

**KITAGAWA**  
**NC ROTARY TABLE**

**INSTRUCTION MANUAL**

**MODEL TR400H2E07**

Thank you for choosing the Kitagawa NC Rotary Table.

Kitagawa, a world-renowned precision equipment manufacturer, has developed the finest quality NC Rotary Table with emphasis in high precision and rigidity as its basic principals in design.

This NC Rotary Table has been designed to provide years of high precision performance. To ensure optimum and trouble-free performance, please read this operation manual carefully before using the unit and retain this copy for your future reference.

Please pay close attention to the procedures with the following warning marks(!) to avoid severe injury and/or accident.



### **SAFETY ALERT SYMBOL**

This is the Industry "Safety Alert Symbol". This symbol is used to call your attention to items or operations that could be dangerous to you or other persons using this equipment.

Please read these messages and follow these instructions carefully.

It is essential that you read the instructions and safety regulations before you attempt to assemble or use this unit.

## **WARNING**



### **DANGER**

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



### **WARNING**

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



### **CAUTION**

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

## **IMPORTANT**

### **IMPORTANT**

Instructions for table performance and avoiding errors or mistakes.



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# 1. Operation for Safety

Please read this manual carefully and follow their instructions.

Warranty does not cover damage or accident caused without following the warning items in this manual.

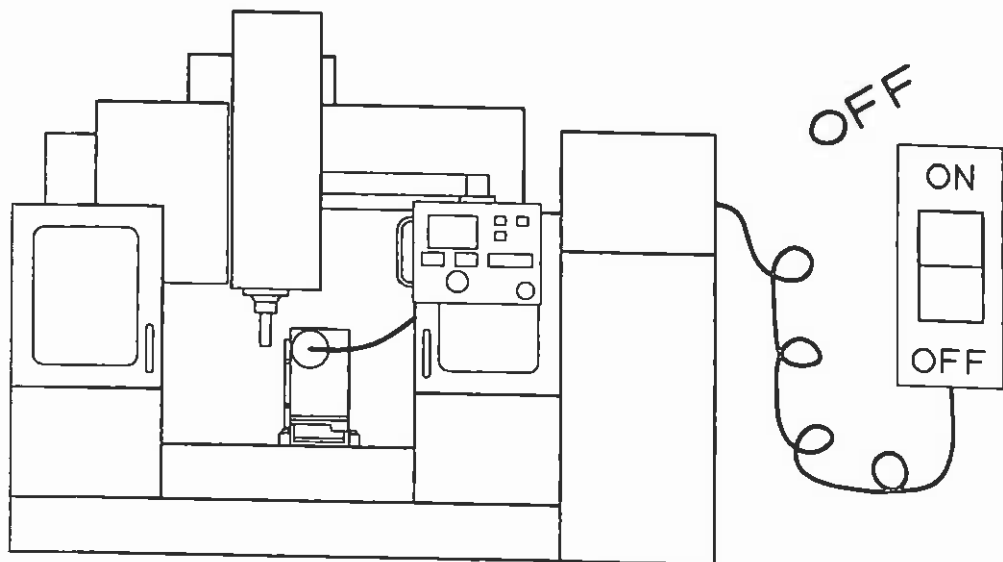


**DANGER**



Be sure to turn OFF power source before mounting, maintaining, inspecting and repairing the NC rotary table.

There is a danger causing any accident because your fingers or clothes may be caught in the table.

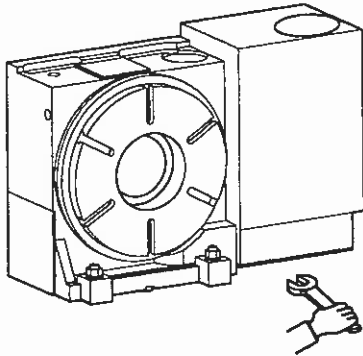




## WARNING



### Securely tighten bolts.



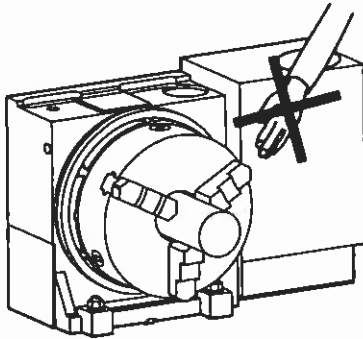
There is a danger of workpiece scattering because the table overturns.

Tighten bolts at specified torque.

Hex. bolt sizes	Tight. trq. (N·m)
M10	33.8
M12	58.9
M16	146.3
M20	294.3



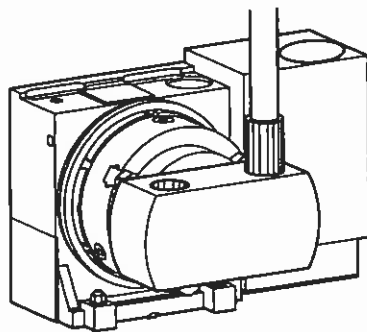
### Do not touch your hands to the rotary member during operation.



There is a danger causing any accident because your fingers may be caught in rotary member.



### Do not apply an excessive cutting force to the NC rotary table.



There is a danger in which the NC rotary table damages and workpiece scatters.

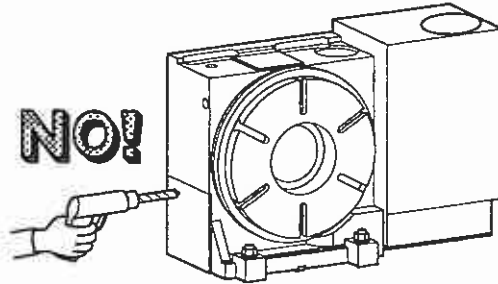


## WARNING



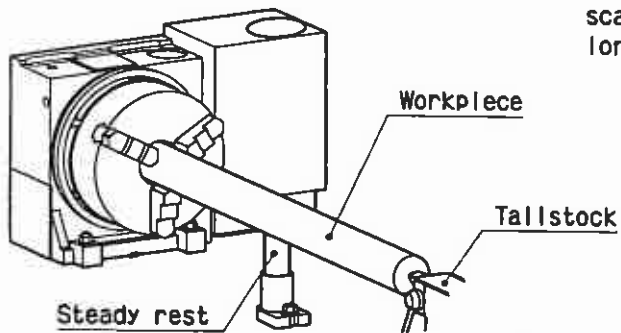
Do not modify the table.

There is a danger in which the NC rotary table damages and workpiece scatters.



For long or heavy workpiece, use the tallstock and steady rest. (See page 7.)

There is a danger of workpiece scattering if workpiece is too long or heavy.





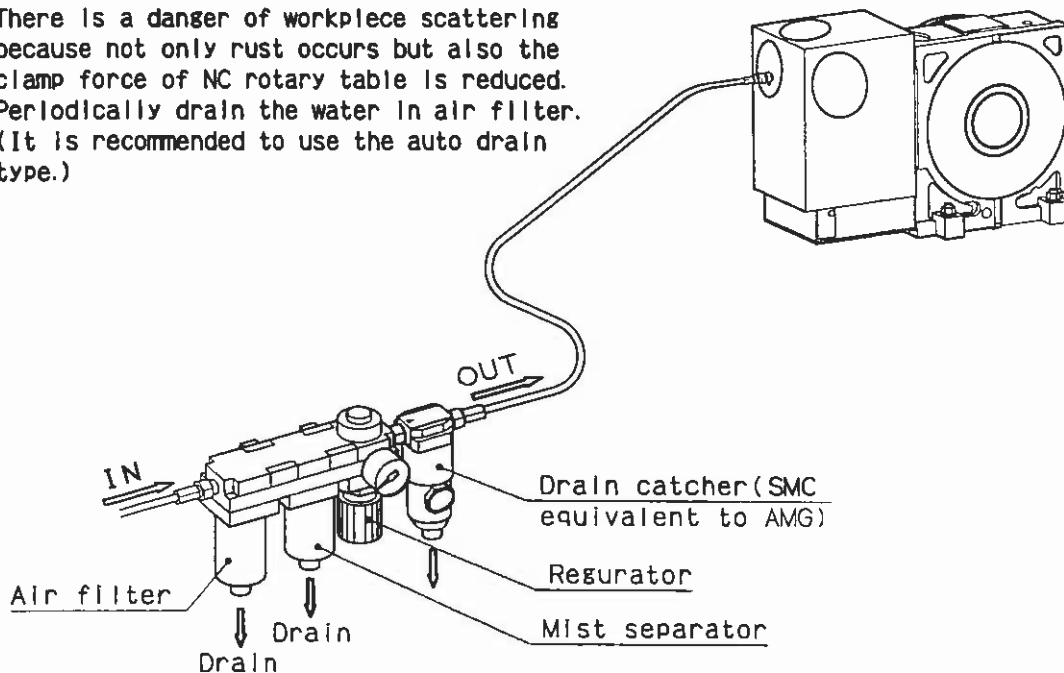


## WARNING



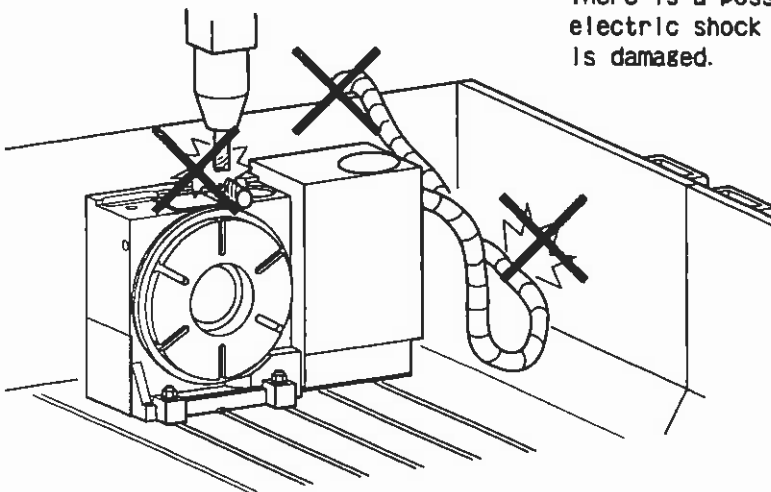
Supply clean air passing through the air combination (Air filter, mist separator and regulator) + drain catcher. (See page 11.)

There is a danger of workpiece scattering because not only rust occurs but also the clamp force of NC rotary table is reduced. Periodically drain the water in air filter. (It is recommended to use the auto drain type.)



Avoid the NC rotary table from interference with mounting equipment. (See page 9)

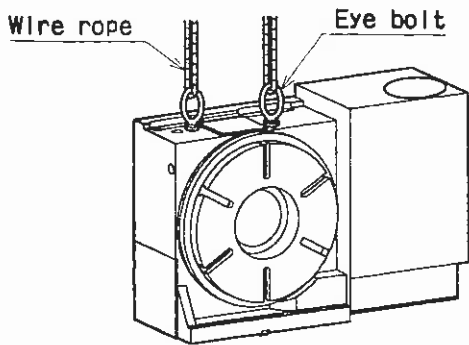
Tool may be broken or scattered. Avoid cable/hose from interference with mounting equipment and from remarkably bending. There is a possibility that any electric shock occurs if the cable is damaged.



 **CAUTION**



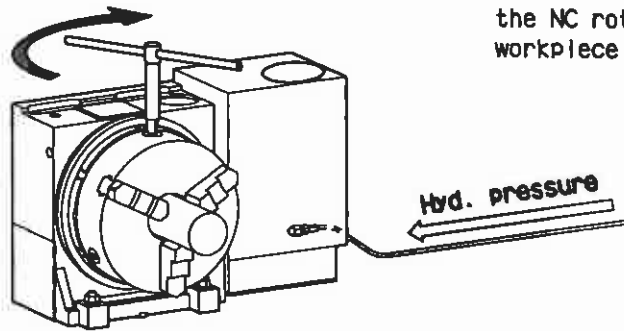
When transferring the NC rotary table, use wire ropes passing through eye bolts.



Take care of falling.



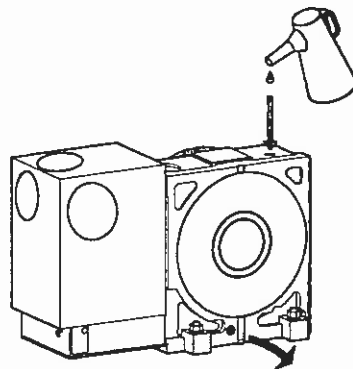
Clamp the table before mounting or removing the workpiece.



In addition to accuracy reduced, the NC rotary table damages or workpiece scatters.



Replace lubrication oil and hydraulic oil every 6-month. (See page 9)

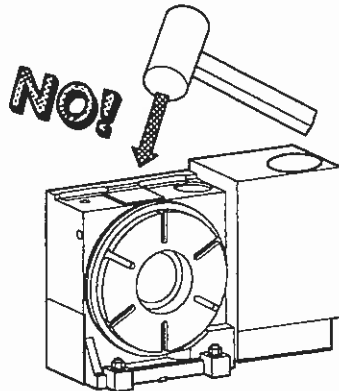




## CAUTION

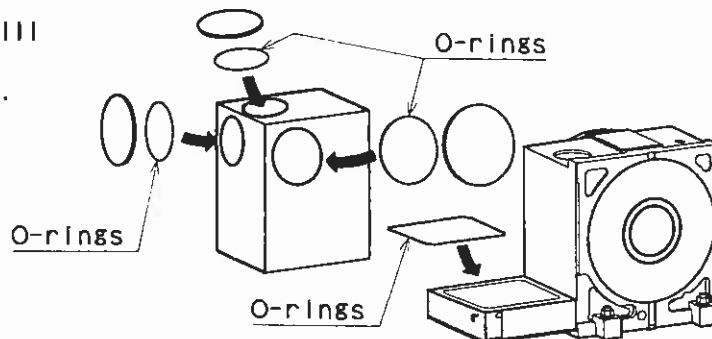


Avoid sudden impact to any part of the unit which may cause damage to the internal mechanism.



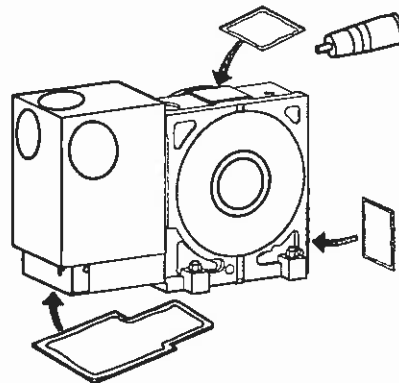
Fit O-rings to all mounting faces before mounting covers. (O-rings not to be damaged.)

Danger by work scattering because NC rotary table will result in misoperation by permeation of coolant, etc.



Coat solution packing on the cover mounting face.

Danger by work scattering because NC rotary table will result in misoperation by permeation of coolant, etc.



## 2. Specifications

NC Rotary Table is dividing unit for workpiece, usually operating machines. [ Machining Center.(NC) milling machine. (NC)drilling machine, etc. ]

Specifications are as follows.

ITEM	MODEL	TR400	TR500	TR630	
		1	Table Diameter	mm	φ400
2	Table Height in Horizontal	mm	250	250	330
3	Center Height in Vertical	mm	255	310	400
4	Center Hole Diameter	mm	φ180	φ200	φ280
5	Through Hole Diameter	mm	φ150	φ170	φ250
6	T-slot width	mm	18	18	18
7	Basic-slot width	mm	18	18	18
8	Clamping Torque [Hydraulic pressure 3.5 MPa]	N·m(kgf·m)	2500(255)	3200(326)	4000(408)
9	Allowable Workpiece Diameter	mm	φ400	φ500	φ630
10	Allowable Mass of Workpiece (kg)	Horizontal	500	600	1000
		Vertical	250	300	400
11	Allowable Work Inertia	Kg·m <sup>2</sup> (kgf·cm·sec <sup>2</sup> )	10.0(102)	18.7(191)	49.6(506)
12	Total Reduction Ratio		1/180	1/180	1/180
13	Max. Rotation Speed	min <sup>-1</sup>	11.1	11.1	11.1
14	Mass of Rotary Table	kg	約350	約550	約900

### IMPORTANT

The above list shows the values in standard specifications.  
Please refer to the outside view for details.

### IMPORTANT

Table clamping force are values of hydraulic pressure 3.5 MPa.  
Max. rotation speed is the value when the motor rotates at 2000min<sup>-1</sup>(rpm) .



### CAUTION

Be sure to observe the allowance work Inertia even if the mass of workpiece is within the allowable value.



### CAUTION

There is a possibility that the tallstock is required by the mass of workpiece, shape, cutting conditions, etc.



### CAUTION

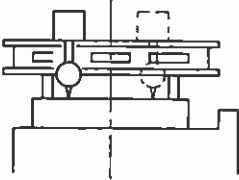
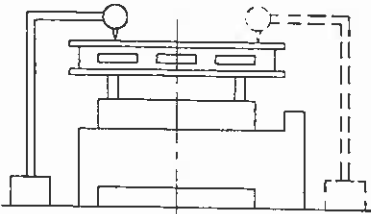
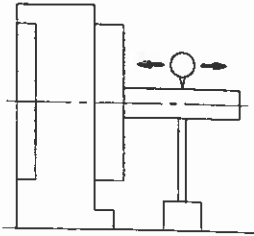
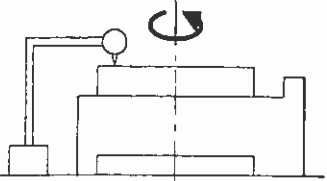
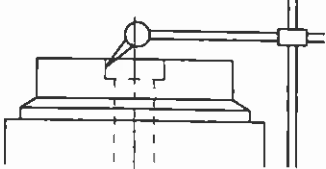
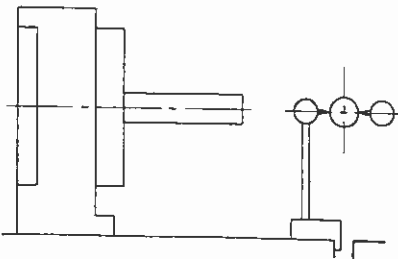
For the conditions for using the table, refer to the above specifications and caution items. Set each cutting condition so as not to exceed the allowance value.

### 3. Accuracy Standard

#### GUARANTEED ACCURACIES

(Unit : mm)

Inspection Item		Allowable Value
1	Straightness of table top face (To be concave.) per 300 mm	0.010
2	Parallelism of table top face and mounting reference face for horizontal installation per 300 mm	0.020
3	Parallelism of rotating axis center line and mounting reference face for vertical installation per 300 mm	0.020
4	Run out of mounting reference face during table rotation	0.010
5	Run out of table reference hole	0.010
6	Parallelism of rotating axis center line and base guide block center line per 300 mm	0.020
7	Offset of rotating axis center line and base guide block center line	0.020
7	Indexing accuracy	cumulative 20 sec
8	Repeatability	cumulative 4 sec

1	2	3
		
4	5	6.7
		
<p>8.9</p> <p>Indexing accuracy is measured by an optical instrument.</p>		

## 4. Operation Ready

Observe the following procedure before performing the operation ready and trial run.

### 4-1 Table transfer and mounting to machine tool

- 1) Carefully transfer the table so as not to apply any shock by slinging the wire ropes of sufficient strength to eye bolts.
- 2) Clean the table face on the machine tool and the reference plane of NC rotary table after checking that burr or flaw is not found on them. If harmful burr or flaw is found, repair it with the oil grinding stone.
- 3) Mount the table on the most suitable place for working. Fit the guide block located on reference plane to the T-slot on the machine tool table. If the clearance between the T-slot and the guide block is large, fit the guide block by putting it aside in the T-slot.
- 4) Securely fix NC rotary table on the machine tool with clamp device attached.



When mounting NC rotary table to the machine tool, check the mounting space. Especially, take care so that NC rotary table, cables and air hoses will not interfere with the splash guide, ATC device, spindle head, etc., of the machine tool when the machine tool table or spindle head, etc., move.



Do not damage the cables by applying unreasonable stress, placing a heavy thing or pinching. If damaged, there is a danger of electric shock.



Effectively use mounting seats and tighten clamping bolts at the specified torque.  
(See page 2)

### 4-2 Oiling of lubrication oil

Lubrication oil has been already filled in NC rotary table before shipping. Check that the lubrication oil is filled to the center line of the oil gauge before operating the machine.



Replace all lubrication and hydraulic oils with new ones every 6-month. Completely drain before replacing. When filling the oil, wipe the refueling entrance so that chips and foreign matter are not entered into the tank. If the chips or foreign matter are entered, the important parts such as bearings, etc., are seized or machining accuracy drops.

#### 4-3 Required volume for lubrication oil

	MODEL	TR400	TR500	TR630
QTY.(l) at Horizontal Installation		4.5	5.4	6.6
QTY.(l) at Vertical Installation		4.1	5.0	6.2

Daphne Multiway 68MT (IDEMITSU) was filled before shipping.

#### 4-4 Recommended lubrication oil

·Viscosity grade ISO VG68

Maker	Oil Name	Maker	Oil Name
Mobil	Vactra Oil No. 2	Cosmo	Dynaway 68
Nippon Oil Corporation	Uniway 68	Idemitsu	Daphne Multiway 68MT
Jomo	Slidus HS68	Esso	Fabis K68
Shell	Shell Tonna Oil S68		

#### 4-5 Supply of hydraulic pressure for clamp

- 1) Connect the hydraulic hose to the connection port (Connection port is Rc3/8).
- 2) Use the hydraulic pressure at 3.5 MPa.
- 3) Securely perform air relief. If air remained in the clamp cylinder, the chuck does not clamp sufficiently. When Clamp and Unclamp motions are repeated by loosening the air relief plug, residual air can be exhausted. For air relief components, see the outside view. See the manual separately for the booster specification.
- 4) When the air relief plug is too loosened, there is a possibility that the air relief plug flies out. Slightly push the air relief plug with the hexagon bar spanner so as not to fly out.

## 4-6 Air purge



Dew drops may occur in the motor case by ambient environment. In this case, each component in addition to electric apparatus may fall or rust. Therefore, the air is purged and exhausted from exhaust port for air purge.

Be sure to supply clean air passing through the filter (air filter, mist separator, regulator and drain catcher).

If there are moisture, oil content, etc., in the air, they are entered in the motor case, thus damaging the equipment. The air in the motor case is exhausted from exhaust port for air purge.

If exhaust port for air purge is closed, condensed drops are not exhausted, and also, pressure is not maintained in the motor cover, thus causing the motor or motor case damage. Consequently, do not close the exhaust port for air purge.

When the air is exhausted, though any exhausting sound occurs, there is no problem.

If the air purge cannot be performed because of no air, be sure to mount the attached cross recessed head screw M5 to the M5 tap of air purge exhaust port shown in the outside view.

(Because coolant is entered in the motor case.)

## 4-7 Air relief (For oil hydraulic system)

Be sure to perform air relief when lubrication oil is supplied after disassembling the table or alarm occurs. If air is not sufficiently exhausted, alarm occurs because of clamp failure.

- 1) Be applied hydraulic pressure to NC rotary table.(Clamp state)
- 2) Loosen the air relief plug shown in the outside view a little to bleed the air.
- 3) After tighten the air relief plug again, stop hydraulic pressure. (Unclamp state)
- 4) When the air mixed into oil is not exhausted from the air relief plug by repeating the above items 1)~3), tighten the air relief plug as it was before.(If the plug is not tightened, exhausted air is breathed again.)

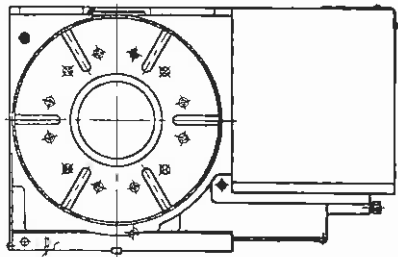
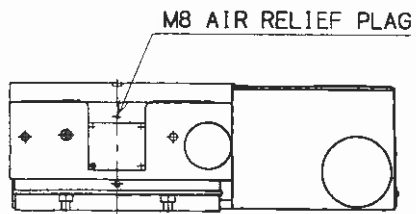


- 1) When the air relief plug is too loosened, there is a possibility that the air relief plug flies out. Slightly push the air relief plug with the hexagon bar spanner so as not to fly out.
- 2) For air relief, take enough time.
- 3) During air relief, since oil of pump unit becomes short, fill the oil into the pump unit.
- 4) After finishing the air relief, cleanly wipe oil spilled around the unit with a waste cloth.
- 5) During clamp state, retain the hydraulic pressure.

## Maintenance inspection

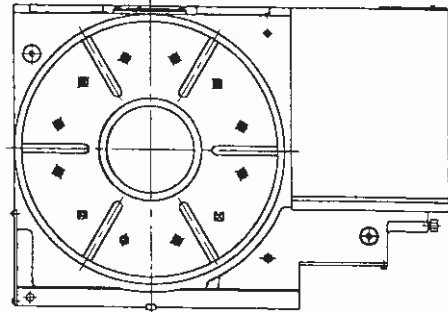
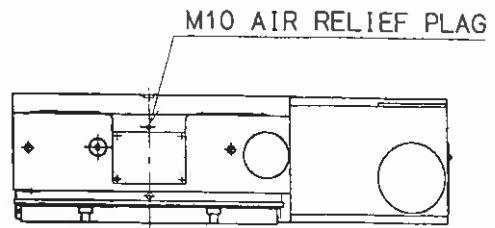
- 1) Air may infiltrate in oil during operation because the piping joint, each plug, etc., are loosened. At this time, relief the air according to the procedure in the preceding clause.
- 2) The operation oil is deteriorated when it is used for a long period of time. Replace the oil every year.
- 3) With the NC rotary table operated after ready for start-up, if a clamp failure occurs, check the air relief in order to make sure.



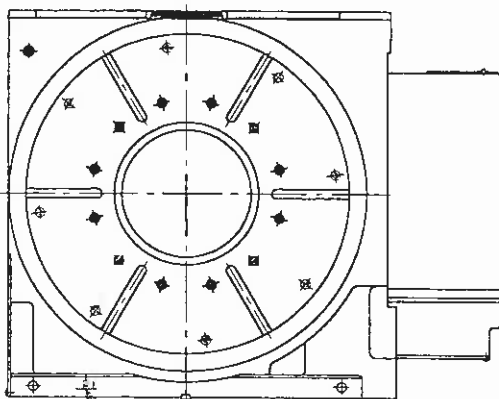
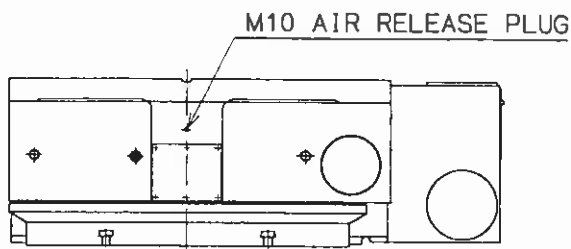


Rc1/8 AIR RELIEF PLAG  
(AT HORIZONTAL INSTALLATION)

TR400



TR500



Rc1/8 AIR RELIEF PLAG  
(AT HORIZONTAL INSTALLATION)

TR630

## 5. Inspection

### Daily inspection

- 1) Check the fixing condition of NC rotary table (including jig if mounted).
- 2) Check the electric connection cables and the air hoses are not damaged, and also, check the hydraulic pressure.
- 3) Check the zero return, indexing motion and position for the machine.
- 4) Check unusual vibration and noise do not occur. (Body, motor, in gear box)
- 5) Check unusual heating. (Body, motor, gear box)

Periodical inspection (Inspect the following items every 6-month.)

- 1) Check the dirt degree of lubrication oil. (In body and In gear box)
- 2) Check connectors are well mounted and cables are not damaged.
- 3) Check wiring cables in the motor case are not corroded or disconnected.

## 6. Table CLAMP

### 6-1 Precautions for table clamp



Be sure to rotate the table with the table unclamped and use the table with it clamped after positioning. If the table is operated in mistake, take care since the worm wheel may be damaged. Check the signals of pressure switch to check CLAMP/UNCLAMP operations.



Never operate the table at clamping torque or more in specification column because the clamping part will be worn and the worm wheel will also be damaged.



If residual pressure is remained in table UNCLAMP, the table may be operated without releasing a clamp state completely. In this case, the worm gear part and clamp part are seized and damaged. Therefore, take extreme care about back pressure. Especially, when the table is clamped by hydraulic pressure, design the circuit so that the back pressure in UNCLAMP is 0.2 MPa or less.

### 6-2 Check device for CLAMP/UNCLAMP

To proceed work securely, be sure to use CLAMP/UNCLAMP confirmation signals. (Refer to Fig. 1.)

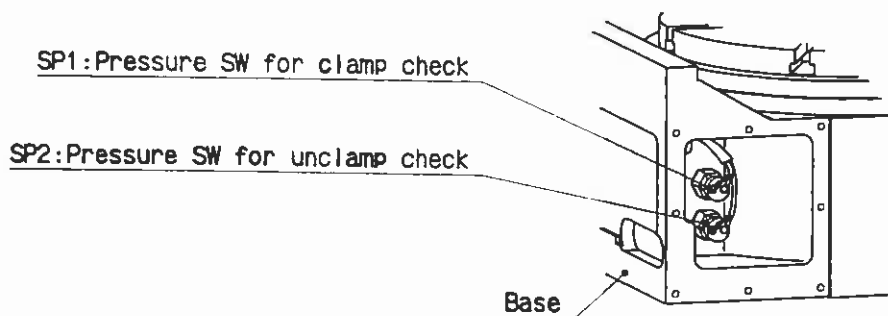


Fig. 1

Pressure switch setting pressure is as shown in the following list according to each clamp system.

Clamp check (SP1)	Unclamp check (SP2)
2.75 MPa (28.0 kgf/cm <sup>2</sup> ) (176 112 800)	0.2 MPa (2.0 kgf/cm <sup>2</sup> ) (176 120 200)

The pressure switches are made by WILLY VOGEL.

## 6-3 Solenoid valve for CLAMP/UNCLAMP

In case of NC rotary table in booster specification, the solenoid valve is incorporated. Since the following piping is used as standard specification, take care when electric cables are connected.

Solenoid ON ——— Unclamp

Solenoid OFF ——— Clamp



When mounting the solenoid valves to the outside of NC rotary table (NC rotary table of hydraulic clamp specifications), connect the cables at the above specifications.

## 7. Mounting the Workpiece

Securely mount the workpiece for high accuracy machining.



If the workpiece is not securely mounted, not only accuracy is wrong but also the machine and the tool are damaged. In the worst case, it will result in serious injury.



If the workpiece which is not flatness and straightness is mounted as is, the workpiece or rotary table is distorted, thus causing accuracy drop or unevenness rotation. In this case, insert shim(s) in the gap between the workpiece and the rotary table.



Clamp the workpiece securely in equalpartition on the rotary table as much as possible.

## 8. Backlash Adjustment of Worm Gears

The worm shaft and worm wheel are made of the special material and they are machined accurately.

The dual lead worm system is adopted for eliminating the backlash of worm shaft/worm wheel. It changes leads of right and left tooth flanks of worm shaft a little and adjusts the backlash for the worm wheel by shifting this worm shaft in the axis direction.

This dual lead worm system adjusts the backlash finely without changing an ideal engagement state and it is theoretical and most secure backlash adjustment method.

Though the backlash of worm gears has already been adequately adjusted before shipping, it may be necessary to adjust it after using for a long period of time. The adequate values of backlash are as follows. These values were measured when the machine is cooled. Thus, they are values assumed after interrupting the machine for a long period of time. Consequently, when operating the machine continuously for a long period of time, each backlash becomes smaller than the following value due to thermal expansion.



If backlash is too small, the worm gears will be seized.

## O Adequate backlash

Table model	TR400	TR500	TR630
Circular arc length at peripheral table position ( $\mu\text{m}$ )	13 ~ 38	12 ~ 36	21 ~ 52
Converted angle (sec.)	13 ~ 39	10 ~ 30	14 ~ 35

When adjusting the backlash, measure the current backlash with the following method. After that, adjust it.

### 8-1 Measuring method for backlash of worm gears on table (Refer to Fig. 2.)

- 1) Set the dial gauge the periphery of T-slot on table top face or periphery of table top face.
- 2) Slowly turn the table with the flat steel or round bar by using the T-slot on the top face of table and release your hand where the worm wheel tooth is touched before reading the value of dial gauge. Next, turn the table under the same condition in the reverse direction. At this time, the difference of measured values is the backlash.
- 3) Perform the above measurement at 8 equipartition positions of outer periphery by turning the table and compare them with the above adequate values. When deviated from the adequate values, adjust the backlash by the following procedure so that the minimum value of backlash will be the adequate value previously described.

### 8-2 Backlash adjusting method of worm gears (Refer to Fig. 3.)



Be sure to turn OFF the power source of control unit or unclamp the NC rotary table before adjusting the backlash.

If your hands or clothes touch the rotating gears, there is a danger to cause a serious accident by winding to the gears.

#### The case of TR400, TR500

- 1) Drain the lubrication oil from the drain port.
- 2) Remove the cover ③.
- 3) Remove the pressure flange ② and the locking elements ④ by loosening the hexagon socket head cap screws ⑤. Then remove the gear ①.
- 4) Loosen hexagon socket head cap screws ⑤ which fix the bearing case ⑥ a little. Next, loosen four adjusting screws ⑦ uniformly a little. When tightening hexagon socket head cap screws ⑤ again, the bearing case ⑥ advances, thus reducing the backlash of worm gears.

#### The case of TR630

- 1) Drain the lubrication oil from the drain port.
- 2) Remove the cover ⑧.
- 3) Loosen hexagon socket head cap screws ⑤ which fix the bearing case ⑥ a little. Next, loosen six adjusting screws ⑦ uniformly a little. When tightening hexagon socket head cap screws ⑤ again, the bearing case ⑥ advances, thus reducing the backlash of worm gears.

**IMPORTANT**

Since the pitch of adjusting screw is 1.25mm (TR400/500) or 1.5mm (TR630), when returning one rotation, the backlash becomes small as shown in the following list.

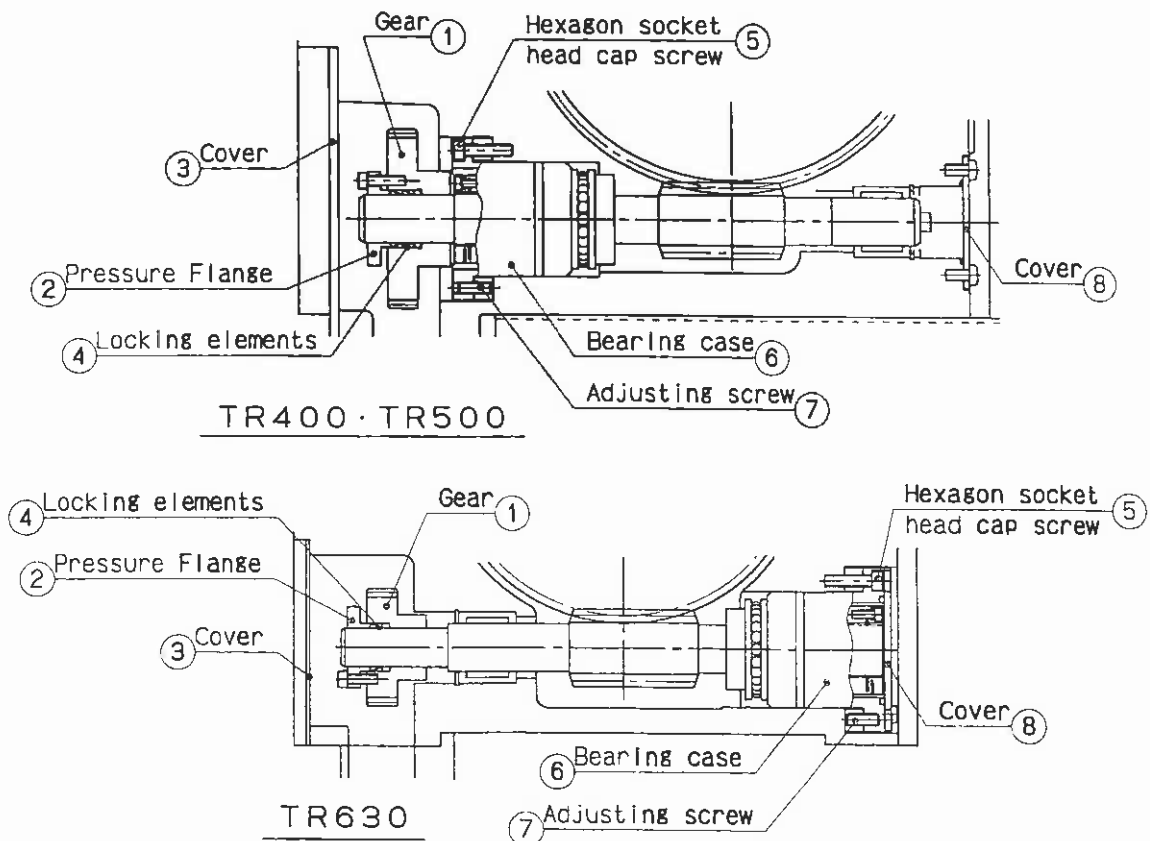
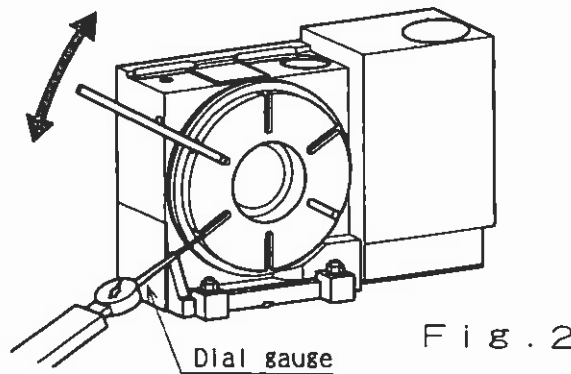
Table model	TR400	TR500	TR630
Circular arc length at peripheral table position ( $\mu\text{m}$ )	ABOUT 29	ABOUT 27	ABOUT 20

When finishing the adjustment, reassemble the table in reverse steps as the above and tighten bolts securely.

After reassembling, measure the backlash at table periphery again at the same positions before adjusting and check the backlash is adequate.

**CAUTION**

When reassembling the gear, tighten fixing hexagon socket head cap screws uniformly so that the run out does not occur at end face of gear. Adjust the backlash gradually and carefully.



## 9. Built-in ZRN (Zero Return) Device

### 9-1 Dog position for ZRN deceleration

The rotational direction for ZRN is clockwise (CW) standard specification.

The dog for ZRN deceleration is mounted under the table and it cannot be found except when the dog position is adjusted. Though the dog can be mounted on the optional periphery position under the table, the table reference slot has been set so that it is at right angle for the reference plane for vertical installation.

Customer needs to adjust the dog position finely when connecting to NC unit.

### 9-2 Adjusting method of dog position (Refer to Fig. 4 & 5.)

When changing the ZRN position, ZRN rotary direction counterclockwise and the dog position, perform the following procedure.

- 1) Drain the lubrication oil.
- 2) Remove the cover ①.
- 3) Turn the table and stop it at the place where the dog ② can be found from the window when the cover ① is removed.
- 4) Loosen set screws ③ that fix the dog ②.
- 5) Move the dog to the proper position.
- 6) When the dog adjustment is finished, securely tighten set screws ③.
- 7) Set the cover ① to the original position.



When putting the cover back, remove the existing sealing compound and uniformly apply with new sealing compound (Three Bond Company Seal Compound 1216).

### 9-3 Structure of sensor part

- 1) Proximity Switch (See Fig. 4)

The proximity switch ④ is fixed with lock nut ⑤ after providing a gap by protruding the switch about 1 mm (thread pitch 0.75 mm of proximity switch) from the periphery of dog ②.

- 2) Limit Switch (See Fig. 5)

A roller plunger actuator ⑦ is provided between the dog ② and the limit switch ⑥. Loosen the hexagon head bolt ⑧ for fine adjustment of the limit switch position.

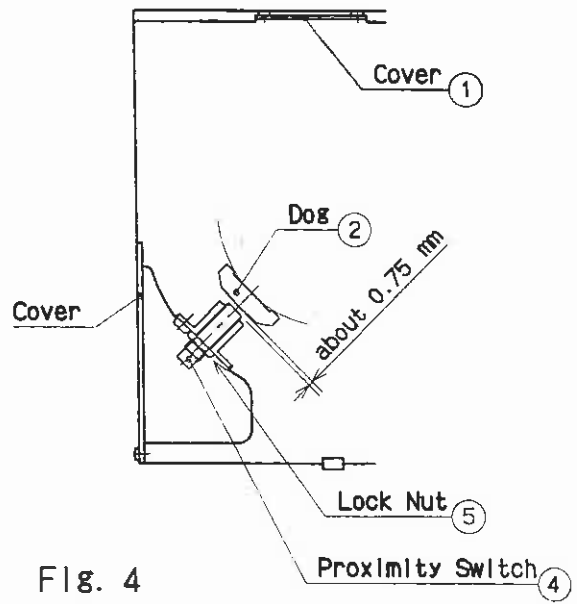
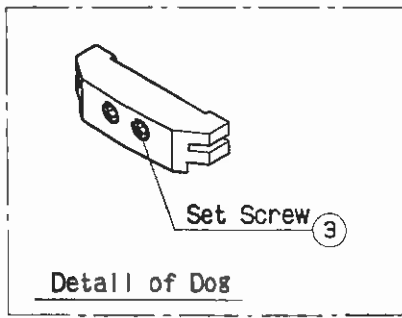


Fig. 4

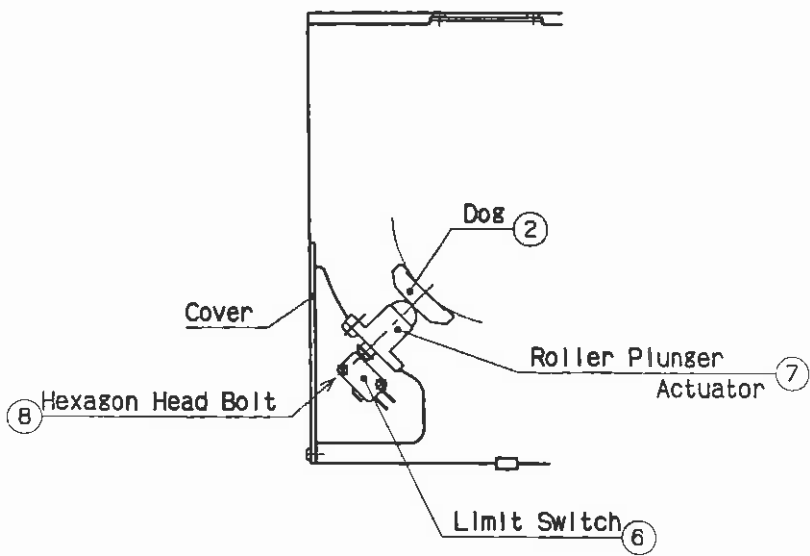


Fig. 5

# 10. Backlash Adjustment of Spur Gears

## 10-1 Adjusting method of backlash of spur gears (Refer to Fig. 6.)

### 10-1-1 Spur gear (Z2⑫) and spur gear (Z3⑬)

- 1) Drain the lubrication oil in the gear box for the drain port.
- 2) Remove the cover ⑥.
- 3) Fix the spur gear (Z3⑬) by the screw driver.
- 4) Touch the dial gauge on the tooth face pitch circle of spur gear (Z2⑫).
- 5) Rotate the spur gear (Z2⑫) and release your hand where the tool of spur gear touches to read the value of the dial gauge. Next, rotate the spur gear under the same condition in the reverse direction until the tooth touches. At this time, the difference of measured values is the backlash.

### 10-1-2 Spur gear (Z1⑪) and spur gear (Z3⑬)

- 1) Drain the lubrication oil in the gear box for the drain port.
- 2) Remove the cover ⑥.
- 3) Fix the spur gear (Z3⑬) by the screw driver.
- 4) Touch the dial gauge on the tooth face pitch circle of spur gear (Z1⑪).
- 5) Rotate the spur gear (Z1⑪) and release your hand where the tool of spur gear touches to read the value of the dial gauge. Next, rotate the spur gear under the same condition in the reverse direction until the tooth touches. At this time, the difference of measured values is the backlash.

The adequate backlash of spur gear is 0.02 ~ 0.04 mm. If the measured backlash is deviated, it is necessary to adjust the backlash.

## 10-2 Backlash adjusting method of spur gears (Refer to Fig. 6.)

### 10-2-1 Spur gear (Z2⑫) and spur gear (Z3⑬)

The adjustment of backlash between the spur gear (Z2⑫) and the spur gear (Z3⑬) is performed by rotating the eccentric shaft ⑦ (eccentricity 0.3 mm) and adjusting the distance between axes.

- 1) Measure the backlash according to Item 10-1-1.
- 2) To measure the backlash, touch the dial gauge on the tooth face pitch circle of spur gear (Z2⑫).
- 3) The eccentric shaft ⑦ is fixed through a steel ball ⑨ with the hexagon socket set screws ⑩ for pushing the steel ball. Remove the hexagon socket set screw ⑦ and loosen the hexagon socket set screws ⑩ for pushing the steel ball a little. Also, rotate the eccentric shaft ⑦ little by little to adjust the distance between shafts of spur gears (Z2⑫) and (Z3⑬), checking the backlash amount with the dial gauge. The amount of the backlash is reduced when the eccentric shaft ⑦ rotates to left and it is increased when rotating to right. The backlash amount has already been set to an adequate value and also, the alignment mark of gear case has also been matched to the alignment mark of eccentric shaft.

### 10-2-2 Super gear (Z1⑪) and super gear (Z3⑬)

- 1) Measure the backlash according to Item 10-1-2.
- 2) Loosen the hexagon head bolt ④ for the stopper.



- 3) Loosen four hexagon socket head bolts ② that fix the motor and tighten the hexagon head bolt ④ for the stopper slowly until the backlash of super gears becomes nearly zero (0).
- 4) Loosen the hexagon head bolt ④ for the stopper again to move the motor ③ until the flange of motor ③ touches the hexagon head bolt.

**IMPORTANT**

Since thread pitch of the hexagon head bolt ④ for the stopper is 1.0 mm, the backlash varies 0.033 mm at 10' revolution (1/36 revolution).

- 5) After tightening hexagon socket head bolts ② securely for mounting the motor, measure the backlash according to Item 10-1-2.

If the backlash is not proper value (0.02 ~ 0.04 mm), repeat the above Items 2) ~ 5) again.

**CAUTION**

Take care so that each tooth surface of super gears will not be damaged when the backlash is measured and adjusted. If the tooth surface is damaged, gears are not smoothly rotated. As a result, noise occurs in operation, and also, indexing accuracy is reduced.

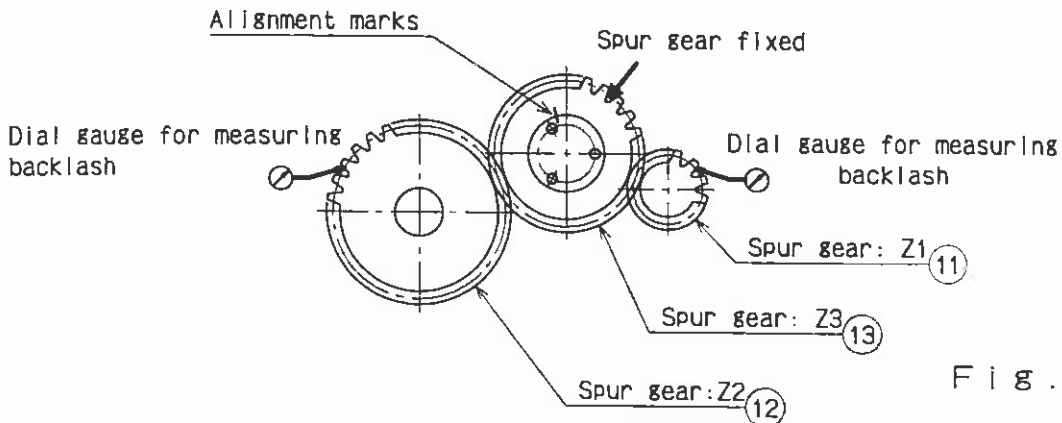
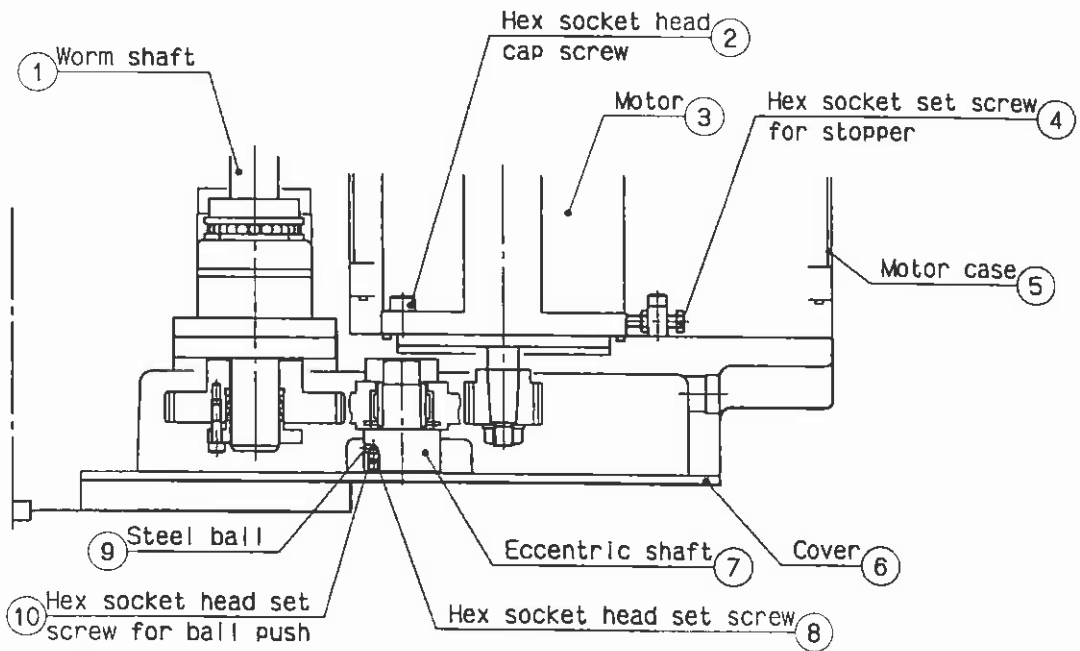


Fig. 6

# 11. Motor Case

## 11-1 Removing of motor case

Please follow the procedure below for removing the motor cover. (See Fig. 7.)

- 1) Loosen hexagon socket head cap screws ⑤ which fix the motor case ④ and move the motor case ④ slowly until internal wiring can be confirmed with the motor case ④ raised.
- 2) After all wirings from the table side to cannon connector ② and terminal box ③ are removed, the motor case ④ is removed.

## 11-2 Counter measure for waterproof

To prevent the motor from coolant penetration, O-rings are used to the mounting face on the motor case ④ and the liquid packing is used on junction of the gear box ⑦ with the cover ⑥.

When removing the cover ⑥ under any circumstances, make sure to strip the existing liquid packing (Three Bond Company Seal Compound 1216) and uniformly apply with new liquid packing before reassembling.



Before the motor ① is removed, drain the lubrication oil from the drain port. Please remove the motor ① slowly after detaching four hexagon socket head cap screws that are fixed of the motor ①.

Please tighten the bolt surely when you install the motor ① again.



When reassembling the motor ① and the motor case ④, take extreme care so that the O-rings will not be damaged. If the O-rings are damaged, coolant may be entered.

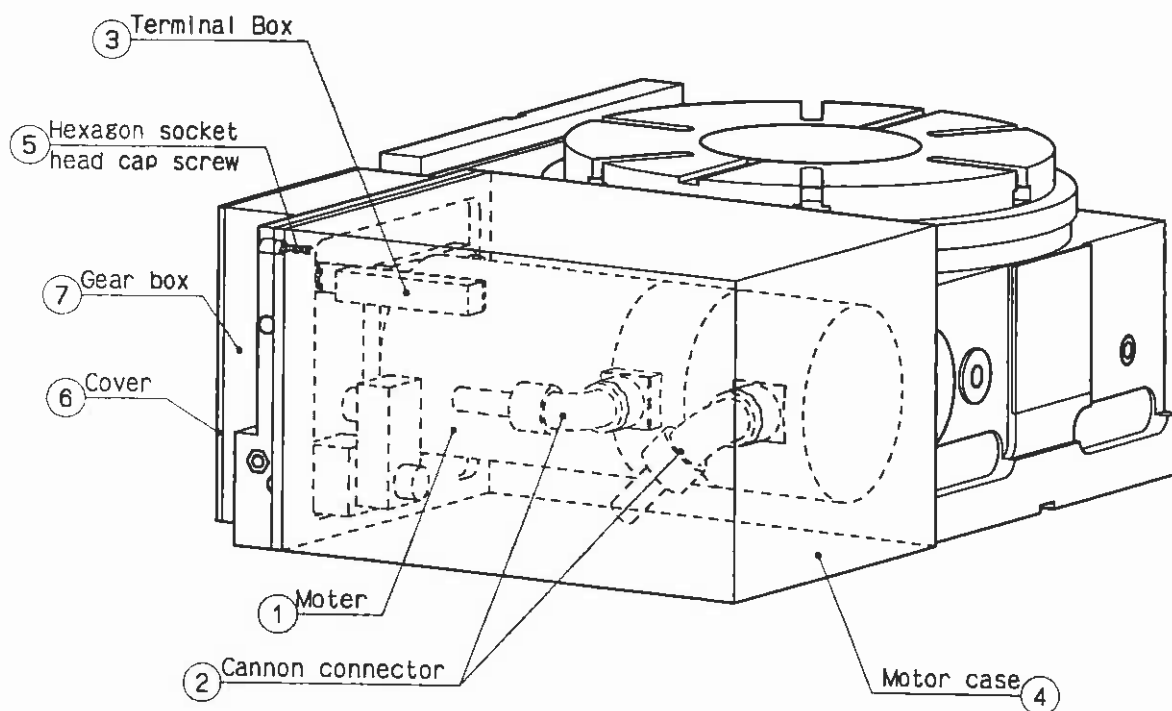


Fig. 7

## 12. Storage



When storing NC rotary table after removing it from the machine tool, place it on the stable wooden base for maintaining accuracy after removing chips or coolant, etc. Coat the table with rust prevention oil and case or lap it with the wooden cover or vinyl cover, etc. When using the wooden base and box, avoid the wooden base and the green wood. Since the green wood is not chemically neutral, use the wood moistened with paraffin.

## 13. Conversion of Peripheral Length and Angle

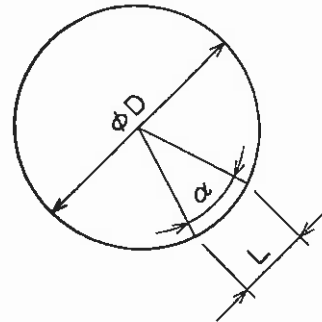


When understanding 'How long at arc length is the accumulative index accuracy 30 seconds?' or 'How angle is the accumulative pitch error 0.05 mm?', use the following formula from the relationship between the angle and the arc length.

D: Workpiece diameter (mm)

$\alpha$ : Angle (seconds)

L: Arc length (mm)



$$\frac{L}{\pi \times D} = \frac{\alpha}{360^\circ \times 60' \times 60''} \quad \text{----- (1)}$$

$$\alpha = \frac{360 \times 60 \times 60 \times L}{\pi \times D} = \frac{L \times 4.125 \times 10^5}{D} \quad \text{----- (2)}$$

$$L = \frac{\alpha \times \pi \times D}{360 \times 60 \times 60} = 2.424 \times 10^{-6} \times \alpha \times D \quad \text{----- (3)}$$

(Examples)

When the workpiece diameter is regarded as 100 mm, the following is formulated by 'Accumulative accuracy of 30 sec., is indicated with arc length.' and formula (3).

$$L = 2.424 \times 30 \times 100 \times 10^{-6} = 0.007272 \text{ mm} \approx 7.3 \mu\text{m}$$

Consequently, the arc length is about 0.0073 mm or 7.3  $\mu\text{m}$ .

The following is formulated by 'Accumulative pitch error is indicated with angle of 0.05 mm.' and formula (2).

$$\alpha = \frac{4.125 \times 0.05 \times 10^5}{100} = 206.25''$$

Therefore, the angle is 206 seconds or 3 minutes and 26 seconds. As shown above, the periphery length and angle are converted by formulas of (2) and (3).

# KITAGAWA

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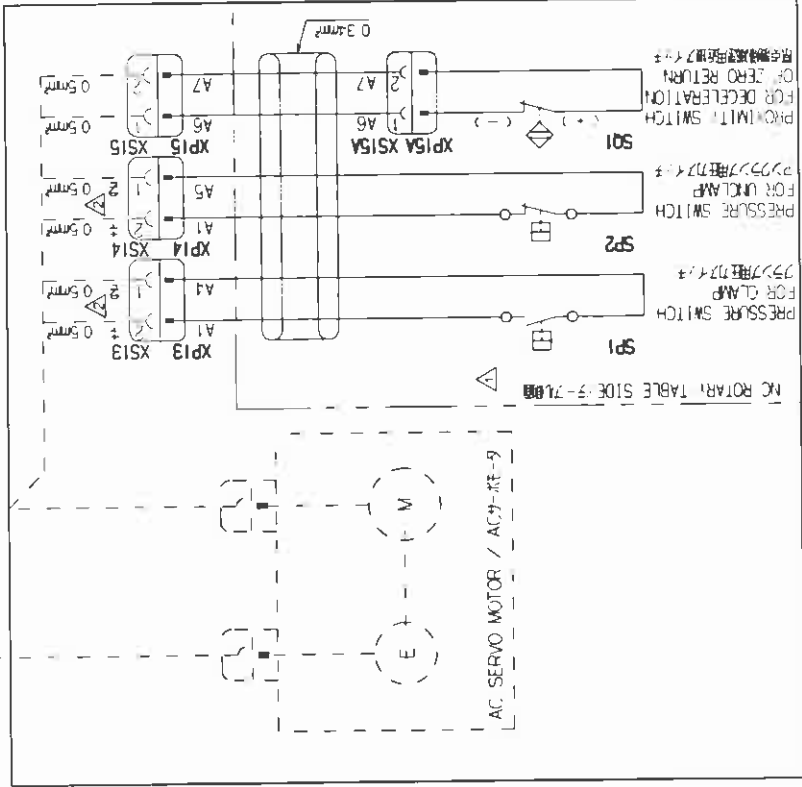
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1 2 3 4 5 6

A B C D

CUSTOMER		
NO	DATE	REASON OF DIVISION
1	07 07 03	ADJUSTMENT (モータの回転速度を5.7rpmに調整)
2	07 12 21	顧客からの仕様変更 (モータの回転速度を5.7rpmに調整)



近接スイッチ仕様書  
SPECIFICATIONS

電源電圧 POWER SUPPLY DC10~30V  
 定格電流 RATED CURRENT 3~100 mA  
 動作電流 OPERATING CURRENT max 0.55 mA  
 残電圧 RESIDUAL VOLTAGE max 3.0 V  
 出力端子 OUT PUT TYPE NC

CONNECTION OF PROXIMITY SWITCH  
 (BROWN) A7  
 (BLUE) A6  
 AVE

MARK 記号	NAME 品名	MAKER メーカー	TYPE 型	QTY 個数	REMARKS 注
SP1	PRESSURE SWITCH 圧力スイッチ	WILLY VOGEL	176 112 800	1	2.75 MPa(28 kgf/cm <sup>2</sup> ) 1a
SP2	PRESSURE SWITCH 圧力スイッチ	WILLY VOGEL	176 120 200	1	0.20 MPa(2.0 kgf/cm <sup>2</sup> ) 1b
SQ1	PROXIMITY SWITCH 近接スイッチ	YANATAKE	FLM-3KH-Z	1	DC10~30V
XP13	PLUG HOUSING プラグハウジング	MOLEX	52116-0240	1	
XP14	PLUG HOUSING プラグハウジング	MOLEX	52116-0241	1	
XP15, XP15A	PLUG HOUSING プラグハウジング	MOLEX	52116-0242	±2	
XS13	RECE HOUSING レセプタクルハウジング	MOLEX	52117-0240	1	
XS14	RECE HOUSING レセプタクルハウジング	MOLEX	52117-0241	1	
XS15, XS15A	RECE HOUSING レセプタクルハウジング	MOLEX	52117-0242	±2	
					△ CUSTOMER MUST PREPARE AND ASSEMBLE 顧客にて準備・組立

CAREER 61E357204	SCALE	TYPE TR400H2E04	WEIGHT	kg
MANAGER	CHIEF	DRAWN BY M.I.K. IEDA	NAME	フジキヨコ
		DATE 03.05.13	3RD ANGLE	3RD ANGLE
KITAGAWA IRON WORKS CO.,LTD.		DRW NO.	61E3618336	2
		NC ROTARY TABLE		







