

# NC Rotary Table

## INSTRUCTION MANUAL

### Model : GT



## **DANGER**

- This instruction manual is for production engineers and maintenance personnel in charge of operation of this product. When a beginner uses this product, receive instructions from experienced personnel, the distributor or our company.
- Before installing, operating or maintaining this equipment, carefully read this manual and the safety labels attached to the equipment. Failure to follow these instructions and safety precautions could result in serious injury, death, or property damage.
- Store this manual near equipment for future reference.
- If any questions related to safety arise about this manual, please confirm them with the distributor or our company.

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 unit is installed on the machining centers and suitable for indexing the angle of machining position of the workpieces. Please contact us if it is used for any other applications.

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.



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



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



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



**Instructions for table performance and avoiding errors or mistakes.**

## EC DECLARATION OF CONFORMITY

We hereby declare that the following our product conforms with the essential health and safety requirements of EC Directives.

Product : NC ROTARY TABLE

Type : MR Series, MRT Series ,GT Series, MX Series,  
TMX Series, THX Series, TRX Series, TLX Series,  
TBX Series, TUX Series, TR Series, TL Series,  
TP Series, LR Series TM Series, TH Series,  
TT Series, TW Series, DM Series

Directives : Machinery Directive 2006/42/EC  
EMC Directive 2004/108/EC

The above product has been evaluated for conformity with above directives using the following European standards.

### Machinery Directive:

EN ISO 12100-1:2003+A1:2009, EN ISO 12100-2:2003+A1:2009,  
EN ISO 14121-1:2007, EN 60204-1: 2006+A1:2009, others

### EMC Directive:

Emission : EN 55011+A2:2007  
Immunity : EN 61000-6-2:2005

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# 1. For Your Safety

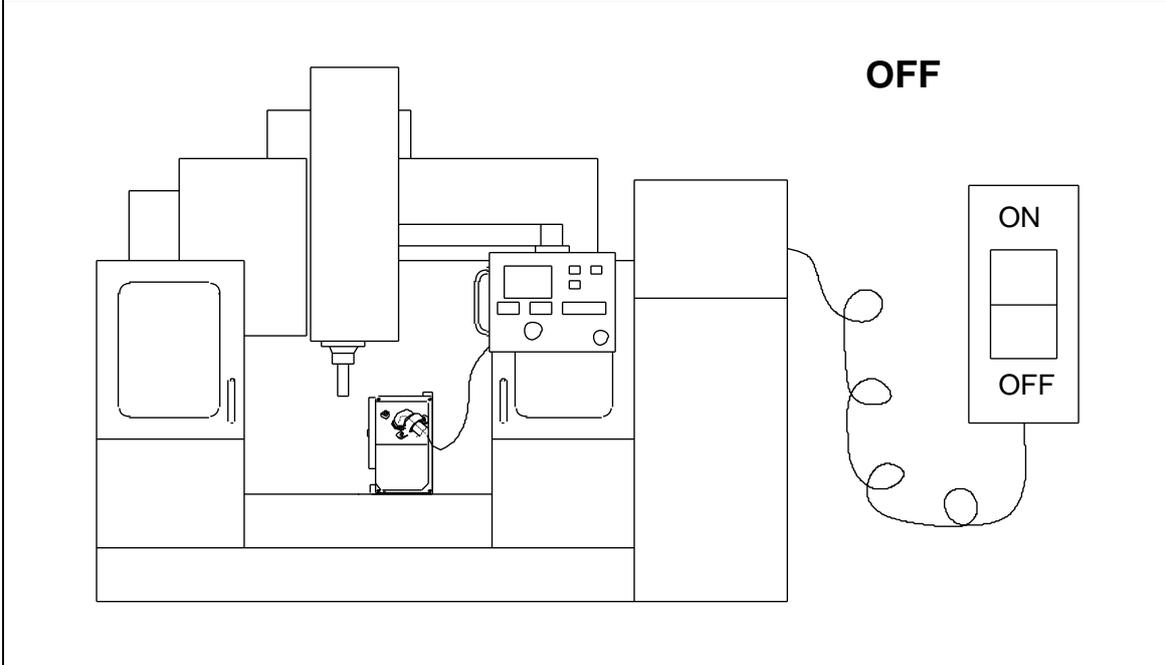
## Basic Safety Tips

Please read this manual and follow instructions carefully.

We cannot assume responsibility for damage or accidents caused by misuse of the NC Rotary indexing tables, through non-compliance with the safety instructions.



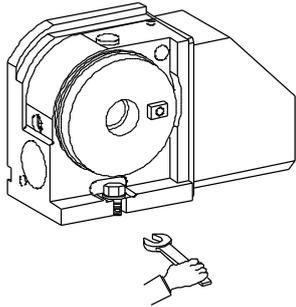
 Turn off the main power of the machine prior to maintenance, check, or repair of the unit, Failure to do so may cause severe injury and/or accident.



The diagram shows a line drawing of a complex industrial machine with various components, including a control panel with a screen and buttons. To the right of the machine is a power switch. The switch is a vertical rectangular box with a horizontal sliding bar. The word "ON" is printed above the bar, and "OFF" is printed below it. The bar is currently in the "OFF" position. A power cord is shown connected to the switch and extending towards the machine. The word "OFF" is also printed in large, bold letters above the switch.



Tighten the bolts securely when mounting the unit on the machine table.



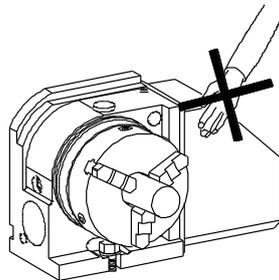
Please refer to the chart below for the recommended tightening torque of the bolts.

Strength Dimension : 10.9

Hex. Bolt Size	Torque N·m
M10	49.9
M12	86.2
M16	214.6
M20	421.4

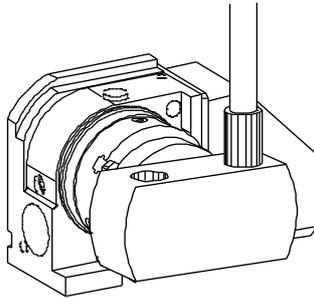


Make sure the working area is clear of any foreign object and/or hand when the unit is in operation to avoid any serious accident and/or injury.



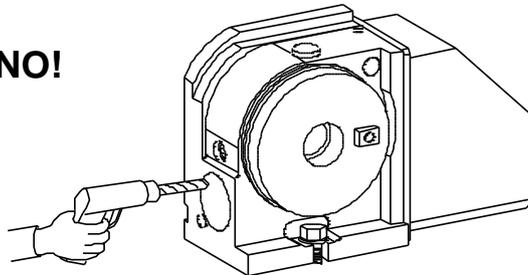


Do not apply cutting force which exceeds the specification in this manual. Failure to do so may cause severe injury and/or damage to the unit.



Please consult your local distributor before attempting any modification of the unit.

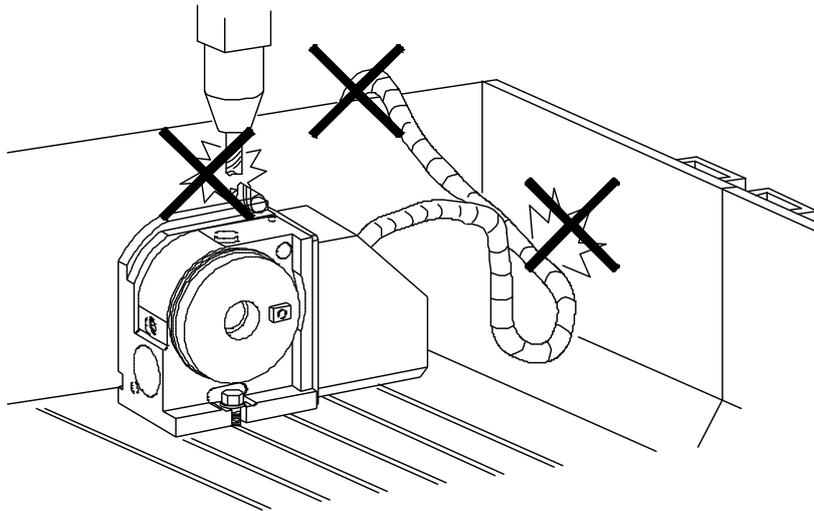
**NO!**



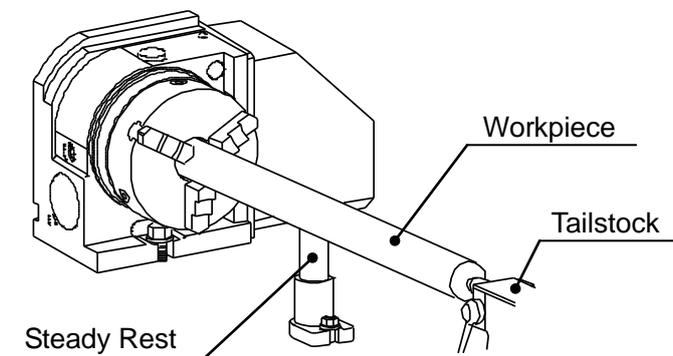


Maintain adequate clearance between the unit and any part of the machine.

Avoid bending the external cables and air tube of the unit.

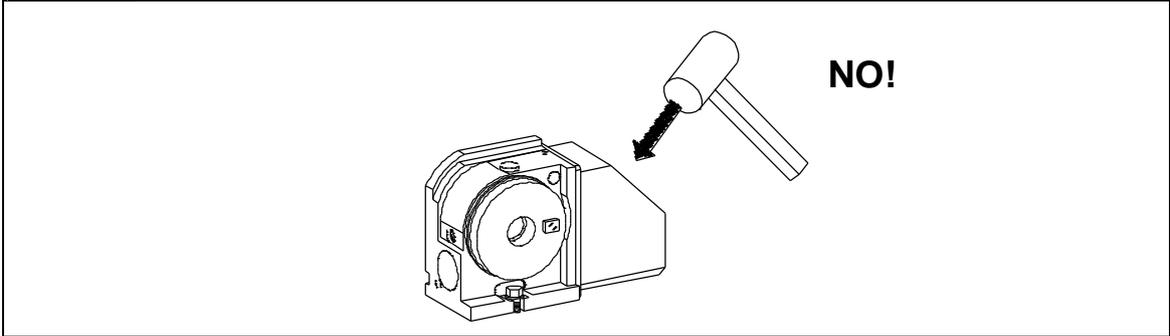


Use a support, steady rest, or tailstock for heavy or long workpieces to prevent any injury and/or accident.

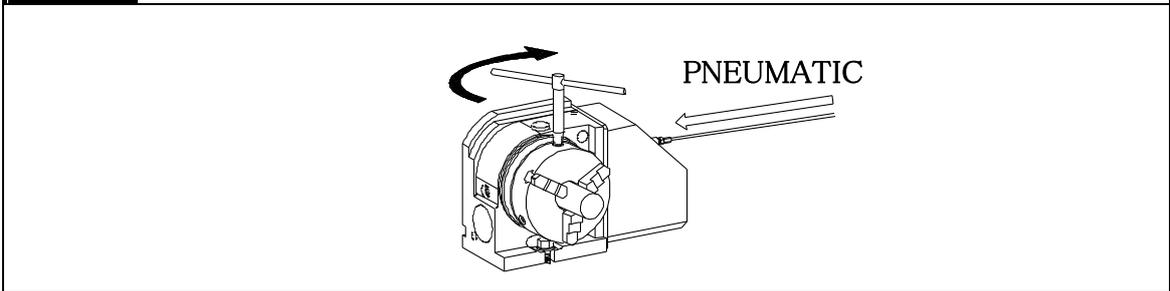


 **CAUTION**

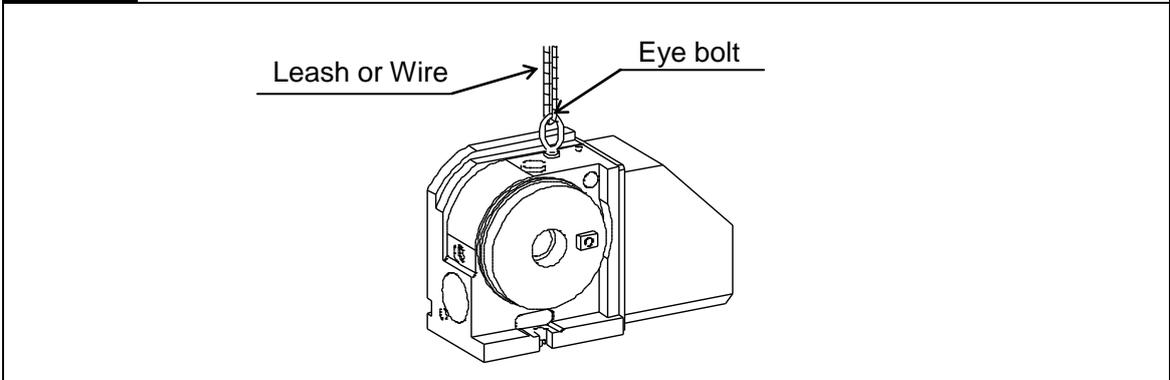
 Avoid sudden impact to any part of the unit which may cause damage to the internal mechanism.



 Mount or dismount the workpiece to or from the unit while the unit is clamped to avoid damage to the internal mechanism and diminished indexing accuracy of the unit.



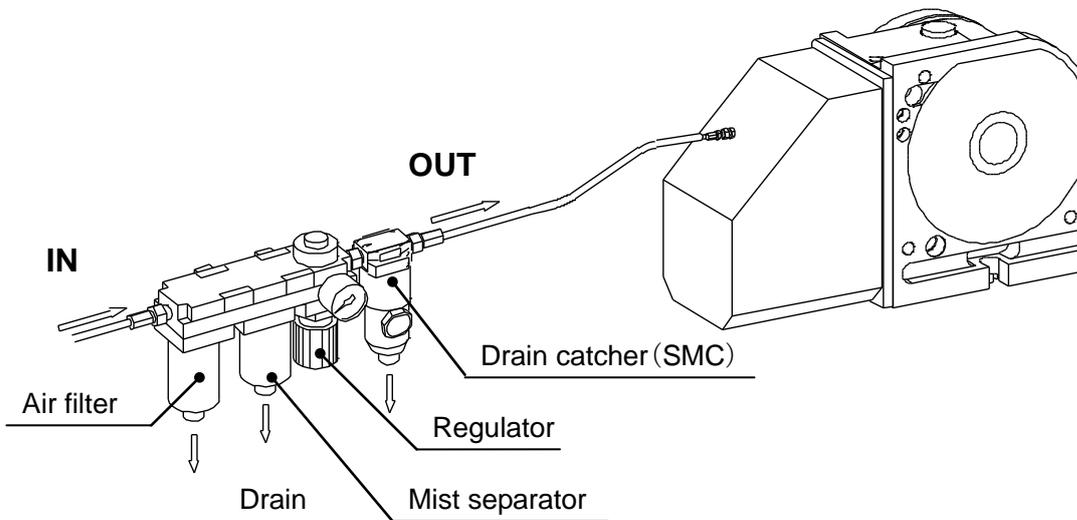
 When transporting the unit, make sure to use eye bolts and a sufficient leash or wire.





Supply air through Air combination (Air filter, Mist separator, regulator) + Drain catcher. (The air supply port is on the motor case.)

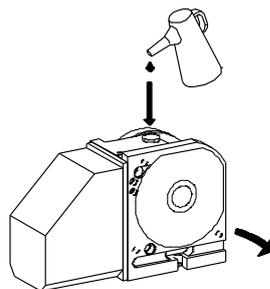
Apply air purge inside the motor case and be sure to provide dry air.



Periodically drain the water in air filter. (It is recommended to use the auto drain type.)



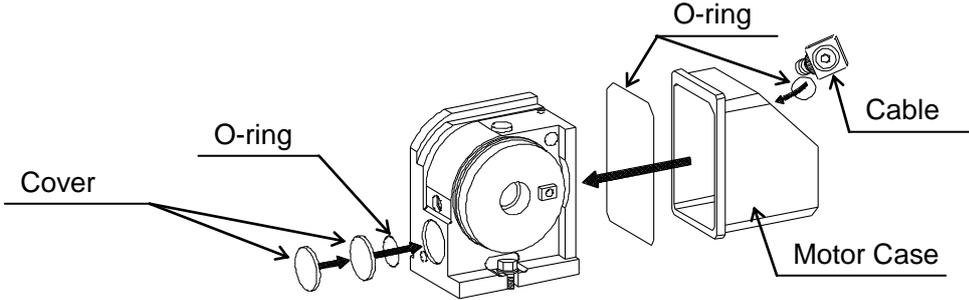
Replace lubricating oil every 6 months.



# NOTICE



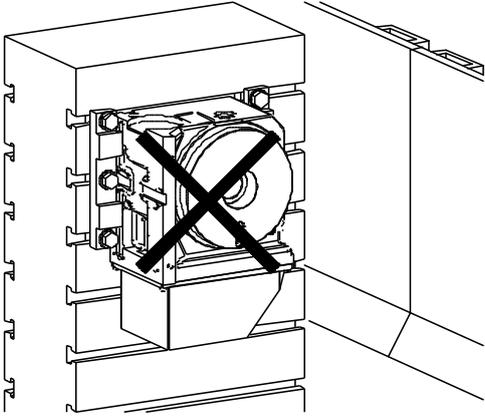
Mount all covers attached with O-rings. (No damages on O-rings)



Do not mount the motor case to the machine tool with the motor case positioned lower than the body.

There is a danger that lubrication oil leaks out of the NC rotary table, thus damaging the brake and worm part.

NO!



## 2. Specifications

ITEM	MODEL		GT(M)200	GT(M)250	GT(M)320	
1	Table Diameter	mm	φ 200	φ 250	φ 320	
2	Table Height in Horizontal	mm	178	185	210	
3	Center Height in Vertical	mm	140	180	225	
4	Center Hole Diameter	mm	φ 65H7	φ 100H7	φ 130H7	
5	Thru. Hole Diameter	mm	φ 45	φ 70	φ 105	
6	Guide Block Width	mm	14h7	14h7	14h7	
7	Clamping Torque [Pneumatics 0.5MPa]	N·m	820	1600	2800	
8	Allowable Workpiece Dia.	mm	310	480	800	
9	Allowable Mass of Workpiece	Horizontal	kg	200	250	350
		Vertical	kg	100	125	180
10	Allowable Work Inertia	kg·m <sup>2</sup>	1.00	1.95	4.49	
11	Total Reduction Ratio		1/72	1/90	1/120	
12	Max. Rotation Speed	min <sup>-1</sup>	41.6	33.3	25 (GT)	16.6 (GTM)
13	Mass of Rotary Table	kg	64	86	145	
14	Operating temperature range	°C	5~40			
15	Operating humidity range	%	30~95			
16	Operating altitude range (above sea level)	m	1000 or lower			
17	Storage temperature range	°C	-10~60			
18	Environmental pollution degree		Degree 3			
19	Noise level	dB	79			

※The noise level is measured at a distance of 1m from the NC rotary table in front, rear, left, and right four positions of the unit.

※When storing the unit, conduct the antirust treatment and store it in a place free from wetting, condensation, or freeze.

## NOTICE

The above specification table shows the values at standard specifications. For details, refer to the Outside View.



## CAUTION

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



## CAUTION

There is any case that the tailstock is required by the mass of workpiece, shape, cutting conditions, etc.



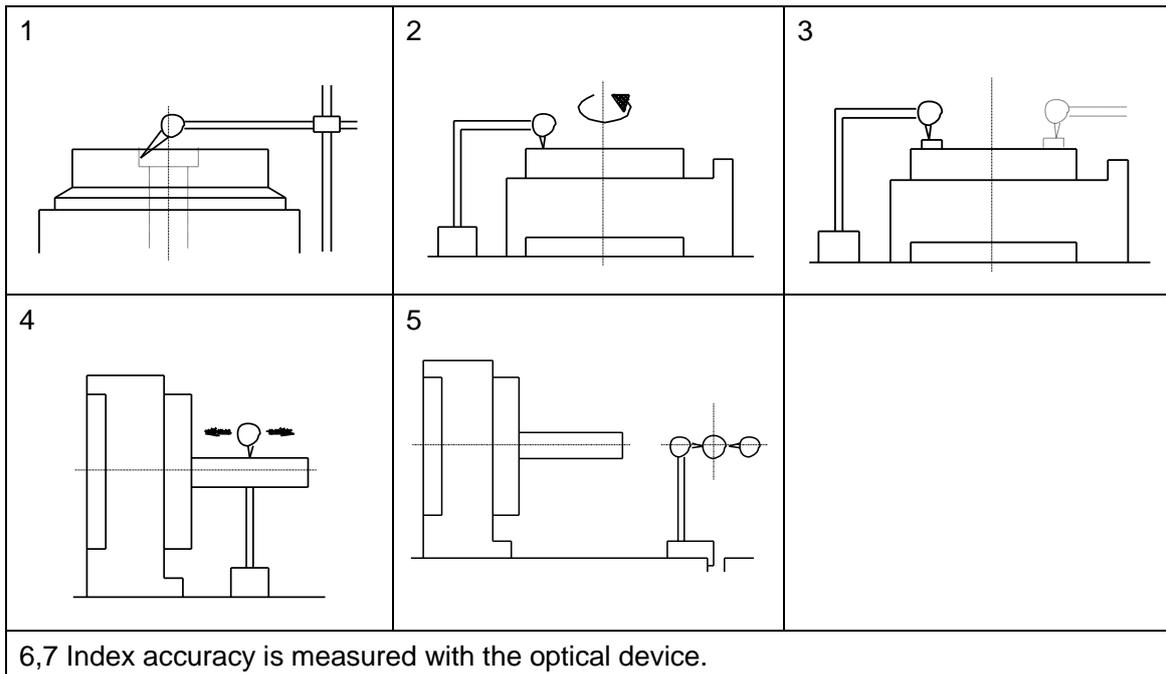
## CAUTION

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

### 3. Accuracy Standard

(Unit: mm)

	Description of Inspection		Guaranteed Accuracy
1	Run-out of center hole		0.01
2	Run-out of table surface		0.02
3	Parallelism of table surface and reference plane for horizontal installation	Per 150mm	0.02
4	Parallelism of rotating axis center line and reference plane for vertical installation	Per 150mm	0.02
5	Parallelism of rotating axis center line and guide block center	Per 150mm	0.02
6	Indexing accuracy	Cumulative	20 sec
7	Repeatability	Cumulative	4 sec



## 4. Operation Ready

After unpacking, the tilting rotary table is mounted to the machine tool. Observe the following procedure before performing the operation (trial run).

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

- 1) When transporting the unit, hook ropes to the eyebolts attached and transport the unit carefully, not giving a shock. The ropes used should be wire ropes having enough strength to lift up the unit.
- 2) Clean the table face on the machine tool and the mounting base surface of NC table after checking that burr or flaw is not found. If the burr or flaw is found, repair them with the oil grinding stone.
- 3) The motor case may be removed depending on the maintenance work. Accordingly, whenever possible, install the NC rotary table in a position where the motor case can be removed. In case of vertical installation, the guide blocks will fit into the slotted groove on the machine. If there is any play between the guide block and the T-slot, place the unit against one side of the T-slot to eliminate the gap.
- 4) Securely fix the NC rotary table to the machine tool with the attached clasper.
- 5) To prevent an attached hoisting tap from chip entering, screw the hexagon socket set screw in the hoisting tap after removing the eye bolt.



Do not enter a part of your body under the NC rotary table during transportation.

Unexpected accidents such as a disengagement of lifting devices may cause the NC rotary table to drop on your body.



When mounting the NC rotary table to the machine tool, check the mounting space carefully. Especially, take care so that the NC rotary table, cables and air/hydraulic hoses will not interfere with the splash guard or ATC device and spindle head of machine tool because the table or spindle head moves.



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



## **WARNING**

Tighten the bolts of clamber at the specified torque by using the mounting seat effectively.



## **CAUTION**

The transport and lifting devices must be operated only by the qualified persons for respective devices.

Operating the transport devices by an unqualified person causes the NC rotary table or machine to be damaged due to an operation error, resulting in accidents.



## **CAUTION**

When transporting a pallet on which NC rotary table is mounted, take measures against over-turning or drop.

Transporting the pallet with NC rotary table mounted unstably may cause the NC rotary table to overturn and then to drop from the pallet.



## **CAUTION**

Disconnect electric cables and working fluid piping when relocating the NC rotary table.

Relocating the NC rotary table with electric cables and working fluid piping connected and hung down causes the NC rotary table to be unstable or the worker to be tripped, resulting in unexpected accidents.

Electric cables or working fluid piping may be damaged during relocation, and if the NC rotary table is installed on the machine again, unexpected accidents may occur.

If electric cables and working fluid piping cannot be disconnected, secure them to the NC rotary table.

### **4-2. Oiling**

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



## **CAUTION**

Replace lubrication oil every 6-month. At this time, completely drain the oil. When filling the oil tank with lubrication oil, remove the chip and foreign matter on the oil filler neck. If the chip and foreign matter are entered, the

important parts such as the worm gear, bearings, etc., are seized and accuracy is reduced.



Fill the tank with lubrication oil to center position of oil gauge. Use the lubricating oil recommended in the table on the item 4-4.

### 4-3. Required Oil Quantity

(Unit: liter)

MODEL	GT(M)200	GT(M)250	GT(M)320
QTY.(l) at Vertical installation	0.2	0.4	0.7
QTY.(l) at Horizontal installation	0.3	0.5	0.8

Daphne Multiway 32MT (Idemitsu) is provided in the unit before shipping.

### 4-4. Recommended Lubricating Oil

Grade of Viscosity : ISO VG32

Maker	Oil Name
IDEMITSU	Daphne Multiway 32MT
MOBIL	Vactra oil No.1
JX NIPPON OIL & ENERGY	Uniway EV32
SHELL	Shell Tonna oil S32
COSMO	Dynaway 32

### 4-5. Safety of Oil and Antirust Oil Used for the Unit

#### 4-5-1. Scope of application

- Specified lubricating oil
- Specified hydraulic oil (MR, MRT, MX, GT, TM2100·3100, TH2100·3100, TT(S)101·120, TT140, DM do not use)
- Antirust oil applied to the unit at delivery (Houghton Japan, Rust Veto 377)

#### 4-5-2. First-aid treatment

Aspiration: In case of much aspiration, go to a place where there is fresh air, and cover your body with a blanket to keep your body warm. Consult a doctor if necessary.

Sticking to your skin: Wipe off the oil, and wash your skin with water and soap. If you feel itchy or you get inflamed, consult a doctor immediately.

Entering your eye: Wash your eye with fresh water for at least 15 minutes, and then consult a doctor.

Accidental drinking: Consult a doctor immediately without vomiting forcibly. If you are polluted in your mouth, wash with water thoroughly.

- For lubrication oils and hydraulic oils other than specified ones, and antirust oils prepared by the customer, refer to the safety information prepared for respective oils.

#### **4-5-3. Flammable characteristics**

- Watch out for fire since lubricating oil and hydraulic oil are flammable. Hazardous substances will be generated if they combusted.
- The flash point of lubricating oil and hydraulic oil put in the unit at the delivery exceeds 200°C. It may be different from that of the lubricating oil and hydraulic oil prepared by the customer.
- Antirust oil is highly volatile and thus likely to catch fire, and also it mixes with air to form explosive mixture gas.
- The flash point of antirust oil applied to the unit at the delivery is 38°C. It may be different from that of the antirust oil prepared by the customer.

#### **4-5-4. Disposal of lubricating oil and hydraulic oil**

Dispose of used lubricating oil and hydraulic oil exhausted from this unit in accordance with the laws and regulations of your country. You may suffer punishment if you disposed of waste oil without following the laws and regulations.

## **5. Inspection**

### **Daily inspection**

- 1) Confirm that the NC rotary tables (including jigs, if attached) are securely fixed.
- 2) Confirm that the chips accumulating in a rotary part of NC rotary table are removed.
- 3) Confirm that the electric connection cables and hoses are not damaged and the pneumatic pressure is appropriate.
- 4) Confirm that the machine-zero operation and indexing operation and position.
- 5) Confirm that there is no abnormal vibration or noise. (eq. Body and motor)
- 6) Confirm that there is no abnormal heating. (eq. Body and motor)
- 7) Is supply air clean? (Maintenance of air combination, replacement of filter, drain volume, etc.)

### **Periodic inspection (Inspect the following items every six months.)**

- 1) Confirm that muddiness of the lubricating oil.
- 2) Confirm that the connectors are securely attached and there is no damage on the cables.
- 3) Confirm that corrosion and breaking of the wiring in the motor case.

## **6. Use of NC Rotary Table**

This unit is installed on the machining centers, and on its table surface the chuck or fixture is attached to clamp the workpiece. It indexes the angle of machining position by the control of machining center or Kitagawa's own controller. During the machining, the working fluid is supplied to retain the workpiece.

## 7. Table Clamp

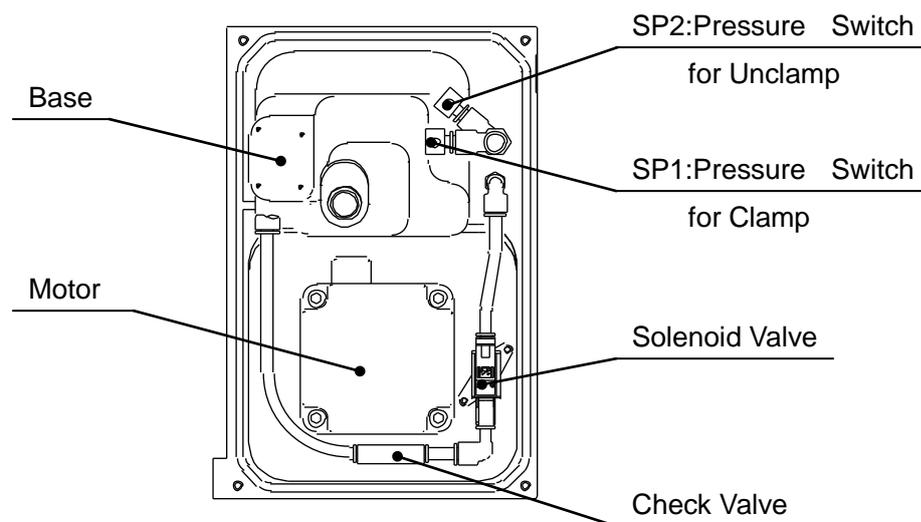
### 7-1. Precautions for table clamp



When the table is positioned, activate the table clamp, When the table is in motion, inactivate the table clamp. Improper procedures in table clamp and/or unclamp may cause severe damage to the internal mechanism. This unit is supplied with two pressure switches for table clamp and unclamp for added safety.



Make sure that your cutting operation on the unit does not exceed the table clamping force specified on the specification sheet. This may cause damage to the internal mechanism.



(GT(M)200)

Fig.1

### 7-2. Supply of pneumatic for clamp

- 1) Use an appropriate filtration system. (Air Filter, Mist separator, Regulator, Drain catcher set)
- 2) Connect the pipe exclusive for air pressure durable to max. operating pressure over 0.6 MPa to the air pressure supply port. The air pressure supply port is provided on the motor case. See the external view attached for details.
- 3) Use this unit in the air pressure range of 0.3 to 0.6 MPa.

- 4) If the tail spindle is used, branch the air pressure from the NC rotary table to the tail spindle by using a tail spindle connection port provided on the NC rotary table. See the external view attached for the location of connection.

### 7-3. Air purge



According to the circumstance of use, the dew may be occurred in the motor case.

Air is exhausted from the portion of the air exhaust so that it causes the obstacle of electric parts or each part.

The air purge is performed by air branched inside of NC table that uses air for clamp.

Be sure to use the clean air (passing through air filter, mist separator, regulator and drain catcher) passing through the filter. If the air contains water content (moisture), oil content, etc., it is entered in the motor cover, thus causing in equipment damage. The air inside of motor case is exhausted from the air exhaust port.

In case that the portion of the air closed, motor case or motor etc. may be damaged so that the dew cannot be exhausted and that air pressure is kept in the motor case. Therefore the portion of exhaust should not be closed.

When exhausting, though exhaust sound occurs, there is no trouble.

### 7-4. Manually-releasing method of clamp

The GT series is of construction to maintain air pressure so as not to exert an influence upon a clamp torque even if air pressure supplied to the clamp mechanism fluctuates temporarily. As a result, the NC rotary table cannot be rotated manually because the clamping state is maintained since air pressure is exhausted from the clamp mechanism even if the air pressure supplied to the clamp mechanism of the NC rotary table is stopped for backlash measurement, adjustment, etc.

To exhaust the air pressure of the clamp mechanism, there are the following two ways.

- 1) Cover the hexagon socket head taper screw plug 1/4 (Fig.2) of tail spindle connection with waste, and remove it slowly with the hexagon wrench to exhaust the air pressure. After exhausting the air pressure, securely tighten the removed hexagon socket head

taper screw plug 1/4 with the hexagon wrench.

## NOTICE

When removing the hexagon socket head taper screw plug with a seal, since the seal may be removed, it is necessary to wind a seal tape around the taper screw plug.

- 2) Since the solenoid valve is built into the motor case, press the manual change button (Fig.3) to exhaust the air pressure.

Moreover, in case of the excitation clamp spec., when stopping the air pressure supply to the clamp mechanism, the NC rotary table can be rotated manually. For the excitation clamp/unclamp specifications, refer to an attached outline view and electric specifications.



## CAUTION

Clamped status is not canceled completely when residual pressure remains while unclamping. Thus, the table operation may continue under half clamped condition.

Since the above mentioned case leads to the seizing of worm gear and clamped part, take extreme care of back pressure.

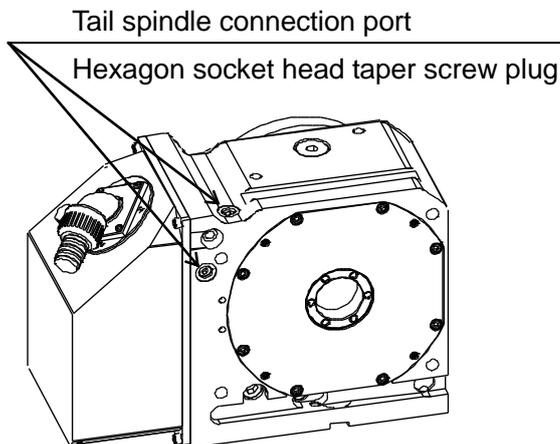


Fig.2

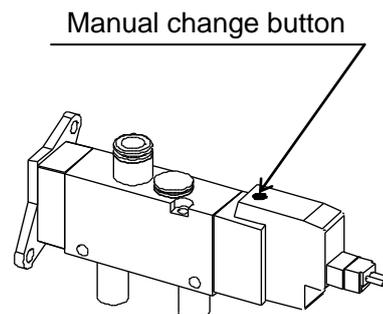


Fig.3

## 7-5. Checking device for CLAMP/UNCLAMP

The unit is equipped with two built-in pressure switches for clamp/unclamp detection as shown in Fig.1. The set up pressure of each switch for pneumatic systems is as follows :

Signal	Clamp Signal (SP1)	Unclamp Signal (SP2)
Pneumatic	0.25 MPa PS1000-R06L-Q-X140	0.055 MPa PS1100-R06L-Q-X141

The pressure switches SMC CORP made are used.

## 7-6. Solenoid Valve for CLAMP/UNCLAMP

For Pneumatic Clamping, a solenoid valve is equipped inside.

Please refer to the specification drawn in outside view and wiring diagram.

### 【 Excitation Unclamp Spec. 】

Solenoid: ON ... Unclamp

Solenoid: OFF ... Clamp

### 【 Excitation Clamp Spec. 】

Solenoid: ON ... Clamp

Solenoid: OFF ... Unclamp



Since there is polarity in the pressure switch by SMC CORP., a proximity switch, and a solenoid valve, please refer to the wiring diagram.

## 7-7. Replacement of excitation CLAMP/UNCLAMP of solenoid valve (See Fig.4)

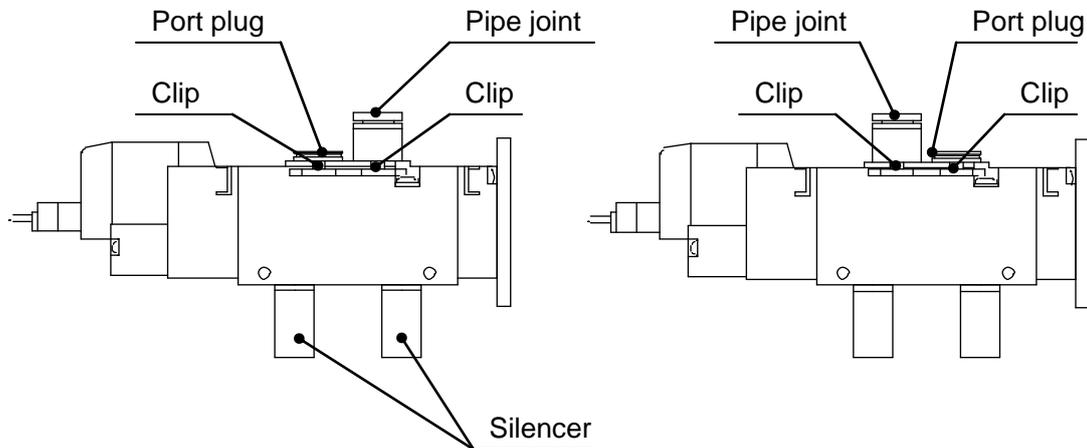
- 1) Remove the motor case from the base (See item 12-1).
- 2) The pipe joint and the port plug are jointed by two clips. Set the minus screw driver in the groove of the solenoid valve to remove two clips fixing the pipe joint and the port plug.
- 3) Remove the pipe joint and the port plug, and change a mounting position before inserting them in a contact part. Set two clips to specified positions and fix the pipe joint and the port plug. After that, check that the pipe joint and the port plug will not be removed.

## NOTICE

When the clamp is used at the excitation clamp spec., it is necessary to change the parameter of the controller.

## NOTICE

When clips are removed, since there is a possibility that clips fly and become lost, support clips by your hand.



**【Excitation Unclamp Spec.】**

**【Excitation Clamp Spec.】**

**Fig.4**

## 8. Mounting the Workpiece

Mount the workpiece securely to increase accuracy.



### WARNING

Securely mount the workpiece to the unit. If this is not done properly, it may cause severe injury and/or accident as well as poor indexing accuracy.



### CAUTION

Avoid mounting a workpiece which has poor flatness or perpendicularity directly to a table face. This may strain the table and prevent smooth rotation, which may result in very poor indexing accuracy. Shimming may be required to prevent this problem.



### CAUTION

Clamp the work in equipartition on the rotary table as much as possible.

## 9. Maintenance Work

### 9-1. Corrective Action in Case of Failure, and Disassembly

See the “Troubleshooting” if a failure occurred in the unit due to any reason. Also, for the disassembly procedure when performing the maintenance work, refer to the parts list and the procedure given in the corresponding maintenance item.

### 9-2. Before Performing Maintenance Work

When performing the maintenance work, shut off the power (primary power supply) of the machining center or Kitagawa’s own controller to set the pressure adjusting valve of air combination that supplies the air to the NC rotary table to 0 MPa or shut off the power of the air compressor to exhaust the compressed air, so as to stop the supply of the working fluid.



Perform the maintenance work with the workpiece removed. Performing the work with the workpiece left on the table may cause the workpiece to be dropped out, resulting in injuries.



Appropriate value in each maintenance item has been set for smooth function of each device, and thus you should observe it. Performing the maintenance work without observing the appropriate value may cause NC rotary table to fail or each device to be damaged.



Clamp the table clamp device of NC rotary table when removing the workpiece.

## 10. Backlash Adjustment of Worm Gears

The amount of backlash has been adjusted to the appropriate range at time of the shipment from the factory. However, if it becomes necessary, excessive backlash between the precisely machined double-lead worm and worm wheel can be eliminated easily with two slightly different inclined leads provided on the worm gear. Appropriate amount of backlash between the worm and worm wheel is shown below. The figures apply only when the unit is cold. The amount of backlash will be affected by thermal expansion when the unit warms up during operation.

### NOTICE

If the amount of backlash is too small, it may cause a heat seizure of the worm and worm wheel.

#### ○ Optimum values of backlash

MODEL	GT(M)200	GT(M)250	GT(M)320
Backlash in Circular Length of Table O.D. ( $\mu\text{m}$ )	14~35	14~42	13~40
Backlash in seconds	29~72	23~69	17~52

If it is necessary to adjust the amount of backlash, measure the backlash using the following procedure:

### 10-1. Backlash measuring method of worm gear (See Fig.5)

#### DANGER

Before proceeding to the backlash adjustment, you must turn off the power to the control unit and set the NC Rotary Table in the “unclamp” mode. If this caution is ignored, your hands or clothes may be caught in the gear while the gear is rotating resulting in serious injury.

Moreover, stop the air pressure supplied to the clamp mechanism and exhaust the air pressure into the clamp mechanism before adjusting the backlash (See item 7-4).

- 1) Set a dial gauge on the side face of the guide block on the top surface of the table.
- 2) Turn the table slowly by using the tap on the surface of the table as shown in fig.5. And read the value of the dial gauge when tooth of the worm wheel makes contact with a worm shaft. At this time, the rotating torque added to the table is as follows. Then, rotate the table on the same conditions to the opposite direction. The difference of these measurements is the amount of backlash.

MODEL	GT(M)200	GT(M)250	GT(M)320
Torque added to table T (N·m)	17	26	30

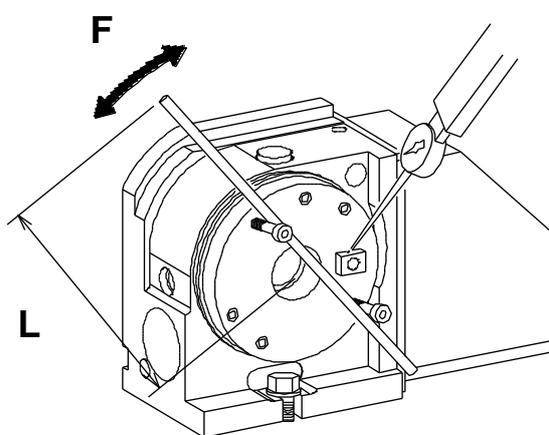
- 3) The above measurements should be conducted at four different points by rotating the table 90 degrees at a time. Compare the readings with the correct amount of backlash shown above. If the reading is out of the range specified, take the following procedures to adjust the backlash so that the minimum reading is within the correct range specified above.

$$T = F \times L$$

T : Torque(N·m)

F : Effort force(N)

L : Distance from table center to point to add power F(m)



**Fig.5**

## 10-2. Backlash adjusting method of worm gear (See Fig.6, Fig.7)



Before proceeding to the backlash adjustment, you must turn off the power to the control unit and set the NC Rotary Table in the “unclamp” mode. If this caution is ignored, your hands or clothes may be caught in the gear while the gear is rotating resulting in serious injury.

Moreover, stop the air pressure supplied to the clamp mechanism and exhaust the air pressure into the clamp mechanism before adjusting the backlash (See item 7-4).

- 1) For the backlash adjustment, you must discharge the lubricating oil through the drain.
- 2) For vertical installation, remove the hexagon socket headless tapered pipe plug ① located on the reference plane for vertical installation, and for horizontal installation, remove the same pipe plug ② located on the reference plane for vertical installation.
- 3) Remove covers ④ and ⑤ (only GT(M)200) located on the opposite side of motor case ③.

- 4) Remove hexagon socket head cap screws ⑭ and ⑮, and seal washers ⑯ fixing cover ⑤, and screw the hexagon socket head cap screw ⑮ in the screw hole where the hexagon socket head cap screw ⑭ was previously screwed and pull it to remove the cover ⑤.
- 5) Using the hexagon socket head cap screw ⑥, turn the worm shaft ⑧ to the place where the hexagon socket head cap screws ⑨ fixing coupling ⑦ and worm shaft ⑧ are seen since coupling ⑦ can be seen from a hole that removed the hexagon socket head taper screw plug on the above item 2).
- 6) Loosen the hexagon socket head cap screw ⑨ screwed to the coupling ⑦ (Do not remove the hexagon socket head cap screw ⑨).
- 7) Loose hexagon socket head cap screws ⑪ which fix the bearing case ⑩ a little. Next, loosen four adjusting screws ⑫ uniformly a little. When tightening hexagon socket head cap screws ⑪ again, the bearing case ⑩ advances, thus reducing the backlash of worm gears ⑧.

## NOTICE

Since the pitch of the adjustment screw ⑫ is set to 1.0 mm, loosening the screw by one rotation will makes the backlash smaller as shown in the following table.

## NOTICE

When reassembling the cover ④ ⑤, take extreme care so that the O-rings will not be damaged.

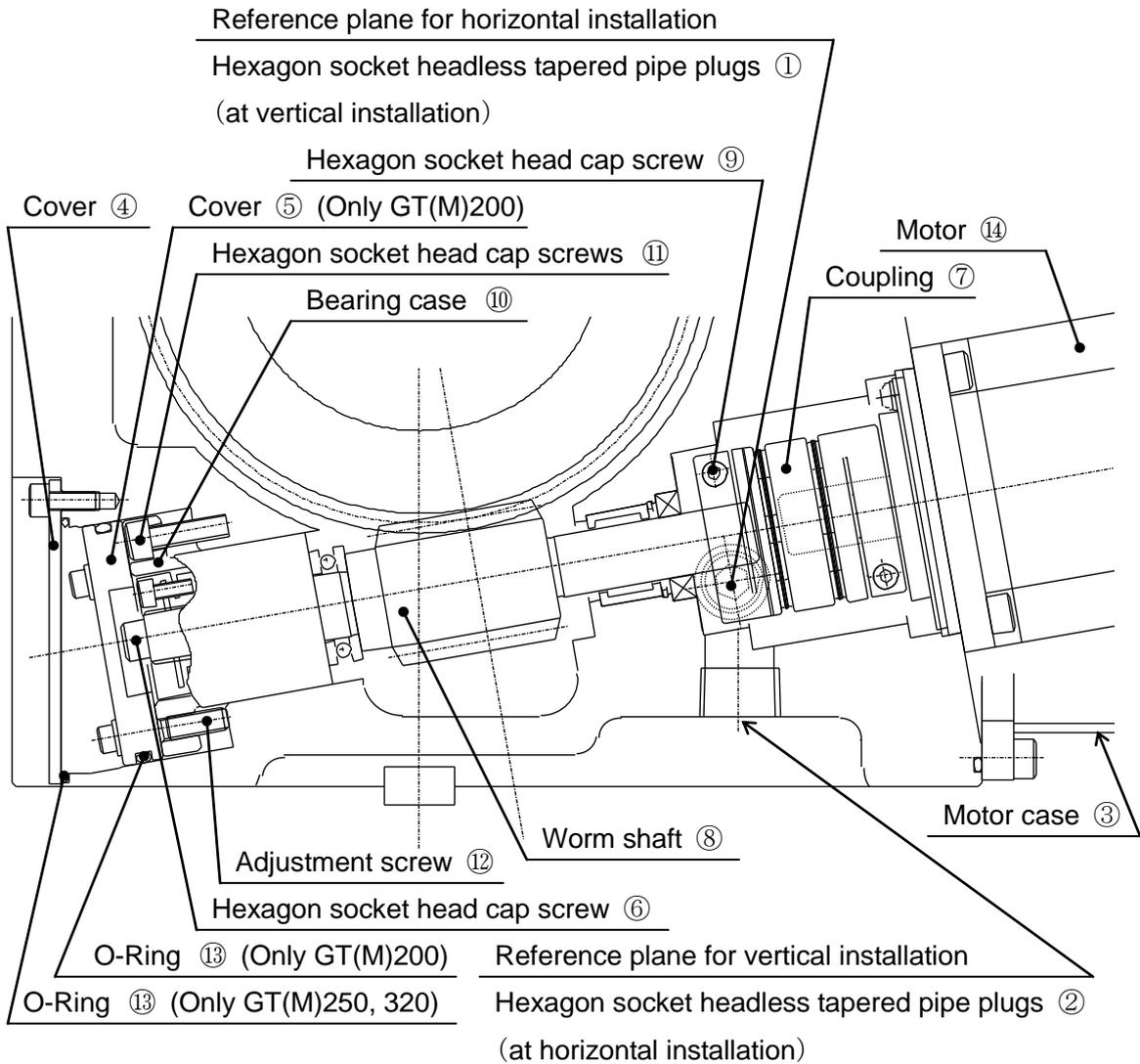
## NOTICE

When removing the hexagon socket head taper screw plug with a seal, since the seal may be removed, it is necessary to wind a seal tape around the taper screw plug.

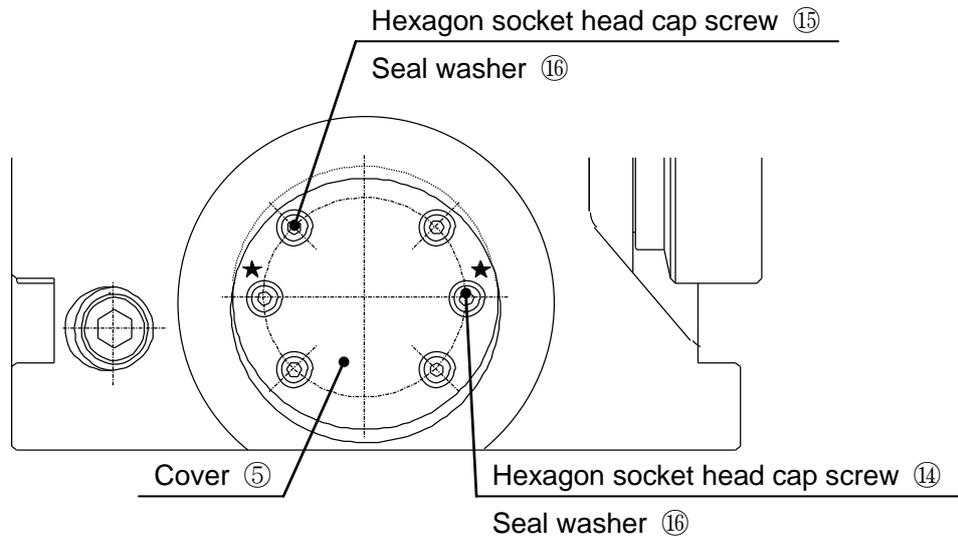
MODEL	GT(M)200	GT(M)250	GT(M)320
Amount of face plate O.D. ( $\mu$ m)	About 46	About 46	About 44

After adjusting, reassemble the worm gears by the reverse procedure of the above and securely tighten the bolts. (Tightening torque of hexagon socket head cap screws ⑨: 3.4 N·m)

After reassembling, measure the backlash again at outside periphery of the table and at the same position. Check that the backlash is proper. If the backlash is inadequate, adjust it again by the above method.



**Fig.6**



**Fig.7 (Only GT(M)200)**

## 11. ZRN (Zero Return ) device

\*\*\*\*\*

The contents of this item are unnecessary for the NC rotary table of Kitagawa's controller spec. and 4th axis spec. which don't have a dog for ZRN deceleration.

Machine zero position of this unit which set at shipment from factory is memorized due to the specification of servo motor with absolute encoder. Accordingly this unit does not have machine zero position device like as proximity SW and Dog.

When changing machine zero position, instruction manual of controller (article for setting of machine zero position) would be referred.

\*\*\*\*\*

### 11-1. ZRN device on table

The ZRN device rotates clockwise (CW) on the standard specification.

The table datum groove comes to position at a right angle to the motor when connected to the NC unit. The dog, which activates the table speed reduction, is located inside the unit. The ZRN deceleration dog is mounted in the table and it can be mounted on the optional position of outer periphery. When shipping a product, the flank of the guide block fitted on the table has been positioned parallel to the reference plane for vertical installation. Fine adjustment of the ZRN position may be required at the customer at the time of interface with the NC controller of the machine.

### 11-2. ZRN device Adjustment (See Fig.8)

When the zero position is changed or when the rotation direction for return is changed to counterclockwise, adjust the ZRN position through the following procedures.

- 1) Remove the flange plug ① located on the top surface of the NC Rotary Table.
- 2) Rotate the table and, thorough the hole made by removing the hexagon socket flange head screw plug ①, loosen the hexagon socket headless set screw M3 ② that fixes the dog ③ to the main shaft of the Rotary Table.
- 3) Move the dog ③ to an appropriate position.
- 4) Upon the completion of the position adjustment, securely fasten the hexagon socket headless set screw ②. Also, securely fasten the hexagon socket headless set screw ①.

### 11-3. Sensor Mechanism

#### 1) Proximity Switch (See Fig.8)

The gap between the dog ③ and the proximity switch ④ should be adjusted to approximately 0.75mm by the 1.00mm pitch thread provided on the proximity switch ④.

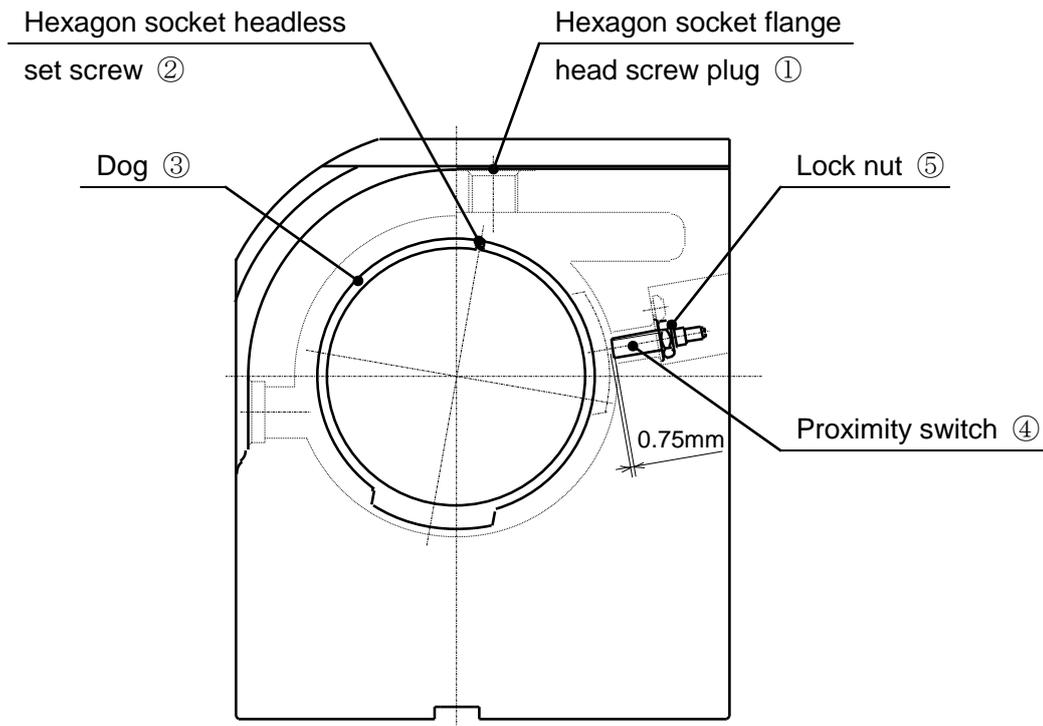


Fig.8

## 12. Motor Cover

### 12-1. To remove motor case

Please follow the procedure below for removing the motor cover. (See Fig.9)

- 1) Remove hexagon socket head cap screws ⑪ jointing the motor case ① and base ⑩.  
At this time, remove the motor case ① slowly, lifting it. Remove the motor carefully so that an unreasonable load is not applied because cables, air hose, etc. are connected into the motor case.
- 2) Remove air hose and wiring from the canon connector of motor.

### 12-2. Countermeasures for waterproofing

In order to prevent the entering of coolant from the outside, O-ring ④ is used at the portion of connection between motor case ① and the body.

#### NOTICE

For detaching the motor, remove either of the hexagon socket headless tapered pipe plug, ⑤ or ⑥, and loosen the hexagon socket head cap screw ⑦ on the coupling ⑧ which connects the worm shaft ⑨ and the motor ②.

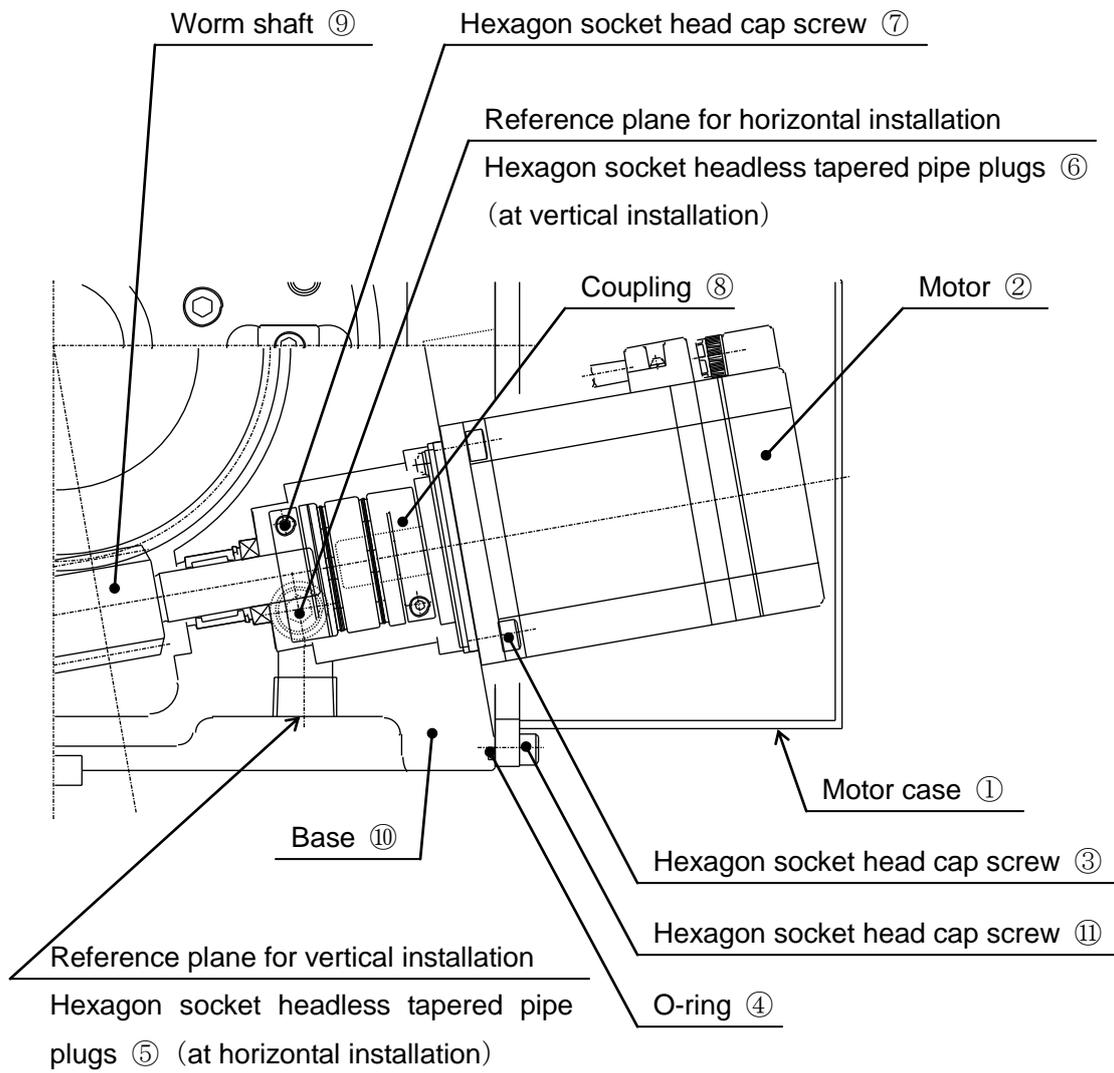
Then, remove the four hexagon socket head cap screws ③ which secure the motor ② in order to detach the motor. When re-installing the motor ②, be sure to securely tighten the bolts and plugs.

#### NOTICE

When the motor case ① is re-installed, be careful not to damage the O-ring. The damaged O-ring may allow the cutting water to enter the motor case.

#### NOTICE

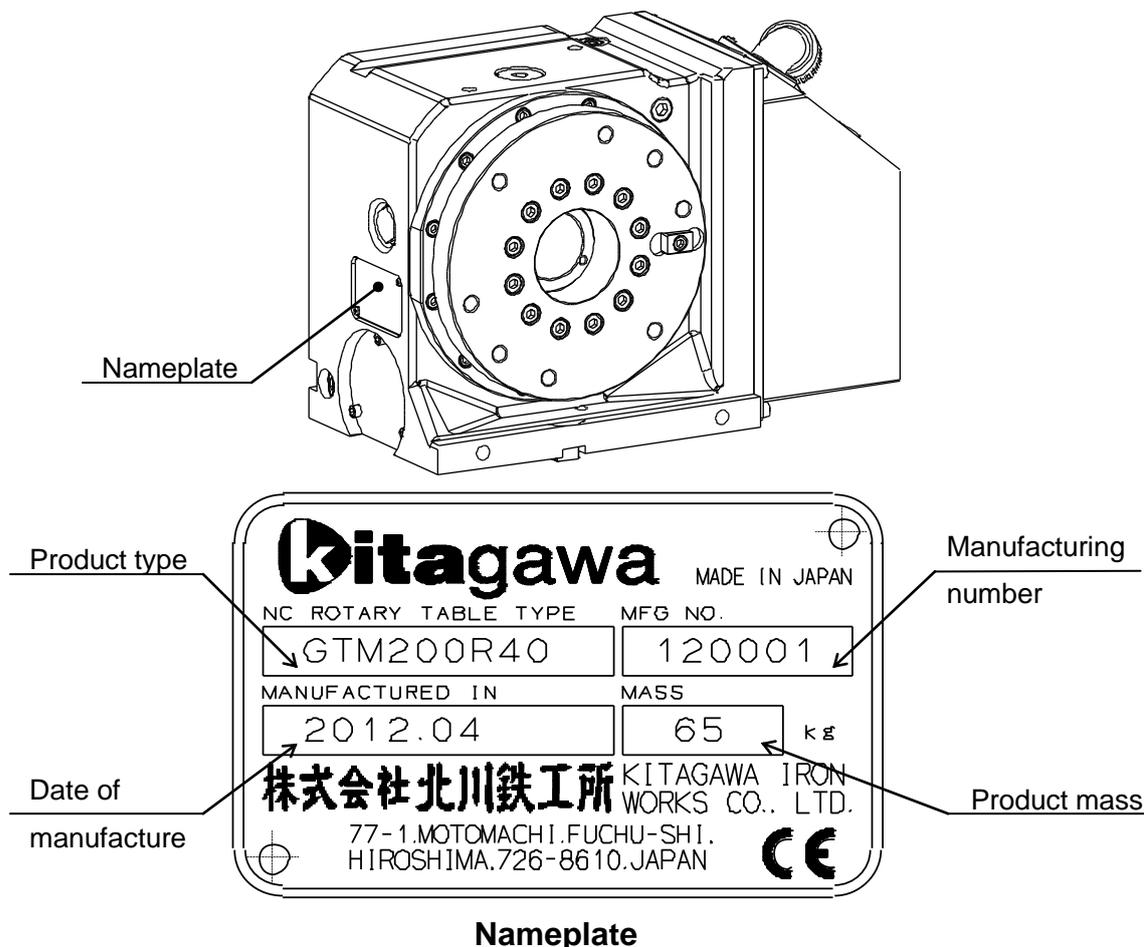
When the motor case ① is re-installed, be careful not to damage the O-ring ④. The damaged O-ring may allow the cutting water to enter the motor case.



**Fig.9**

### 13. Troubleshooting

Check corresponding item given in this chapter to take corrective actions when the unit seems to be faulty. If the fault persists, please contact your sales agent (M/C maker) or us. When making an inquiry, let us know the product type and manufacturing number marked on the nameplate of the NC rotary table body.



Symptom ①: Table does not rotate

Possible causes	Corrective actions
No cable connection between NC rotary table and control unit	Check the cable for connection, and connect it
Broken cable between NC rotary table and control unit	Check the cable for continuity, and replace it
Faulty clamp device	See "Symptom ⑤"
Decentered workpiece, overloaded fixture, and friction torque of steady rest and rotary joint make the load torque larger than the motor torque	Compare the specification of NC rotary table with the work condition to make improvement
Use of unit out of specified temperature range	Adjust ambient temperature within specified temperature range

Symptom ②: Table does not rotate but generates a noise

Possible causes	Corrective actions
Motor makes a howling sound to try to rotate →Seizure of gears due to lack or deterioration of lubricating oil	Stop the use of NC rotary table immediately. Please contact the sales agent.
Gears generate a noise → Faulty rotation due to damaged gears	Stop the use of NC rotary table immediately. Please contact the sales agent.
Unit generates a noise at startup and stops soon →Faulty rotation because foreign substances mix in the oil bath	Supply lubricating oil until foreign substances come out of the drain port.

Symptom ③: Table does not rotate smoothly but generates a noise

Possible causes	Corrective actions
Noise is generated repeatedly during rotation →Gears are damaged	Stop the use of NC rotary table immediately. Please contact the sales agent.
→Faulty rotation of gears because foreign substances mix in the oil bath	Open the lubricating oil drain port, and supply lubricating oil until foreign substances come out of the drain port.
Load due to overloading exceeds motor output	Compare the specification of NC rotary table with the work condition to make improvement
Lack or deterioration of lubricating oil blocks smooth rotation	Check oil level, viscosity and change interval of lubricating oil
Faulty clamp device	See "Symptom ⑤"
Inappropriate backlash amount	Adjust backlash amount to appropriate value

Symptom ④: Chattering occurs during cutting

Possible causes	Corrective actions
Inappropriate clamp condition of NC rotary table or fixture	Check the clamp condition, and correct it
Excess cutting force is applied during cutting	Adjust cutting condition to the specified condition to change the cutting force to appropriate value
Faulty clamp device	See "Symptom ⑤"
Faulty locking of worm spindle in the backlash adjustment	Readjust
Fault due to damaged NC rotary table or expired life of components	Stop the use of NC rotary table immediately. Please contact the sales agent.
Fault occurs only during continuous cutting →Lack or deterioration of lubricating oil blocks smooth rotation →Inappropriate backlash amount	Check oil level, viscosity and date of last change of lubricating oil Adjust backlash amount to appropriate value
Chips accumulate in rotary part of NC rotary table	Remove accumulated chips in daily inspection

Symptom ⑤: Table is not clamped or unclamped

Possible causes	Corrective actions
Faulty solenoid valve	Replace the solenoid valve
Faulty clamp/unclamp confirming device (pressure switch)	Check and replace the clamp/unclamp confirming device (pressure switch)
Damage or connection failure of working fluid pipe for clamp	Check the piping for connection, and replace
Supply pressure of working fluid for clamp is lower than specified value	Change to appropriate value according to the specification
Back pressure acts to the air pressure exhaust port of solenoid valve, as the air purge port in the motor case is blocked.	Remove the cause that blocks the air purge port.
Faulty clamp device	Stop the use of NC rotary table immediately. Please contact the sales agent.
Fault due to damaged NC rotary table or expired life of components	Stop the use of NC rotary table immediately. Please contact the sales agent.
Air is sealed in by the check valve (GT only)	See "Manual clamp release method" (GT only)

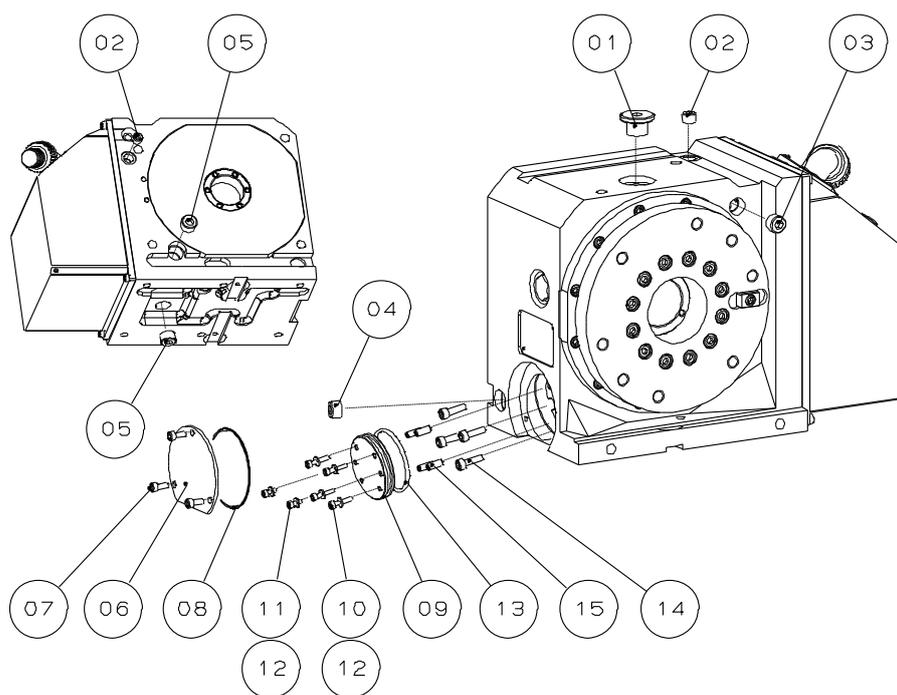
Symptom ⑥: Index accuracy error

Possible causes	Corrective actions
The unit is overloaded during rotation	Compare NC rotary table specification with work condition to make improvement
Workpiece is dislocated due to low clamp torque	Compare NC rotary table specification with cutting condition to make improvement
Zero return position is dislocated due to faulty zero point shift adjustment	Check the zero point and zero point shift amount
Faulty zero point dog position adjustment	Adjust the zero point dog
Faulty zero return deceleration signal device	Check the zero return deceleration signal device and replace the proximity switch
Faulty clamp operation	See "Symptom ⑤"
Inappropriate backlash amount	Adjust the backlash
Inappropriate backlash compensation amount	Change the backlash compensation amount
Worm shaft locking failure in backlash adjustment	Readjust
Fault due to damaged NC rotary table or expired life of components	Stop the use of NC rotary table immediately. Please contact the sales agent.

## 14. Parts List

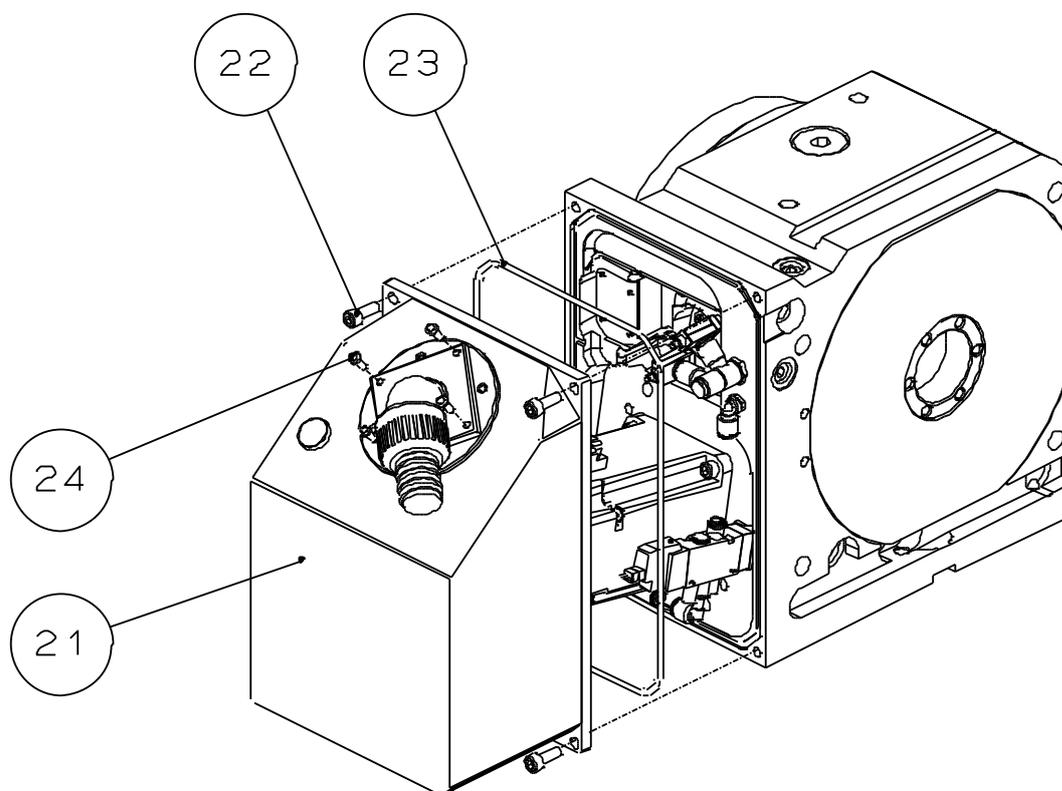
○Main Body

MARK	NAME	GT(M)200	GT(M)250	GT(M)320	Q'ty	Recital
01	Hexagon socket flange head screw plug with O-Ring	M20×1.5			1	Gosho
02	Hexagon socket headless tapered pipe plug with seal	Rc 1/4			2	
03	Hexagon socket headless tapered pipe plug with seal	Rc 3/8			1	
04	Hexagon socket headless tapered pipe plug with seal	Rc 3/8		M20×1.5	1	Gosho
05	Hexagon socket headless tapered pipe plug with seal	Rc 1/2		Rc 3/4	2	
06	Cover "A"				1	
07	Hexagon socket head cap screw for cover "A"	M5×12 (3)	SSH-M5×12 (3)	M5×10 (4)	(*)	
08	O-Ring	—	S90		1	
09	Cover "B"				1	
10	Hexagon socket head cap screw for cover "B"	M4×20	—		4	
11	Hexagon socket head cap screw for cover "B"	M4×10	—		2	
12	Seal washer	4S1	—		6	NDK
13	O-Ring	G55	—		1	
14	Hexagon socket head cap screw for bearing case	M6×20	M6×25		4	
15	Hexagon socket headless set screw (Flat Point)	M6×16			4	



○Motor Case (For M Signal)

MARK	NAME	GT(M)200	GT(M)250	GT(M)320	Q'ty	Recital
21	Motor case				1	
22	Hexagon socket head cap screw for motor case	M6×16 (4)		M6×16 (4)	(*)	
23	O-Ring	GS230	GS260	GS295	1	
24	Machine screw for cable	M4×10			4	

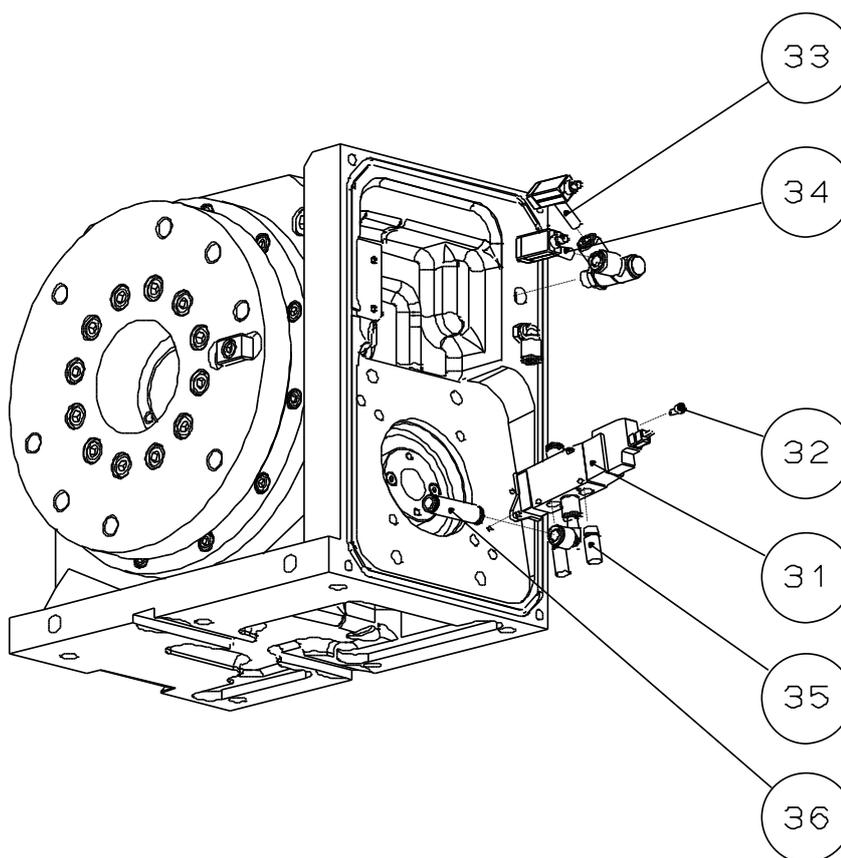


When the specification is 4th axis, the motor case and the cable are different from the above figure.

For detailed models, refer to attached outside view.

○Clamp Detection Device

MARK	NAME	GT(M)200	GT(M)250	GT(M)320	Q'ty	Recital
31	Solenoid valve	VQZ2921B-5L1-C6-F-Q			1	DC24V: SMC
32	Hexagon socket head cap screw for solenoid valve	M3×6			2	
33	Pressure switch for clamp detection	PS1000-R06L-Q-X140			1	SMC
34	Pressure switch for unclamp detection	PS1100-R06L-Q-X141			1	SMC
35	Silencer	EBKY-L4001			2	SMC
36	Check valve	AKH06A-X433			1	SMC

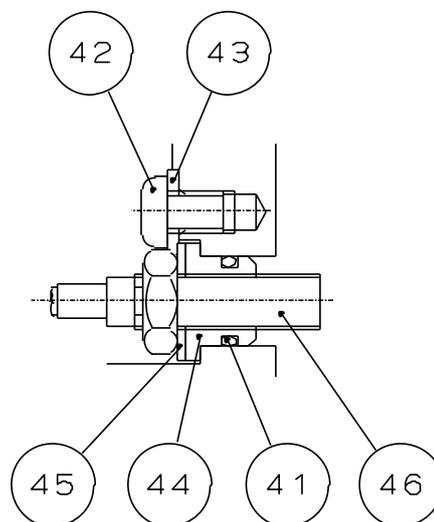
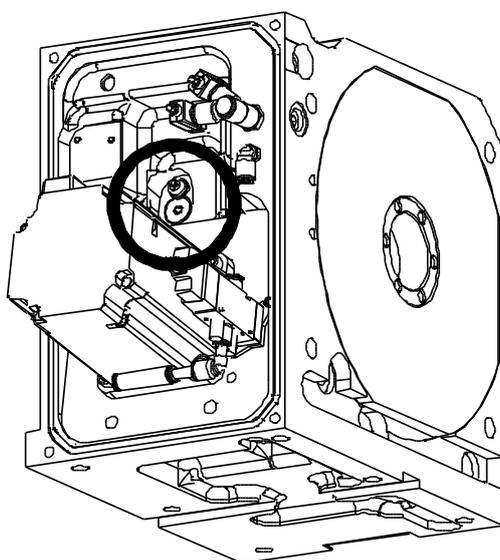


When the specification is different, the model and the installation position of the solenoid valve and the pressure switch are different from the above figure.

For detailed models, refer to attached wiring diagram.

○Built-in ZRN (Zero Return) Device

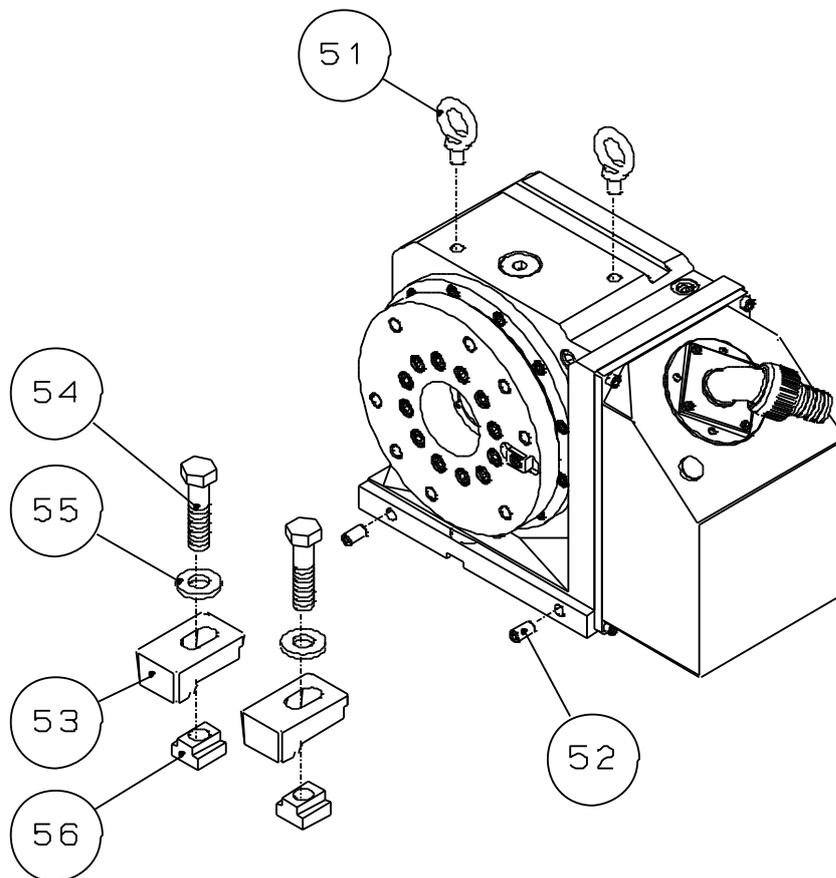
MARK	NAME	GT(M)200	GT(M)250	GT(M)320	Q'ty	Recital
41	O-Ring	P10			1	
42	Machine screw for cover	M6×8			1	
43	Washer				1	
44	Holder for Proximity switch				1	
45	Seal washer	DT-1-8			1	Mitsubishi Cable
46	Proximity switch	FL7M-2K6H			1	Yamatake



No proximity switch is provided for the M signal type.

○Accessory

MARK	NAME	GT(M)200	GT(M)250	GT(M)320	Q'ty	Recital
51	Eye bolt	M10		M12	3	
52	Hexagon socket headless set screw	M10		M12	2	
53	Clamp				4	
54	Hexagon head bolt for clamp	M16×65		M16×75	4	Strength Dimension :10.9
55	Washer	16			4	
56	T-slot nut				4	



When the specification is different, the clamping parts and guide block are different from the above figure. For detailed models, refer to attached outside view.

## 15. Storage

### NOTICE

When removing the unit from the machine table, apply oil to prevent rust and store it on a stable wooden stand or in the original crate with the appropriate cover to protect it from dust and maintain its accuracy.

Some raw wood is chemically unstable and may cause rust on the unit.

## 16. Disposal of NC Rotary Table

Dispose of this unit in accordance with the laws and regulations of your country.

You may suffer punishment if you disposed of this unit without following the laws and regulations.

## 17. Conversion of Arc Length and Angle

### NOTICE

“What is the linear length at the table circumference with 20 seconds cumulative indexing accuracy ?”

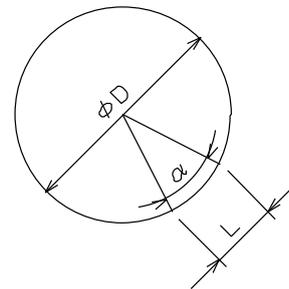
“What is the angle with a cumulative pitch error of 0.01mm ?”

To answer these questions, use the following formula representing the relationship between the angle and linear length at the table circumference.

D: Diameter of Workpiece (mm)

$\alpha$  : Angle (seconds)

L: Linear length at the table circumference (mm)



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

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

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

(Examples)

Assuming the diameter of the workpiece is 100mm, and by using formula (2), the cumulative indexing accuracy of 20 seconds as linear length at table circumference will be :

$$L = 2.424 \times 20 \times 100 \times 10^{-6} = 0.004848mm$$

Therefore, the length is approximately 0.0048mm.

And converting the cumulative pitch error of 0.01mm to an angle, use formula (3) :

$$\alpha = \frac{4.125 \times 0.01 \times 10^5}{100} = 41.25''$$

Therefore, the angle is approximately 41 seconds.

Thus, by using the formula (2) and (3), the indexing precision and pitch error can be converted in terms of linear length and angle.

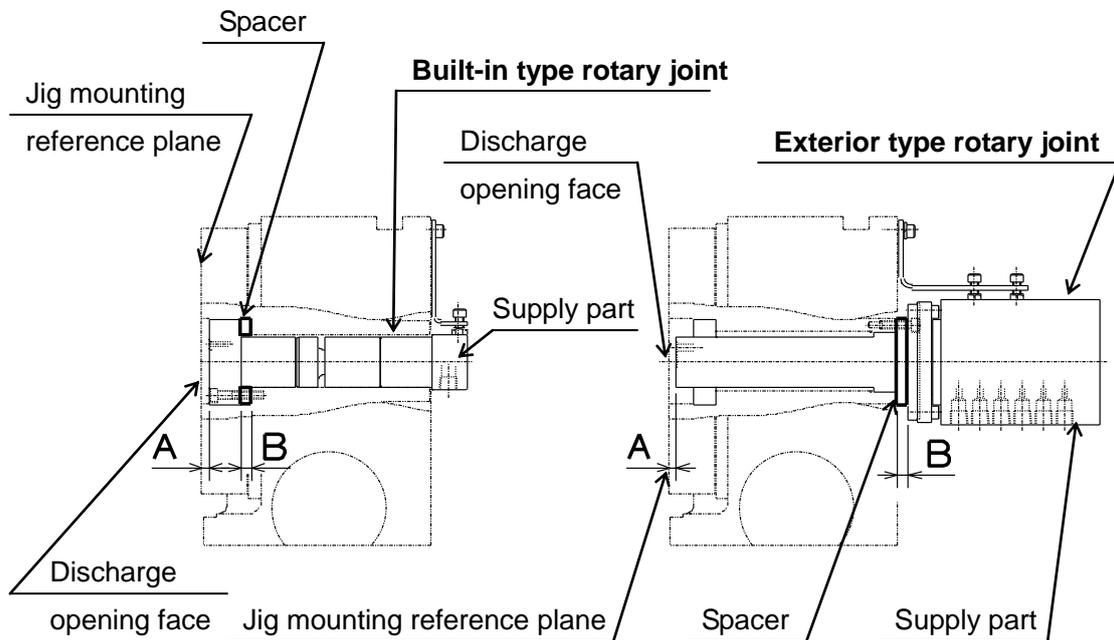
## 18. Mounting Rotary Joint (Option)

### 18-1. Alignment of discharge opening face

To mount the rotary joint, the rotary joint discharge opening face must be aligned with the jig mounting reference plane so that hydraulic oil does not leak to the jig (A-size in the following figure).

To align the position of the rotary joint discharge opening face, the thickness of the spacer attached to the rotary joint must be adjusted (B-size in the following figure).

When the rotary joint is mounted additionally or a set of rotary joint parts is replaced, check the product type and manufacturing number, and contact Kitagawa branch or your agent.



### 18-2. Pining to supply part

To route the pipe to the supply part of the rotary joint, determine a hose length so that the hose will not be moved by the movement of a table for a mounted machine.

Moreover, when turning a joint screw, use the tightening tool carefully so that unreasonable force will not be applied to the supply part.



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