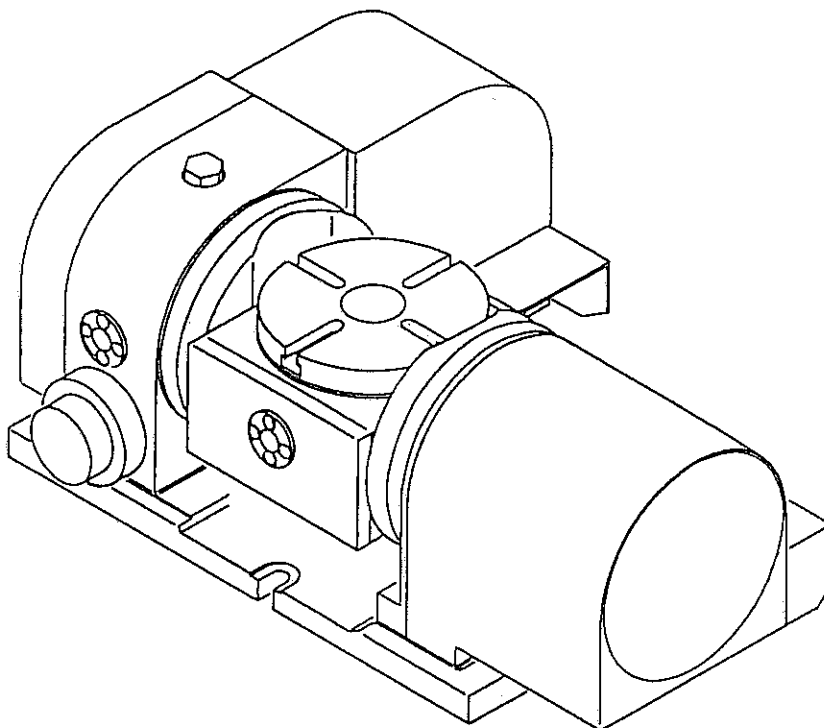


NIKKEN CNC ROTARY TABLE  
5AX-200II SERIES  
INDIVIDUAL INSTRUCTION MANUAL

THIRD EDITION



CE

**NIKKEN KOSAKUSHO WORKS., LTD.**

5-1, 1chome, Minamishinden, Dalto, Osaka, Japan

Tel:(072)869-5810 Fax:(072)869-6210

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This manual was produced using NIKKEN CNC rotary table 5AX200II series.

It is essential that you read the instructions and safety regulations before you attempt to use CNC rotary table.



: This is the industry safety symbol. This symbol is used to bring you attention to items or operations that could cause danger to you or other persons using CNC rotary tables. Please read these messages and follow these instructions carefully.



: This is the industry safety symbol. This symbol is used to bring you attention to items or operations that could be potentially hazardous to you or other persons using CNC rotary tables. Please read these messages and follow these instructions carefully.



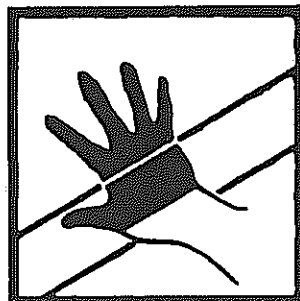
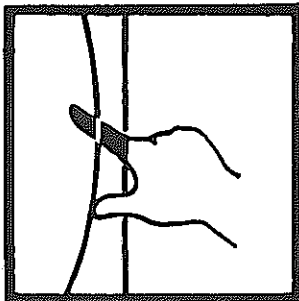
: Use CNC rotary table on the machine with safety door in combination with interlock system.



: Switch off main power of machine tool before setting, inspection or maintenance.



: Make sure your hand is out of the area marked as follows:



: Do not attempt to modify CNC rotary table.



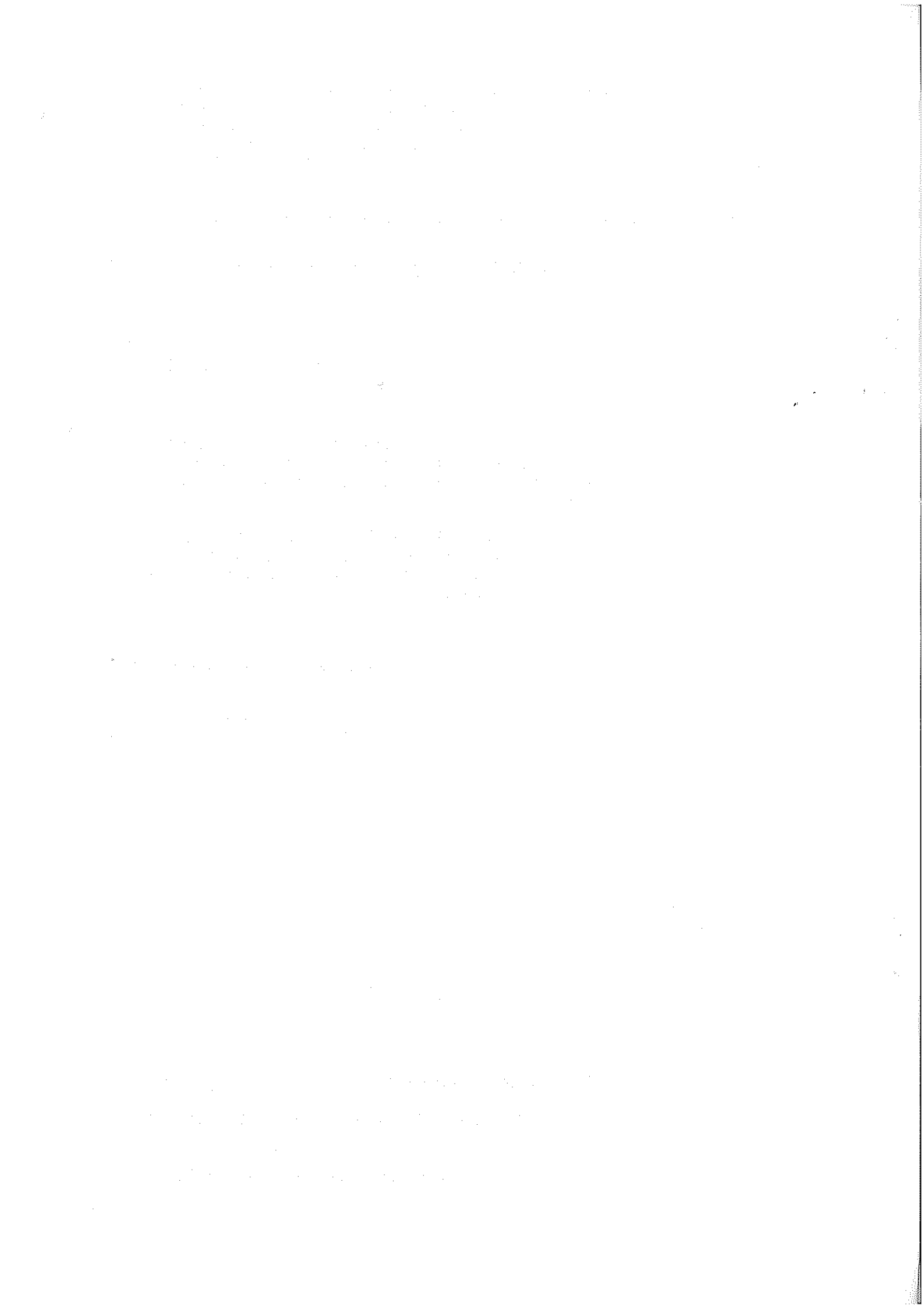
: Never hammer CNC rotary table or workpiece.



: Never attempt to operate CNC rotary table while under the influence of alcohol or drugs.

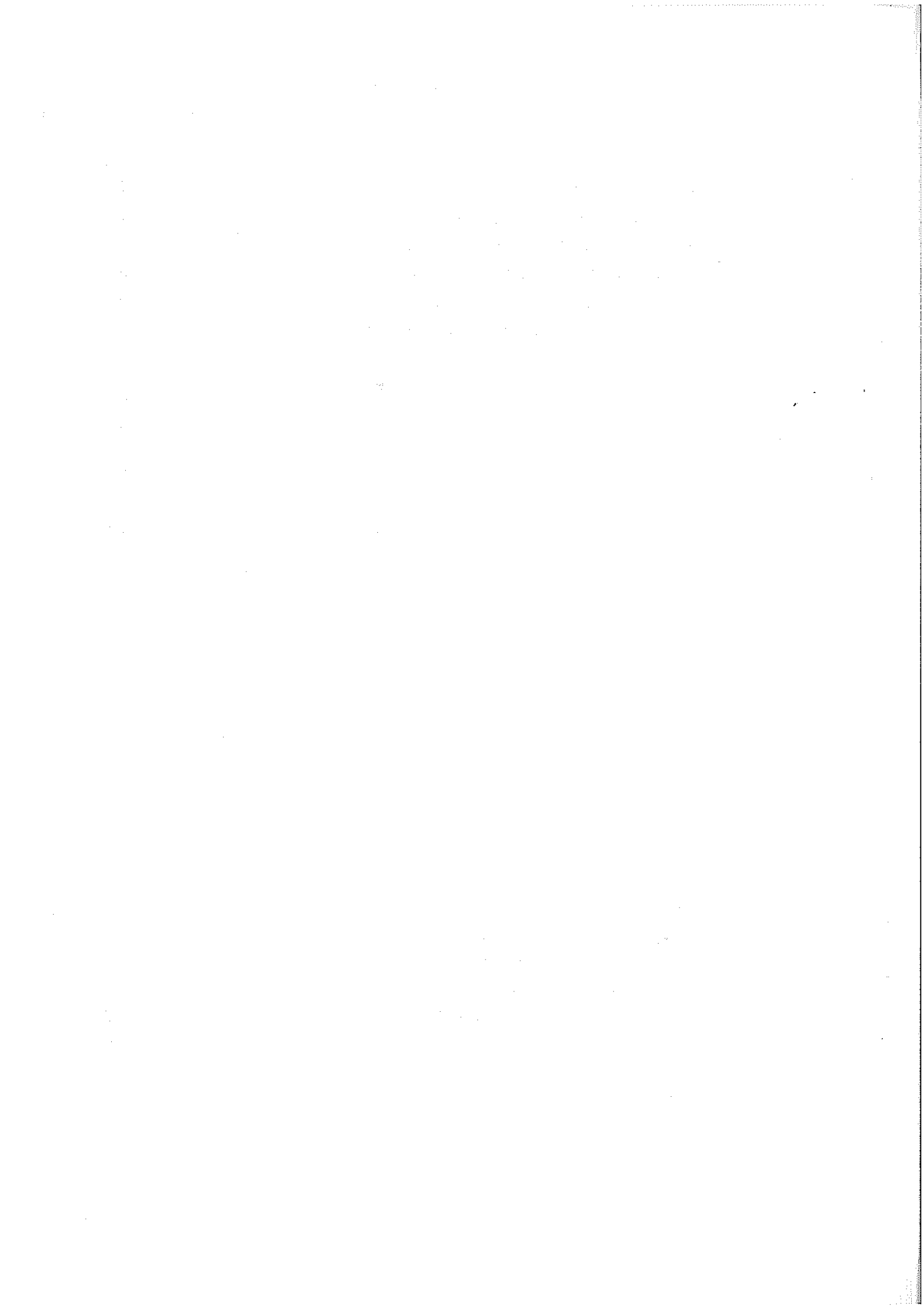


: Gloves and ties should not be worn when operating CNC rotary table.



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## 1 Adjustment of backlash

The worm screw rotates in the totally-enclosed oil bath and the reduction mechanism is composed of a combination of the special ion-nitrided worm wheel and the hardened worm screw, so that it is not necessary to adjust the backlash until four to five years have elapsed after the rotary table is put in service. However, if necessary, the backlash can be adjusted according to the following procedures.

### 1.1 Measurement of the backlash for rotary axis

- 1) Locate the tilting axis at 90 degree and clamp the brake.
- 2) Execute the rotary axis machine zero return and leave the brake off.
- 3) Confirming the backlash

Read a deflection of the dial gauge (G) by inserting the flat plate (H) into a T-slot and manoeuvre the faceplate clockwise and anticlockwise through the plate by hand. A backlash of within 5 to 15 microns is normal, and the adjustment should be done in the event when a backlash of 50 microns or more is observed. The confirmation is to be done on four spots of every 45 degree of table.

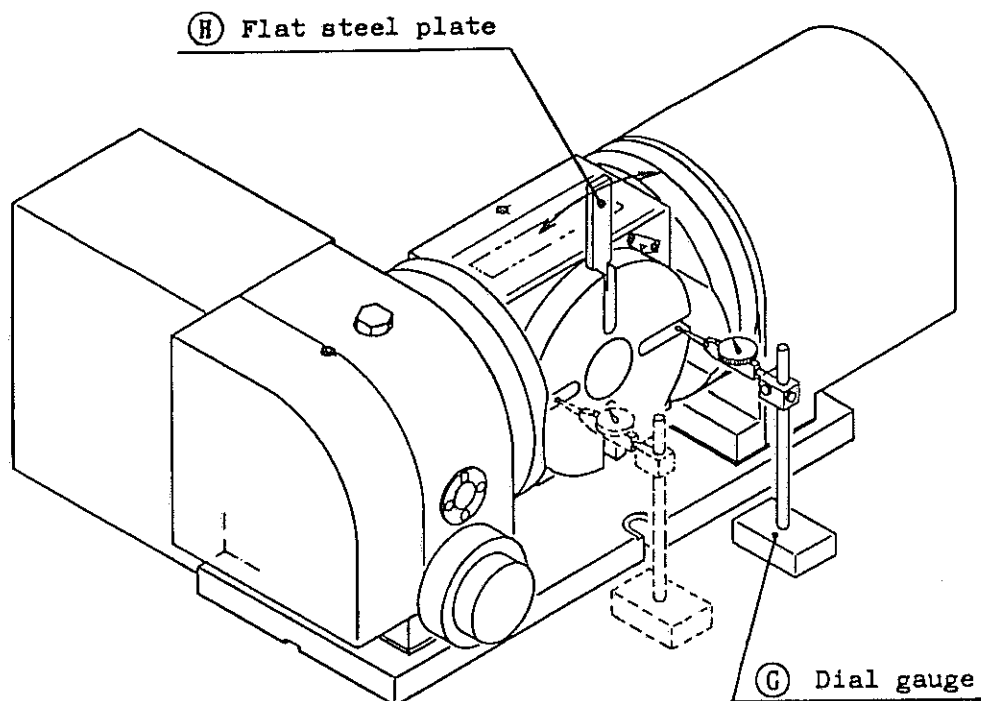


Fig.1 Measurement of backlash for rotary axis

## 1.2 Adjustment of backlash for rotary axis

The adjustment of backlash for rotary axis can be carried out by minimizing the meshing pitch between the spindle (worm wheel) center and the worm screw center.

The adjusting mechanism is illustrated by Fig.2. In order to minimize the meshing pitch, remove the shim plate and thin it by a surface grinder etc. To minimize the backlash by 10 microns, it is necessary to thin the shim plate by about 19 microns.

After completion of adjustment, measure the backlash again to check that it has been adjusted to about 10 to 15 microns.



Be sure to thin the shim plate gradually so as not to thin it excessively.



By no means turn the table at the rapid speed immediately after the adjustment. Be sure to turn it at the low speed (2 r.p.m) for trial running first, then turn it at the rapid speed.

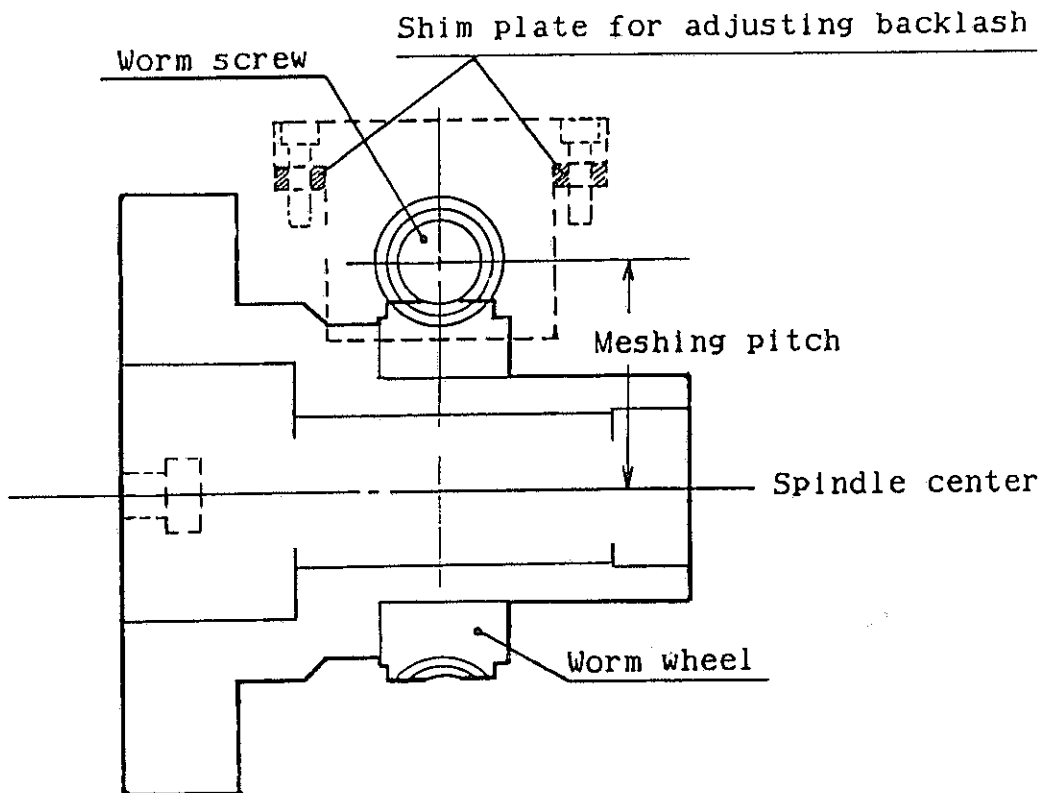


Fig.2 Adjustment of backlash for rotary axis

### 1.3 Measurement of backlash for tilting axis

- 1) Execute the rotary axis machine zero return and leave the brake on.
- 2) Locate the tilting axis at 90 degree and leave the brake off.
- 3) Confirming the backlash

Set the dial gauge onto top surface of the faceplate (at almost centre line of the rotary axis )as illustrated in Fig. 3

Read a deflection of the dial gauge by inserting the flat plate (H) into a top T-slot and manoeuvre the faceplate to the both directions as the arrows show in Fig. 3 A backlash of within 5 to 20 microns is initial amount when shipped, and the adjustment should be done in the event when a backlash of 50 microns or more is observed. The measurement is to be done at four spots of every 30 degree of tilting axis.

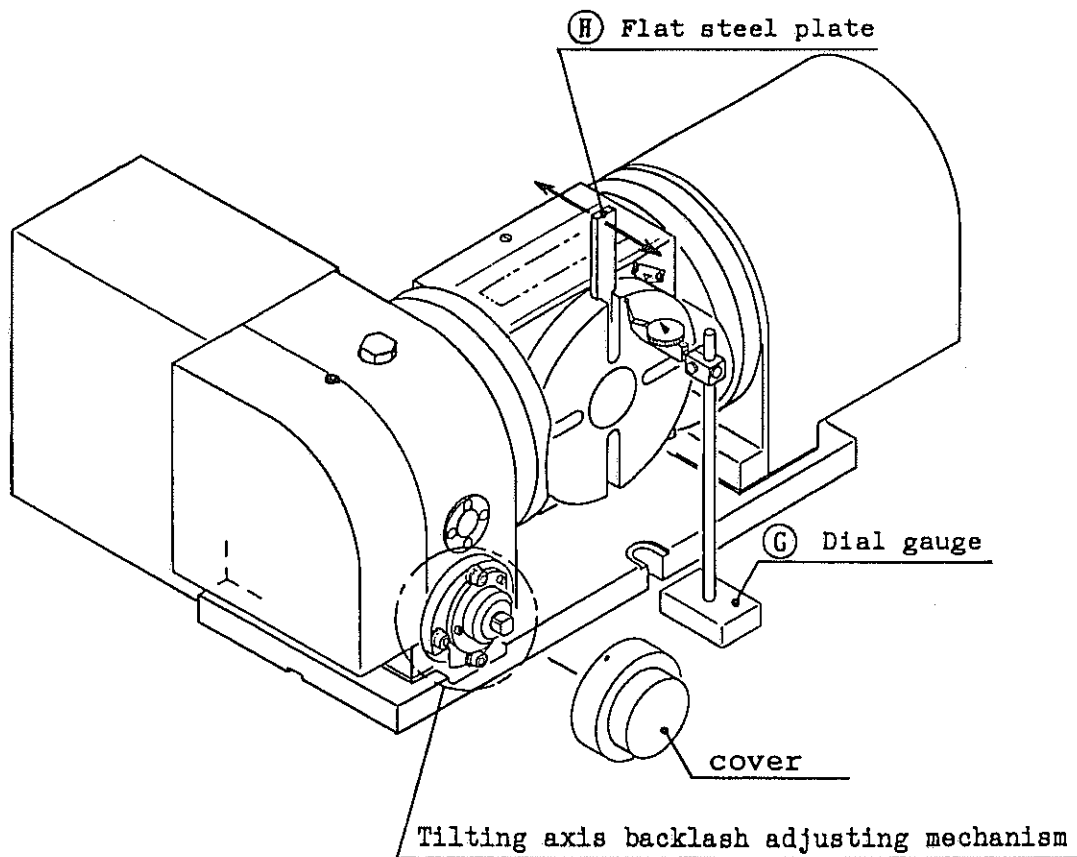


Fig.3 Measurement of backlash for tilting axis

#### 1.4 Adjustment of backlash for tilting axis



- 1) Switch off the main power of machine tool.
- 2) Locate the tilting axis at 75 degree.
- 3) Remove the motor cover.
- 4) Slightly loosen three cap bolts (a) which tighten the eccentric housing .
- 5) There is another cap bolt (b) which fix the housing at the other end. When the bolt is loosened at 2 to 3 turns, the clamp pieces is released and the housing is free for adjustment.
- 6) Reset the dial gauge (G) as shown in Fig. 3, loosen the bolt (c) and tighten the bolt (d) clockwise, then the eccentric housing will turn to get the backlash near to 0 (zero).
- 7) Read a deflection of the dial gauge (G) by inserting the flat plate (H) into a T-slot and manoeuvre the face plate up and down through the plate by hand. Adjust the backlash within 10 to 20 microns.
- 8) After the completion of above adjustment, tighten the bolts (a) & (b) as they were.
- 9) Measure the backlash again and make sure that it has been adjusted to 5 to 10 microns.

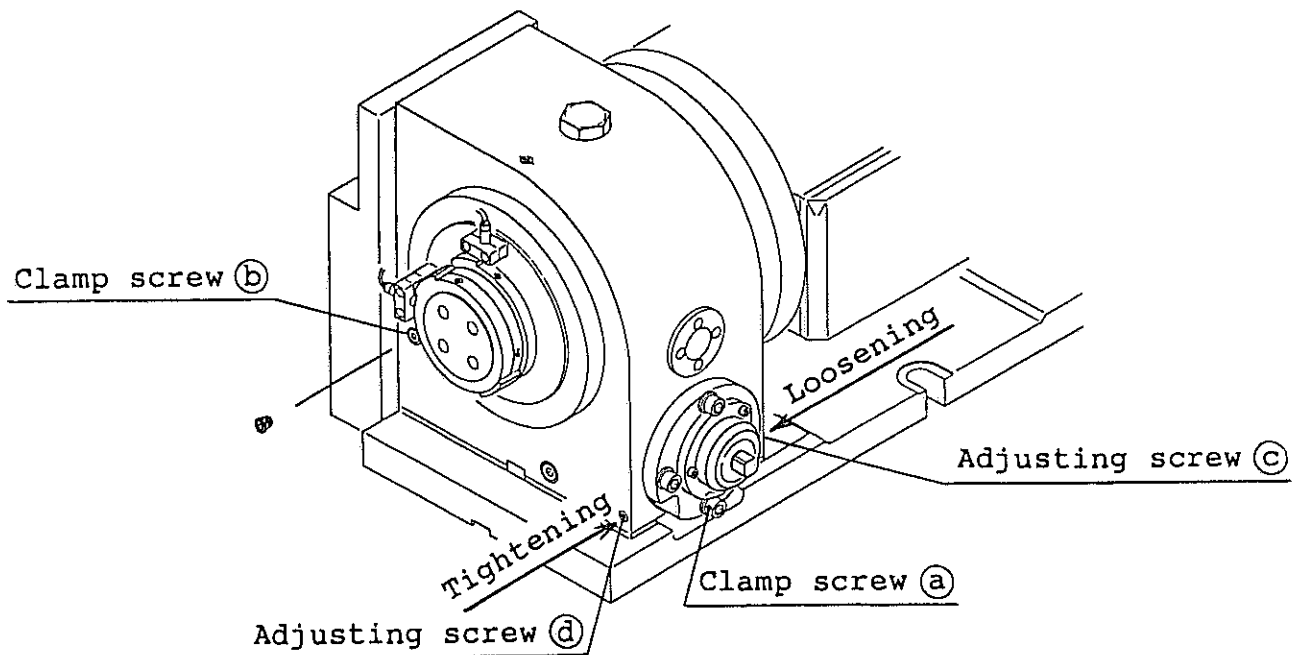


Fig.4 Adustment of backlash for tilting axis

!  
NOTE

Turn the right and left backlash adjusting mechanisms uniformly to maintain the parallelism of the worm screw.

!  
NOTE

Be sure to apply each sealing agent (shown in Fig. 2) to its corresponding part assembling the worm screw, so that no ingress of coolant etc. is permitted.

!  
NOTE

By no means turn the table at the rapid speed immediately after the adjustment. Be sure to turn it at the low speed (2 r.p.m) for trial running first, then turn it at the rapid speed.

## 1.5 Backlash adjustment of gears in gear box

After completion of backlash adjustment between worm wheel and worm screw, carry out the backlash adjustment of gears in gear box according to the following procedure:



- 1) Switch off the main power of machine tool.
- 2) Remove the motor cover.
- 3) Remove the motor mounting plate, tail stock support, support flange.
- 4) Adjustment of backlash gears Z1 & Z2 (Optimum backlash : 0.02 to 0.03mm)

Loosen three bolts for the middle shaft to which the Z2 is fixed. Measure the backlash by setting the dial gauge on the tooth surface of Z2. Make sure that the backlash has been adjusted to within 0.02 to 0.03mm and tighten the three fixing bolts.

- 5) Adjustment of backlash between gears Z2 & Z3.

Reset the motor mounting plate, tail stock support and the support flange. Slightly tighten the motor fitting bolts and push the motor (c/w gear Z3) toward the Z2 and adjust the backlash.

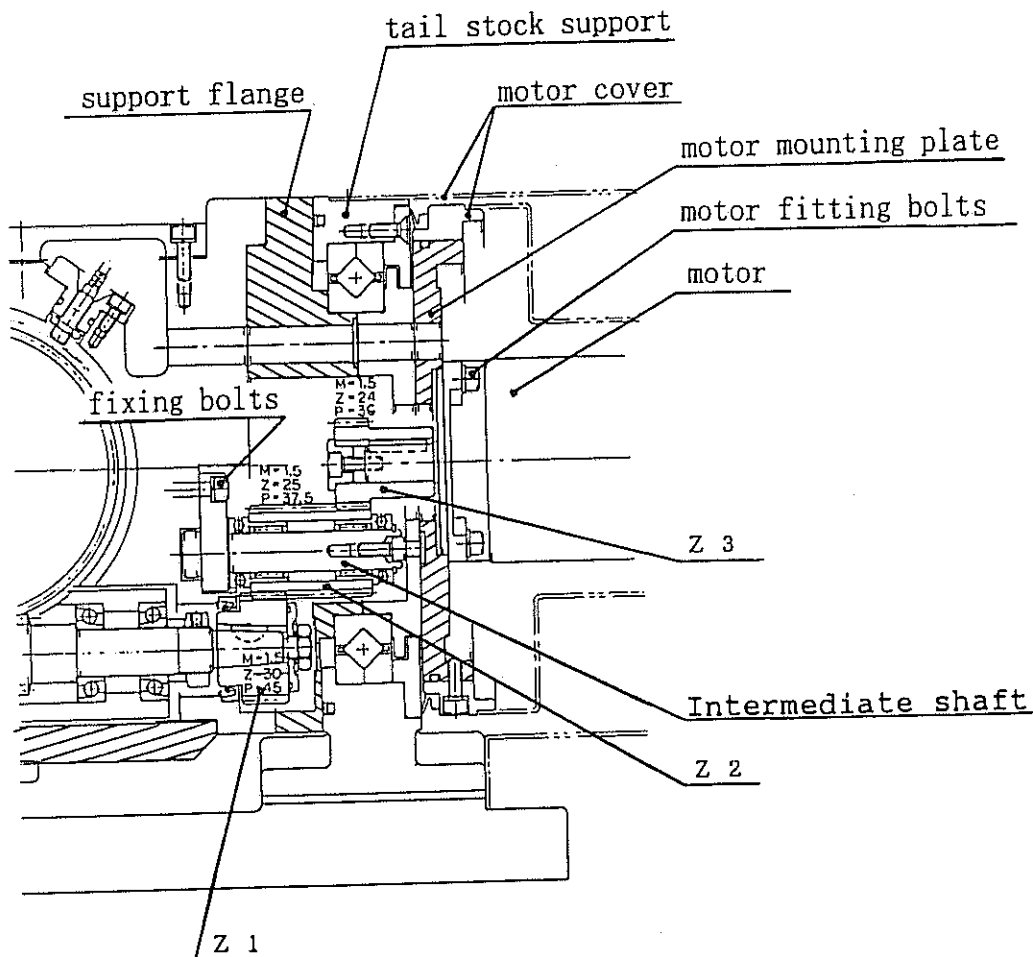


Fig.5 Backlash adjustment of gears in gear box

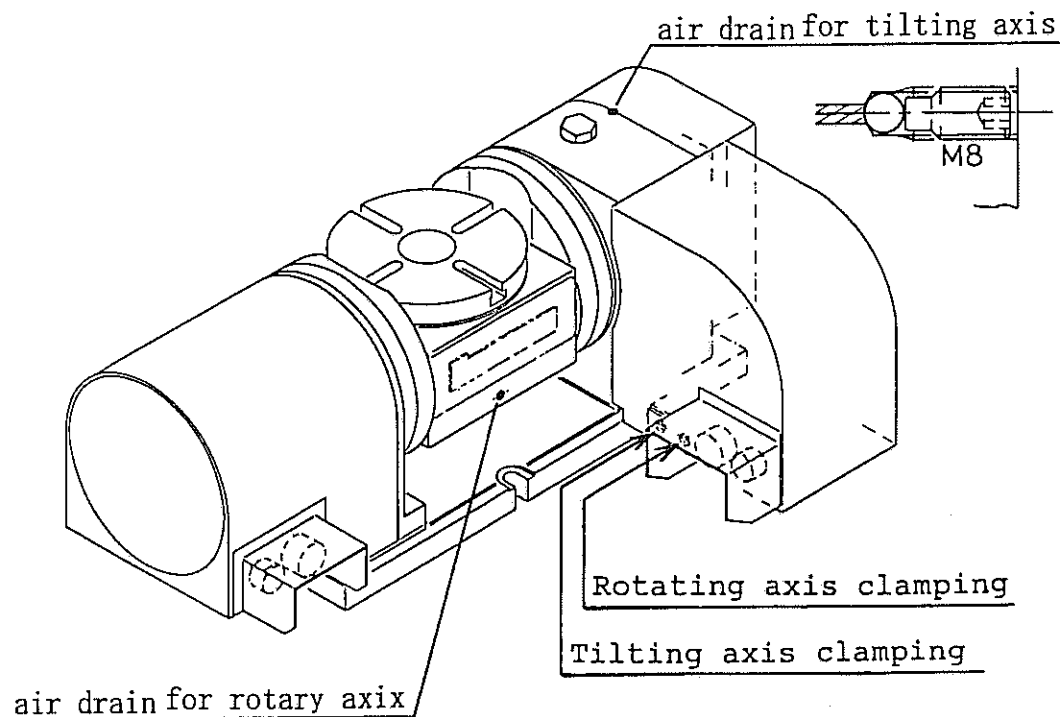
## 2. Brake mechanism

The brake mechanisms for both axis are energised by hydraulic supply. (Single port: Spring return system.)

The solenoid valves for the brake activation are not fitted on the table. Please see the attached diagrams for further details.

Nikken standard 5AX-200 II

- 1) Please see Fig.5 for the locations of Hydraulic connections. The ports have PT3/8 female threads.
- 2) Please make sure that the hydraulic supply pressure is within 35 kgf/cm<sup>2</sup>
- 3) In case of the pressure is more than 35 kgf/cm<sup>2</sup>, install the reducing valve on the hydraulic tank.
- 4) Please ensure that the back pressure is less than 0.5 kgf/cm<sup>2</sup>



**Fig. 6 Brake mechanism**

After completion of hydraulic connection, slightly loosen the air drain bolts for both axis and activate the brake clamp and unclamp several times until the oil starts to come out then tighten the bolts completely.

Make sure that the above air draining operation is done completely or it might cause less powerful brake force than the specified figures.

## A) Rotary Axis

The rotary axis has a disk brake system on the centre spindle of table. The system is activated by hydraulic supply (Single port: Spring return system).

- 1) When the hydraulic pressure for brake clamping is supplied by clamping command, the piston is pushed up with pressing the brake shoe toward the main body for brake on.
- 2) When the hydraulic pressure is stopped by the unclamping command, the piston is pushed back by the disk springs for brake off.

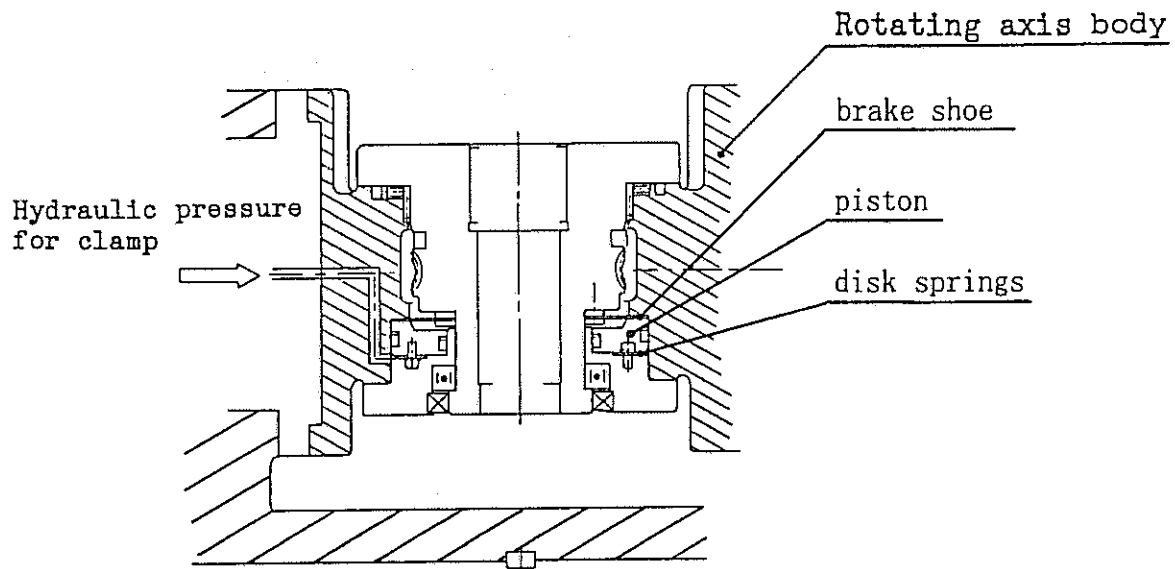


Fig. 7 Brake mechanism for rotary axis

## B) Tilting Axis

- 1) When the hydraulic pressure for brake clamping is supplied into the expanding ring by clamping command, the ring expands toward internal diameter of the table equally and creates the powerful and high precision clamping.
- 2) When the hydraulic pressure is stopped, the expansion of the ring is released for unclamping.

Please ensure that the pressure switches for brake clamp/unclamp confirmation are fitted on the Hydraulic unit according to the enclosed diagrams since the switches are not fitted on neither rotary nor tilting axis of the table. (The pressure setting of the switch should be 30 kgf/cm<sup>2</sup>)

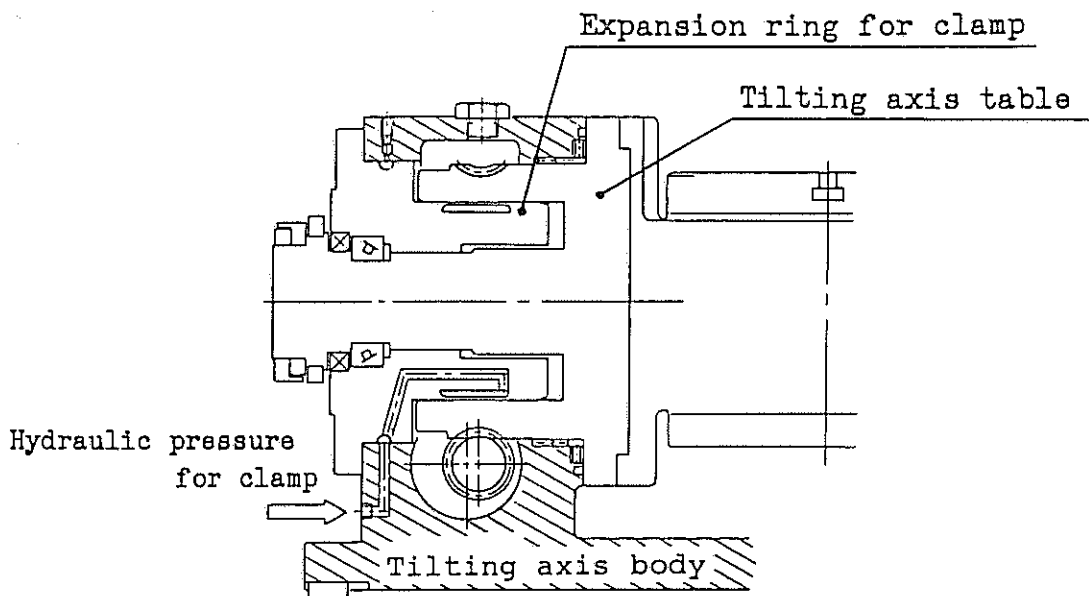
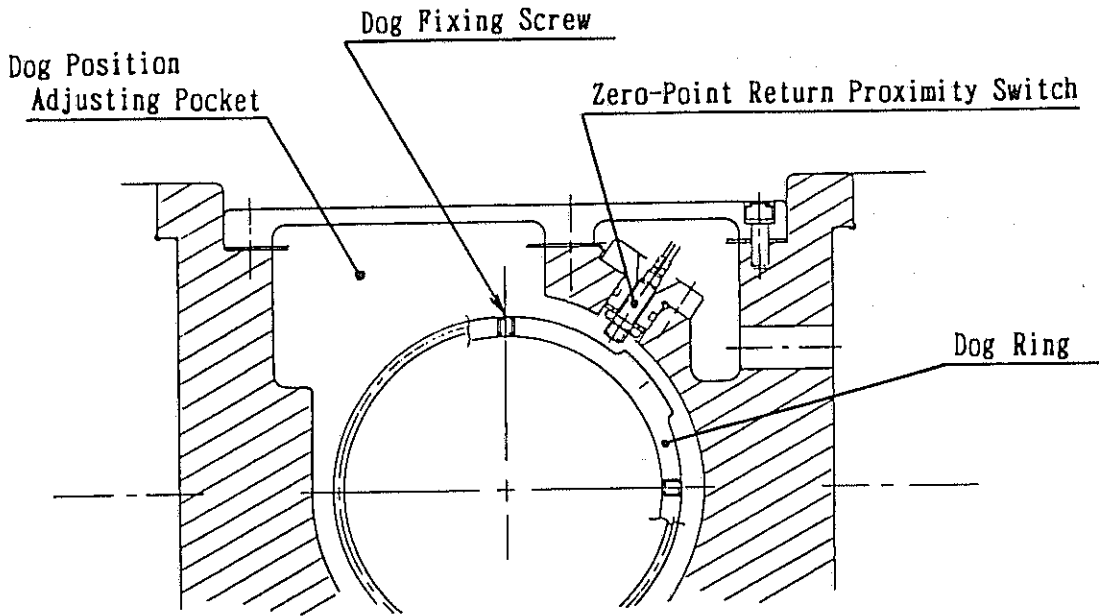


Fig. 8 Brake mechanism for tilting axis

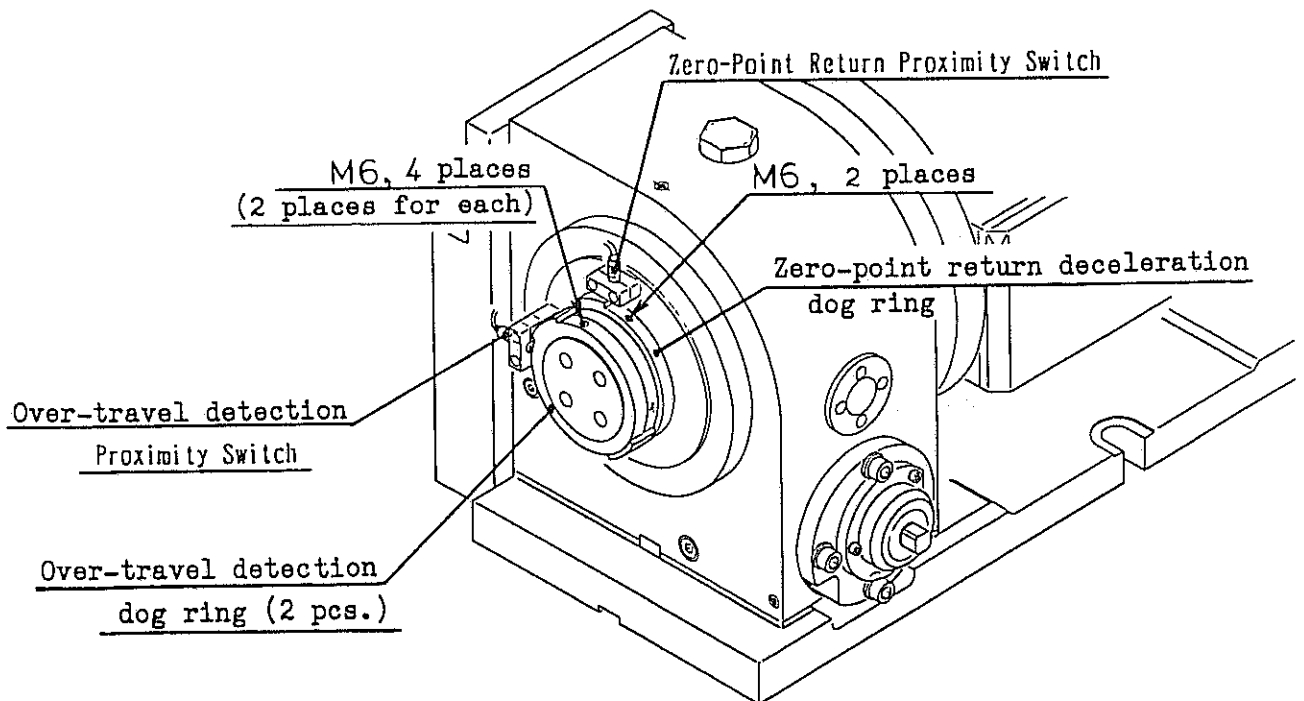
### 3. Zero Return Mechanism

The dog ring mechanism for deceleration (DEC\*) is adapted for both the rotary axis and tilting axis. In case when the correct machine zero-point can not be obtained even if the grid shift amount is varied, adjust the dog ring.

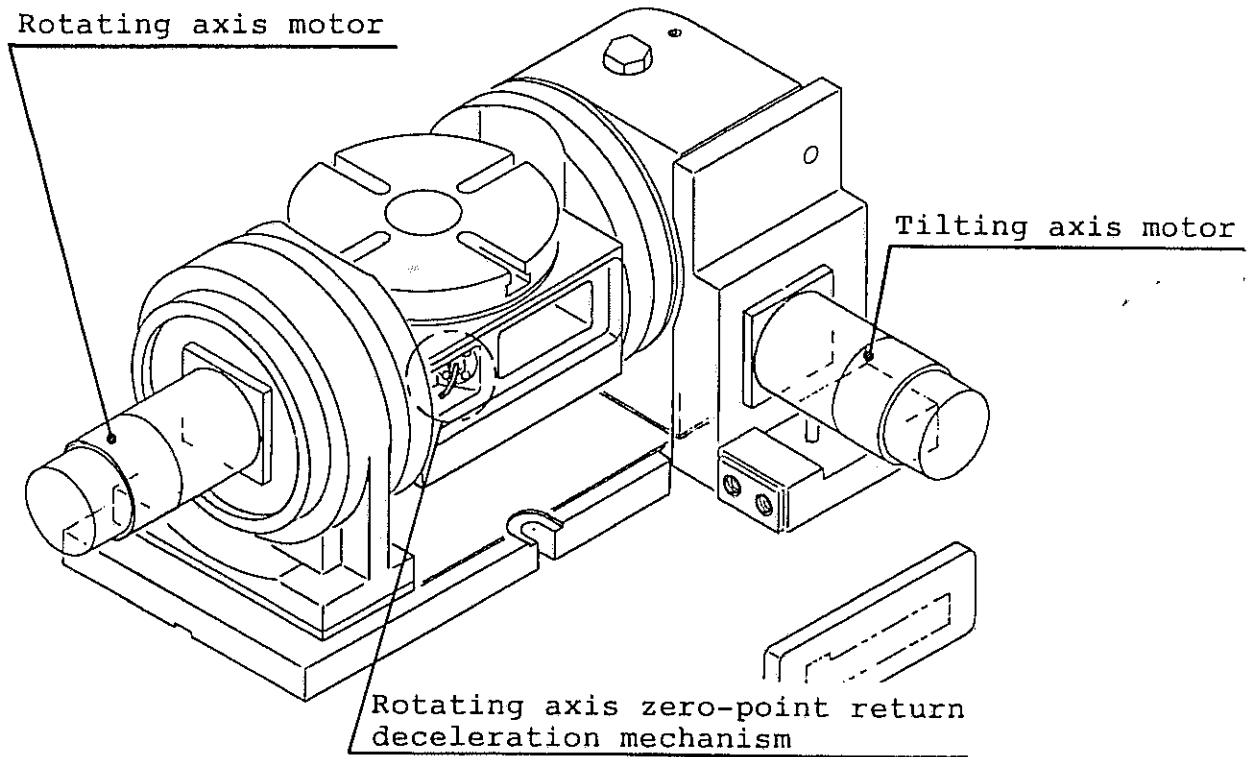


### 4. Over-travel detection mechanism (for tilting axis only)

The dog ring for over-travel detection and over-travel detection Proximity Switch which is B-contact are located at the backside of the tilting axis. The tilting angle ranges from 0° to 105° for standard NIKKEN model, however, this may be changed by previous arrangement.

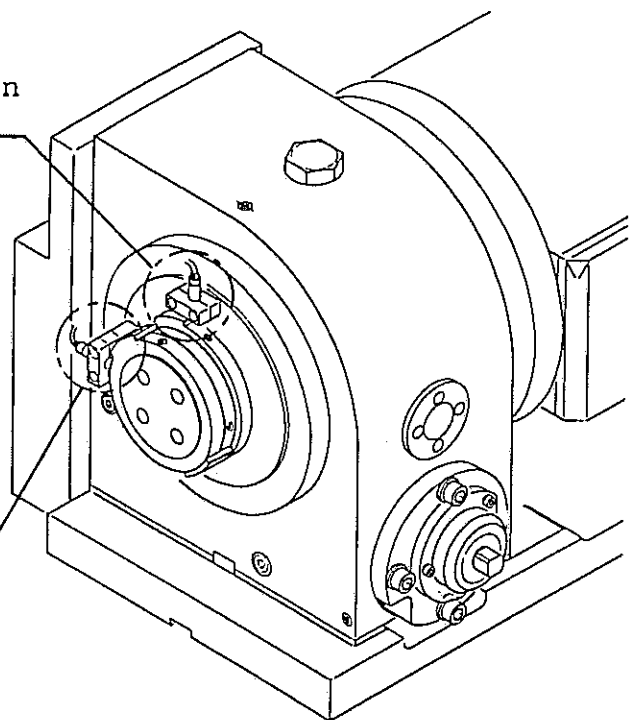


5. Layout of electric parts



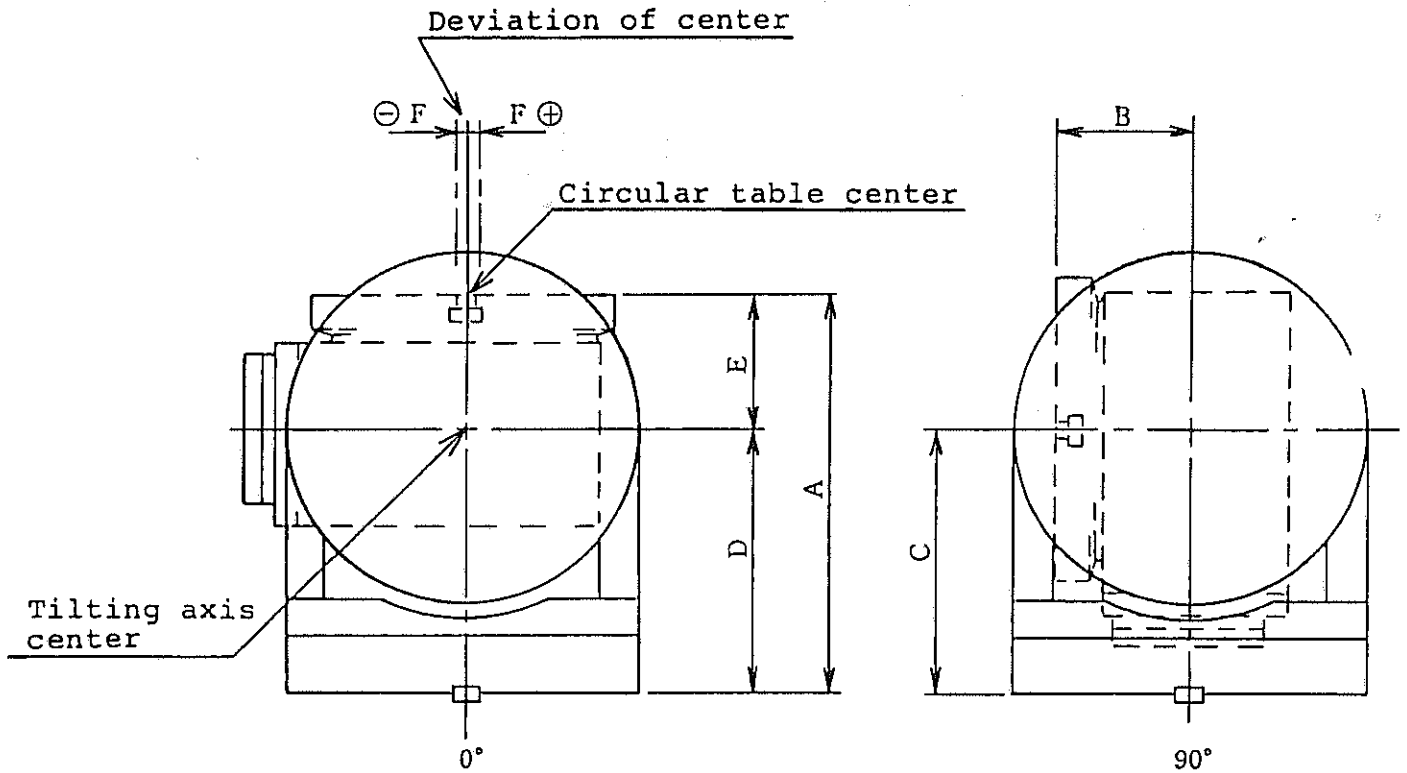
Tilting axis zero-point return deceleration mechanism

Tilting axis over-travel detection on mechanism



APPENDIX

1. How to obtain the coordinate of tilting center by measurement



No.	Location	Value	Remark
1	A ( 260 mm )	.	☆ Measure A, B & C; then calculate D, E & F from the following equations. $D = (A - B + C) / 2$ $E = A - D$ $F = (B + C - A) / 2$
2	B ( 80 mm )	.	
3	C ( 180 mm )	.	
4	D ( 180 mm )	.	
5	E ( 80 mm )	.	
6	F ( 0 mm )	.	

APPENDIX

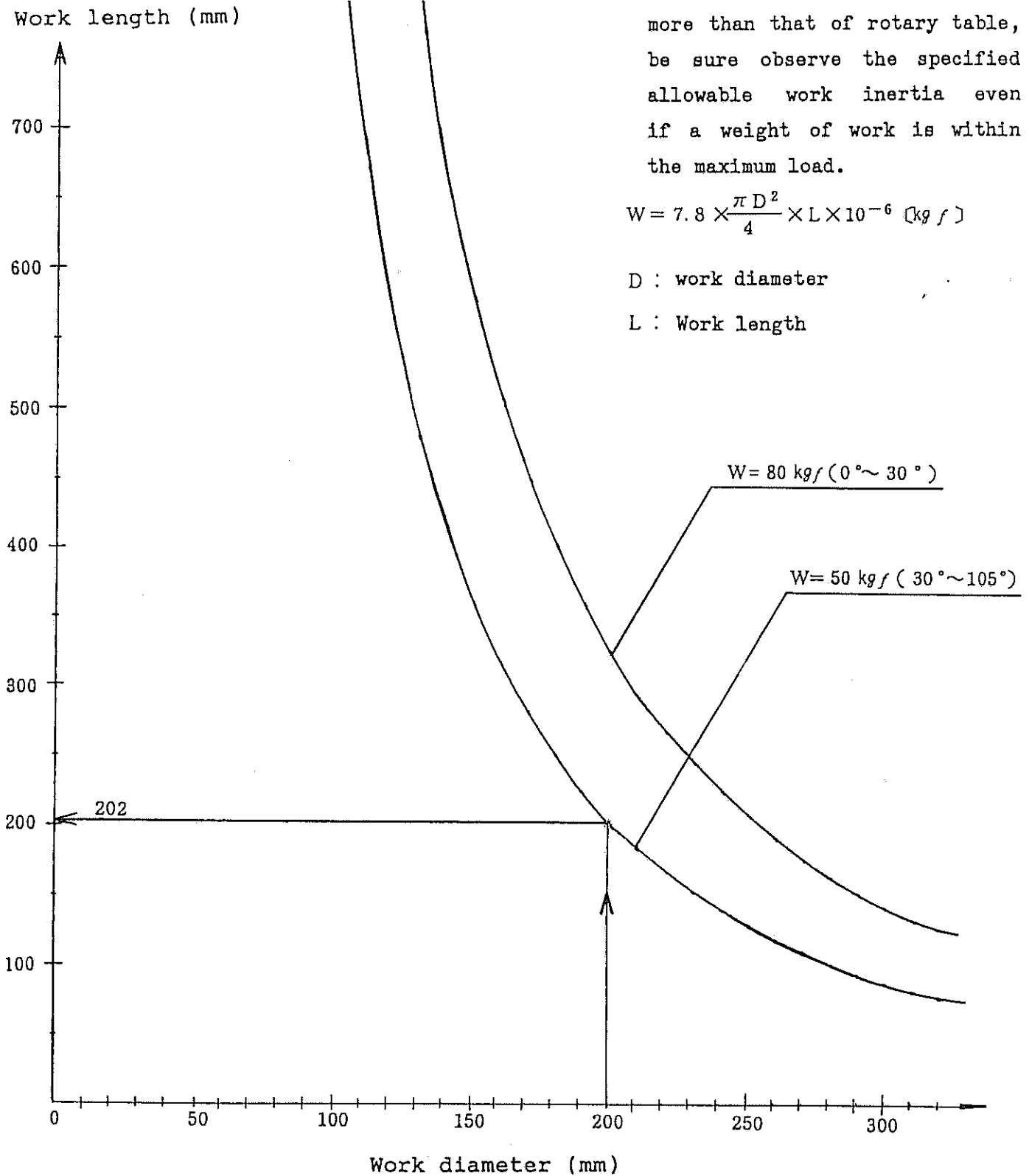
2. Relation between work diameter and length for allowable maximum load (for steel)

Note) For a work having a diameter of more than that of rotary table, be sure observe the specified allowable work inertia even if a weight of work is within the maximum load.

$$W = 7.8 \times \frac{\pi D^2}{4} \times L \times 10^{-6} \text{ [kgf]}$$

D : work diameter

L : Work length

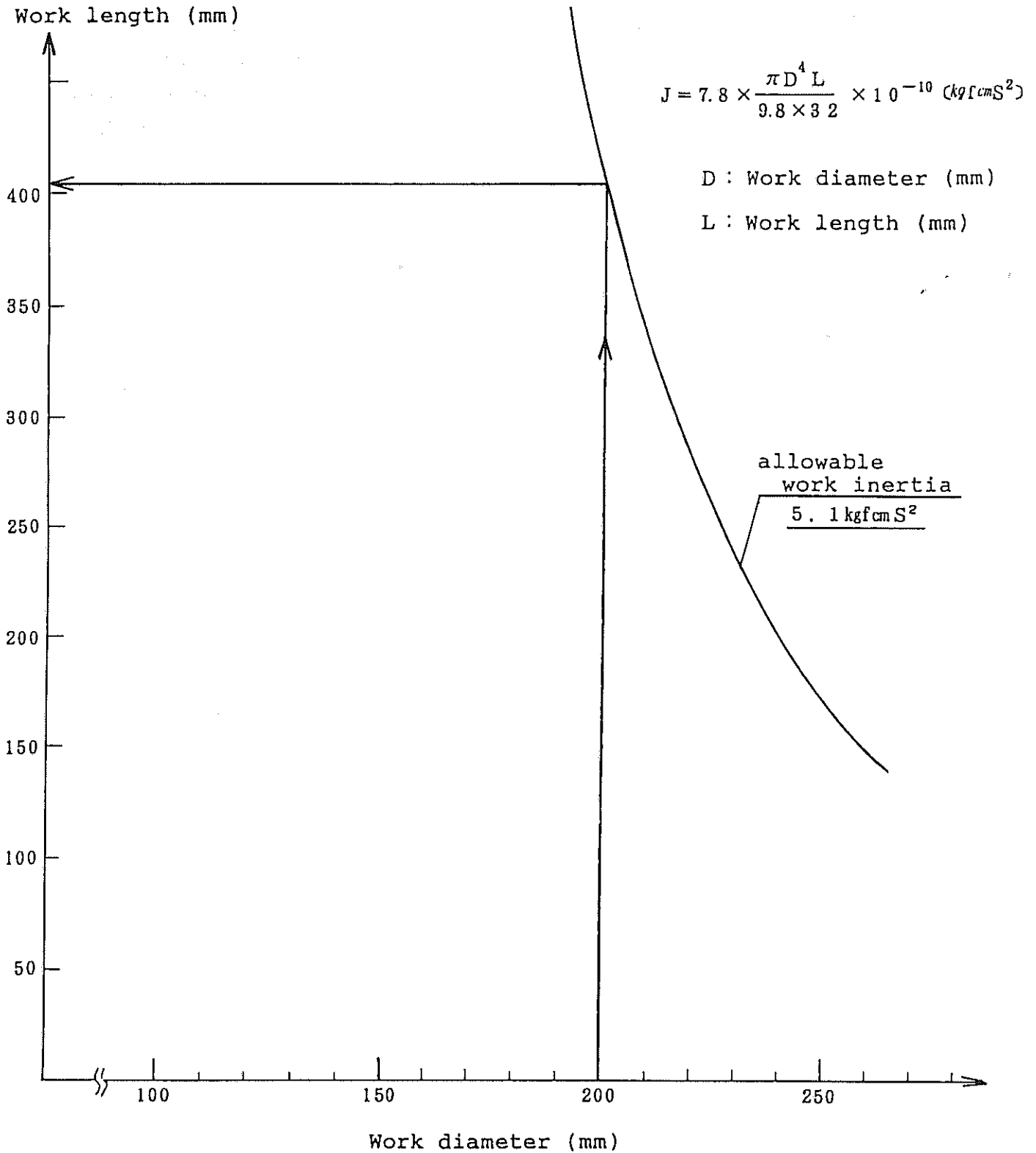


Utilizing method of above figure

A work, having  $\phi$  200 mm dia. and a length of within 202 mm, will have an allowable maximum load of 50 kg.

APPENDIX

3. Relation between work diameter and length for allowable work inertia (for steel)



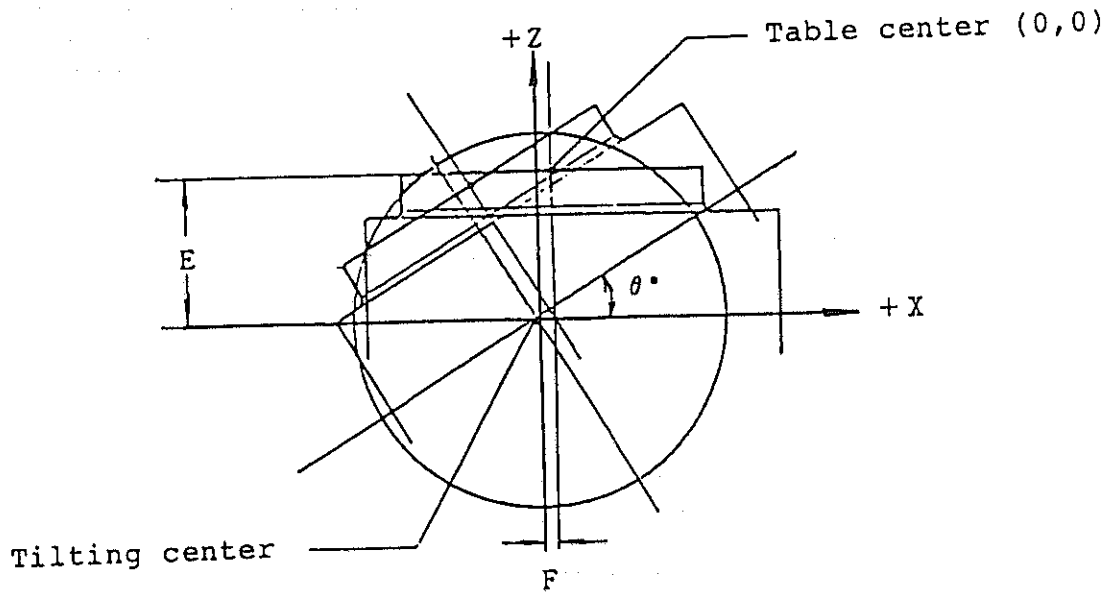
Utilizing method of above figure

A work, having  $\phi 200$ mm dia. and a length of within 408 mm, will have an allowable maximum load of 5.1 kgf.cm.S<sup>2</sup>.

APPENDIX

4. Coordinate calculating equation for table center  
in relation to tilting angle

Assuming that the coordinates of table center when the tilting axis angle =  $0^\circ$  (horizontal) are  $X = 0$  and  $Z = 0$  respectively, the coordinates when the tilting angle is  $\theta^\circ$  can be calculated by the following equations.



For values of E and F, use those values described at the time of shipping.

$$X = F\cos\theta - E\sin\theta - F$$

$$Z = E\cos\theta + F\sin\theta - E$$

When  $E = 75$  and  $F = 0$ , these values become as follows:

$$X = -75\sin\theta$$

$$Z = 75\cos\theta - 75$$

Relation between  $\theta$  and X & Z coordinates is shown in the table of next page.

Tilting angle $\theta$	Table center	
	X	Z
0°	0	0
5°	-6.972	-0.304
10°	-13.892	-1.215
15°	-20.706	-2.726
20°	-27.362	-4.825
25°	-33.809	-7.495
30°	-40.000	-10.718
35°	-45.886	-14.468
40°	-51.423	-18.716
45°	-56.569	-23.431
50°	-61.284	-28.577
55°	-65.532	-34.114
60°	-69.282	-40.000
65°	-72.505	-46.191
70°	-75.175	-52.638
75°	-77.274	-59.294
80°	-78.785	-66.108
85°	-79.696	-73.028
90°	-80.000	-80.000
95°	-79.696	-86.972
100°	-78.785	-93.892
105°	-77.274	-100.706

APPENDIX

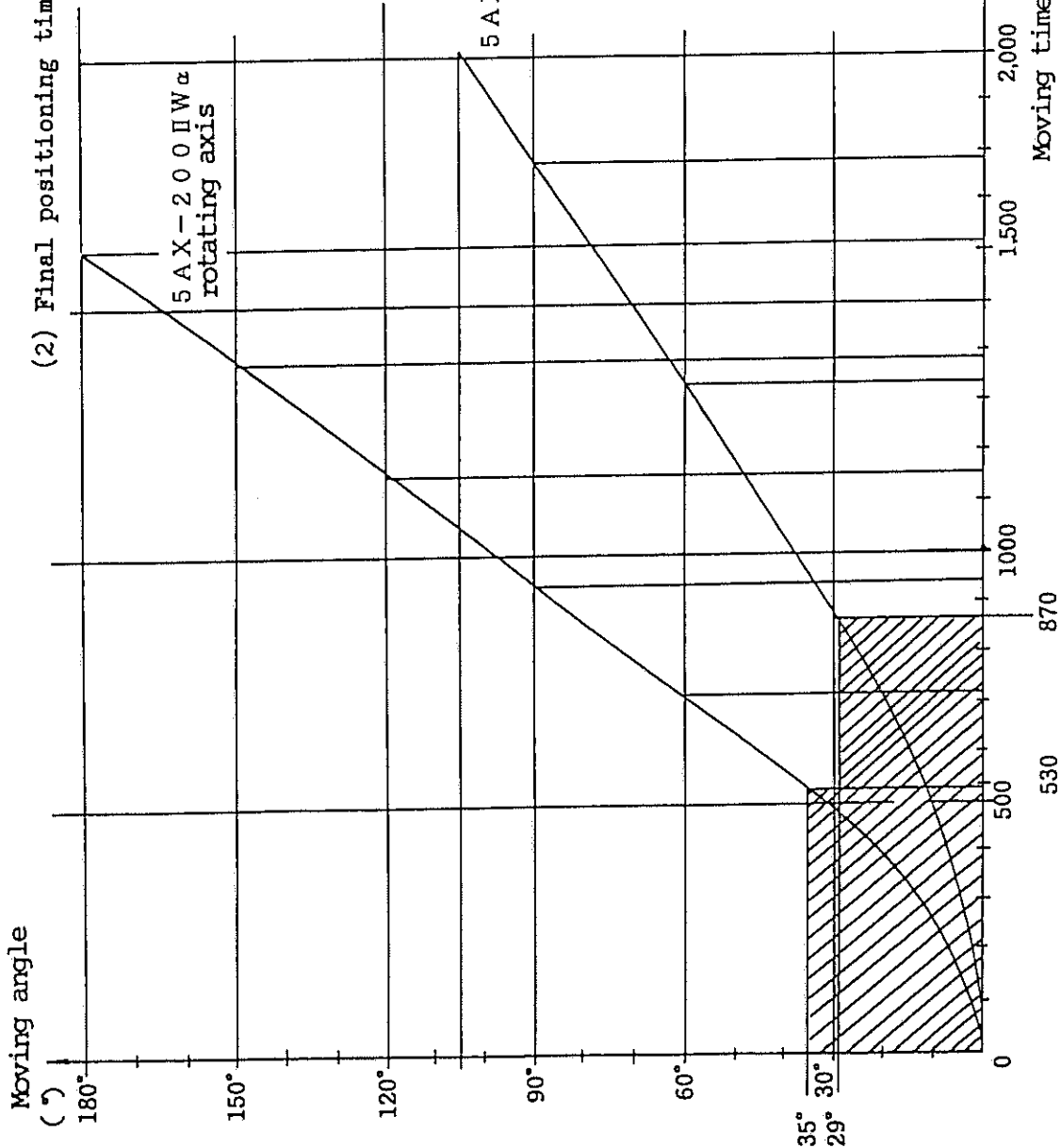
5. Rapid traverse positioning time

The following times are set as standard setting when driven by  $\alpha$  (alpha) controller. Therefore, when it is desirable to shorten the moving time, please consult us in advance.

(1) Moving pre-processing time (parallel with unclamping operation):

500 msec (PRM#59)  
650 msec (PRM#11)

(2) Final positioning time:



Item	Axis	Rotating axis	Tilting axis
Servo loop gain		30 sec <sup>-1</sup>	
Acc./decel. time const.		Ex. function 58 msec	Ex. function 100 msec
Rapid traverse rate		22.2 RPM	11.1 RPM

Item	Axis	Rotating axis	Tilting axis
Unclamp time		200msec	200 msec
Clamp time		300 msec	300msec

Error:  $\pm 20\%$

Clamp action is executed in parallel with 1-block signal finish operation.

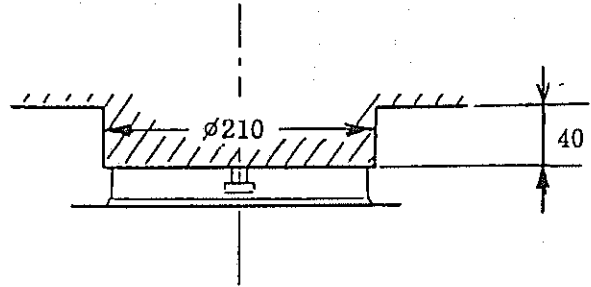
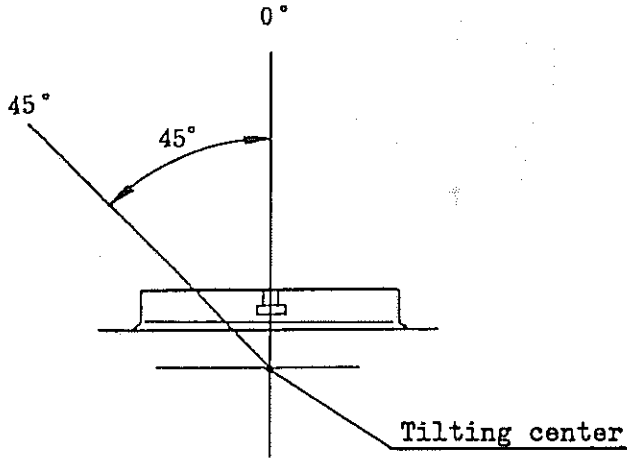
In areas , the table moves only in acceleration and deceleration modes and not in rapid traverse mode.

APPENDIX

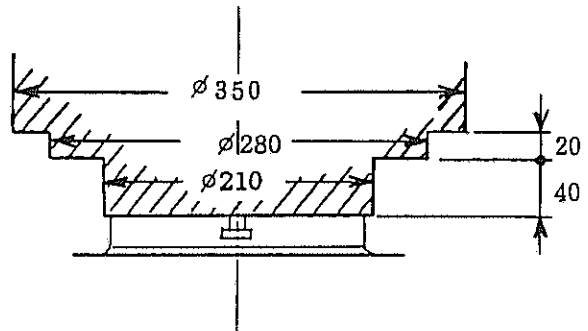
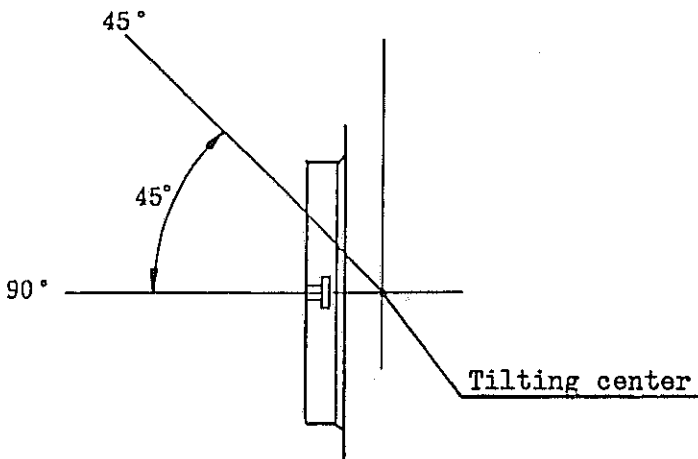
6. Interference zone

The followings are standard interference zone of 5AX-200II  
 If special spec. is required, please consult us in advance.

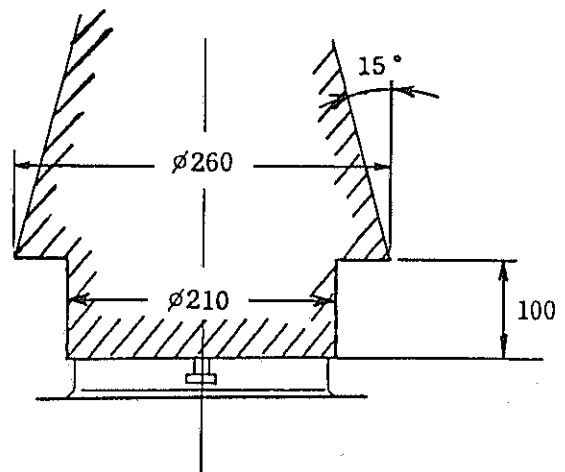
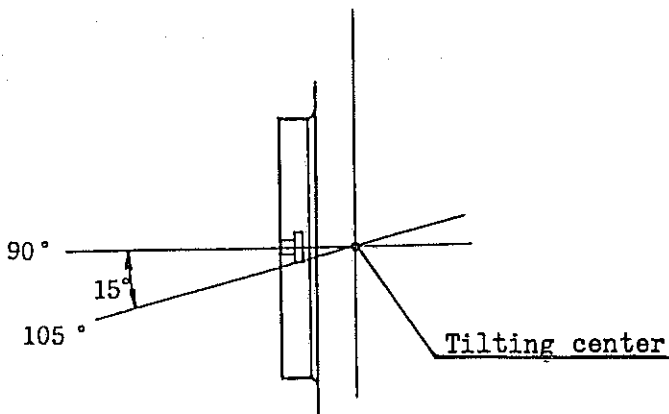
Tilting angle range: 0° to 45° (horizontal)



Tilting angle range: 45° to 90° (vertical)

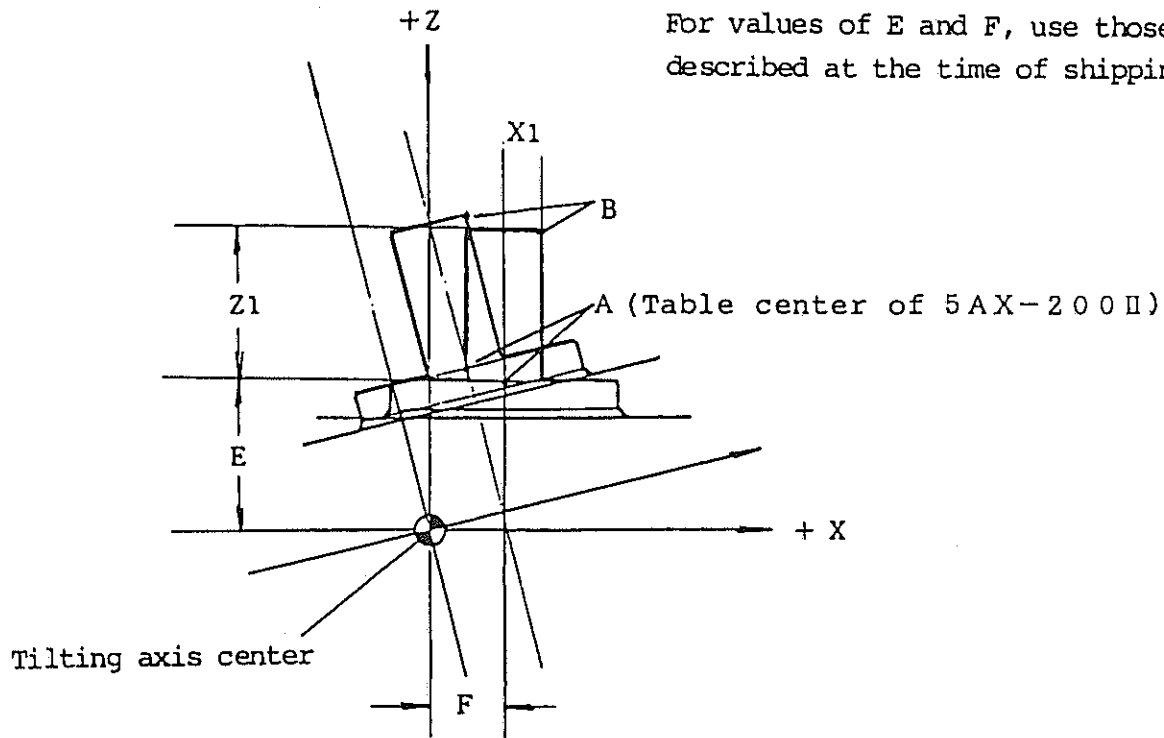


Tilting angle range: 90° to 105° (vertical)



APPENDIX

7. Relation between tilting angle and X & Z Coordinate value



Assuming that the tilting center is at coordinate values (0, 0), coordinate values of respective points become as follows:

A-point for tilting angle of zero degree

$$X(A0) = F$$

$$Z(A0) = E$$

A-point for tilting angle of  $\theta$  degrees

$$X(A\theta) = F\cos\theta - E\sin\theta$$

$$Z(A\theta) = E\cos\theta + F\sin\theta$$

B-point for tilting angle of zero degree

$$X(B0) = F + X1$$

$$Z(B0) = E + Z1$$

B-point for tilting angle of  $\theta$  degree

$$X(B\theta) = (F + X1)\cos\theta - (E + Z1)\sin\theta$$

$$Z(B\theta) = (E + Z1)\cos\theta + (F + X1)\sin\theta$$

APPENDIX

8. Composition of 5AX-200IIW $\alpha$   
(Standard spec.)

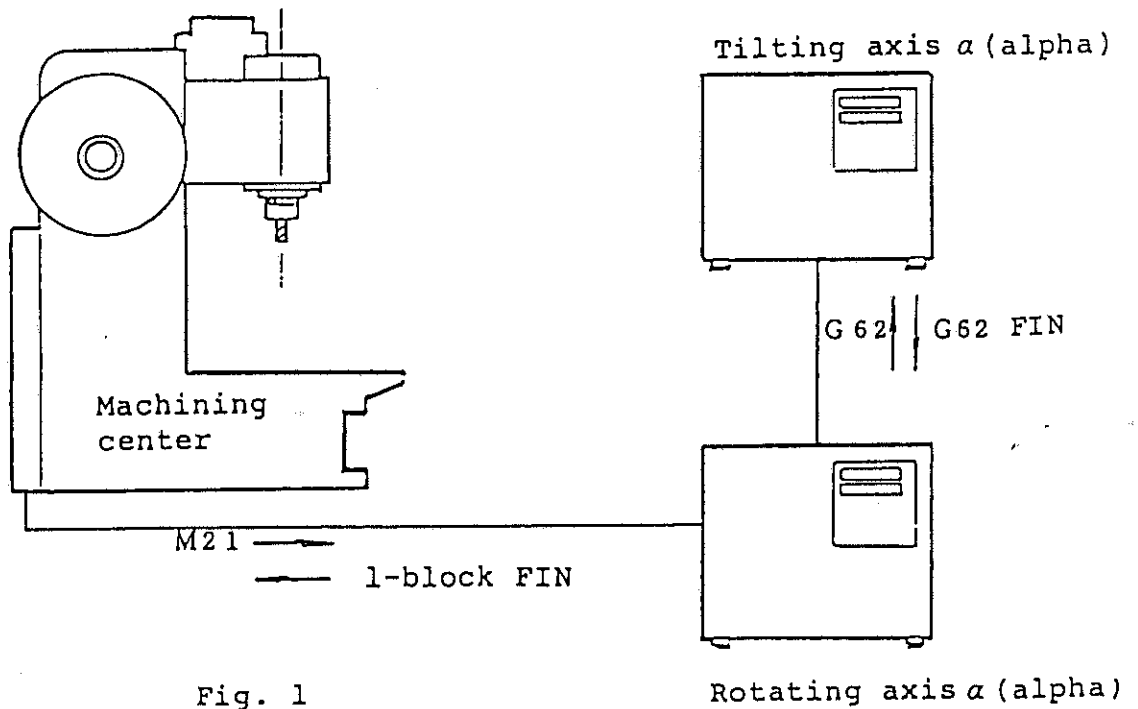


Fig. 1

The emergency stop signal to the rotating axis  $\alpha$  (alpha) can be entered only through B-contact.

M21: Any number will do for M-signal of M/C, but should be valid only for the relevant block under the DISTRIBUTION END mode.

1-block FIN: Finish signal for M21

G62: G62 signal for the rotating axis  $\alpha$  (alpha) causes the tilting axis  $\alpha$  to start. When the rotating axis movement instruction and G62 instruction are given in the same block, the both axes move almost simultaneously. Viewing from the tilting axis  $\alpha$  (alpha) side, G62 signal should be considered as the same with M21 signal (start signal).

G62 FIN: Viewing from the tilting axis  $\alpha$  (alpha) side, G62 FIN signal should be considered as the same with 1-block FIN signal.

Cable layout and junction box for 5ax-200 IIW $\alpha$  (alpha)  
 Installation of the junction box and connection of cables are as  
 illustrated in Fig.2.

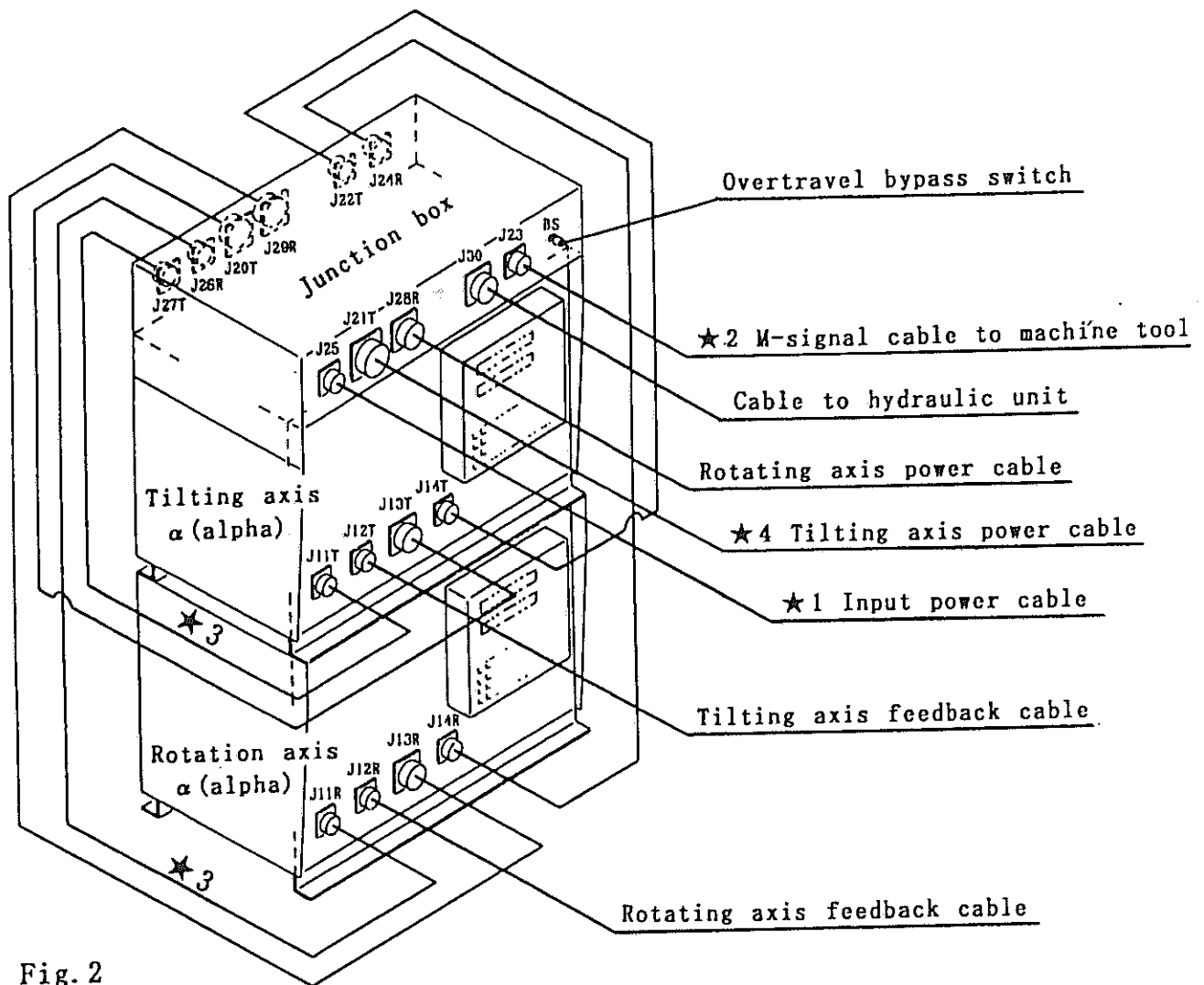


Fig. 2

★1 The input power (single-phase, AC200V ~ AC220V) should be connected to this connection.

Incidentally, in the event when the input power voltage is AC240v, be sure to contact us in advance.

(Voltage adjustment of power supply in the junction box becomes necessary.)

★2 Emergency stop signal from the machine tool can be entered only through B-contact.

★3 Power is supplied from the junction box to each  $\alpha$  (alpha) controller, so that connection of each cable should be carried out correctly.

★4 Differing from 5AX-200 IIW $\alpha$  (alpha), the type of receptacle for tilting axis power cable J21T is JL04V-2A28-11SEZ.

Cable layout and junction box for 5AX-200 $\Pi$ D $\alpha$  (alpha)  
 Installation of the junction box and connection of cable are as  
 illustrated in Fig. 5

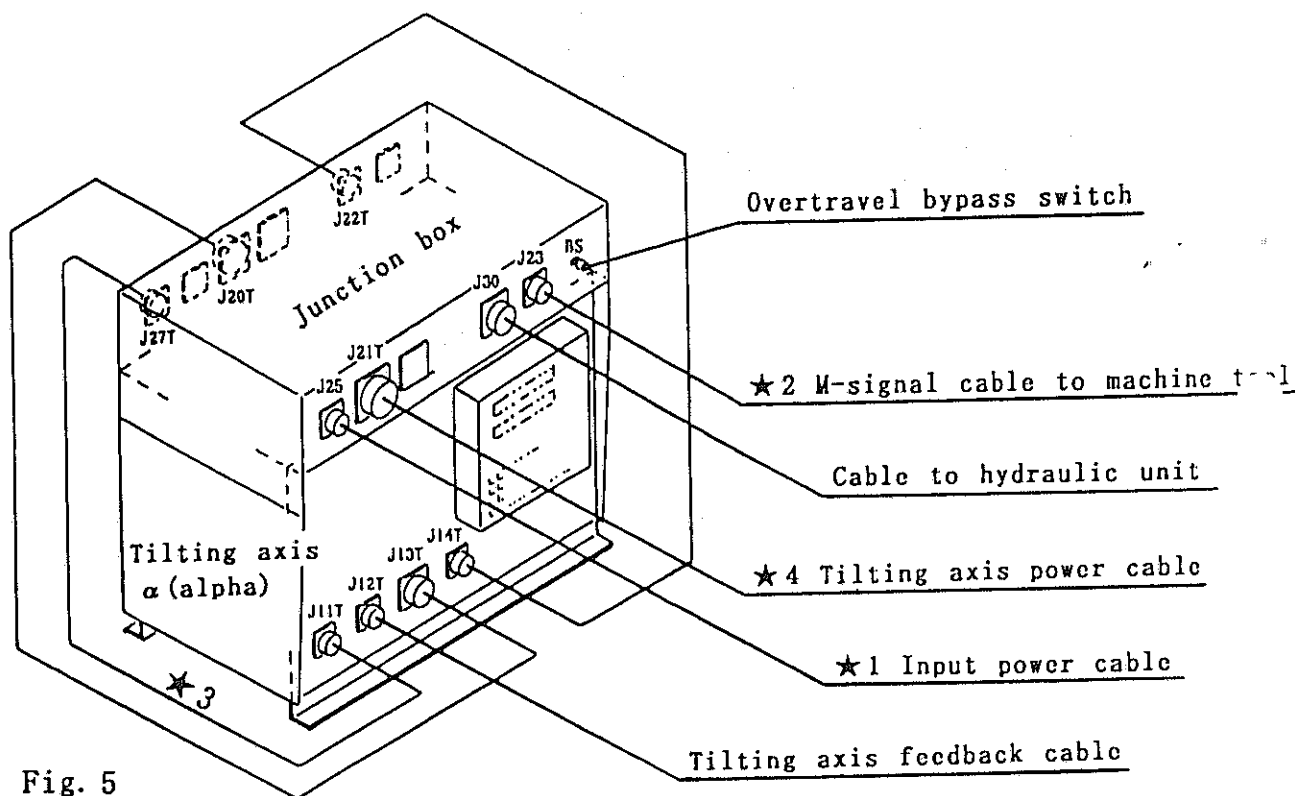


Fig. 5

★1 The input power (single-phase, AC200V ~ AC220V) should be connected to this connection.

Incidentally, in the event when the input power voltage is AC240v, be sure to contact us in advance.

(Voltage adjustment of power supply in the junction box becomes necessary.)

★2 Emergency stop signal from the machine tool can be entered only through B-contact.

★3 Power is supplied from the junction box to each  $\alpha$  (alpha) controller, so that connection of each cable should be carried out correctly.

★4 Differing from 5AX-200 $\Pi$ W $\alpha$  (alpha), the type of receptacle for tilting axis power cable J21T is JL04V-2A28-11SEZ.

APPENDIX

9. Composition of 5AX-200II W $\alpha$   
(Optional spec. for automatic program selection)

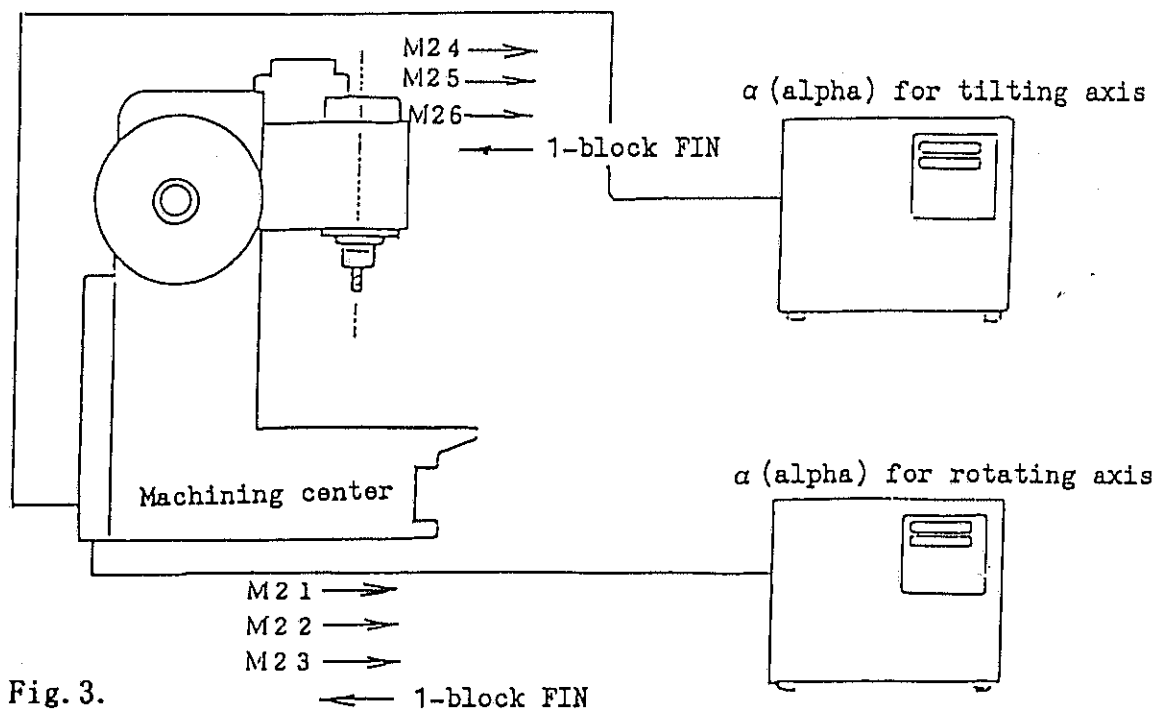


Fig. 3.

Both emergency stop signal for rotating axis  $\alpha$  and tilting axis  $\alpha$  are given to b-contact.

M21: Rotating axis; Program start

M22: Rotating axis; Reset to machine zero-point and N000

M23: Rotating axis; Jump to program execution address

M24: Tilting axis; Program start

M25: Tilting axis; Reset to machine zero-point and N000

M26: Tilting axis; Jump to program execution address

Functions M21 to M23 are completed when 1-block finish signal is given in case of rotating axis, and functions M24 to M26 are completed when 1-block finish signal is given in case of rotating axis.

Concerning the handling of each signal, reference should be made to Chapter 6.7 List of function corresponding to automation in  $\alpha$  Instruction Manual.

Composition of 5AX-200HW $\alpha$ (alpha)  
 (Optional spec. for automatic program selection)

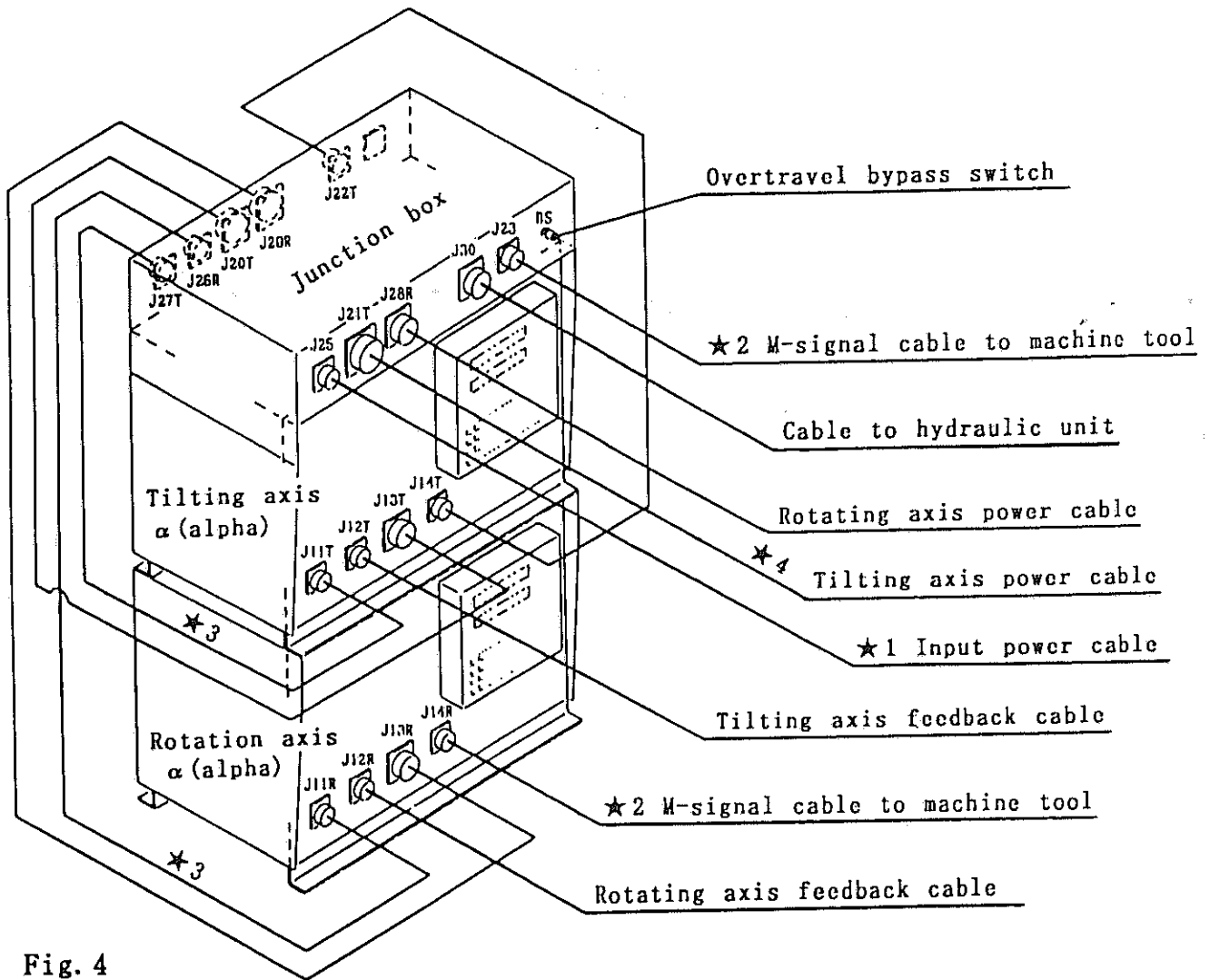


Fig. 4

★1 The input power (single-phase, AC200V ~ AC220V) should be connected to this connection.

Incidentally, in the event when the input power voltage is AC240v, be sure to contact us in advance.

(Voltage adjustment of power supply in the junction box becomes necessary.)

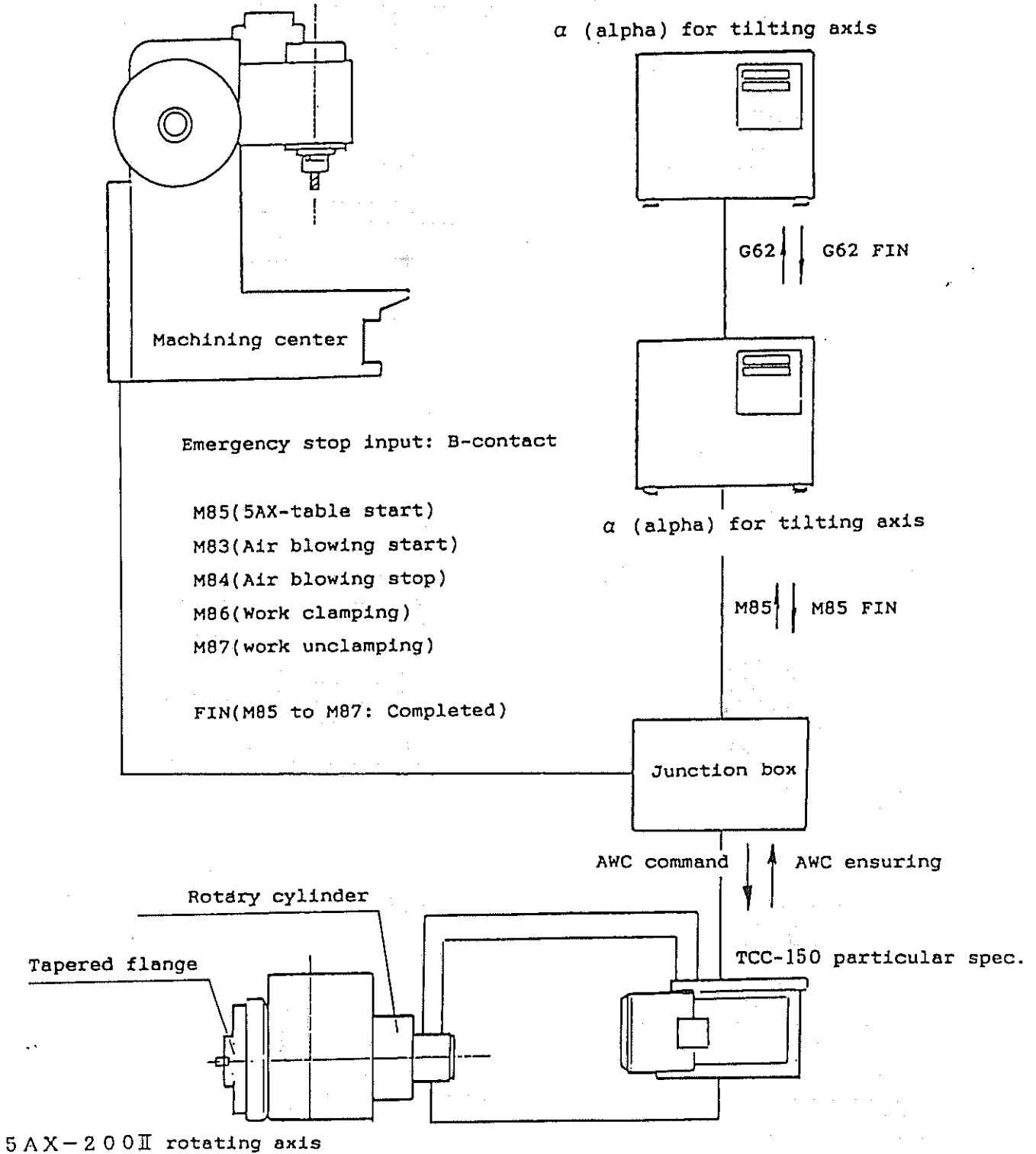
★2 Emergency stop signal from the machine tool can be entered only through B-contact.

★3 Power is supplied from the junction box to each  $\alpha$ (alpha) controller, so that connection of each cable should be carried out correctly.

★4 Differing from 5AX-200HW $\alpha$ (alpha), the type of receptacle for tilting axis power cable J21T is JL04V-2A28-11SEZ.

APPENDIX

10. Composition of 5AX-200II Wα  
(Optional spec. for AWC system)

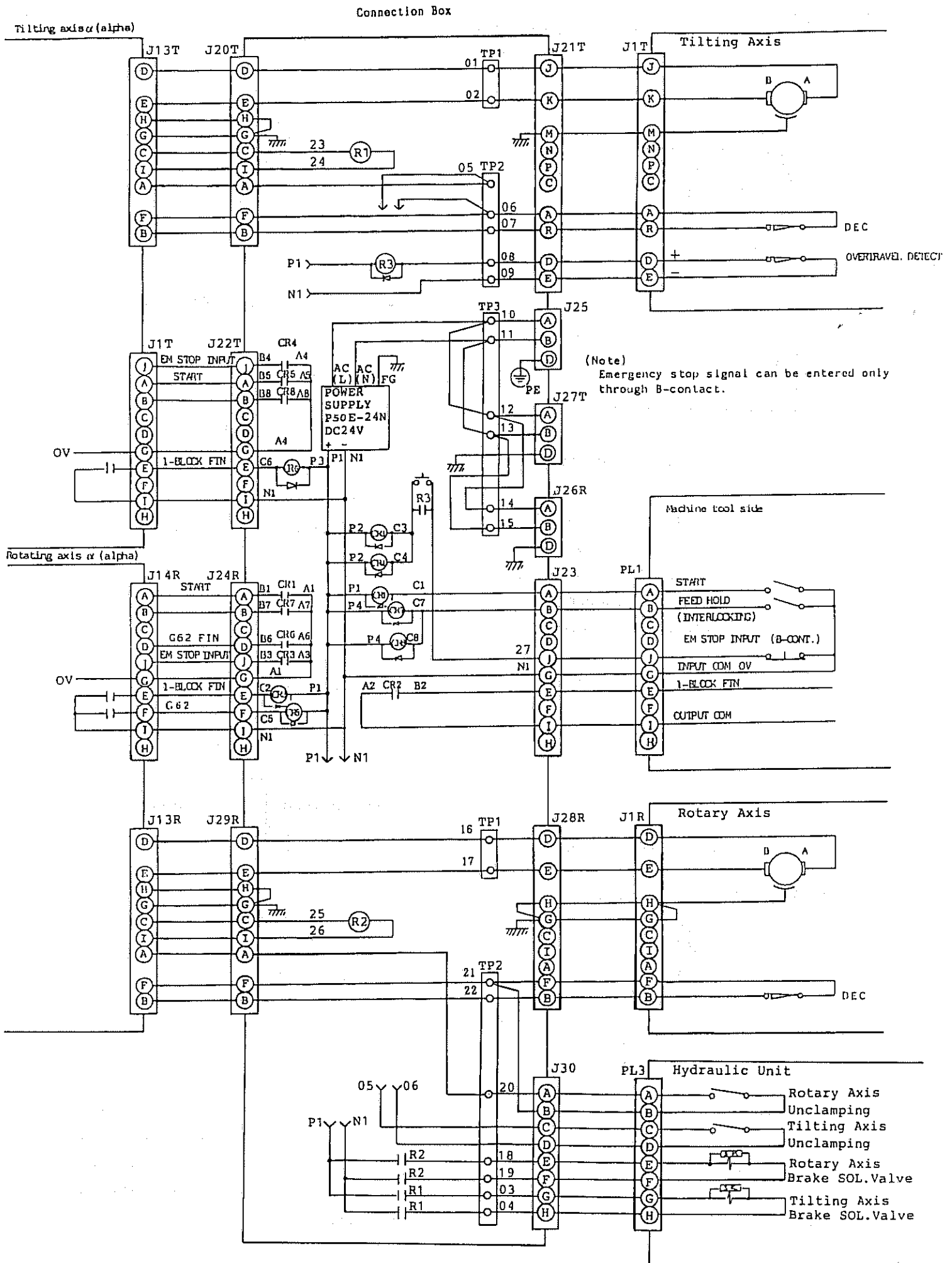


M83 & M84 are not required to be confirmed.  
Time charts for M83, M84, M86 and M87 will be determined by separate agreement.

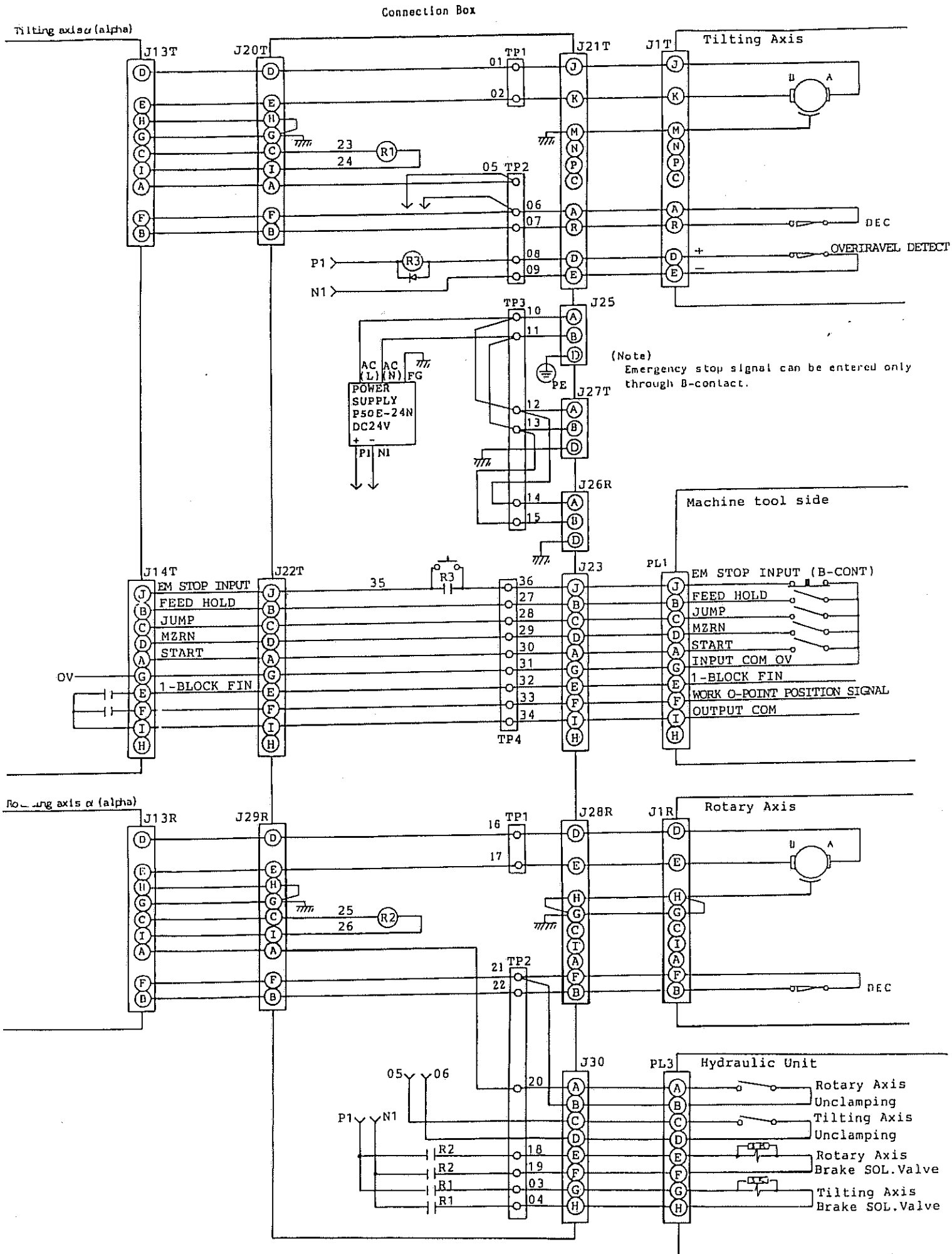
Solenoid valve for work unclamping, solenoid valve (pneumatic) for air blowing and pressure switches for ensuring work clamp/unclamp are incorporated.

# APPENDIX

## 11. Wiring program of junction box for 5AX-200 IIW $\alpha$

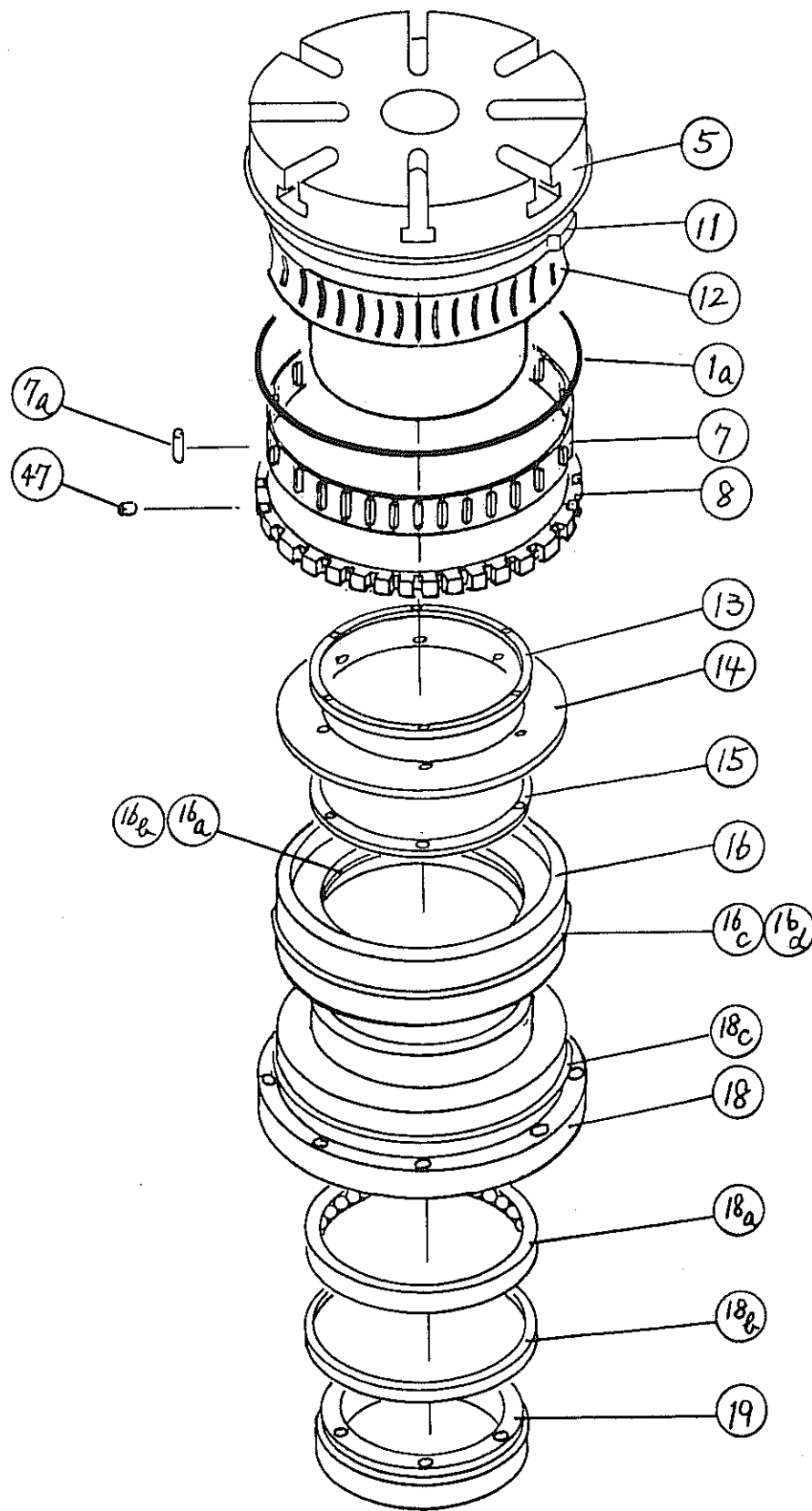


# 12. Wiring program of junction box for 5AX-200 II W $\alpha$ (for Option:Auto. Program Select)





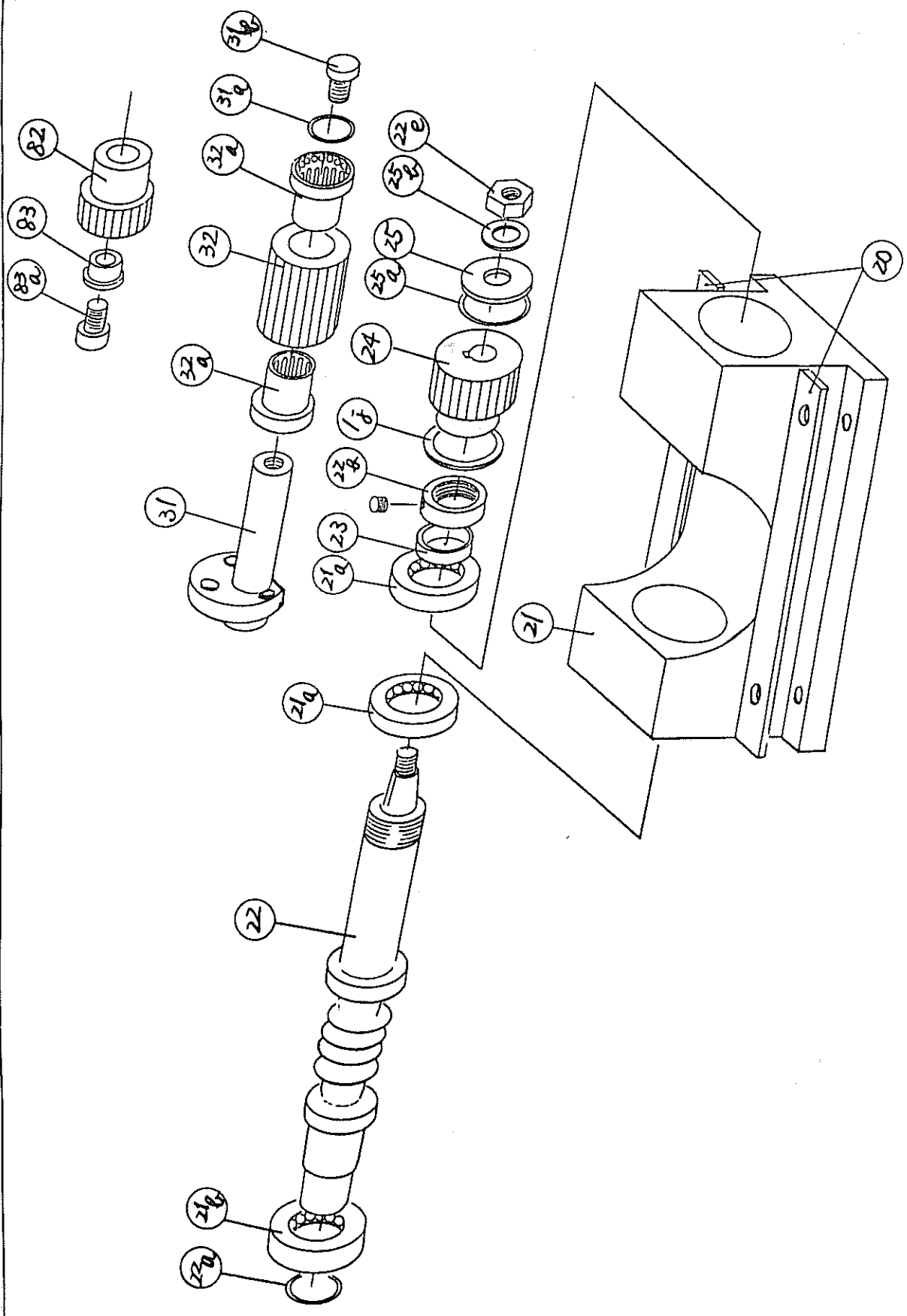
# 6.14 Spare parts list

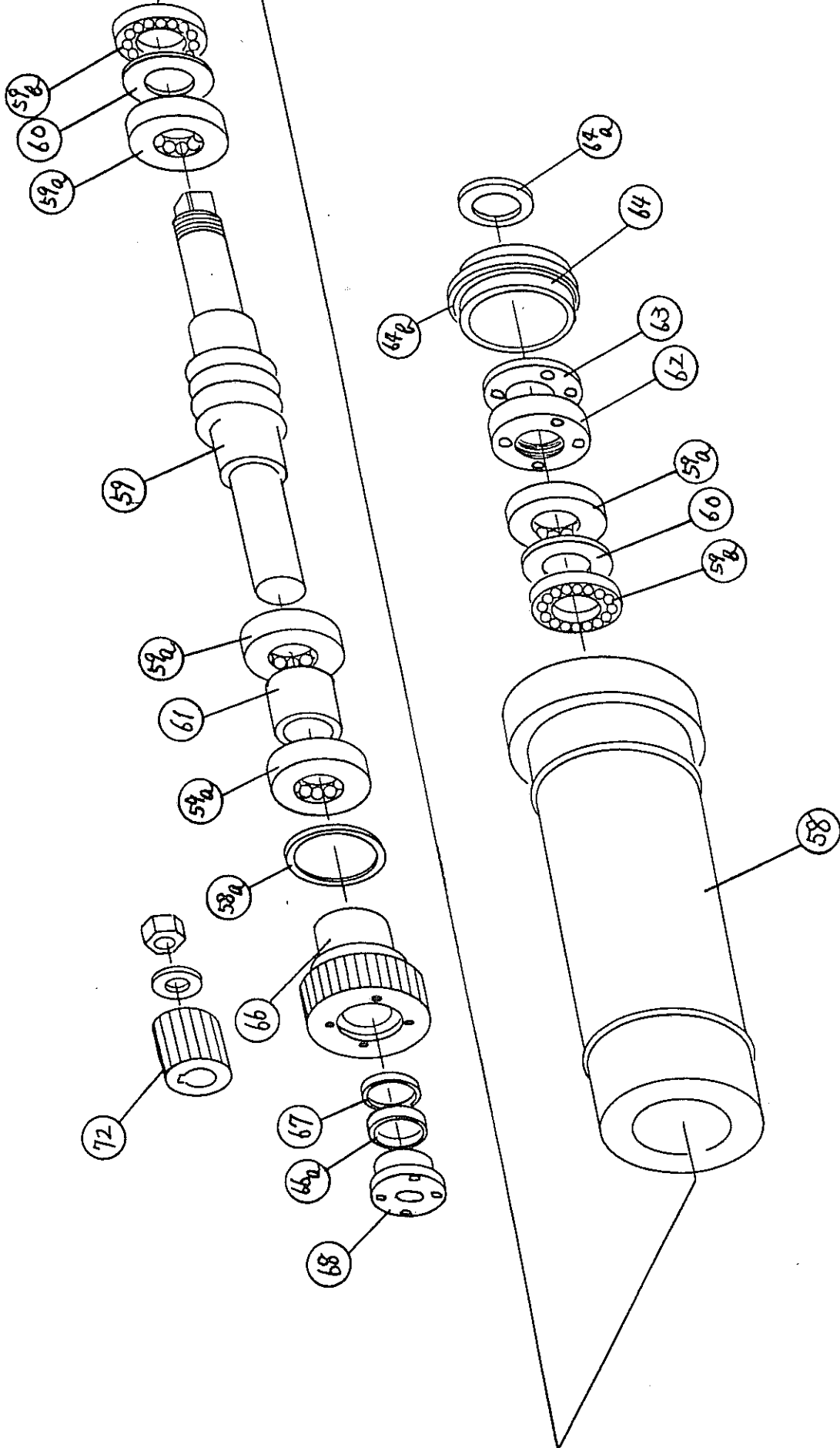


5AX-200II  
ROTARY AXIS SPINDLE  
TCZ-A1002



5AX-200II ROTARY AXIS  
TCZ - A1003





SAX-200II TILTING AXIS (72)  
 TCZ - A1005

No.	REFERENCE	ITEM	PEICES	REMARKS
11	TCZ-A1002	DOG RING FOR MZRN	1	
12	TCZ-A1002	ROTARY AXIS WORM WHEEL	1	
13	TCZ-A1002	BRAKE GAP ADJUSTING PLATE	1	
14	TCZ-A1002	CLAMP DISK	1	
15	TCZ-A1002	BRAKE DISK HOLDER	1	
16	TCZ-A1002	BRAKE PISTON	1	
16a	TCZ-A1002	O-RING	1	P-90
16b	TCZ-A1002	BACK-UP RING	1	SUN-2BP-90
16c	TCZ-A1002	O-RING	1	P-150
16d	TCZ-A1002	BACK-UP RING	1	SUN-2BP-150
18	TCZ-A1002	FLANGE	1	
18a	TCZ-A1002	ANGULAR BEARING	1	#7916C
18b	TCZ-A1002	OIL SEAL	1	TC90,115,13
18c	TCZ-A1002	O-RING	1	AS568-258
19	TCZ-A1002	BEARING HOLDER	1	
1a	TCZ-A1002	FACE SEAL	1	φ 170 WITH O-RING
5	TCZ-A1002	ROTARY AXIS SPINDLE	1	
7	TCZ-A1002	RADIAL RETAINER	1	
7a	TCZ-A1002	NEEDLE ROLLER	30	φ 4 * 11L
8	TCZ-A1002	THRUST RETAINER	1	
47	TCZ-A1002,4	TUBULAR ROLLER	60	
1j	TCZ-A1003	OIL SEAL	1	SC32458
20	TCZ-A1003	SHIM PLATE	2	
21	TCZ-A1003	ROTARY AXIS WORM SREW HAUSING	1	
21a	TCZ-A1003	ANGULAR BEARING	2	#7004
21b	TCZ-A1003	BEARING	1	#6004
22	TCZ-A1003	ROTARY AXIS WORM SCREW	1	
22a	TCZ-A1003	SNAP RING	1	STW-20
22b	TCZ-A1003	LOCK NUT	1	ZM20S
22e	TCZ-A1003	NUT	1	M10
23	TCZ-A1003	SPACER RING	1	
24	TCZ-A1003	MAIN GEAR	1	
25	TCZ-A1003	WASHER WITH O-RING	1	
25a	TCZ-A1003	O-RING	1	S-30
25b	TCZ-A1003	DAI THREAD	1	DT-1-10
31	TCZ-A1003	SHAFT FOR IDLE GEAR	1	
31a	TCZ-A1003	SNAP RING	1	STW-17
31b	TCZ-A1003	BOLT	3	M6 * 15L
32	TCZ-A1003	IDLE GEAR	1	
32a	TCZ-A1003	BEARING	2	NKX-17T2
82	TCZ-A1003	ROTARY AXIS MOTOR GEAR	1	
83	TCZ-A1003	WASHER	1	
83a	TCZ-A1003	BOLT	1	M6 * 20L
1	TCZ-A1004	ROTARY AXIS BODY	1	
2	TCZ-A1004	TILTING AXIS BODY	1	
2a	TCZ-A1004	FACE SEAL	1	φ 205 WITH O-RING
3	TCZ-A1004	TAIL STOCK	1	
33	TCZ-A1004	TAIL STOCK FLANGE	1	
335a	TCZ-A1004	O-RING	1	AS568-263
34	TCZ-A1004	INNER RING HOLDER	1	
35	TCZ-A1004	OUTER RING HOLDER	1	
36	TCZ-A1004	ROTARY AXIS MOTOR FLANGE	1	
3a	TCZ-A1004	CROSS ROLLER BEARING	1	CRBH13025AUUE03
3e	TCZ-A1004	FACE SEAL	1	φ 205 WITH O-RING
43	TCZ-A1004	TILTING AXIS SPINDLE	1	
45	TCZ-A1004	RADIAL RETAINER	1	

No.	REFERENCE	ITEM	PEICES	REMARKS
45a	TCZ-A1004	NEEDLE ROLLER	48	φ 4 * 11L
46	TCZ-A1004	THRUST RETAINER	1	
49	TCZ-A1004	TILTING AXIS WORM WHEEL	1	
50	TCZ-A1004	CENTRE FLANGE	1	
50a	TCZ-A1004	TAPER ROLLER BEARING	1	#32010*U
50b	TCZ-A1004	OIL SEAL	1	AC62.85.12
50c	TCZ-A1004	GAP O-RING	2	SOP-60
50d	TCZ-A1004	RETAINER	2	SUN-SOP-60
50e	TCZ-A1004	O-RING	2	G-105
50g	TCZ-A1004	O-RING	1	G-165
50h	TCZ-A1004	O-RING	1	AS568-260
51	TCZ-A1004	CLAMP RING	1	
515	TCZ-A1004	RING	1	
515a	TCZ-A1004	V-RING	1	V-200L
53	TCZ-A1004	BEARING HOLDER	1	
54	TCZ-A1004	SHAFT FOR DOG RING	1	
55	TCZ-A1004	DOG RING FOR MZRN	1	
56	TCZ-A1004	DOG RING FOR OVER TRAVEL	2	
58	TCZ-A1005	TILTING AXIS ECCENTRIC HAUSING	1	
58a	TCZ-A1005	OIL SEAL	1	SC35.50.8
59	TCZ-A1005	TILTING AXIS WORM SCREW	1	
59a	TCZ-A1005	BEARING	4	#6005
59b	TCZ-A1005	BEARING	2	#51105
60	TCZ-A1005	THRUST RING	2	
61	TCZ-A1005	BEARING SPACER	1	
62	TCZ-A1005	NUT	1	
63	TCZ-A1005	LOCK NUT	1	
64	TCZ-A1005	COVER	1	
64a	TCZ-A1005	OIL SEAL	1	SC18.35.8
64b	TCZ-A1005	O-RING	1	G-50
66	TCZ-A1005	TILTING AXIS MAIN GEAR	1	
66a	TCZ-A1005	SPAN RING	2	RfN8006(25 * 30)
67	TCZ-A1005	SPACER RING	1	
68	TCZ-A1005	FLANGE	1	
72	TCZ-A1005	TILTING AXIS MOTOR GEAR	1	