

NC Tilting Rotary Table INSTRUCTION MANUAL Model : TT150AE-04



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.

KITAGAWA IRON WORKS CO., LTD.

Preface

This manual provides detailed information on the Kitagawa NC rotary table so that you can understand its performance and functions and use it safely and correctly.

Before using this NC rotary table, read this manual carefully to understand how to use it. Always follow the instructions and warnings given in “**Important Safety Precautions**” and “**Precautions for Use**”. Failure to follow these precautions could result in serious injuries.

Terms and Symbols Used for Safety Messages

In this manual, precautions for handling that are considered especially important are classified and displayed as shown below depending on the damage of risk including the seriousness of the harm that could result. Please sufficiently understand the meanings of these terms and follow the instructions for safe operation.

Safety Alert Symbol

This triangle is the safety alert symbol used to alert you to potential safety hazards. To avoid death or injuries that could occur, follow the safety messages given with this safety alert symbol.



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.



Indicates instructions which, if not avoided, could result in damage to the equipment or a shortened work life.

Liability and How to Use this Manual

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.

Kitagawa Iron Works Co., Ltd. shall not be held liable for troubles or accidents that arise from a failure to observe these safety precautions mentioned in this manual.

This manual does not predict all potential hazards in operation, inspection, and maintenance under all environmental conditions. There will be an infinite number of matters that cannot or must not be done, and the manual cannot cover all of them.

Therefore, the matters, unless otherwise mentioned clearly as “can be done” or “may be done” in this manual, should be considered as “cannot be done” or “must not be done”.

Please contact us or our agents if you have any uncertainty about safety when you try to perform operation, inspection, or maintenance not mentioned in this manual.

Others

The contents of the instruction manual are subject to change without notice for improvement or specification change.

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, MX Series, MRT Series, CK Series, GT Series,
DM Series, TMX Series, THX Series, TRX Series,
TLX Series, TR Series, TL Series, TBX Series, TUX Series,
TU Series, LR Series, TP Series, TM Series, TH Series,
TT Series, TW 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+A2:2009/A1:2010
Immunity : EN 61000-6-2:2005

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Appendix 1 Outside View

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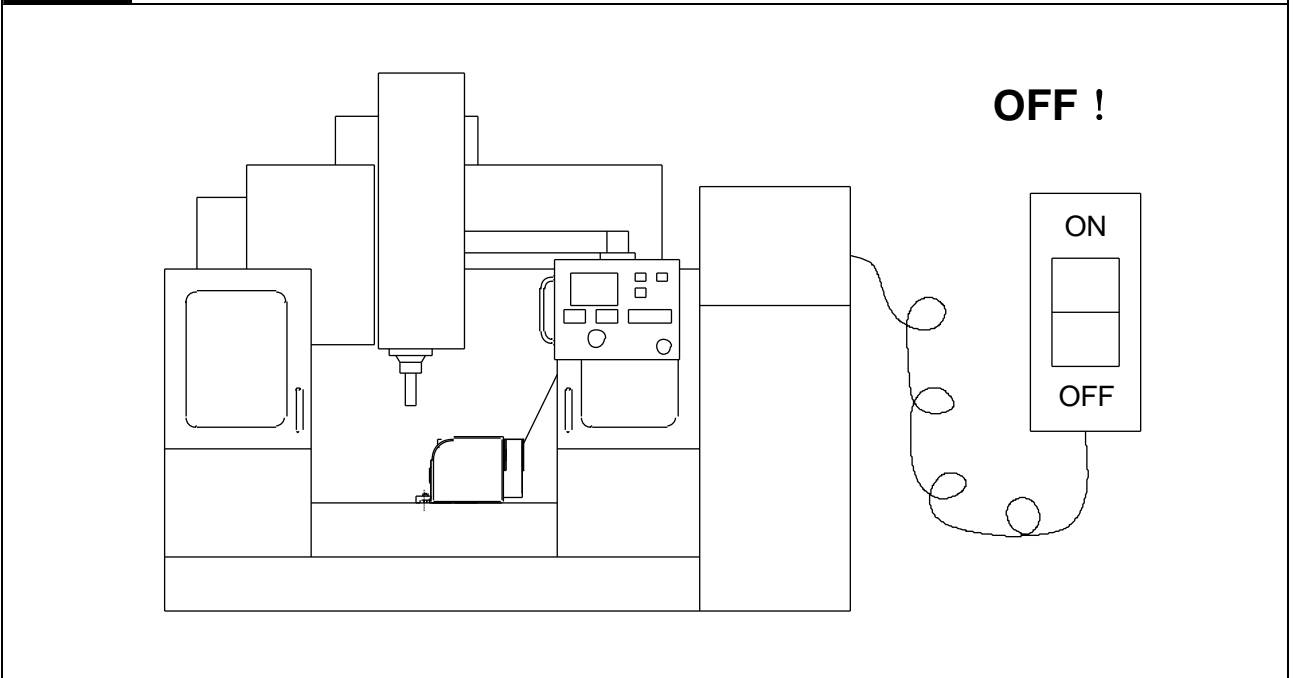
1. For Your Safety

Basic Safety Tips

Please read this manual and follow instructions carefully.



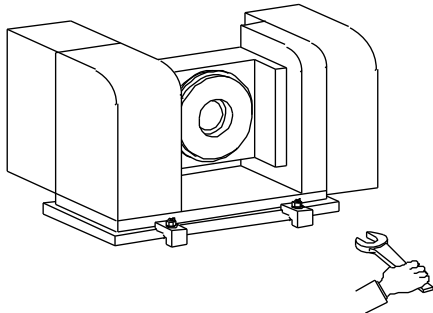
Turn off the main power of the machine prior to maintenance, check, or repair of the unit, Failure to do so may cause severe injury and/or accident.



! WARNING



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



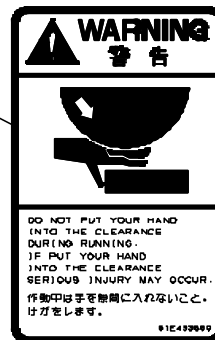
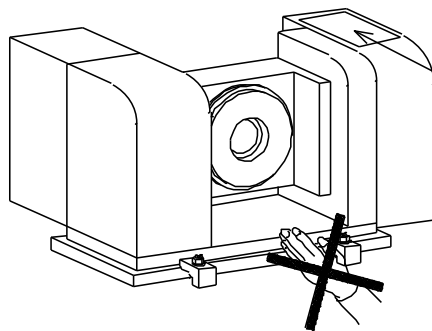
Please refer to the chart below for the recommended tightening torque of the bolts.

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



Do not touch rotating object during operation.

Fingers or hand may be caught into gap.

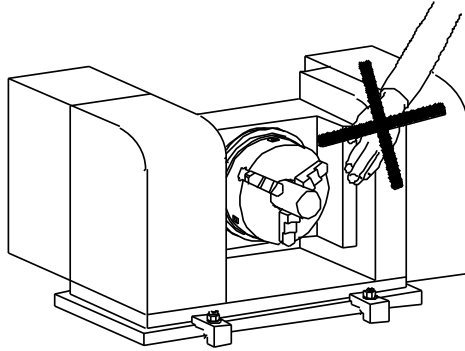




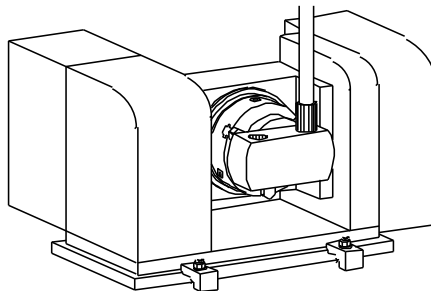
WARNING



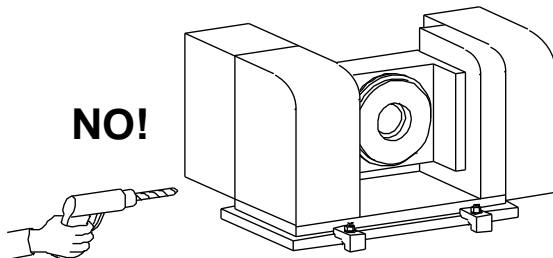
Make sure the working area is clear of any foreign object and/or hand when the unit is in operation to avoid any serious accident and/or injury.




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.



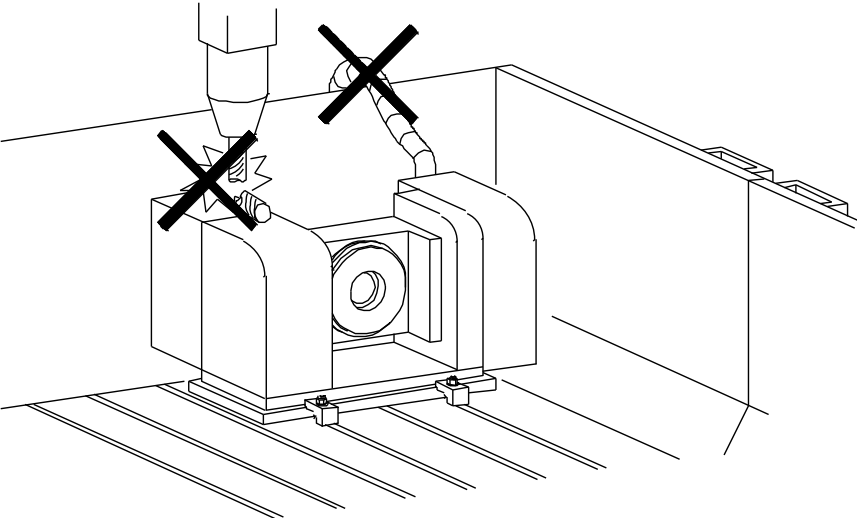
Please consult your local distributor before attempting any modification of the unit.




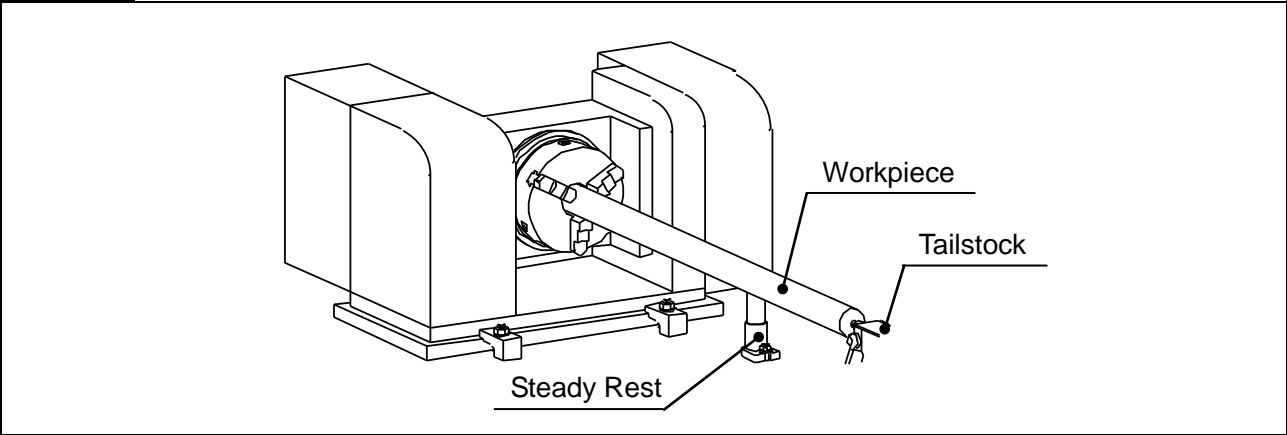
 **WARNING**

 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.

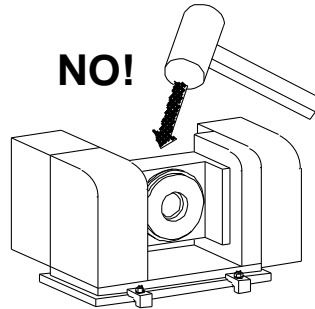




CAUTION

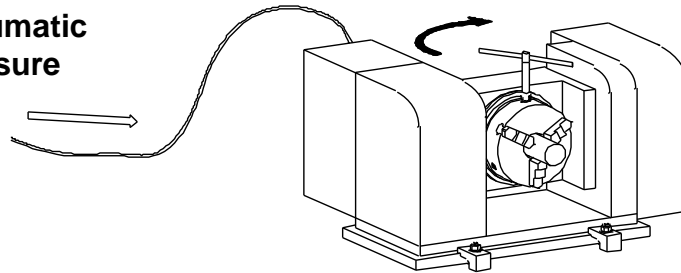


Avoid sudden impact to any part of the unit which may cause damage to the internal mechanism.

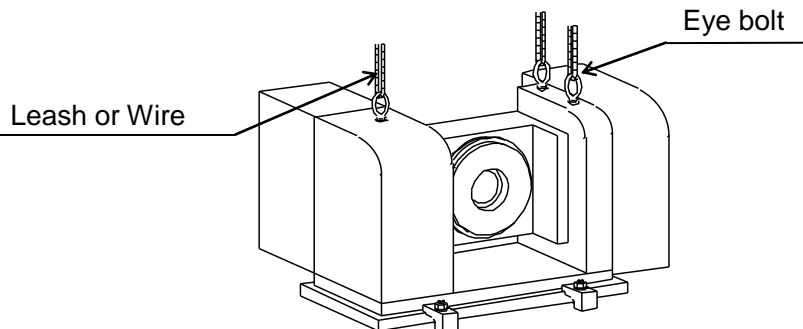


Mount or dismount the workpiece to or from the unit while the unit is clamped to avoid damage to the internal mechanism and diminished indexing accuracy of the unit.

Pneumatic pressure



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



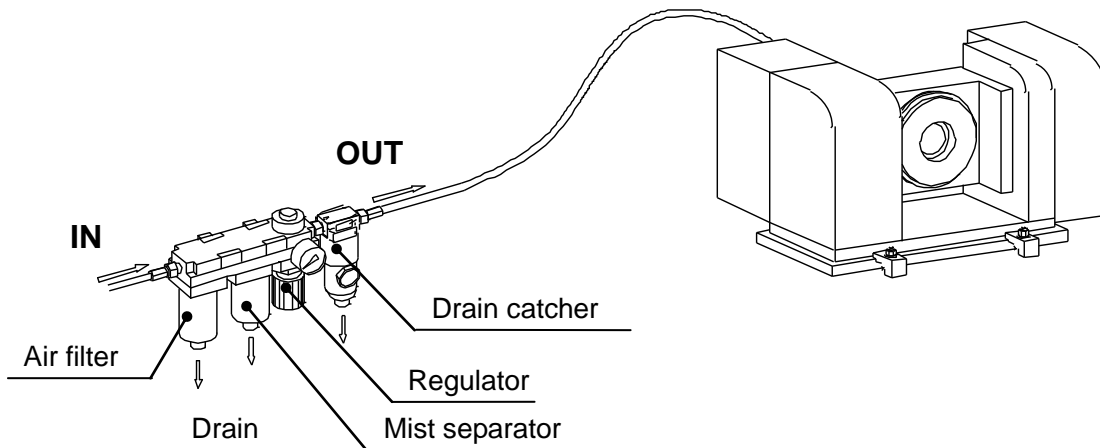


CAUTION



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.

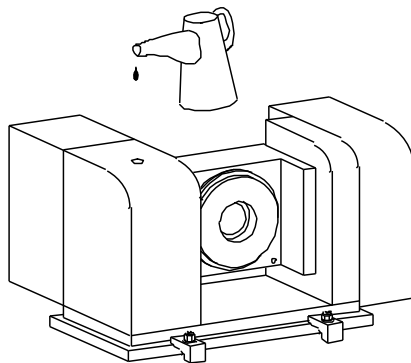


Periodically drain the water in air filter. (It is recommended to use the auto drain type.)

NOTICE



Replace lubricating oil every 6 months.



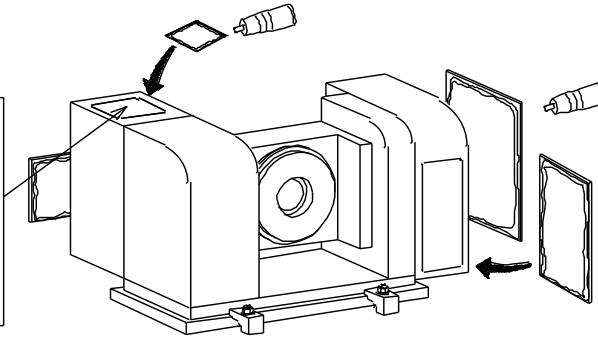
NOTICE



Coat each cover mounting face for motor case with liquid packing.

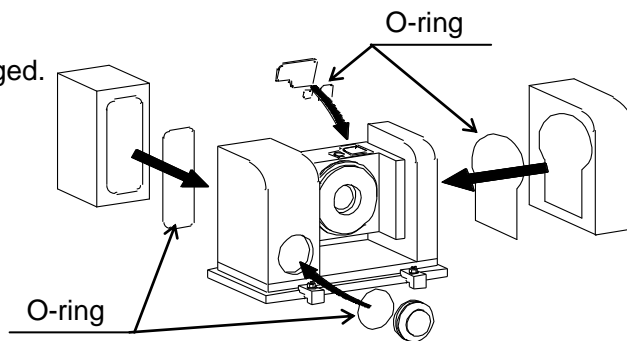
Because coolant is entered,
NC rotary table may be damaged.

注意
接続工事等の後、カバーを組み付けるときは
必ずシリコン系液状ガスケットをむらなく塗
布してください。
ATTENTION
After covers are removed, to assure water
-tightness, a liquid silicon gasket must
be applied before replacing covers.



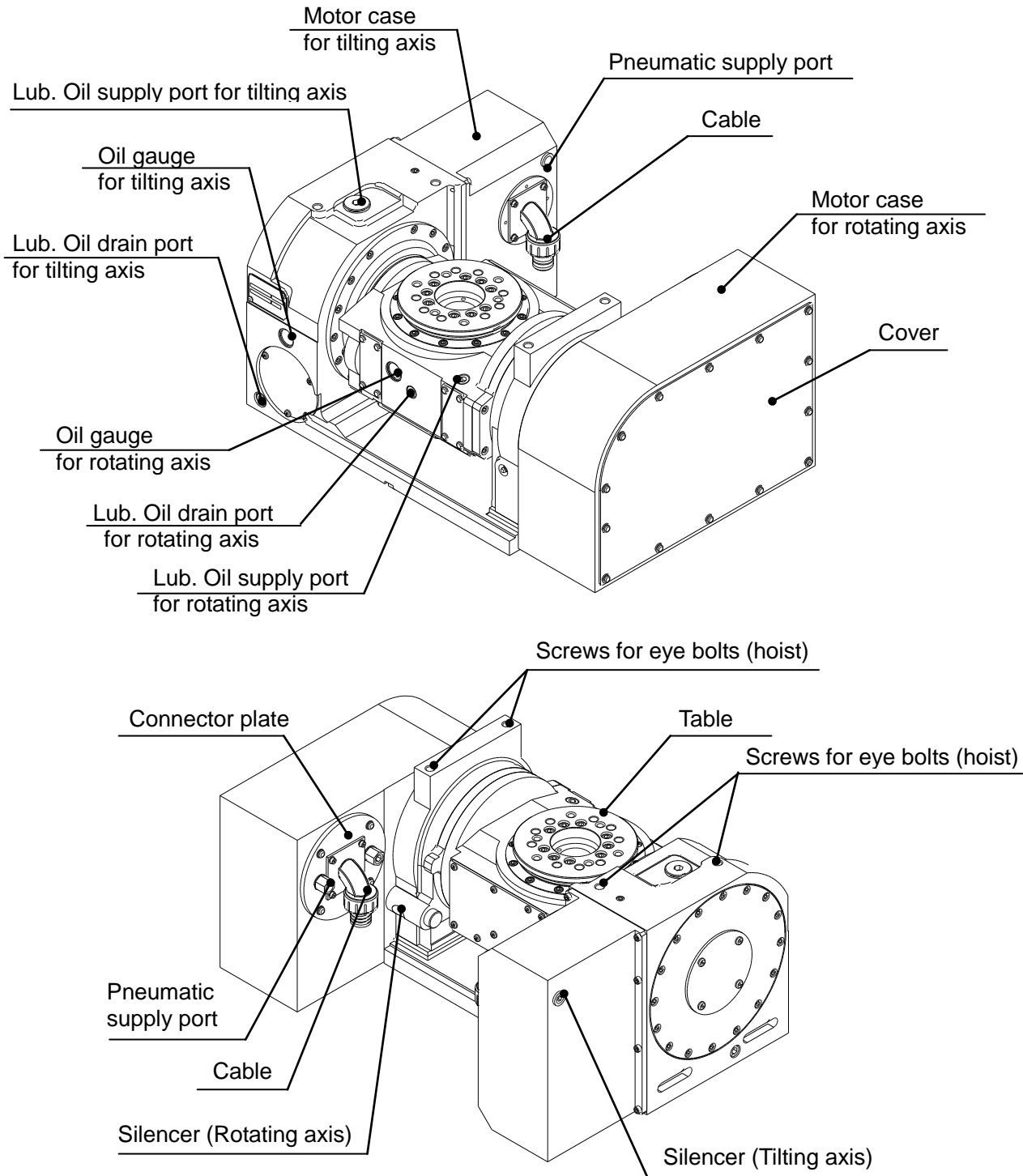
Attach each O-ring to motor case mounting face, etc. as shown in the following figure. (Do not damage each O-ring.)

Because coolant is entered,
NC rotary table may be damaged.



2. Outside view

The following figure is the standard outside view of model TT150. For detailed models, refer to appendix outside views in the end of manual.



3. Specifications

	ITEM	MODEL	TT150	
1	Table Diameter	mm	φ150	
2	Table Height in Horizontal	mm	220	
3	Center Height in Vertical	mm	150	
4	Total Height in Vertical	mm	270	
5	Table reference hole diameter	mm	φ60	
6	Table through hole diameter	mm	φ40	
7	Clamping Torque [Pneumatics 0.5MPa]	(Rotating axis)	N·m	350
		(Tilting axis)	N·m	550
8	Allowable Workpiece Dia.	mm	φ150	
9	Allowable Mass of Workpiece	(Horizontal)	kg	50
		(Vertical)	kg	30
10	Allowable Work Inertia	kg·m ²	0.14	
11	Total Reduction Ratio	(Rotating axis)		1/72
		(Tilting axis)		1/180
12	Max. Rotation Speed	(Rotating axis)	min ⁻¹	41.6
		(Tilting axis)	min ⁻¹	16.6
13	Angle of tilting	degree	-20~110	
14	Mass of Rotary Table	kg	141	
15	Operating temperature range	°C	5~40	
16	Operating humidity range	%	30~95	
17	Operating altitude range (above sea level)	m	1000 or lower	
18	Storage temperature range	°C	-10~60	
19	Environmental pollution degree		Degree 3	
20	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.

NOTICE

Max. table rotation speed is the value when the motor rotates at 3000 min⁻¹.



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.

4. Accuracy Standard

(Unit: mm)

	Inspection Item		Allowable Value
1	Run out of table reference hole		0.010
2	Run out of table top face during table rotation		0.015
3	Straightness of table top face (to be concave side.)	Total length	0.010
4	Parallelism of table top face and mounting reference face (tilting axis direction)	Total length	0.020
5	Parallelism of table top face and guide block center line (Tilting angle : 90°)	Total length	0.020
6	Parallelism of tilting axis center line and mounting reference face	Per 300mm	0.020
7	Indexing accuracy	Rotating axis	Cumulative 30 sec
		Tilting axis	Cumulative 60 sec
8	Repeatability	Cumulative	4 sec

1	2	3
4	5	6
7,8 Index accuracy is measured with the optical device.		

5. Operation Ready

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

5-1. 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 clamper.



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.



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



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.

5-2. Oiling

Lubrication oil has been already filled in the NC tilting rotary table before shipping.

Check the lubrication oil every day before operating the machine. If oil is reduced, replenish it.



Replace lubrication oil every 6-month. At this time, completely drain the oil. When filling the oil tank with lubrication/hydraulic 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. In the air/hydraulic specification, a clamp alarm occurs.

5-3. Required lubrication oil volume

(Unit: liter)

Type	TT150
Tilting axis	0.65
Rotating axis	0.55

Filled with Daphne Multiway 32MT (IDEMITSU) before shipping.

5-4. Recommended lubrication oil

(Viscosity grade ISO VG32)

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

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

5-5-1. Scope of application

- Specified lubricating oil
- Specified hydraulic oil (MR, MRT, MX, GT, RK, TM(H)2100·3100, TT(W)101·120, TT140, TT150, DM do not use)
- Antirust oil applied to the unit at delivery (Houghton Japan, Rust Veto 377)

5-5-2. 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.

5-5-3. 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.

5-5-4. 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.

6. Inspection

Daily inspection

- 1) Check the fixing condition of NC tilting rotary table (including jig if mounted).
- 2) Confirm that the chips accumulating in a rotary part of NC rotary table are removed.
- 3) Check the electric connection cables and the air hoses are not damaged, and also, check the pneumatic.
- 4) Check the zero return motion (machine), indexing motion and position.
- 5) Check unusual vibration and noise do not occur. (Body, motor)
- 6) Check unusual heating. (Body, gear box, motor)

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

- 1) Check the dirt degree of lubrication oil.
- 2) Check connectors are well mounted and cables are not damaged.
- 3) Check wiring cables in the motor case do not corrode or are disconnected.

7. 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.

8. Table Clamp

8-1. Precautions for table clamp



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



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



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 gears and clamped part, take extreme care of back pressure.

8-2. Pneumatic Supply for clamp

- 1) Supply clean air (moisture, oil content, powder dust eliminated) passing through the air combination (Air filter, mist separator, regulator) + drain catcher.
- 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. (Connection port is Rc1/4).
- 3) Use this unit in the air pressure range of 0.4 to 0.6 MPa.

8-3. Air purge



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

The part of air for clamping is used for the air purge. Thus, air is used in the motor case from joint with hole of 0.4mm.

Be sure to supply clean air passing through the filter (air filter, mist separator, regulator and drain catcher). If moisture, oil content, etc., are mixed in the air, its air is entered in the motor case, thus damaging the equipment. The air in the motor case is exhausted from the air purge exhaust port.

If the air purge exhaust port is closed, condensed drops are not exhausted and pressure is kept in the motor cover as is, thus causing in motor case damaging and motor malfunction. Therefore, never close the air purge exhaust port. When exhausting air, although any exhaust sound occurs, there is no problem.

8-4. Check device for Clamp/Unclamp

To proceed a secure work, be sure to use Clamp/Unclamp Check signals. (See Fig.1)

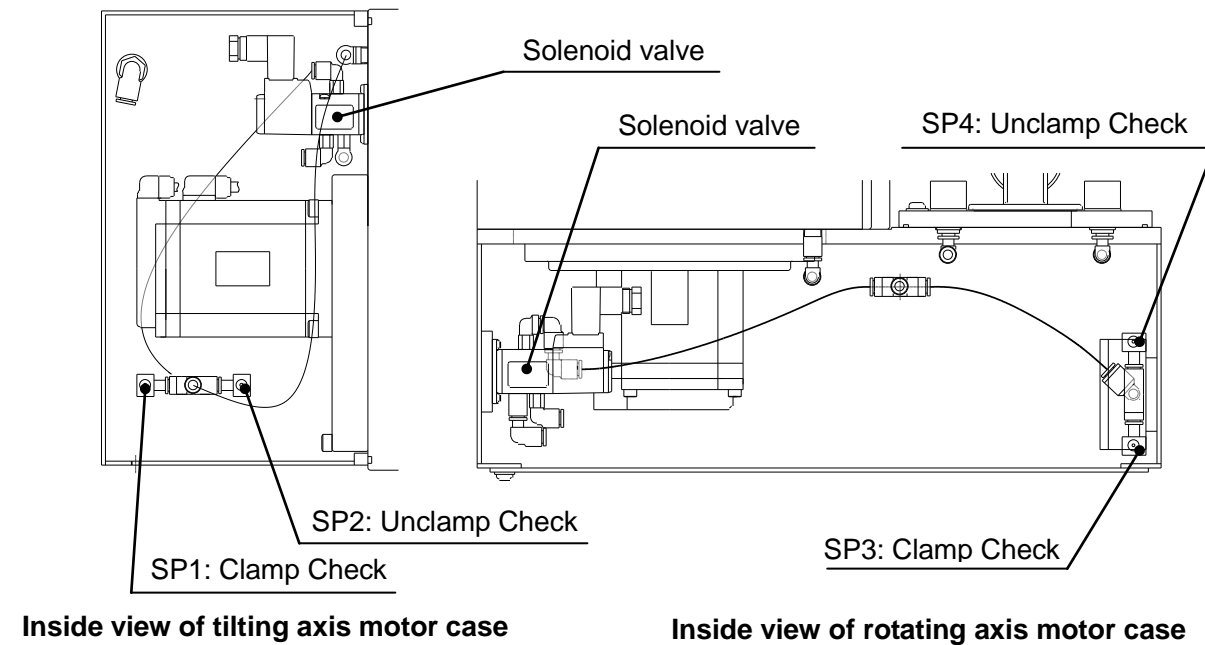


Fig.1

The set pressure values of pressure switches are as follows:

Clamp Check (SP1,SP3)	Unclamp Check (SP2,SP4)
0.25MPa	0.055MPa
PS1000-R06L-Q-X140	PS1100-R06L-Q-X141

8-5. Solenoid valve for Clamp/Unclamp

In case of NC tilting rotary table made by pneumatic clamp specifications, the solenoid valve is incorporated. Since the following piping is used as standard, take care when electric cables are connected.

Refer to outside view of Appendix

【Excitation Unclamp Spec.】

Solenoid: ON ... Table Unclamp

Solenoid: OFF ... Table Clamp

【Excitation Clamp Spec.】

Solenoid: ON ... Table Clamp

Solenoid: OFF ... Table Unclamp



Since polar characters (+, -) exist in each pressure switch, proximity switch and solenoid valve, refer to wiring diagram.

9. Mounting of Workpiece

Mount the workpiece securely to increase accuracy.



If the workpiece is not mounted securely, accuracy becomes not only worse but also the machine and tools are damaged. Therefore, take extreme care because it also causes an accident resulting in injury or death in the worst case.



When the workpiece that flatness and straightness are not obtained is tightened as is, the workpiece or the rotary table may be distorted, thus resulting in low accuracy or unevenness rotation. In such case, insert the shim(s) between the workpiece and the rotary table.



When the workpiece is tightened, fix the workpiece equally and securely on the rotary table as much as possible.

10. Maintenance Work

10-1. 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.

10-2. 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.

11. Backlash Adjustment of Worm Gears

The worm shaft and worm wheel are made of the special materials and they are accurately machined. The dual lead worm system is adopted for eliminating the backlash of worm gears. It changes the lead of right and left teeth of worm shaft a little and adjusts the backlash for the worm wheel by shifting this worm shaft in the axis direction.

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

Although the backlash of worm gears has already been adjusted before shipping, it is necessary to adjust the backlash when the machine is operated for a long period of time. The proper values for backlash are shown in the following list. These are values when the machine is cooled. Thus, they are values after interrupting for a long period of time. Consequently, when the machine is operated for a long period of time, the backlash becomes small in comparison with the following values by thermal expansion.

NOTICE

If backlash is too small, the worm gears will cause seizing.

○ Adequate Backlash

	Arc length at peripheral table position (μm) Converted angle (sec.) in []	
Rotating axis	13 ~ 38	[39 ~ 114]
Tilting axis	4 ~ 7	[12 ~ 20]

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

11-1. Backlash measuring method of worm gears of rotating axis (See Fig.2)

- 1) Set the dial gauge to the block gauge side after mounting the block gauge by using a tap hole on the upper face of table.
- 2) Read the value of dial gauge at the position where the table stops after rotating the table slowly in one way with the flat steel or round bar inserted into the tap hole on the upper face of table (with worm wheel gear tooth attached). At this time, for the torque added to the table, refer to the list described later. Next, rotate the table under the same condition in the reverse direction to read the value of dial gauge. This difference of measured values is the backlash.
- 3) Perform the above measurement at 8 positions by rotating the table and compare them with the above adequate values.

$$T = F \times L$$

T: Torque (N·m)

F: Applied force (N)

L: Distance (m) from table center to point applying force F

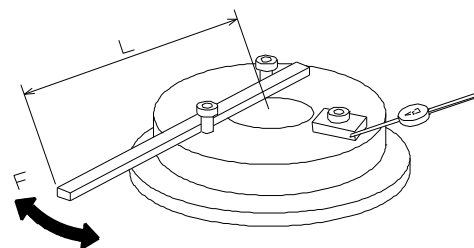


Fig.2

11-2. Backlash measuring method of worm gears of tilting axis (See Fig.3)

- 1) Set the dial gauge to the periphery of the table top face.
- 2) Read the value of dial gauge at the position where the table stops after rotating the tilting body slowly in one way with the flat steel or round bar inserted in eye bolts screwed in tap holes on the table back face (with worm wheel gear tooth attached). At this time, for the torque added to the tilting body, refer to the list described later. Next, rotate the tilting body under the same condition in the reverse direction to read the value of dial gauge. This difference of measured values is the backlash.

$$T = F \times L$$

T: Torque (N·m)

F: Applied force (N)

L: Distance from tilting axis center
to point applying force F (m)

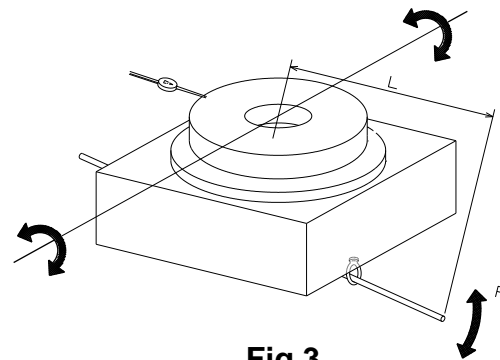


Fig.3

Table type		TT150
Torque T (N·m)	Rotating axis	39
	Tilting axis	20

11-3. Backlash adjusting method of rotating axis worm gears (See Fig.4)

This adjustment affect the indexing accuracy and worm wheel durability, thus it is strongly recommended that a skilled technician should do the adjustment. Please consult Kitagawa distributor before the adjustment.

- 3) Drain lubrication oil from the rotating axis lubrication oil drain port. (See the outside view.)
- 4) Remove the cover ①
- 5) Remove hexagon head bolt ③ and washer ④ which fix lock nut ②.
- 6) The lock nut ② is engaged with the bearing case ⑤ by M42, P1.5 screw. Since six 5mm drill holes are provided on the periphery of the lock nut ② and the bearing case ⑤, fix the bearing case ⑤ with a proper round bar before loosening the lock nut ②.
- 7) When rotating and advancing the bearing case ⑤ clockwise by using the above 5mm drill hole, the backlash becomes small.
- 8) After adjusting the backlash, fix the bearing case ⑤ and tighten the lock nut ② securely. Then, measure the backlash again and check that it is proper.
- 9) After checking that the backlash is proper, mount the cover ① again to the original position with hexagon head bolt ③ and washer ④.

NOTICE

Each interval between the hole and the hole on the periphery of bearing case is 60°. When rotating the bearing case 60°, the backlash of about 11 μ m is reduced at arc length on the peripheral position of table.

CAUTION

Adjust the backlash slowly and carefully without adjusting the backlash at a time.

CAUTION

When mounting the cover ①, do not damage O-ring ⑥.

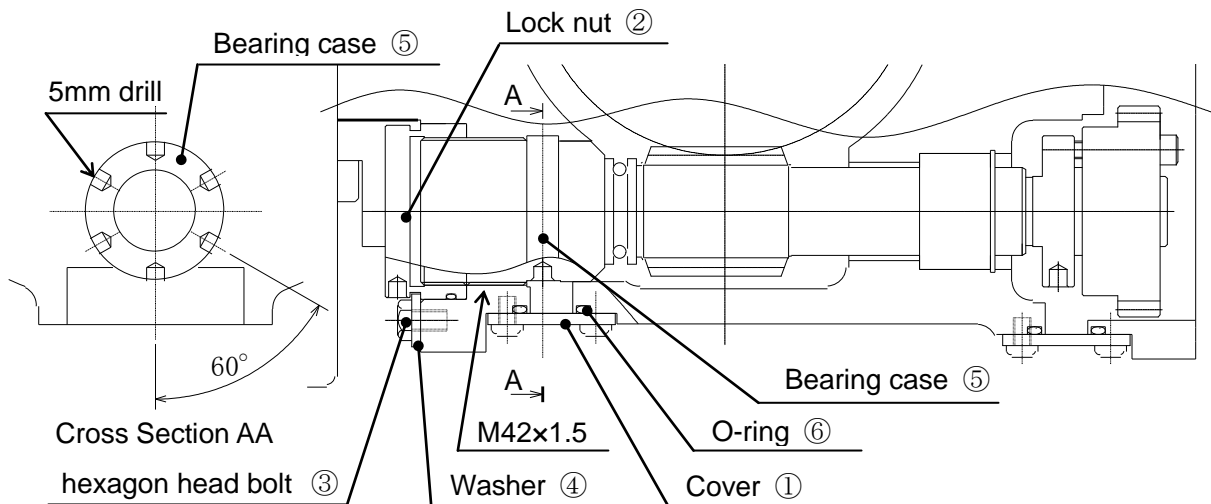


Fig.4

11-4. Backlash adjusting method of tilting axis worm gears (See Fig.5)

This adjustment affect the indexing accuracy and worm wheel durability, thus it is strongly recommended that a skilled technician should do the adjustment. Please consult Kitagawa distributor before the adjustment.

- 1) Remove the workpiece, jig, etc. on the table before adjusting and horizontalize the table.
- 2) Drain lubrication oil from the tilting axis lubrication oil drain port. (See outside view.)
- 3) Remove cross recessed round head screws ⑥ which fix cover ① to remove the cover ①.
- 4) The bearing case ④ is positioned by adjusting screws ② and hexagon socket head cap screws ③.
- 5) When loosening four adjusting screw ② to the same amount and tightening four hexagon socket head cap screws ③ to the same amount, the bearing case ④ advances and the backlash becomes small.

NOTICE

The rotating angle of adjusting screw to reduce the backlash to 0.01mm is as follows:

Type	TT150
Return angle	About 90°

When adjustment is finished, mount the workpiece, jig, etc. by the reverse procedures as the above and tighten bolts securely. After mounting, measure the backlash again on the periphery of table at the same position as the position before adjusting, and check that the measured value is proper.

NOTICE

Adjust the backlash slowly and carefully without adjusting the backlash at a time.

CAUTION

When mounting the cover ①, do not damage O-ring ⑤.

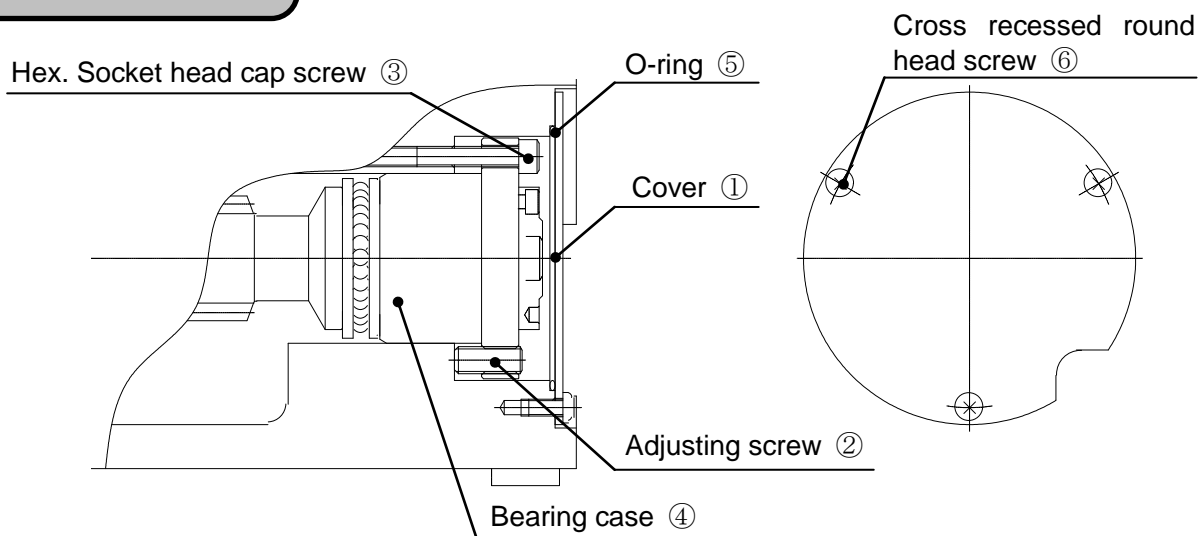


Fig.5

12. Backlash Adjustment of Spur Gears

12-1. Backlash adjusting method of rotating axis drive spur gears (See Fig.6)

The backlash between Z1 - Z2 spur gears is adjusted by changing a center distance after adjusting the motor position.

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

- 1) Adjust the backlash where the table surface is horizontal.
- 2) Drain lubrication oil from the rotating axis lubrication oil drain port (See the outside view).
- 3) Slightly loosen four mounting bolts ③ which fix the motor.
- 4) Move the motor in the arrow direction so that the backlash becomes zero (0) approximately.
- 5) Move the motor by pushing it up in the opposite direction of step 4) so that the backlash of the gear falls within the adequate range (0.02 mm - 0.04 mm). At this time, check the motor movement with the dial gauge attached to the motor side.
- 6) Tighten four mounting bolts ① that loosened slightly.
- 7) After adjusting, run the motor from slow speed to high speed to check that abnormal noise does not occur.

The backlash is not proper value (0.02~0.04mm), repeat the above items 3)~6) again.



When mounting the motor, take care so that O-ring ② will not be damaged.

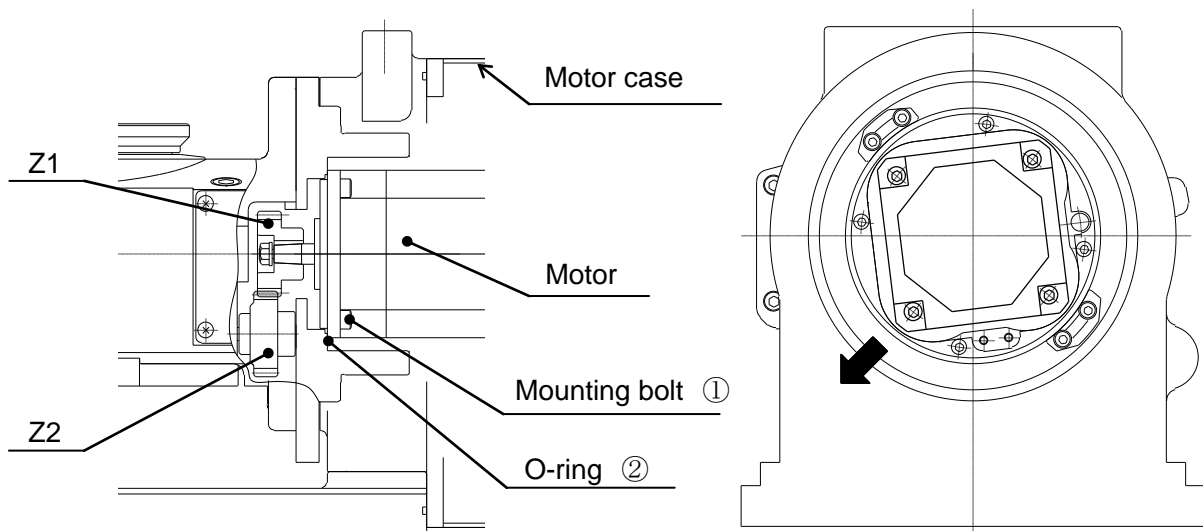


Fig.6

12-2. Backlash adjusting method of tilting axis drive spur gears (See Fig.7)

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

- 1) Drain lubrication oil from the tilting axis lubrication oil drain port (See the outside view).
- 2) Slightly loosen four mounting bolts ③ which fix the motor.
- 3) Insert a rod ① (approximately $\phi 5$, a bar wrench may also be used) in the hole of adaptor ④ located above the motor and operate it to lower the motor position until the backlash becomes zero (0) approximately.
- 4) Insert a rod ② (approximately $\phi 5$, a bar wrench may also be used) in the hole of adaptor ④ located below the motor and operate it to move the motor until the backlash falls within the adequate range (0.02 mm - 0.04 mm). At this time, touch the dial gauge to the motor side to check the movement of motor.
- 5) Tighten four mounting bolts ③ that loosened slightly.
- 6) After adjusting, run the motor from slow speed to high speed to check that abnormal noise does not occur.



When mounting the motor, take care so that O-ring ④ will not be damaged.

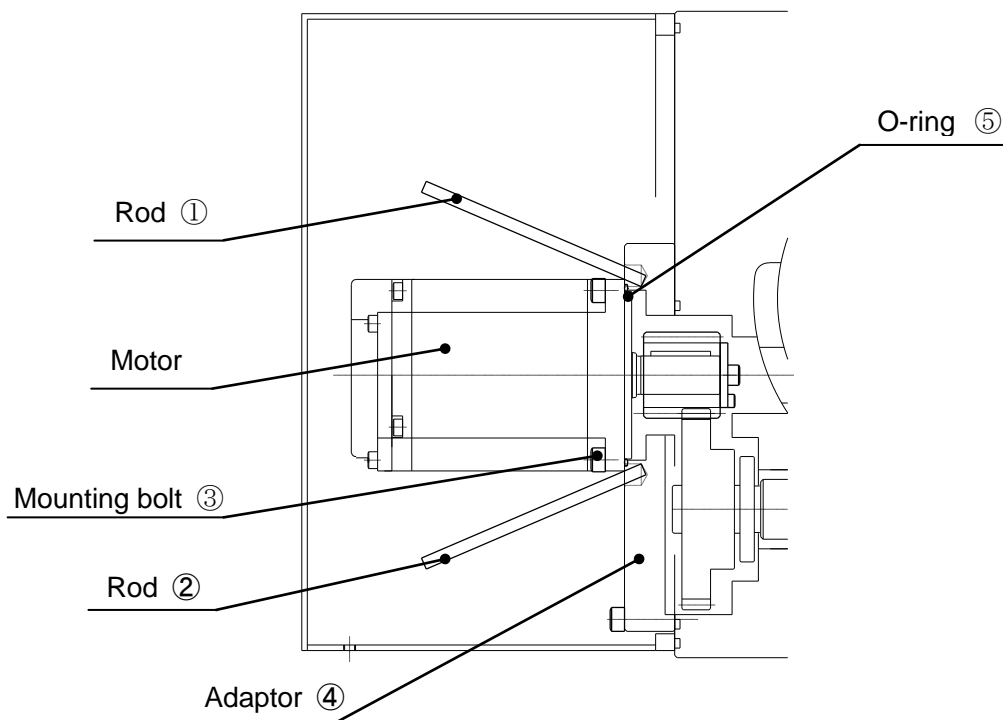


Fig.7

13. Machine zero point setting

For the NC rotary table with the additional axis but without our controller and the dog type zero point return specification, it is necessary to set the machine zero point to the machine as the machining reference point of the rotary table.

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 our Controller Instruction Manual (in the section of zero point setting procedure) or 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 or controller.
- ◇When the encoder backup battery on the machine side or controller runs down.
- ◇When the servo motor, encoder, or encoder cable is replaced or repaired.

13-1. Dog type zero point return device (OPTION)

NOTICE

(OPTION)

The contents of this section is applicable to the NC rotary table with the dog type zero point return specification.

13-1-1. Rotating axis ZRN (Zero Return) device (See Fig.8-1)

The dog for ZRN deceleration is mounted inside of table and it can be mounted on the circumferential position (angle).

When a zero position is changed or return rotation direction is changed to the other direction, since it is necessary to change the dog position, the following procedure is recommended for adjustment.

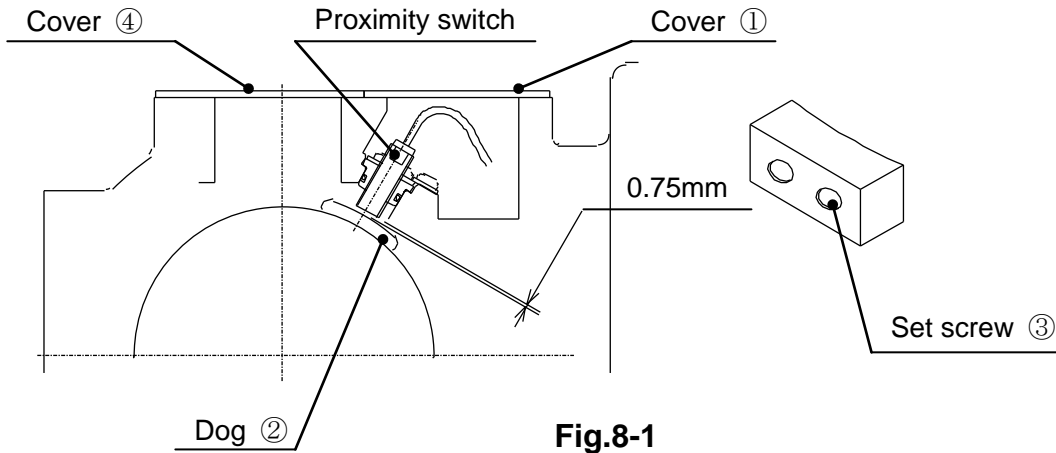
- 1) Drain lubrication oil from the tilting axis lubrication oil drain port (See the outside view).
- 2) Remove covers ① and ④.
- 3) When the cover ④ is removed, since a dog adjusting hole is found, rotate the table with the manual pulse generator or Manual axis feed key to the place where the dog can be found.
- 4) Loosen set screws ③ which fix the dog ②.
- 5) Move the dog ② to the proper position.
- 6) After adjusting the dog position, tighten set screws ③ securely.



CAUTION

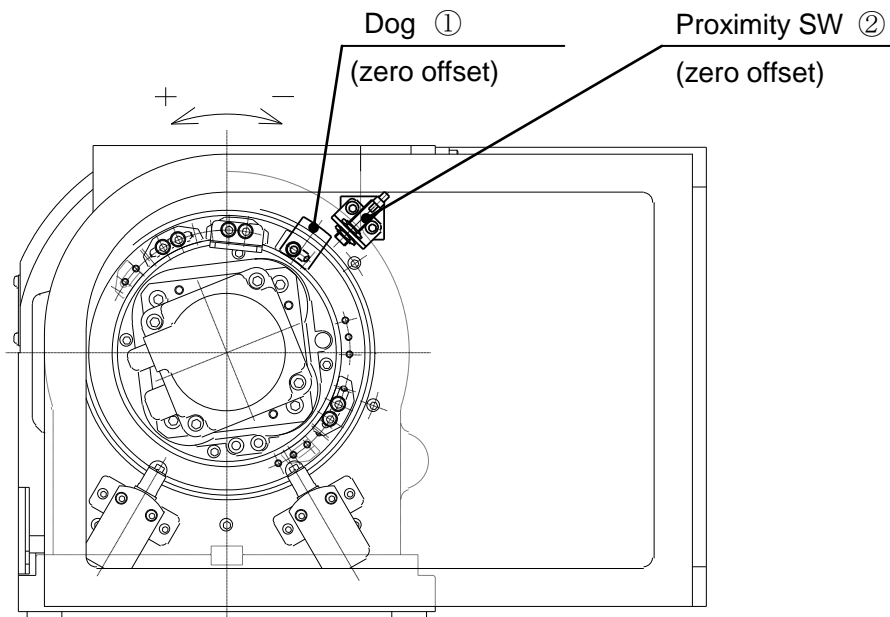
When mounting the cover again after adjusting the dog position, take care so that O-ring is not damaged.

The proximity switch is used as the dog detecting sensor. The gap between the dog and the proximity switch is set to about 0.75mm. (Thread pitch for mounting the proximity switch is 1mm.) The proximity switch with a lamp is used. When the dog is detected, since the lamp goes off, use the proximity switch as a target when the dog position is adjusted.



13-1-2. Tilting axis ZRN device (See Fig. 8-2)

- 1) The ZRN deceleration dog and the proximity switch are contained into the rotating axis motor case.
- 2) In the standard specification, the horizontal table face position is regarded as an origin. The proximity switch (2) detects dog (1).
- 3) When you change the vertical mechanical-zero position from horizontal one (standard spec), Please contact of our company.



14. Tilting Axis Over Travel Stop Device

14-1. Tilting axis over travel stop device (See Fig.9)

- 1) Remove the cover on the motor case side.
- 2) The dog and the limit switch for over travel of the tilting axis stroke limit are contained into the rotating axis motor case.
- 3) The limit switch A ③ detects dog A ① of stroke limit on the horizontal table face position side.
- 4) The limit switch B ④ detects dog B ② of stroke limit on the vertical table face position side.
- 5) The angle until the emergency stop mode is applied to the machine from the horizontal table face is about 20°. The angle until the emergency stop mode is applied to the machine from the vertical table face is about 20°.



The angle values of 20° or more from the horizontal table face and 20° or more from the vertical table face cannot be set.



The angle may be limited within a standard value in advance by customer conditions or to prevent the interference with the jig, workpiece, etc. In this case, it cannot be set more than the limited angle.

14-2. Adjusting methods of dog for vertical over-travel

- 1) When the customer will change position of dog A ① according to the shape of workpiece and jig, loosen hexagon socket head cap screw which fix the dog A ①. Once remove the dog A ①. (See Fig.9.)
- 2) Rotate the tilting axis to the tilting angle to be set in the minus direction with the manual minus generator or the Manual axis feed key, checking that it does not interfere with the jig or workpiece.
- 3) After rotating the rotary table to the desired tilting angle, slightly tighten hexagon socket head cap screws which fix the dog A ①.
- 4) Slide the dog A ① in the reverse direction clockwise (CW) before fixing until the over-travel alarm lamp lights. Tighten hexagon socket head cap screw that loosened slightly.
- 5) After fixing the dog A ①, rotate the tilting axis again with the manual pulse generator or the Manual axis feed key and check that the tilting axis stops at the desired tilting angle position and alarm lamp lights.
- 6) After adjusting, mount the side cover of motor case on the rotating axis side.



When mounting the cover, coat the cover with liquid packing (liquid gasket 1216 made by THREE BOND) evenly.

14-3. Adjusting methods of dog for horizontal over-travel

- 1) When the customer will change position of dog B ② according to the shape of workpiece and jig, loosen hexagon socket head cap screw which fix the dog B ②. Once remove the dog B ②. (See Fig.9.)
- 2) Rotate the tilting axis to the tilting angle to be set in the minus direction with the manual pulse generator or the Manual axis feed key, checking that it does not interfere with the jig or workpiece.
- 3) After rotating the rotary table to the desired tilting angle, slightly tighten hexagon socket head cap screws which fix the dog B ②.
- 4) Slide the dog B ② in the reverse direction counterclockwise (CCW) before fixing until the over-travel alarm lamp lights. Tighten hexagon socket head cap screw that loosened slightly.
- 5) After fixing the dog B ②, rotate the tilting axis again with the manual pulse generator or the Manual axis feed key and check that the tilting axis stops at the desired tilting angle position and alarm lamp lights.
- 6) After adjusting, mount the side cover of motor case on the rotating axis side.



When mounting the cover, coat the cover with liquid packing (liquid gasket 1216 made by THREE BOND) evenly.

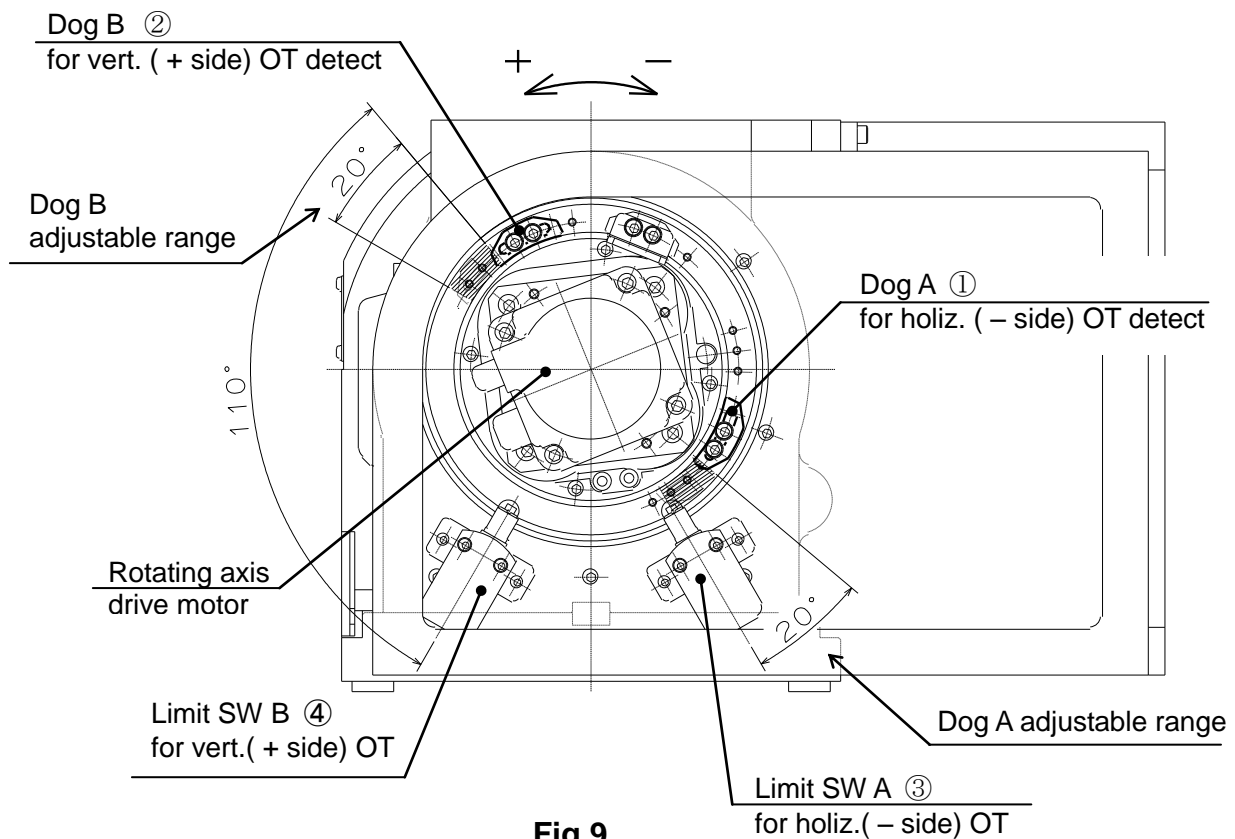


Fig.9

15. Motor case

15-1. To remove motor case

When removing the motor case of tilting axis for maintenance, etc., the following procedure is recommended.

- 1) Loosen hexagon socket head cap screws ④ which fix the motor case ① and remove the motor case slowly with the motor case ① raised.

Remove the air hose and disconnect wiring cables from electric apparatuses of motor and solenoid valves, etc. (For piping, refer to the piping diagram of item 23.)

15-2. Countermeasures for waterproof

To prevent the motor from coolant penetration, O-rings are used to the mounting faces on the motor case ①, cover ② and the connector plate ③, and also, liquid packing (1216 made by Three Bond) are used on connection parts between the motor case ① and covers ②.



When reassembling the motor case ①, cover ② and connector plate ③, take extreme care so that the O-rings will not be damaged. If the O-rings are damaged, coolant may enter into the motor case.



When reassembling the covers ②, coat connection parts with liquid packing.



Connect the air hose correctly and take care so as not to bend it.

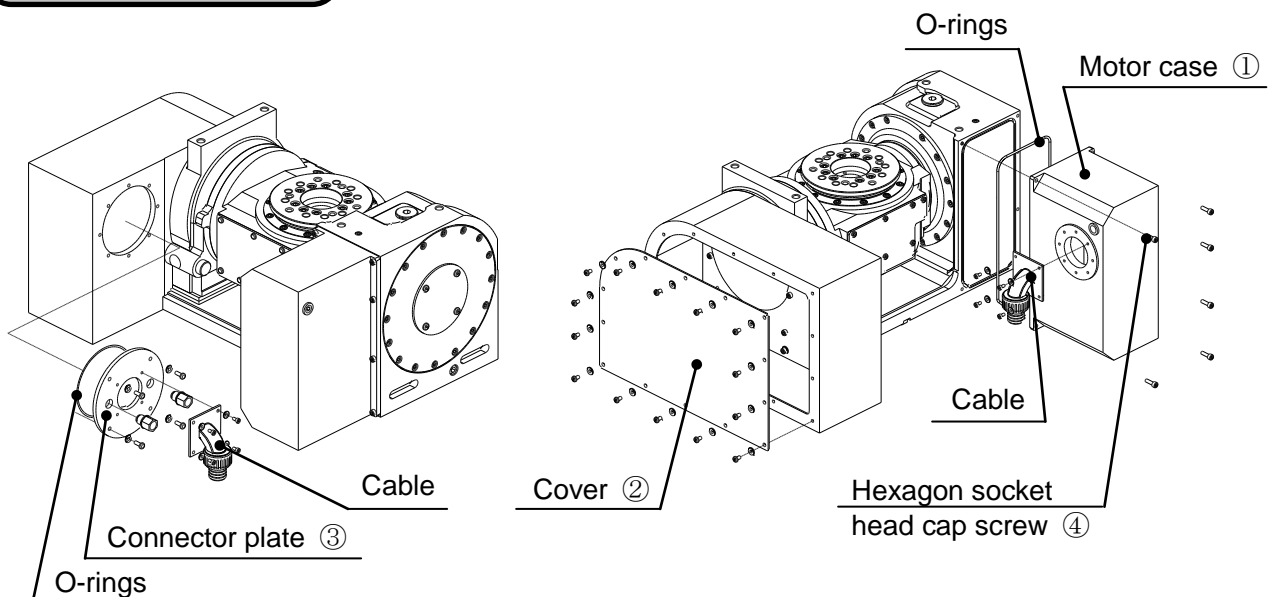


Fig.10

16. Motor

16-1. Tilting axis drive motor

16-1-1. To remove drive motor

When replacing the motor, remove the motor according to the following procedure. (See Fig.11)

- 1) Drain lubrication oil from the tilting axis lubrication oil drain port. (See outside view.)
- 2) Remove the motor case according to item 15-1.
- 3) Remove hexagon socket head cap screws ⑤ which fix the motor ④.
- 4) Remove the motor ④ slowly, raising it.

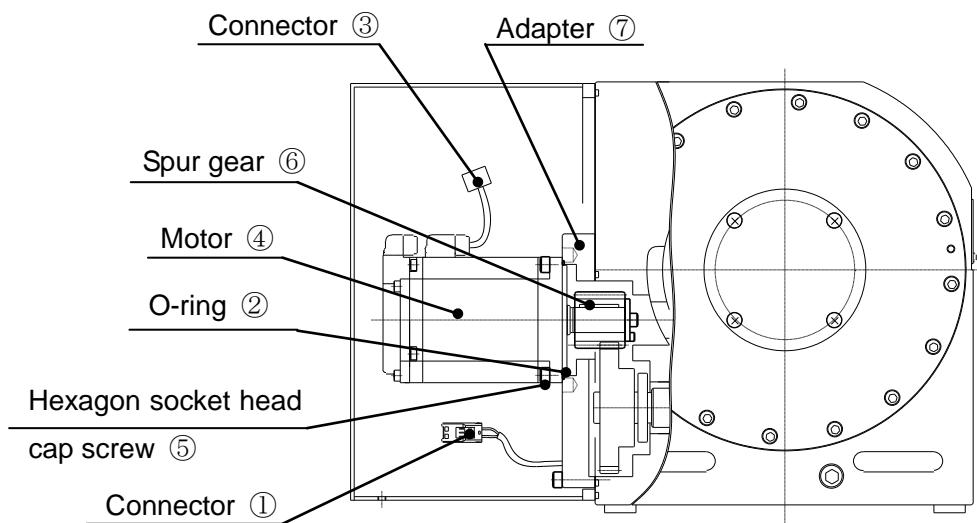


Fig.11

16-1-2. To mount drive motor

- 1) Clean mounting face (adapter ⑦ and motor ④) and O-ring groove.
- 2) Mount the O-ring ② and mount the motor ④ by the reverse procedure as the above removing.
- 3) After mounting the motor, adjust the backlash of spur gears ⑥ according to item 12.



Mount the motor to the spur gear ⑥ carefully after cleaning so that the spur gears are not damaged.



When mounting the motor ④, take extreme care so that O-ring ② is not damaged because lubrication oil may enter into the motor case.



Connect the connector ① according to item 17-2. Connect the connector ③ securely so that the pin does not cause contact failure, and also cables are not bent or crushed.

16-2. Rotating axis drive motor

16-2-1. To remove drive motor

When replacing the motor, remove the motor according to the following procedure. (See Fig.12)

- 1) Drain lubrication oil from the rotating axis lub. oil drain port. (See the outline drawing.)
- 2) Remove the cover ⑦.
- 3) Remove hexagon socket head cap screws ⑤ which fix the motor ④.
- 4) Remove the motor ④ slowly, raising it.

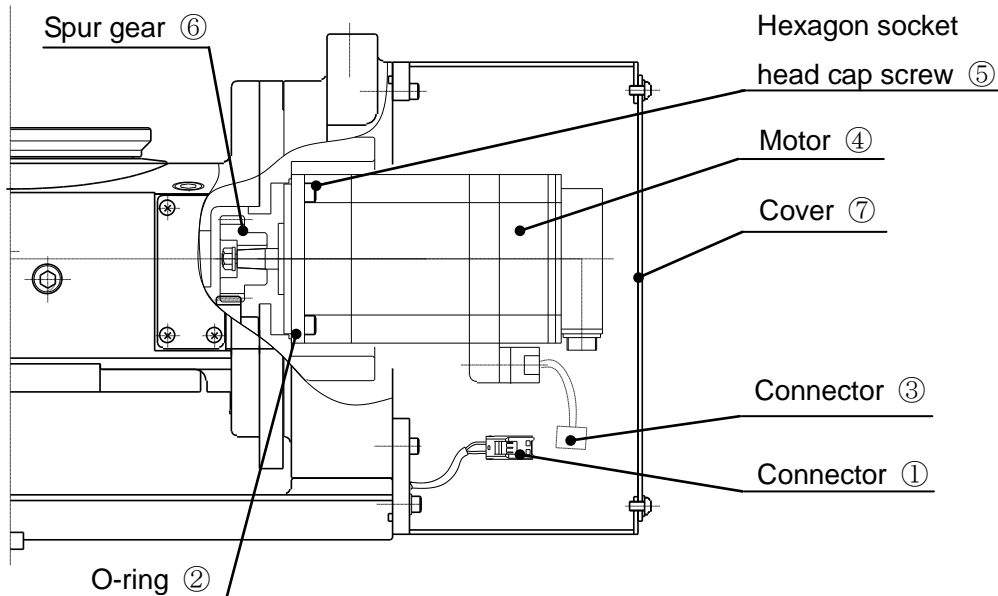


Fig.12

16-2-2. To mount drive motor

- 1) Clean mounting face (motor ④) and O-ring groove.
- 2) Mount the O-ring ② and mount the motor ④ by the reverse procedure as the above removing.
- 3) After mounting the motor, adjust the backlash of spur gears ⑥ according to item 12.



Mount the motor to the spur gear ⑥ carefully after cleaning so that the spur gears are not damaged.



When mounting the motor ④, take extreme care so that O-ring ② is not damaged because lubrication oil may enter into the motor case.



Connect the connector ① according to item 17-2. Connect the connector ③ securely so that the pin does not cause contact failure, and also cables are not bent or crushed.

16-3. To mount spur gears

The mounting method of spur gears varies by the motor shaft and flange diameter. The following procedure is recommended to mount the spur gears by three-method mainly used.

○Taper shaft

- 1) Wipe up dust adhered on the taper shaft surface and inside of spur gears.
- 2) Attach the key to the shaft before mounting the spur gear.
- 3) Attach the washer and tighten the nut securely.

○Straight shaft (with key)

- 1) Wipe up dust adhered on the straight shaft surface and inside of spur gears.
- 2) Attach the key to the shaft.
- 3) Fix the spur gear and washer securely.
- 4) Mount the spur gear with the washer to the shaft securely by using the bolt.

○Straight shaft (locking element spec.)

- 1) Wipe up dust adhered on the straight shaft surface and inside of spur gears and coat them with oil or grease. However, do not use lubricate of silicon system or molybdenum system, or oil and grease including an extreme-pressure additive agent.
- 2) Insert the washer, locking element, spacer and spur gear in order.
- 3) At this time, attach the locking element (Generic name for inner ring and outer ring) so as to pressurize the inner ring.
- 4) Tighten bolts on each diagonal line equally in order so that the end face of spur gear and the flange end face of motor become parallel.
- 5) Tighten the bolts until washers do not move in an axial direction. After that, adjust the mounting position of spur gear.
- 6) Attach the dial gauge to the end face of spur gear and tighten bolts equally. Rotate the spur gears and also, tighten each bolt until the run out of dial gauge becomes 0.01mm or less.
- 7) Check that the spur gears are fixed to the shaft securely.

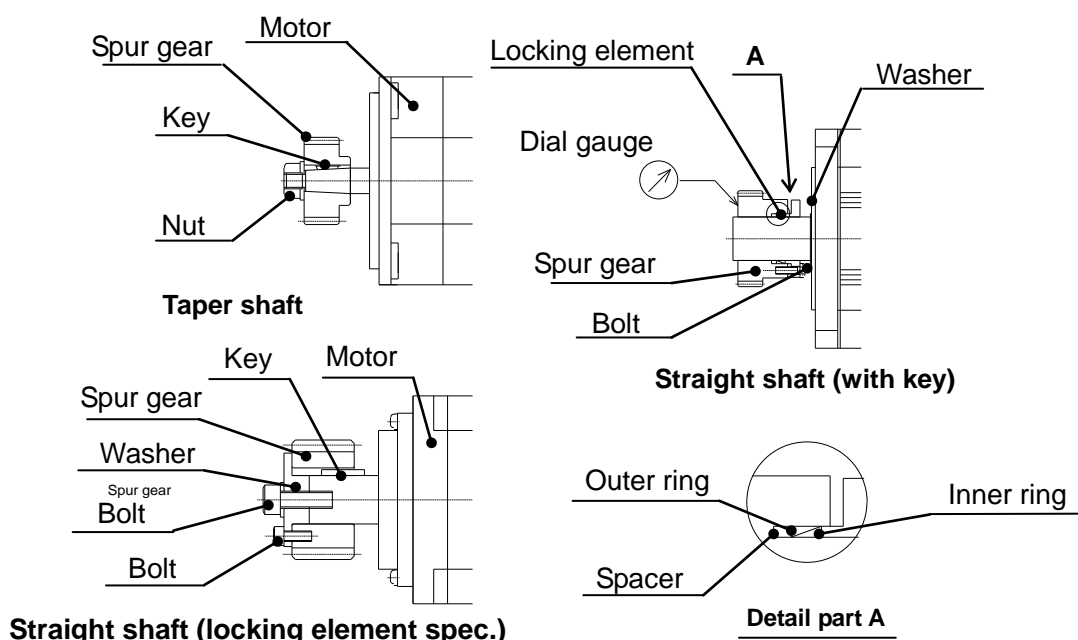


Fig.13

17. Connector

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

17-1. To remove connector

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

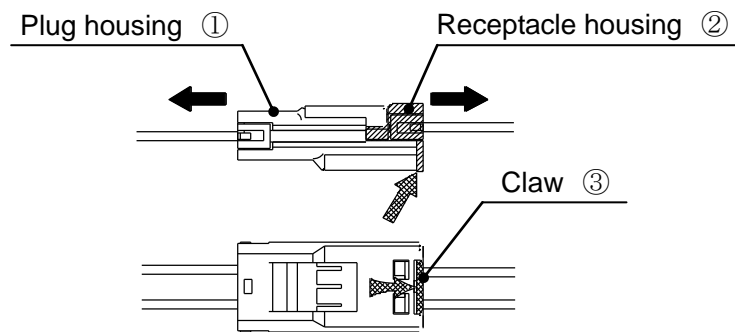


Fig.14



Do not apply any load to cables.
Connect cables so as not to be bent or crushed.

17-2. To mount 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.

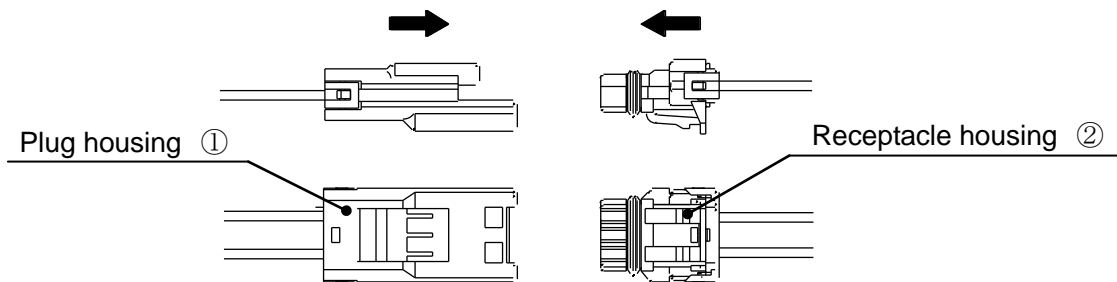


Fig.15



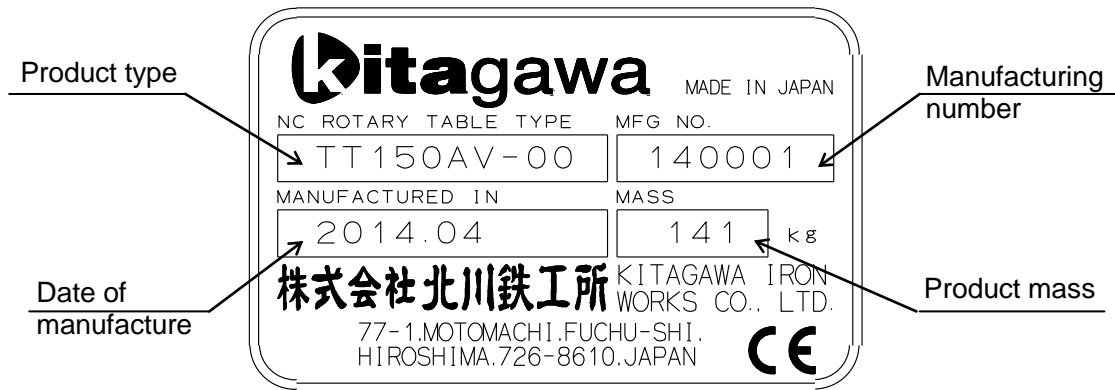
Check that connectors and cables are not damaged before connecting.



Do not apply any load to cables.
Connect cables so as not to be bent or crushed.

18. 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.

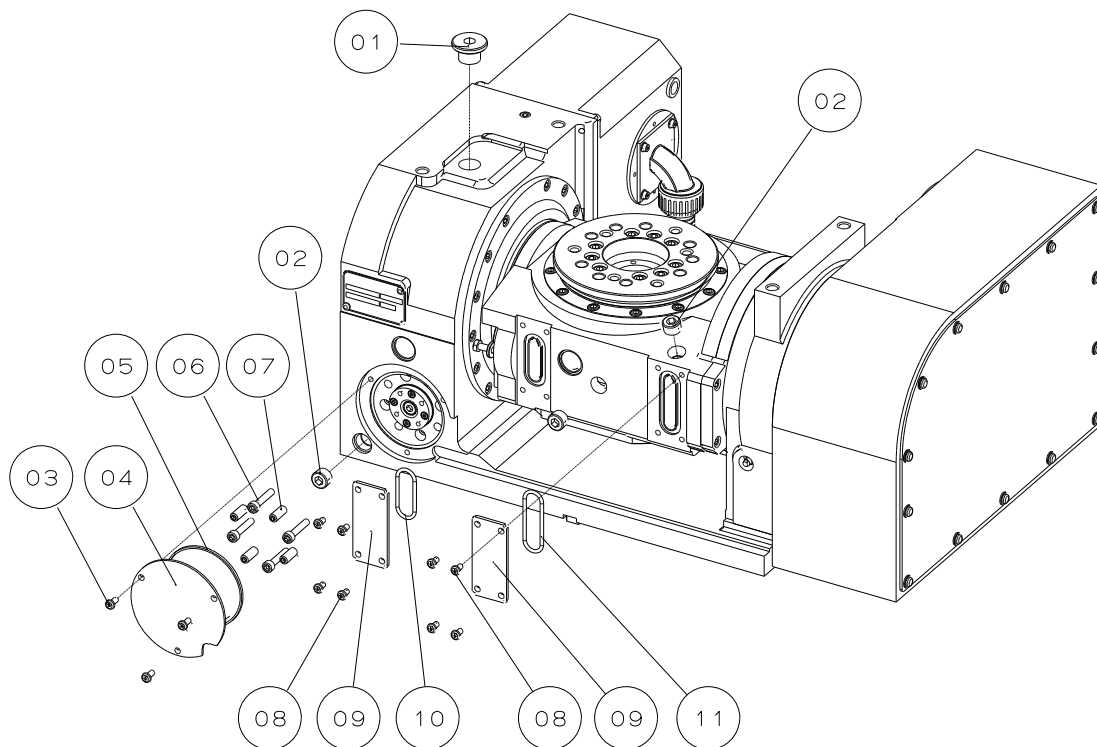
Symptom ⑥: Index accuracy error

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.

19. Parts List

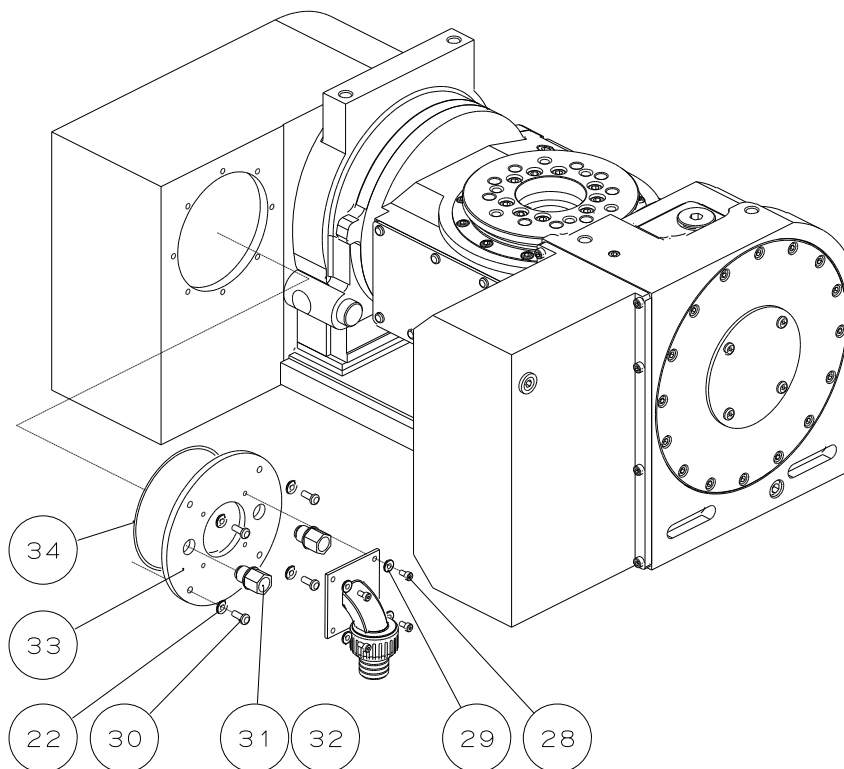
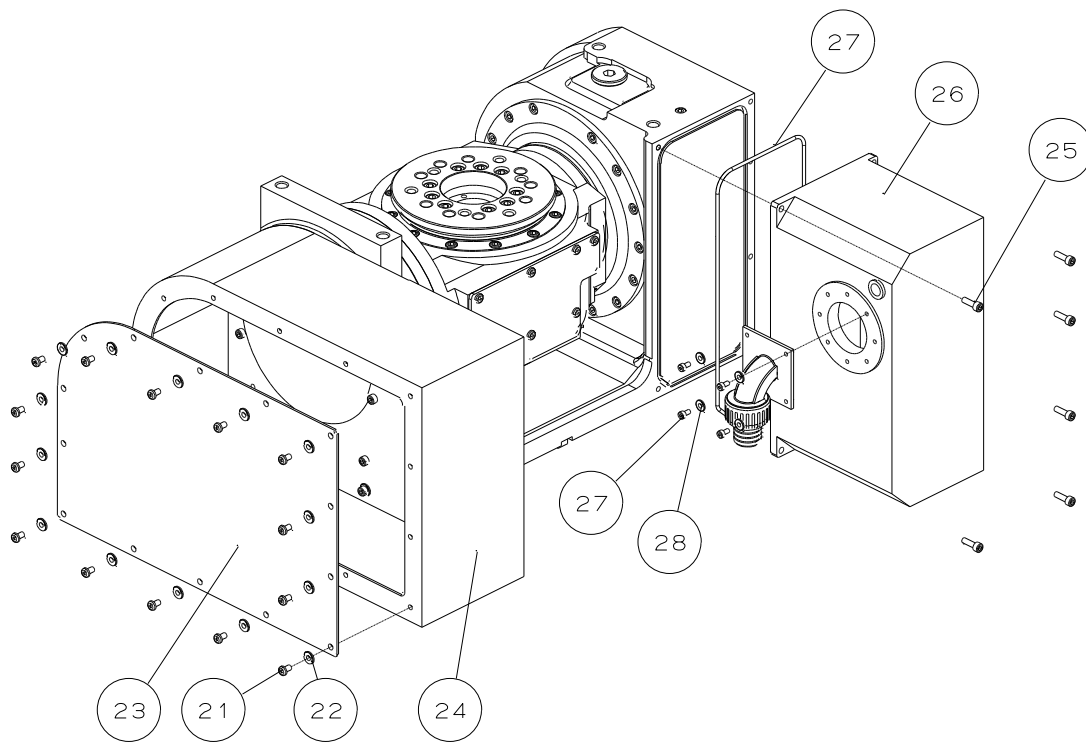
○ Main Body

MARK	NAME	TT150	Q'ty	Recital
01	Hexagon socket flange head screw plug with O-Ring	M20x1.5	1	Gosho
02	Hexagon socket headless tapered pipe plug	Rc3/8	3	
03	Machine screw	M5x10	3	
04	Cover (1)		1	
05	O-ring	S75	1	
06	Hexagon socket head cap screw	M6x30	4	
07	Hexagon socket headless set screw (Flat Point)	M8x20	4	
08	Machine screw	M5x8	8	
09	Cover (2)		2	
10	O-ring	G35	1	
11	O-ring	G45	1	



○ Motor Case(For M Signal)

MARK	NAME	TT150	Q'ty	Recital
21	Machine screw	M5x8	14	
22	Seal washer	5	18	
23	Cover (1)		1	
24	Motor case (1)		1	
25	Hexagon socket head cap screw	M5x16	6	
26	Motor case (2)		1	
27	O-ring	GS115	1	
28	Hexagon socket head cap screw	M4x8	8	
29	Washer	4	8	
30	Machine screw	M5x16	4	
31	Tube connector	KQ2E06-02A	2	SMC
32	Seal washer	14S1	2	
33	Connector plate		1	
34	O-ring	S130	1	
35	Hexagon socket head cap screw	M5x14	11	

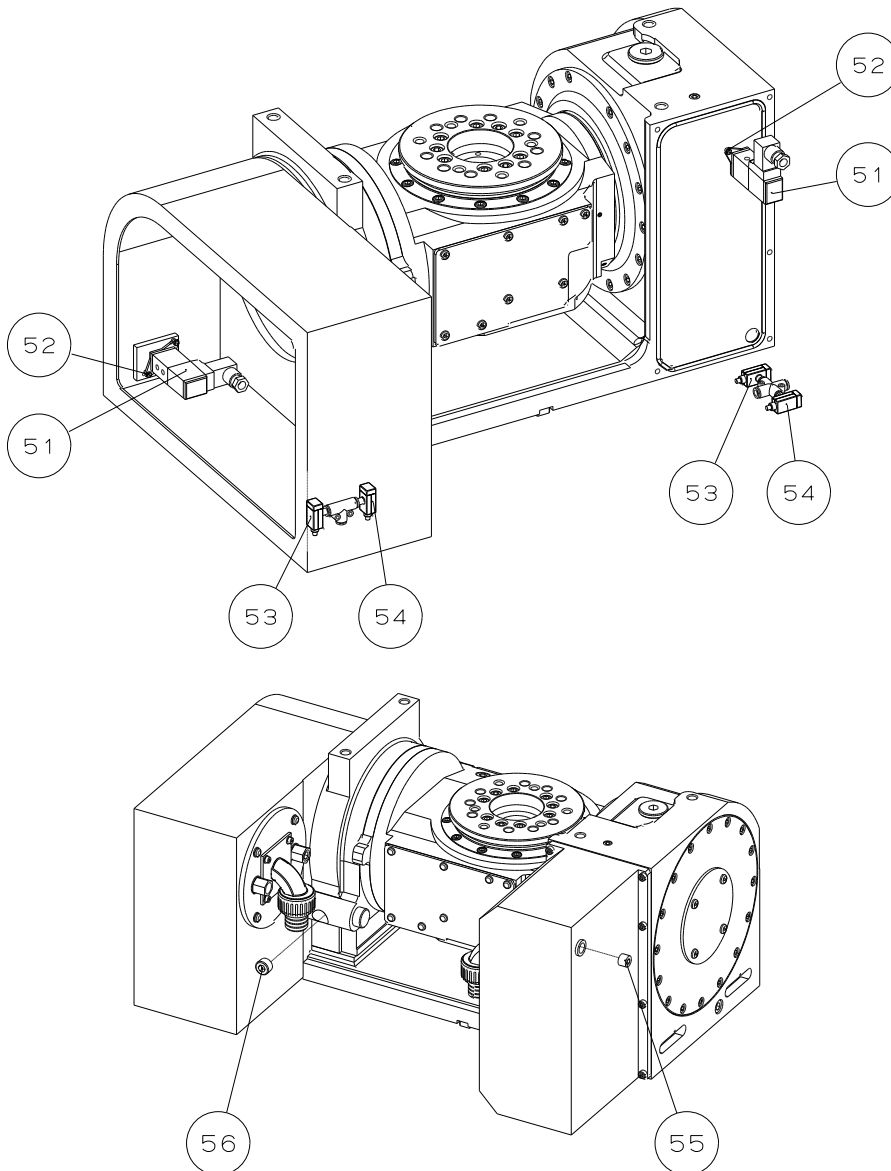


When the specification is 4th and 5th axes, the motor case and the cable are different from the above figure.

For detailed models, refer to attached outside view.

○ Clamp Detection Device

MARK	NAME	TT150	Q'ty	Recital
51	Solenoid valve	VK332-5DS-M5-F-Q	2	SMC
52	Machine screw	M3x6	4	
53	Pressure switch for clamp detection	PS1000-R06L-Q-X140	2	SMC
54	Pressure switch for unclamp detection	PS1100-R06L-Q-X141	2	SMC
55	Plug silencer	PSA102	1	TAIYO
56	Plug silencer	PSA103	1	TAIYO

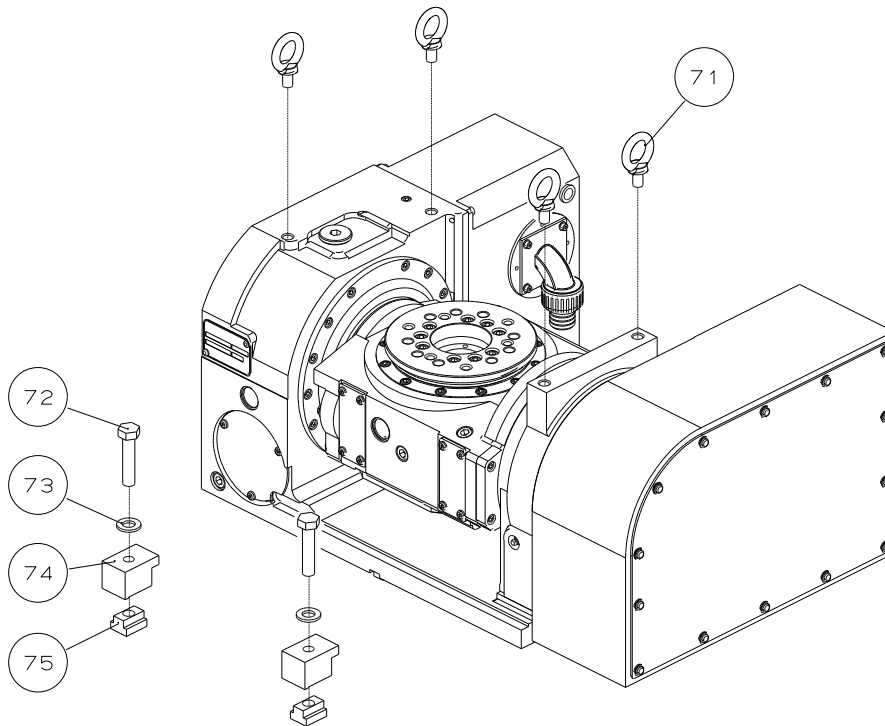


When the specification is different, the model and the installation position of the solenoid valve and the pressure switch are different from the above figure.

For detailed models, refer to attached wiring diagram.

○ Accessory

MARK	NAME	TT150	Q'ty	Recital
71	Eye bolt	M10	3	
72	Hexagon head bolt	M12x55	4	
73	Washer	12	4	
74	Clamp		4	Strength Dimension : 8.8
75	T-slot nut	1412	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.

20. Storage

NOTICE

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

21. 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.

22. Reference Data

22-1. Conversion of arc length and angle

NOTICE

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

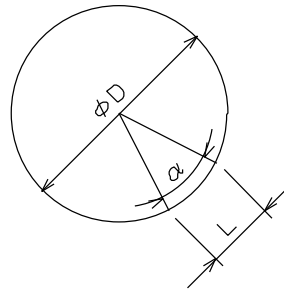
“What is the angle with a cumulative pitch error of 0.01mm ?”

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)

α : 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 :

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

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.

22-2. Workpiece interference area

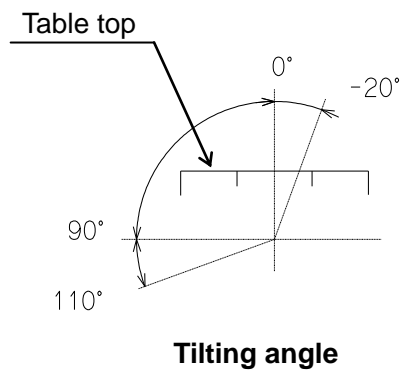
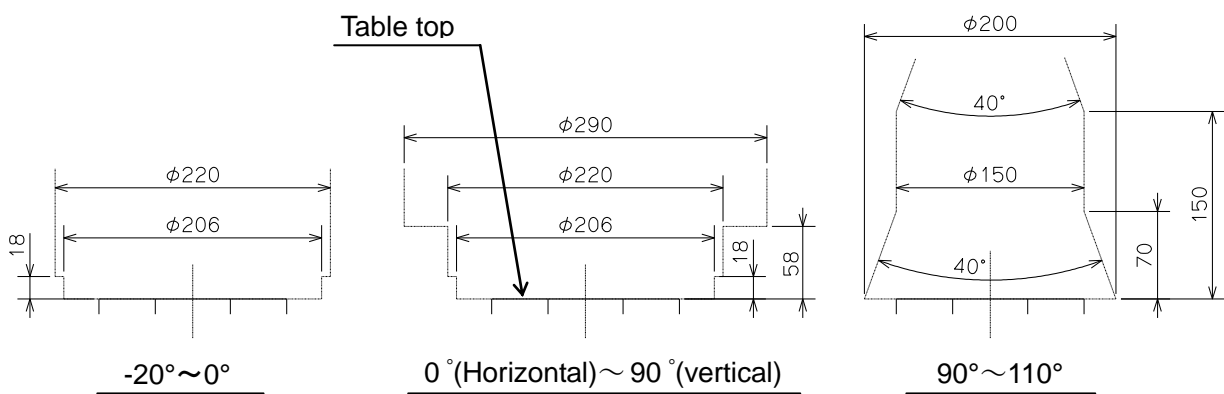
Since the following shows standard specifications, take care in case of special specifications.
Interference with the clamp device is not considered.

Tilting range may be reduced due to fit the Jig or Chuck onto Face plate.

(Refer to the back of the Instruction Manual drawing and the outside view.)

Set a soft limit by the parameter to prevent interference at the customer.

〈TT150〉

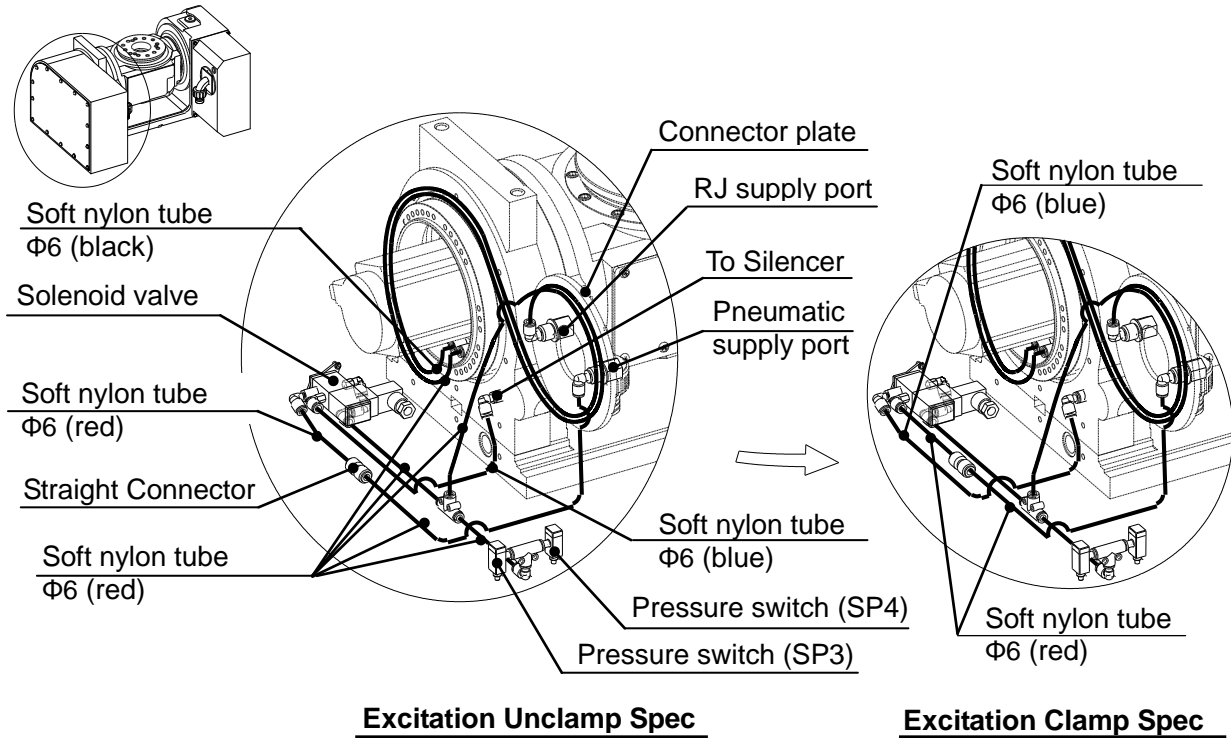


23. Piping Diagram on Pneumatic Specifications

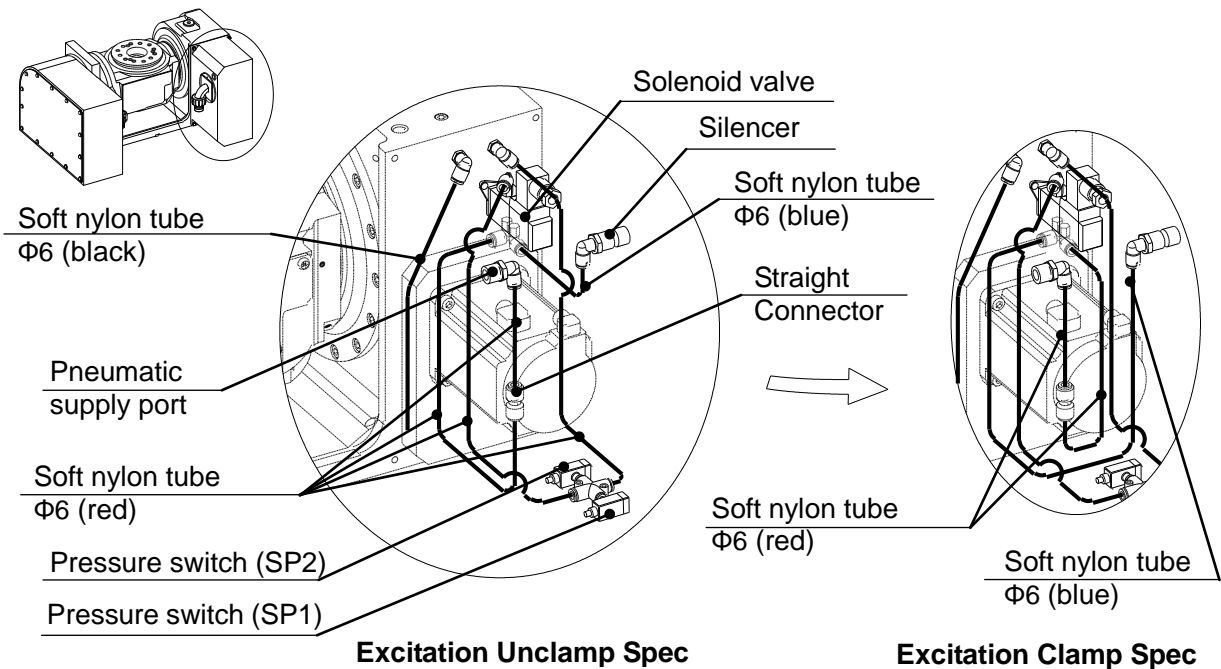
When removing the piping unavoidably to remove the motor case, refer to the following outside view and circuit diagram.

23-1. Outside view of connection piping system

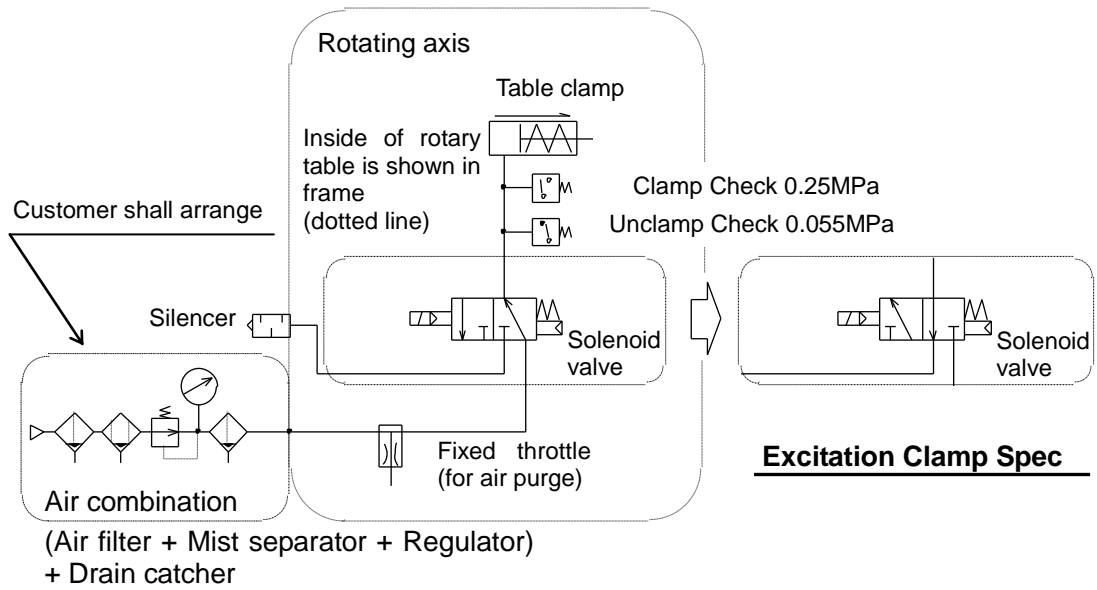
23-1-1. Outside view of piping system for rotating axis



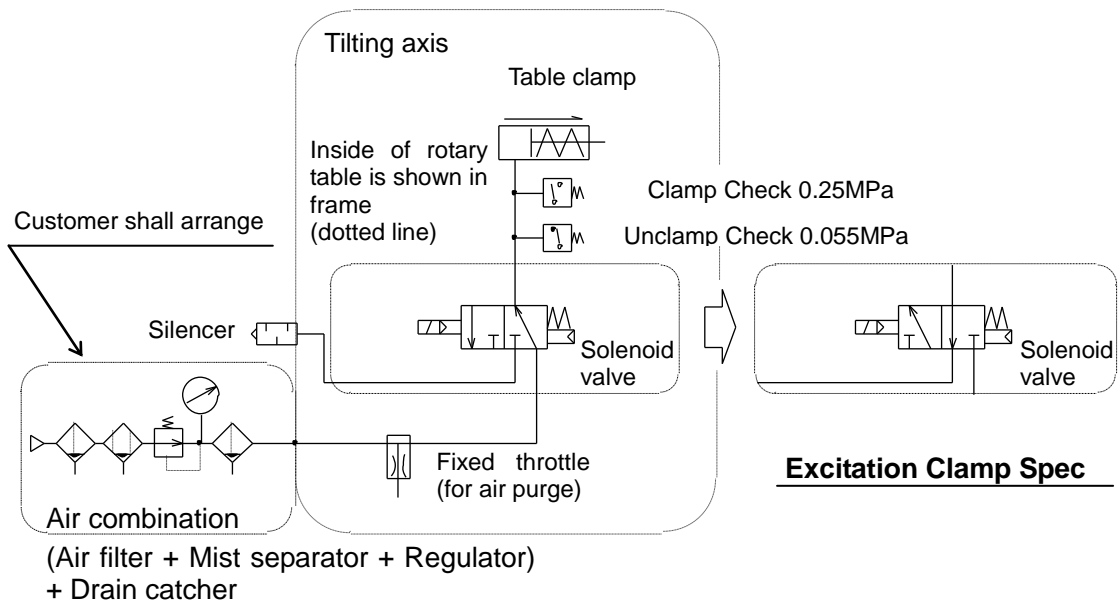
23-1-2. Outside view of piping system for tilting axis



23-2. Pneumatic circuit diagram



Excitation Unclamp Spec



Excitation Unclamp Spec

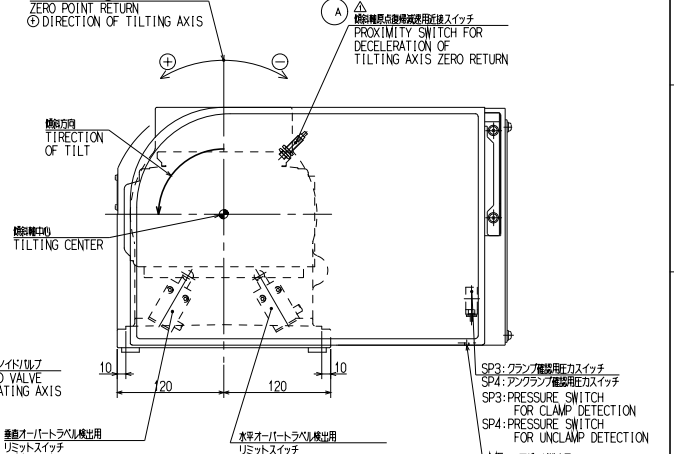
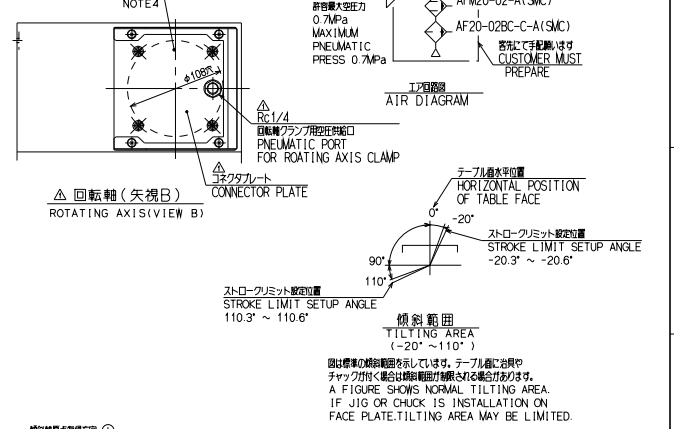
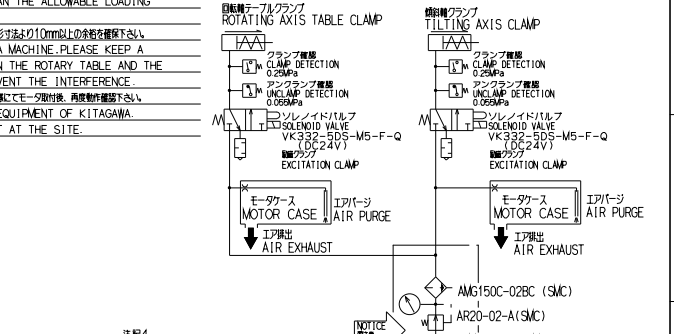
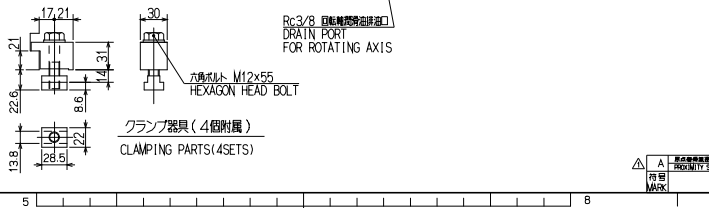
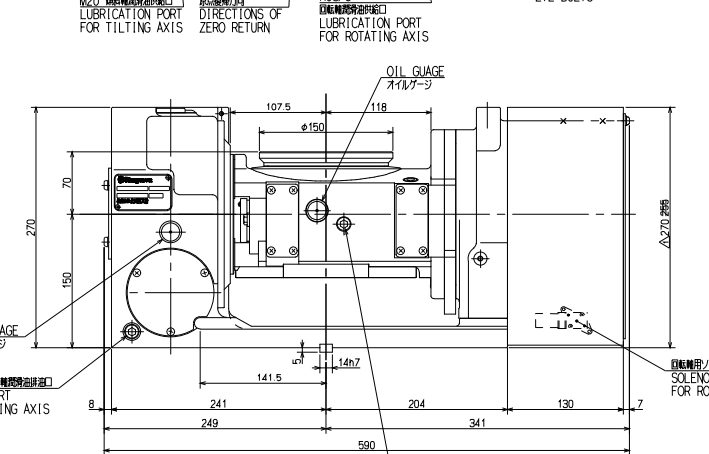
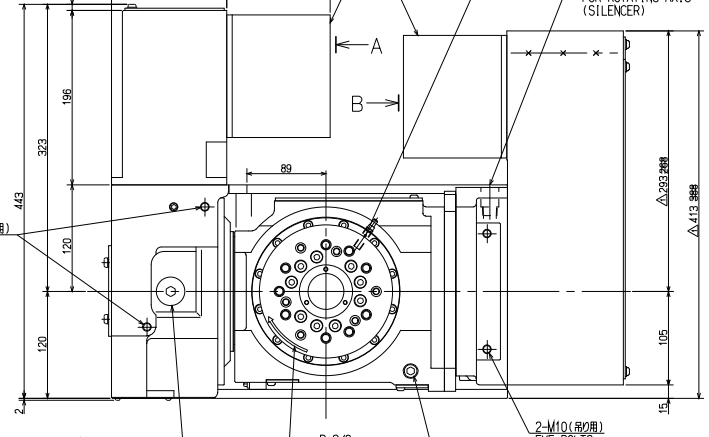
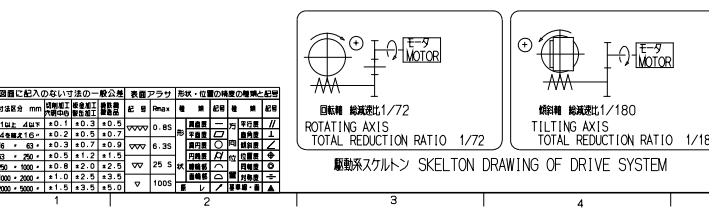
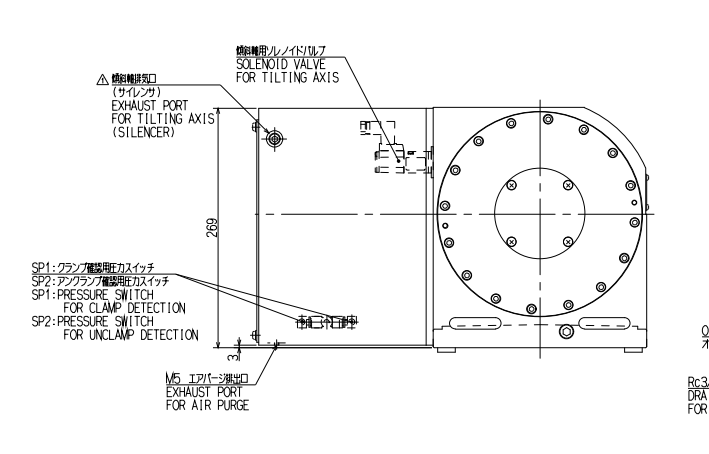
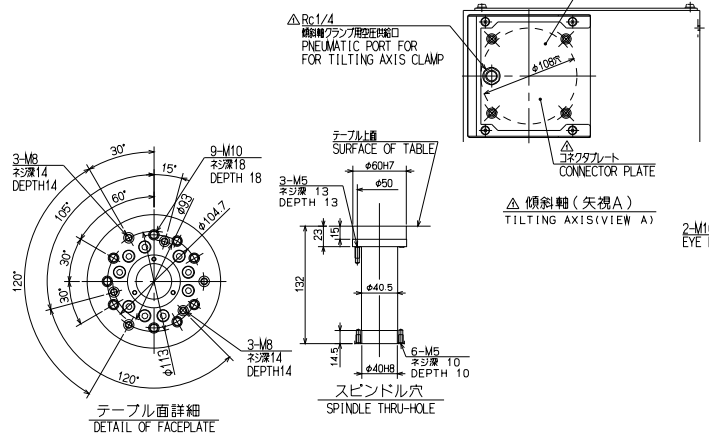
仕様 SPECIFICATIONS		傾斜軸 TILTING AXIS	
回転精度 INDEXING ACCURACY	30 sec/rev	傾斜精度 INDEXING ACCURACY	60 sec/rev
再現精度 REPEATABILITY	4 sec/rev	再現精度 REPEATABILITY	4 sec/rev
テーブル最高回転速度 MAXIMUM ROTATION SPEED [モータ MOTOR]	41.6 min ⁻¹ [3000 min ⁻¹]	テーブル最高回転速度 MAXIMUM ROTATION SPEED [モータ MOTOR]	16.6 min ⁻¹ [1300 min ⁻¹]
クランプトルク CLAMPING TORQUE [空気 PNEUMATIC PRESS]	350 N·m [0.5 MPa]	クランプトルク CLAMPING TORQUE [空気 PNEUMATIC PRESS]	550 N·m [0.5 MPa]
許容最大空気圧 MAXIMUM PNEUMATIC PRESS	0.7 MPa	許容最大空気圧 MAXIMUM PNEUMATIC PRESS	0.7 MPa
総減速比 TOTAL REDUCTION RATIO	1/72	総減速比 TOTAL REDUCTION RATIO	1/180
駆動系モータ慣性モーメント MACHINE INERTIA (REDUCED TO MOTOR SHAFT)	0.000277kgm ²	駆動系モータ慣性モーメント MACHINE INERTIA (REDUCED TO MOTOR SHAFT)	0.000179kgm ²
許容質量 ALLOWABLE MASS OF WORK	水平時 HORZ 50 kg	傾斜時 TILT 30 kg	
許容ワーク径 ALLOWABLE WORK DIA.			φ150 mm
質量 MASS OF ROTARY TABLE			141 kg

注記 NOTE

- 1) ACサーボモータを指定して手配及び取付をお願いします。
WITHOUT MOTOR (SETTING WORKS OF MOTOR AT TECNARA OR CUSTOMER).
回転軸サーボモータ: FANUC αIF 2/5000 (α1A1000)(A06B-0205-B000)
傾斜軸サーボモータ: FANUC αIF 2/5000 (α1A1000)(A06B-0205-B000)
傾斜軸サーボモータ: FANUC αIF 2/5000 (α1A1000)(A06B-0205-B000)
傾斜軸サーボモータ: FANUC αIF 2/5000 (α1A1000)(A06B-0205-B000)
- 2) 図に記述のない精度規格は、カタログ記載のものとする。
ACCURACY STANDARDS EXCEPT STATED IN THIS DRAWING SHOULD BE APPEALED TO THAT IN CATALOGUE.
- 3) 図に記述のない材質規格は、必ずシロコシ液密性ガasketを必ず装着して下さい。
AFTER COVERS ARE REMOVED, TO ASSURE WATER TIGHTNESS, A LIQUID SILICON GASKET MUST BE APPLIED BEFORE REPLACING COVERS.
- 4) 本機はエアポート仕様ですので必ず空気管からクリーンエアを供給して下さい。
THIS ROTARY TABLE IS DESIGNED UNDER THE CONDITION OF AIR PURGE. ACCORDINGLY CLEAN AIR FROM PNEUMATIC PORT HAVE TO BE SUPPLIED. PNEUMATIC PORT MUST BE PREPARED BY CUSTOMER.

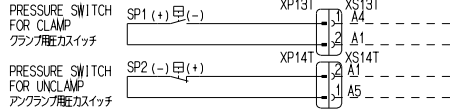
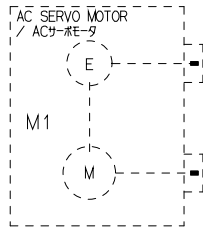
- 5) ワーク換装可能な場合はカタログを参照ください。換装を越える場合は弊社に問合せ下さい。
PLEASE REFER TO THE CATALOGUE FOR ALLOWABLE LOADING AREA. IF THE WORK PIECE SIZE IS LARGER THAN THE ALLOWABLE LOADING AREA, PLEASE CONTACT US.
- 6) 本機を機械に設置する場合には、固定の干渉を防止するために、外径が10mm以上の物を装着して下さい。
WHEN YOU INSTALL A ROTARY TABLE ON A MACHINE, PLEASE KEEP A CLEARANCE OF MORE THAN 10 mm BETWEEN THE ROTARY TABLE AND THE MACHINE SPLASHGUARD IN ORDER TO PREVENT THE INTERFERENCE.
- 7) 本テーブルは、真円自動検査機にて動作確認をしております。お客様にてモータ取付後、再度動作確認下さい。
OPERATION CHECK SHALL BE CARRIED OUT AT THE SITE.

CUSTOMER		
MF. NO.	DATE	REASON OF REVISION
1	15.04.01	ADJUSTMENT (A16 PLACES)



CAREER	61E113963.61E114143	SCALE	TYPE	TT150AE-04	WEIGHT	kg
W. D.	61E275042 61E02045	1:3		NCテーブル NC ROTARY TABLE		
MANAGER	CHIEF	DRAWN BY	NAME	TT150AE-04	カイクイ	
		Y. YAM ASAKI		OUTSIDE VIEW		
KITAGAWA IRON WORKS CO., LTD	DATE	15.03.12	DRW NO.	61E114301		

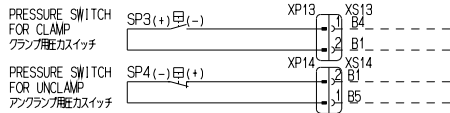
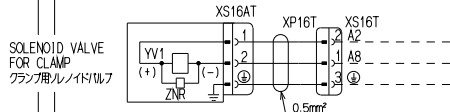
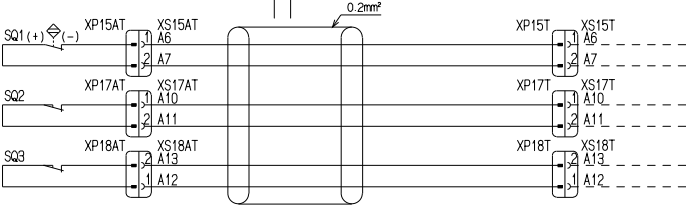
TILTING AXIS / 傾斜軸



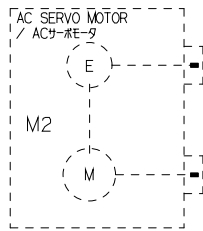
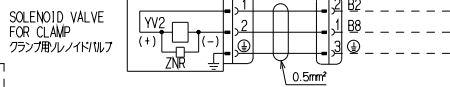
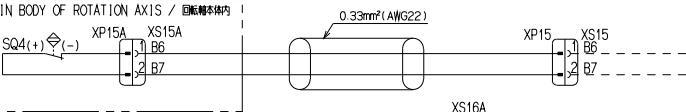
PROXIMITY SWITCH FOR DECELERATION OF ZERO RETURN
 原点復帰減速用接近スイッチ

LIMIT SWITCH FOR HORIZONTAL STROKE LIMIT
 水平オートラバール検出用ミットスイッチ

LIMIT SWITCH FOR VERTICAL STROKE LIMIT
 垂直オートラバール検出用ミットスイッチ



PROXIMITY SWITCH FOR DECELERATION OF ZERO RETURN
 原点復帰減速用接近スイッチ

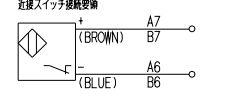


ROTATING AXIS / 回転軸

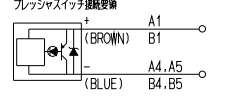
(SOL VOLTAGE / ソレノイド電圧) ※ □

MARK 記号	NAME 品名	MAKER メーカー	TYPE 型式	Q'ty 数量	REMARKS 備考
SP1, SP3	PRESSURE SWITCH 圧力スイッチ	SMC	PS1000-R06L-Q-X140	2	0.25MPa 1a
SP2, SP4	PRESSURE SWITCH 圧力スイッチ	SMC	PS1100-R06L-Q-X141	2	0.055MPa 1b
SQ1, SQ4	PROXIMITY SWITCH 接近スイッチ	Azbiil	FL7M-2K6H	2	DC10~30V
SQ2, SQ3	LIMIT SWITCH 限位スイッチ	Azbiil	LJM-D2502L1	2	
YV1, YV2	SOLENOID VALVE ソレノイドバルブ	SMC	VK332-5DS-M5-F-Q	2	DC24V
XS16A, XS16AT	CONNECTOR コネクタ	SMC	VK300-82-1	2	SOLENOID VALVE ACCESSORIES ソレノイドバルブ付属品
XP13, XP13T	PLUG HOUSING プラグハウジング	MOLEX	52116-0240	2	
XP14, XP14T	PLUG HOUSING プラグハウジング	MOLEX	52116-0241	2	
XP15, XP15A XP15T, XP15AT XP17, XP17A XP17T, XP17AT XP18, XP18A	PLUG HOUSING プラグハウジング	MOLEX	52116-0242	8	
XP16, XP16T	PLUG HOUSING プラグハウジング	MOLEX	52116-0341	2	
XS13, XS13T	RECE. HOUSING レセプタハウジング	MOLEX	52117-0240	2	ACCESSORIES 付属品
XS14, XS14T	RECE. HOUSING レセプタハウジング	MOLEX	52117-0241	2	ACCESSORIES 付属品
XS15A, XS15AT XS17AT, XS18AT	RECE. HOUSING レセプタハウジング	MOLEX	52117-0242	4	
XS15, XS15T XS17, XS18T	RECE. HOUSING レセプタハウジング	MOLEX	52117-0242	4	ACCESSORIES 付属品
XS16, XS16T	RECE. HOUSING レセプタハウジング	MOLEX	52117-0341	2	ACCESSORIES 付属品

CONNECTION OF PROXIMITY SWITCH



CONNECTION OF PRESSURE SWITCH



SPECIFICATIONS

近接スイッチ仕様

OPERATING VOLTAGE RANGE	使用電圧範囲	DC10~30V
SWITCHING CURRENT	制御出力制御電流	3~100 mA
LEAKAGE CURRENT	漏れ電流	max. 0.55 mA
RESIDUAL VOLTAGE	制御出力残留電圧	max. 3.0 V
OUTPUT CONTACT	出力接点	NC

SPECIFICATIONS

圧力スイッチ仕様

OPERATING VOLTAGE RANGE	使用電圧範囲	DC12~24V
SWITCHING CURRENT	制御出力制御電流	5~40 mA
LEAKAGE CURRENT	漏れ電流	max. 1.0 mA
RESIDUAL VOLTAGE	制御出力残留電圧	max. 5 V
OUTPUT CONTACT	出力接点	NO (PS1000-R06L-Q-X140) NC (PS1100-R06L-Q-X141)

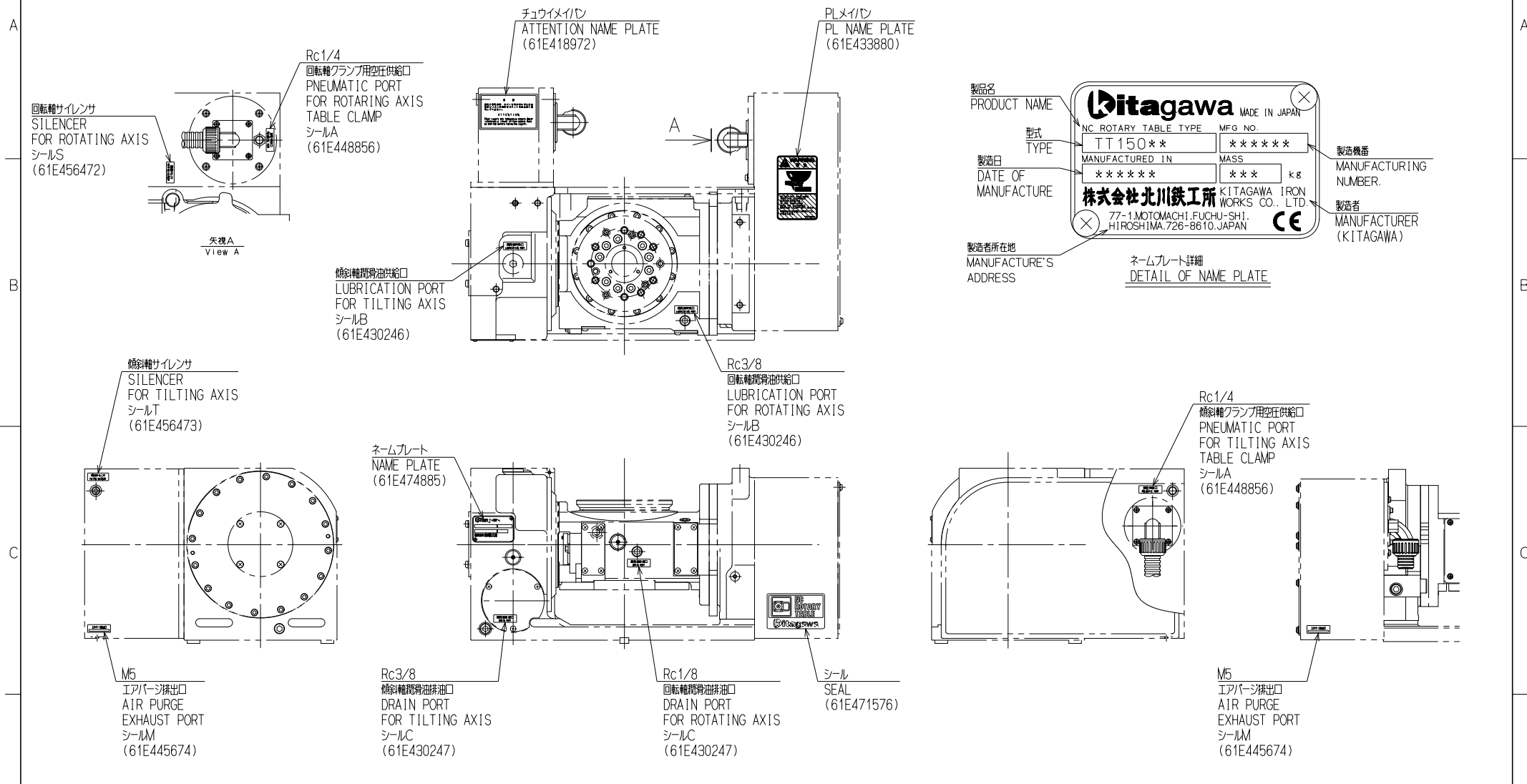
SOLENOID VALVE SPECIFICATIONS

ソレノイドバルブ仕様

	YV1, YV2	
RATED SUPPLY VOLTAGE	定格電源電圧	DC24V
POWER CONSUMPTION	消費電力	4W

CAREER	61E829453, 61E274303	SCALE	TYPE	TT150AE-04	WEIGHT	k.8
MANAGER	CHIEF	DRAWN BY	NAME			
		M. Waka kasa	NC ROTARY TABLE NCテーブル			
		DATE	WIRING DIAGRAM			
		15.03.23	タンキシヨウ			
KITAGAWA IRON WORKS CO., LTD.			DRW NO.	61E275042		

CUSTOMER	
MOD. NO.	DATE REASON OF REVISION



製品名
 PRODUCT NAME
 NC ROTARY TABLE TYPE MFG NO.

型式
 TYPE
 TT150**

製造日
 DATE OF MANUFACTURE
 MANUFACTURED IN MASS

製造者所在地
 MANUFACTURER'S ADDRESS
 株式会社北川鉄工所
 KITAGAWA IRON WORKS CO., LTD.
 77-1.MOTOMACHI.FUCHU-SHI.
 HIROSHIMA.726-8610.JAPAN

製造機番
 MANUFACTURING NUMBER

製造者
 MANUFACTURER
 (KITAGAWA)

ネームプレート詳細
 DETAIL OF NAME PLATE

要注意 NOTE

1) 図はTT150AV-00のメイバン位置を示しています。
 貼り付け位置詳細は外形図を参考にしてください。
 THE POSITION OF TT150AV-00 NAMEPLATE IS SHOWED IN THIS DRAWING.
 THE POSITION OF NAMEPLATE SHOULD BE REFERRED TO OUTSIDE VIEW.

CAREER		SCALE	TYPE	TT150AV-00	WEIGHT	kg
MANAGER	CHIEF	DRAWN BY	NAME	NCテーブル NC ROTARY TABLE		
		S. SA TOH		メイバン詳細図 DETAILS OF NAME PLATE		
KITAGAWA IRON WORKS CO., LTD.		DATE	3RD ANGLE	DRW NO.	61E826882	
		14.09.11				



<http://www.kiw.co.jp>

KITAGAWA IRON WORKS CO., LTD.

77-1 Motomachi Fuchu-shi, Hiroshima-pref., 726-8610, Japan

TEL +81-847-40-0526

FAX +81-847-45-8911

America Contact	<p>KITAGAWA-NORTHTECH INC. http://www.kitagawa.com 301 E. Commerce Dr, Schaumburg, IL 60173 USA TEL +1 847-310-8787 FAX +1 847-310-9484</p>
	<p>TECNARA TOOLING SYSTEMS, INC. http://www.tecnaratools.com 12535 McCann Dr, Santa Fe Springs, California 90670 USA TEL +1 562-941-2000 FAX +1 562-946-0506</p>
Europe Contact	<p>KITAGAWA EUROPE LTD. http://www.kitagawaeurope.com Unit 1 The Headlands, Downton, Salisbury, Wiltshire SP5 3JJ, United Kingdom TEL +44 1725-514000 FAX +44 1725-514001</p>
	<p>KITAGAWA EUROPE GmbH http://www.kitagawa.global/de Borsigstrasse 3, 40880, Ratingen Germany TEL +49 2102-123-78-00 FAX +49 2102-123-78-69</p>
	<p>KITAGAWA EUROPE GmbH Poland Office http://www.kitagawaeurope.com 44-240 Zory, ul. Niepodleglosci 3 Poland TEL +48 607-39-8855 FAX +48 32-749-5918</p>
	<p>KITAGAWA EUROPE GmbH Czech Office http://www.kitagawa.global/cz Purkynova 125 621 00 Brno, Czech Republic TEL +420 549-273-246 FAX +420 549-273-246</p>
	<p>KITAGAWA EUROPE GmbH Romania Office http://www.kitagawa.global/ro Strada Heliului 15, Bucharest 1, 013991, Romania TEL +40 727-770-329</p>
	<p>KITAGAWA EUROPE GmbH Hungary Office http://www.kitagawaeurope.com Dery T.u.5 , H-9024 Győr, Hungary TEL +36 30-510-3550</p>
Asia Contact	<p>KITAGAWA INDIA PVT LTD. http://www.kitagawa.global/in Plot No.215, 4th Phase, Bommasandra Industrial Area, Bommasandra Jigani Link Road, Bangalore 560 099, Karnataka, India TEL +91-80-2976-5200 FAX +91-80-2976-5205</p>
	<p>KITAGAWA (THAILAND) CO., LTD. Bangkok Branch 9th FL, Home Place Office Building, 283/43 Sukhumvit 55Rd. (Thonglor 13), Klongton-Nua, Wattana, Bangkok 10110, Thailand TEL +66 2-712-7479 FAX +66 2-712-7481</p>
	<p>KITAGAWA IRON WORKS (SHANGHAI) CO., LTD. Room 308 3F Building B. Far East International Plaza, No. 317 Xian Xia Road, Chang Ning, Shanghai, 200051 China TEL +86 21-6295-5772 FAX +86 21-6295-5792</p>
	<p>KITAGAWA IRON WORKS (SHANGHAI) CO., LTD. Guangzhou Office B07/25/F, West Tower, Yangcheng International Trading Centre, No. 122 East Tiyu Road, Tianhe District, Guangzhou, China TEL +86 20-2885-5276</p>
	<p>DEAMARK LIMITED http://www.deamark.com.tw No. 6, Lane 5, Lin Sen North Road, Taipei, Taiwan TEL +886 2-2393-1221 FAX +886 2-2395-1231</p>
	<p>KITAGAWA KOREA AGENT CO., LTD. http://www.kitagawa.co.kr 803 Ho, B-Dong, Woolim Lion's Valley, 371-28 Gasan-Dong, Gumcheon-Gu, Seoul, Korea TEL +82 2-2026-2222 FAX +82 2-2026-2113</p>
Oceania Contact	<p>DIMAC TOOLING PTY. LTD. http://www.dimac.com.au 69-71 Williams Rd, Dandenong South, Victoria, 3175 Australia TEL +61 3-9561-6155 FAX +61 3-9561-6705</p>

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