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 massages 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.

⚠ **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.**
NOTICE	**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:

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

CONTENTS

1. For Your Safety

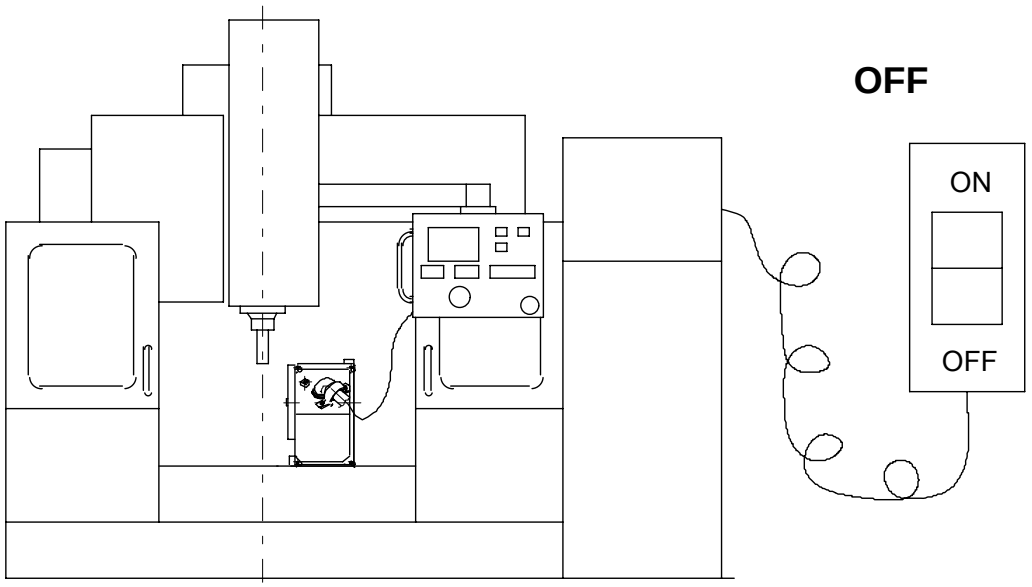
Basic Safety Tips

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.

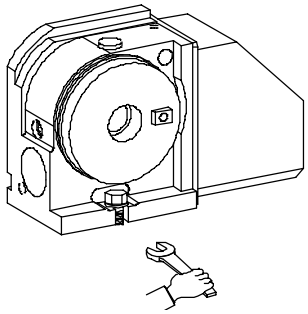
DANGER

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.



WARNING

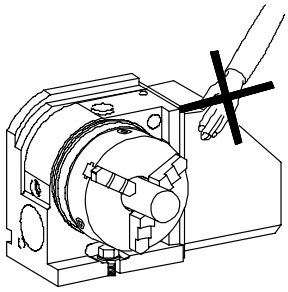
Tighten the bolts securely when mounting the unit on the machine table.



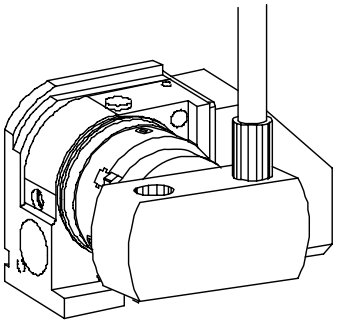
Please refer to the chart below for the recommended tightening torque of the bolts.

Hex. Bolt Size	Torque N·m
M10	33.8
M12	58.9
M16	146.3
M20	294.3

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.

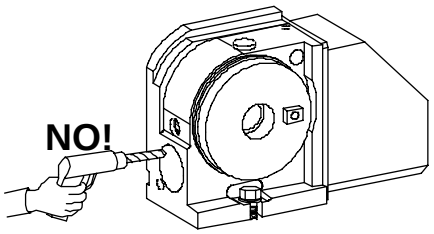


Do not apply cutting force which exceeds the specification in this manual. Failure to do so may cause severe injury and/or damage to the unit.



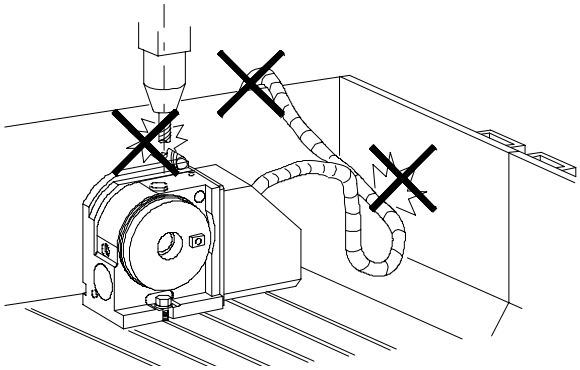
WARNING

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

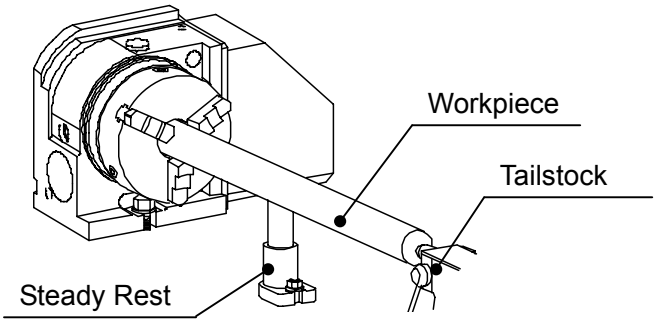


Maintain adequate clearance between the unit and any part of the machine.

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

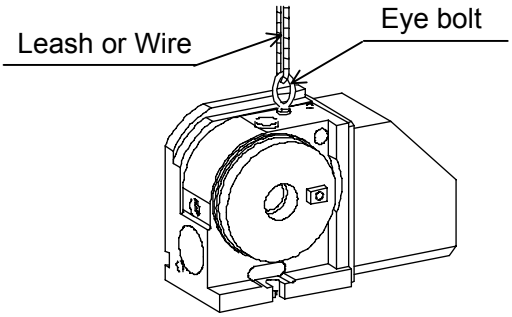


Use a support, steady rest, or tailstock for heavy or long workpieces to prevent any injury and/or accident.

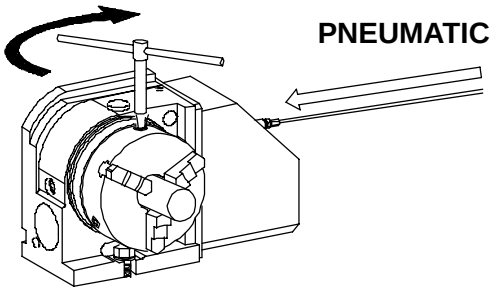


CAUTION

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

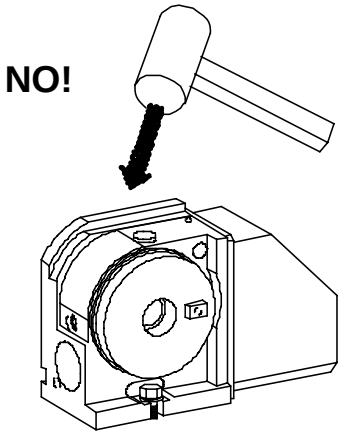


Mount or dismount the workpiece to or from the unit while the unit is clamped to avoid damage to the internal mechanism and diminished indexing accuracy of the unit.



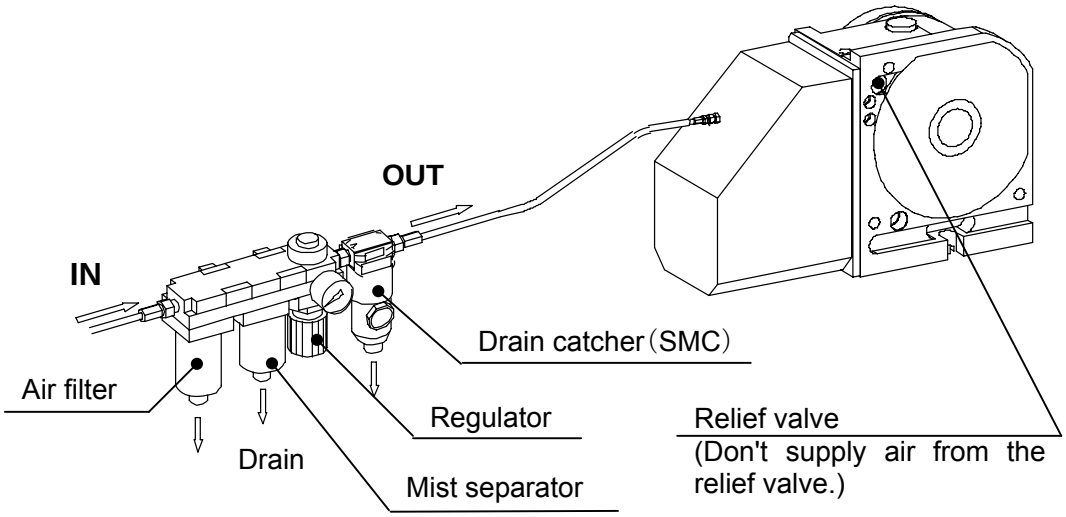
CAUTION

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



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

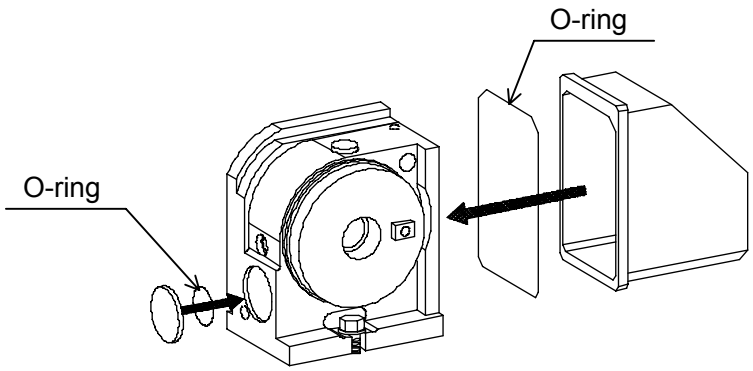
Apply air purge inside the motor case
and be sure to provide dry air.



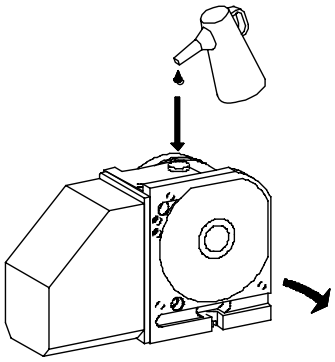
Periodically drain the water in air filter. (It is recommended to use the auto drain type.)

NOTICE

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



Replace lubricating oil every 6 months.



2. Specifications

NC Rotary Table is dividing unit for the workpiece, usually operating machines.

［ Machining Center,（NC）milling machine, （NC）drilling machine, etc. ］

Specifications are as below.

	ITEM / MODEL		MR162	MR202
1	Table Diameter	mm	ϕ 165	ϕ 200
2	Center Height in Vertical	mm	140	
3	Center Hole Diameter	mm	ϕ 50	
4	Thru. Hole Diameter	mm	ϕ 40	
5	T-slot width	mm	12h7	
6	Clamping Torque ［Pneumatics 0.5MPa］	N･m	310	
7	Allowable Workpiece Dia.	mm	ϕ 200	
8	Allowable Massof Workpiece	(Vertical) kg	80	
9	Allowable Work Inertia	$kg \cdot m^2$	0.51	
10	Total Reduction Ratio		1/72	
11	Max. Rotation Speed	min^{-1}	41.6	
12	Mass of Rotary Table	kg	45	
13	Operating temperature range	°C	5～40	
14	Operating humidity range	%	30～95	
15	Operating altitude range (above sea level)	m	1000 or lower	
16	Storage temperature range	°C	-10～60	
17	Environmental pollution degree		Degree 3	
18	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-mentioned list shows the value in standard specification. Please refer to the outside view for details.

NOTICE

Table clamping torque is measured at 0.5MPa pneumatic pressure. Max. Rotation Speed is at 3000 min^{-1}(rpm) of the motor rotation.

⚠ 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.

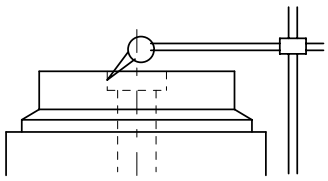
3. Accuracies

Guaranteed Accuracies

(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

1



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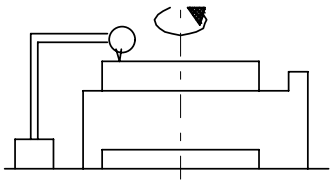

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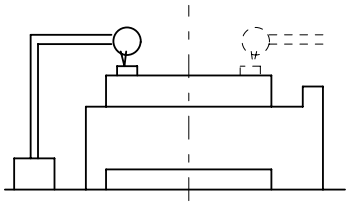

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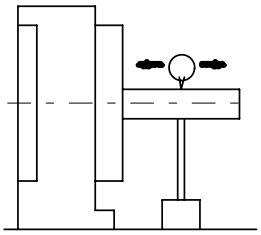

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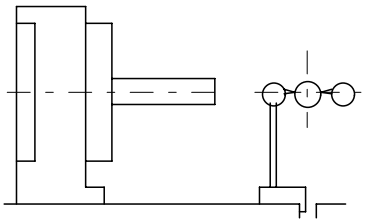


6,7 Index accuracy is measured with the optical device.

4. Preparation

Unpack the unit and remove the packing material.

4-1. Installation

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 unit thoroughly with an adequate clean agent. When installing the unit on the machine table, make sure there is no foreign material nor damage such as nicks and burrs on the mating faces. Use an oil stone for correction if necessary.
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) Firmly clamp down the unit to the machine with the furnished clamping fixtures.

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.

Apply the clamping fixtures to the step of the unit provided, and clamp the bolts with the specified torque.

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.

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.

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.

When the unit is installed on the machine, ensure to avoid any interferences with any part of the machine. Especially when the machine has a capability of X-Y-Z axis movement of the spindle head or the machine bed, the interference must be checked carefully before starting the operation.

4-2. Lubrication

Change the lubricating oil every 6 months. Be sure to drain all oil from the unit first. When pouring oil into the unit, make sure to clean the area around the lubrication port so that no foreign material will enter the system. It may cause severe damage to the internal mechanism. Use recommended oil shown 4-4.

4-3. Required Oil Quantity

(Unit : liter)

MODEL	MR162	MR202
QTY.(l) at Vertical installation	0.4	0.4

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

4-4. Recommended Lubricating Oil

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

・Grade of Viscosity : ISO VG32

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)

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 and Unclamp

7-1. General Instruction

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.

If some excessive pressures remain when it is unclamped, the unit is operating under a half-clamp situation. This may cause severe damage to the internal mechanism.

7-2. Inlet Pressure for Table 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 0.45 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. Confirmation of Clamp and 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.

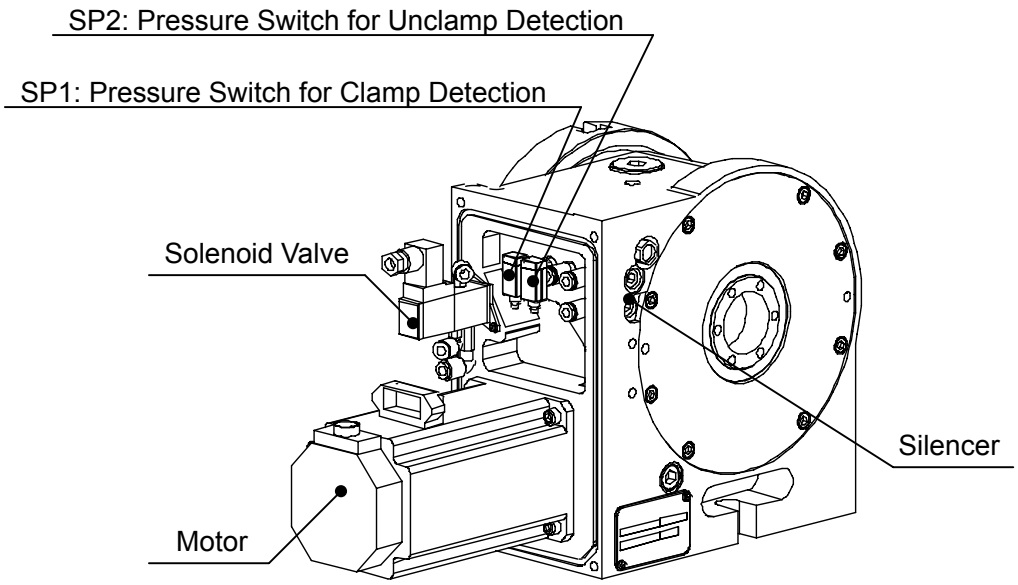


Fig.1

7-5. Solenoid Valve for Clamp and 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.

8. Mounting the Workpiece

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.

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.

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. Adjustment of Backlash between Worm Wheel and Worm Gear

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.

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	MR162	MR202
Circular arc length at peripheral table position（μm）	13～33	16～40
Converted angle	33～82	33～82

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

10-1. Measuring the Backlash of the Worm Gear [See Fig.2]

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.2. 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	MR162	MR202
Torque added to table T（N･m）	15	

3) The above measurements should be conducted at eight different points by rotating the table 45 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×L　　T: Torque (N･m)

F: Effort force (N)

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

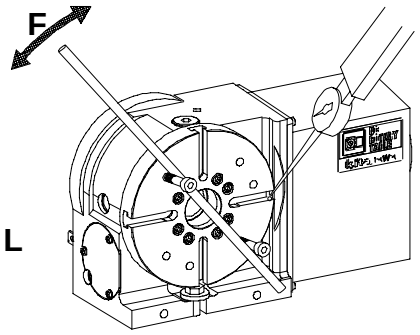


Fig.2

10-2. Adjusting the Backlash of the Worm Gear [See Fig.3]

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.

1) Drain lubrication oil from the lubrication oil outlet ①
2) Remove the cover ③ on the opposite side of the motor case ②
3) Remove the sealing hexagon socket head taper screw plug ④
4) The coupling ⑤ can be seen from the hole with the sealing hexagon socket head taper screw plug ④ removed. Turn the worm shaft □ to the position where the coupling fixing hexagon socket head cap screw ⑥ can be seen. Use the hexagonal hole on the shaft end face to turn the worm shaft.
5) After turning the worm shaft ⑦ to the position where the coupling fixing hexagon socket head cap screw ⑥ can be seen, loosen the hexagon socket head cap screw ⑥ slightly.
6) Loosen the hexagon socket head cap screw ⑨ fixing the bearing case ⑧. Then, slightly loosen the four adjusting screws ⑩ evenly. Adjust the loosening amount by referring to the following table. If the hexagon socket head cap screw ⑨ is retightened with the adjusting screws ⑩ loosened, the bearing case ⑧ moves forward to the motor side and the backlash of the worm shaft ⑦ is reduced.

NOTICE

Since the pitch of the adjustment screw ⑩ is set to 1.0 mm, loosening the screw by one rotation will makes the backlash smaller as shown in the following table.

MODEL	MR162	MR202
Circular arc length at peripheral table position (μ m)	About 48	About 58

When finishing the adjustment, reassemble the table in reverse steps as the above and tighten bolts securely. (Tightening torque of hexagon socket head cap screws ⑥ : 3.4 N･m)

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

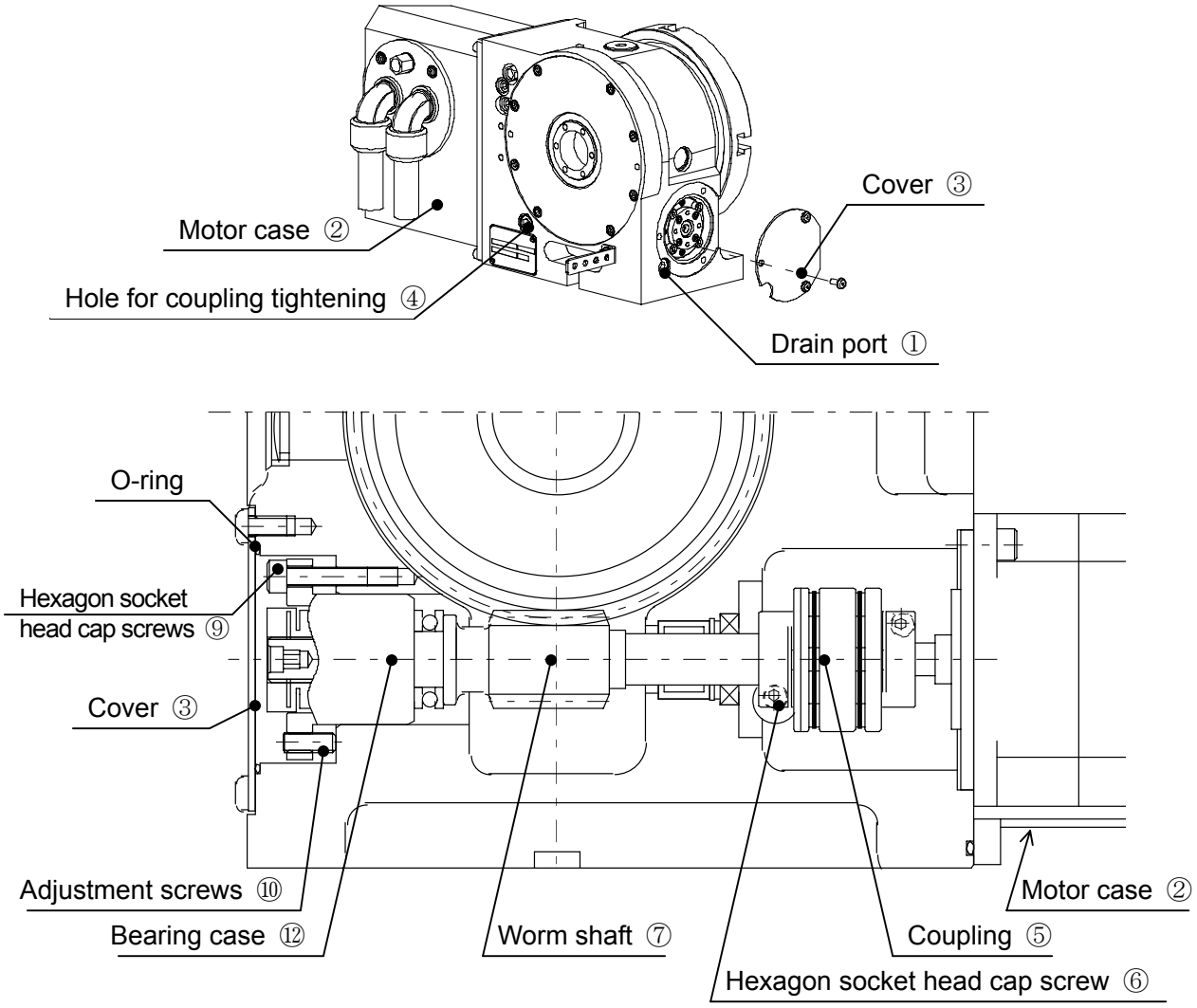


Fig.3

11. Machine zero point setting

It is necessary to set an arbitrary position as the machine zero point when installing the rotary table for the proper use. This operation is called "machine zero point setting".

This rotary table does not contain a mechanical zero point return deceleration dog. Since this rotary table is equipped with a motor with an absolute encoder, the machine zero point must be set on the CNC of the machine on which the rotary table is installed. When setting the machine zero point, move the NC rotary table to the position where the machine zero point will be set. Then set the position as the machine zero point using the CNC parameters. For the machine zero point setting procedure using the parameters, refer to the instruction manual for the machine on which the rotary table is installed.

NOTICE

Basically, machine zero point should be set at the installation of the NC rotary table. So it does not need to be set under normal conditions of use. However, it must be reset in the following cases.

- ◆When the encoder cable of the rotary table is removed from the machine
- ◆When the encoder backup battery on the machine side runs down
- ◆When the servo motor, encoder, or encoder cable is replaced or repaired

12. The notes of replace

O-rings are used on the mounting surface of the motor case to prevent cutting fluid from entering from outside. Sealing washers are used on the threaded portions where cutting fluid may enter, and sealing hexagon socket head taper screw plugs are used on the taper screw holes.

NOTICE

O-rings, sealing washers, and plugs are consumables. Replace them to ensure sealing quality as necessary when reassembling them.

12-1. Removing / installing cables

Use the following procedure to replace the cables.

12-1-1. Removing cables

1) Remove the motor case side cover ①.
2) Remove the connector plate ② on which the cables are mounted, and remove the tube ③ connected inside. Disconnect the tubes according to section 12-3.
3) Pull out the internal wiring of the cable, and disconnect the connectors connected to the electrical parts. Disconnect the connectors according to section 12-4.
4) Disconnect the connector connected to the motor from the hole on the side of the motor case.

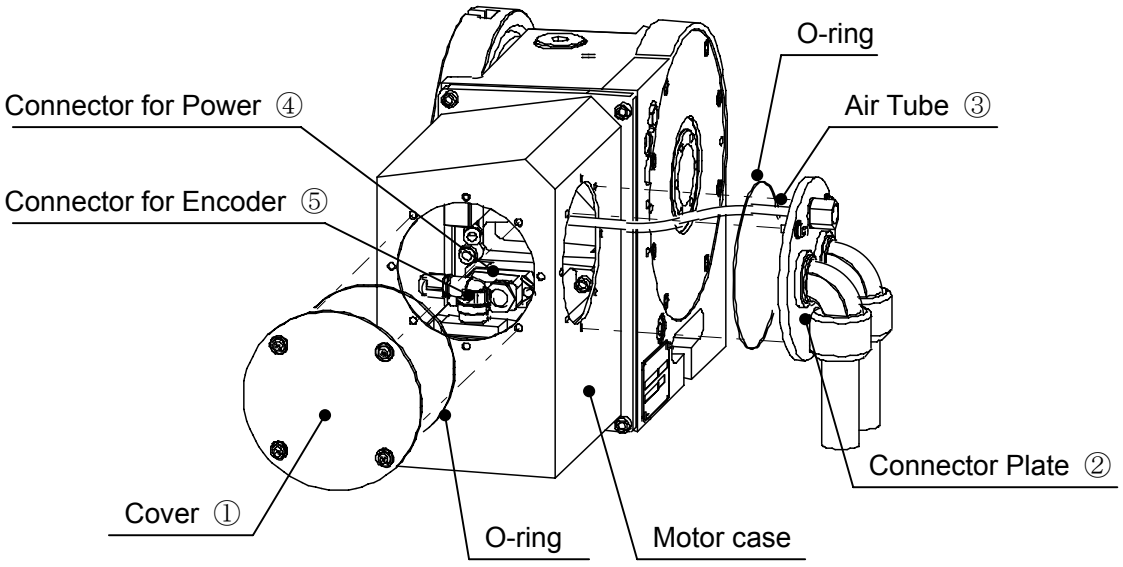


Fig.4

12-1-2. Installing cables

Reinstall the cables in the reverse order of the above procedure after replacing the parts. Install the tubes according to section 12-3. Connect the connectors according to section 12-4. Securely connect the connectors to avoid contact failure of the pins. Install the cables and tubes so that they are not bent or crushed.

Be careful not to damage the O-rings when reinstalling the cables. If the O-rings are damaged, cutting fluid may enter.

12-2. Removing / installing motor case (motor)

Use the following procedure to remove the motor case (motor) when replacing the electrical parts.

12-2-1. Removing motor case

1) Remove the hexagon socket head cap screw ① fixed to the base, and slide the motor case ② gradually to the position where the internal wiring and so on can be confirmed.
2) After disconnecting the connectors of the electrical parts and the air tube, remove the motor case ②. Disconnect the tubes according to section 12-3. Disconnect the connectors according to section 12-4.

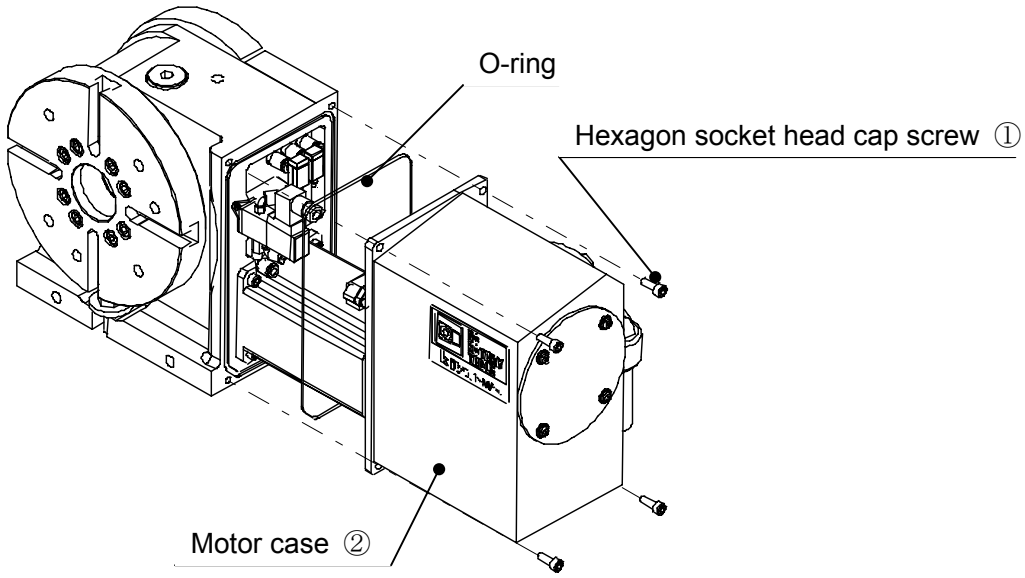


Fig.5

12-2-2. Installing motor case

Reinstall the motor case in the reverse order of the above procedure after replacing the parts. Install the tubes according to section 12-3. Connect the connectors according to section 14-4. Securely connect the connectors to avoid contact failure of the pins. Install the cables and tubes so that they are not bent or crushed.

CAUTION

Be careful not to damage the O-rings when reinstalling the cables. If the O-rings are damaged, cutting fluid may enter.

12-2-3. Removing motor

Use the following procedure to replace the motor.

1) Remove the sealing hexagon socket head taper screw plug ①
2) The coupling ② can be seen from the hole with the sealing hexagon socket head taper screw plug ① removed. Turn the worm shaft ④ to the position where the coupling fixing hexagon socket head cap screw ③ can be seen. Use the hexagonal hole on the shaft end face to turn the worm shaft manually. (Refer to section 9-2.)
3) After turning the worm shaft ④ to the position where the coupling fixing hexagon socket head cap screw ③ can be seen, loosen the hexagon socket head cap screw ③ slightly.
4) Remove the hexagon socket head cap screw ⑥ fixing the motor ⑤, and remove the motor ⑤.
5) Measure the position of the coupling using the following procedure. (See Fig.11-3-B)
6) Loosen the coupling fixing hexagon socket head cap screw ⑦, then remove the coupling ②.

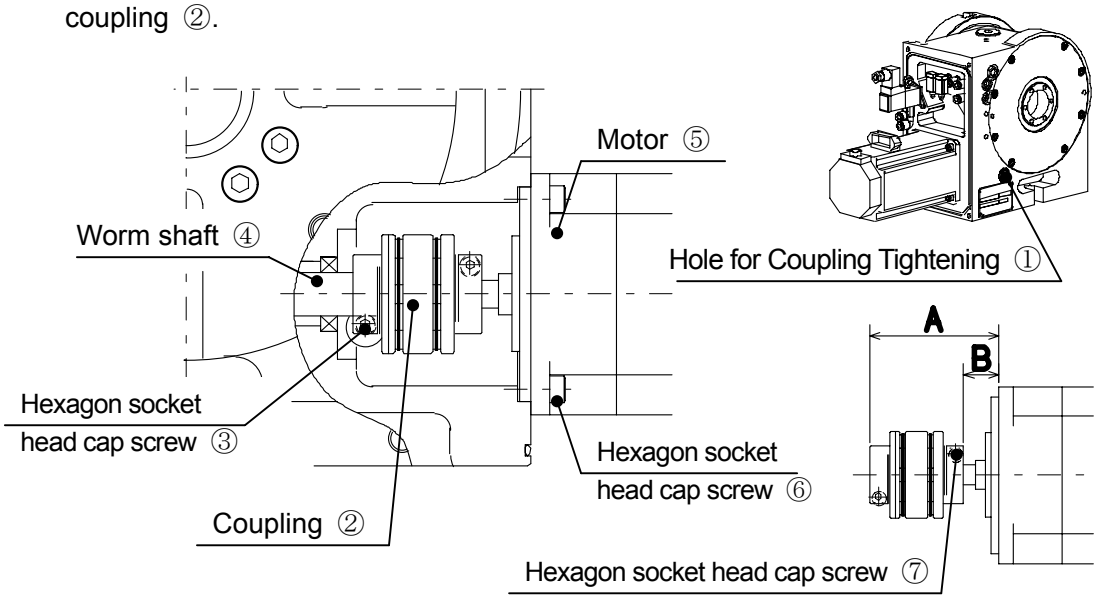


Fig.6

12-2-4. Installing motor

1) Align the coupling ⑥ to the position measured above, and tighten the coupling fixing hexagon socket head cap screw ⑦. For the tightening torque, refer below. (Tightening torque of hexagon socket head cap screws ⑦ : 3.4 N･m)
2) Reinstall the motor in the reverse order of the above procedure after replacing the parts.

NOTICE

Pay attention to the installation position and tightening torque when installing the coupling ⑥ to avoid damage to the sealing of the shaft and the coupling body.

12-3. Removing / installing piping

Use the following procedure to remove the tubes when removing/installing the motor case and so on.

12-3-1. Removing piping

1) Push the release bushing ① of the piping joint evenly into the direction of arrow with your fingers.
2) Pull out the tube ② while holding the release bushing ① to prevent it from being pushed back.

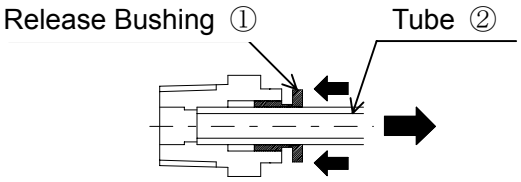


Fig.7

CAUTION

Do not pull out the tube with air pressure supplied .

NOTICE

If the release bushing is not pressed sufficiently, the tube digs into further and becomes hard to be pulled out.
When reusing the removed tube, cut off the portion where the tube digs into. Using the portion where the tube digs into may cause air leakage and makes it difficult to remove the tube.

12-3-2. Installing piping

1) Insert the tube ② gradually, and securely push it in to the tube end.
2) After inserting the tube ② to the end, pull it lightly to check that it is not pulled out.
3) Check that the tube is not bent or crushed when installing it.

NOTICE

If the release bushing is not pressed sufficiently, the tube digs into further and becomes hard to be pulled out.
When reusing the removed tube, cut off the portion where the tube digs into. Using the portion where the tube digs into may cause air leakage and makes it difficult to remove the tube.

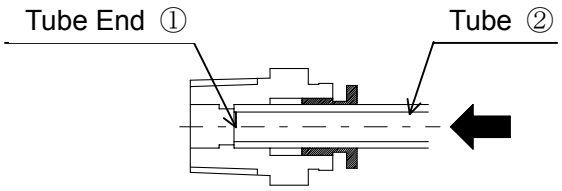


Fig.8

12-4. Removing / installing Connector

When removing connectors (made by MOLEX) such as proximity switches, etc., unavoidably in motor case removing, the following procedure is recommended.

12-4-1. Removing connector

1) Pushing the claw ③ of receptacle housing, remove the plug housing ① and receptacle housing ②.

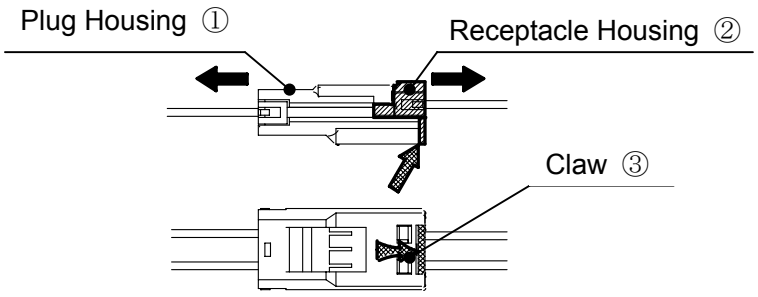


Fig.9

12-4-2. Installing connector

1) Mate the plug housing ① to the receptacle housing ② as shown in the following figure.
2) Insert the receptacle housing ② into the plug housing ① securely until a clicking noise occurs.
3) After mounting, pull the receptacle housing ② slightly and check that it does not draw out.

CAUTION

Check that connectors and cables are not damaged before connecting.
Connect cables so as not to be bent or crushed.
Do not apply any load to cables.

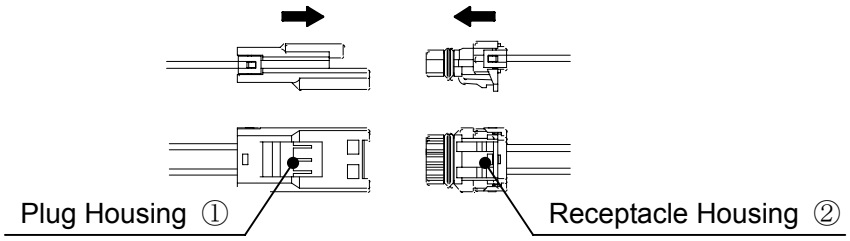
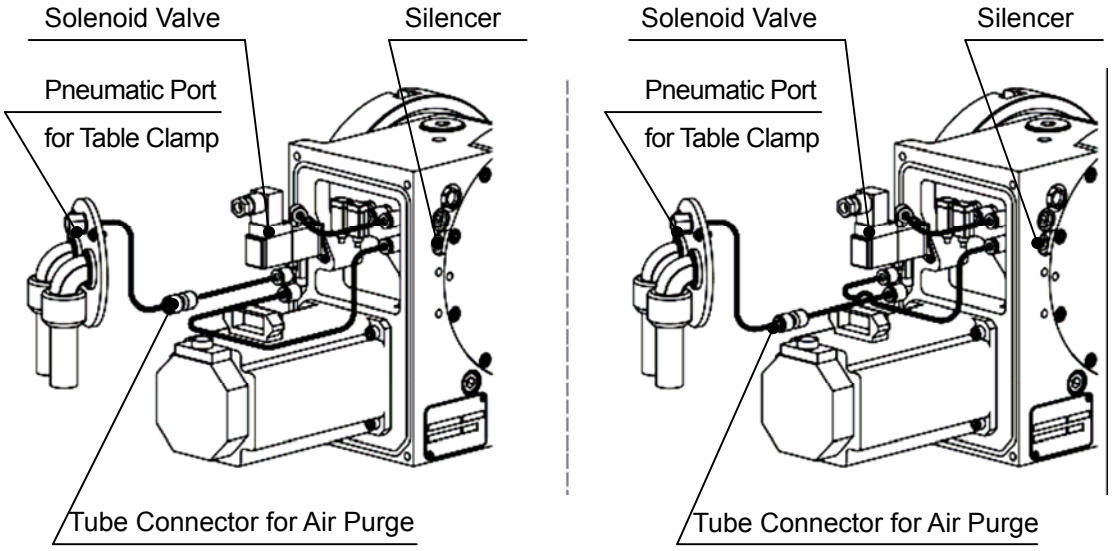


Fig.10

12-5. Piping Diagram

When removing the piping to remove the motor case, refer to the following outside view and diagram.

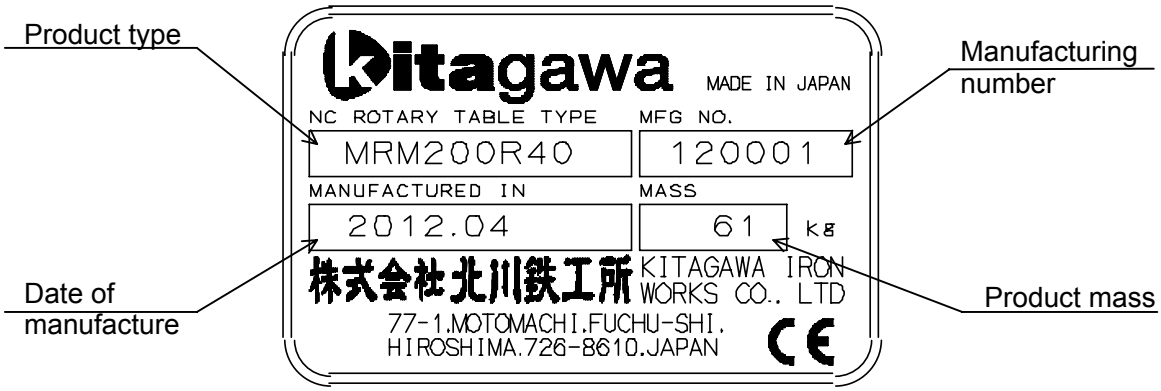


EXCITATION CLAMP　　EXCITATION UNCLAMP

Fig.11

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.



Nameplate

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.

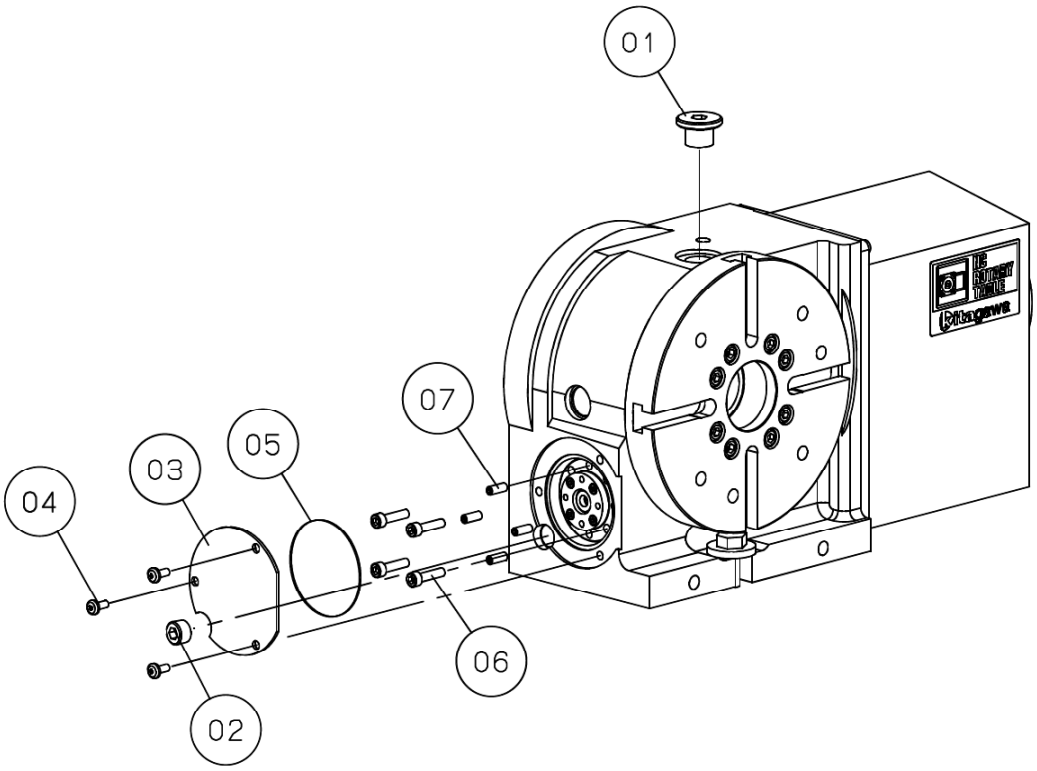
Symptom ⑥: Index accuracy error

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

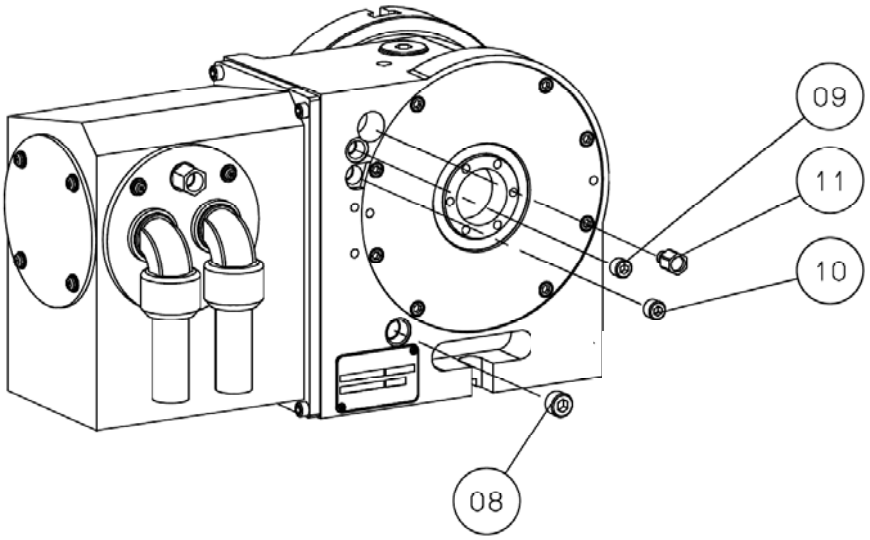
○ Main Body

MARK	NAME	MR162	MR202	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	Rc3/8		1	
03	Cover "A"			1	
04	Machine screw for Cover "A"	M6×12		3	
05	O-ring	S 67		1	
06	Hexagon socket head cap screw	M6×25		4	
07	Hexagon socket headless set screw	M6×16		4	Flat Point



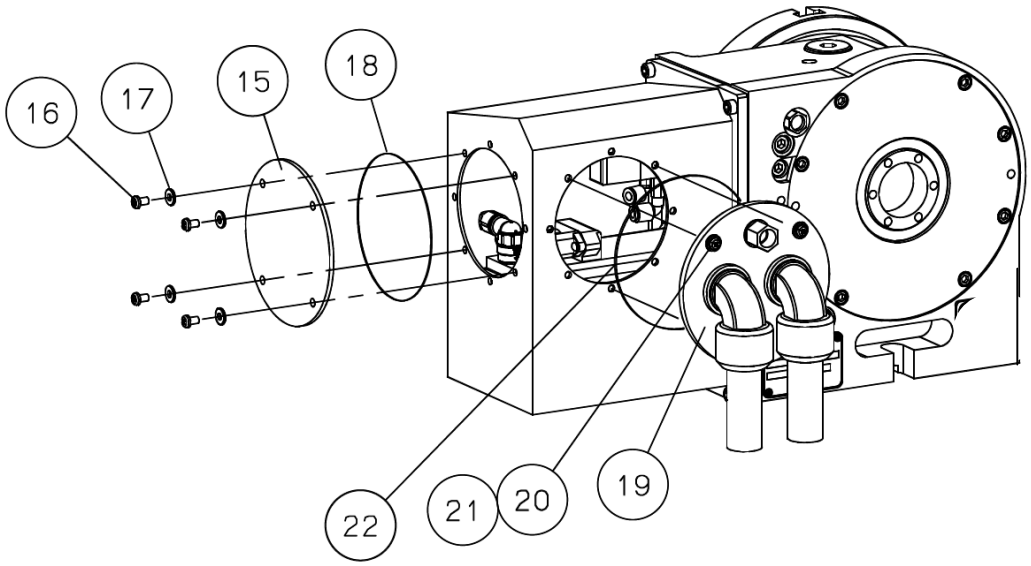
○ Main Body

MARK	NAME	MR162	MR202	Q'ty	Recital
08	Hexagon socket headless tapered pipe plug with seal	Rc3/8		1	
09	Hexagon socket headless tapered pipe plug with seal	Rc1/4		1	
10	Silencer			1	
11	Relief valve			1	



○ Motor Case

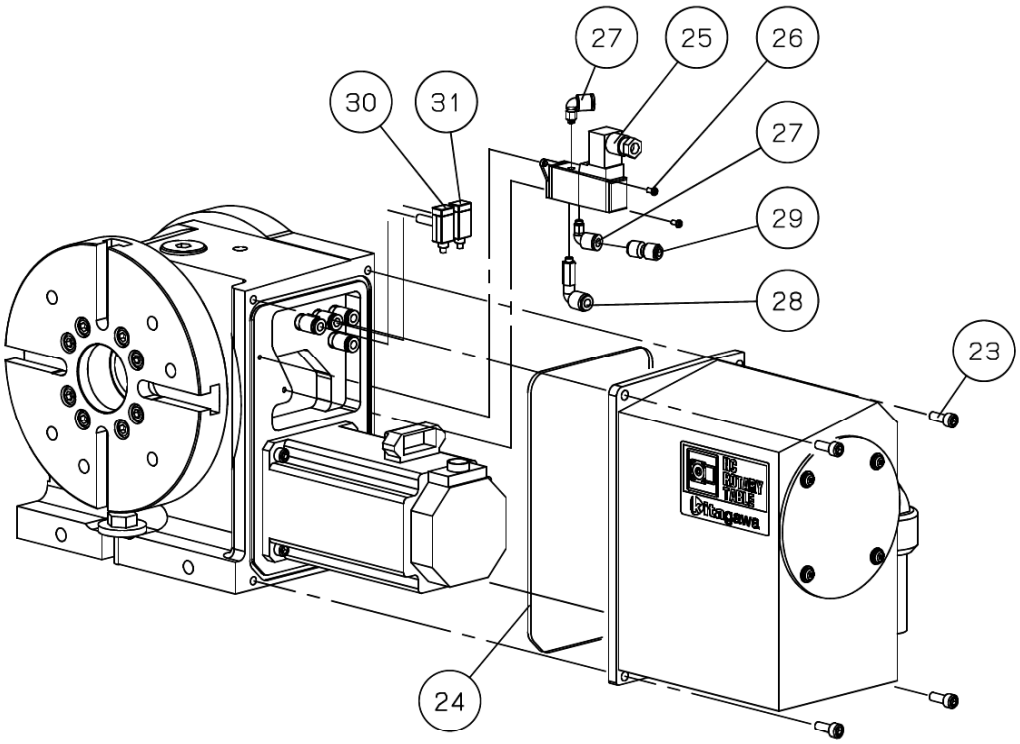
MARK	NAME	MR162	MR202	Q'ty	Recital
15	Cover "P"			1	
16	Machine screw for Cover "P"	M5×8		4	
17	Seal Washer			4	
18	O-Ring	S 112		1	
19	Connector Plate			1	
20	Machine screw for Connector Plate	M5×12		3	
21	Seal Washer			3	
22	O-Ring	S 112		1	



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.

○ Motor Case

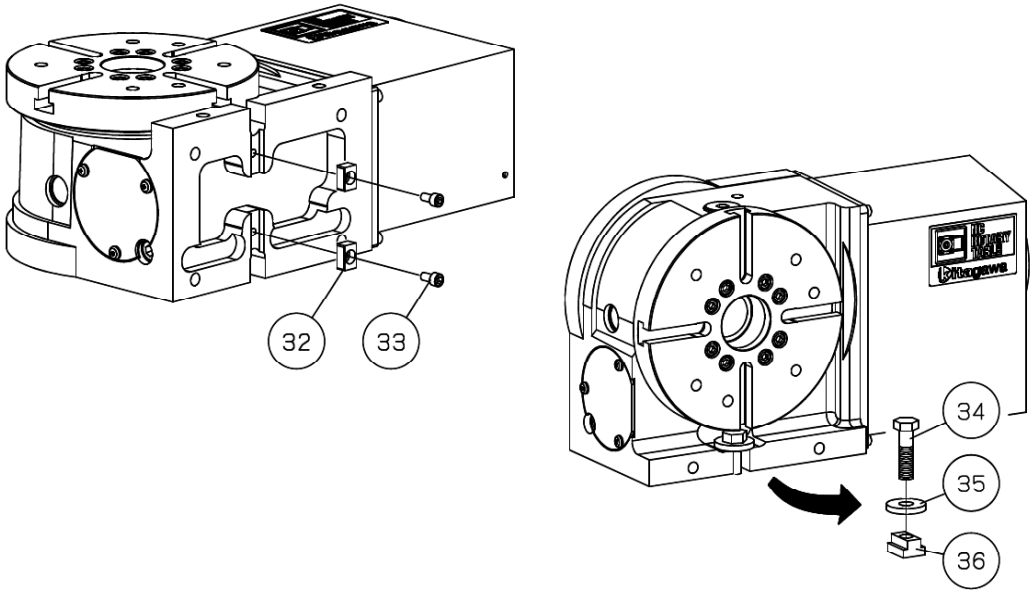
MARK	NAME	MR162	MR202	Q'ty	Recital
23	Hexagon socket head cap screw	M6×16		4	
24	O-Ring	GS 195		1	
25	Solenoid Valve	VK332-5DS-M5-F-Q		1	DC24V
26	Machine screw	M3×6		2	
27	Tube Connector			2	
28	Tube Connector			1	
29	Tube Connector for Air Purge			1	
30	Pressure switch for clamp detection	PS1000-R06L-Q-X140		1	0.25MPa
31	Pressure switch for unclamp detection	PS1100-R06L-Q-X141		1	0.055MPa



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.

○ Accessory

MARK	NAME	MR162	MR202	Q'ty	Recital
32	Guide block			2	
33	Hexagon socket head cap screw	M6×12		2	
34	Hexagon head bolt for clamp	M12×45		2	
35	Washer			2	
36	T-slot nut			2	



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.

Note：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. Indexing Accuracy and Pitch Error

NOTICE

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

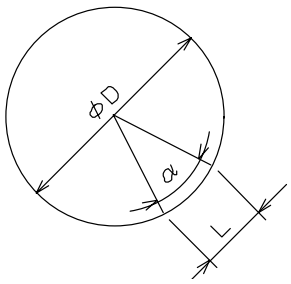
“ What is the angle with a cumulative pitch error of 0.01mm ?”

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)

α: Angle (seconds)

L: Linear length at the table circumference (mm)



$$\frac{L}{\pi \times D} = \frac{\alpha}{360° \times 60' \times 60''} \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \quad (1)$$

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

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

(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.

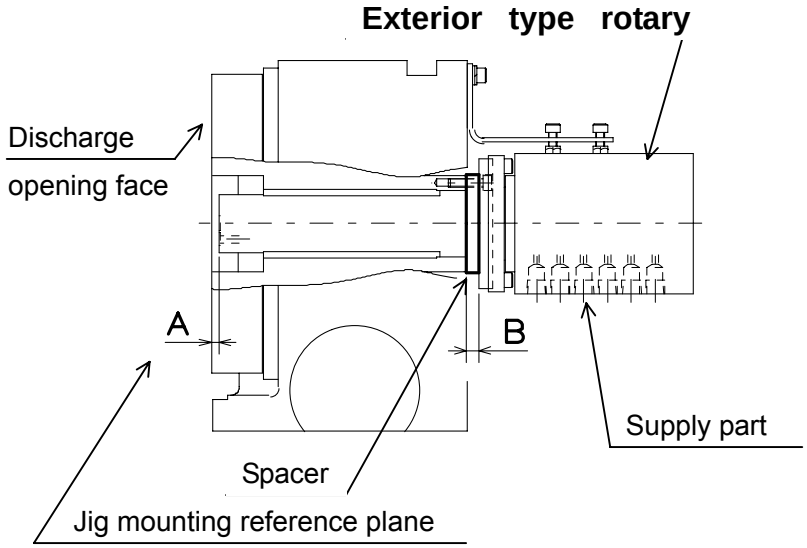
18. Mounting Rotary Joint (Option)

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.