SHARP

HORIZONTAL BORING & MILLING MACHINE

Model: KHM-140

OPERATION MANUAL

CONTENTS

1. Machine Specifications

1.1 Specification of

	CS-HB120	CS-HB140	CS-HB180
1. Capacity			
Table travel (X axis)	1200mm	1400mm	1800mm
Head travel (Y axis)	1200mm	1200mm	1400mm
Table travel (Z axis)	800mm	1100mm	1250mm
Spindle center to table top	0-1200mm	0-1200mm	0-1400mm
Spindle end to table center	255-1055mm	255-1355mm	255-1505mm
2. Table			
Table size overall	1100x800mm	1100x800mm	1500x800mm
T-Slot (width *no. *pitch)	20x7x100mm	20x7x100mm	20x7x100mm
Table load capacity	1200kgs	1400kgs	2000kgs
3. Spindle Head			
Spindle nose	ISO R297 No.50	ISO R297 No.50	ISO R297 No.50
Spindle speed (60Hz) 12 steps	45-1500rpm	45-1500rpm	45-1500rpm
4. Feed / Rapid			
X,Y,Z rapid (60Hz)	2880mm/min	2880mm/min	2880mm/min
X,Y,Z auto feed (60Hz)	28-875mm/min	28-875mm/min	28-875mm/min
Z axis boring feeds (12 steps)	0.028-0.875mm/rev	0.028-0.875mm/rev	0.028-0.875mm/rev
5. Motots			
Spindle motor	AC10HP (7.5kW-4P)	AC10HP (7.5kW-4P)	AC10HP (7.5kW-4P)
Feed motor	AC2HP (1.5kW-4P)	AC2HP (1.5kW-4P)	AC2HP (1.5kW-4P)
Lube pump for headstock	AC0.2kW-4P	AC0.2kW-4P	AC0.2kW-4P
Lube pump for slideway	AC3.5W-2P	AC3.5W-2P	AC3.5W-2P
Coolant pump	AC1/6HP (0.12kW-2P)	AC1/6HP (0.12kW-2P)	AC1/6HP (0.12kW-2P)
Hydraulic pump for axis clamp	AC2HP (1.5kW-4P)	AC2HP (1.5kW-4P)	AC2HP (1.5kW-4P)
6. Machine Size			
Floor area	3150x3400mm	3310x3600mm	4420x3750mm
Net weight (Approx.)	7800kgs	8400kgs	11500kgs

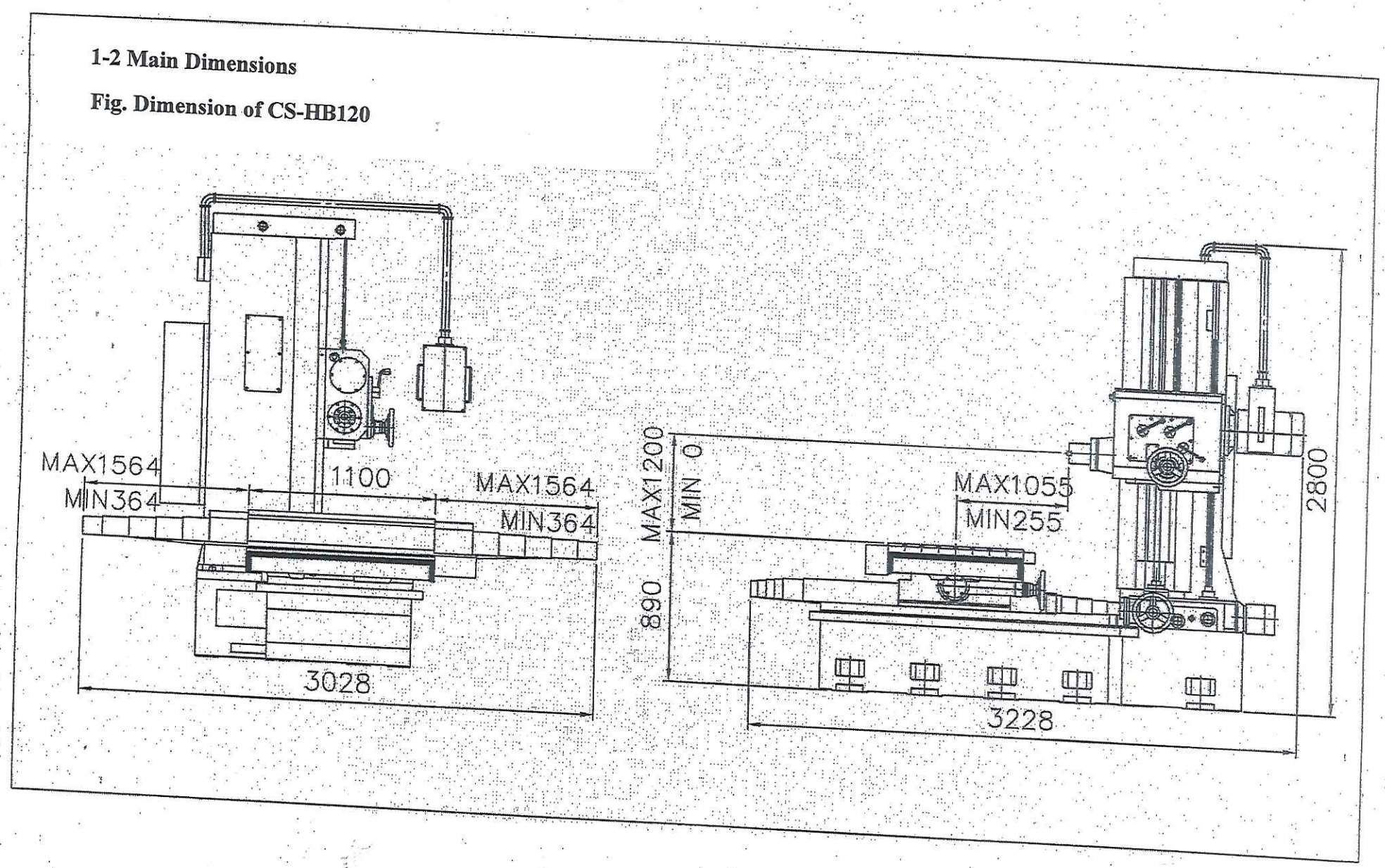
Standard accessories:

1. Automatic lubrication system
2. Coolant system
3. Index table, 600x600mm, 72Divisions
4. Air power draw-bar
5. With Digital Read Out
6. X & Y-axis with ballcrew
7. Tapping function
8. X,Y & Z-axis with clamp
9. Tool box with adjustment tools
10. Leveling blocks and bolts

Design and specifications are subject to change without prior notice.

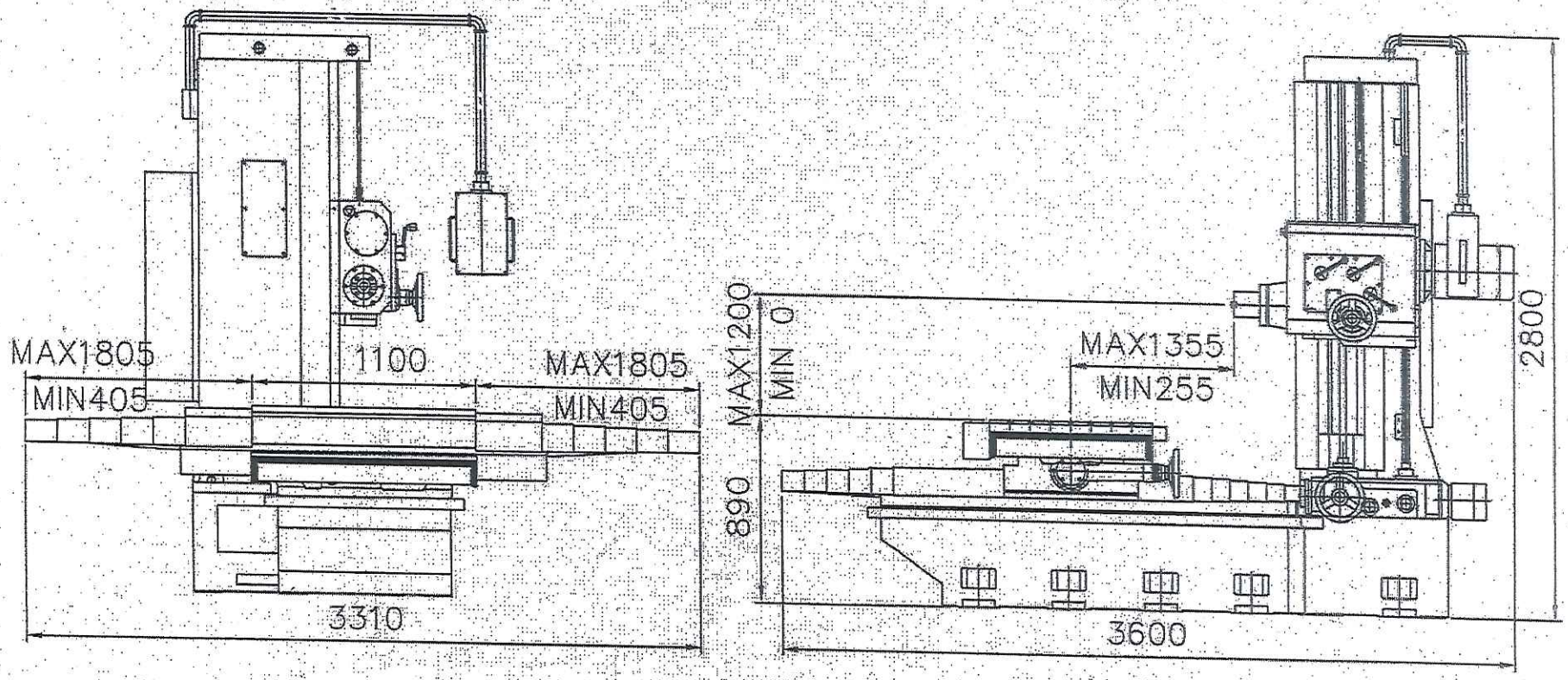
1-2 Main Dimensions

Fig. Dimension of CS-HB120



1-3 Main Dimensions

Fig. Dimension of CS-HB140



1-4 Main Dimensions

Fig. Dimension of CS-HB180

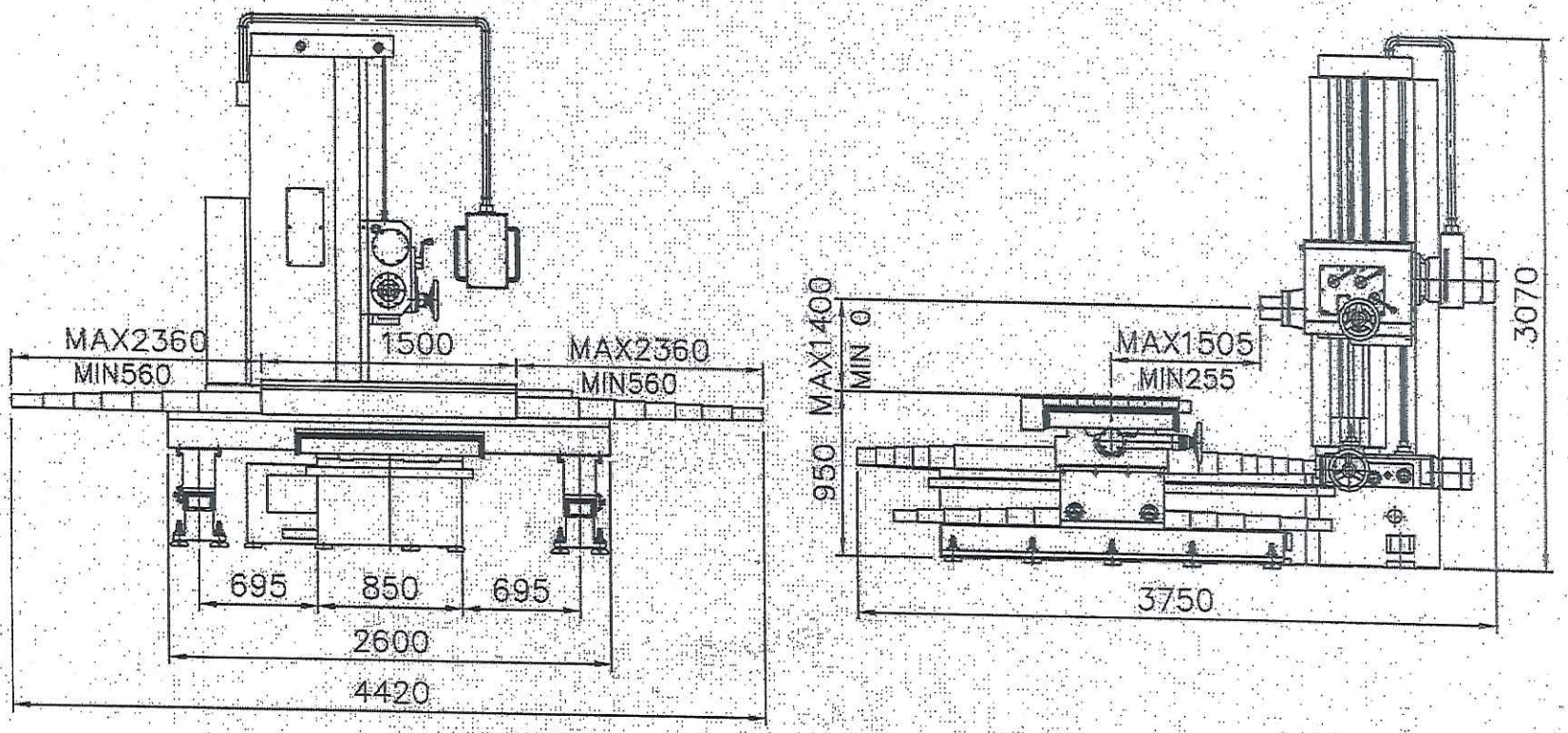
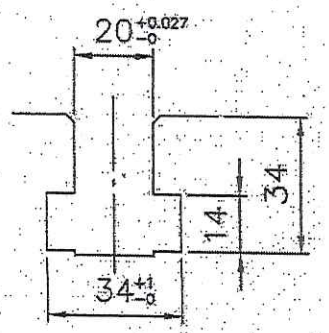
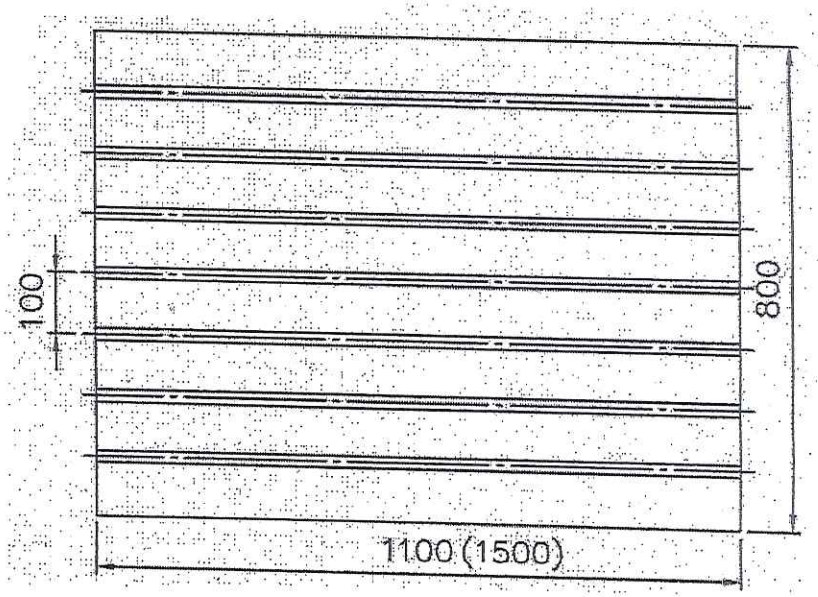
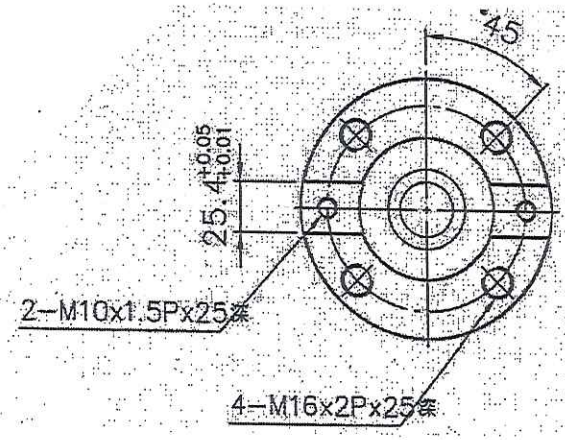


Fig.4 Dimension of Table

Fig.5 Dimension of T-Slot







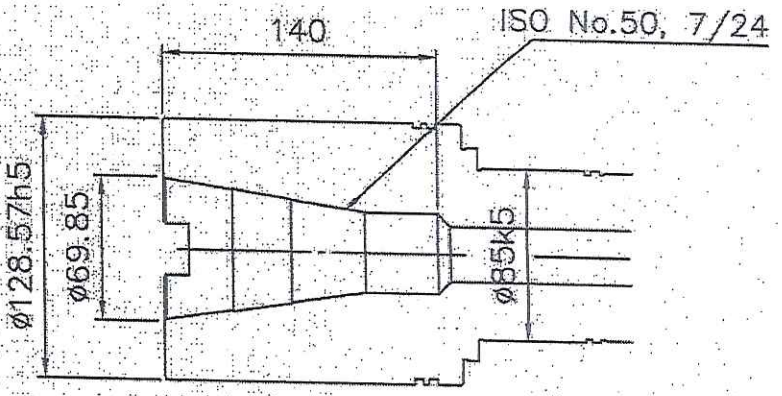


Fig.6 Dimension of Spindle Nose

2. Installation of the machine

2-1 Transportation (Fig.7)

Fix every part of the machine before hanging it. Especially pay attention to the fixation of spindle head and balancing weight (1).

Put the balancing weight at the position of side window of column by using the hand wheel of spindle head (2).Then use steel bar and bolts (3.4) to fix balancing weight from the holes of window.

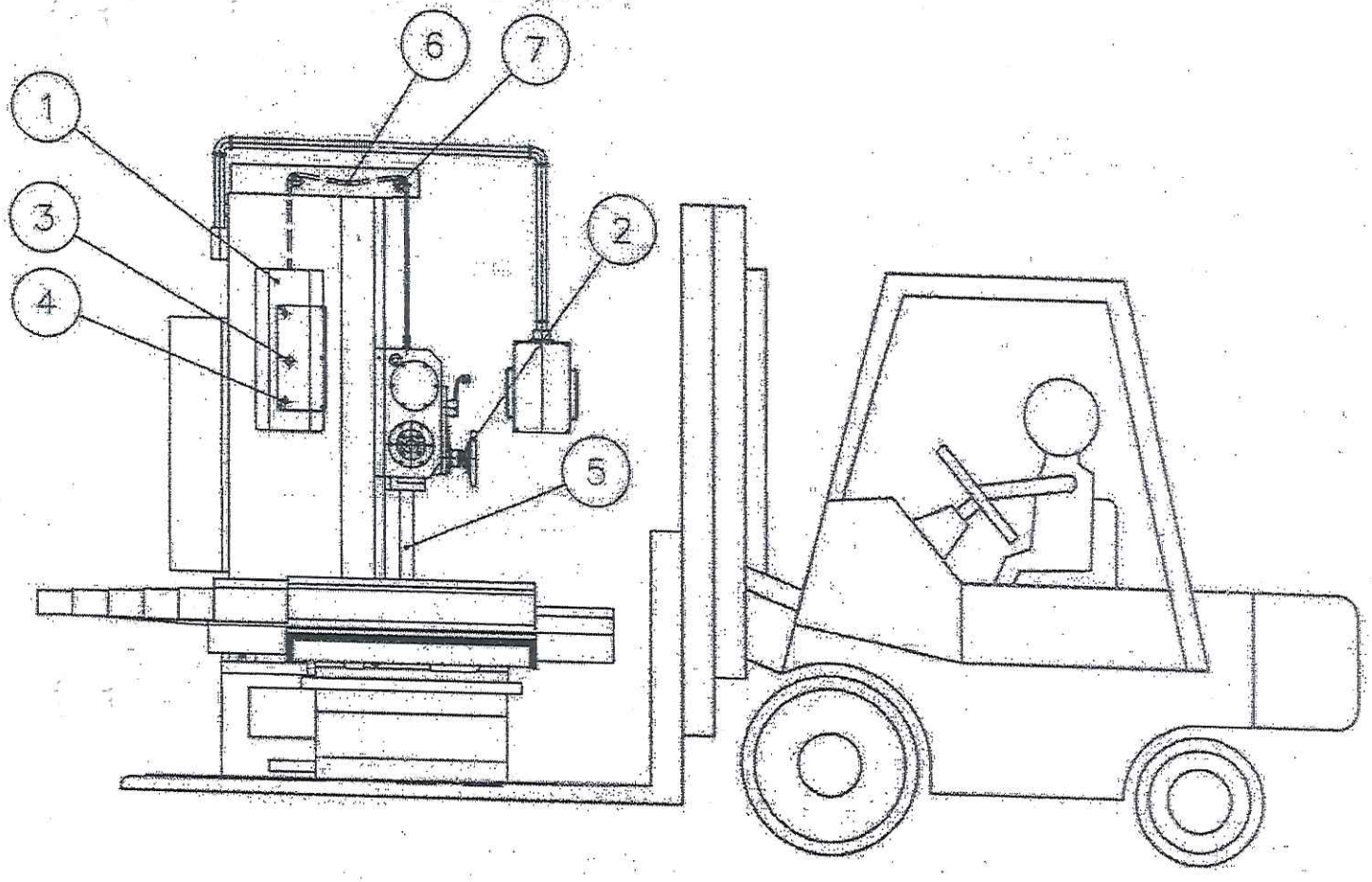
Place the table to the middle position of machine and move saddle to the middle of bed. Move spindle head about 50 mm upward by hand wheel of spindle head and insert the support bar (4) between bed and spindle head, hence the chain (6) is at loose condition. Both end of support bar should be cushioned with cloth or rubber to avoid damage of machine. Use steel rope to lift the machine shown on. Cloth or rubber should be cushioned between the rope and machine surface. Steel rope should not be touched the weak parts of the machine.

Loosening the clamping units of machine (fig.7)

After the transportation is completed loosen the clamping units of the machine and be careful to remove the support bar and to stretch the chain (6) slowly. Whether contact the sprocket (7) tightly or not due to transportation. Before removal of support bar and the chain in good condition , shake the hand wheel (2) of spindle head to move the spindle head upward for removing the support bar. Then move the spindle head downward slowly and smoothly until the chain is properly stretched.

✱NOTE: The chain can not stand impact load or it would be broken.
Examine the chain in good condition once more, then loosen and remove the bolts (side window of column) for fixed balancing weight. But remember during spindle head downward before chain is stretched, the bolts of fixed balancing weight are absolutely not allowed to take out.

Fig 7 Transportation of Machine



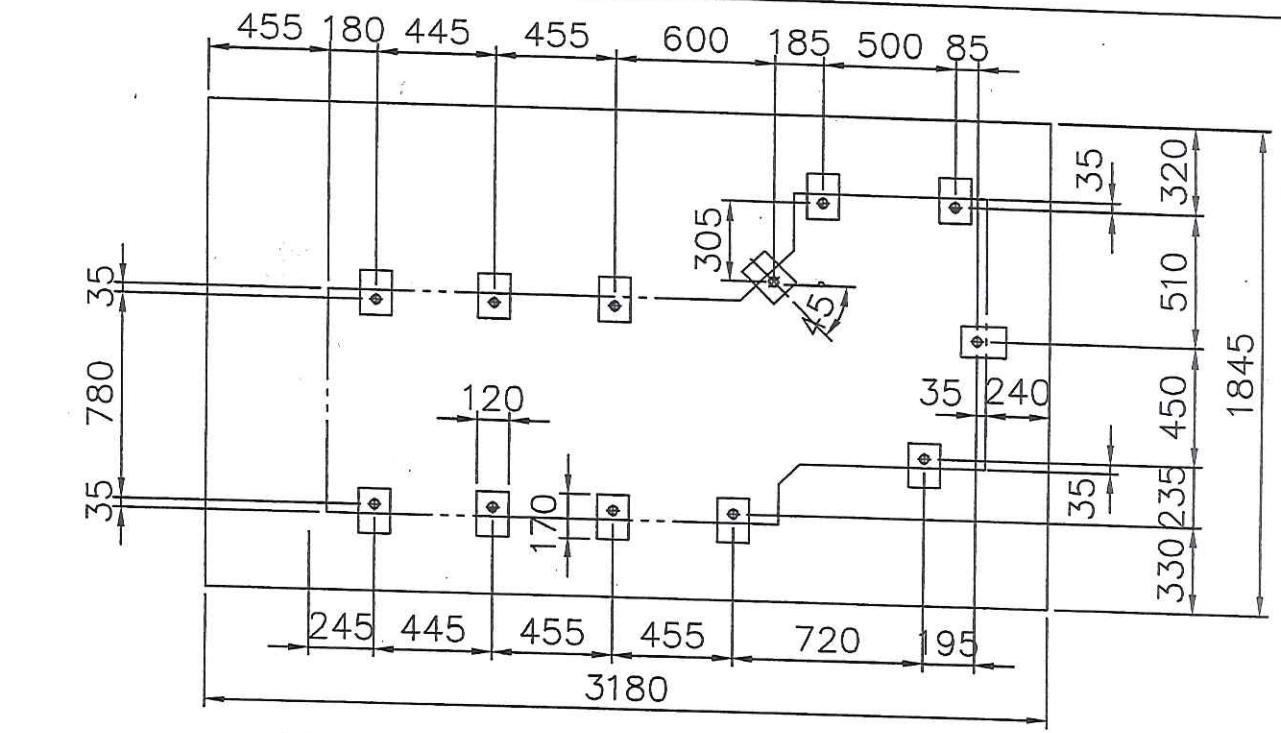
2-2 Leveling and Foundation (Fig. 8,9,10)

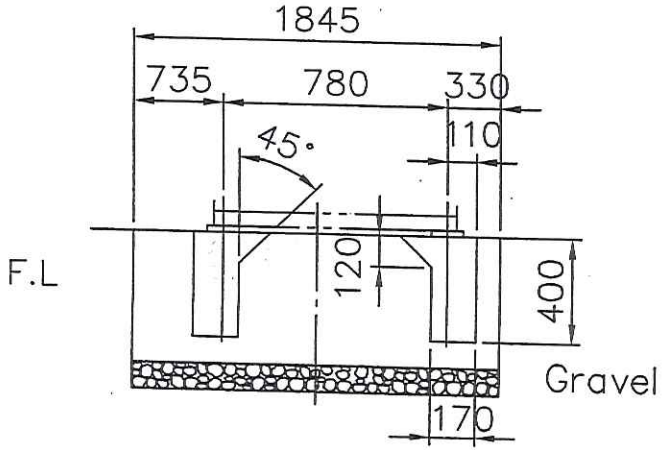
The machine can be set on 600 mm thick concrete foundation, to ensure the accuracy of the machine and prevent cutting vibration.

Shown on (fig.8,9,10) move the table to the middle position and clamp spindle head at the middle position of the column, then put the precision level (accuracy 0.02-0.05 mm/1000mm) on the table to adjust the leveling of machine. After finishing the leveling .Pour the concrete into the anchor bolt holes, tighten the bolt after the concrete is completed rigid, check the machine leveling once more, clean the machine base (sands & scraps etc.)Then pour concrete between machine base and floor.

2-3 Cleaning the machine

The machine is protected by grease or antirust oil before shipment. But the machine should be cleaned with gasoline before putting the protecting oil.





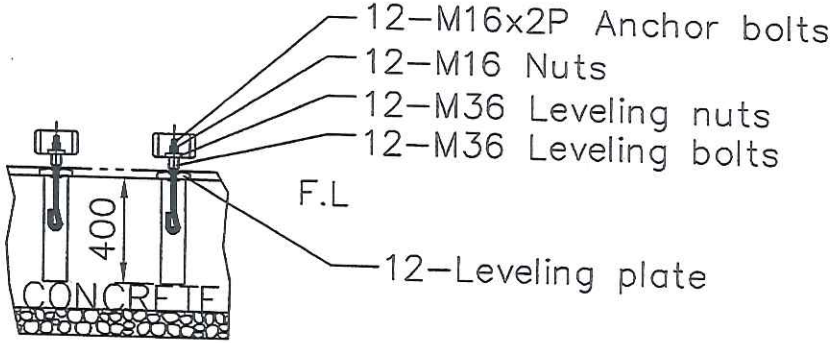
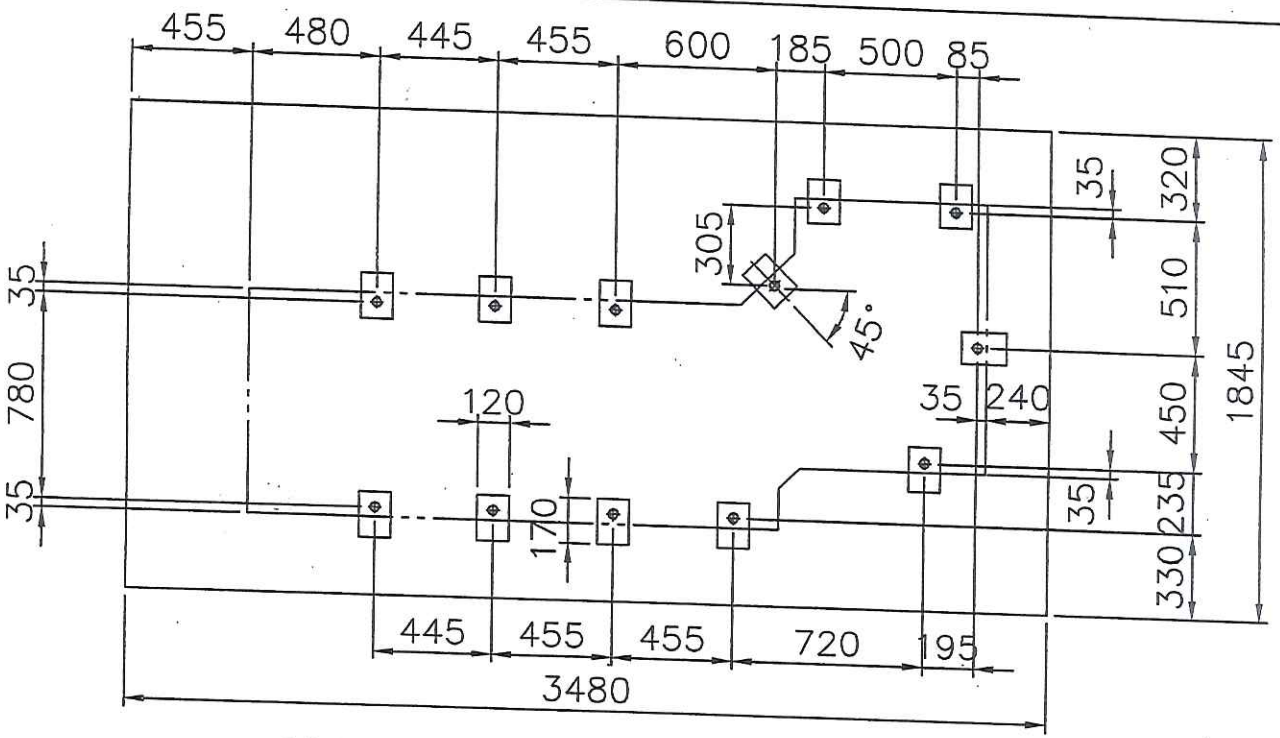
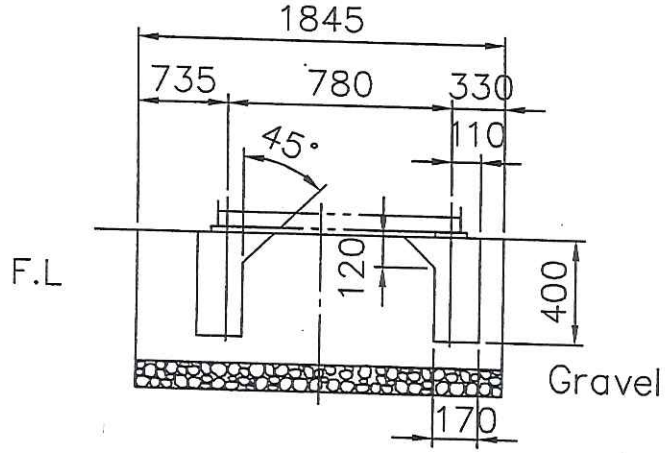


Fig.8 Foundation drawing of CS-HB120





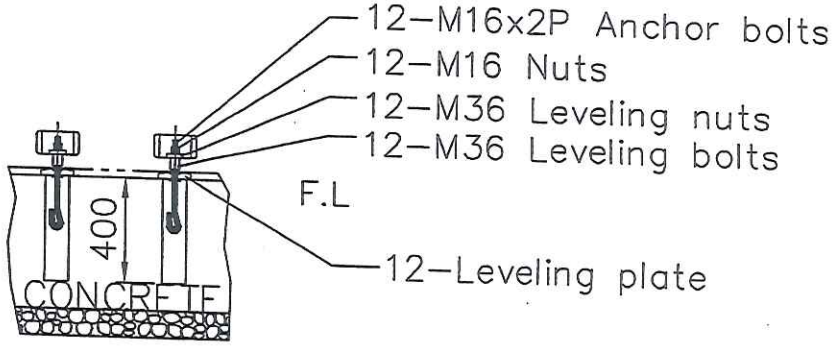
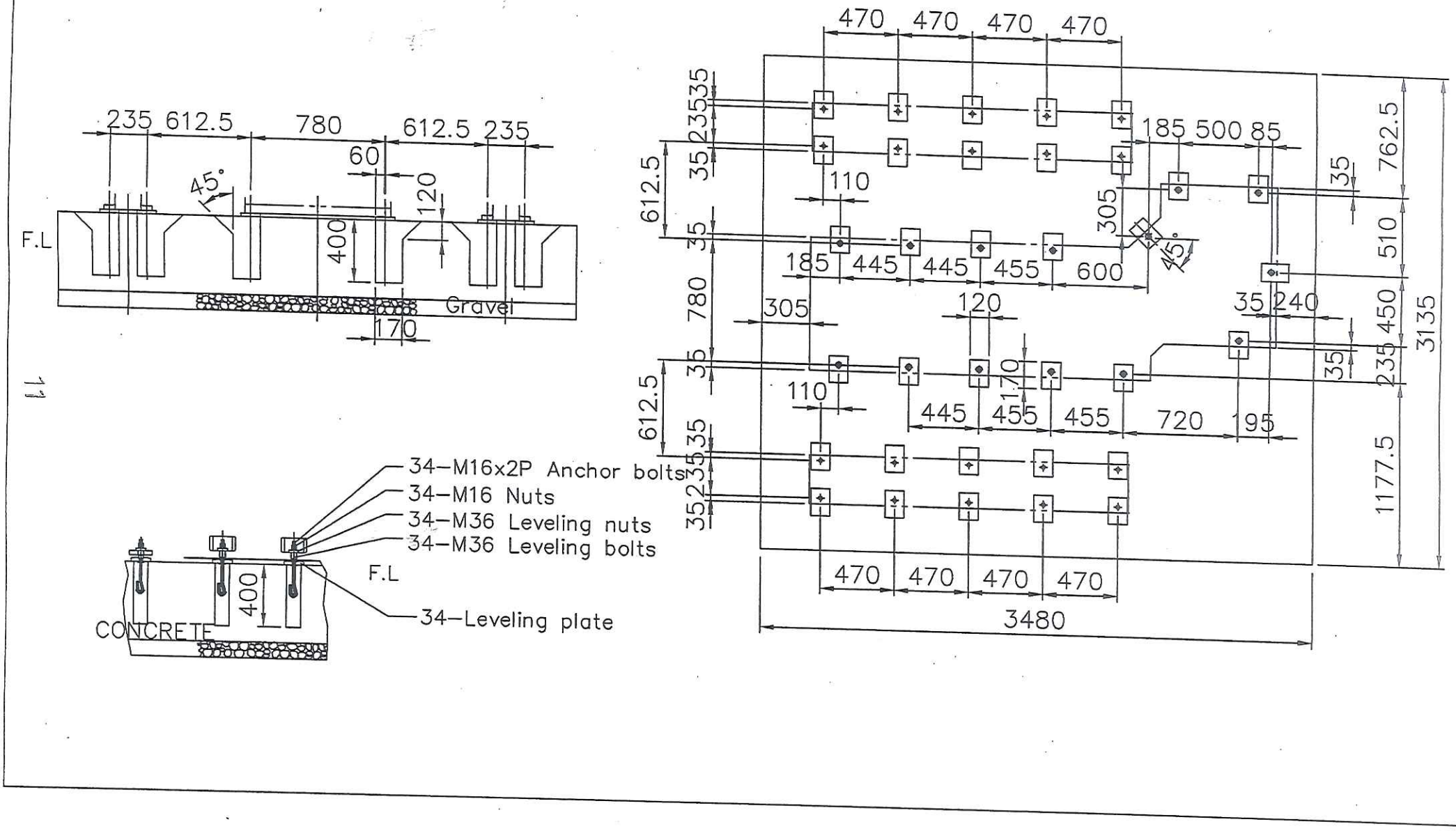


Fig.9 Foundation drawing of CS-HB140

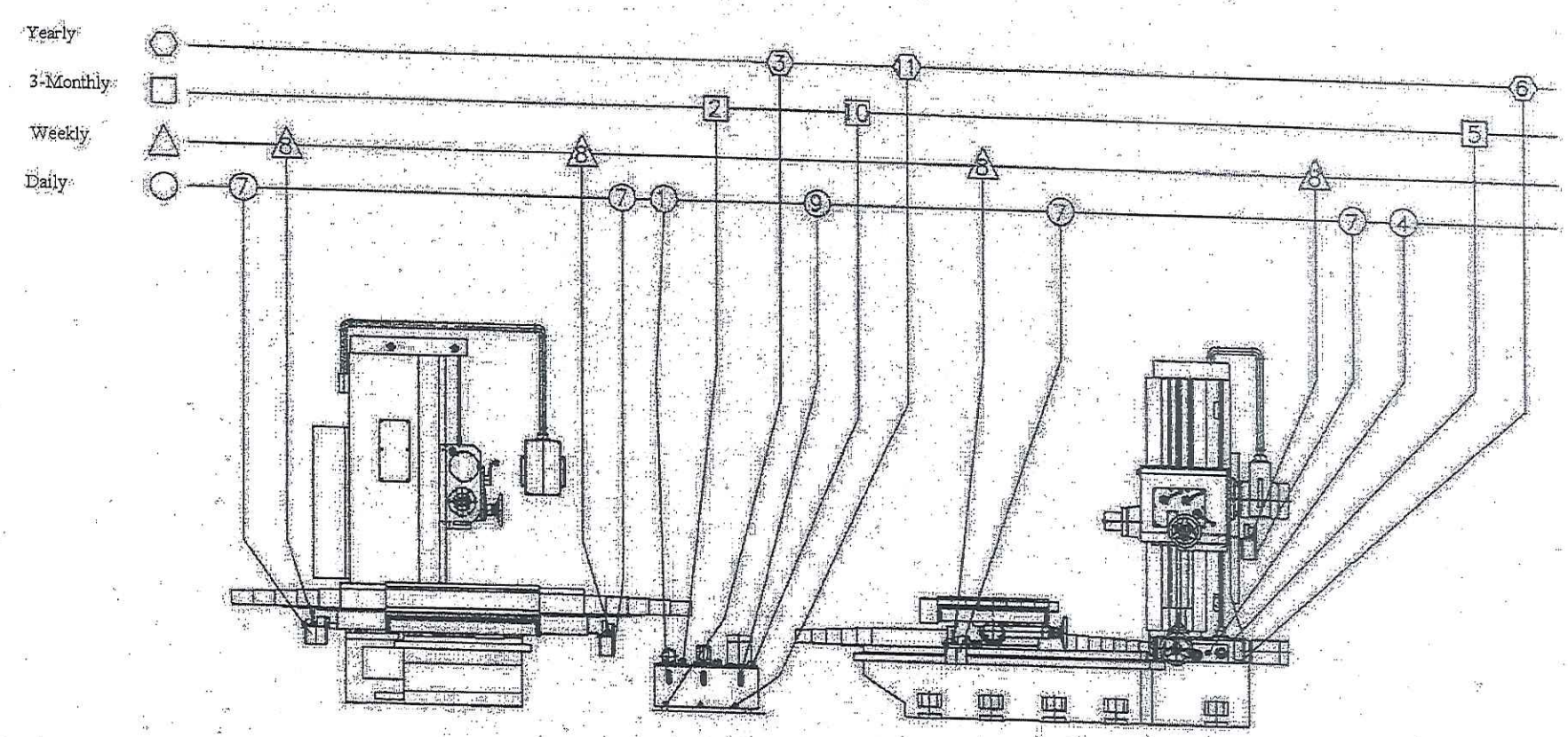
Fig.10 Foundation drawing of CS-HB180



3 . Lubrication

3 -1 Refer to (Fig.11) and table 1 & 2.check all of the lubricating portions of the machine which should be applied with suitable amount of oil in compliance with the regulation. When the machine is in operation, inspect again all of the moving parts in good lubricating condition in order to ensure the superior function.

Fig. 11 Table of mechanical lubrication



Action Points	Spindle Head Gear			Feed gear Box			Slideways & Feed Screws		Hydraulic Oil Box		
	1	2	3	4	5	6	7	8	9	10	11
Symbol / Item											
Check	Daily			Daily			Daily		Daily		
Fill		3-Monthly			3-Monthly			Weekly		3-Monthly	
Clean & Replace			Yearly			Yearly					Yearly
Lubricant		CB32			Spindle Oil R12			G68		HM32	
Quantity		6L	20L		1.2L	5L		2L		6L	20L
Remark											

TABLE Instruction for correct lubricant

	Application Fields	Properties	Symbol and Viscority Grade	Kinemntic Viscosity (40℃)			REKARKS
				Menn.	min.	max.	
CEARS	Enclosed moderately loaded gear (spur gear, bevel gear)	Refined mineral oils with good wxidation stability	CB 32 CB 68 CB 150	32 68 150	28.8 61.2 135	35.2 74.8 165	Pinion speeds (motor output) 2000-5000 rpm (within 3.7kw) 1000-2000 rpm (within 7.5kw) -1000 rpm (within 15kw)
	Enclosed heavily loaded gears (worm and wheel)	Refined oils with good oxidation stability and with improved load-carrying ability	CC 150 CC 320 CC 460	150 320 460	135 288 414	165 352 506	Worm speeds 2000- rpm 1000- rpm -1000 rpm
BEARJNGS	Spindles bearings and associated clutches	Refined mineral oils with superior anticorrosion and anti-oxidation performnces.	FC 2 FC 10 FC 22	2.2 10 22	1.98 9.00 19.8	2.42 11.0 24.2	Shaft speeds (shaft dia.) 10,000- rpm (-30mm) 2000-10,000 rpm (30-150mm) -2000 rpm (150- mm)
SLIDE WAYS	Slide ways	Refined mineral oils with imoroved lubricity and tackiness perfromance preventing stickslip	G68 G220	68 220	61.2 198	74.8 242	Slide way (surface pressure) Horizontel (under 4kgf/c㎡) Vertical (under 4kgf/c㎡)
HYDRAULIC SYSTEMS	Hydraulic systems	Refined mineral oils with superior anti-corrosion and anti-oxidation performance.	HL32 HL68	32 68	28.8 61.2	35.2 74.8	Oil perature (Rated pressure) 0-50℃ (under 35kgf/c㎡) 15-65℃ (under 35kgf/c㎡)
		Refined moneral oils with superior anti-corrosion, anti-oxidation and antiwear performances.	HM32 HM68	32 68	28.8 61.2	32.2 74.8	Oil temperature (Reted pressure) 0-50℃ (under 140kgf/c㎡) 15-65℃ (under 140kgf/c㎡)
	Hydraulic and Slide ways	Refined mineral oils of HM type with anti-stick-slip propertics.	HG 32 HG 68	32 68	28.8 61.2	32.2 74.8	Oil temperature (Reted pressure) 0-50℃ (under 70kgf/c㎡) 15-65℃ (under 70kgf/c㎡)
CREASE		Premlum quality greases with superior anti-oxidation and anti-corrosion pronertics.	XM 1 XM 2	Viscosity (25℃) SSU 310 - 340 265 - 295			Centralized systems Cup or hand gun

TABLE THE GENERAL LUBRICANTS FOR MACHINE TOOL

	SYMBOL	CPC	ESSO/ESSO	SHELL	MOBIL	DAPHNE
Gears	CB32	R32	Teresso 32	Tulus Oil C32	DTE Oil Light	Mechanic Oil 32
	CB68	R68	Teresso 68	Tulus Oil C68	DTE Oil Heavy Medium	Mechanic Oil 68
	CB150	R150	Teresso 150	Tulus Oil C150	DTE Oil Extra Heavy	Mechanic Oil 150
	CC150	R150	Spartan EP150	Omala Oil 150	Gear 629	CE Compound 150S
	CC320	R320	Spartan EP320	Omala Oil 320	Gear 632	CE Compound 320S
	CC460	R460	Spartan EP460	Omala Oil 460	Gear 634	CE Compound 460S
Bearings	FC2	R12	Spinesso 10	High Spin Oil C2	Velocite Oil NO.3	Mechanic Oil 2
	FC10			Telus Oil C10	Velocite Oil NO.6	Mechanic Oil 10
	FC22	R22	Spinesso 22	Telus Oil C22	Velocite Oil NO.10	Mechanic Oil 22
Slide Ways	G68	Slide way oil	Febis K68	Tonna T68	Vactra Oil NO.2	Multiway 68C
	G220	Slide way oil	Febis K220	Tonna T220	Vactra Oil NO.4	Multiway 220C
Hydraulic System	HL32	R32	Teresso 32	Telus Oil C32	DTE Oil Light	Hydraulic Fluid 32
	HL68	R68	Teresso 68	Telus Oil C68	DTE Oil Heavy Medium	Hydraulic Fluid 68
	HM32	32AW	Nuto HP32	Telus Oil 32	DTE 24	Super Hydraulic Fluid 32
	HM68	68AW	Nuto HP68	Telus Oil 68	DTE 26	Super Hydraulic Fluid 68
	HG32		Powerex DP32	Tonna Oil T32	Vacuoline Oil 1405	Multiway 32
	HG68		Powerex DP68	Tonna Oil T68	Vacuoline Oil 1408	Multiway 68
Grease	XM1	Gulferown Grease E.P. NO.1	Listan 1	Alvania Grease 1	Mobilux EP1	Cornex Grease NO.1
	XM2	Gulferown Grease E.P. NO.2	Listan 2	Alvania Grease 2	Mobilux 2	Cornex Grease NO.2

C.P.C. China Petrolum Co. , Ltd.

4. Device of coolant pump and Headstock lubricant pump.

4-1 Cutting Fluid Pump Device (fig.12)

Cutting fluid pump (P1) located on the right side of the machine is operated by switch buttons (P3) on the operation panel. It will rotate in left position together with spindle, or rotate in right position by itself.

Volume of cutting fluid is about 25 L injected from pan (P2) until the gauge (P3) reaches the upper limit. Release the rotary plug to change the cutting fluid.

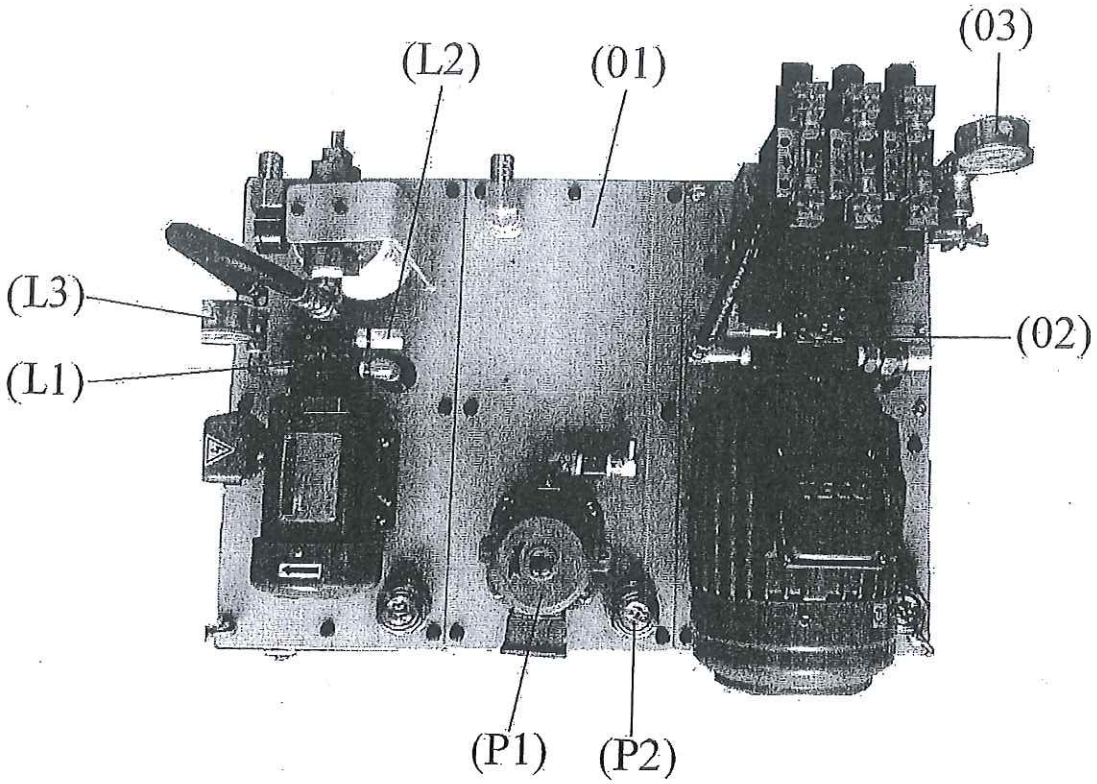
Cutting fluid nozzle is located on the front side of spindle head, held by nozzle clamper.

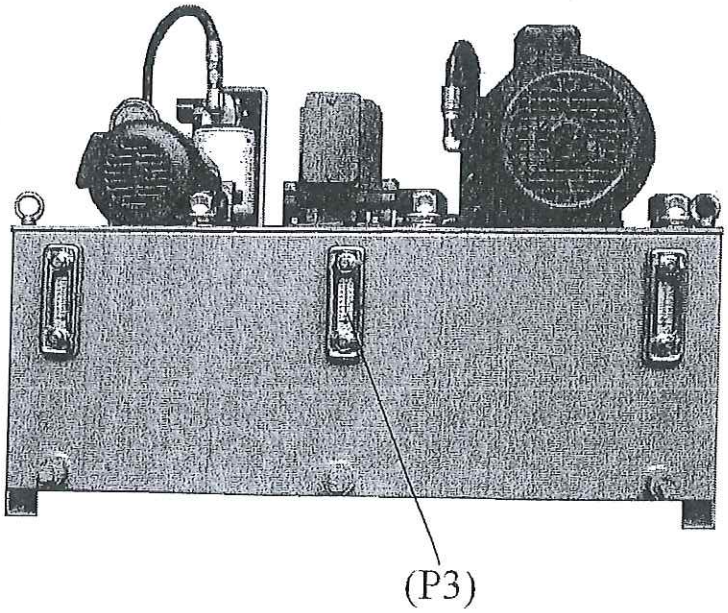
The nozzle direction is adjustable and easy to take apart.

4.2 Lubrication of spindle head

When the spindle is running, lubricant were come to headstock automatically for inside gears and bearings. The pump was on the oil box located by the machine and set the pressure at 0.8 kg/cm^2. There is a regulator on the pump could be used for adjusting the pressure. The lubricant may overflow from spindle end if the pressure be set too high.

Fig.12 Device of coolant and headstock lubrication and hydraulic system





5. Operation

5.1 Preparation for operation

Before operating the machine, check and prepare the following item
Item (1) and (2) are belonged to regular maintenance item.

(1) Clean the dust or cutting scraps on each sliding surface and circumference and bore of spindle.

(2) Inject oil to each sliding part according to the oil recommendation (Fig. 11, Table 3 & 4), especially when the machine turn off for a long period.

(3) Connect the power source (220V, 50Hz) to R.S.T terminals board of electrical cabinet according to the wiring diagram.

(4) Turn on the no-fuse breaker. The pilot lamps of operation panel will be lit up when current is conducted.

(5) The machine may cause injury please read the manual carefully before operation.

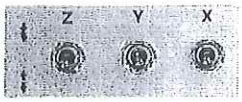
5.2 Name and function of switches

(1) Power on/ off button

Turns on/off power on the machine, the lamp will be lit when power on.

(2) Coolant on/off switch

Turns the switch to left, the coolant start or stop accompany with spindle together. Turn the switch to right that coolant comes directly. Put the switch at the middle that the coolant off.



(3) Hydraulic clamp on/off switch for X, Y and Z-axis

Select the axis clamp on or off, axis clamp action when the toggle switch at upper and unclamp at lower position.

(4) Joystick switch of Z-axis feed and rapid

The Z-axis automatic feeding is controlled by the joystick switch. Table forward moving as marked "+Z", Backward as marked "-Z". The rapid feeding also controlled by the joystick switch, push the button which on the top of joystick and push to operate in the direction. The rapid feed speed is 2880mm/mm.

(5) Joystick switch for X, Y-axis feed and rapid

The X, Y-axis automatic feeding is controlled by the joystick switch. Spindle head upward moving as marked "+Y", downward as marked "-Y". The table right direction moving as marked "+X" and left moving as marked "–X". The rapid feeding also controlled by the joystick switch, push the button which on the top of joystick and push to operate in the direction. The rapid feed speed is 2880mm/mm.

(6) Display of X,Y, Z-axis feed rate

When the Axis is moving by auto feed or rapid that the speed is showed on this monitor.

(7) Spindle CW / CCW switch

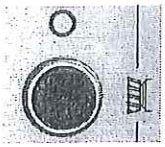
The spindle could be turned in CW and CCW direction controlled by this switch.

(8) Tapping mode switch 

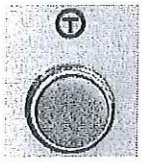
This function is available to perform tapping machining. Normally put this switch at left side for milling or boring, Switching to right side when using tapping function. The spindle will run in CW direction when Z-axis feeding closing to spindle and in CCW direction automatically when Z-axis backward from spindle end.

(9) Spindle start button 

The spindle will be start by this button.

(10) Spindle stop button 

The spindle will be stop by this button.

(11) Spindle inching button 

In case the spindle speed couldn't be change easily push this button to shift the spindle a little to change he spindle speed that you need.

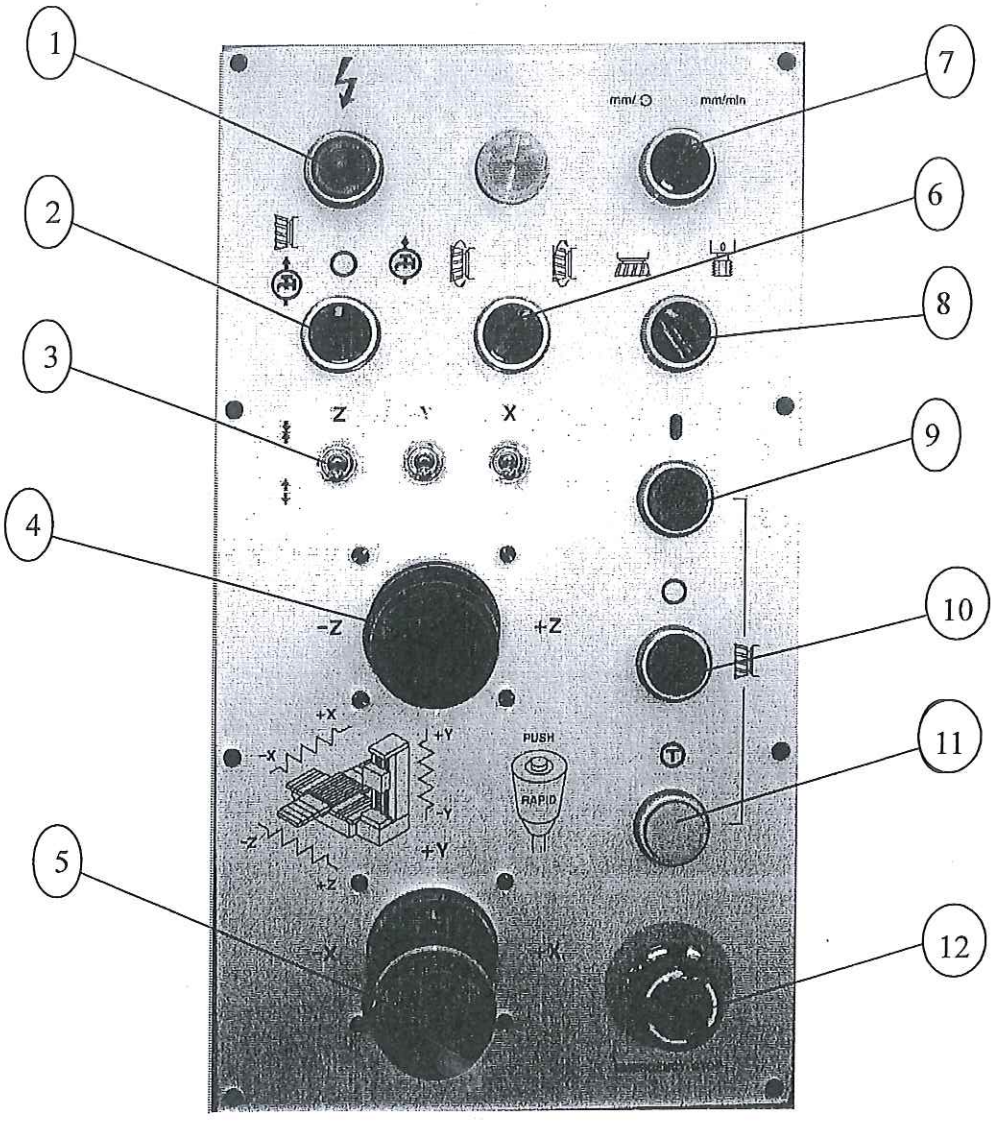
(12) Feed rate adjusting knob 

The X, Y and Z-axis feed rate can be adjusting by this knob, right sight to increase speed and left side to slow down.

(13) Emergency push button 

In an emergency case push this button immediately to stop the machine.

Fig. 13 Operating panel



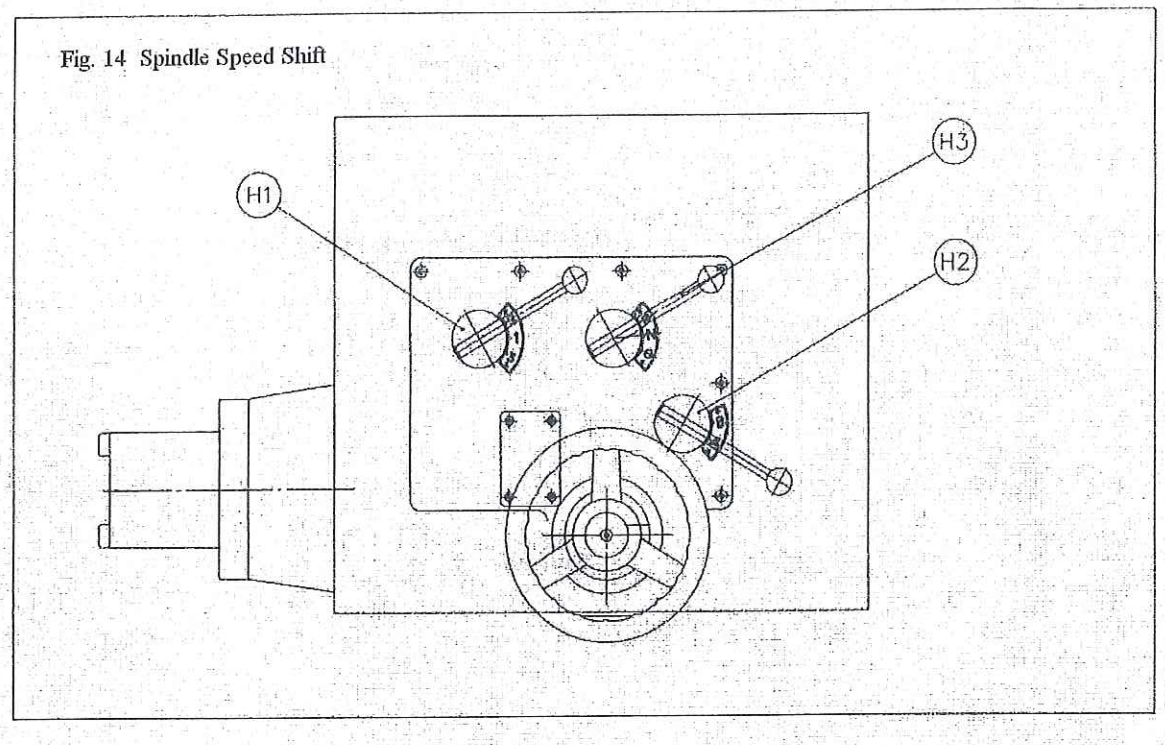
5.3 Spindle speed change (Fig. 14)

The spindle can be run in range from 45 to 1500rpm at 60 Hz with 12 steps, shift by 3 levers. The lever H1 with 3 shifts, the lever H2 has 2 shifts and a nature position, the H3 with 2 shifts.

Warning:

Please don't operate the levers when the spindle was running. The levers can be shifted only when the spindle was stopped.

Fig. 14 Spindle Speed Shift



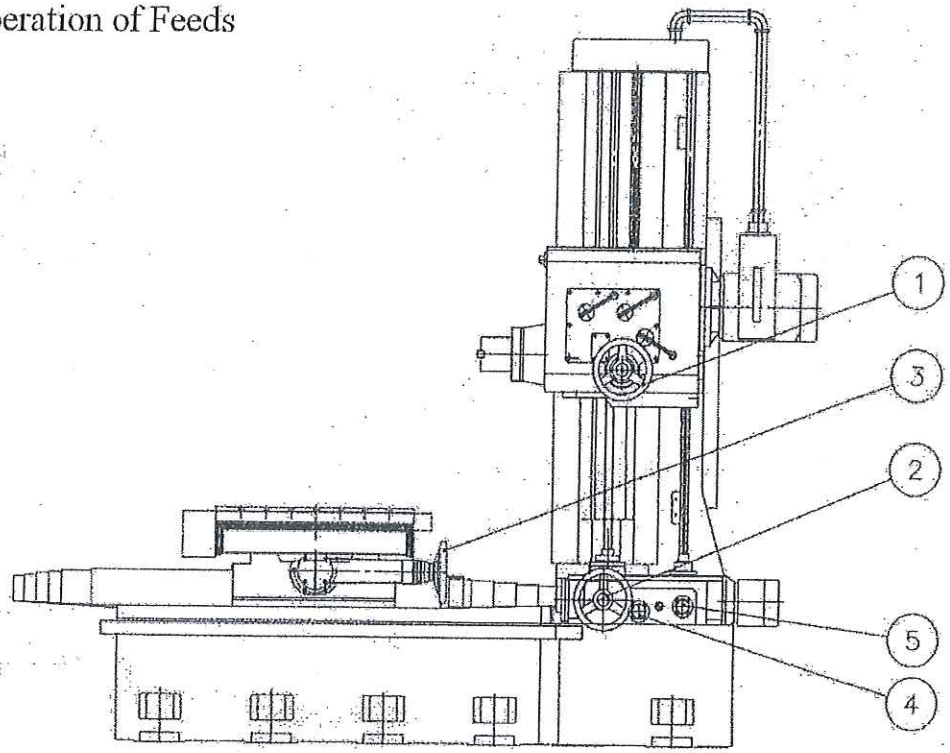
5.4 Hand feed of X, Y and Z-axis (Fig. 15)

Please be sure that the hydraulic clamp switch at unclamp position before operation axis feeding. Push the axis feed handwheel (1, 2, 3) to engage the clutch for feeding. Handwheel will move forward or backward 3mm in each revolution. There is a dial scale on the handwheel with 0.02mm per graduation.

5.5 Automatic feed speed change of X, Y, and Z-axis (Fig. 15)

The feed speed of X, Y and Z-axis with variable can be changed by potential meter on the panel. Increase feeding speed in clockwise direction and decrease in counter clockwise direction. The speed rate is showed in the monitor on the top of the panel. Operator should be adjustment a suitable speed for actually machining situation.

Fig.15 Operation of Feeds



6. Adjustment

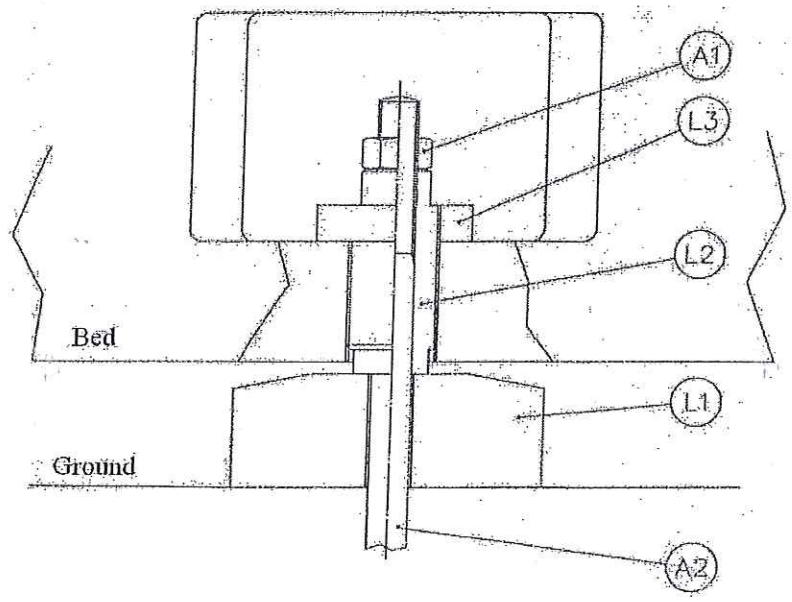
The machine was adjusted in good condition before shipping, if necessary to readjustment the machine please following steps as below.

Besides, the machine must do level adjustment before operation.

6-1 The level adjustment of the machine (fig. 16)

1. Place two levels of 0.02-0.05mm/1000mm accuracy on the table perpendicular to each other.
2. Loosen the nuts (A1) of anchor bolts (A2)
3. Loosen the leveling fixed nuts (L3)
4. Loosen the leveling bolts (L2) and adjust the levels (12 leveling bolts to be adjusted) until the leveling was accurate.
5. Looking the leveling and fixed nuts (L3) (don't rotate the leveling bolts).
6. Look the anchor bolts with nuts (A1).
7. Recheck the air bubbles displacement on the level.

Fig.16 Adjusting Machine Level

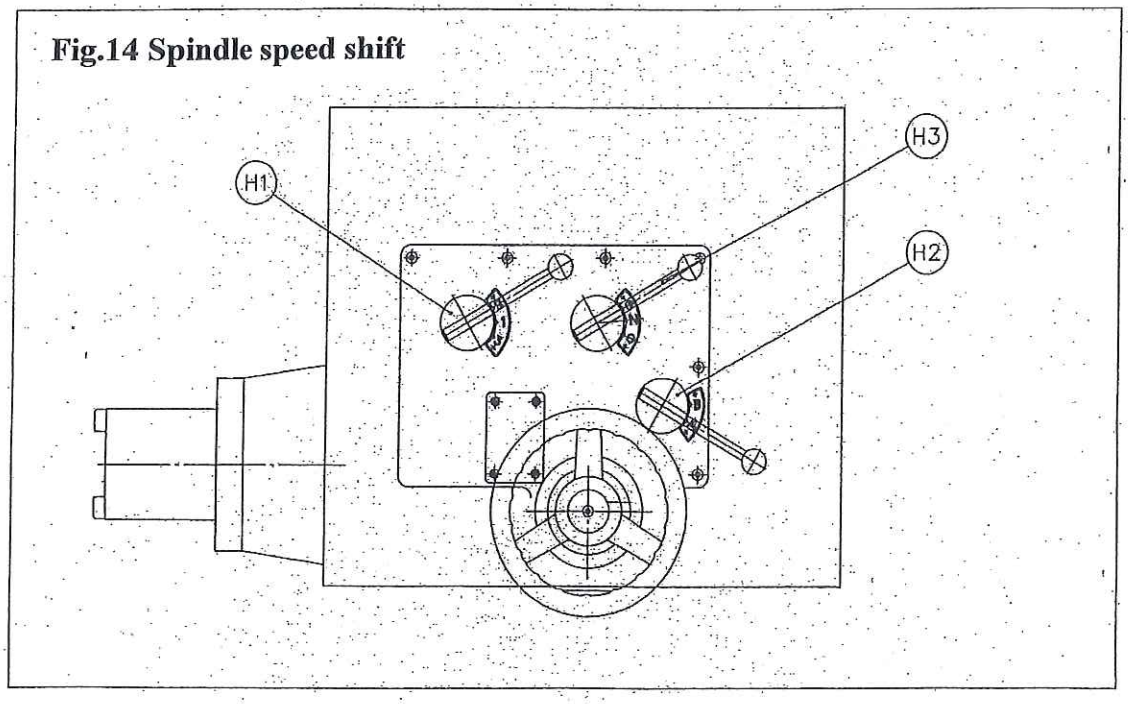


6-2 Adjustment of spindle (Fig. 17)

The spindle may need readjustment if temperature of spindle bearing rise or loose spindle. The readjustment should be taken carefully.

1. Take apart the cover of spindle head (2).
2. Loosen the fixed bolts then screwing the adjustable nut in properly tightness according to what material be machining. If the bearing over heating loosen the nut a little, loose spindle tighten it.
3. Tighten the fixed bolts.
4. Reassembly the cover (2) of the head.

Fig.14 Spindle speed shift



6-3 Adjustment of V-Belt of spindle transmission (Fig. 18)

After longtime service the V-belts will be loose, so the adjustment should be taken according to the following steps.

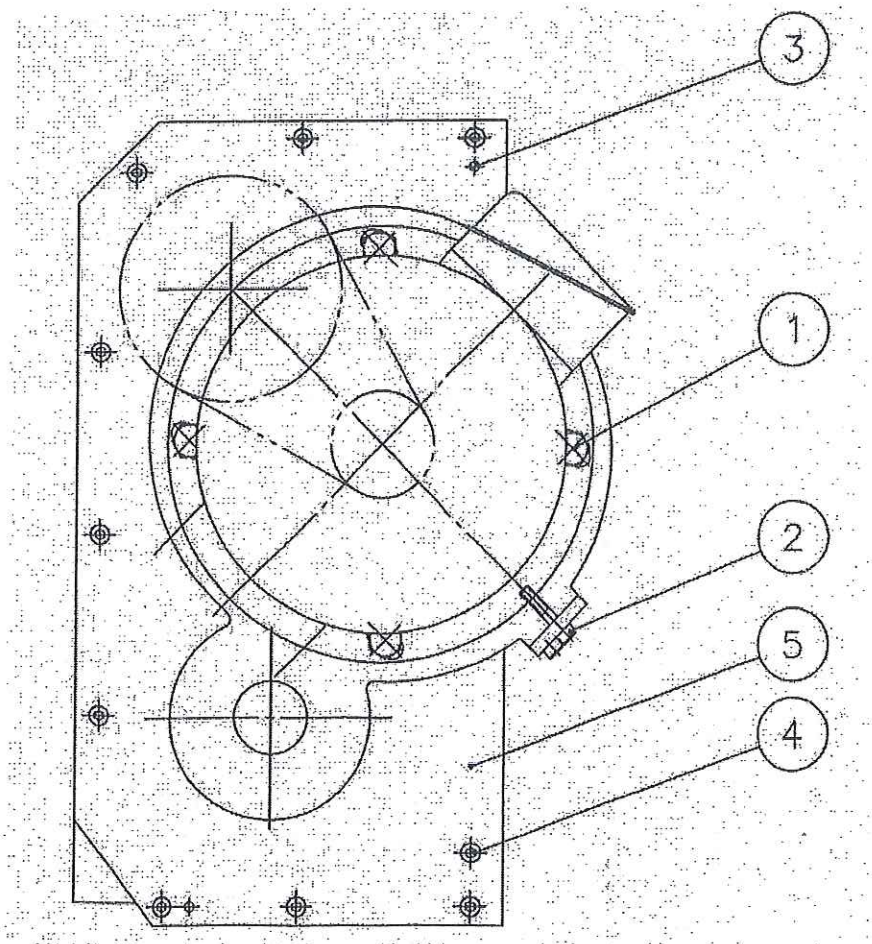
1. To loosen the 4 fixed bolts (1) of motor.
2. To use the adjustable bolt (2) and move the position of motor. You can feel the tension of V-belts by finger suitable or not.
3. Screw the fixed bolts (1) to fasten the motor.

6-4 Replacement of V-belt of spindle transmission (Fig. 18)

The replacement should be taken when it is worn or broken. The following steps should be carried.

1. Take out the adjustable bolt (2) and 4 fixed bolts of motor.
2. Move the motor out from 6 belts.
3. Take off 14 bolts (4) and 2 pins (3) to apart the motor plate (5).
4. Take off the 6 used v-belts and replace with new belts (3Vx265)
5. Reinstall the motor plate (5), pin into the plate first then screw the bolts (4).
6. Move the motor to original position and adjustment the V-belt with adjustable bolt (2) unit it is suitable.
7. Screw the 4 fixed bolts to fasten the motor.

Fig.18 V-Belt Adjustment and Replacement of Spindle



7. Adjustment of slide ways gibs

When the slideway was loose, the gib should be make a suitable adjustment.

7-1 Adjustment of headstock's (Y-axis) gib (Fig. 19)

The headstock's gibs were arranged in the middle of slideways. Loosen the lower adjustable bolt (H1) of gib first then screw in upper adjustable bolt (H2) to tighten the gib. Try to move headstock up and down and adjust the gib several times to make sure it is in suitable tightness.

7-2 Adjustment of table's (X-axis) gib (Fig. 20)

There are 2 gibs arranged at front slideway each at both end of table, the gib can be adjusted by the nuts (T1) and (T2). Try to move the table right and left and adjust the gib several times to make sure it is in suitable tightness.

7-3 Adjustment of Saddle's (Z-axis) gib (Fig. 21)

The saddle's gibs were arranged in the middle of slideways. Loosen the rear adjustable bolt (S1) of gib first then screw in front adjustable bolt (S2) to tighten the gib. Try to move saddle forward and backward and adjust the gib several times to make sure it is in suitable tightness.

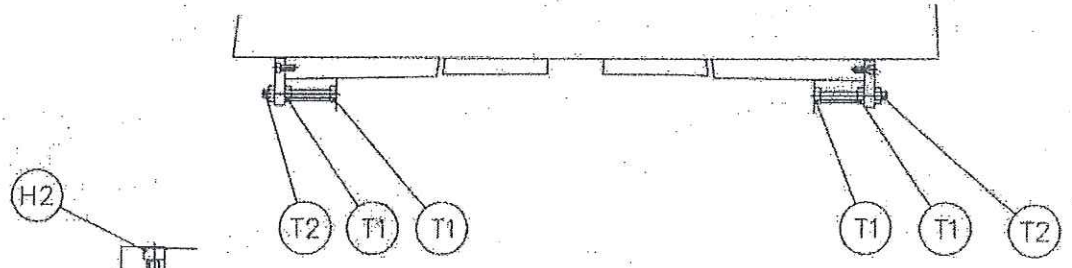


Fig. 20 Gibs of table

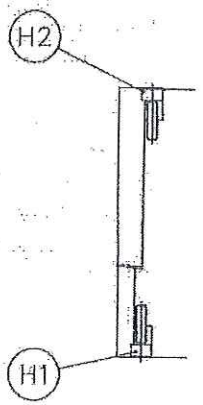


Fig. 19 Gibs of headstock

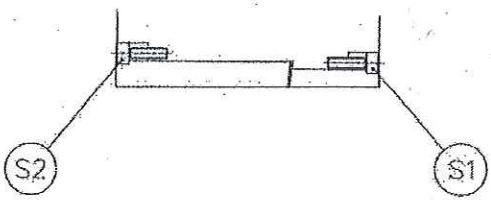


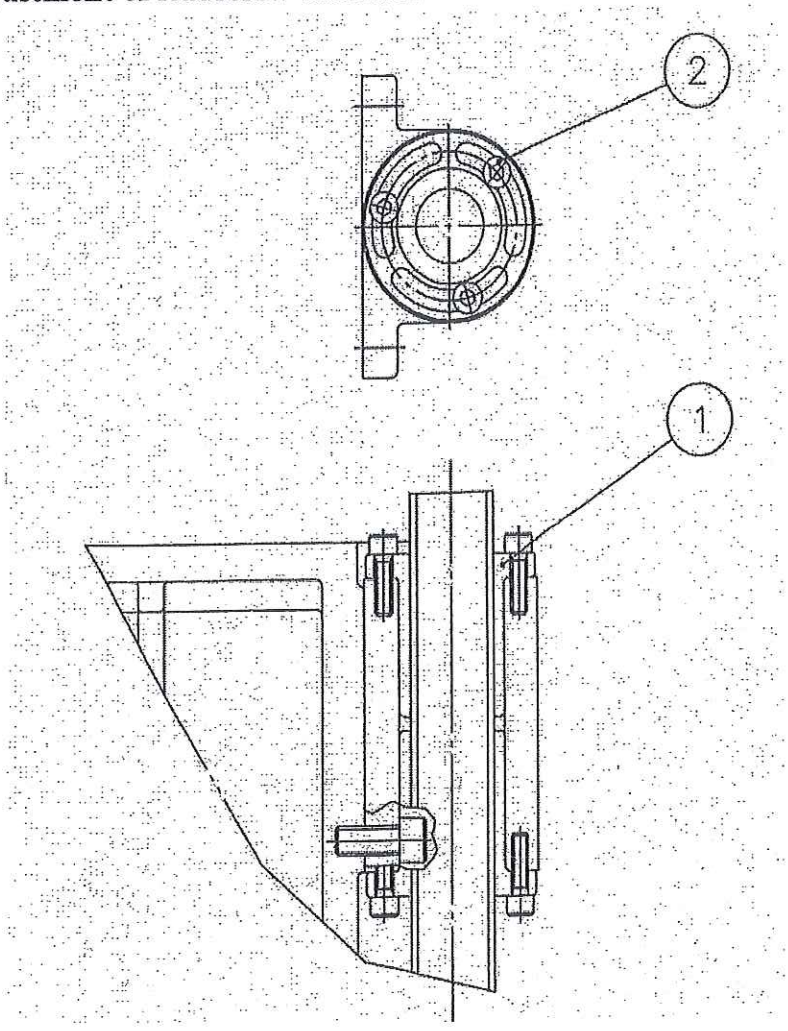
Fig. 21 Gibs of saddle

7-4 Adjustment of Y-axis feed lead screw (Fig. 22)

After long time service the feed lead screw has been worn out and backlash increased gradually the adjustment should be taken if necessary.

1. Move the headstock at lower position for easy to adjusting the adjustable nut (1)
2. To loosen the 3 bolts (2) of adjustable nut (1).
3. Screw the adjustable nut (1) by clockwise direction to make the lead screw only for rotation without backlash. Try to move the headstock up and down by handwheel several times until the leadscrew smoothly.
4. Tighten the 3 bolts (2) of nut (1).

Fig. Adjustment of leadscrew backlash



9. REFERENCE FOR MACHINING

9-1 CUTTING SPEED

The cutting speed of milling cutter can be found as follows :

$$V = \frac{\pi DN}{1000}$$

V = CUTTING SPEED (M/MIN)
D = DIAMETER OF CUTTER (MM)
N = REVOLUTION OF CUTTER PER MINUTE (R.P.M) .

The cutting speed is accorded to metal of workpiece , metal of cutter and some condition of machining . The followings are the considerations for machining :

(1) For longer life time of the milling cutter , using the lower cutting speed .

(2) For rcugh cutting surface using lower cutting speed and higher feed ; for fine cutting surface using higher cutting speed and lower feed .

(3) When some special workpiece to be cut , it is better to use medium cutting speed at first , then increase the speed . Gradually up to adaptting condition .

The suitable cutting speed is shown in table 6 .

9-2 FEED

The table feed is based on the revolution of cutter per minute , number of teeth in cutter and feed per cutting edge . It can be found as follows :

$$S = N \times S \times Z$$

S = FEED PER MINUTE (MM / MIN)
N = REVOLUTION OF CUTTER (R.P.M)
Z = NUMBER OF TEETH (EDGE) .
S = FEED PER CUTTING EDGE (MM / TOOTH-R) .

The feed of per cutting edge is used usually to account the table feed .

The suitable feed per cutting edge for high speed steel , and tungsten carbide steel is shown in chart 7 .

Table 1

Milling cutter	Work			Feed amount per tooth mm					
	Quality of materials		Brinell hard-ness HB	Face milling cutter	Plane milling cutter with helical teeth	Slotting saw and side milling cutter	End mill	Formed cutter	Saw blade milling cutter
High-speed steel milling cutters	Special steel	Hard	300 400	0.1	0.075	0.075	0.05	0.05	0.025
		Tough	220 300	0.13	0.125	0.1	0.075	0.05	0.05
		Annealed	180 220	0.2	0.175	0.125	0.1	0.025	0.05
	Low - carbon steel	Malleable	152 197	0.25	0.2	0.13	0.125	0.075	0.075
		Cuts well	150 180	0.3	0.25	0.175	0.13	0.1	0.035
	Cast iron	Hard	220 300	0.27	0.2	0.13	0.13	0.1	0.075
		Medium hard	150 250	0.325	0.25	0.175	0.175	0.1	0.0075
		Soft	150 180	0.4	0.325	0.225	0.2	0.125	0.1
	Brass and bronze	Hard	150 250	0.225	0.225	0.13	0.125	0.075	0.05
		Medium hard	100 150	0.35	0.35	0.2	0.175	0.1	0.075
		Cuts well	80 100	0.55	0.55	0.325	0.27	0.175	0.125
	Magnesium and its alloys			0.55	0.45	0.325	0.27	0.175	0.125
	Aluminum and its alloys			0.55	0.45	0.325	0.27	0.175	0.125
	Plastic			0.375	0.3	0.225	0.175	0.125	0.1

Table 2 (Continue)

Milling cutter	Work			Feed amount per tooth mm					
	Quality of materials		Brinell hardness (HB)	Face milling cutter	Plane milling cutter with helical teeth	Slotting saw and side milling cutter	End mill	Formed cutter	Saw blade milling cutter
Sper-hard alloy milling cutter	Special steel	Hard	300 400	0.25	0.2	0.13	0.125	0.075	0.075
		Tough	220 300	0.3	0.25	0.175	0.13	0.1	0.075
		Annealed	180 220	0.35	0.27	0.2	0.175	0.1	0.1
	Low – carbon steel	Malleable	152 197	0.35	0.27	0.2	0.175	0.1	0.1
		Cuts well	150 180	0.4	0.325	0.225	0.2	0.125	0.1
	Cast iron	Hard	220 300	0.3	0.25	0.175	0.13	0.1	0.075
		Medium hard	180 220	0.4	0.325	0.25	0.2	0.125	0.1
		Soft	150 180	0.5	0.4	0.3	0.25	0.13	0.125
	Brass and bronze	Hard	140 250	0.25	0.2	0.13	0.125	0.075	0.075
		Medium hard	100 150	0.3	0.25	0.175	0.13	0.1	0.075
		Cuts well	80 100	0.5	0.4	0.3	0.25	0.13	0.125
	Magnesium and its alloys			0.4	0.45	0.3	0.25	0.13	0.125
	Aluminum and its alloys			0.4	0.45	0.3	0.25	0.13	0.125
	Plastic			0.3	0.3	0.225	0.175	0.125	0.1

Table

Work			Cutting speed	
Material		Brinell hardness HB	High-speed steel cutter	Super-hard alloy cutter
			m / min	m / min
Special steel	Hard Tough Annealed	300 400 220 300 180 220	13 15 15 23 23 35	30 50 50 75 75 108
Low-carbon steel	Malleable Cuts well	152 197 150 180	28 46 35 46	90 130 108 130
Cast iron	Hard Medium hard Soft	220 300 180 220 150 180	15 23 23 33 35 46	50 75 75 108 108 130
Brass and Bronze	Hard Medium hard Cuts well	150 250 100 150 80 100	21 46 46 83 83 116	63 130 130 200 200 330
Magnesium and its alloys			116 500	
Aluminum and its alloys			66 500	
Plastic			66 500	

Note : The above table should be regarded as a general criterion . Attention must be paid to the following when operating the machine .

9-3 DEPTH OF CUTTING

The depth of cutting varies with different kinds of cutting surfaces which is shown probably in table 8 .

TABLE 8 DEPTH OF CUTTING

KIND OF CUTTING SURFACE	DEPTH OF CUTTING
FINE CUTTING SURFACE	0.3 - 0.5
GENERAL CUTTING SURFACE	0.5 - 1.5
ROUGH CUTTING SURFACE	1.5 - 5

10 TROUBLE SHOOTING

Table 9

Trouble	Possible causes	Correction
1.Running out of cutter	1.Not accurate for cutter edges 2.Not accurate for cutters' holder 3.Dirty inside the spindle hole	1.Regringing the cutter edges 2.Replace new one 3.Clean it
2.Chatter	1.Tool shank too long or too fine 2.Laek of rigidity in the machine, fixture or workpiece 3.Spindle bearing too loose or worn 4.Feed rate too high 5.Dull of cutter 6.Cutting angles of cutter not proper 7.Back-lash of feed screw too loose 8.Gib of table too loose	1.Replace suitable one 2.Improve rigidity 3.Adjust or change it 4.Reduce feed rate 5.Resharpen it 6.Regring it 7.Adjust by the adjustable nut 8.Adjust by the adjustable screws
3.Poor surface finish	1.Feed too high 2.Dull tool 3.Speed too low 4.Insufficient number of cutter teeth	1.Reduce feed or increase cutting speed 2.Resharpen it 3.Increase surface speed of cutter 4.Adding more teeth for cutter
4.Vibration	1.Loose of leveling screws 2.Torn or mismatch of V-belt 3.Motor out of balance 4.Unbalance of pulley	1.Tighten it 2.Replace with new set 3.Replace it 4.Replace it
5.Cutter burns	1.Insufficient lubricants 2.Speed too high	1.Add more sulfur base oil 2.Reduce speed
6.Teeth bearing	1.Feed too high 2.Lack of rigidity of workpiece	1.Reduce feed 2.Improve design of workpiece or fixture
7.Out of dimension of work piece after taking off from fixture	1.Not suitable of fixture 2.Some residual stress in the inside of workpiece 3.Rough surface	1.Improve design of fixture 2.Improve heat treatment 3.Refinishing
8.Stepped machining surface	Center line of spindle not in perpendicular to table or slide way of carriage or bed	Readjust it correctly

11. MAINTENANCE SCHEDULE

Table 10

ITEM	POSITION	FREQUENCY			
		DAILY	WEEKLY	MONTHLY	YEARLY
1.LUBRICATION	ACCORDING TO TABLE 3	1	1-2		
2.ACCURACY	ACCORDING TO ACCUR A-INSPECTION CHART				1
3.CLEANING AND CORROSION PROTECTION	ALL SLIDDING SURFACES, TABLE SURFACE, T-SLOTS, SPINDLE NOSE, SPINDLE HOLE, ALL EXPOSED FI-NISHING SURFACES	1			
4.ADJUSTING OF GIBS	TABLE , SADDLE , SPINDLE , HEAD			2	
5.ADJUSTMENT OF FEEDING SCREWS	FTABLE , SADDLE , SPINDLE , HEAD			1	
6.ADJUSTING OF FTXED MECHAN-ISM	TABLE , SADDLE , SPINDLE HEAD			2	
7.LEVELLING AND TIGHTEN	FOUNDATION BOLT & SETTING SCREWS				2
8.TEMPERATURE OF BEARINGS CHECK UP	SPINDLE , GEAR BOX , BEARINGS MOTORS AND HYDRAULIC SYSTEM			1	
9.VIBRATION AND SOME ABNORMAL MOVEMENT CHECK UP	MOTORS , HYDRAULIC SYSTEM , GEARS AND SOTHER TRANSMISSION		1		
10.ELECTRIC CIRCUIT CHECK UP	MOTORS , SWITCHSCON-NECTING POINTS OF WIRE , PUSH BUTTONS			1	

SHARP

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