

Modification instructions

Version 1.4.7

Adapter kit CNC milling machine BF16 Vario / BF20 Vario / BF20L Vario



Keep for future reference!

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1 Packing list

Bezeichnung <i>Designation</i>	CNC - Anbausatz MK F 20 PD BF20 Vario; BF20L Vario
Artikelnummer Anbausatz <i>Item No. adapter kit</i>	357 0020
Netto Gewicht <i>Net weight</i>	5,6 kg
Brutto Gewicht <i>Gross weight</i>	6,3 kg
Abmessung (L x B x H) <i>Dimension (L x W x H)</i>	320 x 285 x 80 mm

Nr. <i>No</i>	Bezeichnung <i>Description</i>	Artikelnummer <i>Item No.</i>	Teile Nr. <i>Part N o.</i>	Grösse <i>Size</i>	Abbildung <i>Illustration</i>	Stck. <i>Qty.</i>
1	Gehäuse für Z - Achse <i>Driver housing for Z axis</i>	359 0201	BF20CNC-01			1
2	Gehäuse für X , Y - Achse <i>Driver housing for X , Y axis</i>	359 0202	BF20CNC-02			2
3	Montagering X - Achse <i>Assembly ring</i>	359 0203	BF20CNC-03			1
4	Stützhülse <i>Support sleeve</i>	359 0204	BF20CNC-04			2
5	Zahnriemenscheibe für Welle Z - Achse <i>Toothed belt disk for shaft Z axis</i>	359 0205	BF20CNC-05	36 Zähne/teeth, HTD-18-3M-9 ZL 103		1
6	Zahnriemenscheibe für Welle X , Y - Achse <i>Toothed belt disk for shaft X , Y axis</i>	359 0206	BF20CNC-06	30 Zähne/teeth, HTD-18-3M-9 ZL 103		2
7	Zahnriemenscheibe für Motor X , Y - Achse <i>Toothed belt disk for motor X , Y axis</i>	359 0207	BF20CNC-07	24 Zähne/teeth, HTD-18-3M-9 ZL 103		2

Nr. No	Bezeichnung Description	Artikelnummer Item No.	Teile Nr. Part No.	Grösse Size	Abbildung Illustration	Stck. Qty.
8	Zahnriemenscheibe für Motor Z - Achse <i>Toothed belt disk for motor Z axis</i>	359 0208	BF20CNC-08	18 Zähne/teeth, HTD-18-3M-9 ZL 103		1
9	Abdeckplatte Antriebsgehäuse <i>Housing cover gear case</i>	359 0209	BF20CNC-09			3
10	Abdeckplatte Z-Achse <i>Housing cover Z-axis</i>	0357002010	BF20CNC-10			1
11	Schraube <i>Screw</i>	-	GB70	M6 x 45		2
12	Schraube <i>Screw</i>	-	GB70	M6 x 25		1
13	Schraube <i>Screw</i>	-	GB70	M6 x 12		4
14	Zahnriemen <i>Gear belt</i>	359 0211		3M-9 255 Zähne/teeth		3
15	Schraube <i>Screw</i>	-	GB70	M4 x 8		12
16	Schraube <i>Screw</i>	-	GB70	M5 x 12		12
17	Schraube <i>Screw</i>	-	GB77	M4 x 5		6
18	Schrittmotor Z-Achse, X-Achse, Y-Achse <i>Step motor Z axis, X axis, Y axis</i>	357 3304		23H280-01EA 2,2 Nm 3A 40V		3
19	Kabel <i>Cable wire</i>	359 0212		4 x 0,75mm ²		9m

Prüfer: <i>Verified by:</i>		Datum: <i>Date:</i>	
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2 Safety warnings (warning notes)

2.1 Classification of hazards

We classify the safety warnings into various levels. The table below gives an overview of the classification of symbols (pictograms) and warnings for the specific danger and its (possible) consequences.

Picto-gram	Alarm expres-sion	Definition/Consequences
	Danger!	Imminent danger that will cause serious injury or death to personal.
	WARNING!	Risk: A danger that might cause serious injury or death to personal.
	CAUTION!	Danger of unsafe procedure that might cause injury to personal or damage to property.
	ATTENTION!	Situation that could cause damage to the machine and product and other types of damage. No risk of injury to personal.
	INFORMATION	Application tips and other important or useful information and notes. No dangerous or harmful consequences for personal or objects.

In the case of specific dangers, we replace the pictogram by



2.1.1 Glossary of symbols

	gives additional advices
	enumerations

2.2 Proper use



WARNING!

In the event of improper use of the add-on pieces, it

- will endanger the user,
- will endanger the machine and other material property of the operator or user,
- may affect proper operation of the machine.

The add-on pieces as conversion kit are provided for the computer-aided - CNC, Computerised Numerical Control - milling operations of your machine.

The drive of the step motors may also be performed manually with a control unit (potentiometer).

Improper use!

The milling machine with the adapter kit must only be placed and operated in dry and ventilated rooms.

The hand wheels need to be disassembled.

If the adapter kit is used in any way other than described above or modified without approval of the company Optimum Maschinen Germany GmbH the adapter kit is no longer properly used.

We do not take liability for any damage caused by improper use.

We would like to stress that any modifications to the construction, or technical or technological modifications that have not been authorised by Optimum Maschinen GmbH will also render the guarantee null and void.

2.3 Required auxiliary material

- Means of shaft lock-down device "Loctite 648, join the shaft".
- The designation of the parts in the assembly description corresponds to the numbering of the packing list.
- In order to degrease the shaft, a cleaner for brakes or a corresponding cleaning agent is required.
- A tenacious grease e.g. Mobilux 3 or a corresponding lubricating grease serves to grease the bearings.

Required tools:

- lubricating oil for thread cutting, twist drill 5mm,
- counter sink; screw tap M6, manual drilling machine, calliper gauge,
- a set of Allen keys, set of fork wrenches, blow-back proof plastic tip hammer,
- box wrench 13mm, screw driver, tongs, chipping spanner,
- soldering iron with accessories, abrasive cloth, small chisel (you may also use a small screw driver).

3 Assembly

CNC conversion kit MK F 20 PD

3.1 Assembly X axis

3.1.1 Disassemble the self-locking nut and the shim of the left handwheel of the X axis.

3.1.2 Remove the handwheel with a blow-back proof plastic tip hammer with smooth knocks. Turn the handwheel at the same time.

unscrew the
handwheel of the X
axis

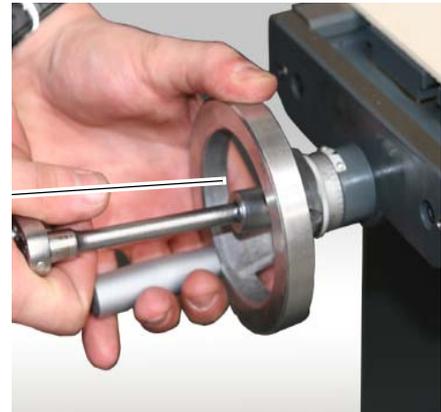


Fig.3-1: Handwheel on the left

3.1.3 Remove the rivet of the nonius with a hammer and a small chisel (or use a screw driver as chisel).

3.1.4 Grind off the relief with an abrasive cloth in order to facilitate the mounting of the assembly ring.

grinding of the relief

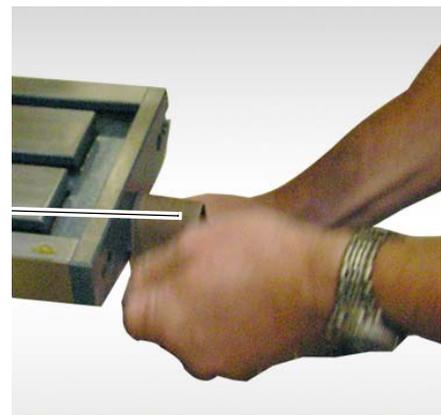


Fig.3-2: Grinding



INFORMATION

The axial deep groove ball bearing of the milling machine table has to be disassembled on the right side and reassembled on the left side. The bushing of the milling machine table has to be disassembled on the left side and reassembled on the right side.

- 3.1.5 Modify the axial deep groove ball bearing and the bushing.
- 3.1.6 Shift the assembly ring (No. 3) with the slot downward on the relief - if required - with slight beats of the hammer with a blow-back proof plastic tip hammer.
- 3.1.7 Beat on the assembly ring until a small collar is being formed (2 to 3mm). In this place the housing will centre later on.

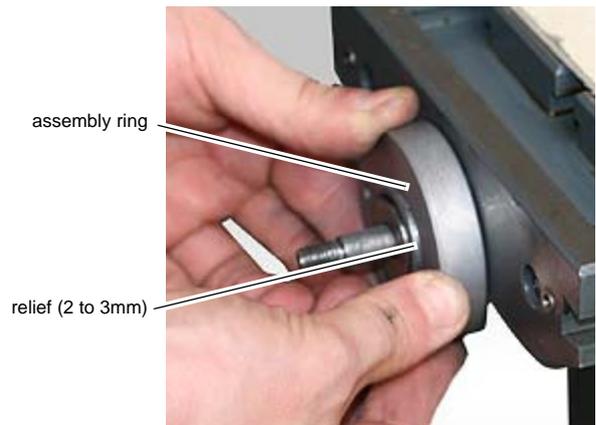


Fig.3-3: Assembly ring

- 3.1.8 Do not clamp the assembly ring yet! (The ring should be positioned as parallel as possible).
- 3.1.9 Mount the pulley of the toothed belt (No. 6) on the shaft.
- 3.1.10 Fasten the pulley of the toothed belt with the nut and shim of the handwheel.
- 3.1.11 Do not fasten the nut too much otherwise the shaft might clamp.
- 3.1.12 Check if the shaft is running well by turning the pulley of the toothed belt.

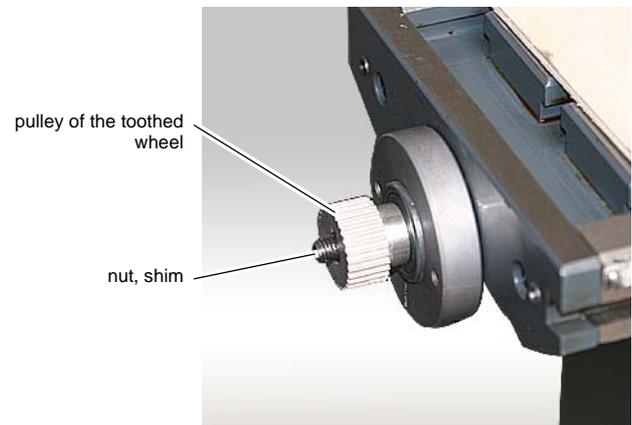


Fig.3-4: Pulley of the toothed wheel X axis

- 3.1.13 If the shaft is too tight, detach the nut a little.
- 3.1.14 Uniformly fasten the housing (No. 2) with the screws (No.12) on the assembly ring.
- 3.1.15 The housings differ in the diameter of the through hole. The hole for the Z axis is a little larger.

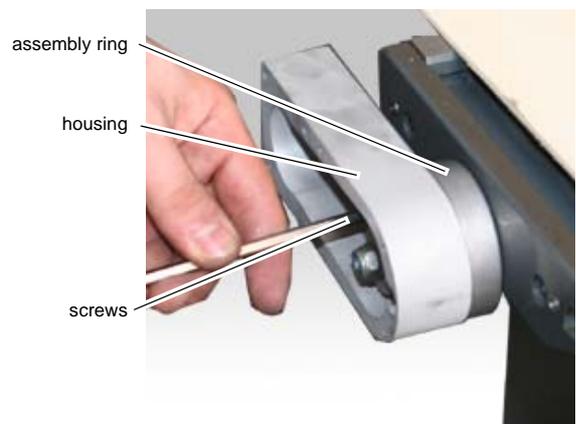


Fig.3-5: Assemble housing

- 3.1.16 Horizontally aline the housing with a blow-back proof plastic tip hammer.



Fig.3-6: Aline the housing

- 3.1.17 Fasten the assembly ring with a screw (No. 11).

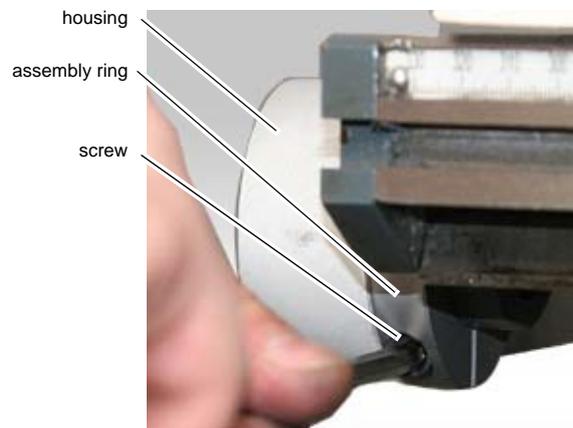


Fig.3-7: Assembly ring



CAUTION!

Danger by catching or winding up.

- 3.1.18 The right handwheel needs to be disassembled. It is not sufficient to have the handle disassembled.

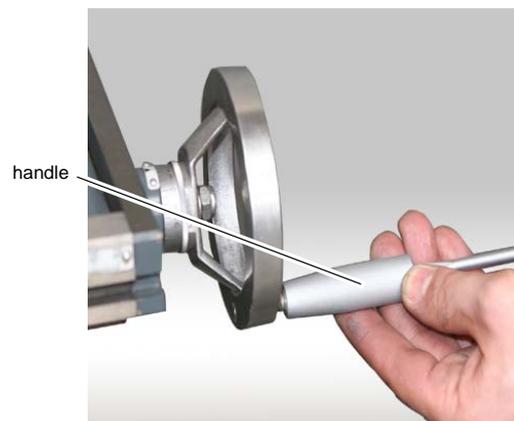


Fig.3-8: Right handwheel

- 3.1.19 Assemble the step motor as described under  "Installation of step motors" on page 19.

3.2 Assembly Y axis

3.2.1 Disassemble the self-locking nut and shim of the handwheel.

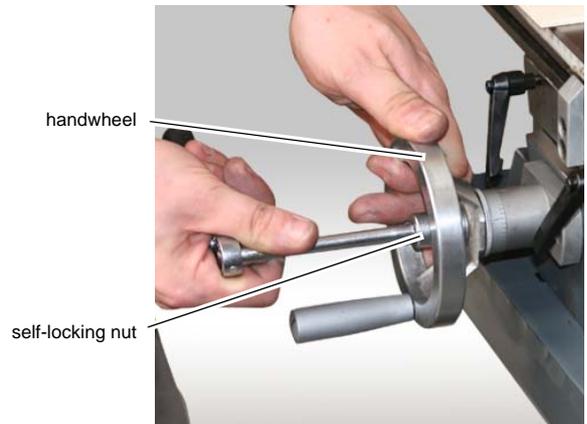


Fig.3-9: Diemndwheel Y axis 1

3.2.2 Remove the handwheel with a blow-back proof plastic tip hammer with smooth knobs. Turn the handwheel at the same time.

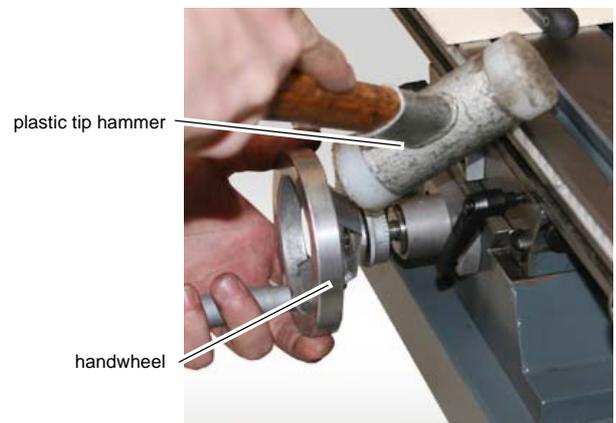


Fig.3-10: Disassembly handwheel Y axis 2



CAUTION!

Do not fasten the self-locking screw with force. Allow enough clearance for the spindle (air, clearance).

3.2.3 Mount the pulley of the toothed belt (No. 6) on the shaft and fasten it with the self-locking nut and the shim of the handwheel.

3.2.4 Control if it is running well by turning the pulley of the toothed belt manually.

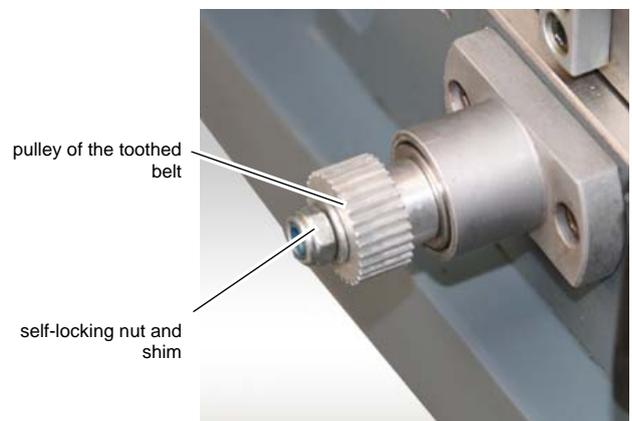


Fig.3-11: Assembly of the pulley of the toothed belt Y axis



CAUTION!

Do not turn the shaft after loosening the screws.

3.2.5

Remove the screws for the pillow block of the handwheel.



Fig.3-12: Remove screws



CAUTION!

Always fasten the screws uniformly so that the housing will not jam.

3.2.6

Assemble housing (No. 2) with screws (No. 10).

3.2.7

The two supporting bushings (No. 4) need to be inserted between the housing and the pillow block. The smaller diameter of the supporting bushing needs to be oriented to the machine!

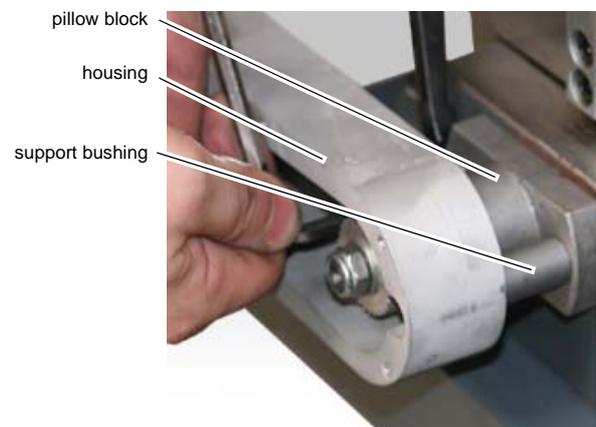


Fig.3-13: Assembly housing

3.2.8

Mount the step motor as described under  "Installation of step motors" on page 19.

3.3 Assembly Z axis



CAUTION!

Imperatively clamp the Z axis, otherwise, the whole milling head will slide downward as soon as you remove the nut of the Z axis.



INFORMATION

For machines from model 2006 the fastening holes of the housing are already provided in the lid of your machine. Therefore, it is not required to disassemble the lid with the nut from the Z axis.

3.3.1 Wind the milling head in the Z axis completely up.

3.3.2 Clamp the Z axis with the clamping levers!

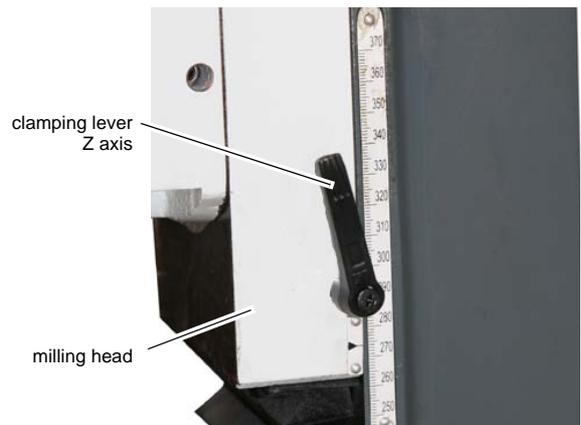


Fig.3-14: Clamp Z axis

3.3.3 Disassemble the covering of the groove nuts.

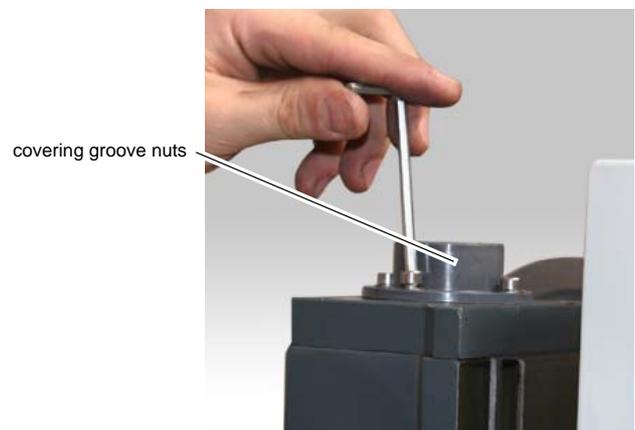


Fig.3-15: Disassemble covering

- 3.3.4 Remove the two nuts of the shaft with a sickle spanner.

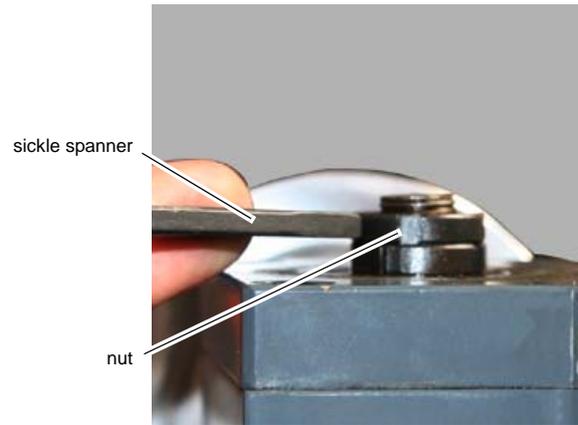


Fig.3-16: Disassemble nut

- 3.3.5 Unscrew the screws from the lid and remove the lid.

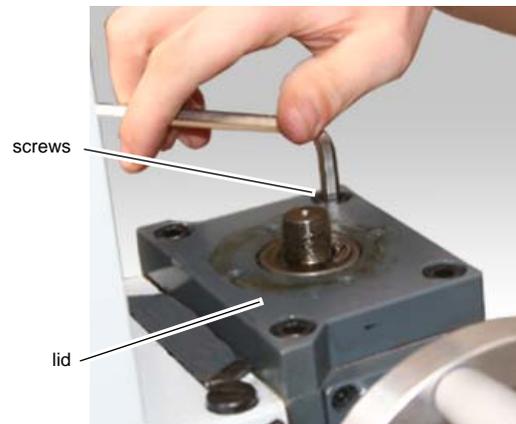


Fig.3-17: Disassemble lid

- 3.3.6 Remove the bearings from the lid.
- 3.3.7 In order to avoid soiling put the bearing on a clean cloth and protect it from dust.
- 3.3.8 Before inserting the axial deep groove ball bearing, grease it again.

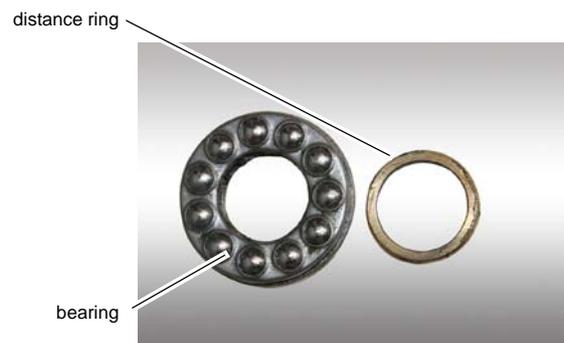


Fig.3-18: Bearing

- 3.3.9 Mark the holes on the covering plate in a way that the assembled housing will be at an angle of 45° degrees to the right if you look at the machine from the rear.

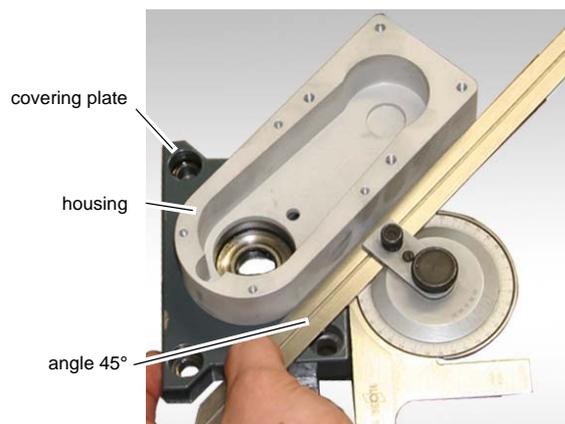


Fig.3-19: Mark the holes

- 3.3.10 In order to determine the distance between the holes of the housing, simply put the housing on the covering plate and align the holes of the housing and of the lid to one another (screw-hole circle 50 mm).

- 3.3.11 Mark the holes with a felt pen.

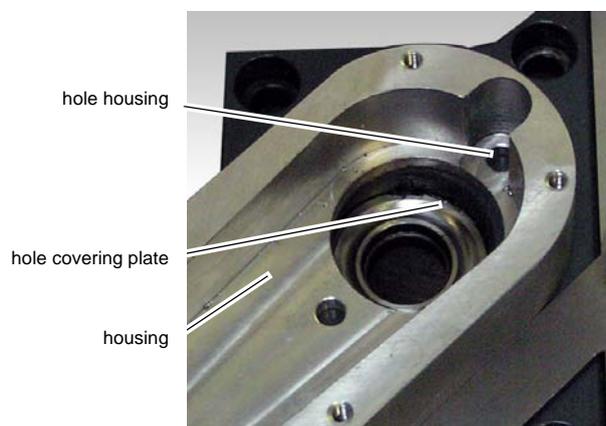


Fig.3-20: Align holes

- 3.3.12 Mark the holes which you had previously marked with a felt pen with a center punch now (see red framed marking on the illustration).

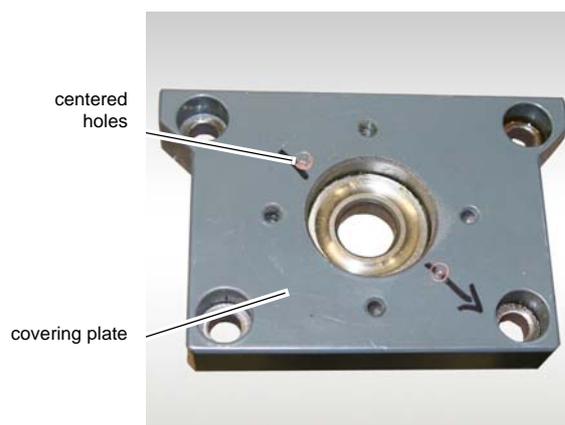


Fig.3-21: Center the holes

3.3.13 Drill holes of 5 mm into the covering plate with a core hole drill.

3.3.14 When both holes are drilled deburr the holes with a counter sink.

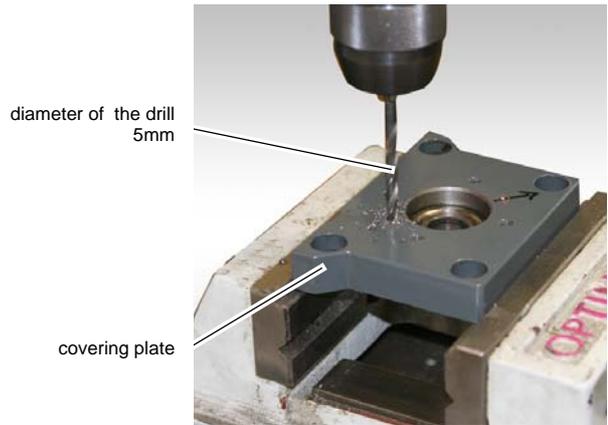


Fig.3-22: Drill holes

3.3.15 Cut a thread M6 into the lid. Make sure that the screw tap is placed at a right angle.

3.3.16 Use cutting oil when threading.

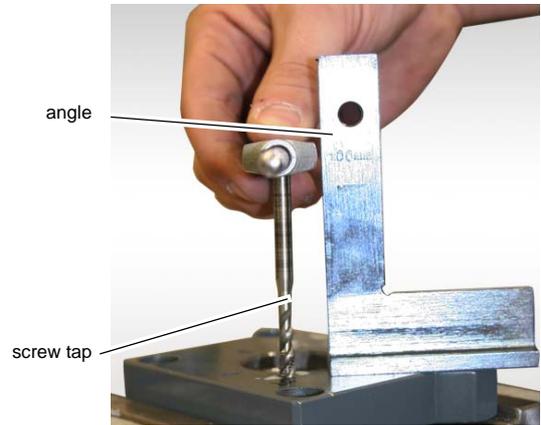


Fig.3-23: Threading

3.3.17 Thoroughly clean the covering plate after threading (seat of the bearing and thread) in order to prevent from latter damages.

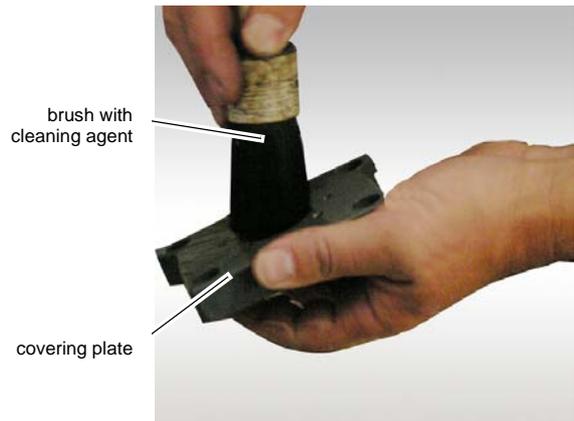


Fig.3-24: Clean covering plate

- 3.3.18 Grease the seat of bearing of the shaft with grease for bearings. Do not use any spray grease as this grease tends to resinify.

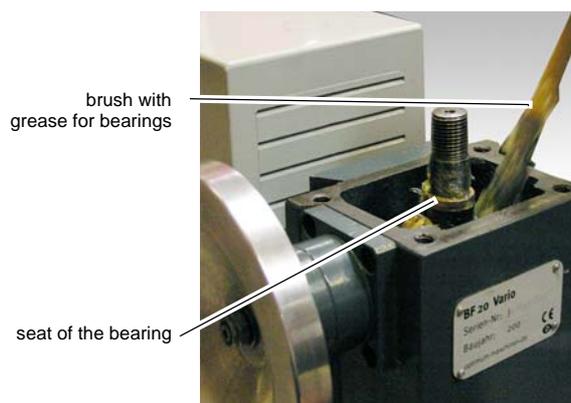


Fig.3-25: Greasing

- 3.3.19 Mount the covering plate and insert the bearing into the seat of the bearing. Grease the bearing.

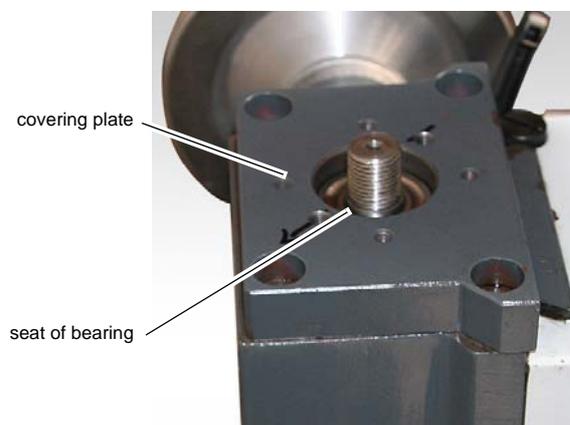


Fig.3-26: Covering plate

- 3.3.20 Uniformly screw down the lid with four screws. The milling head has to be at the top position.

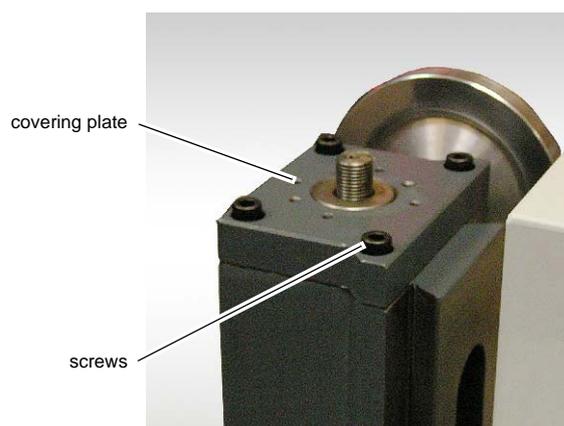


Fig.3-27: Tighten the covering plate

- 3.3.21 Grease the thread of the shaft and pulley part 5, apply means of securing (join shaft) to the thread.
- 3.3.22 Screw the groove nut on the shaft (hand-tight).
- 3.3.23 Detatch the clamping of the axis and check the clearance by actuating the handwheel and by moving the machine on the axis.
- 3.3.24 If required detach the nut a little more if the shaft is too tight.

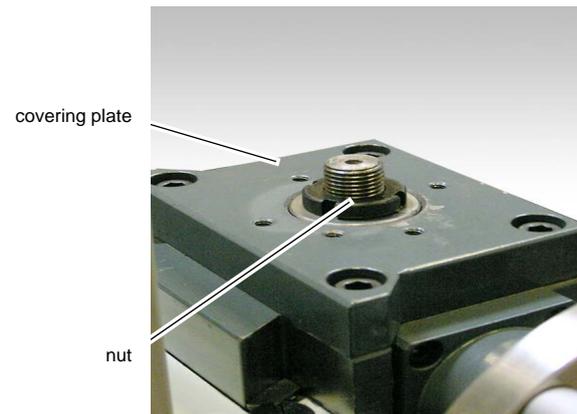


Fig.3-28: Clearance of the shaft

- 3.3.25 Screw the pulley item 5 on the shaft, hold the nut with the sickle spanner and tighten the pulley with a wrench.
- 3.3.26 Then control the clearance once again, if required, losen the nut of the shaft a little.

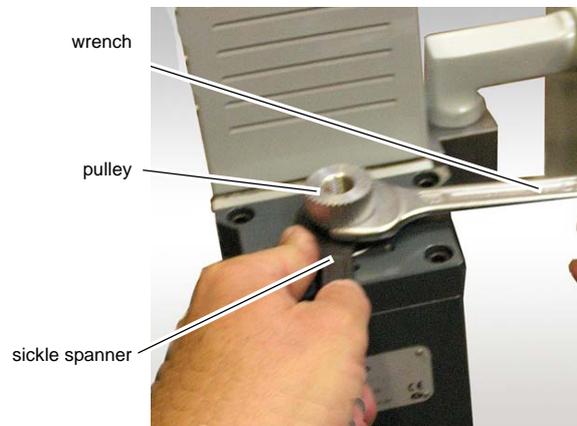


Fig.3-29: Assemble pulley

- 3.3.27 Mount housing item 1 and tighten it with screws item 12.
- 3.3.28 The housings differ in the diameter of the through hole. The hole of the Z axis is a little larger.

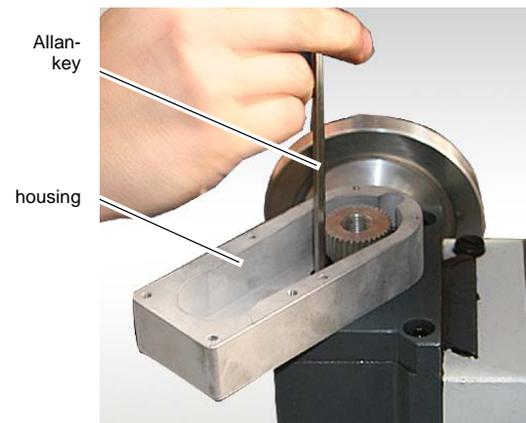


Fig.3-30: Mount housing

- 3.3.29 Remove screws and shims from the handwheel.
Unscrew the four screws of the fastening and remove the whole handwheel fixture.

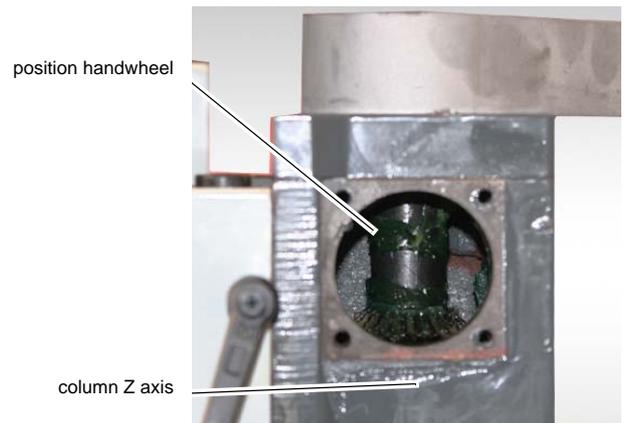


Fig.3-31: Disassemble handwheel

- 3.3.30 Fasten the lid item 10 with the 4 screws of the handwheel.

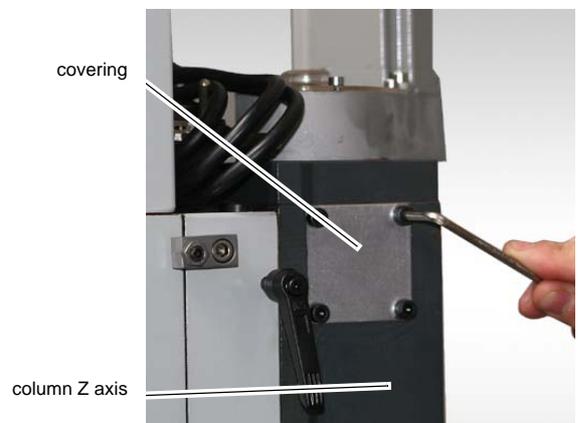


Fig.3-32: Assemble covering

- 3.3.31 Mount the step motor as described under  "Installation of step motors" on page 19.

4 Installation of step motors

4.1 Wiring X / Y / Z axis

4.1.1 Open the lid of the step engine with a cross slot screwdriver.

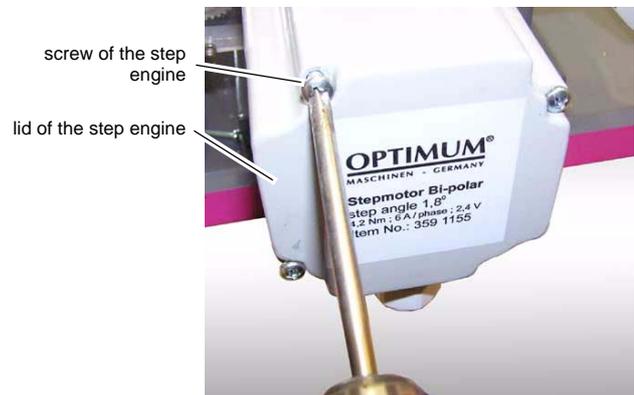


Fig.4-1: Open the lid of the step engine

4.1.2 Remove the outer isolation of the cable and make sure that the lower isolation of the single conductor will not be damaged.

4.1.3 The bared part should be about 6 cm long.

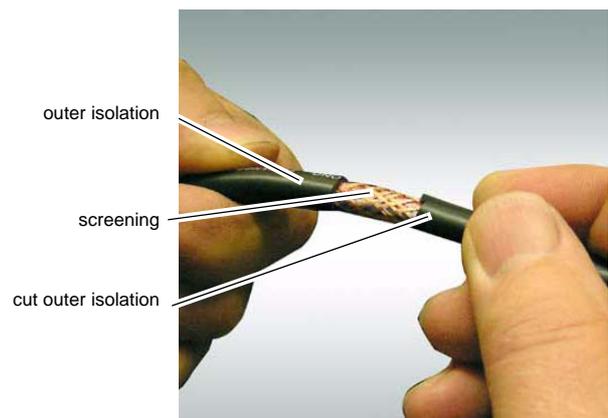


Fig.4-2: Remove outer isolation

4.1.4 Twist the fabric of the shielding.

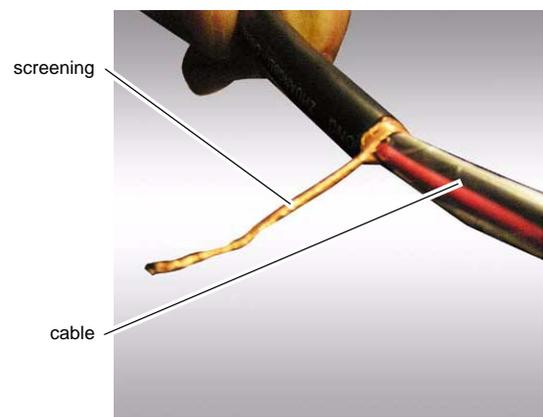


Fig.4-3: Twist screening



INFORMATION !

The shielding will be connected to the terminal block of the engine on one side.

- 4.1.5 The cables will be peeled off at a length of about 5 mm with insulation stripping tongs.
- 4.1.6 Plug and press wire terminations on the ends of the cable.
- 4.1.7 Plug the strain relief over the cable.
- 4.1.8 Insert the cable through the opening of the cover plate of the step engine.
- 4.1.9 Connect the cable to the engine and tighten the strain relief.
- 4.1.10 The twisted screening goes with the clamping "GND" .

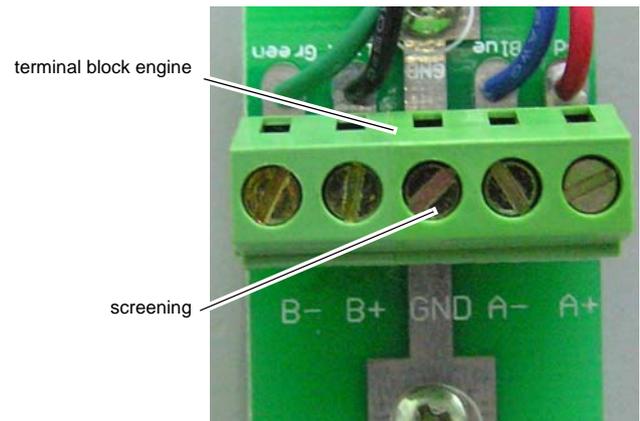


Fig. 4-4: Terminal block of the engine

- 4.1.11 Fasten the lid of the step engine with the cross slot screwdriver.
- 4.1.12 Then cut the cable to the length which is required to connect it to the CNC controller.



Fig. 4-5: Screw the lid

- 4.1.13 Connect the cable to the CNC controller as required.

Motor		Controller
A-	to	A-
A+	to	A+
B-	to	B-
B+	to	B+
GND		

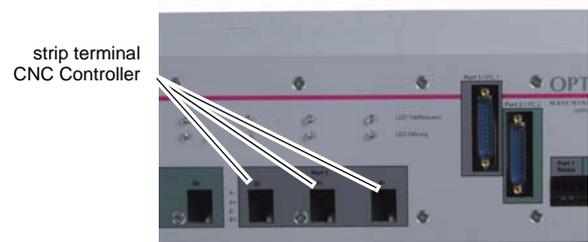


Fig. 4-6: Strip terminal CNC Controller VI



INFORMATION !

Do not connect a screening nor an earthing cable to the CNC Controller.



INFORMATION !

If the turning direction of one or several step motors for CNC operation via a CNC software is wrong, please exchange the respective connection on the step motor or on the CNC Controller.

Example:

Motor		Controller
A-	to	B-
A+	to	B+
B-	to	A-
B+	to	A+
GND		

4.2 Assembly X / Y / Z -Axis

- 4.2.1 Measure the distance between the outer edge of the pulley wheel and the housing edge.
- 4.2.2 Leave the measure set on the caliper gauge.

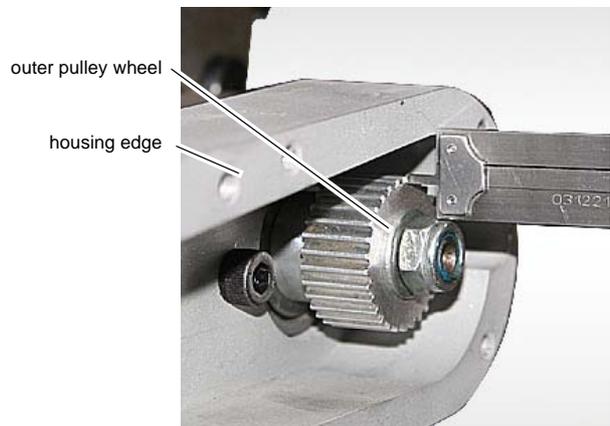


Fig.4-7: Measure distance

- 4.2.3 Grease the shaft of the step motor item 17 and apply a little of the fastener (join the shaft). Insert the pulley wheel item 7 at the Z axis item 8.
- 4.2.4 The direction of the pulley wheel is irrelevant. The pulley wheel must be attached in a way that the distance of the pulley wheel to the surface of the engine corresponds to the measured distance.



Fig.4-8: Assemble pulley wheel

- 4.2.5 Fasten the pulley wheel with the hexagon socket screw item No. 16 (additionally lock with a small quantity of loctite 601.)

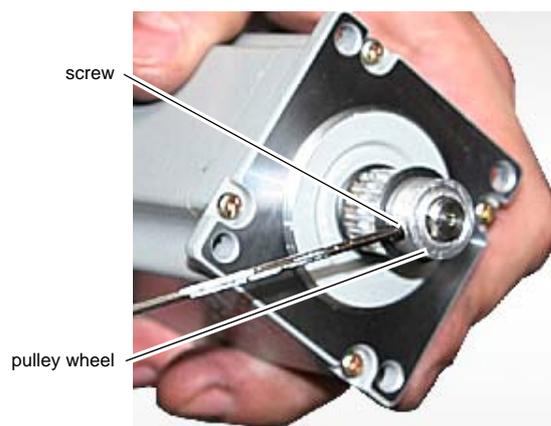


Fig.4-9: Assemble pulley wheel

- 4.2.6 Put the toothed belt item No. 13 on the engine shaft and insert it into the housing from the right.

- 4.2.7 Correctly apply the toothed belt on both pulley wheels and then fasten the engine with the screws item No. 15.

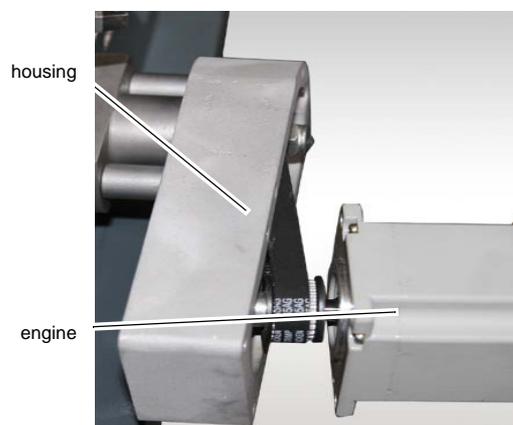


Fig.4-10: Assembly toothed belt

- 4.2.8 Screw the covering plate item No. 9 with the screws item No. 14.

- 4.2.9 Do not fasten it too tight, as the lid is made of plastic.



Fig.4-11: cover

5 Assembly and maintenance instruction ball bearing spindle

Ball bearing spindle foot nuts without strippers)

The delivery of the ball bearing nut with assembly bushing (ready-for-assembly) as well as the spindle are corrosion resistant. The ball screws are not mounted.



The ball screws are precision parts and need to be handled with cleanness and care.

The ball nut is packed ready for assembly.

Please take the ball bearing spindle off the packing only directly before assembly.



5.1 Assembly

- Thoroughly clean the spindle up to the groove of the thread.
- Remove the retaining ring on the side of the assembly bushing which is not displaced.
- Push the nut with the assembly bushing over the treated shaft end (concentrically put on the spindle axis, refer to the illustration) and push it carefully and completely onto the spindle. Remove the assembly bushing only after having completed the assembly.
- Adjust the clearing between the nut and the spindle with the adjusting screw (refer to the illustration). It should be possible to move the spindle slightly into both directions. Check the clearing at several points along the whole length of the spindle by holding the spindle and moving the nut axially; there must be no clearance (the axial clearance will be attained before the radial clamping).

5.2 Installation with spindle

The ball bearing spindle needs to be installed radial and without tension: When you tighten the bearing, the slide needs to be moved on the corresponding side to and fro.

5.3 Lubricating notes

Before commissioning, imperatively lubricate the spindle on the complete length of the thread with the help of the nut .

You may use common oils and greases for ball bearings (soda soap greases) as lubricant. But please avoid lubricants with additives such as graphite and MOS.

Due to the axial movement between nut and spindle the loss of lubricant is higher than for ball bearings so that it is not possible to have it lubricated for life time.

Oil viscosity classes according to DIN 51517 T3		
CLP ISO-VG for spindle Ø 16mm		
Average speed [min ⁻¹]	Recommended SO viscosity class at 40 ° C	Required viscosity at operating temperatures of about 30 °C (cST)
20	ISO VG 460	about 875
100	ISO VG 220	about 360
500	ISO VG 46	about 66
1000	ISO VG 22	about 36
1500	ISO VG 15	about 28

○ Oil lubrication

For higher speeds of the spindle (>500 min⁻¹) there is less heating up with oil lubrication then with grease. But the maintenance intervals will be reduced depending on the applications you should lubricate every 40 to 60 operating hours.

○ Grease lubrication

The grease lubrication will offer the advantages of an independent installation position and larger lubricating intervals (from 300 to 700 operating hours) up to a speed of about 800 min⁻¹.

If possible, use soda soap lubricants KP 2 K according to DIN 51 825.

5.4 Protective measures

Protect the lubricated ball screws from dust, chips.

5.5 Packing list

No	Axis	Designation	Item No	Illustration	pc.	
1	Z - axis	Spindle nut Spindle (458 mm) Adapter	3574351		 	1 1 1
2	Y -axis	Spindle nut Spindle (350 mm)	3574350			1 1
3	BF 20 X - axis	Spindle nut Spindle (586 mm)	3574352			1 1
4	BF 20 L X - axis	Spindle nut Spindle (788 mm)	3574353			1 1
5	Assembly kit X, Y, Z-axis		3574355		 	1

6 Modification BF20 to a ball bearing spindle

- 6.0.1 Screw off hand wheels or step motors as well as pulleys and housings (modification instruction CNC) on the X- and Y-axis.

Screw off hand wheel
X-axis



Illustr.6-1: Hand wheel right hand side

Screw off hand wheel
X-axis



Illustr.6-2: Hand wheel left hand side

Step motor



Illustr.6-3: Step motor left hand side

6.0.2 Loosen nut and disassemble toothed wheel.

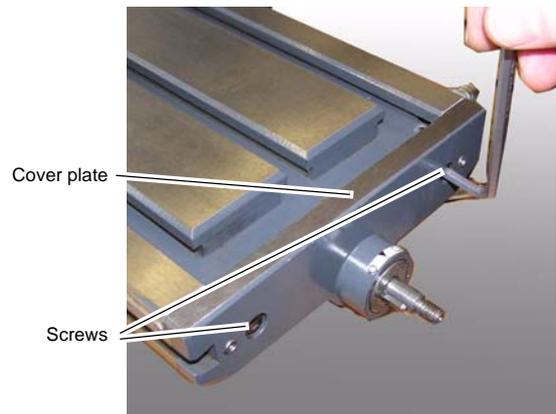


Illustr.6-4: Loosen nut



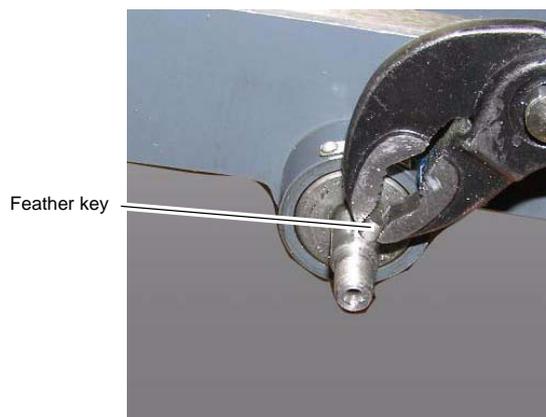
Illustr.6-5: Disassemble toothed wheel

6.0.3 Unscrew the two screws of the cover plate of the table X-axis left and right hand side.



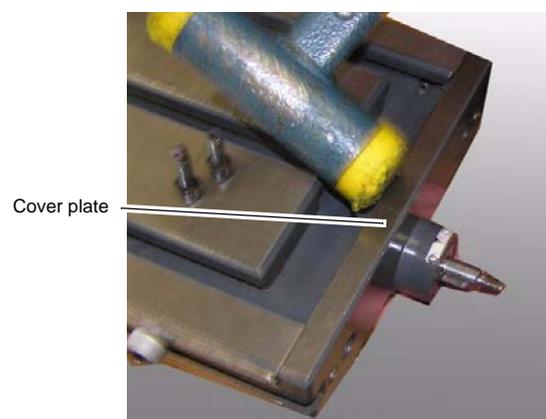
Illustr.6-6: Cover plate right hand side

- 6.0.4 Pull off the feather key on both sides of the shaft.



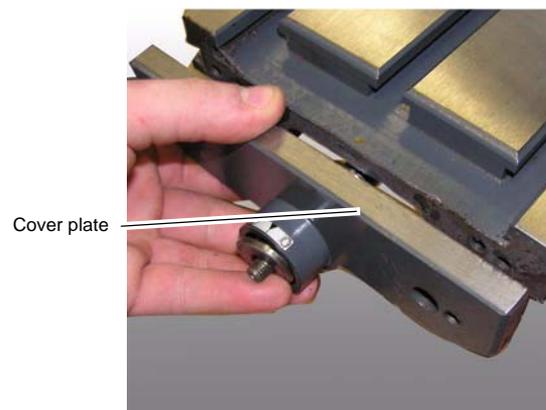
Illustr.6-7: Feather key right hand side

- 6.0.5 Take off the cover plate, beat with a plastic tip hammer, if required.



Illustr.6-8: Cover plate right hand side

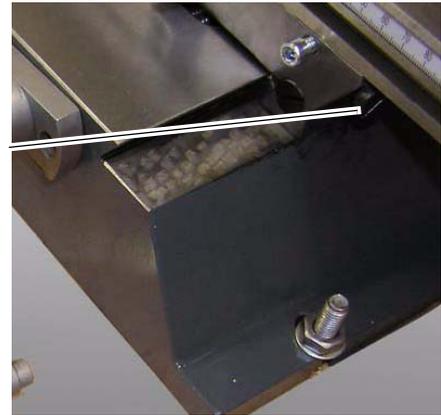
- 6.0.6 When disassembling the cover plates, please make sure that the bearings do not fall off.



Illustr.6-9: Cover plate right hand side

- 6.0.7 Loosen the V-ledge on the clamping screws and pull off the table to the side. Please remove the limit stop on the left hand side of the X-axis first.

Clamping screws



Illustr.6-10: Loosen V-ledge

Limit stop



Illustr.6-11: Disassemble limit stop



CAUTION!

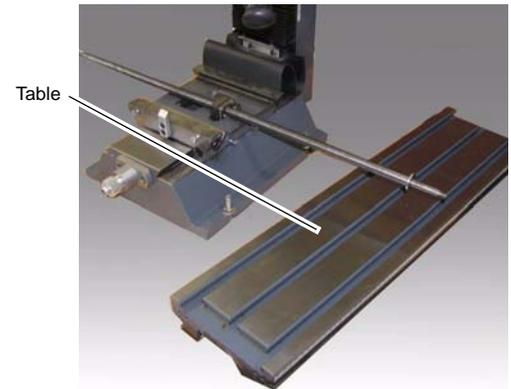
Risk of crushing when pulling off the table. The table is very heavy!

Table

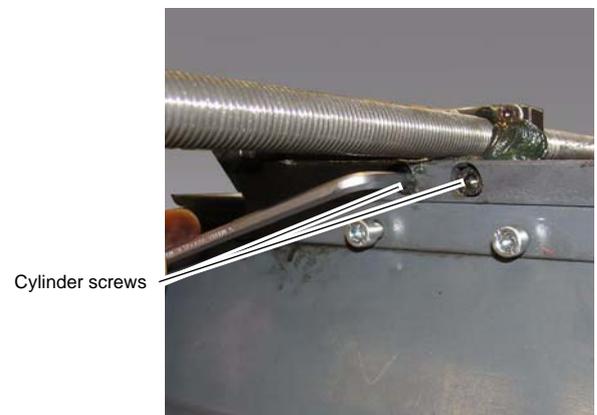


Illustr.6-12: Disassemble limit stop

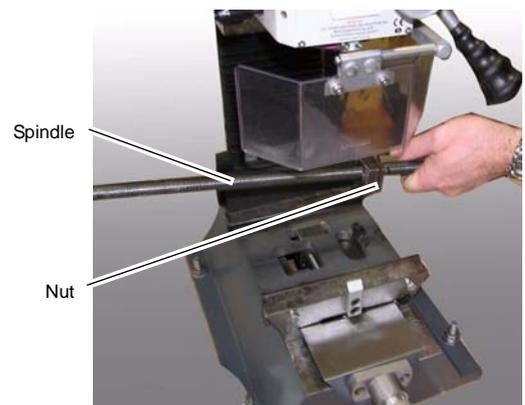
- 6.0.8 Unscrew the cap screw of the spindle nut on the X-axis and remove the nut with the spindle.



Illustr.6-13: Take off the table

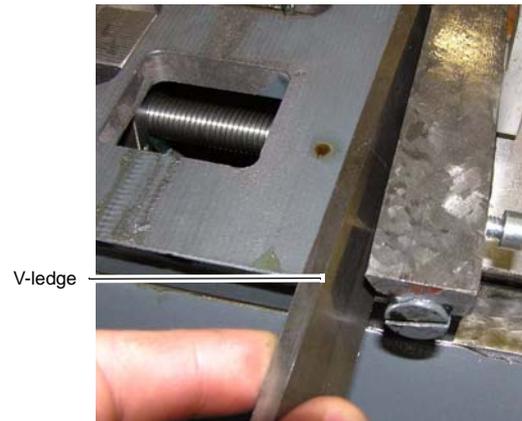


Illustr.6-14: Unscrew cylinder screws



Illustr.6-15: Remove nut and spindle

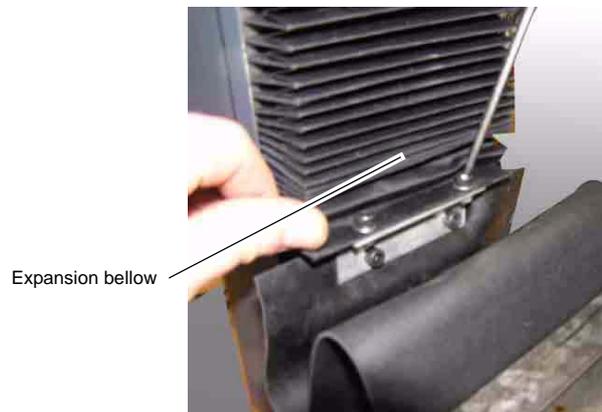
6.0.9 Pull off the V-ledge.



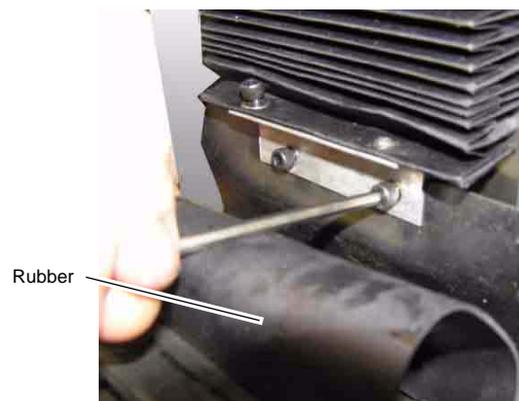
Illustr.6-16: Pull off V-ledge

6.0.10 Clean all guidances!

6.0.11 Disassemble expansion bellows and unscrew the rubber from the Y-axis.



Illustr.6-17: Disassemble expansion bellow

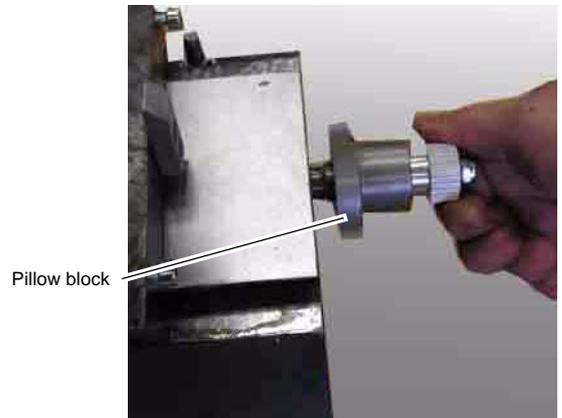


Illustr.6-18: Unscrew rubber



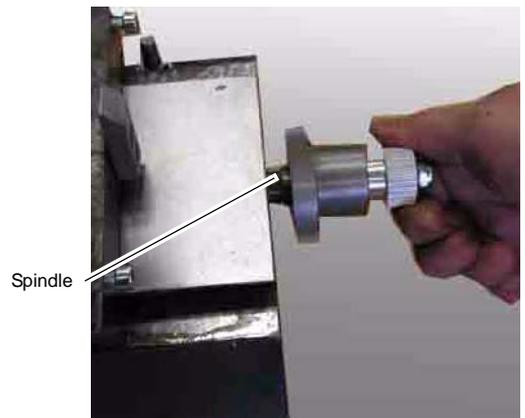
Illustr.6-19: Unscrew rubber

6.0.12 Unscrew pillow block of the Y-axis.



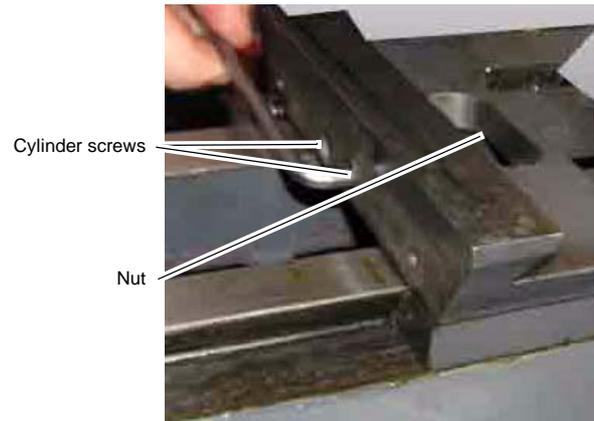
Illustr.6-20: Unscrew pillow block

6.0.13 Unscrew spindle.



Illustr.6-21: Unscrew spindle

6.0.14 Loosen cylinder screws and loosen and remove the nut of the Y-axis.

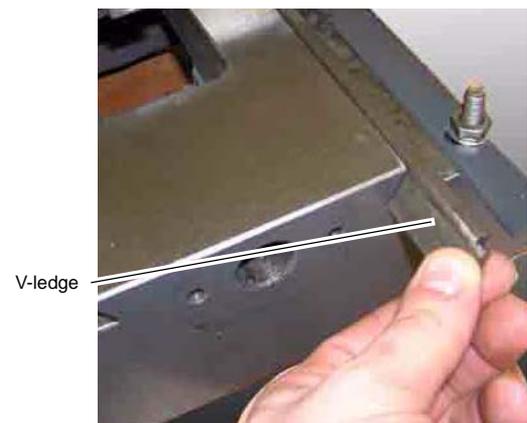


Illustr.6-22: Loosen nut

6.0.15 Loosen and remove V-ledge.

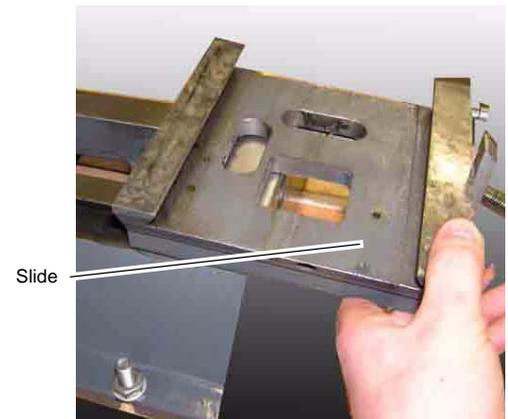


Illustr.6-23: Loosen V-ledge



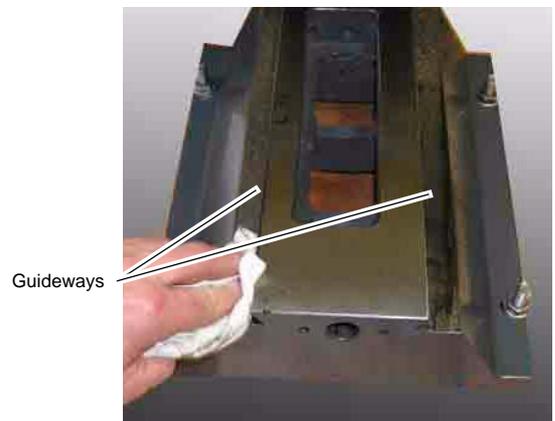
Illustr.6-24: Remove V-ledge

6.0.16 Pull the slide off the Y-axis.



Illustr.6-25: Pull off the slide (Y-axis)

6.0.17 Clean all guideways.

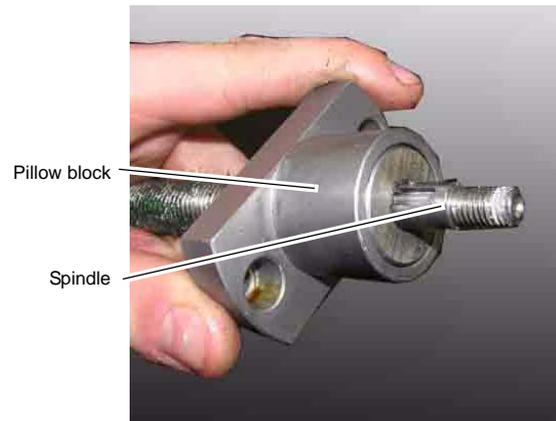


Illustr.6-26: Clean guideways

6.0.18 Disassemble the spindle Y-axis from the pillow block. Remove the feather key.



Illustr.6-27: Remove feather key



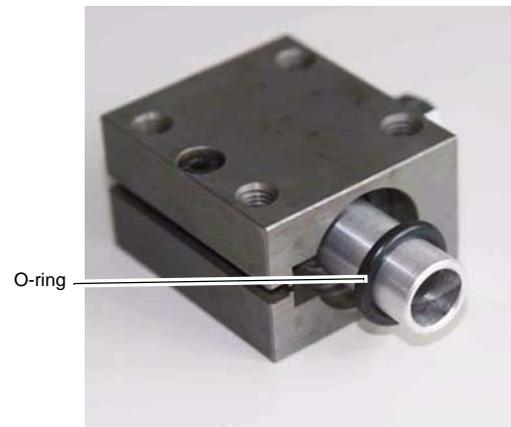
Illustr. 6-28: Remove spindle

- 6.0.19 Assembly spindle nut:
→ Remove the O-Ring on the flat side of the aluminum bushing.

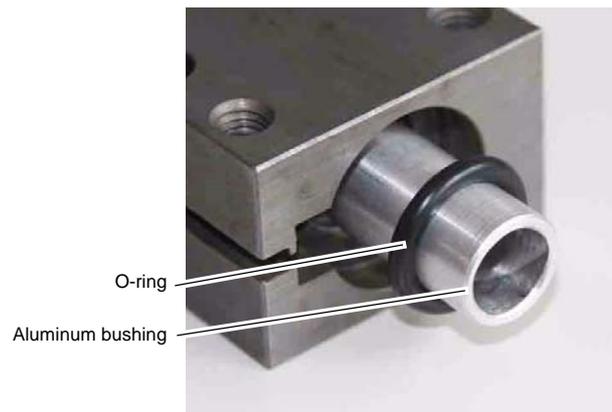


CAUTION!

Please make sure that the machine faced side of the aluminum bushing is placed upon the spindle!



Illustr. 6-29: Remove O-ring

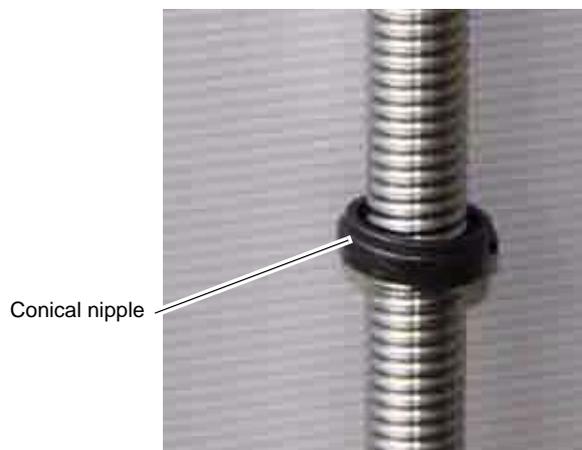


Illustr. 6-30: Remove O-ring

- Push the conical nipple with the flat side downward on the spindle.

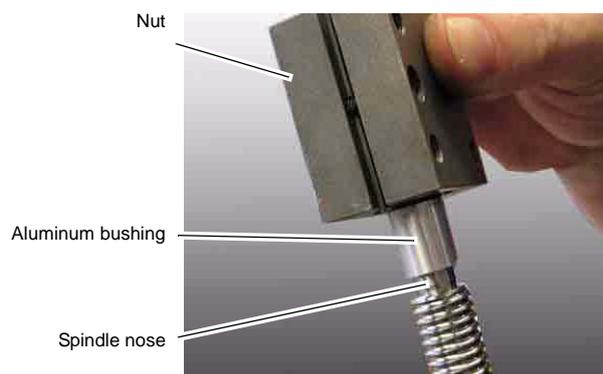


Illustr.6-31: Mount conical nipple



Illustr.6-32: Mount conical nipple

- Put the aluminum bushing with the nut on the spindle nose and press firmly against it.



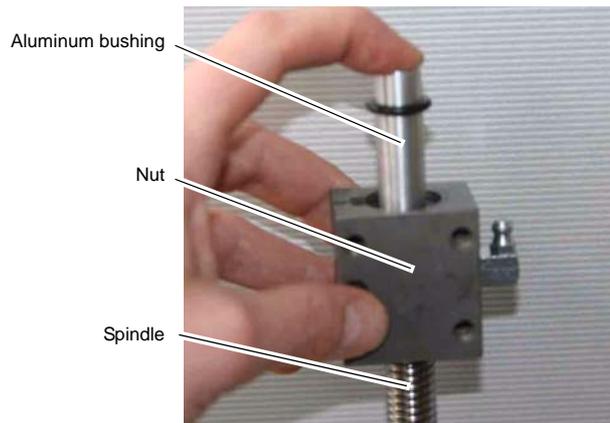
Illustr.6-33: Screw-on the spindle



CAUTION!

If you do not press on the bushing with enough force, the balls may fall off the nut. Then the nut becomes unserviceable!

→ Have the nut slide on the spindle.



Illustr. 6-34: Screw-on the spindle



CAUTION!

Please make sure that the machine faced side of the bushing is placed onto the spindle!

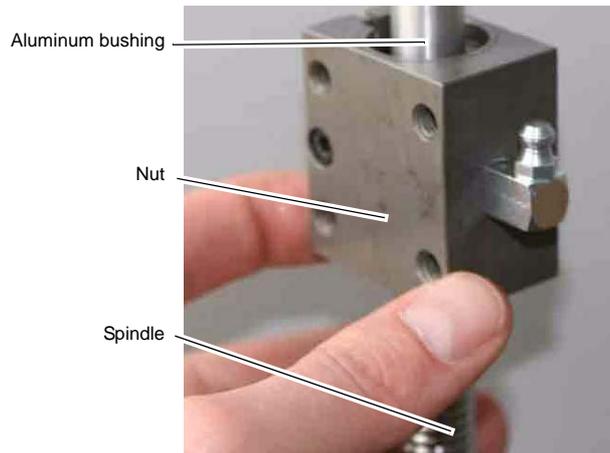
→ The nut has to run on the spindle by itself.

→ Turn the nut clockwise on the spindle. If the nut does not run smoothly, just turn it back and try again.



CAUTION!

Do not force the nut downward, as it would be destroyed!



Illustr. 6-35: Screw-on the spindle



INFORMATION

If you need the lubricating nipple after assembly at the other side of the nut, you have to remove the relief from the aluminium bushing.

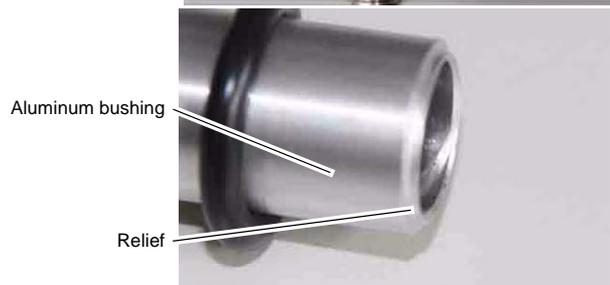
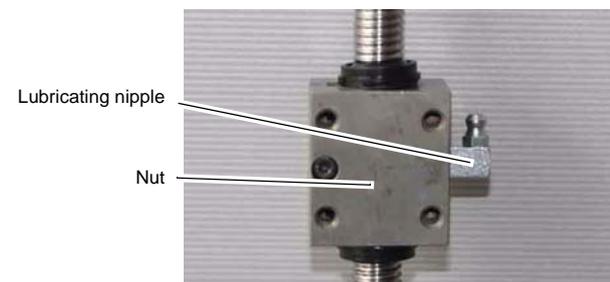
→ Place the nut with the machine faced side onto the spindle.

→ Assemble the nut on the spindle as described above.

→ Remove the relief.

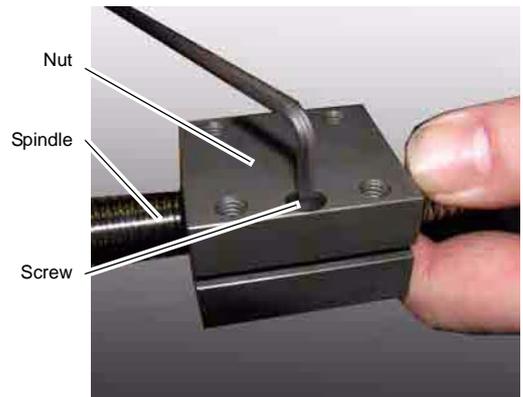
→ Re-assemble the nut.

→ Turn the nut by 180° and re-assemble it as described above.



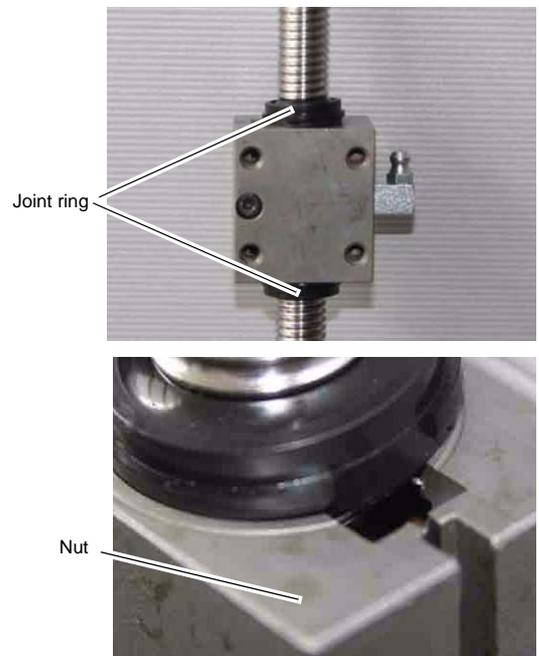
Illustr. 6-36: Remove relief

- 6.0.20 Check the well-running of the spindle and if required re-adjust the clearance with the screw on the nut.



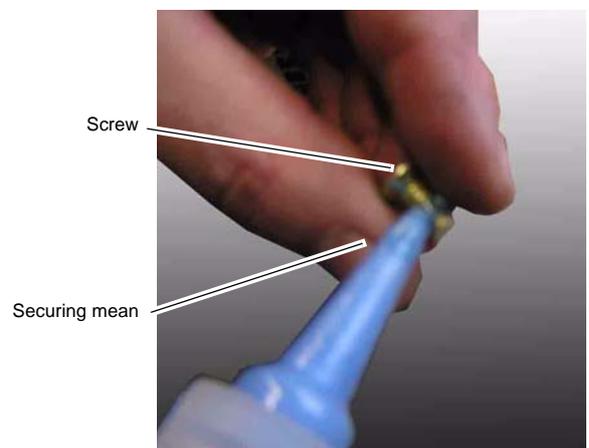
Illustr.6-37: Check the spindle

- 6.0.21 Press the joint ring on both sides of the nut. Make sure that the groove of the joint ring and the groove of the nut are matching. The joint rings need to be assembled with the flat side outside. Before assembling the joint rings, please apply some lubricating grease on the nut.



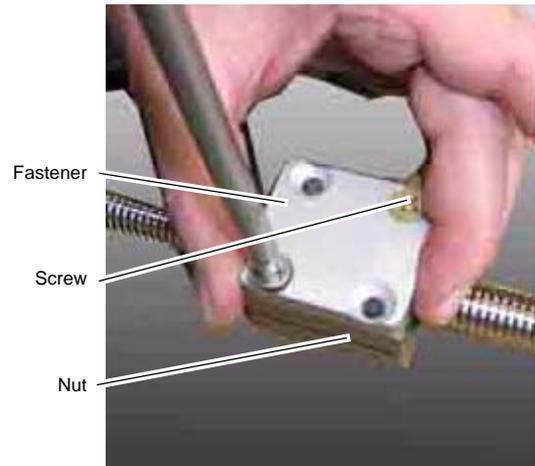
Illustr.6-38: Press the joint ring

- 6.0.22 Screw the fastener of the X-axis on the spindle nut of the X-axis. Apply securing mean.



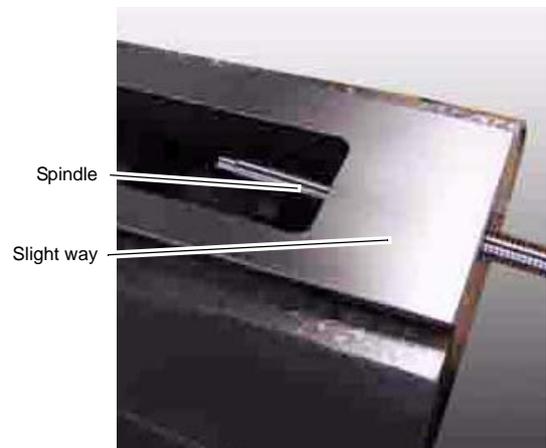
Illustr.6-39: Secure screws

- 6.0.23 Check if the fastener is rectangular after screwing it on the nut, rework it, if required.



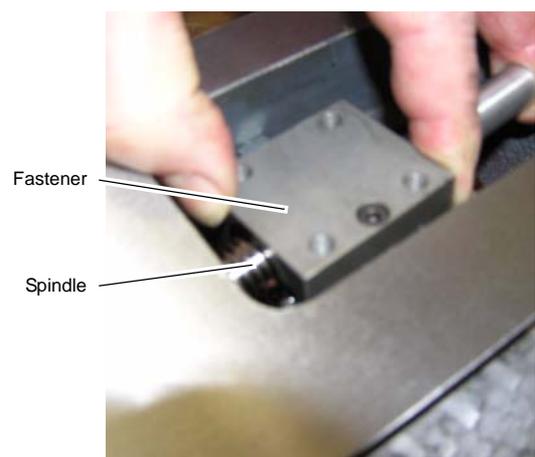
Illustr.6-40: Screw fastener

- 6.0.24 Insert the spindle into the Y-axis.

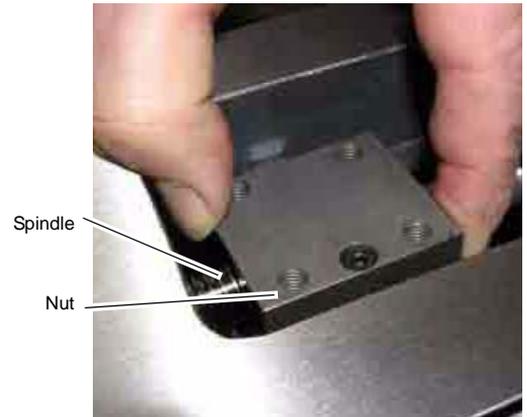


Illustr.6-41: Insert spindle

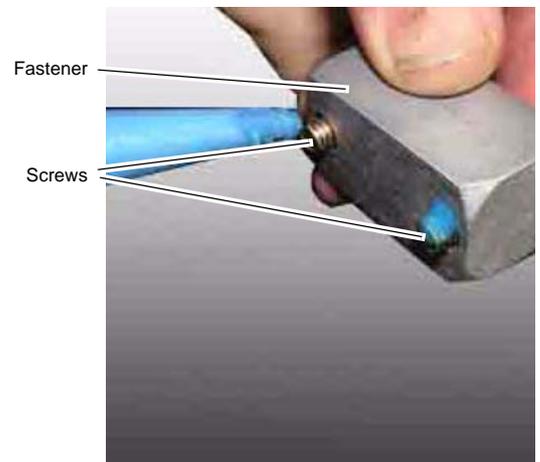
- 6.0.25 In order to assemble the fastener of the Y-axis, the nut needs to be mounted on the spindle in the machine. Only then, the fastener will be screwed on.



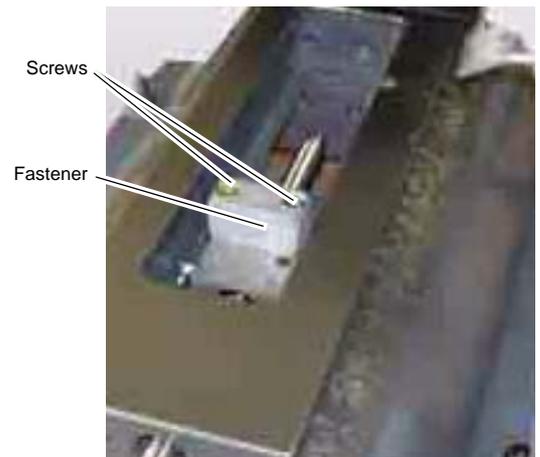
Illustr.6-42: Screw spindle



Illustr.6-43: Screw spindle

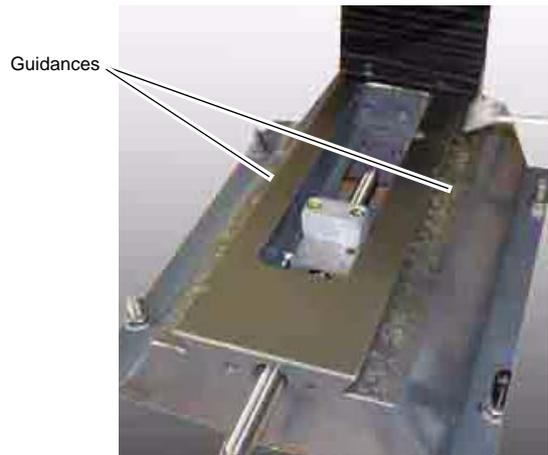


Illustr.6-44: Secure screws



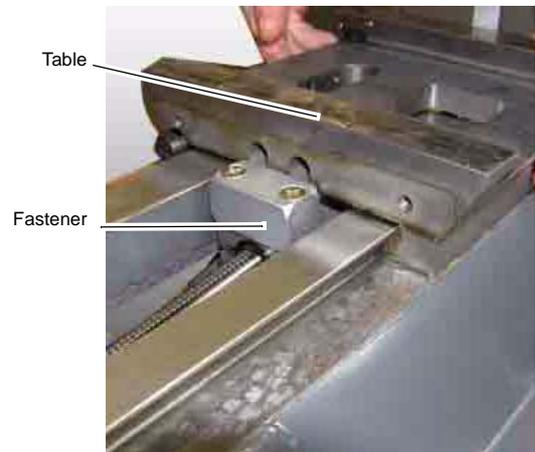
Illustr.6-45: Screw fastener

- 6.0.26 Oil guidances and remount the table.
Mount the bearing block of the Y-axis
and the V-ledges.

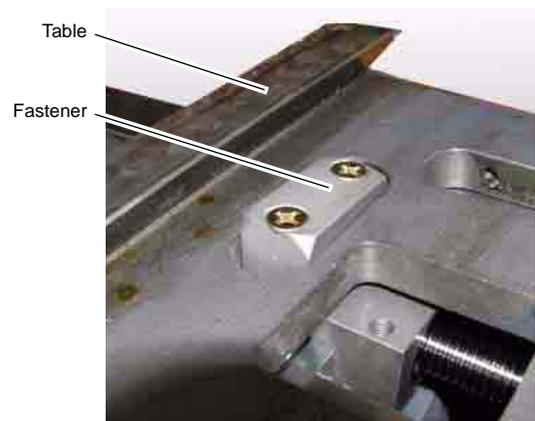


Illustr.6-46: Oil guidances

- 6.0.27 Mount the table of the Y-axis.

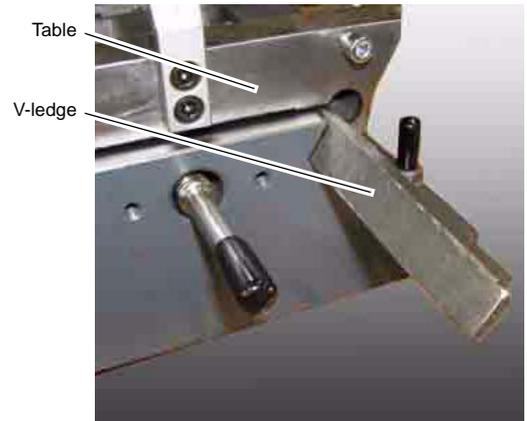


Illustr.6-47: Mount the table of the Y-axis



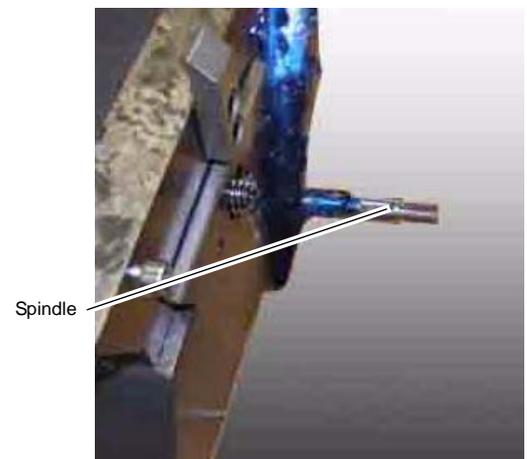
Illustr.6-48: Mount the table of the Y-axis

6.0.28 Mount V-ledges.



Illustr.6-49: Mount V-ledge

6.0.29 Grease spindle.



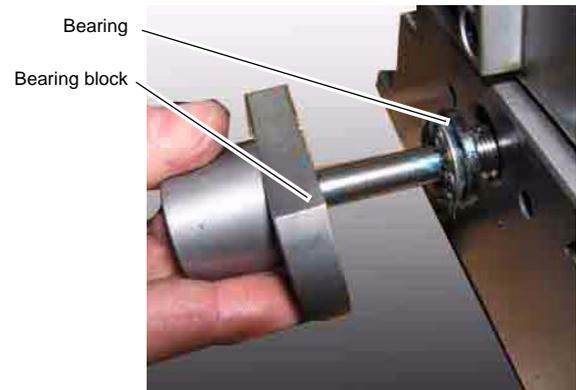
Illustr.6-50: Grease spindle

6.0.30 Grease bearing.



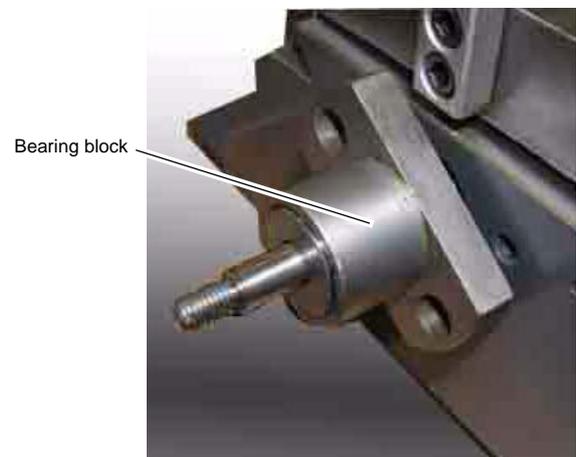
Illustr.6-51: Grease bearing

6.0.31 Mount bearing and bearing block.



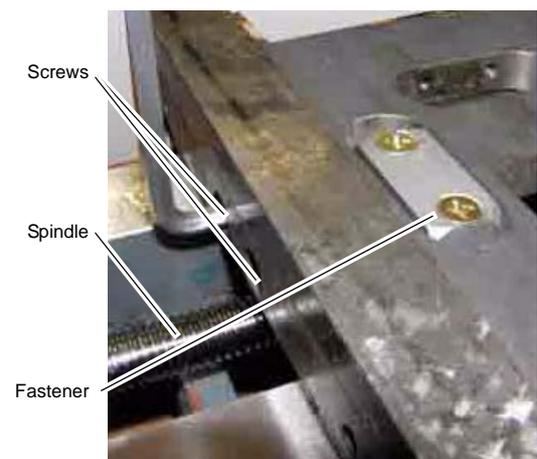
Illustr.6-52: Mount bearing and bearing block

6.0.32 Screw bearing block.



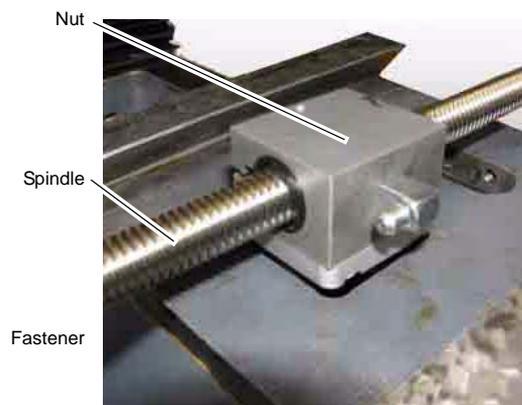
Illustr.6-53: Screw bearing block

6.0.33 Adjust V-ledges. Fasten the nut with two screws in the machine. In order to better fix the nut, slightly turn the spindle and screw on the nut at the same time. Move the table until it is almost positioned in front of the pillar in order to adjust the clearance.



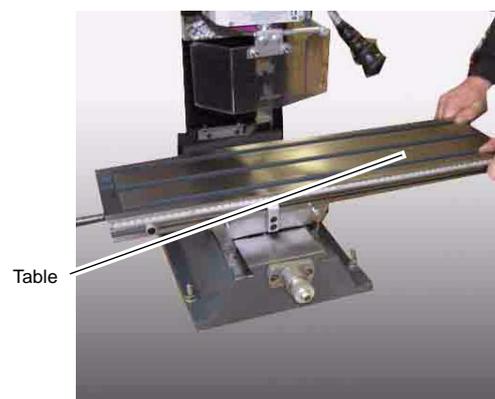
Illustr.6-54: Screw fastener

- 6.0.34 Attach the spindle to the X-axis. Oil guidances. Mount the fastener on the X-axis.



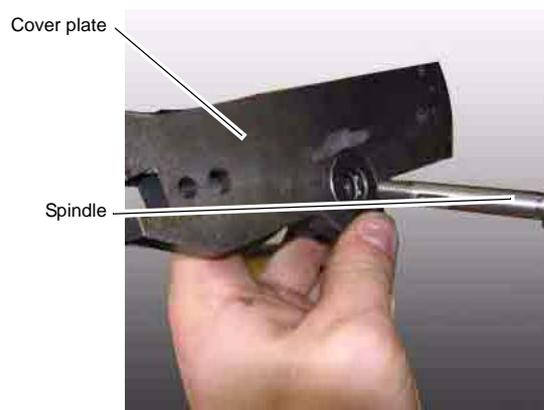
Illustr.6-55: Attach spindle

- 6.0.35 Push the table on the X-axis. Push the table of the X-axis completely outside, then move it slightly in this position and fasten the nut. Then make sure that the nut will not tilt. Otherwise, it will be very difficult to move the table or it cannot be moved at all. Mount and adjust V-ledges.

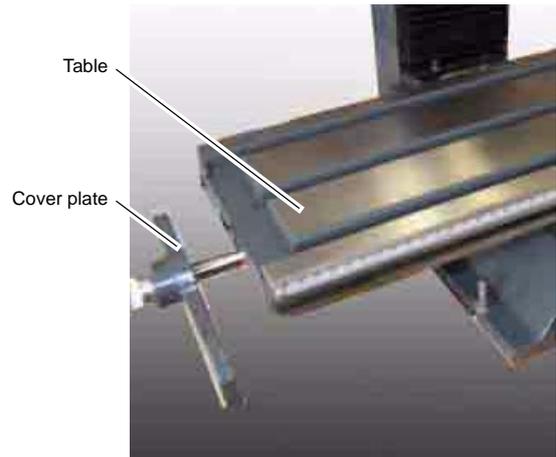


Illustr.6-56: Push on the table

- 6.0.36 Mount cover plates.



Illustr.6-57: Mount cover plates



Illustr.6-58: Mount cover plates

6.0.37 Reassemble rubber cover and screw on the limit stop again.



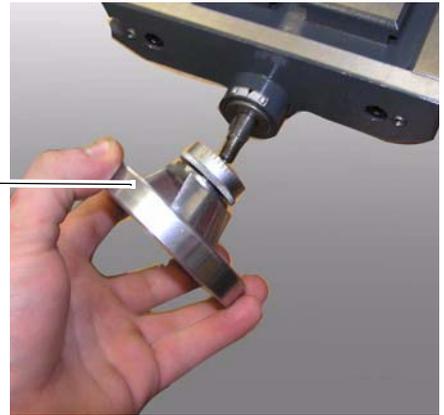
Illustr.6-59: Assemble rubber cover



Illustr.6-60: Screw on limit stop

- 6.0.38 Remount hand wheel or step motors as well as pulleys and housings (modification instruction CNC) onto the X and Y-axis. Adjust clearance of the bearings.

Hand wheel of the X-axis



Illustr.6-61: Mount hand wheel

Hand wheel of the X-axis



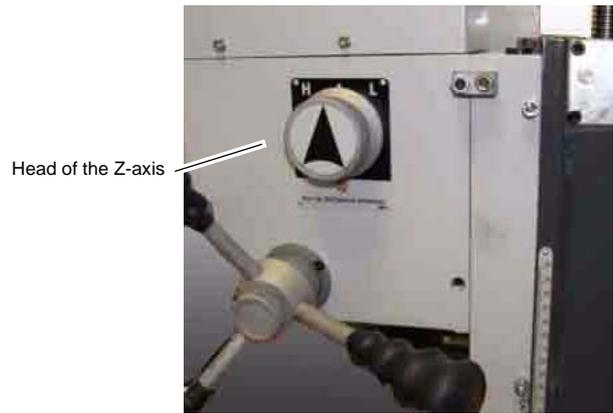
Illustr.6-62: Mount hand wheel

Step motor



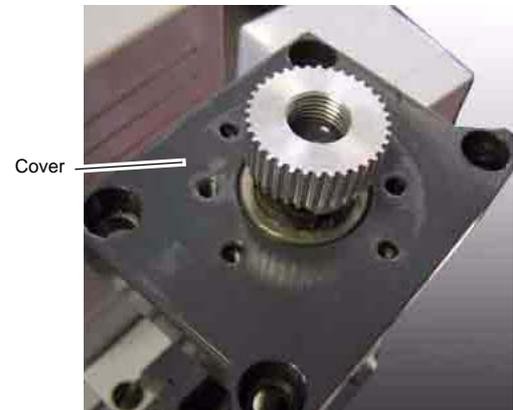
Illustr.6-63: Mount step motor

6.0.39 Move the milling head of the Z-axis fully upward and clamp it.

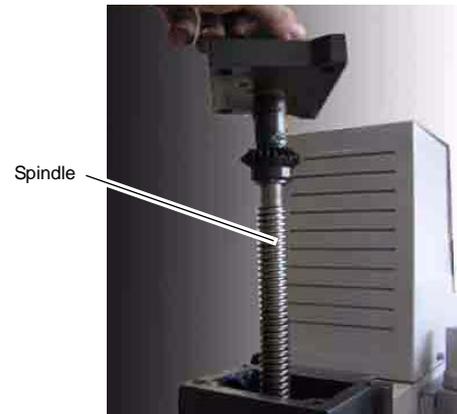


Illustr.6-64: Head of the Z-axis

6.0.40 Unscrew the screws of the cover of the Z-axis and almost completely unscrew the spindle from the nut.

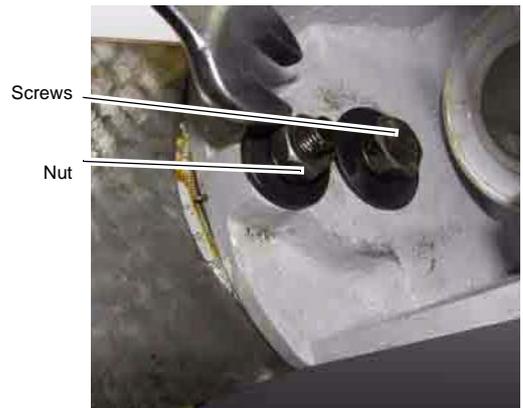


Illustr.6-65: Unscrew cover

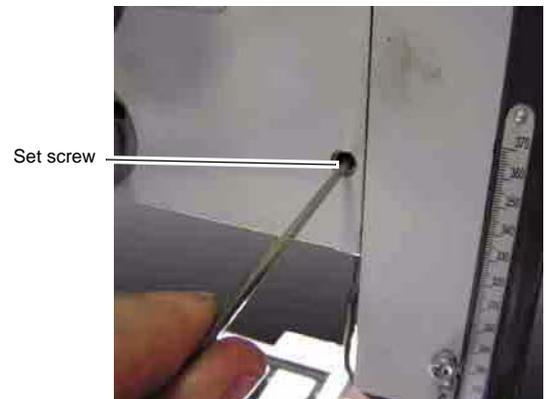


Illustr.6-66: Unscrew spindle

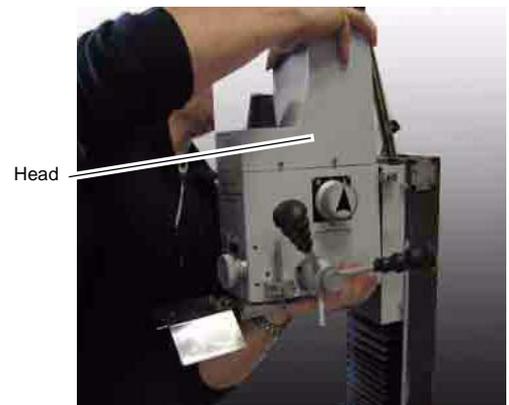
- 6.0.41 Loosen the three screws or the nut of the milling head and remove the head.



Illustr.6-67: Loosens screws



Illustr.6-68: Loosen set screw

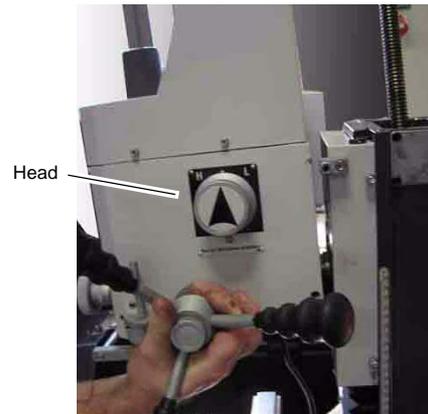


Illustr.6-69: Remove head



CAUTION!

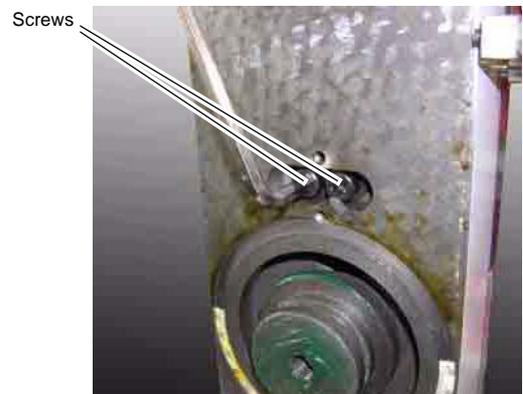
Risk of crushing when removing the milling head. The milling head is very heavy!



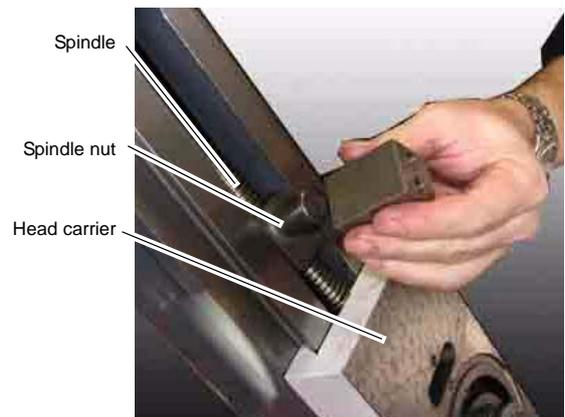
Illustr.6-70: Remove head

6.0.42

Loosen the clamping of the Z-axis and unscrew the screws of the spindle nut. Shift the head carrier downward. Guide the spindle nut through the groove and unscrew it. Remove the spindle.

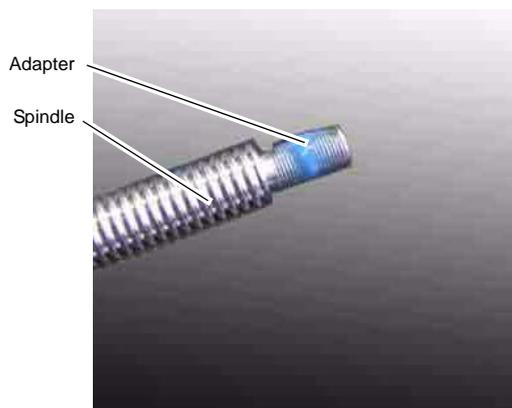


Illustr.6-71: Loosen screws

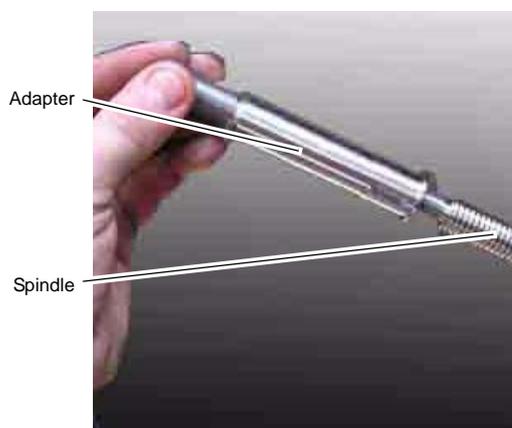


Illustr.6-72: Head carrier

- 6.0.43 Screw the adapter on the shaft of the Z-axis. Apply securing mean at the end of thread.

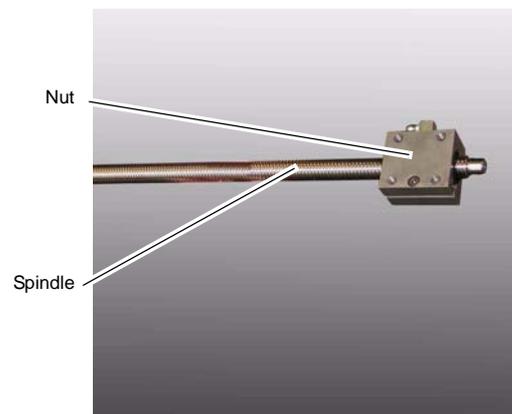


Illustr.6-73: Apply securing mean



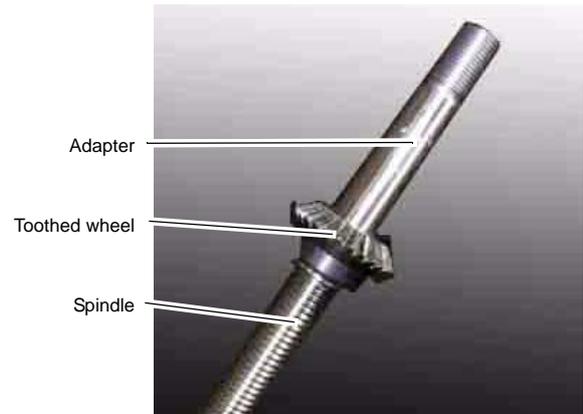
Illustr.6-74: Screw on the adapter

- 6.0.44 Mount the nut on the spindle of the Z-axis and adjust the clearance as described under point 6.0.19 „Assembly spindle nut:“ on page 36.



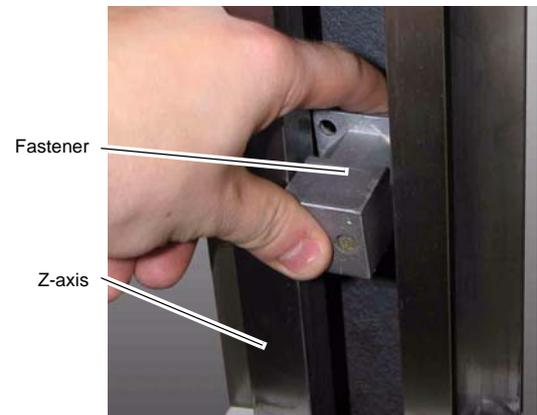
Illustr.6-75: Mount nut

- 6.0.45 Mount the toothed wheel for the hand wheel from the old spindle to the new spindle.



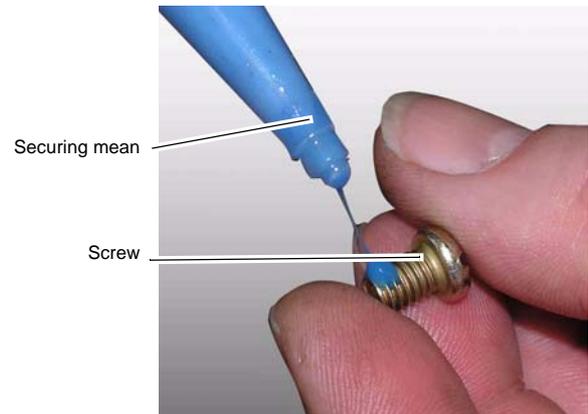
Illustr.6-76: Mount toothed wheel

- 6.0.46 Shift the fastener from the back in the guidance of the Z-axis.



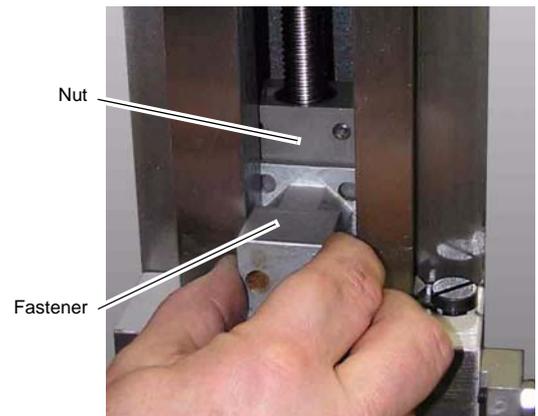
Illustr.6-77: Shift fastener on the Z-axis

- 6.0.47 Apply securing mean.



Illustr.6-78: Secure screws

6.0.48 Screw the fastener on the nut of Z-axis.



Illustr.6-79: Screw fastener



Illustr.6-80: Screw fastener

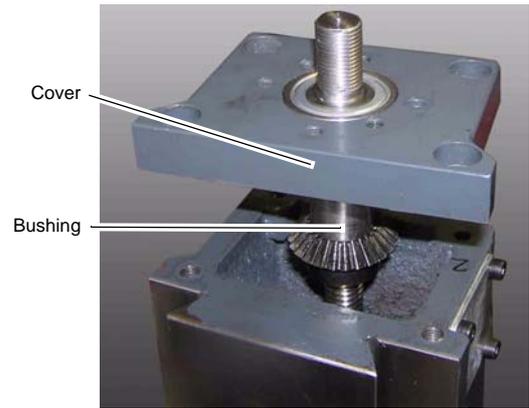
6.0.49 If the bearing 3203 2Z is used on the Z-axis, the cover needs to be turned out on the whole length of a diameter of 40 -0.06 mm (tight fit) and the bearing 3203 2Z needs to be pressed into the cover. Additionally a bearing with the outside diameter of 20 mm and a length of 38 mm is required with the hole for the adapter of the Z-axis.



Illustr.6-81: Mount bearing

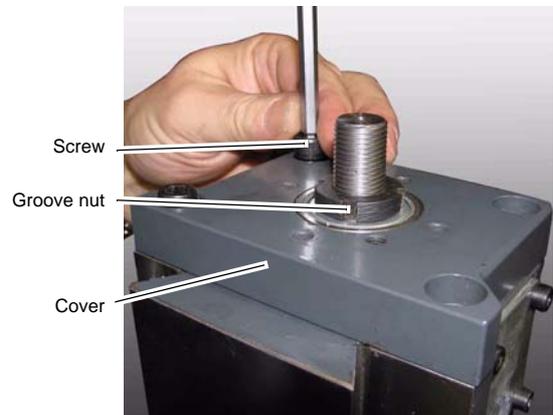
If the default bearing is used, this point will not apply.

6.0.50 Mount bushing and cover on the Z-axis.



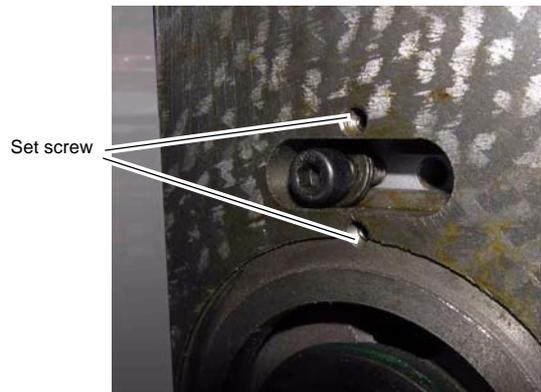
Illustr.6-82: Mount bushing and cover

6.0.51 Fasten the cover and fasten the spindle with the groove nut on the cover. Adjust clearance.



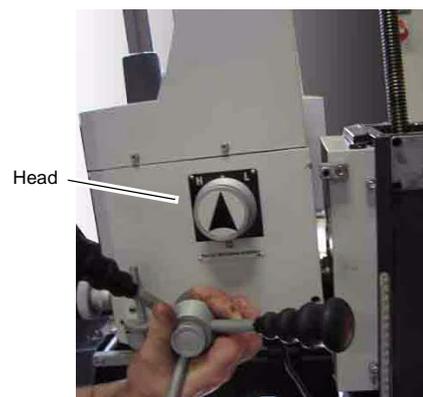
Illustr.6-83: Fasten cover and spindle

6.0.52 Fasten the fastener on the pillar and adjust the distance between the spindle nut and the spindle and this way adjust the mobility of the spindle.



Illustr.6-84: Adjust distance

- 6.0.53 Mount milling head and refasten it with the three screws respectively nuts.



Illustr.6-85: Mount head



CAUTION!

Risk of crushing when mounting the milling head. The milling head is very heavy!

- 6.0.54 Refasten the milling head with the screws and clamp it.



Illustr.6-86: Clamp milling head



CAUTION!

Resecure the milling head with the set screw!



Illustr.6-87: Fasten set screw

7 Appendix

7.1 Copyright

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This document is copyright. All derived rights are also reserved, especially those for translation, re-impression, use of figures, broadcast, reproduction by photo-mechanical or similar means and recording in data processing systems, whether partial or total.

The company reserves the right to make technical alterations without prior notice.

7.2 Warranty

Within the term of warranty, the company Optimum warrants for a perfect quality of its products and will reimburse any cost for overhaul or exchange of defective parts in case of construction error, fault in material and/or defect of fabrication.

The term of warranty for commercial use is 6 months and for use as an amateur it is 24 months. Condition for a warranty claim due to construction errors, faults in material and/or defects of fabrication is:

- Proof of purchase and that the instructions for use had been followed.
In order to assert the claim of warranty, you have to present a typescript original receipt of purchase. It must comprise the complete address, date of purchase and type designation of the product.
The instruction for use the corresponding device as well as the safety information are to be observed. Damages due to operator's mistakes may not be accepted as warranty claims.
- Correct use of the devices.
The products of the company Optimum had been designed and built for certain purposes. They are listed in the operating manual. The warranty claim may not be accepted if the operating manual is not being followed properly or if it is used for a purpose which has not been intended or with improper accessory.
- Maintenance work and cleaning.
It is absolutely necessary to maintain and clean the machine in regular intervals according to the prescriptions of the instruction for use.
By intervention of a third party, any warranty claim will expire. Maintenance work and cleaning are usually not part of the claim of warranty.
- Original spare parts.
Make sure to use only original spare parts and original accessory. This can be acquired from authorized distributors of the machine. When other than original spare parts are being used, consequential damages may occur and danger of accidents will increase. Disassembled or partially disassembled devices and devices which are repaired with foreign parts are excluded from warranty claims.
- Wearing parts.
Certain components are subject to wear out by time respectively a standard wear by use on the corresponding machine.
Among these components are e.g. V-belts, ball bearings, switches, main cables, gaskets and washers, etc. These wearing parts are not part of the warranty.

7.5 EC Declaration of Conformity

**The manufacturer /
retailer:** Optimum Maschinen Germany GmbH
Dr.-Robert-Pfleger-Str. 26
D-96103 Hallstadt

hereby declares that the following product,

Machine type: Ball bearing spindle

Relevant EU directives:

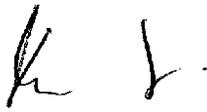
EMV Directive 89/336/EWG

Low Voltage Directive 73/23/EWG

meets the provisions of the aforementioned directive, including any amendments valid at the time of this statement.

In order to ensure conformity, the following harmonized standards in particular have been applied:

DIN EN 62079:2001 Editing of instructions - structure, content and illustration
(VDE 0039)
IEC 62079:2001



Thomas Collrep
(Manager)



Kilian Stürmer
(Manager)

Hallstadt, 03 / 08 / 2006

8 Appendix

8.1 Copyright

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8.2 Terminology/Glossary

Term	Explanation
CNC	Computerised Numerical Control
Adapter kit	Components
Movement rate	Free, smooth mobility of components
blow-back proof plastic tip hammer	A plastic tip hammer which is filled with sand which does prevent a spring-back when knocking.
Disassembly	Remove, relieve
Toothed belt disc	Disc with gearing to receive a toothed belt.

8.3 Warranty

Within the term of warranty, the company Optimum warrants for a perfect quality of its products and will reimburse any cost for overhaul or exchange of defective parts in case of construction error, fault in material and/or defect of fabrication.

The term of warranty for commercial use as an amateur it is 24 months. Condition for a warranty claim due to construction errors, faults in material and/or defects of fabrication is:

- Proof of purchase and that the instructions for use had been followed.
In order to assert the claim of warranty, you have to present a typescript original receipt of purchase. It must comprise the complete address, date of purchase and type designation of the product.
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- Wearing parts
Certain components are subject to wear out by time respectively a standard wear by use on the corresponding machine.
Among these components are e.g. V-belts, ball bearings, switches, main cables, gaskets and washers, etc. . These wearing parts are not part of the warranty.

8.4 Disposal



Disposal of used electric and electronic machines

(Applicable in the countries of the European Union and other European countries with a separate collecting system for those devices).

The sign on the product or on its packing indicates that the product must not be handled as common household waste, but that it needs to be delivered to a central collection point for recycling. Your contribution to the correct disposal of this product will protect the environment and the health of your fellow men. The environment and the health are endangered by incorrect disposal. Recycling of material will help to reduce the consumption of raw materials. Your District Office, the municipal waste collection station or the shop where you have bought the product will inform you about the recycling of this product.

