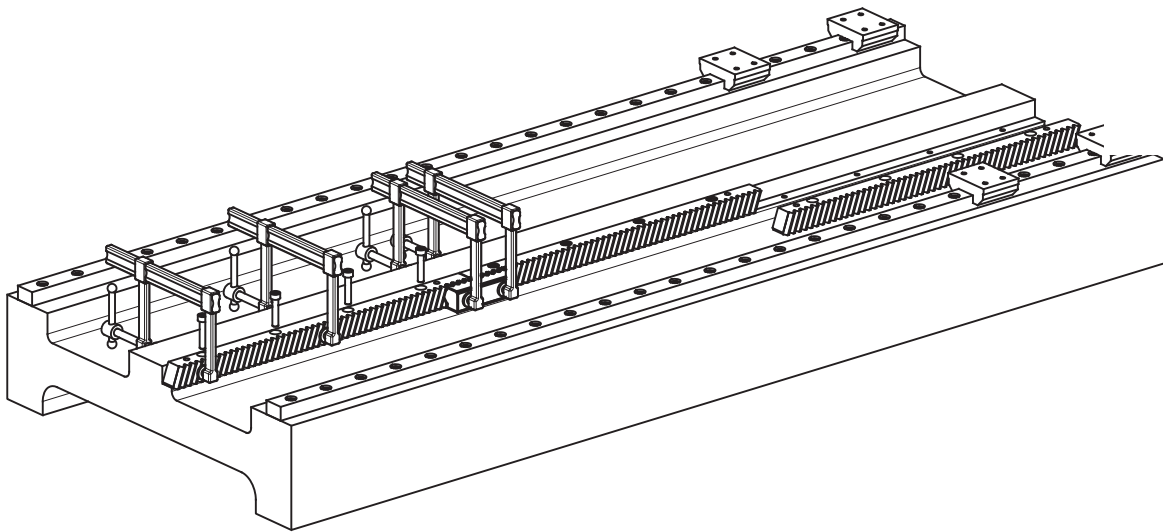
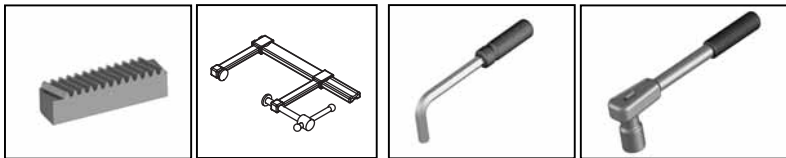


Fig. 6.8

SMART CLASS

- ➔ Place the next rack and position it centrally over the respective threaded bores.
- ➔ Place the spacer between the rack and the guide rail and clamp the rack to the spacer and guide rail (e.g. with a screw clamp). The clamping force should be selected in such a way that the assembling aid (spacer with or without assembling jig) can be taken out easily after the screw attachment.
- ➔ Insert the first cylinder head screw in mounting direction.
- ➔ Tighten the cylinder head screw with the specified tightening torque (see [Table 6.1](#) in Chapter 6.1.2) and repeat the previous steps for the remaining cylinder head screws.
- ☺ Check the evenness of the joint as described in Chapter 6.1.6 (PREMIUM CLASS / VALUE CLASS) before mounting the next rack.
- ➔ Repeat the previous steps for the remaining racks.

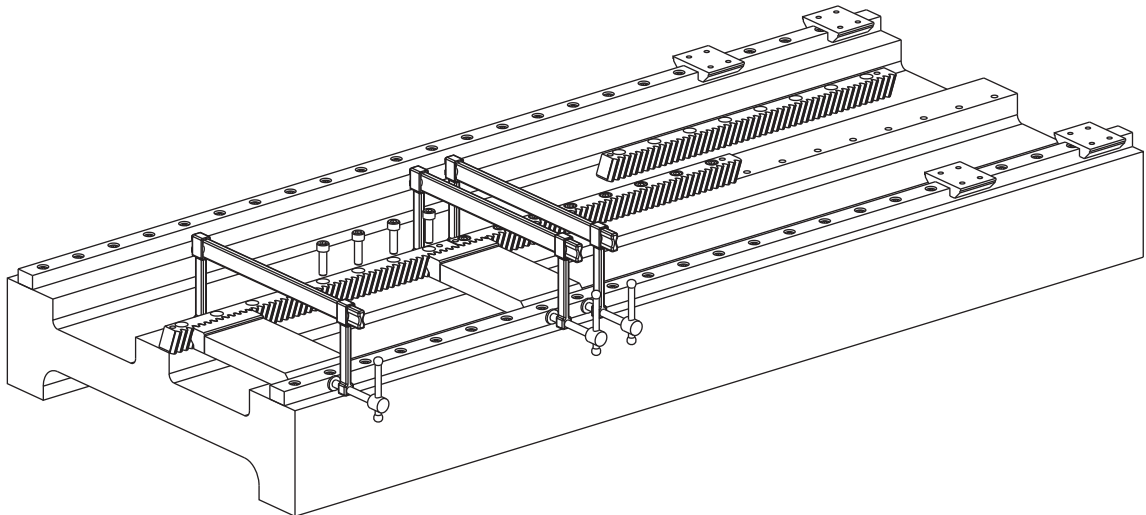
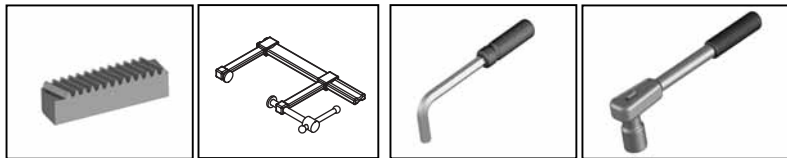


Fig. 6.9

6.1.6 Checking during assembly

The evenness and the joint should be checked before the next rack is placed.

PREMIUM CLASS / VALUE CLASS

Possible procedure:

- ➔ Fasten the dial gauge holder onto the machine carriage.
- ☺ The needle roller can be positioned easier if it has been magnetized previously or a magnet is placed on the rack.
- ➔ Place the needle roller in the joint (B) and in the gearing left (A) and right (C) of it (see [Fig. 6.10](#)) and measure the respective height deviance.
- ➔ The permitted height deviance from rack to rack may be up to about 30 µm. The joint (B) should be between the highest and the lowest measure (A and C) of the rack.
- ➔ Align the parallelism to a minimum measure by attaining the desired height tolerance on the dial gauge with beats by a copper hammer at the first mounting bore to the previous rack towards or against the mounting direction.
- ▽ Due to the tight height tolerance limitations there is normally no additional assembly alignment necessary if a respective parallelism of the reference surface is given to the guide rails (see prescribed parallelism tolerance of the manufacturer of rail guides).
- ➔ After successful completion of the joint clamp just the screw clamps again and tighten the cylinder head screws with the full tightening torque (see [Table 6.1](#) in Chapter 6.1.2).
- ➔ Repeat the previous steps for the remaining racks (Fig. 6.8).
- ➔ Remove the screw clamps.

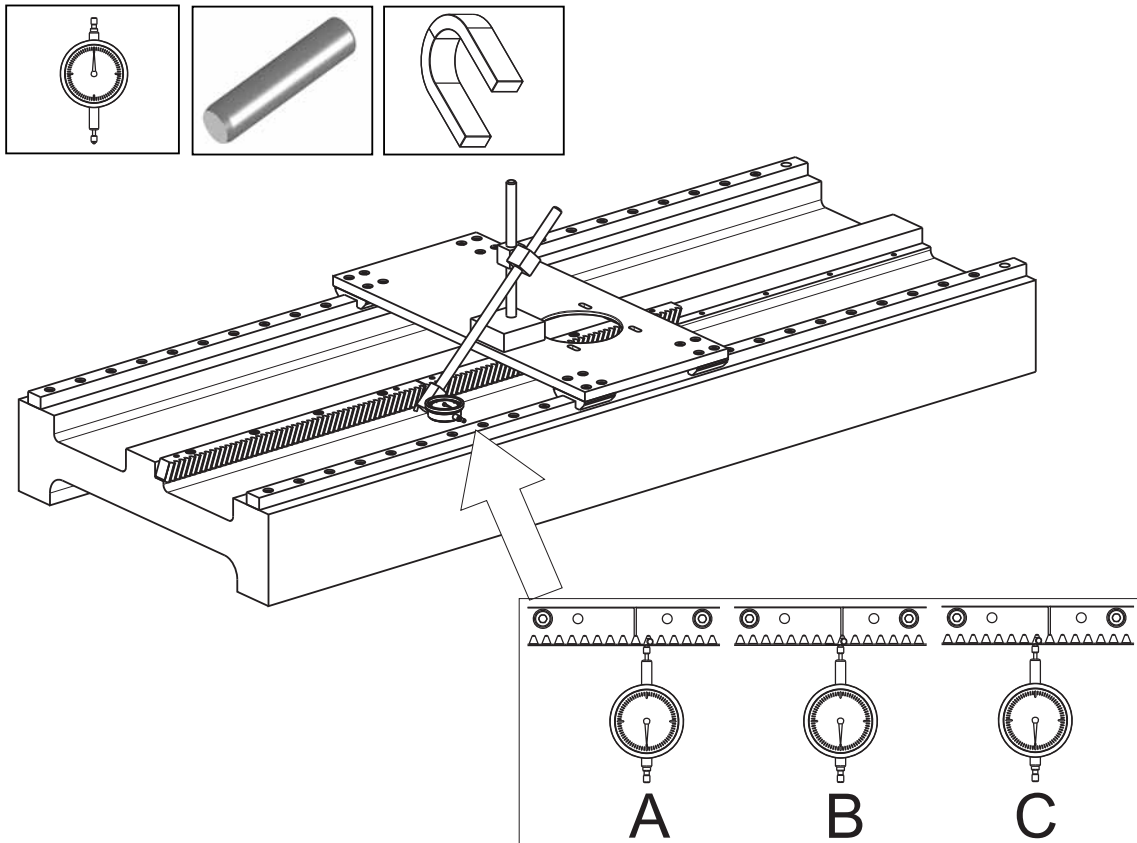


Fig. 6.10

Checking for evenness

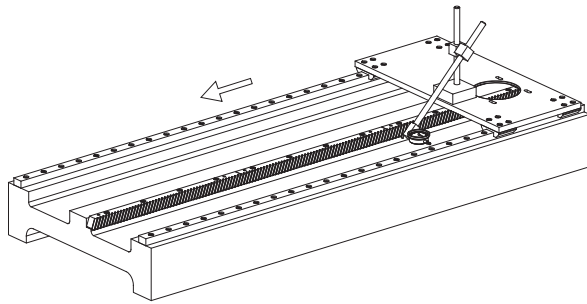


Fig. 6.11

- ➔ Fasten the dial gauge holder onto the machine carriage and move it towards the outer rack.
- ➔ Place the needle roller there in any root of a gear tooth.
- ➔ Position the dial gauge on the needle roller and set the dial gauge to zero.
- ➔ Mark the measuring point on the rack with a pen.

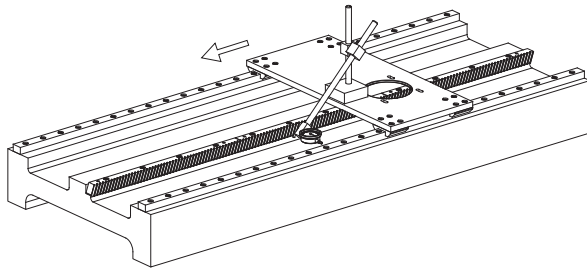


Fig. 6.12

- ➔ Move the machine table to the next measuring position.
- ➔ Place the needle roller once more in the root of a gear tooth.
- ➔ Check the deviation to the previous measurement.
- ➔ Mark the measuring point and note the deviance on the rack.
- ➔ The permitted height deviance may be 30 µm.

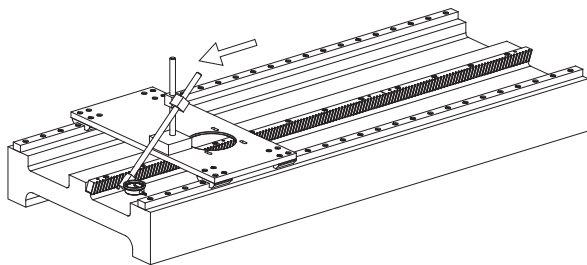


Fig. 6.13

- ➔ Repeat the process for further measuring points.
- ➔ Specify the highest measuring point of the whole movement range. This measuring point is needed for the gearhead mounting.
- ☺ For a simplified measuring the tooth point of the rack can be used as a reference point.

6.1.7 Pinning

PREMIUM CLASS / VALUE CLASS and SMART CLASS

- ➔ Clamp the rack to all pinning bores with screw clamps so that there can be no deformations ([Fig. 6.14](#)).
- ➔ Drill the pinning bores into the machine bed according to the rack bore holes.
- ➔ Widen the bores together to the respective fitting size for the cylinder pins (see [Table 6.1](#) in Chapter 6.1.2).
- ➔ Fixate the racks permanently with cylinder pins.

- ➔ If pinning the rack is not possible from the assembly view for the SMART CLASS, please contact **alpha getriebebau**.

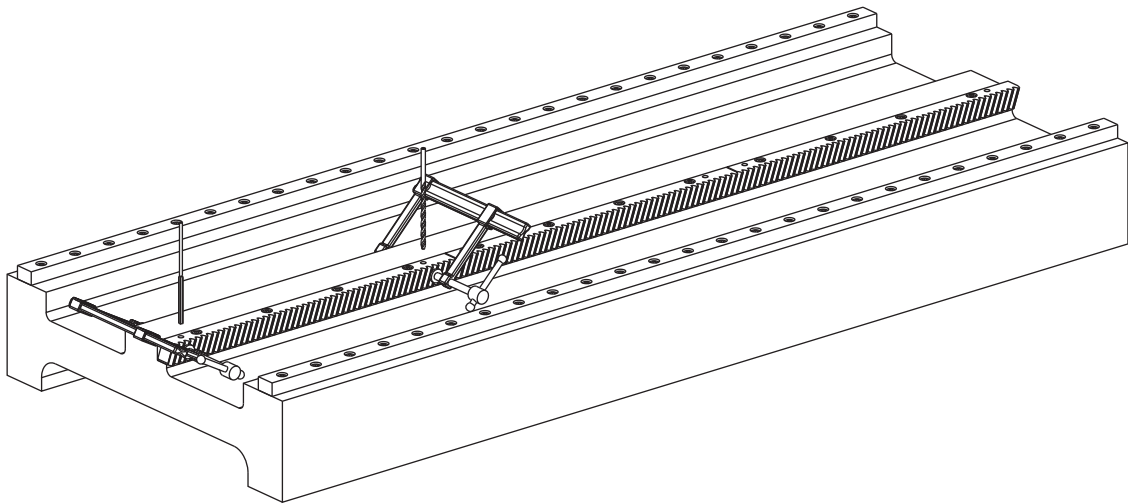
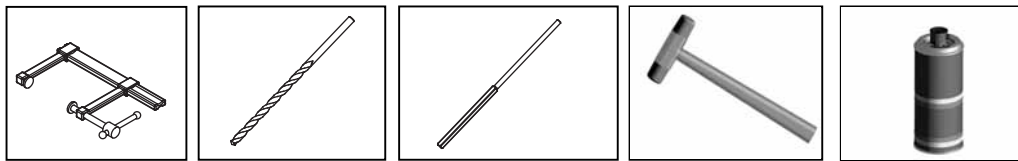


Fig. 6.14

6.2 Mounting the gear reducer

The gearhead is supplied complete with mounted pinion.
 The machine table should be constructed so that assembly and alignment (e.g. with an adjustment device) is as easy as possible.

Check right angles

- ➔ Depending on the mounting position check the right angle between the carriage and the rack's back or the tooth points.

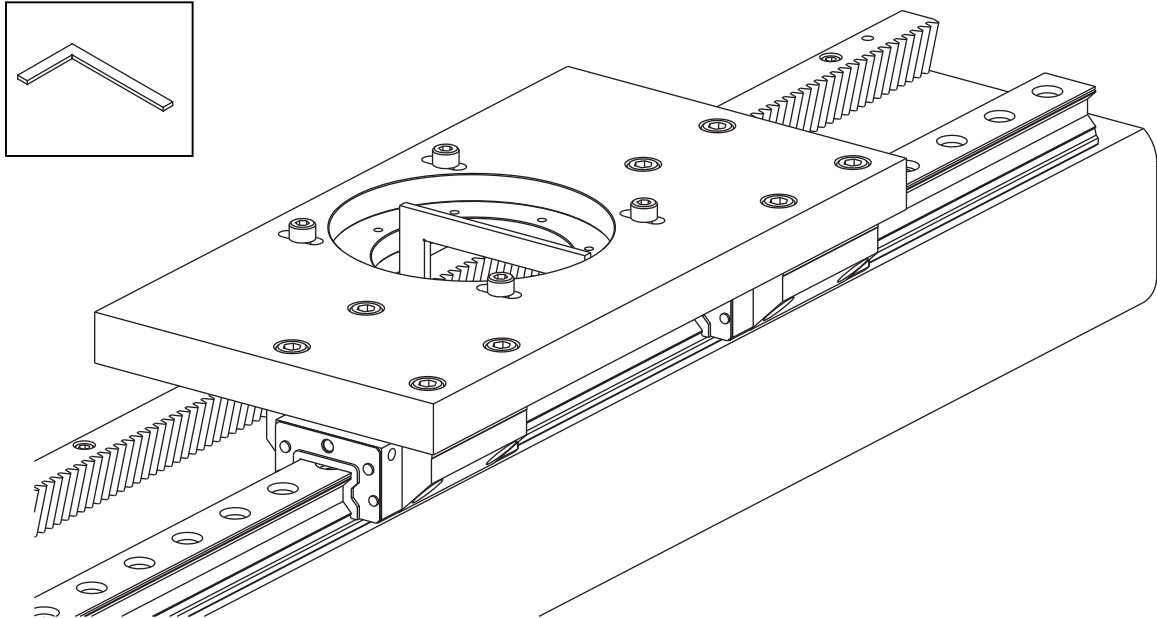


Fig. 6.15

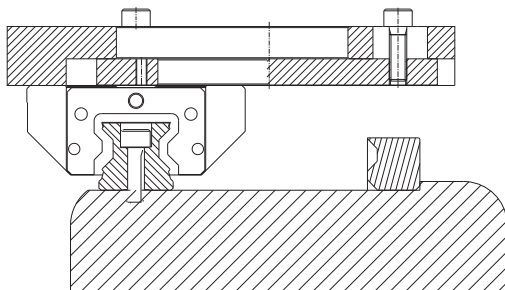


Fig. 6.16

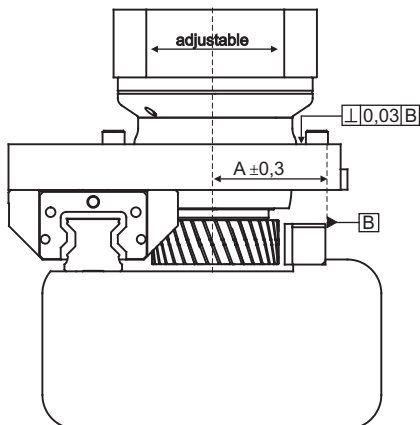


Fig. 6.17

Please refer to our catalogue or our Internet page for the feed distance "A" (for PREMIUM CLASS / VALUE CLASS):

<http://www.alphagetriebe.de/en>.

Mounting the gearhead to the highest point

The gearhead can be mounted in any mounting position without adjusting the amount of lubricant.

On the PREMIUM CLASS / VALUE CLASS pinion the highest point has been marked in the factory by an "H".

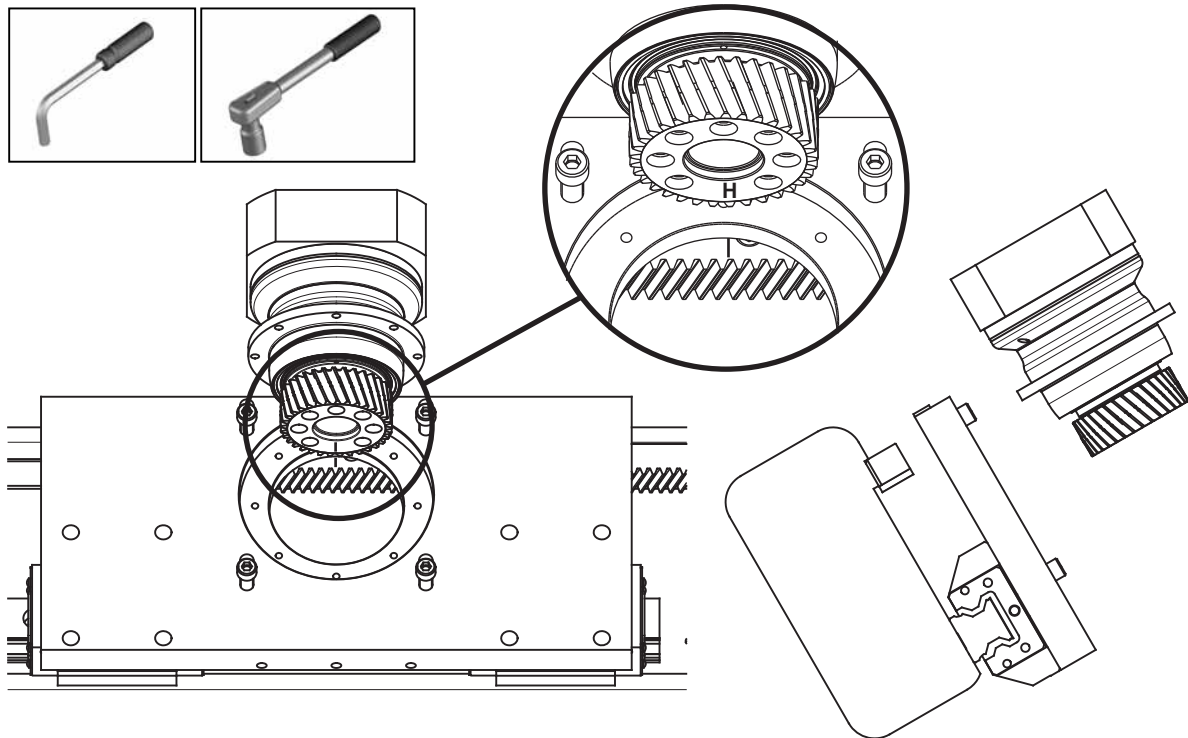


Fig. 6.18

- Align the "highest point" markings from rack and pinion.
- Place the gearhead into the adjustment device on the carriage.
- Coat the bolts with screw-bonding agent and screw the gearhead to the adjustment device.

Example of adjustment device

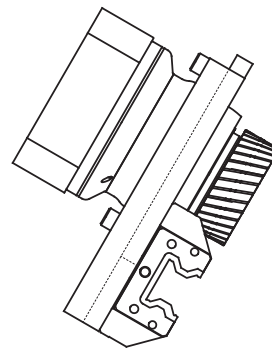
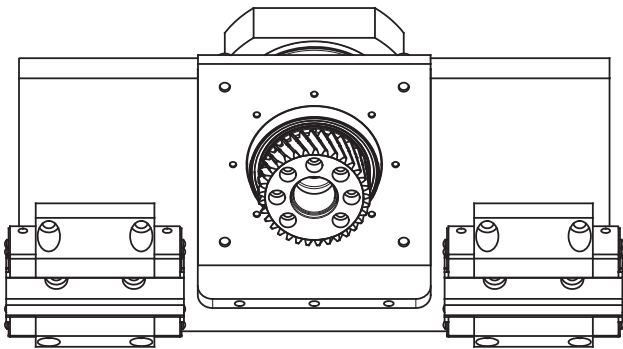


Fig. 6.19

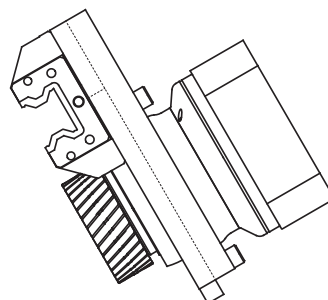
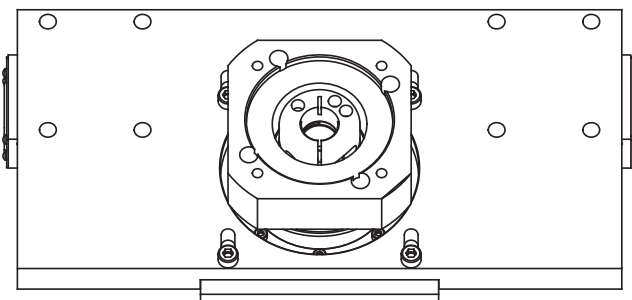


Fig. 6.20

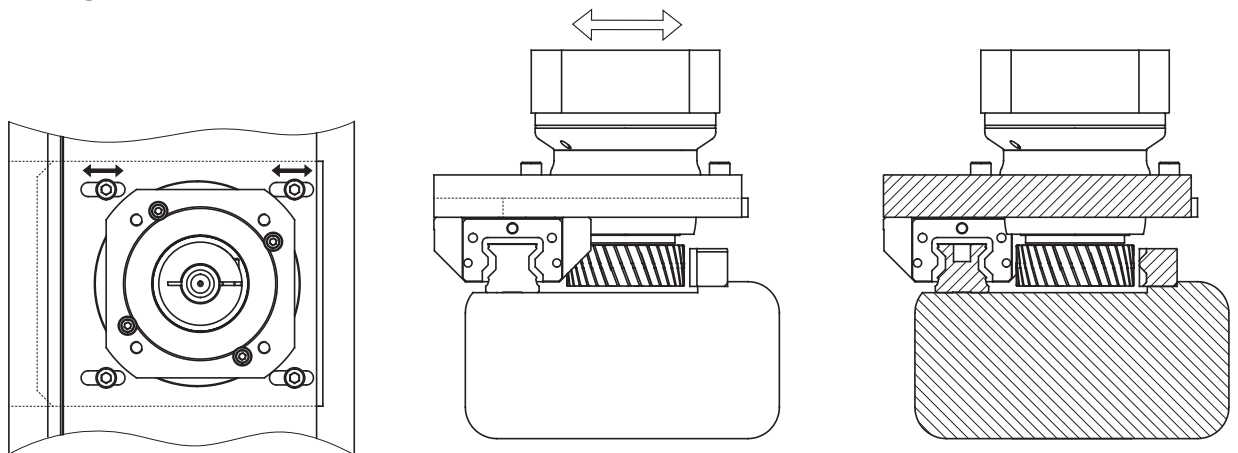
Feed gearhead

Fig. 6.21

- ➔ Press the adjustment device manually into the gearing until the pinion sits backlash-free in the rack.
- ➔ Fixate the position of the adjustment device.

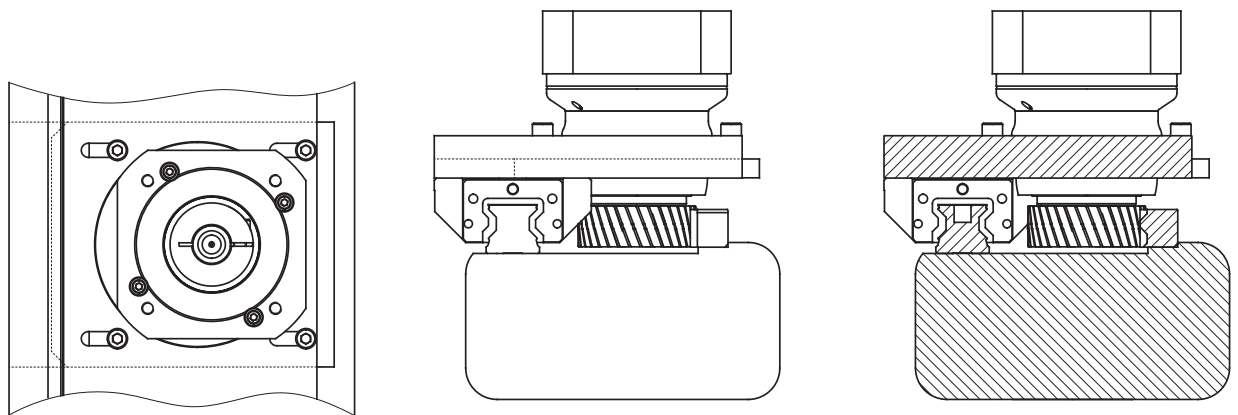


Fig. 6.22

With this hand-tight pretightening a flank backlash is possible in parts of the travel path. When using PREMIUM CLASS / SMART CLASS racks and pinions an additional pretightening can be applied. Thus a backlash-free drive is possible along the entire travel path.

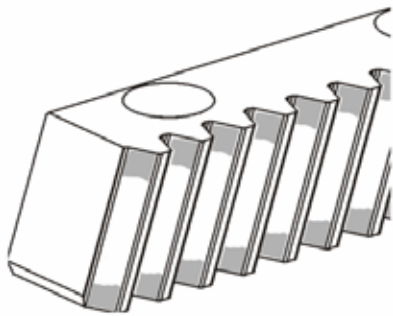
- ➔ Please consult our technical service department (see 1.1) to receive the released pretightening data.

Final inspection

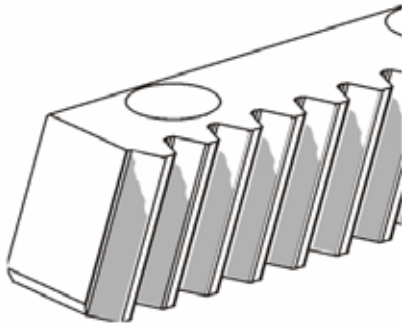


Fig. 6.23

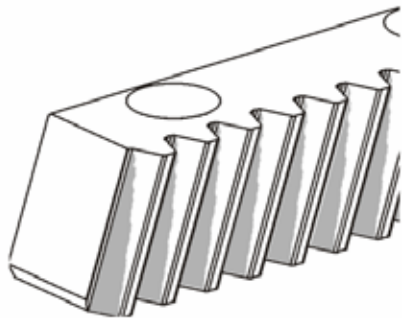
- ➔ De-grease the tooth flanks of the rack (e.g. with Aceton).
- ➔ Mark the tooth flanks with a waterproof felt pen.
- ➔ Shift the carriage several times so that the pinion runs over the marked tooth flanks.
- ▽ Check hereby the free movement of the gearing.
- ▽ Check in which area the ink was removed from the tooth flanks.
- ▽ Judge the alignment of the gearing according to the following figures.
- ➔ Correct the alignment of the gearing if necessary.



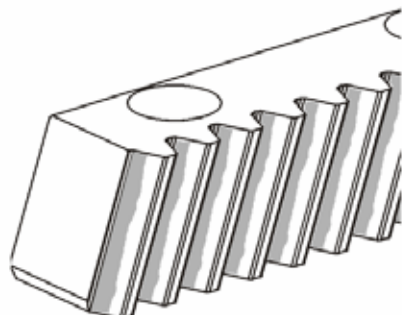
Correct



Not at right angles



Not parallel



Wrong centre distance

6.2.1 Check the running characteristic after the assembly

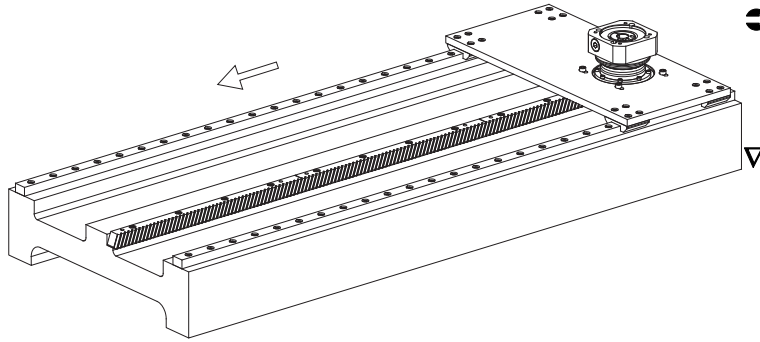


Fig. 6.24

- Push the carriage along the entire movement range several times so that the pinion runs over the tooth flanks. The force needed and the sound of the running should remain constant thereby.

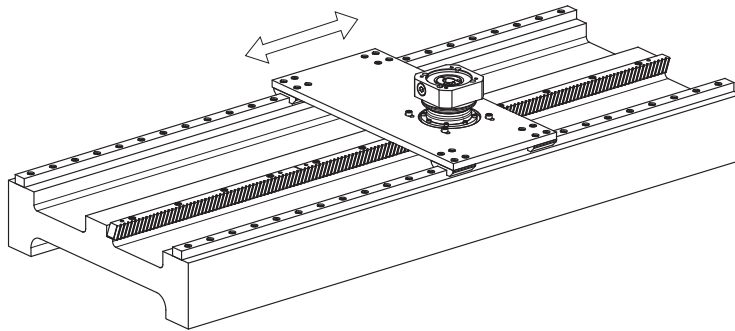


Fig. 6.25

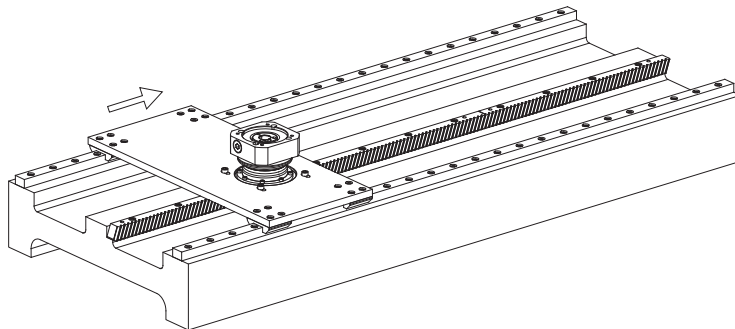


Fig. 6.26

6.3 Mount lubricator

➔ Please observe the instructions in Chapter 3.3.1 [“General safety instructions”](#). The lubricator consists of an automatic greaser, a lubricating felt pinion with fastening axle and the pre-filled lubrication line. Additionally a sensor kit monitors the fill level.

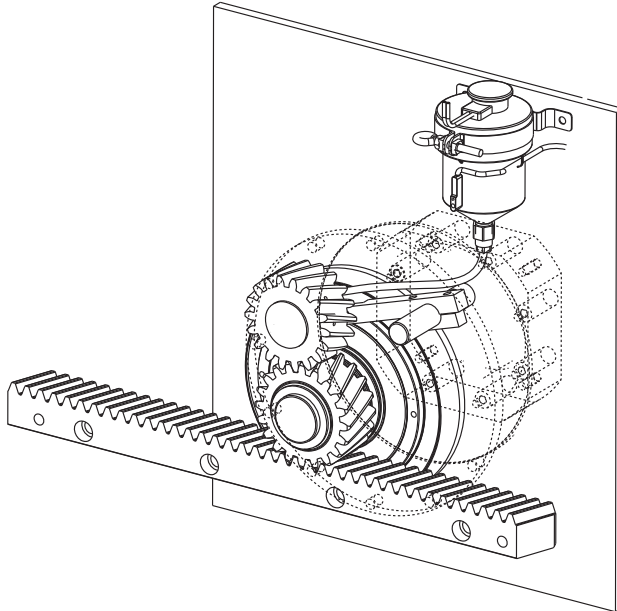


Fig. 6.27

- ☺ The fastening axle of the lubricating felt pinion has a threaded journal on the back side. Position the lubricating felt pinion so that it can reach into the pinion / the rack and fasten it.
- ☺ Please refer to our catalogue or our Internet site for the installation dimensions:
<http://www.alphagetriebe.de/en>.



CAUTION

Unlubricated startup of the drive system damages the gearing.

- ➔ Grease or oil the rack and the pinion before startup.
- ➔ **IMPORTANT:** The lubricating felt pinion needs to be thoroughly greased before the startup with a similar lubricant as in the greaser, because otherwise the lubricating felt pinion is not soaked with lubricant.

A pre-filled plastic hose serves as lubricant line. The maximum supplied length should not be exceeded. For grease lubrication the hose may be no more than 2 metres long.

- ➔ Note the maximum line length and mount the greaser at a suitable location.
- ➔ Use the pre-filled line or fill your supply line bubble-free with our lubricant.
- ➔ Mount the line between greaser and lubricating felt pinion. Install the supply lines so that they cannot fold during operation.
- ➔ Please note the centre distance between pinion and lubricating felt pinion. The centre distance can be calculated by the following formula:

$$\text{Centre distance} = \frac{d \text{ lubricating felt pinion} + D_0 \text{ pinion}}{2}$$

or

$$\text{Centre distance} = \frac{d \text{ lubricating felt pinion}}{2} + h \text{ rack}$$

**CAUTION**

Unlubricated startup of the drive system damages the gearing.

- Grease or oil the rack and the pinion before startup.
- Soak the lubricating felt pinion with our lubricant before the startup, because there are different pressure build-up times for different setting times of the greaser (see Chapter 6.5.5).

➤ Please observe the instructions in Chapter 3.3.1 "General safety instructions".
The drive system must be installed in a clean and dry environment. Coarse dust and liquids of all kinds impair its function.

The specifications for lubricants and operating temperatures can be found in Chapter 4.3. Divergent operating conditions may make different lubricant quantities and different lubricants necessary.

➤ In these cases, please consult **alpha getriebebau**.

7 Operating conditions rack & pinion

**CAUTION**

Too little lubrication damages then gearing.

- Make sure there always is enough lubrication and replace the greaser in time.

- Ensure the proper alignment between gearhead unit and rack.
- The guide carriage (horizontal) should be moveable by hand evenly in freewheeling (brake raised and regulator switched off).
- If there are any jams, then the distance between rack and carriage should be measured again by a dial gauge.

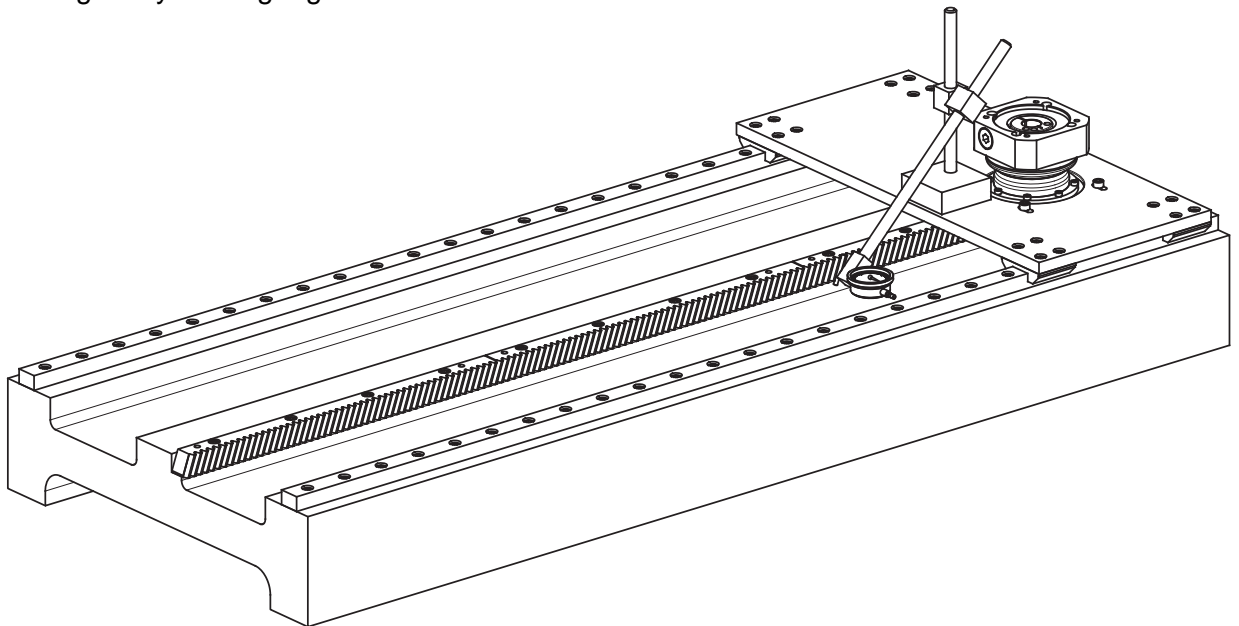


Fig. 7.1

8 Maintenance

8.1 Shutdown, preparation

- ➔ Please observe the instructions in Chapter 3.3.1 [“General safety instructions”](#).
- ➔ Shut down the machine in which the drive system is installed.
- ➔ Disconnect the machine from the mains before starting maintenance work.

8.2 Inspection schedule

Maintenance work / See Chapter...	Maintenance periods			
	At start-up	After 500 operating hours or 3 months	Every 3 months	Yearly
Visual inspection / 8.3.1	X	X	X	
Lubrication system inspection / 8.3.2	X	X	X	

Table 8.1

8.3 Maintenance work

8.3.1 Visual inspection

- ➔ Check the entire gear reducer by carrying out a thorough visual inspection for exterior damage and lubricant leakage.
- ➔ Repair or replace defective or leaky parts promptly.
- ☺ Please contact our technical service department if you have any maintenance questions (see 1.1).

8.3.2 Lubrication system inspection

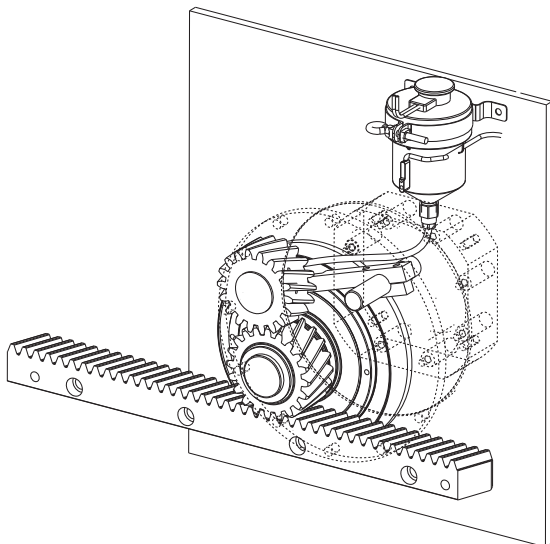


Fig. 8.1

- ➔ Check the entire lubrication system by carrying out a thorough visual inspection for exterior damage such as loosened or defective hoses and worn or soiled (clogged) lubricating felt pinions.
- ➔ Replace damaged or soiled ports promptly in order to ensure a steady lubrication.
- ☺ The service life of the lubricating felt pinion depends on the ambient conditions. In case the lubricating felt pinions wear and tear or soil quicker during their application, shorten the inspection intervals.

- ➔ Check the fill level in the greaser. If necessary replace the greaser immediately.
- ➔ Even if the indicator light of the battery is still flashing, the greaser ought to be replaced every two years for reasons of process reliability.

8.4 Startup after maintenance work

- ➔ Clean and grease the rack and the pinion.
- ➔ Assemble all safety devices.
- ➔ Do a test run before re-releasing the machine for operation.

8.5 Malfunction list (troubleshooting)

- ➔ Seek an immediate solution if you notice lubricant loss, increased noise during operation, or increased operating temperatures.

Error	Possible cause	Solution
Increased operating temperature	Dimensioning insufficient	Check the technical specifications.
	Motor is heating the gearhead	Check the wiring of the motor, replace the motor or provide adequate cooling
	Ambient temperature too high	Ensure adequate cooling
Increased noise during operation	Jammed motor / gearing unit	Please consult our technical service department.
	Damaged bearings	
	Damaged gear teeth	
	Jammed rack & pinion unit	
Loss of lubricant	Lubricant quantity too high	Wipe off discharged lubricant and continue to watch the gearhead and the lubricator. Lubricant discharge should stop after a short time.
	Leakages	Please consult our technical service department.

Table 8.2

9 Dismantling



DANGER!

Improperly executed work can lead to injury and damage.

- ➔ Make sure that the drive system pinion unit is only installed, maintained or dismantled by trained technicians.
- ☺ The removal of the gearhead can be found in the instructions for the gearhead.

9.1 Preparation

- ➔ Shut down the machine in which the drive system is installed.
- ➔ Make sure that it is possible to dismantle the drive system without hazard for the whole machine.
- ➔ Before starting work, disconnect the machine from the mains.

9.2 Remove rack

Unscrew all fastening bolts and loosen the racks with a suitable tool (see example Fig. 9.1) from the pin holders.

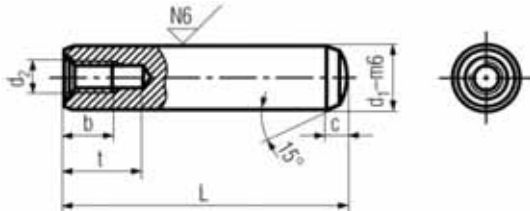


Fig. 9.1

Remove the racks carefully, so as to safeguard the drive system and adjacent parts against damage.

10 Disposal

If our product is no longer of use and you wish to dispose of it, refer to the instructions here. If you have any questions regarding ecological disposal methods, please consult our technical service department (see 1.1).

- ☺ If you should need supplementary information (e.g. disassembly, or disposal), please contact our technical service department (see 1.1).

10.1 Lubricants



Dangerous for the environment

Lubricants (oils and greases) are hazardous substances, which can contaminate soil and water.

- ☞ Dispose of the drained-off lubricant according to the valid national guidelines.
- ☞ Do not mix polyglycols with mineral oils that are meant for recycling.

10.2 Sealing rings

- ☞ Dispose of sealing rings as composite material (metal/plastic)

10.3 Metal

- ☞ Divide up the drive system, if possible, into:
 - iron
 - aluminium (e.g. adapter plate), and
 - non-ferrous heavy metal (e.g. motor windings).

11 Appendix

11.1 Operating manual lubricator

11.1.1 Safety

The following symbols are used in this operating manual to warn you of hazards:



DANGER!

This symbol warns you of danger of injury to yourself and others.



Attention

This symbol warns you of the risk of damage to the gearhead.



Environment

This symbol warns of environmental pollution risk.

11.1.2 Safe handling of lubricating grease

The material safety data sheet for MICROLUBE GB 0 is available upon request.



DANGER!

Contact with lubricating grease can cause irritations.

- Avoid longer and intensive skin contact. Take off soiled and soaked clothing immediately. After work clean and care for your skin.
- After contact with the eye: Rinse with plenty of water.
- After swallowing: Do not induce vomiting. Get to doctor.



DANGER!

Measures for fire fighting:

- Suitable extinguishing agents: Water spray, foam, dry powder, carbon dioxide (CO₂)
 - Unsuitable extinguishing agents: Full water jet
- A fire can release: Carbon monoxide, hydrocarbons
- Do not breath in explosion and fires gasses.
 - Usual measures in case of fires with chemicals.



Attention

Incompatibility with oxidants

- Do not store with oxidants.



Environment

- Do not release into the environment

11.1.3 Assembly preparations

- Clean and grease the lubrication points (e.g. entire rack).
- Install the lubricating felt pinion and the filled lubrication line.



Attention

➤ Connect without bubbles / avoid bubbling



Fig. 11.1

- Pull the plug from the greaser.
- Attach the greaser and connect it with the lubrication line.
- Take off the lid of the greaser (not threaded).

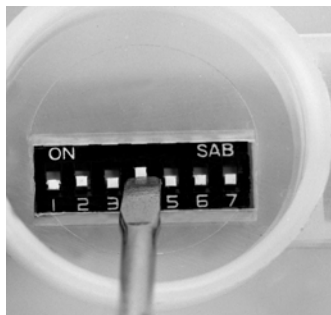


Fig. 11.2

- Set the lubricating time
(M = month. E.g. 6M = 6 months lubricating time)

The indicator light lights up about every 10 seconds as long as the greaser is switched on.

Battery capacity about 2400 milli-Amp.

Consumption for 1 year:

25 micro Amp. x 8640 h = 216 milli-Amp.

Function light:

8 micro Amp. x 8640 h = 69 milli-Amp.

Annual consumption = 285 milli-Amp.

thus more than 80 % reserve capacity remain

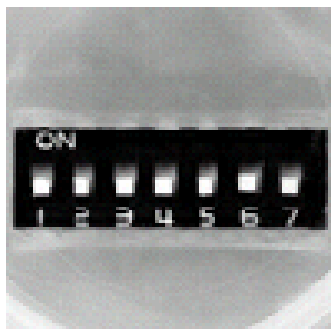


Fig. 11.3

- To switch off: Switch all switches to "off".
- To switch over: Set any switch.

Lubrication time changes or combinations of the switch times are possible (e.g. 2 + 6 months).
(refer to lubrication setting times in [Chapter 6](#))

11.1.4 Synchronisation with machine runtime

Greaser 125 ccm with micro switch

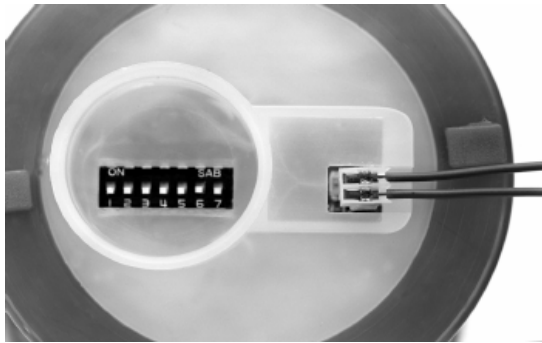


Fig. 11.4

- Setting like standard greaser without cables. Extend cable and connect to switch or contactor with floating contacts. No external power necessary.

Advantages:

Lubrication time changes or combinations of the switch times are possible (refer to page 2, setting combinations).

High reserve capacity:	=	2400 mA
Battery capacity about	=	2400 mA
Consumption in 1 year:	=	216 mA
25 micro Amp. x 8640 h	=	216 mA
Function light:	=	69 mA
8 micro Amp. x 8640 h	=	69 mA
Annual consumption	=	285 mA

- ☺ Before mounting the lubricator, lubricate the lubrication point generously with a grease gun. This ensures that the grease flow functions without a problem.

Greaser 475 ccm with cable connection

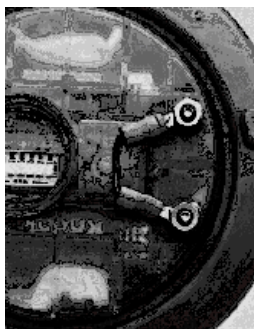


Fig. 11.5

Can be used normally with contact bridge

Externally controllable with cable connection, for that:

- Remove the contact bridge by the nuts.
- Attach the cable and connect it to a floating contact.

11.1.5 Pressure build-up times

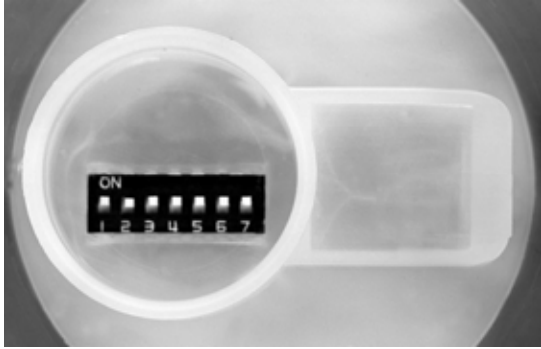


Fig. 11.6

The batteries need a certain lead time to build up the pressure. They initiate an electro-pneumatic reaction in a built-in nitrogen chamber and transfer the pressure by a bellows to the plunger. This chamber needs to be replaced at the end of the lubrication time.

Pressure build-up 1st possibility

Switch all switches to “on”. Pressure build-up time 6-8 hours. Then set the desired runtime. (Refer to Lubrication guide tables in [Chapter 6](#).)

Pressure build-up 2nd possibility

Simply set the desired runtime and mount. This results in the following pressure build-up times:

Setting times in months	1	2	3	6	12	18
DIP switch	1	2	3	4	5	6
Pressure build-up time in days	1	2	3	6	10	14

Table 11.1

Shortening the pressure build-up times by switchover is possible.

After this pressure build-up time the lubrication begins. Pressure remains intact even when the greaser should be switched of in the meantime.

When switched on, the lubrication commences immediately, because the pressure remains.

Immediate lubrication and safety control:

- ➡ Switch all switches to ON. Pressure build-up times about 6-8 hours.
- ➡ Then reset all switches and set the desired runtime.

Technical tips:

An extension by hose or pipe by up to about 0.5 metres for grease lubrication is possible. For oil lubrication 1 metre extension is possible. Fill line with lubricant before startup. The values of the lubrication tables vary in these cases, e.g. for oil filling set about 40 % longer runtime, because there is lesser resistance. For oil lubrication a check valve with 0.2 bar is recommended.

Technical specifications:

- Supply voltage (2 x 1.5 V) 3 V
- BSV 03 ATEX E 223
- Standard design: Varta Electric Power 8008 for group I and IIC T 3
- Special design: Varta Industrial Mignon / AA for group I and IIC T 4
- II 2G EEx ib IIC T4/T3
- I M2 EEx ib I
- For lubricator with cable connection there is no explosion protection



Attention

Ambient temperature max. -20 °C to max. +50 °C
 Avoid electro-static charging of the lubricator (e.g. rubbing with cloths or strong air drafts).



Attention

Older lubricating points are often soiled or the grease is gummy.
 If you retrofit a lubricating point with the greaser, clean the point first and wipe it with new grease. This should also be done at the transfer point (lubricating felt pinion). This ensures that the grease flow functions without a problem.

11.1.6 Lubrication guide

Lubrication guide I

How much grease is fed with the following setting times:

30	days setting time	=	4	ccm daily	=	till now	4	grease gun strokes
60	days setting time	=	2,1	ccm daily	=	till now	2	grease gun strokes
90	days setting time	=	1,3	ccm daily	=	till now	1,3	grease gun strokes
180	days setting time	=	0,7	ccm daily	=	till now	1/2	grease gun strokes
360	days setting time	=	0,35	ccm daily	=	till now	1/3	grease gun strokes

Table 11.2

Lubrication guide II

Conventionally lubrication has been:

daily	3-4	grease gun strokes	=	30 days	setting time of the greaser
every 2-3 days	3-4	grease gun strokes	=	60 days	setting time of the greaser
weekly	8-10	grease gun strokes	=	90 days	setting time of the greaser
bi-weekly	8-10	grease gun strokes	=	180 days	setting time of the greaser
monthly	8-10	grease gun strokes	=	360 days	setting time of the greaser

Table 11.3

Lubrication guide III

Depending on the conditions of usage it is possible to set the greaser with a micro switch to various emptying times (3, 6, 9, 12 or 24 months). Our recommendation for a constant movement speed of 90 m/min:

Module 2: 0.175 to 0.35 cm³ /day (24 months or 12 months)

Module 3: 0.35 to 0.7 cm³ /day (24 months or 12 months)

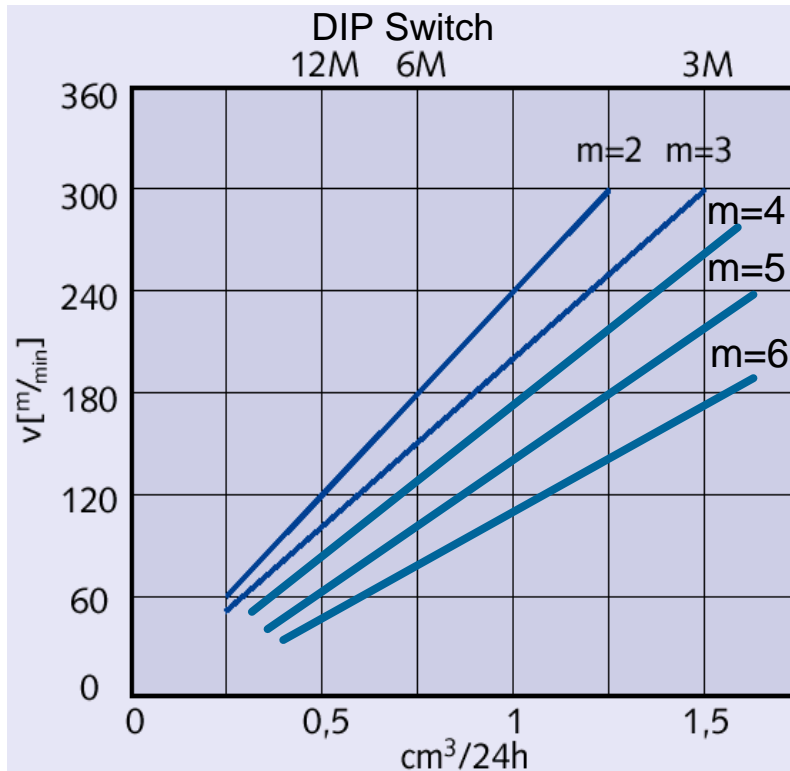


Fig. 11.7

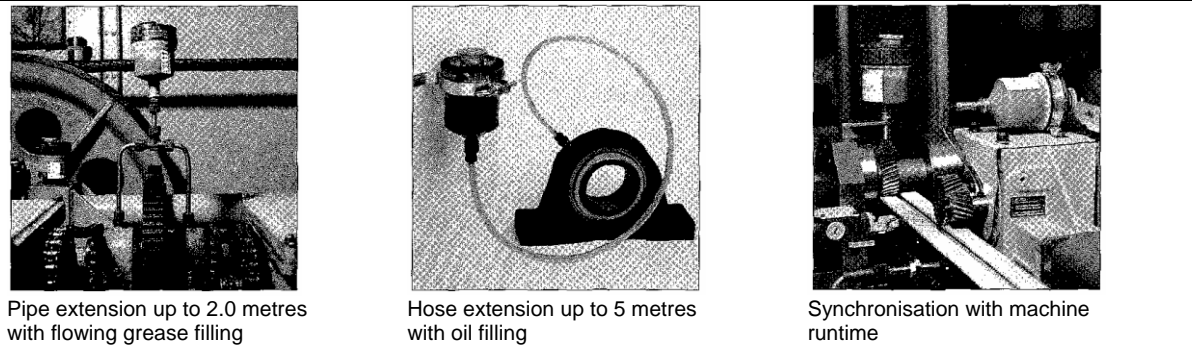
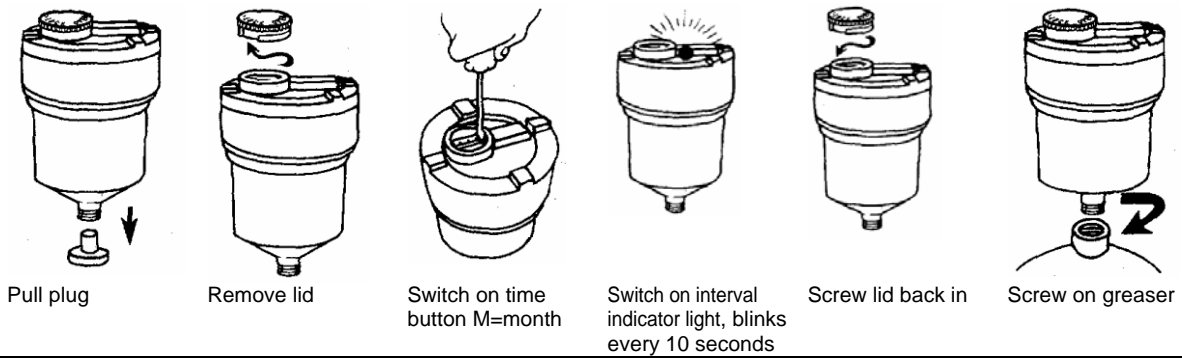
Setting combinations for lubricator

DIP switch Position	Lubricant quantities daily		Lubrication times for lubricator
Switch for ON. Indicator light lights up in brief intervals.			
	Type 125	Type 475	
6 = 18 M	0.175 cm ³	0.60 cm ³	18 months
5 = 12 M	0.35 cm ³	1.20 cm ³	12 months
4 = 6 M	0.70 cm ³	2.5 cm ³	6 months
3 = 3 M	1.30 cm ³	4.5 cm ³	3 months
2 = 2 M	2.10 cm ³	7.5 cm ³	2 months
1 = 1 M	4.00 cm ³	14 cm ³	1 month
All switches activated	9.00 cm ³	34 cm ³	14 days
Combinations:			
5 + 4	1.05 cm ³	3.5 cm ³	121 days
5 + 3	1.74 cm ³	8.5 cm ³	71 days
4 + 3	2.08 cm ³	15.8 cm ³	57 days
5 + 4 + 3	2.35 cm ³	30.5 cm ³	51 days
5 + 2	2.45 cm ³	13.4 cm ³	52 days
4 + 2	2.60 cm ³	6.0 cm ³	45 days
3 + 2	3.48 cm ³	28.0 cm ³	35 days
5 + 3 + 2	3.83 cm ³	8.5 cm ³	28 days
4 + 3 + 2	4.16 cm ³	23.1 cm ³	30 days
5 + 4 + 3 + 2	4.53 cm ³	7.3 cm ³	27 days
4 + 1	4.80 cm ³	9.1 cm ³	24 days
3 + 1	5.56 cm ³	16.8 cm ³	23.5 days
2 + 1	6.26 cm ³	14.5 cm ³	20 days
5 + 2 + 1	6.61 cm ³	30.0 cm ³	19 days
3 + 2 + 1	7.65 cm ³	12.2 cm ³	17 days
5 + 3 + 2 + 1	8.00 cm ³	26.8 cm ³	16 days
4 + 3 + 2 + 1	8.33 cm ³	19.5 cm ³	15 days
5 + 4 + 3 + 2 + 1	8.70 cm ³	22.0 cm ³	14.5 days



	Technical specifications:	Small greaser	Large greaser
	Weights: Height	100	150
	mm: Ø mm	80	115
	Content about cm ³	125	475
	Connection thread	R ¼"	R ½"
	Setting time	1 m, 2 m, 3 m, 6 m, 12 months	
	Weight	370 g	1000 g
	Generation of pressure	0.2 to 3 bar	
	Drive	2 x 1.5 V	4 x 1.5 V
	Temperature range	-20 °C to +50 °C	
	Battery capacity	about 2000 mA/hr.	about 4000 mA/hr.
	Battery consumption after one year	about 285 mA/hr.	about 800 mA/hr.
	Grease filling	Klüber Microlube GB 0	
	Reduction pieces	R ½" – R ¼"	
Accessories	Sensor kit, replacement greaser		

Assembly:



11.1.7 End-position detection at electronically controlled lubricator

Technical description for the empty sensor

➔ Mount the magnet sensor according to the figure 3 mm above the lower edge of the greaser. The magnet sensor determines the position of the pressing plunger and signals the condition “empty” (about 5 % grease or oil reserve until container completely empty) of the electronic lubricator to a signal emitter (e.g. signal light, loudspeaker) or its control.



Technical data for magnet field sensor (PNP normally open contact)

Characteristics

Rated switch field strength H_n	1.2 kA/m
Secured switch field strength H_n	≥ 1.2 kA/m
Hysteresis H	≤ 45 % of H_n
Temperature drift of the switch-on point	≤ 0.3 %/°C
Ambient temperature T_a	-25...+70 °C
Utilisation category	DC 13

Electrical data

Operating voltage U_B	10...30 V DC
Line voltage drop U_d at $I_e \leq 100$ mA	≤ 3.1 V
Rated insulation voltage U_i	75 V DC
Rated operational current I_e	200 mA
Idle current I_o alive / de-energised	≤ 30 mA/ ≤ 10 mA
Residue current I_r	≤ 80 μ A
Reverse battery protection	Yes
Short circuit proof	Yes
Permitted load capacity	≤ 1 μ F

Mechanical data

Type of protection acc. IEC 529	IP 67
Housing material	LCP
Connection type	Cable
Number of lines x line diameter	3 x 0.14 mm ²

Installation instructions / Terminal pin assignment for inductive switch:

<u>Pin</u>	<u>Colour</u>	<u>Connection</u>
Bu	Blue	- (negative) supply voltage, 10-30 V DC (direct voltage)
Bn	Brown	+ (positive) supply voltage, 10-30 V DC (direct voltage)
Bk	Black	Output (positive)

For example a light or a relay winding can be connected between pin bk (black) and pin bu (blue). If the switch is closed (yellow LED is lit), then the + (positive) signal of the supply voltage is applied, max. possible current of 200 mA, at 30 V supply voltage.

In this case for example the light or the relay winding between pin bk (black) and pin bu (blue) can be energised, which would cause the light to light up or the relay to close.

When connecting a relay, a protective diode should be connected over the relay winding, so that the inductive voltage that is induced in the relay in the drop mode is shorted so that it cannot destroy the switch.