

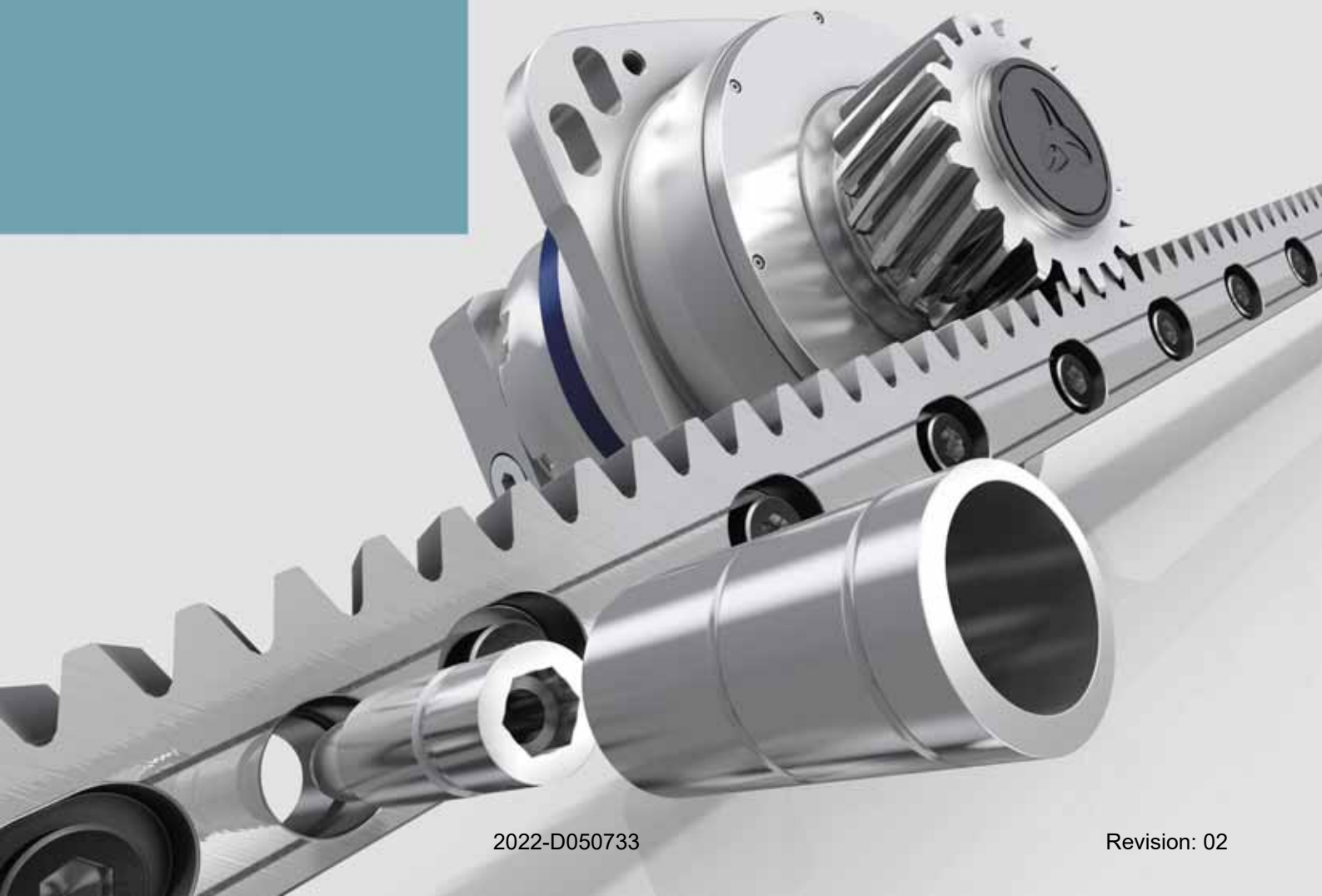


WITTENSTEIN

alpha

INIRA®

Assembly instructions



WITTENSTEIN alpha GmbH

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Utility film



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1 About this manual

This operating manual contains necessary information to safely and correctly install the racks.

The operator must ensure that this operating manual is read by all persons assigned to install, operate, or maintain the drive system, and that they fully comprehend its content.

In addition, the basic instructions for the "alpha rack and pinion system" (doc. no 2022-D001333), which contain additional important safety information, must also be read.

Store this manual within reach of the drive system.

Inform colleagues who work in the area around the machine about the **safety and warning notices** to avoid injuries.

The original instructions were prepared in German; all other language versions are translations of these instructions.

1.1 Information symbols and cross references

The following information symbols are used:

- Indicates an action to be performed
- ➡ Indicates the results of an action
- ① Provides additional information about the action

A cross reference refers to the chapter number and the header of the target section (e. g. 2.3 "Intended use").

A cross reference on a table refers to the table number (e. g. Table "Tbl-15").

1.2 Scope of delivery

- Check the completeness of the delivery against the delivery note.
- ① Missing parts or damage must be notified immediately in writing to the carrier, the insurance company, or **WITTENSTEIN alpha GmbH**.

2 Safety

These instructions, especially the safety and warning notices as well as the rules and regulations valid for the operating site, must be observed by all persons working with the racks.

The following, especially, must be strictly adhered to:

- Observe the instructions for transport and storage.
- Apply the racks exclusively in accordance with their intended use.
- Carry out maintenance and repair work appropriately and professionally in conformity with the specified intervals.
- Always mount, dismantle, and operate the racks properly (e.g. also test run only with lubrication).
- Operate the racks only with lubrication (type and amount).
- Prevent soiling of the racks.
- Only carry out modifications or reconstructions when these are approved in writing by the **WITTENSTEIN alpha GmbH**.

Personal injuries or material damage, or other claims arising from non-observance of these minimum requirements, are the sole responsibility of the operator.

In addition to the safety-related information in this manual, also observe any legal and otherwise applicable rules and regulations, particularly for accident prevention (e.g. personal safety equipment) and environmental protection.

2.1 EC/EU Directive

2.1.1 Machinery Directive

The racks are considered a "machine component" and are therefore not subject to the EC Machinery Directive 2006/42/EC.

Startup is prohibited within the area of validity of the EC directive until it has been determined that the machine in which these racks are installed corresponds to the regulations within this directive.

2.2 Personnel

Only technicians who have read and understood this operating manual may perform work on the racks. Based on their training and experience, technicians must be able to evaluate the tasks assigned to them in order to recognize and avoid risks.

2.3 Intended use

Racks are used to convert rotational motion to linear motion or vice versa and are intended to be installed in a machine.

- To avoid danger to the operator or damage to the machine, employ the racks only for their intended use and in a technically flawless and safe state.
- If you notice any altered operating behavior, check the racks in accordance with Chapter 8 "Malfunctions".
- Read the general safety instructions before beginning to work (see Chapter 2.5 "General safety instructions").

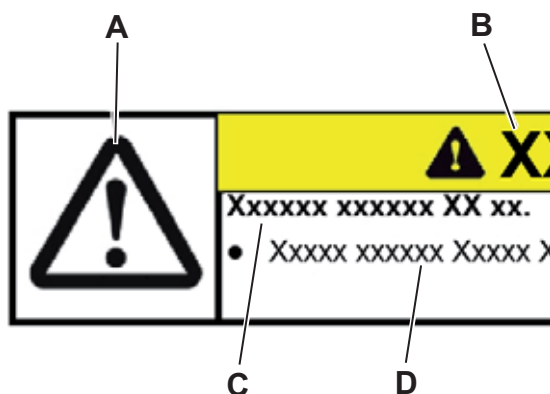
2.4 Reasonably foreseeable misuse

All applications other than the intended use specified, are deemed to be improper use and are therefore prohibited.

2.5 General safety instructions

	<p>The general safety instructions are contained in the basic operating manual "alpha rack and pinion system" (doc. no. 2022-D001333). Ignoring the safety instructions can lead to severe injuries or to damage to the racks and/or the machine in which these are fitted.</p>
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2.6 Structure of warning instructions



Warning instructions are situation-specific. They will be precisely where tasks are described in which dangers can arise.

The warning instructions in this manual are designed according to the following pattern:

- A** = Safety symbol
(see Chapter 2.6.1 "Safety symbols")
- B** = Signal word (see Chapter 2.6.2 "Signal words")
- C** = Type and consequence of the danger
- D** = Avoiding the danger

2.6.1 Safety symbols

The following safety symbols are used to indicate possible hazards, prohibitions, and important information:



General hazard



Environmental protection



Information

2.6.2 Signal words

The following signal words are used to indicate possible hazards, prohibitions, and important information:

	<p style="text-align: center;">⚠ DANGER</p> <p>This signal word indicates an imminent danger that will cause serious injuries or even death.</p>
	<p style="text-align: center;">⚠ WARNING</p> <p>This signal word indicates a potential hazard that could cause serious injuries and even death.</p>
	<p style="text-align: center;">⚠ CAUTION</p> <p>This signal word indicates a potential hazard that could cause minor or serious injuries.</p>
	<p style="text-align: center;">NOTICE</p> <p>This signal word indicates a potential hazard that could lead to material damage.</p>
	<p>A note without a signal word indicates application hints or especially important application hint for handling the rack.</p>

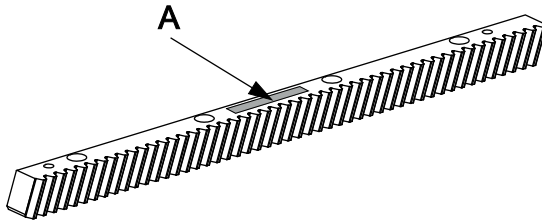
3 Description of racks

Depending on the application, a range of different rack variants are available.

For the assembly described in this operating manual, additional tools/materials are required.

- ① Additionally, **WITTENSTEIN alpha GmbH** offers a tool kit INIRA. Further information and the material number of the tool kit INIRA can be found in the "alpha Linear Systems" catalog.

3.1 Ordering code / Name plate



The ordering code (A) for the racks is located on the racks (e.g.: ZST 200-334-1000-R1C-35).

The name plate for the gearbox is located on the gear housing.

- ① More information is available in our catalog or at www.wittenstein-alpha.de.


4 Transport and storage

4.1 Packaging

The racks are delivered individually wrapped in VCI paper / protective foil and packed in cardboard boxes if necessary.

- Dispose of the packaging materials at the recycling sites intended for this purpose. Observe the applicable national regulations concerning disposal.

4.2 Transport

	⚠ CAUTION
	<p>If the rack falls, it could lead to severe injuries or to damage to the rack.</p> <ul style="list-style-type: none"> • Suitable hoisting equipment should be used when transporting heavy racks. • When using hoisting equipment, do not stand below the suspended load. • Wear protective gloves and safety shoes.

Details on the weight of the racks can be found in Chapter 9.1 "Weight of racks".

4.3 Storage

Store the racks at a temperature of 0 °C to +40 °C in the original packaging. Store the racks for no more than 2 years. Consult our Customer Service department if conditions are different.

For storage logistics, we recommend the "first in - first out" method.

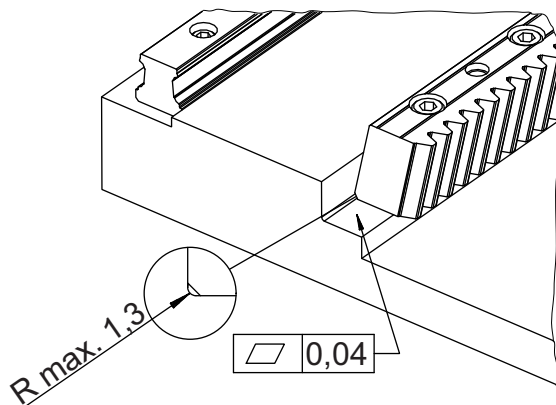
5 Assembly

- Read the general safety instructions before beginning to work (see Chapter 2.5 "General safety instructions").
- If you have questions about correct mounting, consult our Customer Service department.

5.1 Requirements in respect of installation location and mounting base

Requirements in respect of installation location:

- The racks must be installed in a clean and dry environment. Dust and liquids of any kind impair its function.
- The precision of installation and geometric tolerance of the assembly surfaces in the mounting base depend on the application. For applications with high requirements regarding positioning accuracy and smooth running, the aim should be to achieve low deviations. For applications with low requirements, greater deviation may be allowed.

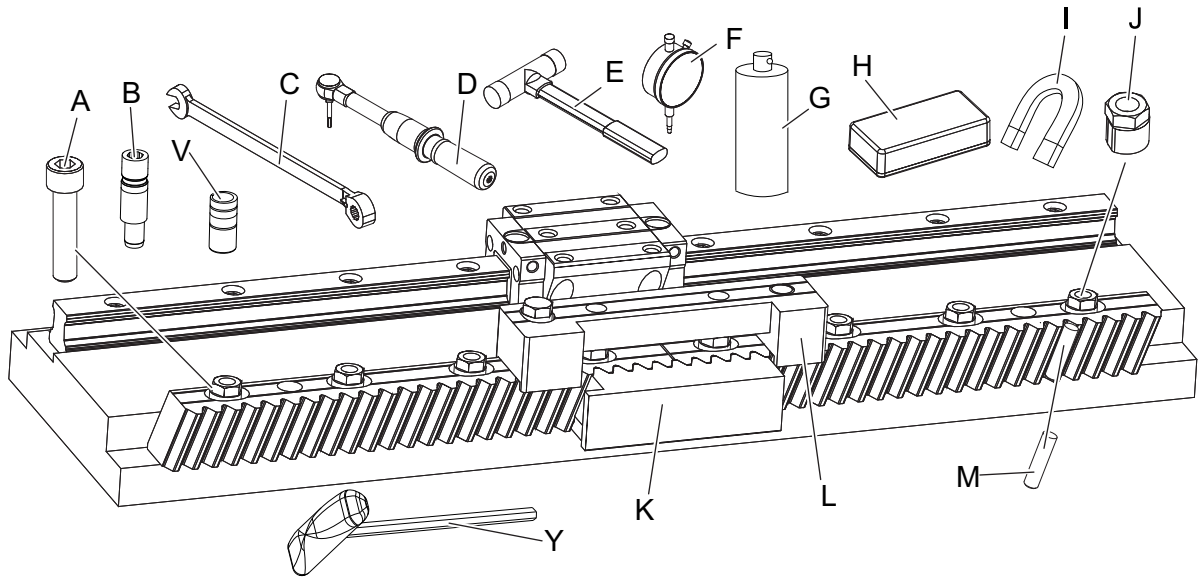


Requirements in respect of mounting base:

- The rack is designed with a chamfer at the transition point between the screw-on and stop surface. This allows the mounting base to be designed without recesses. The mounting base on the machine must be designed in such a way that the milling edge does not collide with the rack chamfer.
- The stop surfaces should not fall below a minimum height of 5 mm.
 - ① Information on the maximum permissible height of the stop surfaces can be found in Chapter 9.4 "Maximum height of the stop surface on the machine bed".
- The threaded holes for the fastening screws have to feature a sufficient screw-in depth depending on the material of the mounting base.
 - ① The necessary length of the fastening screws can be found in Chapter 9.2.1 "Overview of the required fastening screws".

5.2 Required tools and assembly material

Below is an overview of the tools/materials needed for assembly.



Pos.	Tool / Material	Task / Purpose	Additional information
A	Fastening screws (WITTENSTEIN alpha cylinder head screws)	To bold the racks to the screw-on surface	Included in the scope of delivery of the racks Required size, see Chapter 9.2.1 "Overview of the required fastening screws"
B	Mounting pins (part of the mounting kit MKP)	For efficient pinning of the racks to the mounting base (for INIRA pinning)	Included in the scope of delivery of the racks Required size, see Chapter 9.2.2 "Overview of the mounting kit MKP (mounting pin)"
C	Open-end wrench	To tension the assembly bushings (J)	Required width across flats, see Chapter 9.2.3 "Overview of tool sizes"
D	Torque wrench with hex key insert	To tighten the fastening screws (A)	Hex key size, see Chapter 9.2.3 "Overview of tool sizes"
E	Soft-head hammer	To tap in the racks afterwards / drive in mounting pins (B) and assembly bushings (V)	–
F	Dial gauge holder with dial gauge	To check the parallelism of the assembly surfaces and the assembled racks	Resolution: 0.01 mm
G	Cleaning agent	To clean the assembly surfaces	–
H	Dressing stone		–
I	Magnet	To magnetize the needle rollers (M)	–

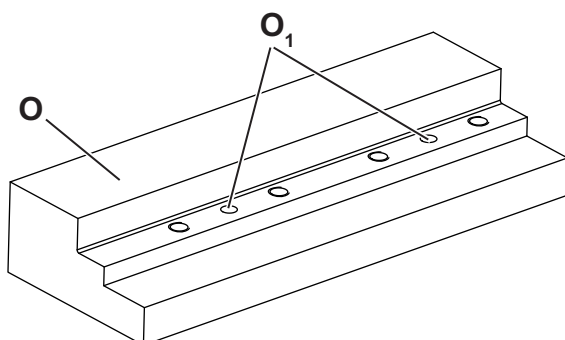
Pos.	Tool / Material	Task / Purpose	Additional information
J	Assembly bushings	To press the racks onto the stop surface	Included in the tool kit INIRA Further information and the material number can be found in the "alpha Linear Systems" catalog.
K	Assembly jig	To align the transition point between two racks	
L	Adjustment tool	For fine adjustment of the transition point between two racks	
M	Needle roller	To check the roll dimensions using a dial gauge	
V	Assembly bushings (part of the mounting kit MKP)	For efficient pinning of the racks to the mounting base (for INIRA pinning)	–
Y	Hexagon socket screwdriver	To hold the fastening screws (A) / align mounting pins (B) and assembly bushings (V)	–

Tbl-1: List of necessary tools/materials

5.3 Preparations

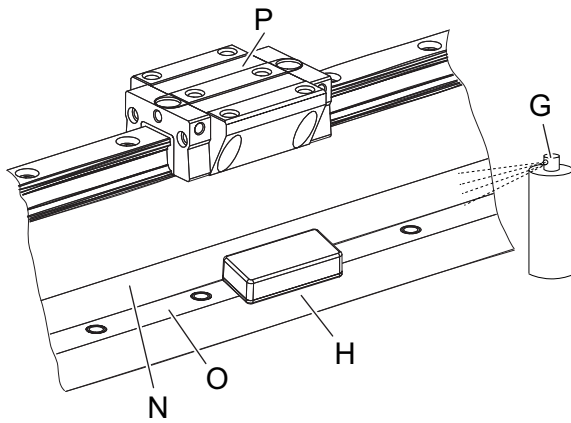
	<h2>⚠ CAUTION</h2>
	<p>If the rack falls, it could lead to severe injuries or to damage to the rack.</p> <ul style="list-style-type: none"> • Suitable hoisting equipment should be used when transporting heavy racks. • When using hoisting equipment, do not stand below the suspended load. • Wear protective gloves and safety shoes.
	<ul style="list-style-type: none"> • Observe the safety and processing instructions of the cleaning agent to be used.

- Unpack the racks to be assembled and remove the VCI paper or protective foil in which the racks are packed.
- Check the ordering codes (see Chapter 3.1 "Ordering code / Name plate") of all racks. Use only racks with the same ordering code for the same application.
 - ① Always enter the ordering code when ordering spare parts in order to receive precisely coordinated racks and pinions.

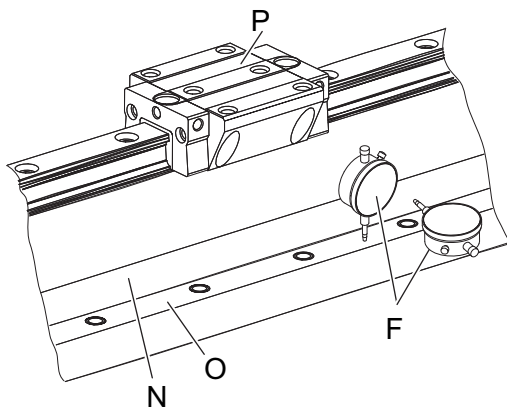


The pin bores (O_1) of the mounting base (O) for installing the rack in the machine can already be drilled to final dimension during the manufacturing process. Thus there is no need for machining during installation of the rack.

- ① For the bore diameter and minimum depth of pin bores, see Chapter 9.3 "Specifications for mounting onto a mounting base".
 - ① The position of the pin bores (O_1) can be found in the "alpha Linear Systems" catalog or the dimensional drawing of the respective product.
- ① You can find the dimensional drawing of your rack on our website at www.wittenstein-alpha.de or contact our Customer Service.

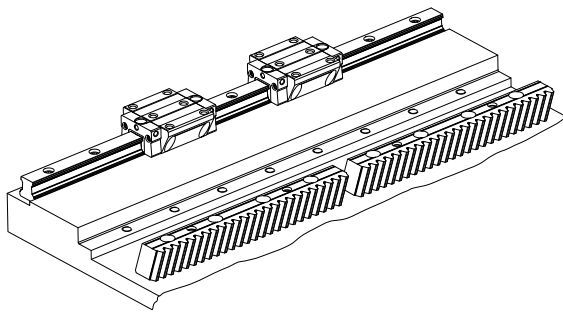


- Remove all traces of the anti-corrosion agent before mounting the racks. Use a clean, lint-free cloth and a grease-dissolving, non-aggressive cleaning agent.
- Clean the stop surface (N) and the screw-on surface (O) with a dressing stone (H), a suitable cleaning agent (G), and a lint-free cloth.



- Check the parallelism between the stop surface (N) / screw-on surface (O), and the linear guide (P) with a dial gauge (F).
 - ① For permissible tolerances, see Chapter 5.1 "Requirements in respect of installation location and mounting base".

5.3.1 After the cleaning

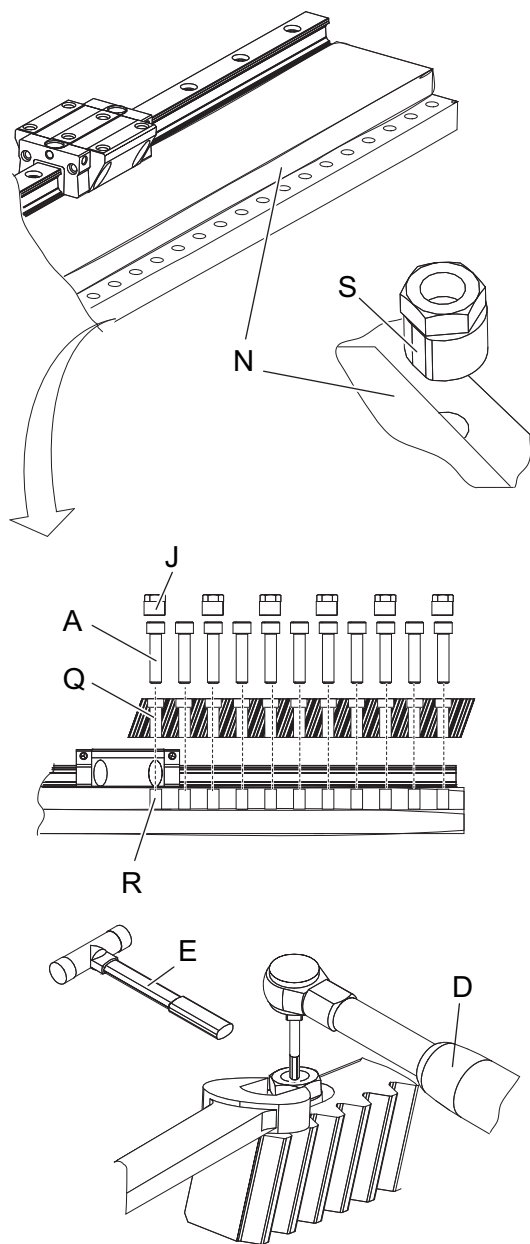


Uneven temperatures between the rack and mounting base can have a considerable impact on the smooth running and positioning accuracy of the drive system.

- Place the unpacked racks on the mounting base in adequate time before assembly in order to allow the temperatures to equalize.

5.4 Mounting the racks

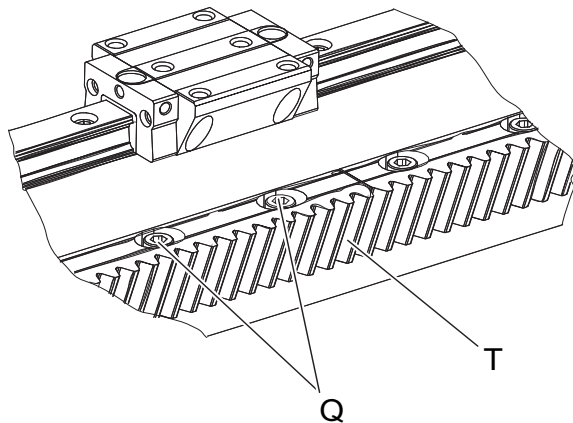
5.4.1 Assemble first rack with INIRA clamping



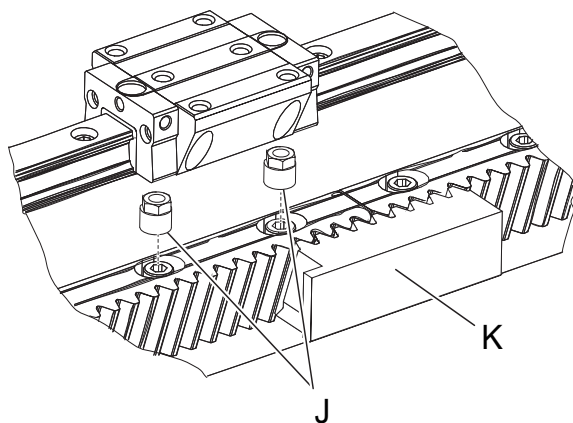
- Position the first rack in the middle of the machine bed.
 - ① The through-holes (Q) of the rack have to be centered above the corresponding threaded holes (R) of the screw-on surface.
- Insert the fastening screws (A).
 - ① To secure the screws, we recommend using a threadlocker (e.g. Loctite 243).
- Position the fastening screws free of backlash (with no tightening torque).
- Place the assembly bushings (J) in the following positions on the heads of the fastening screws, with the flat side (S) facing in the direction of the stop surface (N).
 - ① Place the assembly bushings on the first and last fastening screws.
 - ① Also on every second fastening screw or at least every 125 mm (depending on the hole pattern).
- Tighten all assembly bushings counterclockwise with an open-end wrench one after the other.
 - ① For the necessary tightening torque: see Chapter 9.2.4 "Tightening torques for assembly bushings".
- Proceed uniformly from one end of the rack to the other.
 - ① While doing so, hold the cylinder head screws in place with the hex key (D), to prevent them from loosening.

- Tap the tooth crests with a soft-head hammer (E) along the entire rack to ensure even positioning of the rack.
- Tighten all fastening screws that do not have an assembly bushing one after the other, using the required tightening torque (see Chapter 9.9 "Tightening torques for common thread sizes in general mechanical engineering").
- Tighten all fastening screws that have assembly bushings one after the other, using the required tightening torque.
 - ① Use an open-end wrench to keep the assembled assembly bushings in place while doing so to prevent them coming loose.
- Loosen and remove the corresponding assembly bushing with an open-end wrench after tightening each fastening screw.
 - ① While doing so, keep the fastening screw in place with the torque wrench/hex key so that it does not come loose.
- Check the tightening torque of all fastening screws again after loosening all assembly bushings and, if necessary, retighten the screws.

5.4.2 Assembling subsequent racks

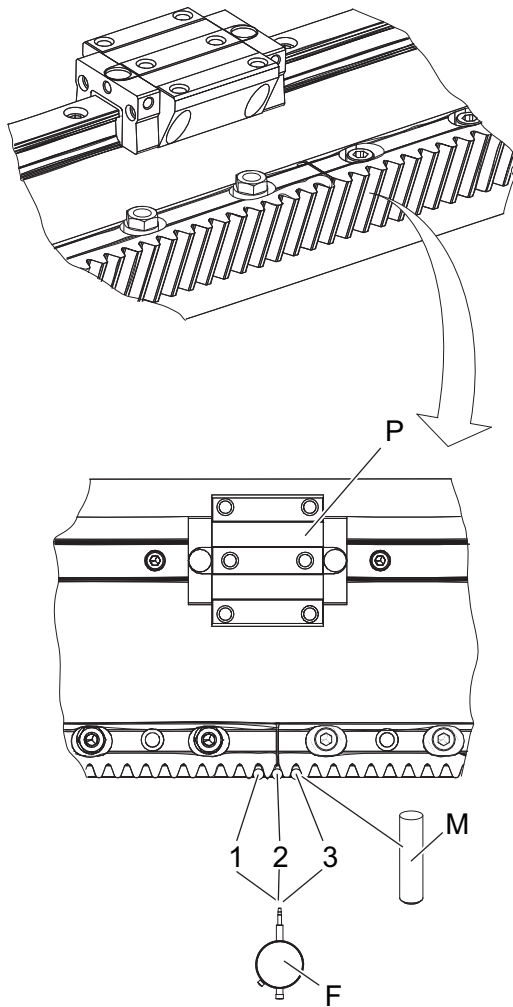


- Position the rack (T) to be assembled beside the previously assembled rack.
 - ① Make sure the through-holes of the rack are centrally above the corresponding threaded holes of the screw-on surface.
- Insert a fastening screw into the first two through-holes (Q) beside the joint.



- Insert the assembly jig (K) into both racks at the joint as shown in the diagram, in order to adjust the transition between the two racks.
- Position the fastening screws without backlash (with no tightening torque).
- Place the assembly bushings (J) on the two screw heads and tension the assembly bushing as described for the first rack.

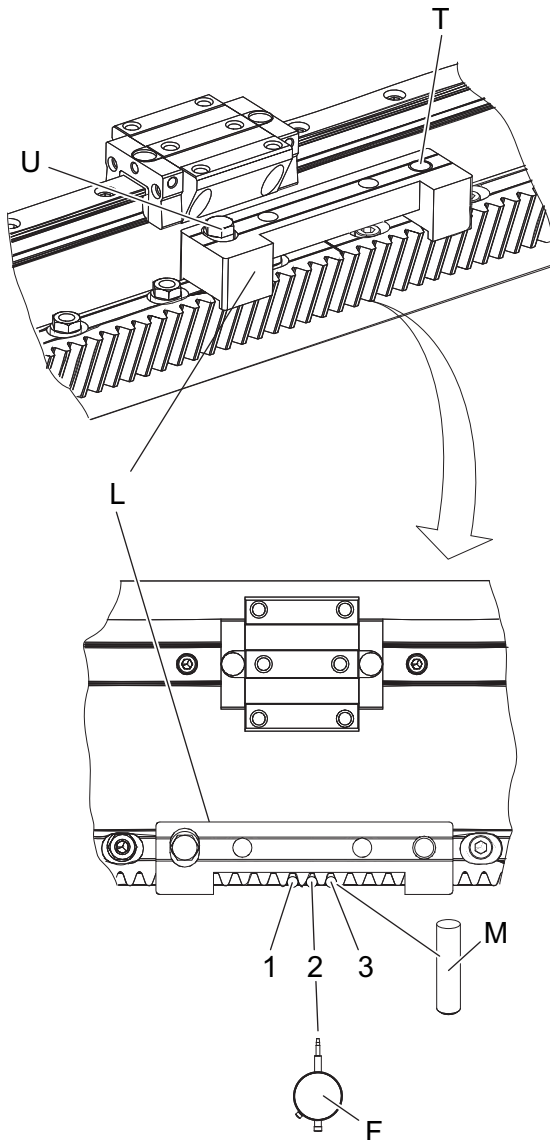
5.4.3 Checking the transition between the racks



- Magnetize the needle rollers (M) with a suitable magnet.
- Insert the magnetized needle rollers into positions 1, 2 and 3, as shown in the diagram.
 - ① Due to the magnetization, the needle rollers remain attached to the positions.
- Attach the dial gauge holder to the guiding carriage (P) and insert the dial gauge.
- Measure the highest point at each of the needle rollers at position 1 and position 3 using the dial gauge (F) and calculate the midpoint of the two points.
 - ① The midpoint is the target value for the highest point of the needle roller at position 2.
 - ① Maximum permissible deviation in height from position 1 to position 3: see Chapter 9.6 "Permissible roll size fluctuation at the rack transition"
- Measure the highest point of the needle roller at position 2 with the dial gauge.
- If the value falls within the range of tolerance, assemble the remaining screws in the rack as described for the first rack.
 - ① Make sure that an assembly bushing is tensioned at the first and last fastening screw as well as at least at every second fastening screw or every 125 mm in between.
- If the value falls outside of the range of tolerance, correct the transition between the two racks as described in the following section.

5.4.4 Correct the transition between the racks with INIRA adjusting

- Carry out the following steps in case the transfer between the racks exceeds the tolerance range.

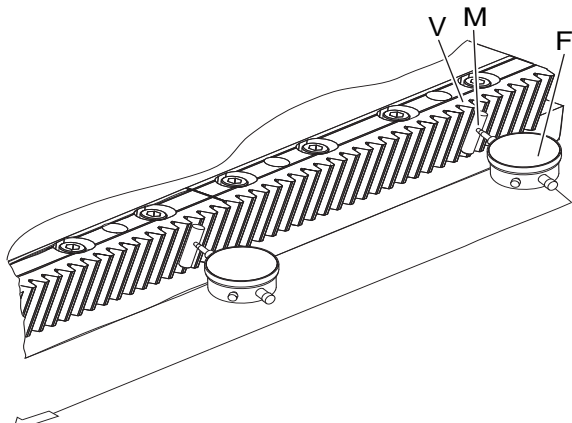


- Position the adjustment tool (L) on the two racks, as shown in the adjacent diagram picture.
 - ① Do not make any changes to the dial gauge holder and dial gauge (F), so as not to lose the previously-set zero position.
- Place the centering pin (T) of the adjustment tool (L) and the eccentric bolt (U) into the fitting bores of the two racks to be aligned to each other.
- Move towards the highest point of the needle roller in position 2.
- Set the target value for the roll size on the needle roller in position 2 by turning the eccentric bolt (U) on the adjustment tool.
- Tighten the screws below the two assembly bushings with the required tightening torque (keep a hold of the eccentric bushing).
- Remove the adjustment tool (L).
- Remove the two assembly bushings on the rack with the open-end wrench.
- Assemble the remaining screws in the rack as described for the first rack.
 - ① Make sure that an eccentric bushing is mounted at the first and last fastening screw and at least at every 125 mm in between.

5.4.5 Mounting additional racks

- Mount all additional racks in the same manner as described in the sections above.

5.5 Checking the parallelism of all racks



- Attach the dial gauge holder to the guiding carriage and move this to the end of the axle.
- Place a magnetized needle roller (M) if possible at the outer end of the axle into a tooth gap.
- Move the dial gauge (F) towards the highest point of this needle roller and set the dial gauge to "0".
- Mark the measurement value at the measuring point (V) (reference point) with a pin on the rack.
- Insert at least 5 further needle rollers into tooth gaps at regular intervals per 1000 mm of axle length.

- Check the deviation from the reference point with the dial gauge.
 - Mark the deviation from the reference point at each measuring point.
 - ① For permissible deviations within an axis, see Chapter 9.7 "Permissible roll size fluctuation within an axis".
 - Identify the highest point of measurement of the entire axle and mark this.
 - ① This measuring point is necessary for the correct adjustment of the gearing backlash between the pinion and the rack.
- Further information can be found in the basic operating manual "alpha rack and pinion system" (doc. no. 2022-D001333).

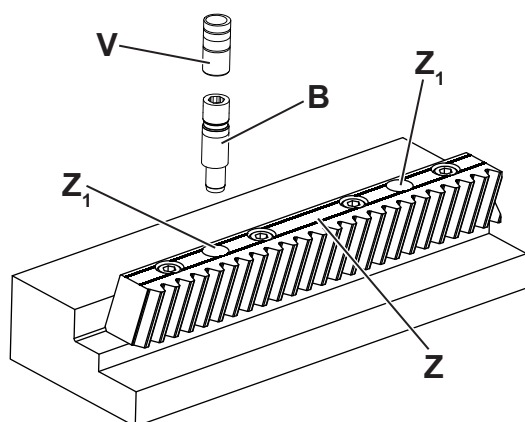
5.6 Pinning the racks

5.6.1 Pinning the racks (conventional)

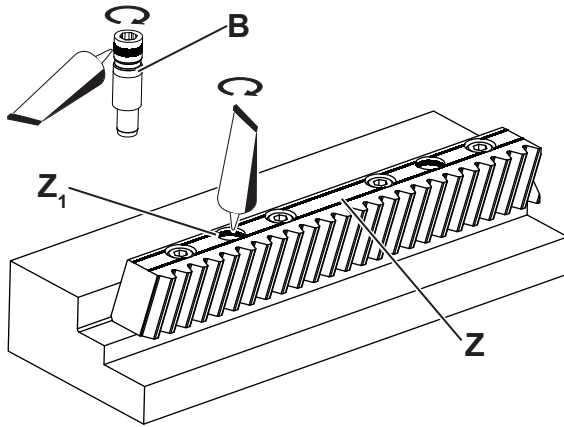
No conventional pinning is intended for this type of rack.

5.6.2 Pinning the racks with INIRA pinning

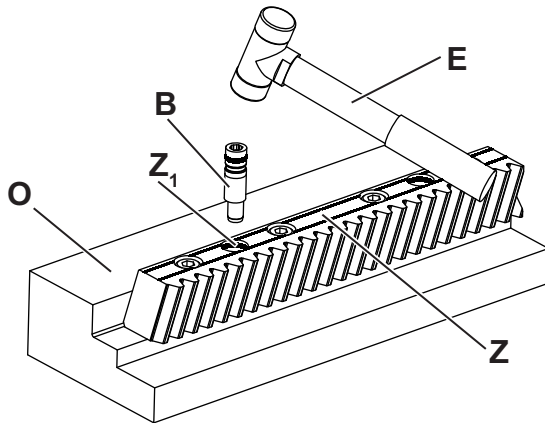
	<ul style="list-style-type: none"> ● Observe the safety and processing instructions for the threadlocker to be used.
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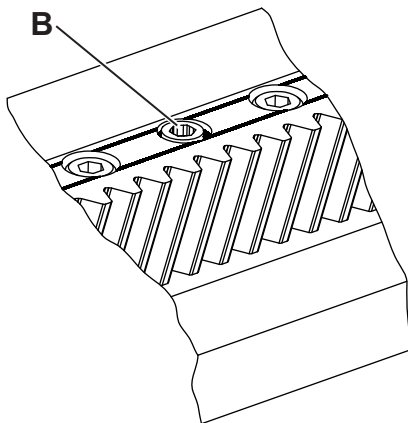
- Clean/Degrease and dry the following components using a clean and lint-free cloth, and a grease-dissolving, non-aggressive cleaning agent:
 - Mounting pins (B)
 - Assembly bushings (V)
 - Pin bores (Z_1) of the racks
- ① The mounting pins (B) and assembly bushings (V) are included in the scope of delivery.



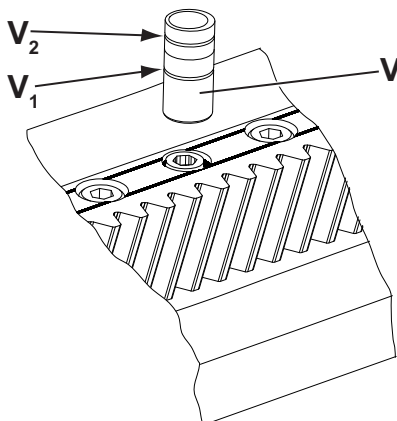
- ① Only use the mounting pins included in the scope of delivery for pinning the racks.
- Apply threadlocker all around the upper part of the pin bore (Z₁) and the mounting pin (B) (e.g. Loctite® 243).



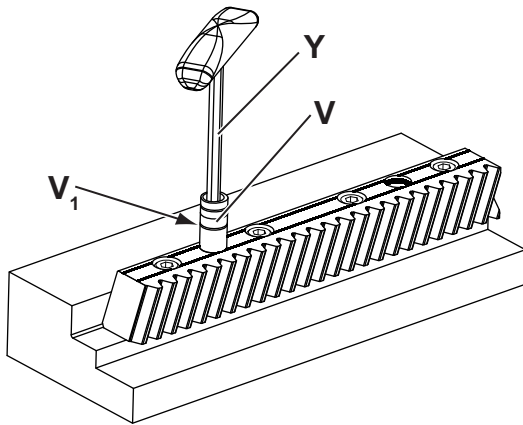
- Push the mounting pin (B) through the pin bore (Z₁) and insert it into the pin hole of the mounting base (O).
- Tap in the mounting pin (B) with a soft-headed hammer (E).



- ➡ The mounting pin (B) has to be flush with the upper edge of the rack.



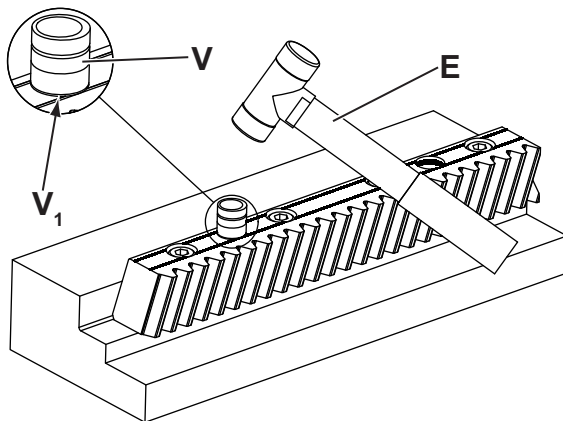
- ① Only use the assembly bushing (V) included in the scope of delivery for pinning the racks. The assembly bushing has two identification grooves (V₁, V₂) on the top side.
- Place the assembly bushing, with the identification grooves facing upward, between the pin bore and the mounting pin.



- Push a hex key (Y) through the assembly bushing (V) and insert it into the hex socket of the mounting pin.

① Size hex socket mounting pin, see Chapter 9.2.2 "Overview of the mounting kit MKP (mounting pin)".

- Turn the assembly bushing and mounting pin in opposite directions with slight axial pressure until the assembly bushing slides between the joint surfaces of the mounting pin and the pin bore of the rack.



- Press in the assembly bushing by hand until the lower identification groove (V_1) has reached the upper edge of the pin bore.

- Tap in the assembly bushing (V) with the soft-headed hammer (E).

➡ The assembly bushing has to be flush with the top edge of the rack.

- Repeat the steps above for all other pin bores.

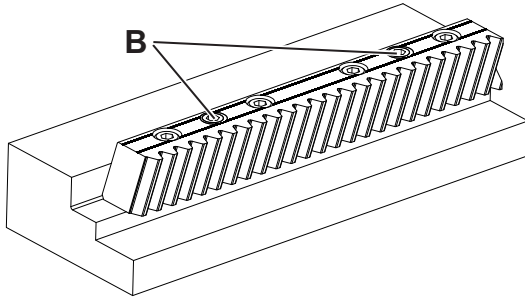
6 Startup and operation

- Read the general safety instructions before beginning to work (see Chapter 2.5 "General safety instructions").
- Ensure that the racks are always well lubricated during startup and operation.
 - ① Further information can be found in the basic operating manual "alpha rack and pinion system" (doc. no. 2022-D001333).

7 Maintenance and disposal

- Read the general safety instructions before beginning to work (see Chapter 2.5 "General safety instructions").


7.1 Disassembly / replacement



- ① To allow easy disassembly, the mounting pins have an interior thread.
- Remove the mounting pins (B) with an appropriate pulling device.
 - ① Size interior thread, mounting pin, see Chapter 9.2.2 "Overview of the mounting kit MKP (mounting pin)", Table "Tbl-4".
 - ① Mounting pins that are undamaged may be used again.


- Loosen all fastening screws and remove the rack.
- Remove the rack with care, so as to safeguard the drive train and adjacent parts against damage.
 - ① For information on the assembly of the new rack: see Chapter 5 "Assembly".


7.2 Disposal

	⚠ CAUTION
	<p>Solvents and lubricants are flammable, can cause skin irritation, and can pollute soil and water.</p> <ul style="list-style-type: none"> • Use protective gloves to avoid direct skin contact with solvents and lubricants. • Use and dispose of the cleaning solvents and lubricants properly.

- Remove all deposits of lubricant from the individual racks.
- Dispose of the lubricant deposits and the racks at the appropriate disposal sites.
 - ① Observe the applicable national regulations concerning disposal.

8 Malfunctions

	NOTICE
	<p>Changed operational behavior can be an indication of existing damage to the drive train or can cause damage to the drive train.</p> <ul style="list-style-type: none"> • Take action immediately if lubricant loss, increased operating noise, increased operating temperatures, frictional corrosion on tooth flanks, broken teeth, or position deviations become noticeable within the travel path. • Do not put the drive train back into operation until the cause of the malfunction has been rectified.

	<p>Rectifying of malfunctions may only be done by specially trained technicians.</p>
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- ① Further information can be found in the basic operating manual "alpha rack and pinion system" (doc. no. 2022-D001333).

9 Appendix

9.1 Weight of racks

Weight of racks [kg]					
Length [mm]	Module 2 mm	Module 3 mm	Module 4 mm	Module 5 mm	Module 6 mm
167	0.7	-	-	-	-
250	-	1.5	-	-	-
333	1.4	-	-	-	-
480	1.9	2.7	4.7	-	-
500	2.1	3	-	6.5	9.9
506	-	-	5.4	-	-
960	-	-	-	-	-
1000	4.1	5.9	10.7	13.1	19.9
1500	6.2	8.9	-	19.5	27.1
2000	8.2	11	21.4	26	36.2

Tbl-2: Weight

9.2 Information for mounting the racks

9.2.1 Overview of the required fastening screws

The special fastening screws with optimized screw heads are included in the scope of delivery of the racks. Make sure that the correct screw length is selected when ordering.

The required screw lengths depend on the shearing strength τ_B of the internal thread material. Screws of the property class 12.9 are used.

Rack module [mm]	$\tau_B > 200 \text{ N/mm}^2$		$\tau_B > 300 \text{ N/mm}^2$	
	Fastening screw	Material number	Fastening screw	Material number
2	M6x35	20059051	M6x30	20058979
3	M8x45	20059052	M8x35	20058980
4	M10x55	20059053	M10x45	20058981
5	M12x65	20059054	M12x60	20058982
6	M16x80	20059055	M16x70	20058983

τ_B = Shearing strength of the internal thread material

Tbl-3: Overview of the required fastening screws

9.2.2 Overview of the mounting kit MKP (mounting pin)

Rack module [mm]	Mounting kit	Material number	Hex socket [mm]	Internal thread [mm]
2	MKP ZST 200	20064392	Size 5	M4
3	MKP ZST 300	20064393	Size 6	M5
4	MKP ZST 400	20064394	Size 8	M6
5	MKP ZST 500	20064395	Size 10	M8
6	MKP ZST 600	20064396	Size 10	M8

Tbl-4: Mounting kit

9.2.3 Overview of tool sizes

Tool	Rack module [mm]				
	2	3	4	5	6
Fastening screw width across flats (Hex socket)	5	6	8	10	14
Assembly bushing width across flats (Hex head)	SW10	SW13	SW17	SW19	SW24

Tbl-5: Overview of tool sizes

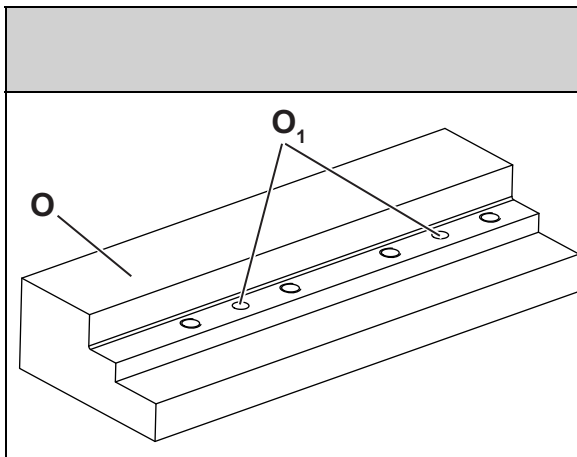
9.2.4 Tightening torques for assembly bushings

The specified tightening torques must be complied with when tensioning the assembled rack through the assembly bushings (see Chapter 5.4 "Mounting the racks"):

Assembly bushing	Tightening torque
MZST M6	3 ± 0.5
MZST M8	4.5 ± 0.5
MZST M10	7 ± 1
MZST M12	8 ± 1
MZST M16	11 ± 1

Tbl-6: Tightening torques for assembly bushings

9.3 Specifications for mounting onto a mounting base

	Rack module [mm]	Pin bore \varnothing (O_1) x depth [mm] x [mm]
		2
	3	8 H7 x 14
	4	10 H7 x 18
	5	12 H7 x 23
	6	16 H7 x 23

Tbl-7: Specifications for mounting onto a mounting base

9.4 Maximum height of the stop surface on the machine bed

The maximum permissible height of the stop surfaces must not exceed the following values:

Rack module [mm]	Max. stop surface height [mm]
2	16
3	19
4	26
5	33
6	39

Tbl-8: Maximum height of the stop surface on the machine bed

9.5 Permissible parallelism deviation of the assembly surface

Rack module [mm]	Parallelism deviation [μm]		
	Requirements in respect of positioning accuracy and smooth running		
	High	moderate	Low
2	10	15	30
3			
4			
5			
6			

Tbl-9: Permissible parallelism deviation of the assembly surface

9.6 Permissible roll size fluctuation at the rack transition

Rack module [mm]	Measurement over pins deviation [μm]		
	Requirements in respect of positioning accuracy and smooth running		
	High	moderate	Low
2	10	15	25
3	15	20	40
4	15	20	45
5	20	25	45
6	20	25	50

Tbl-10: Recommended roll size deviation between two neighboring tooth gaps at the rack transition

9.7 Permissible roll size fluctuation within an axis

Rack module [mm]	Roll size deviation [μm]		
	Requirements in respect of positioning accuracy and smooth running		
	High	moderate	Low
2	30	45	85
3	35	50	100
4	40	55	110
5	40	60	120
6	40	60	120

Tbl-11: Recommended roll size deviation between two neighboring tooth gaps at the rack transition

9.8 Overview of the assembly accessory kit

The assembly accessory kit is needed for the rack assembly and is not included in the scope of delivery of the racks.

The assembly accessory kit includes:

- Assembly jig
- Adjustment tool
- Assembly bushings
- Needle rollers / Cylinder rollers

Further information can be found in the "alpha Linear Systems" catalog or our website at www.wittenstein-alpha.de

9.9 Tightening torques for common thread sizes in general mechanical engineering

The specified tightening torques for set screws and nuts are calculated values and are based on the following conditions:

- Calculation in accordance with VDI 2230 (February 2003 version)
- Friction value for thread and contact surfaces $\mu=0.10$
- Utilization of the yield stress 90%
- Torque tools type II classes A and D in accordance with ISO 6789

The settings are values rounded to usual commercial scale gradations or setting possibilities.

- Use the **exact** values in this table to set your tools.

	Tightening torque [Nm] with thread												
Property class screw / nut	M3	M4	M5	M6	M8	M10	M12	M14	M16	M18	M20	M22	M24
8.8 / 8	1.15	2.64	5.2	9.0	21.5	42.5	73.5	118	180	258	362	495	625
10.9 / 10	1.68	3.88	7.6	13.2	32.0	62.5	108	173	264	368	520	700	890
12.9 / 12	1.97	4.55	9.0	15.4	37.5	73.5	126	202	310	430	605	820	1040

Tbl-12: Tightening torques for set screws and nuts

Revision history

Revision	Date	Comment	Chapter
01	31.03.14	New version	All
02	07.12.18	INIRA pinning	All



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