Instructions for Use (No.920304)

Milling Angle Heads

FUH

Manufacture:

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Summary of safety and working conditions

Before using!!!
make sure that fixing screws 9,10 and 13 (see page 4, fig. 1) are correctly tighten (see the Table 1 - Tightening Torque for Screws) – see page 5.

Before starting!!!
make sure that the taper shank is correctly inserted in the machine spindle, the arresting pin in the retaining block and the head spindle is not arrested for both sense of rotation. Check the temperature of the head, the safe clamping of the tool in the collet and the **required sense of spindle rotation**. (see page 4., fig. 1; see page 7 and 8 – Table of basic technical data)

Take care by handling!!!
with the head regarding to the possible injury by sharp cutting tool clamped in the head or by fall of the relatively heavy device.

Before the start of the automatic tool change (ATC)!!!
check carefully the timing of the cycle especially the loading in the machine spindle, unloading from the spindle and transport in the tool magazine.

In the course of operation!!!
regularly check the reliable function of the arresting pin and the free motion of the pin on feeding in the retainig block and make sure that the screw 13 (see page 4, fig. 1) is corrrectly tighten

CAUTION! – models PVM and FXM
The permissible input and torque for the base assembly of modular heads are lower compared with the fixed modification.

CAUTION!
The clean contact surfaces are the main condition for the correct and rigid clamping of the head in the machine spindle cavity. Before using of the milling angle head, we recommend to inspect the condition of the spindle of the machine tool. Make sure by means of the control taper arbor and marking grease that the taper mates on the whole surface in the spindle cavity. Check the run-out of the clamped control arbor in distance of 150 mm (ISO, CAT, BT 40) / 160 mm (ISO, CAT 50) / 165 mm (BT 50) from the face (see the Figure 14, page 13).The run-out should not exceed 0,02 mm in this point.

WARNING!!!
Within the first automatic change cycle, make sure that the head loaded in the changing device does not clash with the other tools and system elements.

Recommendation
The clean contact surfaces of the tool, spring collet and collet chuck, the corresponding size of the collet are the main conditions for the correct and rigid clamping of the tool and make possible to keep the run-out within 0,02 mm. A little amount of rotation of the collet in the chuck cavity could reduce the run-out and eliminate the potencial inaccuracy of the chucking.

CAUTION!
It is not allowed to tighten the nut by striking on the wrench. The non-observance of this warning may cause heavy damage of the bevel gears and bearings. Removing of the tool is realised by loosening of the clamping nut or by reverse clamping method.

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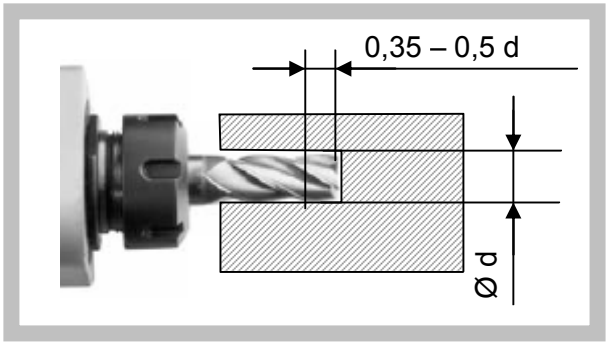
WARNING !
The maximum driving torque Mk_{max} [Nm] and power N_{max} [kW] are mentioned for every model in diagrams on Fig. 22 (see page 18) for preventing of any overload of these heads.

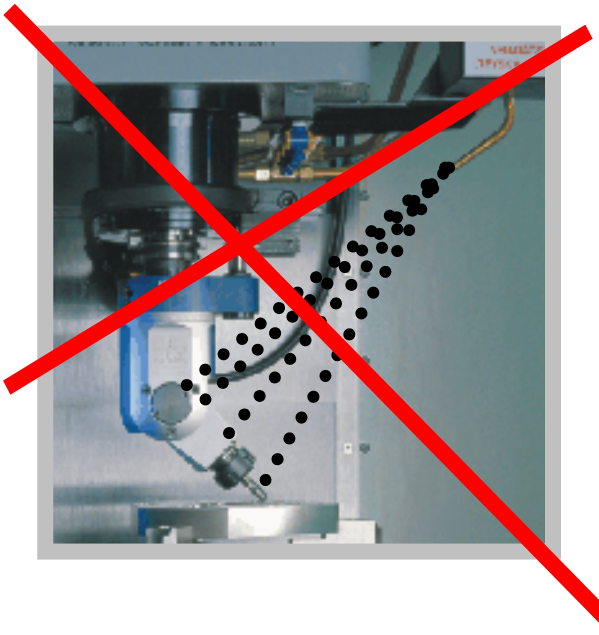
CAUTION!
Keep the recommended time for lubrication and amount of grease. The insufficient or excessive lubrication may be harmfull.

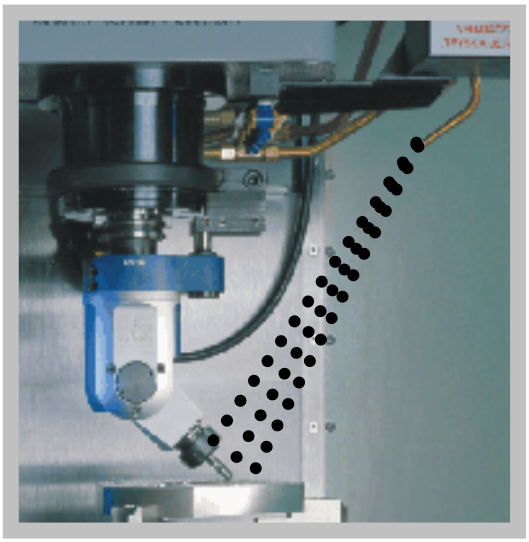
CAUTION!
Recommended depth for milling steel during one cycle not to exceed 0,35 - 0,5 diameter of tool according to quality of material. For maximum cutting conditions see page 22.



CAUTION!

Make sure that the cooling is pointed toward the cutting part of tool. Direction toward angle head body could result in rusting of inside parts if the head is not used for a longer period.





CAUTION!
Read carefully the instruction manual before use.

Contents

1. Delivery conditions

Milling angle heads are delivered with basic accessories in wooden box according to the code specification in the order. It is necessary to order collets and modular parts as separate items in the order, otherwise they are not included in the delivery.

List of basic accessories

FUH-PVI ER 25
special wrench REGO-FIX E 25
open-end wrench 36 DIN 894
hexagon key 2 ČSN 23 0710
hexagon key 2,5 ČSN 23 0710
hexagon key 4 ČSN 23 0710
hexagon key 5 ČSN 23 0710
hexagon key 6 ČSN 23 0710
retaining block

FUH-PVI ER 32
special wrench REGO-FIX E 32
open-end wrench 46 DIN 894
hexagon key 2 ČSN 23 0710
hexagon key 2,5 ČSN 23 0710
hexagon key 5 ČSN 23 0710
hexagon key 10 ČSN 23 0710
retaining block

FUH-FXI ER 25
special wrench REGO-FIX E 25
open-end wrench 36 DIN 894
hexagon key 2 ČSN 23 0710
hexagon key 2,5 ČSN 23 0710
hexagon key 5 ČSN 23 0710
hexagon key 6 ČSN 23 0710
retaining block

FUH-PVI ER 32
sepcial wrench REGO-FIX E 32
open-end wrench 46 DIN 894
hexagon key 2 ČSN 23 0710
hexagon key 2,5 ČSN 23 0710
hexagon key 5 ČSN 23 0710
hexagon key 10 ČSN 23 0710
retaining block

2. Description and use

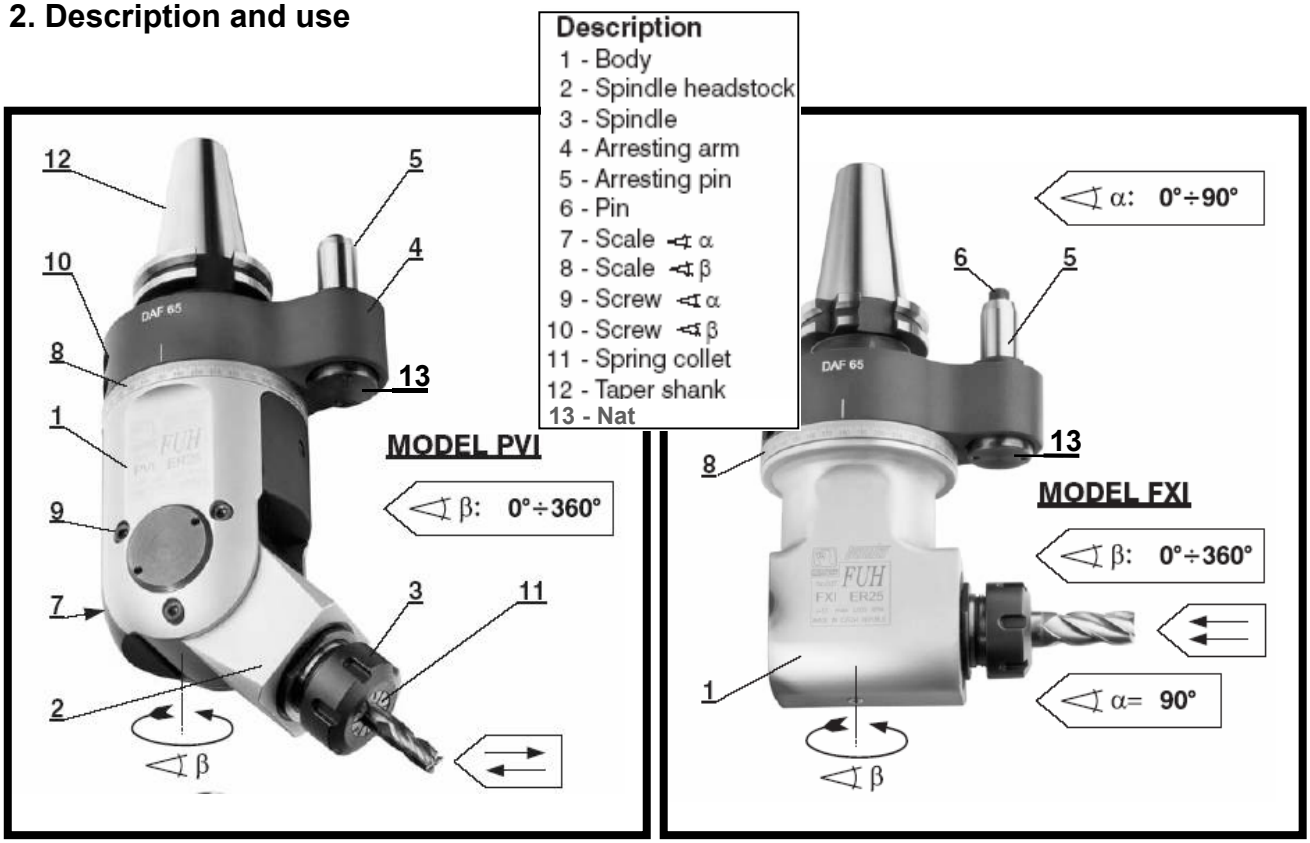


Fig. 1

Generally

The milling angle head is a precise device specified for use on NC and CNC machine tools, especially on boring and milling centres. The angular adjustable spindle makes possible to machine surfaces, for usual machine tools inaccessible, by one clamping of the workpiece. The milling angle heads increase the technologic features of the machine tools, working productivity and reduce the setting and handling times and the necessity of special clamping jigs. All these features have positive effect upon increasing of machining accuracy, because it is not necessary to change the position of the clamped workpiece.

The milling angle head is a precise device specified for milling and drilling. This head with the special collet for taps is applicable for tapping. The tapping is limited by admissible torque Mk [Nm]and power N [kW] depending on the used speed of rotation - see the diagrams. For orientation, we recommend to calculate the necessary power and maximum torque and compare this values with limits found in mentioned diagrams. If necessary, the cutting conditions have to be adapted.

The adjustable angle heads PVI and PVM have the angular adjustable working spindle within the range 0°- 90° to the machine spindle. Zero accords with the axis of the machine spindle (straight direction), while the slope angle of 90° represents the upright position of the working spindle to the machine spindle. The head body is possible to turn within the range 0°- 360° equally to the stright angle head FXI. The working spindle may be adjusted in any spatial position, which makes possible to machine any arbitrary oriented surface.

The stright angle head FXI has the working spindle upright to the machine spindle and its position is adjustable within the range 0°- 360°. It makes possible to drill the holes upright to the machine spindle or to mill various surfaces, slots or recesses inaccessible for milling cutters clamped in the machine spindle.

3. Safety Recommendations

Before using!!!
make sure that fixing screws 9,10 and 13 (see page 4, fig. 1) are correctly tighten (see the Table 1 - Tightening Torque for Screws) – see page 5.

Before starting!!!
make sure that the taper shank is correctly inserted in the machine spindle, the arresting pin in the retaining block and the head spindle is not arrested for both sense of rotation. Check the temperature of the head, the safe clamping of the tool in the collet and the **required sense of spindle rotation**. (see page 4., fig. 1; see page 7 and 8 – Table of basic technical data)

Take care by handling!!!
with the head regarding to the possible injury by sharp cutting tool clamped in the head or by fall of the relatively heavy device.

Before the start of the automatic tool change (ATC)!!!
check carefully the timing of the cycle especially the loading in the machine spindle, unloading from the spindle and transport in the tool magazine.

In the course of operation!!!
every 40 – 50 working hours, check the reliable function of the arresting pin and the free motion of the pin on feeding in the retainig block.

Table 1 –Tightening Torque for Screws

Thread size	Type of head	Function	Position	Torque (Nm)
M5	PVI ER 25, PVM ER 25	Angular position of the spindle	9	8
M6	PVI ER 32, PVM ER 32	Angular position of the spindle and body	10, 9	8 - 10
	PVI ER 25, PVM ER 25	Angular position of the body	10	
	FXI ER 25, FXM ER 25	Angular position of the body	10	
	FXI ER 32, FXM ER 32	Angular position of the body	10	

4. Basic technical data

Table 2

Model	Collet	Adjusting range	Modular parts	Taper shank
PVI ER 25 PVI ER 32	ER 25 ER 32	α=0° ÷ 90° β=0° ÷ 360°	DAF „A“	Compact with primery shaft, non-exchangeable
FXI ER 25 FXI ER 32	ER 25 ER 32	α=90° β=0° ÷ 360°	DAF „A“	
PVM ER 25 PVM ER 32	ER 25 ER 32	α=0° ÷ 90° β=0° ÷ 360°	DAF „A“ or PS + UP; PC	Exchangeable VKF Modular system
FXM ER 25 FXM ER 32	ER 25 ER 32	α=90° β=0° ÷ 360°	DAF „A“ or PS + UP; PC	

Description *(fig. 1)*

The base part of this head is the body (Pos. 1, see page 5, fig. 1). The adjustable heads PVI and PVM have a sloping spindle headstock (Pos. 2), making possible to set the angular position of the working spindle α within the range 0° ÷ 90°. The setting may be performed after loosening of 3 + 3 screws (Pos. 9). The value of the angle α may be read-off in the window – view direction 7. The spindle headstock of the fixed heads FXI and FXM is an integral part of the body and the working spindle makes an angle α = 90° with the axis of the taper shank (Pos. 12).
In the top part of the body, is a scale-ring (Pos. 8) that may be swung after loosening of the locking screw in the requisite position – see „Resetting of the angular scale“ on the page 14.
The arresting arm (Pos. 4), mounted on the body above the scale, has a mark for setting of the angle β.
The setting may be performed by swinging of the body regarding to the arresting arm after loosening of two screws (Pos. 10).
The primery shaft of models PVI and FXI and the taper shank constitute an integral part. On the other hand, the primery shaft of models PVM and FXM is equipped with a cylindric part with key for the exchangeable taper shank –VKF.
The arresting device of the arresting arm ensures the position of the primery shaft or taper shank regarding to the aressting pin (Pos. 5). Deblocking is realised by pushing of the pin (Pos. 6) about cca 6 mm. If the device is arrested, it is not possible to turn with the primary shaft.
The working spindle (Pos. 3) is equipped with a collet chuck designed for collets type ER 25 or ER 32 DIN 6499B.
At first, the slot of the collet has to be pressed on the tooth of the collet nut and then, it is necessary to screw the nut with the collet on the spindle. The tooth makes possible to pull out the collet after the nut is loosened.

The nut shall be tighten or loosen with two wrenches included in the accessories (Chapter 8) at any time!

Models PVM and FXM are designed for using in the modular system allowing to combine individual modular parts, if necessary.

The base assembly:
- head FUH PVM or FXM
- taper shank VKF
- arresting arm DAF (A)

The milling angle head is clamped by means of the taper shank in the machine tool spindle and its position is fixed with the arresting arm DAF. This head is useful for application on NC-machine tools with automatic tool change.

CAUTION!

The permissible input and torque for the base assembly of modular heads are lower compared with the fixed modification.

Special assembly:
- head FUH PVM or FXM
- taper shank VKF
- flange with scale PS
- universal flange UP
- (extension part PC) if necessary

The body of the milling angle head is clamped by means of flanges PS + UP to the spindle headstock of the machine tool. This modification is useful for application on conventional machine tools.

Basic technical data
models: **PVI ER 25; PVI ER 32**

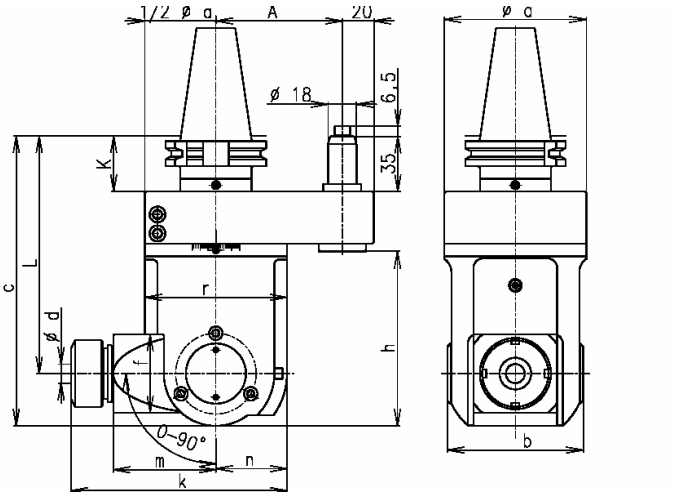


Fig. 2

Table of dimensions

mm	PVI ER 25	PVI ER 32
a	90	110
b	86	104
c	183	200
d	∅2÷ ∅ 16	∅2÷ 20∅
f	50	65
h	110	127
k	136	158
m	65	73
a	45	55
o	90	110

Assortment of taper shanks

code	Model	Taper shank	A /mm/ ▲	A /mm/ Δ	K /mm/	L /mm/	kg	↓
253 - 022	FUH - PVI ER 25	ISO 40 DIN 69871 A	65	80	35	150	6,65	■
- 015	FUH - PVI ER 25	CAT 40	65	80	35	150	6,65	■
- 039	FUH - PVI ER 25	BT 40	65	80	35	150	6,85	■
- 046	FUH - PVI ER 25	ISO 40 DIN 2080	65	80	35	150	6,55	o
- 053	FUH - PVI ER 25	ISO 50 DIN 69871 A	65	80	35	150	8,95	■
- 060	FUH - PVI ER 25	CAT 50	65	80	35	150	8,95	■
- 077	FUH - PVI ER 25	BT 50	65	80	50	165	9,15	■
- 084	FUH - PVI ER 25	ISO 50 DIN 2080	65	80	35	150	8,75	o
- 091	FUH - PVI ER 25	HSK 63 A DIN 69893	65	80	43	158	6,75	o
- 213	FUH - PVI ER 32	ISO 50 DIN 69871 A	80	110	35	160	12,5	■
- 206	FUH - PVI ER 32	CAT 50	80	110	35	160	12,5	■
- 220	FUH - PVI ER 32	BT 50	80	110	50	175	13,5	■
- 237	FUH - PVI ER 32	ISO 50 DIN 2080	80	110	35	160	12,6	o
- 244	FUH - PVI ER 32	HSK 100 A DIN 69893	80	110	46	171	11,5	o

■ basic suply
o for demand

Table of basic technical data

Quantity	**Unit**	**Model PVI ER 25**	**Model PVI ER 32**
Power input at max. speed **N**	kW	5	7,5
Max. torque **Mk**	Nm	15	28
Max. speed **n**	rpm	4000	3500
Gear ratio **i**	1	1:1	1:1
Sense of rotation (IN - OUT)	**1**	**unequal**	**unequal**
Type of the clamping collet DIN 6499		ER 25	ER 32
Chucking range **d**	mm	∅2 ÷ ∅16	∅2 ÷∅ 20
Working temperature **t**	°C	50	50
Max. temperature $\mathbf{t_{max}}$	°C	70	70

BASIC TECHNICAL DATA – models **FXI ER 25**
FXI ER 32

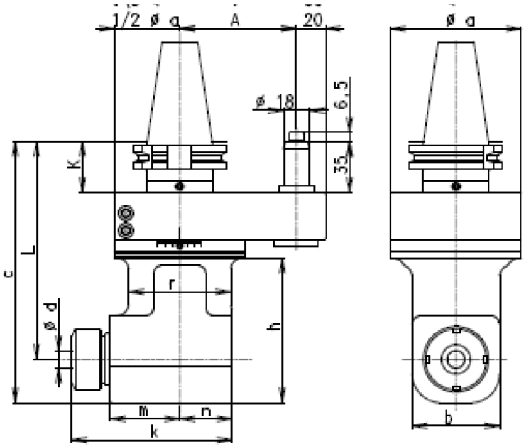


Table of dimensions

[mm]	FXI ER 25	FXI ER 32
a	90	110
b	60	78
c	180	198
d	2 ÷ 16	2 ÷ 20
h	100	125
k	110	144
m	48	66
a	36	48
r	70	90

Fig. 3

Assortment of taper shanks

code	Model	Taper shank	A /mm/ ▲	A /mm/ Δ	K /mm/	L /mm/	kg	↓
255 - 026	FUH - FXI ER 25	ISO 40 DIN 69871 A	65	80	35	150	5,7	■
- 019	FUH - FXI ER 25	CAT 40	65	80	35	150	5,7	■
- 033	FUH - FXI ER 25	BT 40	65	80	35	150	5,9	■
- 040	FUH - FXI ER 25	ISO 40 DIN 2080	65	80	35	150	5,6	o
- 057	FUH - FXI ER 25	ISO 50 DIN 69871 A	65	80	35	150	8,1	■
- 064	FUH - FXI ER 25	CAT 50	65	80	35	150	8,1	■
- 071	FUH - FXI ER 25	BT 50	65	80	50	165	8,2	■
- 088	FUH - FXI ER 25	ISO 50 DIN 2080	65	80	35	150	7,9	o
- 095	FUH - FXI ER 25	HSK 63 A DIN 69893	65	80	43	158	5,8	o
- 217	FUH - FXI ER 32	ISO 50 DIN 69871 A	80	110	35	160	11,8	■
- 200	FUH - FXI ER 32	CAT 50	80	110	35	160	11,8	■
- 224	FUH - FXI ER 32	BT 50	80	110	50	175	12,8	■
- 231	FUH - FXI ER 32	ISO 50 DIN 2080	80	110	35	160	11,9	o
- 248	FUH - FXI ER 32	HSK 100 A DIN 69893	80	110	46	171	10,8	o

DAF A …. ▲ Standard ↓ ■ basic supply
Δ Non-standard o for demand

Table of basic technical data

Quantity		Unit	Model FXI ER 25	Model FXI ER 32
Power input at max. speed	**N**	kW	6,5	9
Max. torque	**Mk**	Nm	18	32
Max. speed	**n**	Min^{-1}	4000	3500
Gear ratio	**i**	1	1:1	1:1
Sense of rotation (IN - OUT)		**1**	**equal**	**equal**
Type of the clamping collet DIN 6499			ER 25	ER 32
Chucking range	**d**	mm	∅2 ÷ ∅16	∅2 ÷∅ 20
Working temperature	**t**	°C	50	50
Max. tempe·rature	$\mathbf{t_{max}}$	°C	70	70

Basic technical data – models PVM ER 25
PVM ER 32
FXM ER 25
FXM ER 32

MODEL PVM

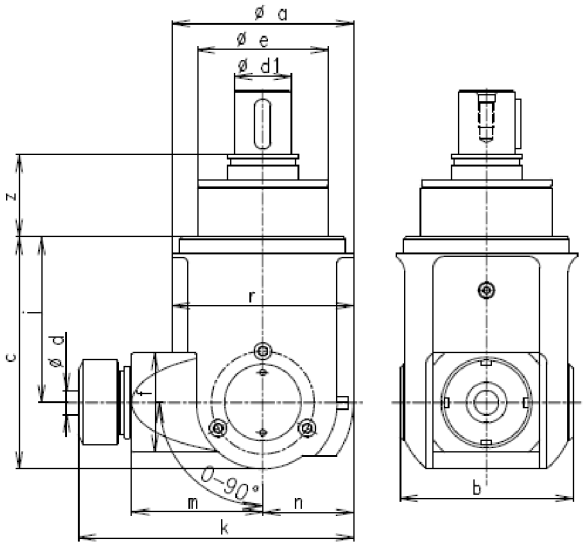


Fig. 4

MODEL FXM

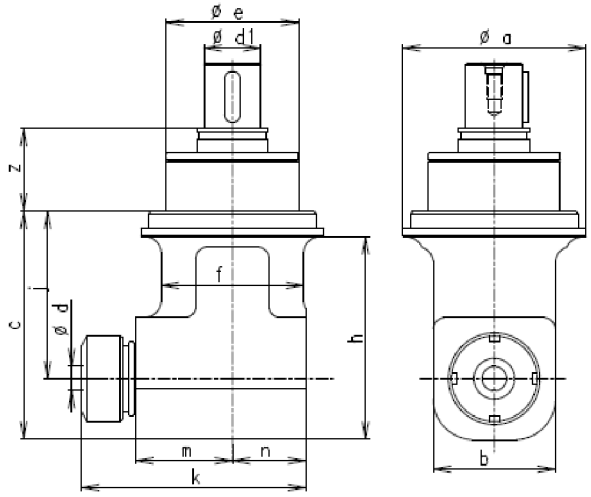


Fig. 5

Table of assortment and dimensions

Code	Model	/mm/													kg	↓
		a	b	c	d	d1	e	f	g	z	j	k	m	a		
253 - 305	FUH-PVM ER 25	90	86	115	2÷ 16	28	65	50	46	41	82	136	65	45	5,4	■
- 329	FUH-PVM ER 32	110	104	132	2 ÷20	44	85	65	46	45	92	158	73	55	9,6	■
- 312	FUH-FXM ER 25	90	60	112	2 ÷16	28	65	70	-	41	82	110	48	36	4,4	■
- 336	FUH-FXM ER 32	110	78	130	2 ÷20	44	85	90	-	45	92	144	66	48	8,9	■

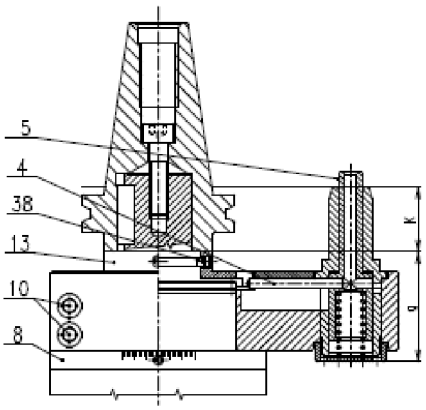
■ basic supply

Table of technical data

Quantity		Unit	Model PVM ER 25	Model PVM ER 32	Model FXM ER 25	Model FXM ER 32
Power input at max. speed	**N**	kW	3	5	3,5	6
Max. torque	**Mk**	Nm	10	18	12	21
Max. speed	**n**	min	4000	3500	4000	3500
Gear ratio	**i**	1	1:01	1:01	1:01	1:01
Sense of rotation (IN-OUT)		**1**	**unequal**	**unequal**	**equal**	**equal**
Type of the clamping collet	DIN 6499	-	ER 25	ER 32	ER 25	ER 32
Chucking range	**d**	mm	ø 2÷ ø 16	ø 2÷ ø 20	ø 2÷ ø 16	ø 2÷ ø 20
Working remperature	**t**	°C	50	50	50	50
Max. temperatura	$\mathbf{t_{max}}$	°C	70	70	70	70

BASIC TECHNICAL DATA – modular parts

1. Exchangeable taper shank



Model VKF

Code	Model	Taper shank	K /mm/	kg	↓
253 - 510	ER 25 / VKF 25	ISO 40 DIN 69871 A	27	5,7	■
- 503	ER 25 / VKF 25	CAT 40	27	5,7	■
- 527	ER 25 / VKF 25	BT 40	27	5,9	■
- 534	ER 25 / VKF 25	ISO 40 DIN 2080	27	5,6	o
- 541	ER 25 / VKF 25	ISO 50 DIN 69871 A	27	8,1	■
- 558	ER 25 / VKF 25	CAT 50	27	8,1	■
- 565	ER 25 / VKF 25	BT 50	42	8,2	■
- 572	ER 25 / VKF 25	ISO 50 DIN 2080	27	7,9	o
- 589	ER 25 / VKF 25	HSK 63 A DIN 69893	35	5,8	o
- 701	ER 32 / VKF 32	ISO 50 DIN 69871 A	23	11,8	■
- 718	ER 32 / VKF 32	CAT 50	23	11,8	■
- 725	ER 32 / VKF 32	BT 50	38	12,8	■
- 732	ER 32 / VKF 32	ISO 50 DIN 2080	23	11,9	o
- 749	ER 32 / VKF 32	HSK 100 A DIN 69893	34	10,8	o

■ basic supply
o for demand

Fig. 6

2. Arresting arm DAF

Table of assortment and dimensions

Code	Type	a [mm]	E [mm]	z [mm]	kg
253 – 909	DAF 25/65	90	65	33	0,5
253 – 916	DAF 25/80	90	65	33	0,55
253 – 923	DAF 32/80	110	85	33	0,6
253 – 930	DAF 32/110	110	85	33	0,8

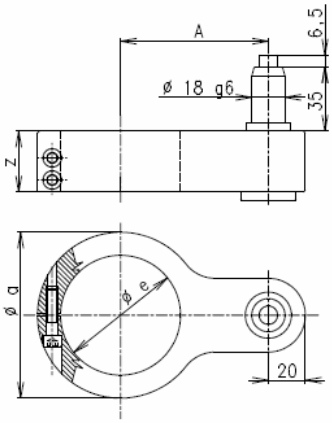


Fig. 7

Assembly of parts 1 and 2 on the models PVM and FXM

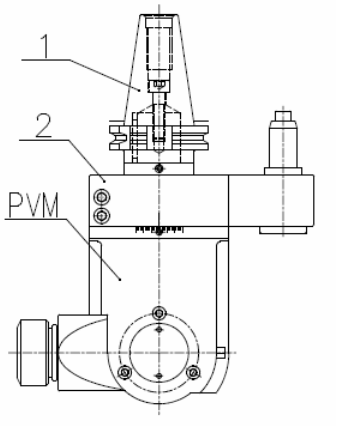


Fig.8

Assembly of arresting arm DAF and taper shank VKF on the milling head body

1. Make sure that the scale (Pos. 8) is mounted on the body.
2. Clean the contact surfaces of the body and arresting arm.
3. Loosen the screws (Pos. 10) on the arresting arm, push the screwdriver in the slot of the arresting arm and put the arm on the top part of the body, so that it may fit to the scale (Pos. 8). The arresting pin (Pos. 5) shall be situated on the same side as the taper shank.
4. Put the locating ring (Pos. 13) on the primery shaft, protruding from the body, so that the pin of the arresting arm (Pos. 4) may fit together with the radial slot on the periphery.

5. Screw the screws (Pos. 38), so that they may fit together with the recess in the primary shaft and then tighten them slightly.
6. Push the arresting pin, so that the pin may be unlocked, turn the primary shaft with the locating ring (Pos. 13) several times and make sure that this ring moves without friction.
7. In this case, loosen the screws (Pos. 38) slightly, lift the locating ring (Pos. 13) a little and retighten the screws (Pos. 38).
8. Clean the cylindric part of the primary shaft and the bore of the taper shank VKF and make sure that the key is mounted in the shaft.
9. Put the taper shank on the primary shaft, so that the key may fit togehther with the key slot, screw the screw (Pos. 14) fastening the taper shank with the primary shaft and tighten this screw firmly.

3. Flange with scale – PS

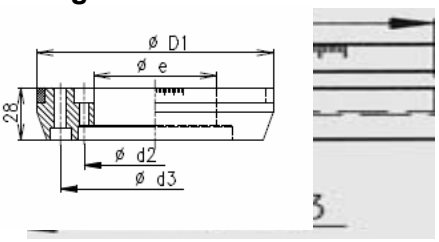


Fig. 9

Accessories for flanges PS 25 and UP 25

screw M5 x 20	ČSN 02 1143	6 pcs
screw M6 x 35	ČSN 02 1143	6 pcs
hexagon key 4	ČSN 23 0710	1 pc
hexagon key 5	ČSN 23 0710	1 pc

4. Universal flange UP

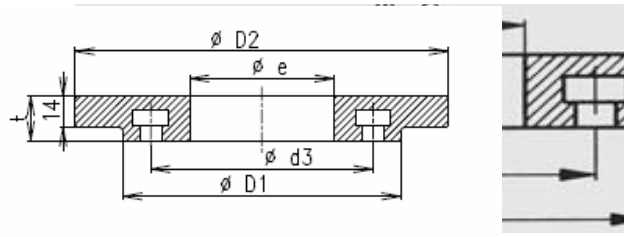


Fig. 10

Accessories for flanges PS 32 and UP 32

screw M5 x 20	ČSN 02 1143	8 pcs
screw M6 x 35	ČSN 02 1143	6 pcs
exagon key 4	ČSN 23 0710	1 pc
hexagon key 5	ČSN 23 0710	1 pc

Table of assortment and dimensions

Code	Type	Dimensions [mm]						kg
		e	D_1	D_2	d_2	d_3	t	
253 - 909	PS 25	65	125	-	75	100	-	1,7
253 - 916	PS 32	85	156	-	95	125	-	2,7
253 - 923	UP 25	65	125	168	75	100	20	2,1
253 - 930	UP 32	85	156	196	95	125	20	2,9

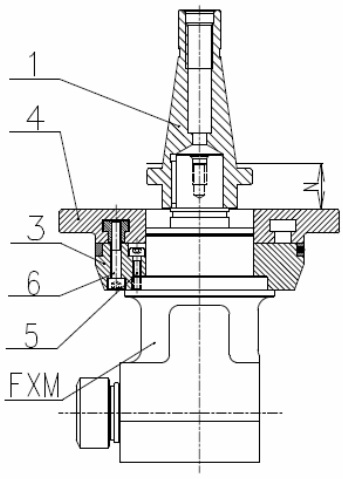


Fig. 11

Assembly of parts 1, 3 and 4 on the models PVM and FXM *(fig. 11)*

Assembly of the flange with scale PS, the universal flange US and the taper shank

Before the proper assembly, the customer has to solve the fixing of the universal flange US to the spindle headstock of the machine tool. The universal flange UP is made from alloy steel, thermal refined on 750 – 850 MPa.. It is possible to drill and tap in the periphery part of this flange. It is very important to know the correct distance N respecting the location of the taper shank in the machine spindle.

For FUH ER 25 N = K + 1 (mm)
FUH ER 32 N = K + 5 (mm

1. Take down the scale (Pos. 8) from the head body (see page 10, fig. 6)
2. Clean the contact surfaces of the head body and the flange with scale.

3. Put the flange with scale on the head (with the scale up).
4. Fasten the flange with scale to the head body by means of screws (Pos. 5, fig.11)
5. Locate the T-slot nuts in the universal flange according to the screws (Pos. 6, fig.11)
6. Clean the universal flange UP (Pos. 4, fig. 11), put it on the head body and screw the screws (Pos. 6) in T-slot nuts.
7. Clamp the taper shank VKF in the machine spindle.
8. Fasten the assembled head with flanges PS and UP to the spindle headstock of the machine tool, so that the primary shaft with the key, protruding from the head body, may fit together with the bore of the taper shank VKF. In this case, the taper shank is not fastened to the primery shaft with any screw.

5. Extension part PC *(Fig. 12)*

Table of assortment and dimensions

Code	Type	dimensions [mm]									
		a	e	d2	d1	M	L1	L2	S1	S2	kg
253 - 909	PS 25	90	65	75	28	M8	32	47	94	68	2,8
253 - 916	PS 32	110	85	95	44	M12	48	53	108	68	4,4

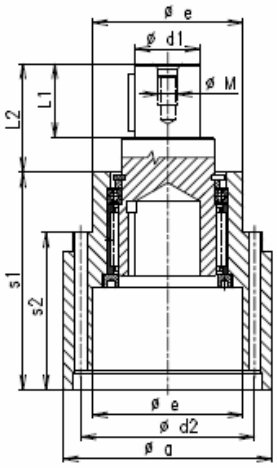


Fig. 12

Accessories for PC 25
screw M5 x 80 ČSN 02 1143 6 pcs
Accessories for PC 32
screw M6 x 80 ČSN 02 1143 8 pcs

Example for using of the extension part PC
For model FXM
1 - Exchangeable taper shank
2 - Extension part
3 - Flange with scale
4 - Universal fůange
5 - Screw

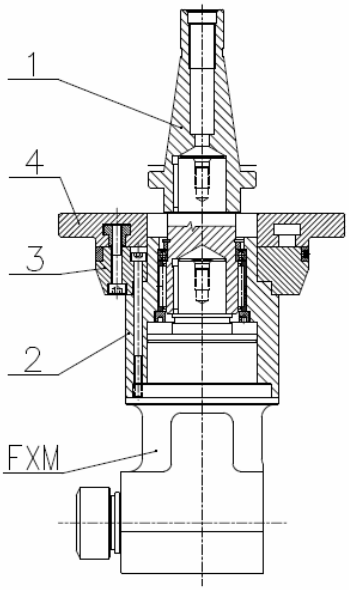


Fig. 13

Assembly of the extension part PC *(fig. 13)*

The extension part PC should be mounted together with the flange with scale and universal flange only.

1. Take down the scale (Pos. 8) from the head body.
2. Clean the contact surfaces of the head body and the extension part PC.
3. Put the extension part (Pos. 2) on the head.
4. Put the flange with scale (Pos. 3) on the extension part.
5. Fasten the flange with scale PS and the extension part PC to the head body by means of long screws M5 (M6) x 80.
6. Further method of assembly is identical as the assembly of flanges PS, UP and taper shank.

5. Clamping of the heads on the machine

Models with fixed or exchangeable taper shank and arresting arm are clamped by means of the taper shank in the machine spindle and the arresting arm, put on the retaining block, holds the head and the reacting forces being caused by machining. This clamping method is the most customary one and it is not used for clamping of models PVM and FXM with flanges PS and UP only.
The mechanical damage of the spindle cavity as well as the greater radial run-out of the machine spindle affect the output parameters of the head negatively and contribute to vibrations and run-out of the tool by work.

CAUTION!
The clean contact surfaces are the main condition for the correct and rigid clamping of the head in the machine spindle cavity. Before using of the milling angle head, we recommend to inspect the condition of the spindle of the machine tool. Make sure by means of the control taper arbor and marking grease that the taper mates on the whole surface in the spindle cavity. Check the run-out of the clamped control arbor in distance of 150 mm from the face (see the Figure 14).The run-out should not exceed 0,02mm in this point.

5.1 Location of the Retaining Block

The retaining block is supplied in the standard modification according to the Fig. 16 and it is included in the basic accessories.

Instruction for the assembly of the block

- Specify the suitable location for the assembly on the spindel headstock according to the disposition of the machine.
- The distance between the axis of the hole in the block and the spindle axis is specified by the dimension „Y“ in the figure 15. The standard arresting arm is supplied with Y = 65, Y = 80 or Y = 110 mm.
- Locate the retaining block so that the feed of the arresting pin may be exactly $6^{-0,5}$ mm.

Determination of the thickness of the shim

a) Clamp the head in the machine spindle and measure the distance „X“.
b) Remove the head from the spindle and put the retaining block on the arresting pin. Measure the distance „Z“ without pressing of the pin in the arresting pin.
c) Calculate the thickness of the shim according to the formula

S = X – Z + 6 [mm] **(Tolerance value – 0,5 mm is applied for both head types)**

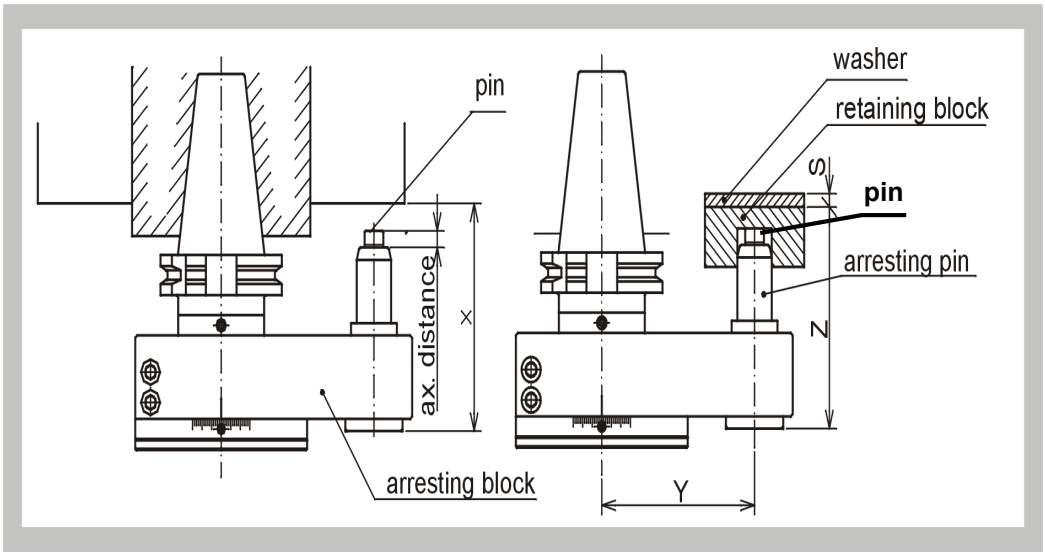


Fig. 15

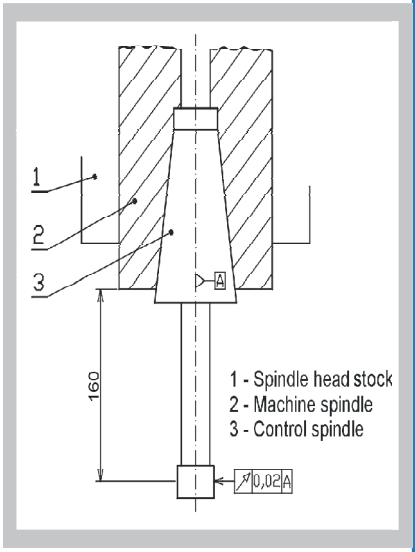


Fig. 14

5.2 Orientation of the Taper Shank in Regard of the Arresting Pin

Carry out the exact setting of the retaining block and orientation of the taper shank in regard to the arresting pin by following procedure – see the fig. 17.

a) Tighten slightly the retaining block by fixing screws (Pos. 5) to the machine spindle headstock.
b) Loosen the locking screws (Pos. 3) on the ring (Pos. 4) with one turn and put the taper shank in the machine spindle and the arresting pin in the retaining block. Check the free motion of the pin before clamping the head.
c) Retighten the fixing screws (Pos. 5) of the retaining block by fixed position of the head
d) Remove the locking screws (Pos. 3), clean and degrease this screws carefully and apply 2 drops of adhesive (e.g. Loctite 243) on the threads.
e) Check the correct position of the taper shank regarding to the tool change device and screw the locking screws with adhesive in degreased holes of the ring (Pos. 4). Retighten this screws carefully.
f) Try the correct action of the automatic tool change device with this angle head.

WARNING!!!

Within the first automatic change cycle, make sure that the head loaded in the changing device does not clash with the other tools and system elements.

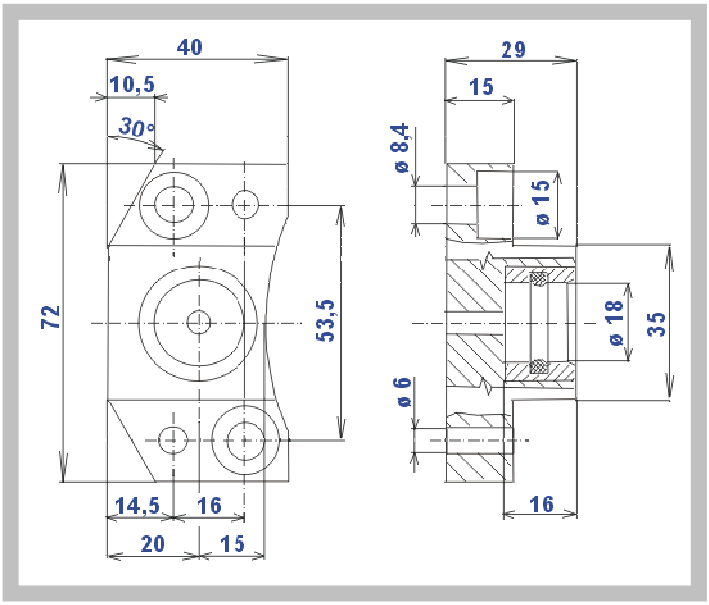


Fig. 16

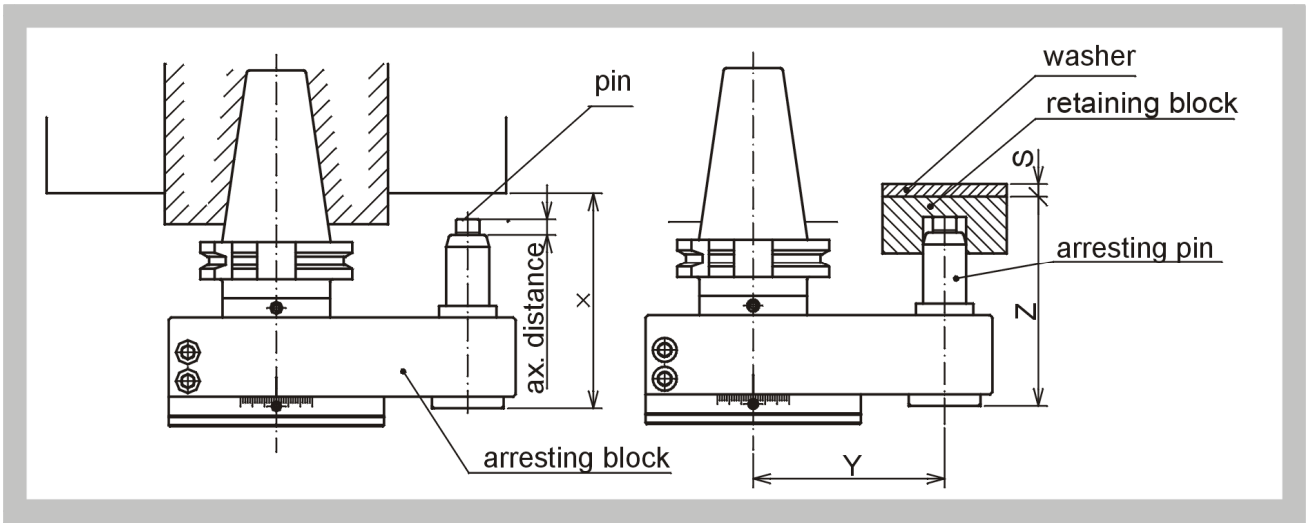


Fig. 17

6. Setting of the Angular Position of the Head Body

6.1 Setting of the Angular Position of the Head Body – Models FXI (FXM) *(Fig. 18)*

The head body (Pos. 1) can turn round the lengthwise axis of the head – it is possible to set any angular position β within the range 0° - 360°.

a) Clamp the head in the machine spindle.
b) Loosen two screws (Pos. 10).
c) Turn the body (Pos. 1) to the required angular position β according to the scale. Before the first setting, it is necessary to reset the scale according to the article 6.3.
d) Tighten two screws (Pos. 10) slightly, clamp the control arbor (Pos. 14) in the spring collet and set the precise position of the head by means of the dial gauge.
e) Retighten two screws (Pos. 10) by torque according to the table1 (see page 5).
f) Remove the control arbor and put it in the casette.

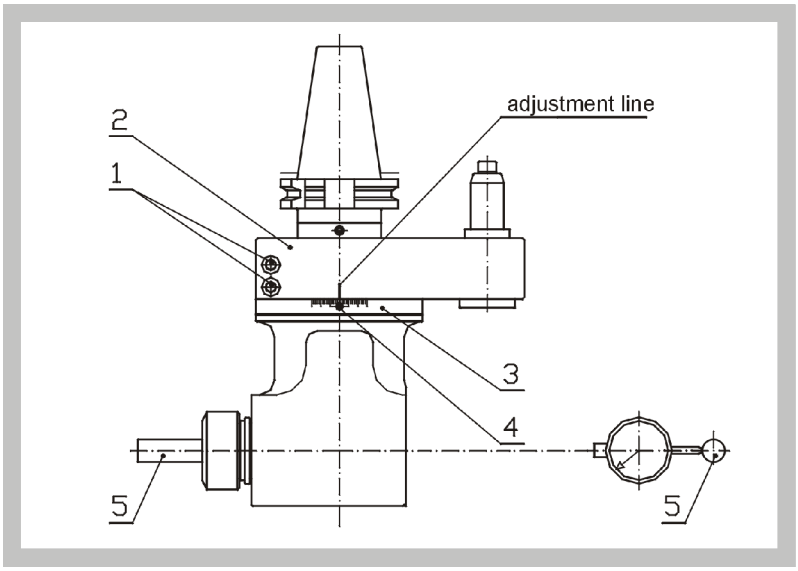


Fig. 18

6.2 Setting of the Angular Position of the Head Body – Models PVI (PVM) (*Fig. 19)*

Method of setting of the angular position of the head body is identical as in article 6.1.
After clamping of the head in the machine spindle according to the point a), it is necessary to swivel the head spindle in the position 90° according to the method mentioned in chapter 7 and points b) – f) of the article 6.1.

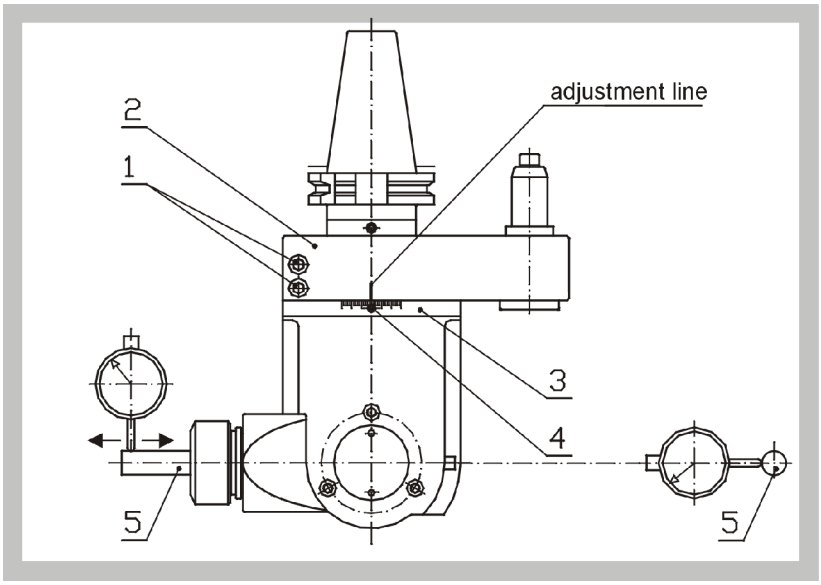


Fig. 19

6.3. Resetting of the Angular Scale *(Fig. 19)*

If you have set the precise angular position of the head body by means of the control arbor and dial gauge according to the article 6.1, loosen now the locking screw (Pos. 4) and turn the scale (Pos. 3) so that the value of this angle may be in coincidation with the mark on the arresting arm. After retigtening the screw (Pos. 4), the scale is calibrated for this machine tool.

7. Setting of the Angular Position of the Head Spindle – Models PVl (PVM)- Fig. 20

The slope angle of the head spindle α may be set within the range 0°- 90°.

Method of setting:

a) Loosen 6 screws (Pos. 9) and set the slope by means of the scale.
b) Retighten these 6 screws (Pos. 9) by torque according to the table1.

If the slope of the spindle should be set more exactly than ± 30´, it is necessary to use the control arbor clamped in the spindle and realise the exact setting by means of the dial gauge (Fig. 20).It is efficient to use the sine bar.

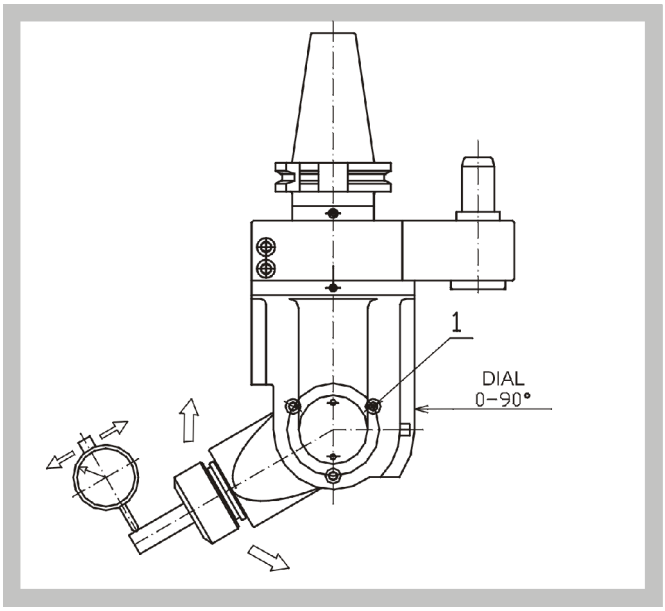
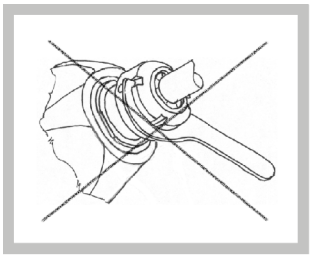


Fig. 20



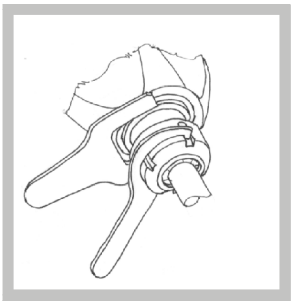


Fig. 21

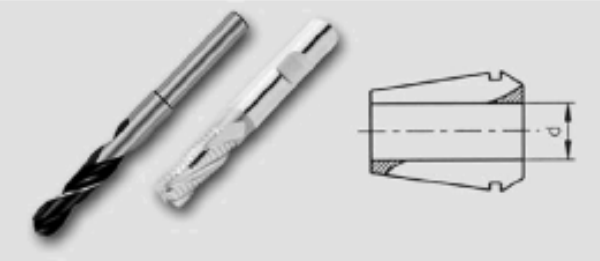


Fig. 25

8. Clamping of Tools

Cutting tools are clamped in steel spring collets type ER 25 or 32 DIN 6499.

The correct method for tool clamping:

a) Put the spring collet in the clamping nut so that the tooth of the nut may fit in the slot of the collet.
b) Put the necessary tool with straight shank in the collet and tighten firmly the clamping nut by two wrenches supplied in the accessories. The nut shall be tightened by the special wrench while the spindle is held by the open end wrench – Fig. 21.

Recommendation

The clean contact surfaces of the tool, spring collet and collet chuck, the corresponding size of the collet are the main conditions for the correct and rigid clamping of the tool and make possible to keep the run-out within 0,02 mm. A little amount of rotation of the collet in the chuck cavity could reduce the run-out and eliminate the potencial inaccuracy of the chucking.

CAUTION!

It is not allowed to tighten the nut by striking on the wrench. The non-observance of this warning may cause heavy damage of the bevel gears and bearings. Removing of the tool is realised by loosening of the clamping nut or by reverse clamping method.

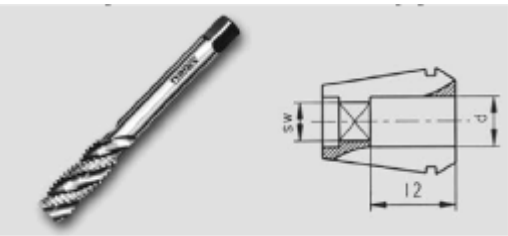
Spring Collets

The spring collets are not included in the basic accessories and therefore it is necessary to order them as an individual item.

Chucking range /mm/	ER 25	ER 32
3,00 2,00	283 - 012	283 - 302
4,00 3,00	283 - 029	283 - 319
5,00 4,00	283 - 036	283 - 326
6,00 5,00	283 - 043	283 - 333
7,00 6,00	283 - 050	283 - 340
8,00 7,00	283 - 067	283 - 357
9,00 8,00	283 - 074	283 - 364
10,00 9,00	283 - 081	283 - 371
11,00 10,00	283 - 098	283 - 388
12,00 11,00	283 - 104	283 - 395
13,00 12,00	283 - 111	283 - 401
14,00 13,00	283 - 128	283 - 418
15,00 14,00	283 - 135	283 - 425
16,00 15,00	283 - 142	283 - 432
17,00 16,00	-	283 - 449
18,00 17,00	-	283 - 456
19,00 18,00	-	283 - 463
20,00 19,00	-	283 - 471

Spring collets of standard accuracy

d /mm/	SW /mm/	l2 /mm/	NORMA	ER 25-GB	ER 32-GB
4,0	3,15/3,2	18	ISO, JIS	284 - 002	284 - 200
4,5	3,4	18	DIN	284 - 019	284 - 217
5,0	4,0	18	ISO, JIS	284 - 026	284 - 224
5,5	4,3	18	DIN	284 - 033	284 - 231
5,5	4,5	18	JIS	284 - 040	284 - 248
6,0	4,5	18	JIS	284 - 057	284 - 255
6,0	4,9	18	DIN	284 - 064	284 - 262
6,2	5,0	18	JIS	284 - 071	284 - 279
6,3	5,0	18	ISO, JIS	284 - 088	284 - 286
7,0	5,5	18	DIN, JIS	284 - 095	284 - 293
7,1	5,6	18	ISO, JIS	284 - 101	284 - 309
8,0	6,2/6,3	22	DIN, ISO	284 - 118	284 - 316
8,5	6,5	22	JIS	284 - 125	284 - 323
9,0	7,0/7,1	22	DIN, ISO	284 - 132	284 - 330



Spring collets ER-GB are not on stock usually and it is necessary to inquire for their delivery. (Fig. 25 on the page 14)

9. Service conditions

Heads are supplied after a short running-in mode only, that is necessary for the verification of perfect working. For the first use, we recommend to increase the speed successively so that the grease filling may be formed. (The grease may be stiff after some time of non-using)
The working temperature should be kept within the range 30 ÷ 50°C when the head is greased correctly. We recommend to increase the speed successively also, if the starting temperature of this device is lower than 5°C.

Mode of successive speed increase

- 500 rpm for 10 minutes
- 2000 rpm for 5 minutes
- 2500 rpm for 5 minutes
- 3000 rpm for 5 minutes

After realisation of this mode, the temperature of the head reaches the recommended value and the grease covers all lubricated surfaces reliably. If the temperature reaches the maximum admissible value after first time of working, this situation is not critical supposing that the temperature has a falling trend after one working hour and it is not accompanied with an excessive noise.

WARNING!

The maximum driving torque Mk_{max} [Nm] and power N_{max} [kW] are mentioned for every model in diagrams on Fig. 22 for preventing of any overload of these heads.

These diagrams illustrate the relations of torque Mk [Nm], power N [kW] and speed of rotations of the head spindle n [rpm]. It is possible to determine the maximum values of torque and power at applied speeds for all types of heads.

Relation of torque (Mk) and speed of rotation (n) Relation of power (N) and speed of rotation (n)

Speed-torque diagram Mk= f(r) **Speed-power diagram N =f(r)**

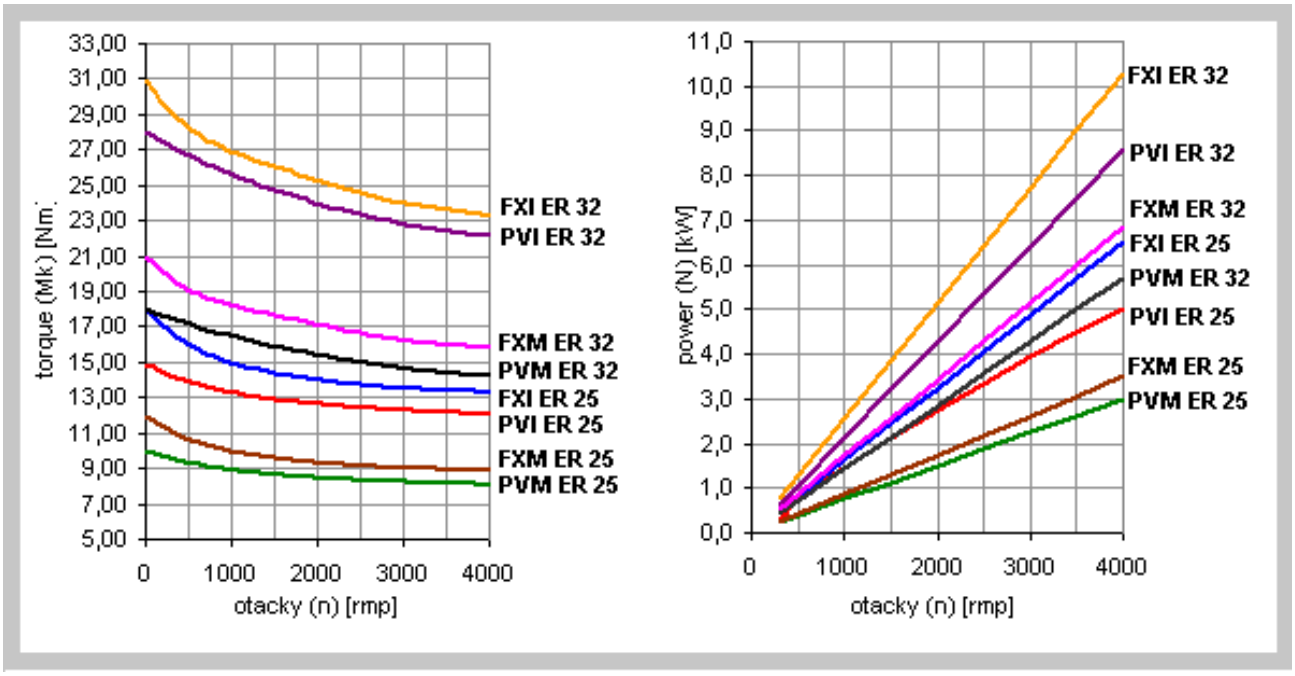


Fig. 22

10. Maintenance and storing

The milling angle heads shall be stored in dry rooms with max. relative humidity 75 % and protected against mechanical damage and chemical effects. We recommend to protect the ground surfaces with an anticorrosive agent for long-termed storing.
The heads are supplied well greased and prepared for use. In course of their use, it is necessary to fill the grease according to the following instructions.
Models PVI and PVM – every 500 working hours fill 30 – 50 g of grease in the hollow after dismantling of the protecting cover (Pos 3 on fig. 24).
Models FXI and FXM – every 1000 working hours press 30 – 50 g of grease in the grease cup on the bottom side of the head (Pos. 42 on fig. 23).

Recommended grease: METABOND F1,5 mixed 4:1 with grease BLASOLUBE 301

CAUTION!
Keep the recommended time for lubrication and amount of grease. The insufficient or excessive lubrication may be harmfull.

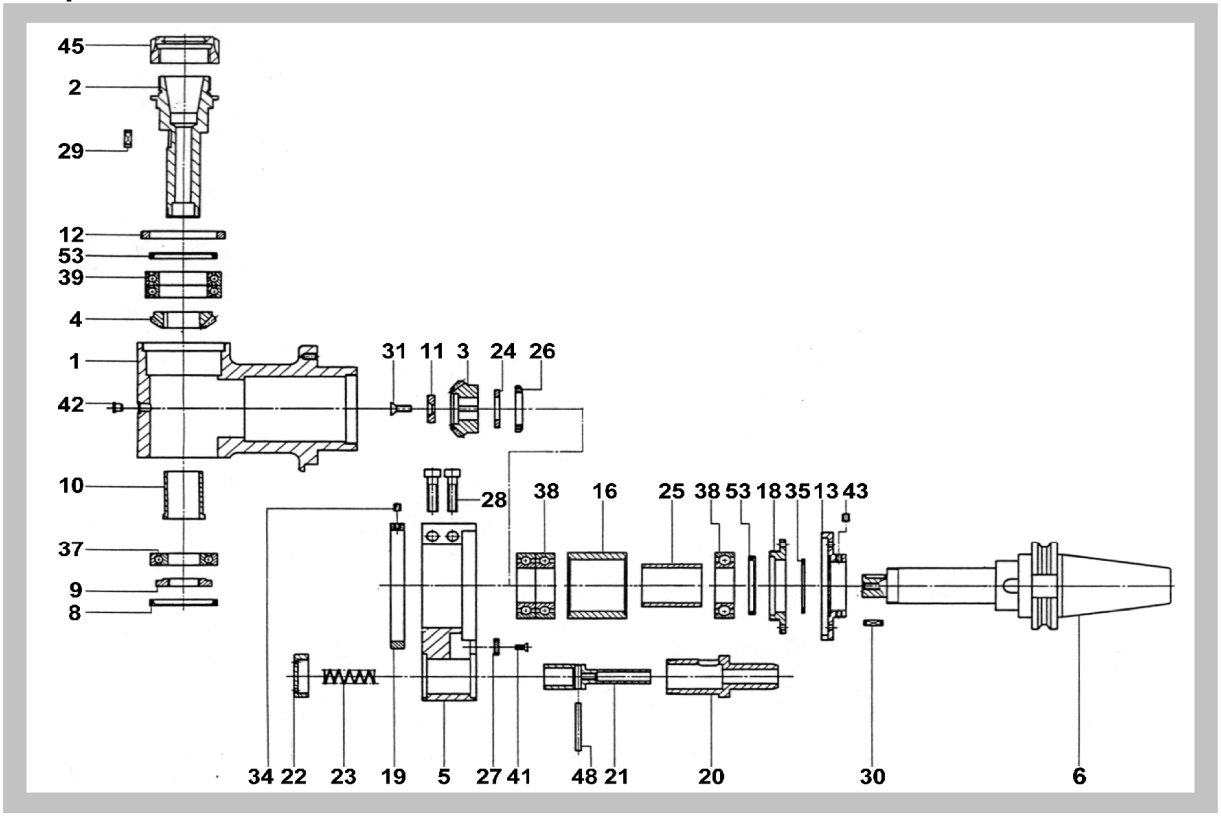
11. Liquidation of the packing

The packing is the constituent part of the product and it consists of the wooden box and pliant plastic packing block.
Disposal of packing: burning

12. Guarantee and guarantee conditions

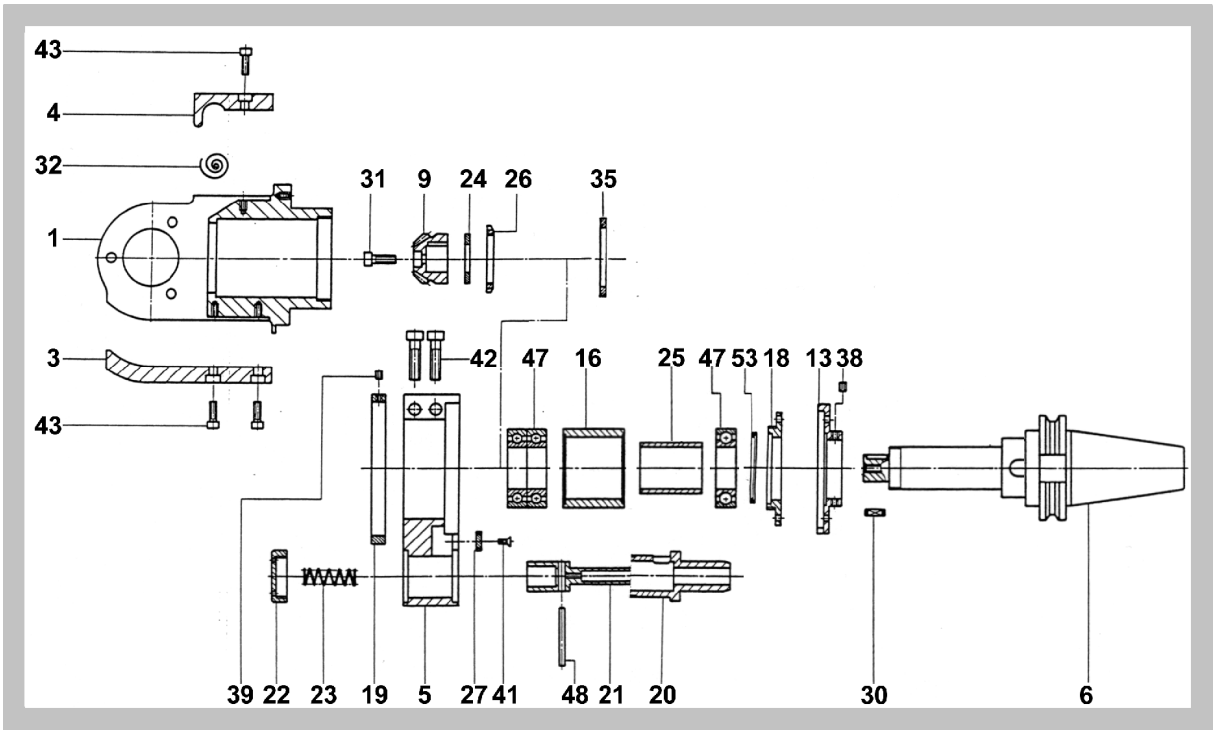
1. Term of guarantee: The manufacturer provides the guarantee for the trouble-free service within the 12 months since the day of sale to the first direct user, no longer than the 18 months since the day of delivery to the wholesaler.
2. The guarantee is not provided for parts having the shorter working life specified in standards or being replaced periodically. The manufacturer does not warrant for the damage done by sender, for defects done by the incompetent staff, by unsuitable storing, by overloading or wasteful handling.
3. The manufacturer reimburses the transport expenses to the place of guarantee repair and back after his agreement with the mode of transport only.
4. In case of reclamation, it is needful to send or submit the invoice unconditionally. The repair cannot be admitted without this invoice as guarantee repair and it has to be reimbursed. The guarantee is admitted if:
   a) the device was used according to the instruction for use and all recommendations for maintenance and operation were observed.
   b) the device was not modified by the user or by the third person without agreement of the manufacturer.
5. The guarantee repairs are realized within 30 days since receiving from the sender.
6. The manufacturer realizes all repairs after validity of guarantee as well.
7. The other affairs are solved according to the commercial code

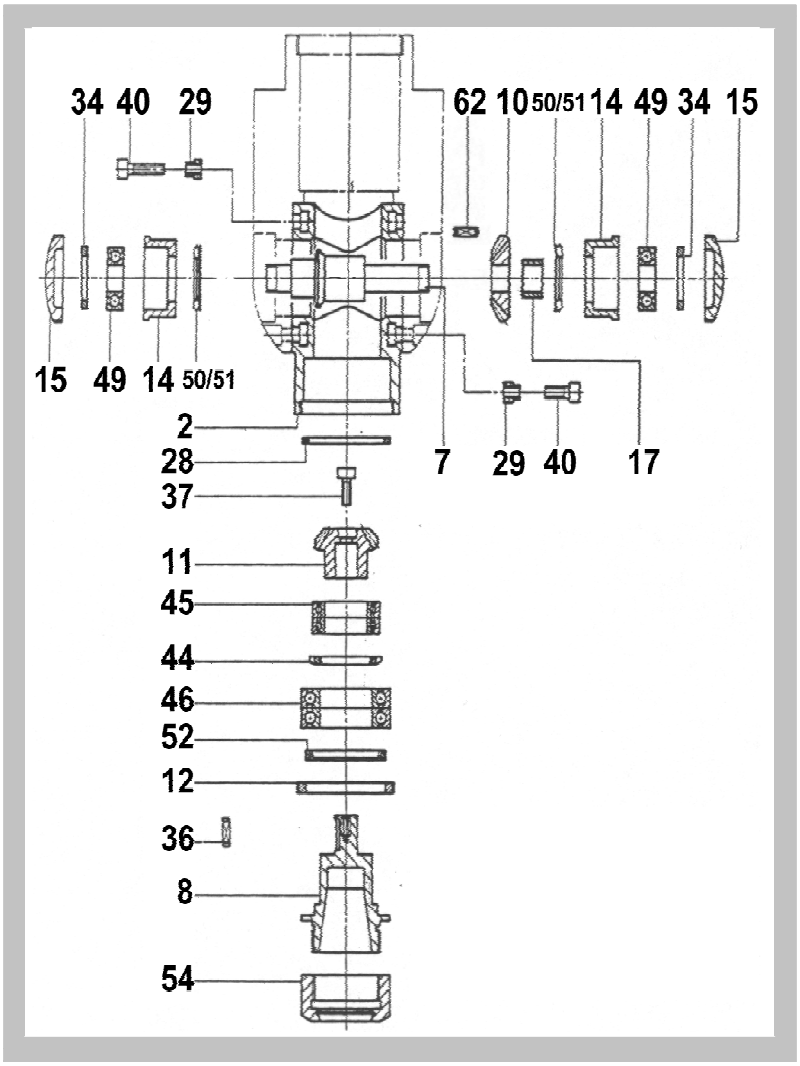
13. Spare Parts



1	Body	11	Washer	21	Pin	30	key	42	Grease cup
2	Spindle	12	Spindle nut	22	Nut	31	Screw	43	Screw
3	Bevel gear	13	Flange	23	Spring	33	Exchangeable	45	Collet nut
4	Bevel gear	16	Distance	24	Ring		taper shank	48	Needle
5	Arresting arm		sleeve	25	Distance	34	Screw		rooler
6	Taper shank	17	Nut of the		sleeve	35	Ring	53	Seal
8	Cover		taper shank	26	Nut	37	Ball bearing	59	Screw
9	Nut	19	Scale	27	Cover	38	Ball bearing	60	Key
10	Distance	20	Arresting	28	Screw	39	Ball bearing		
	sleeve		pin	29	Key	41	Screw		

List of Spare Parts for PVI ER 25, PVI ER 32
PVM ER 25, PVM ER 32





1 Body
2 Spindle headstock
3 Rear cover
4 Fore cover
5 Arresting arm
6 Driving shaft
7 Countershaft
8 Spindle
9 Bevel gear
10 Bevel gear
11 Bevel gear
12 Spindle nut
13 Flange
14 Distace sleeve
15 Cover
16 Distace sleeve
17 Distace sleeve
18 Nut of the taper
19 Scale
20 Arresting pin
21 Pin
22 Nut
23 Spring
24 Ring
25 Distace sleeve
26 Nut
27 Cover
28 Ring
29 Segment
30 Key
31 Screw
32 Spiral spring
34 Ring
35 Ring
36 Key
37 Screw
38 Screw
39 Screw
40 Screw
41 Screw
42 Screw
43 Screw
44 Nut
45 Ball bearing
46 Ball bearing
47 Ball bearing
48 Needle roller
49 Ball bearing
50 Axial cage with needles
51 Axial ring
52 Seal
53 Seal
54 Collet nut
62 Key

14. Ordering mode of spare parts

It is necessary to specify:
1. Model – mark and serial number
2. Position number and name
3. Number of ordered parts

Example:

Model PVI ER 25No.: 001
Pos. 20 – arresting pin 1 pc
Pos. 49 – ball bearing 2 pcs

CAUTION!
Number of positions mention in the order only from the list of spare parts – 13rd secton.

15. Catting conditions – working examples

WORKING EXAMPLES

Angle heads			PVI ER 25	PVM ER 25	FXI ER 25	FXM ER 25	PVI ER 32	PVM ER 32	FXI ER 32	FXM ER 32
Max. torque		[Nm]	15	10	18	12	28	18	32	21
End mill max.		Ř[mm] (*)	16 (5/8")	16 (5/8")	16 (5/8")	16 (5/8")	20 (3/4")	20 (3/4")	20 (3/4")	20 (3/4")
Al-ALLOY ks 680 N/mm^2	Speed max.	RPM	1200	1200	1200	1200	1000	1000	1000	1000
	Feed max.	mm/min	0,03	0,025	0,04	0,035	0,03	0,025	0,035	0,03
	Millig deep max.	mm	11	9	15	12	15	12	25	18
	Tapping max.		M20	M20	M22	M22	M24	M24	M27	M27
CAST IRON ks 1600 N/mm^2	Speed max.	RPM	540	540	540	540	430	430	430	430
	Feed max.	mm/min	0,025	0,02	0,03	0,025	0,025	0,02	0,03	0,02
	Millig deep max.	mm	8	6	12	10	10	8	15	12
	Tapping max.		M14	M14	M16	M16	M16	M16	M20	M20
C40 STEEL ks 2600 N/mm^2	Speed max.	RPM	400	400	400	400	470	470	470	470
	Feed max.	mm/min	0,02	0,015	0,025	0,02	0,02	0,015	0,025	0,02
	Millig deep max.	mm	8	6	10	8	10	8	12	10
	Tapping max.		M12	M12	M14	M14	M14	M14	M16	M16

(*) For cast iron and steel: chip breaker cutter
All the data shown is for indicative purposes only and can be obtained only under ideal working conditions and with heads equipped with an ISO 50, CAT 50 or BT 50 tool drive.

16. Defects, causes, remedy – Angle Head Fuh – PVI, PVM, FXI, FXM

Number:	DEFECT	CAUSE	WAY OF THE REMEDY
1	The head clamped in the machine spindle is vibrating at the speed without any load	►the taper is not clamped properly in the spindle cavity	► clean the spindle, check status of spindle cavity for colour, clamp the head into another machine
		►excessive clearance between the locking pin and opening of stopping cube	►hand over the head to repair
		►runout of driving shaft	►hand over the head to repair
		►clearance in the bearings of the driving shaft	►hand over the head to repair
		►loosened screws of the arrestment holder	►tighten close the screws 42
2	The head is vibrating under the load only	►insufficient rigidity in attachment of the head box towards the machine	►tighten close the screws 42 of arrestment holder ►tighten close the nuts of locking pin 22 ►reduce the clearance between the pin and the opening of stopping cube to 0,02 mm
		►increased straining of the head by the cutting hole of the tool	►reduce cutting conditions ►select cutter with higher number of teeth
		►the cutting tool is blunt	►replace the blunt tool for a sharp one
		►clearance in the bearings of the driving shaft	►hand over the head to repair
		►insufficient clamping of the work piece	►increase rigidity of work piece or fixture clamping
		►interrupted cut	►reduce the cutting conditions
		►insufficient clamping of the head taper in the spindle cavity	►clean the spindle, check status of spindle cavity for colour, clamp the head into another machine
3	The clamped tool in the collet shows runout greater than 0,03mm	►poor clamping in the collet	►clean the clamping device of collet, remove the pressed-in and stuck impurities from the ground surfaces ►try to turn the collet by 180 grades
		►defective tool (bent or damaged clamping shank)	►replace the tool
		►the spindle is bent (in the cavity for the collet it shows runout greater than 0,02mm)	►hand over the head to repair

Number:	DEFECT	CAUSE	WAY OF THE REMEDY
4	When running the head overheats, the temperature exceeds 60°C and still grows	►insufficient lubrication of bearings and tooth wheels	►refill the grease (see instruction manual)
		►defective bearings ►incorrect clearance in the gear ►impurities in the gear box ►increased friction on the packing rings of the shafts	►hand over the head to repair
5	The head shows increased noisiness when running without load	►insufficient lubrication of bearings and tooth wheels	►refill the grease (see instruction manual)
		►defective bearings ►clearance in bearings	►hand over the head to repair
6	The driving shaft is stuck, cannot rotate	►position blocked with the pin of the locking pin	►check the function of locking pin (when pressing in the locking pin, the pin must stick out from the flange and release the position of the shaft)
		►seized bearings ►seized gear	►hand over the head to repair
7	The spindle does not keep the set angle	►insufficiently tightened screws	► tighten the screws
		►defect in mounting of the headstock in the body	►hand over the head to repair
8	The head does not keep the position set on the machine	►insufficiently tightened clamping joint of the arrestment holder	►tighten both screws 42
		►the head is overloaded with cutting resistance or by using the unsuitable or blunt cutter	►adjust the cutting conditions, change the used tool
9	The head drags at automatic change of the tool	►incorrectly set position of the locking pin	►change the setting of position using the instruction manual
		►poorly installed stopping cube	► check the clearance of the pin mounting towards the opening of the stopping cube, keep the alignment of both diameters in the value of 0,01mm at maximum
		►defect in locking pin	►check if the spindle easily moves, it cant drug ►remedy the defect