ＮＣ円テーブル
NC ROTARY TABLE

取扱説明書
INSTRUCTION MANUAL

Model　TBX250BE05

重要	IMPORTANT
取扱説明書本文に記載してある危険・警告事項の部分は、製品を使用する前に注意深く読み、理解すること。	Please read and understand DANGER / WARNING items in this manual before operating your NC Rotary Table.
将来いつでも使用できるように大切に保管すること。	Please keep this manual by your side for answers to any questions you may have and to check.

KITAGAWA IRON WORKS CO., LTD.

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

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

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

SAFETY ALERT SYMBOL

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

WARNING

DANGER

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

WARNING

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

CAUTION

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

IMPORTANT

IMPORTANT

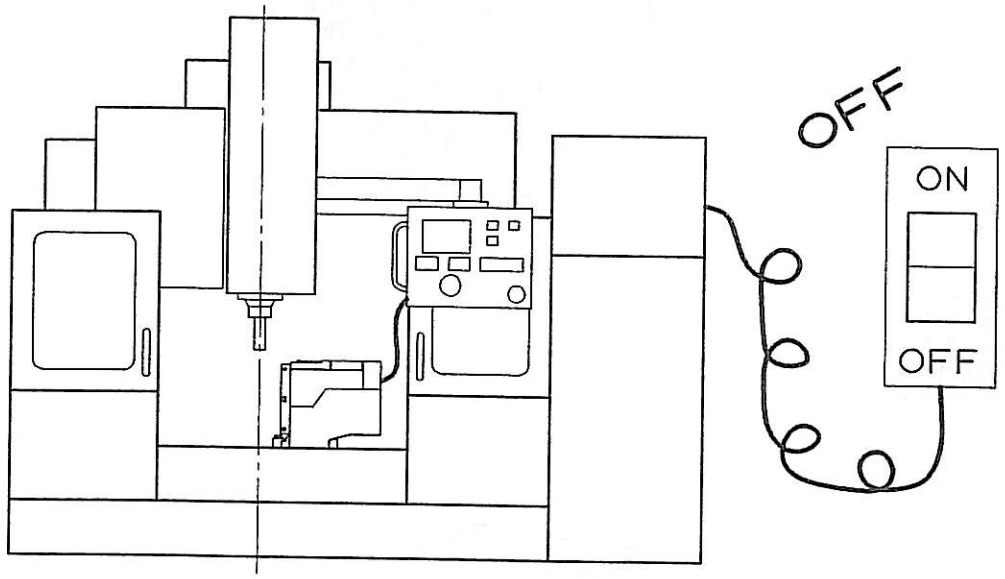
Instructions for table performance and avoiding errors or mistakes.

1 Operation for Safety

Please read this manual carefully and follow their instructions. Warranty does not cover damage or accident caused without following the warning items in this manual

DANGER

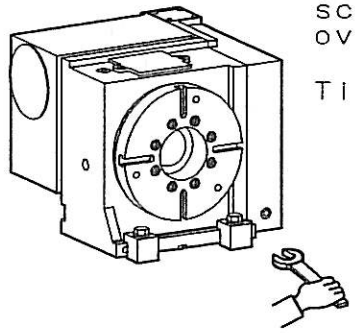
Be sure to turn OFF power source before mounting, maintaining, inspecting and repairing NC rotary table.



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

⚠ WARNING

Securely tighten bolts.



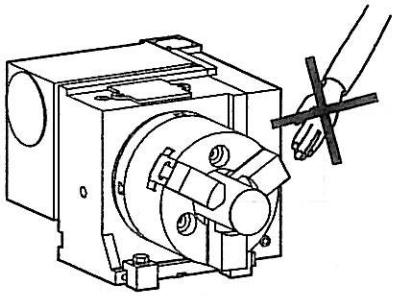
There is a danger of workpiece scattering because the table overturns.

Tighten bolts at specified torque.

Hexagon bolt sizes	Tightening torque (N-m)
M10	72.5
M12	107.8
M16	250.0
M20	401.8

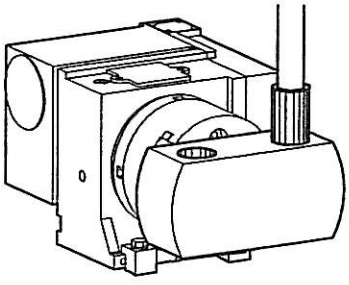
Do not touch your hands the rotary member during operation.

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



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

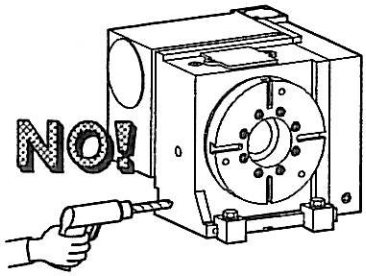
There is a danger in which NC rotary table damages and workpiece scatters



⚠ WARNING

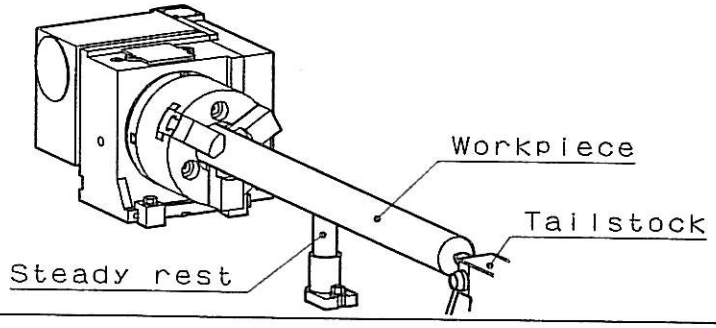
Do not modify the table.

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



For long or heavy workpiece, use the tailstock and steady rest.
(See page 8)

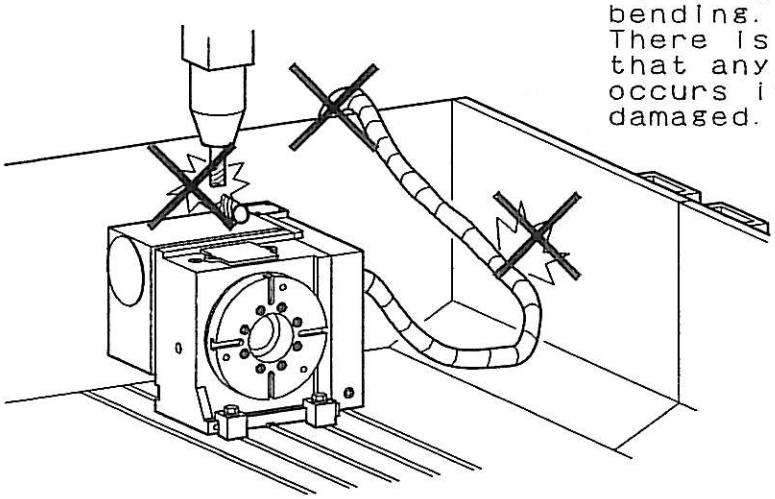
There is a danger of workpiece scatter-ing if workpiece is too long or heavy.



WARNING

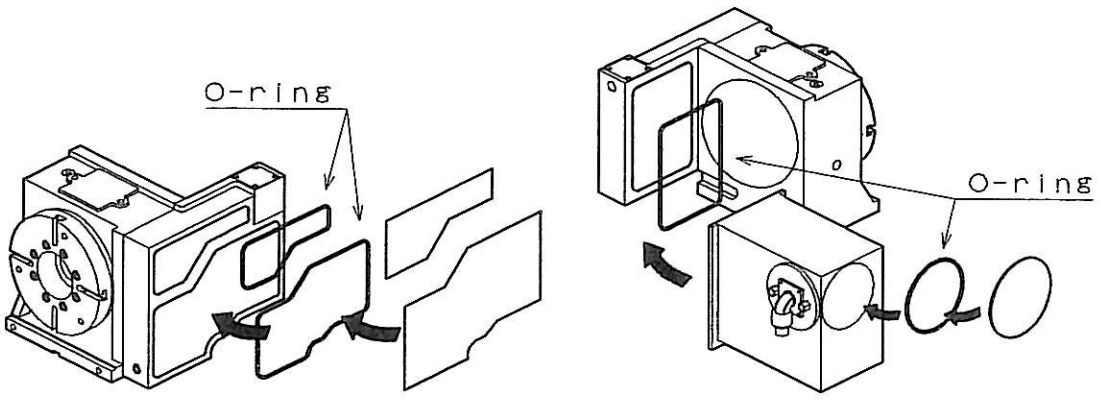
Avoid NC rotary table from interference with mounting equipment.
(See page 10)

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



CAUTION

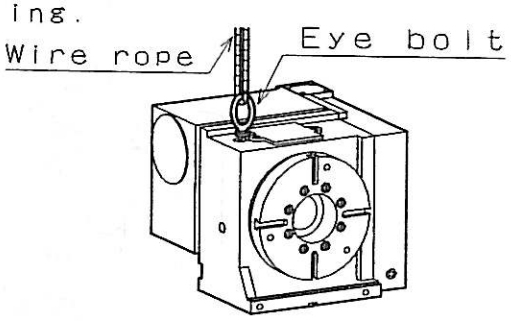
Fit O-rings to all covers.
(No damages on O-rings)



⚠ CAUTION

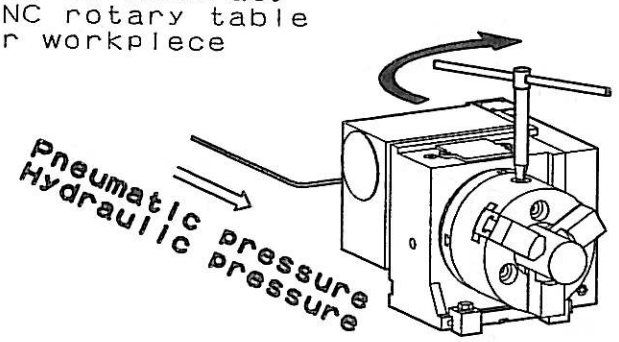
When transferring NC rotary table, use wire ropes and eye bolts. (See page 10)

Take care of falling.

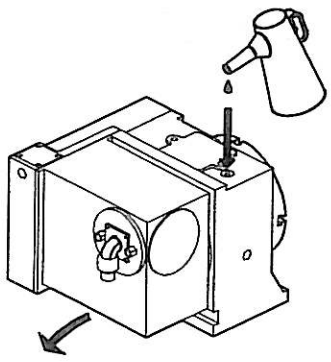


Clamp the table before mounting or removing the workpiece.

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



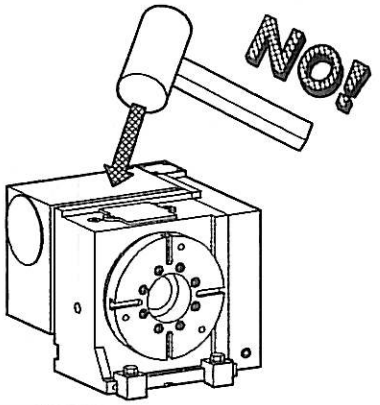
Replace lubrication and operation oil every 6-month. (See page 10)



CAUTION

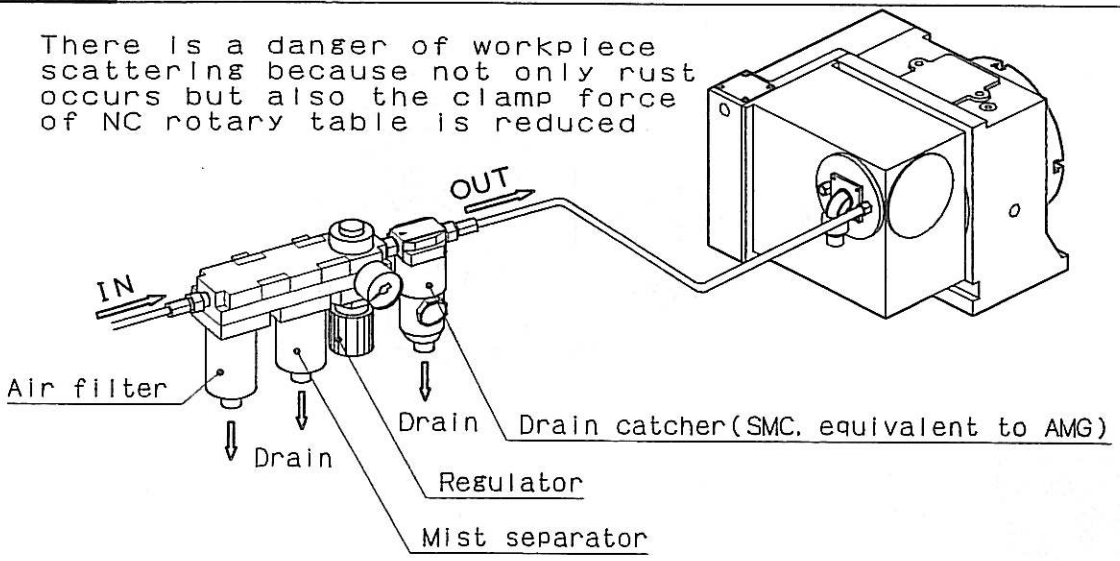
Do not apply any shock to each component of NC rotary table.

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



Supply clean air passing through the air combination (Air filter, mist separator and regulator) + drain catcher. (See page 12)

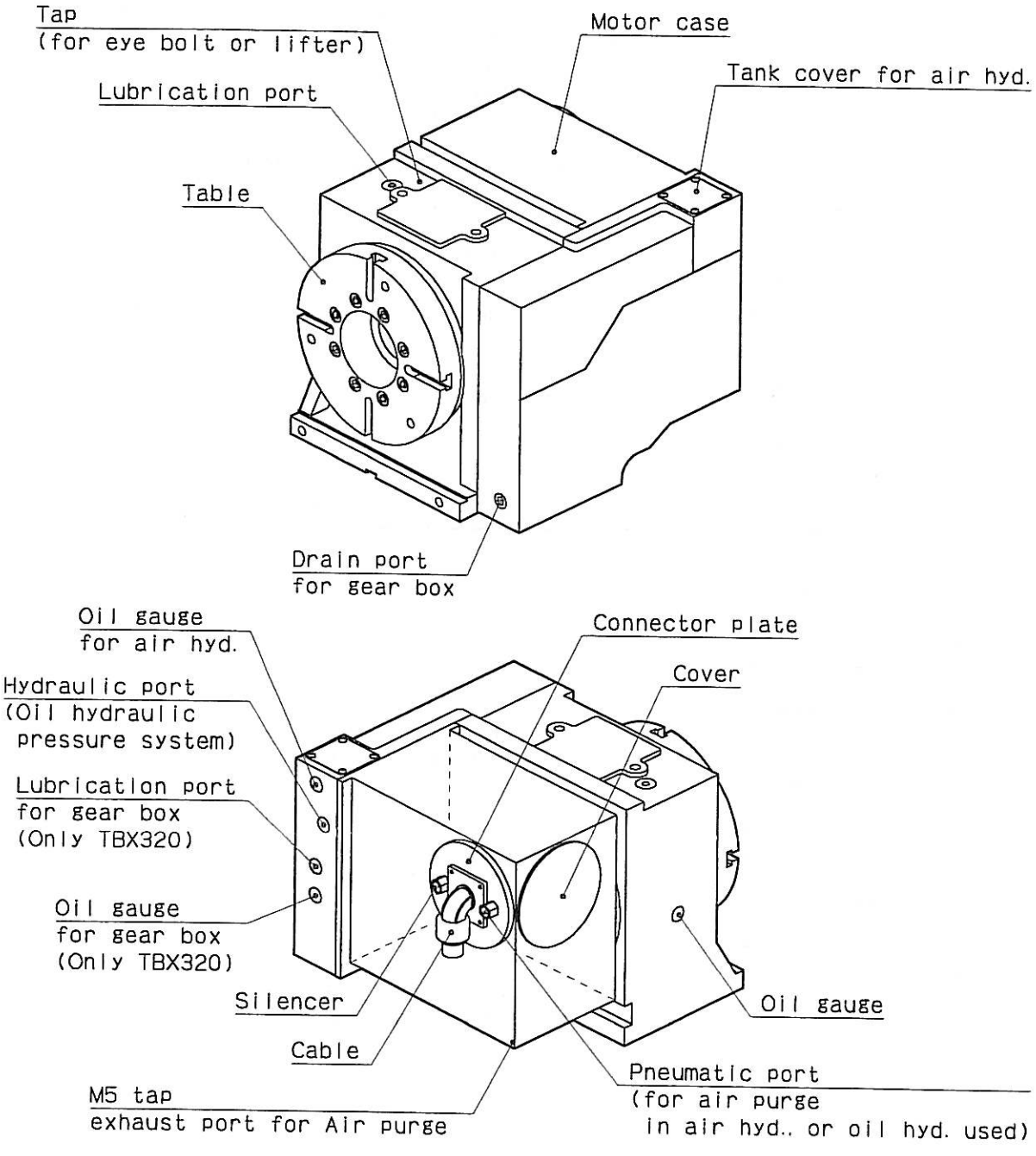
There is a danger of workpiece scattering because not only rust occurs but also the clamp force of NC rotary table is reduced



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

2 Outside View

The following figure is the standard outside view of model TBX. Since the table clamp device is displayed without classifying the oil hydraulic pressure specification and the air hydraulic pressure specification in the following figure. the oil hydraulic pressure supply port becomes valid only when the oil hydraulic pressure system is used. Thus. the air hydraulic booster is built-in only when the air hydraulic pressure system is used.For detailed models. refer to attached outside view.



3 Specifications

	Item \ Type		TBX160	TBX200	TBX250	TBX320
1	Table diameter	mm	φ165	φ200	φ250	φ320
2	Table thickness	mm	265	296	335	408
3	Center height	mm	120	140	180	225
4	Center hole diameter	mm	φ50	φ75	φ105	φ135
5	Through hole diameter	mm	φ40	φ52	φ78	φ110
6	T-slot width	mm	12	12	12	14
7	Basic-slot width	mm	12	12	12	14
8	Clamping torque [Pneumatic 0.5MPa (5.1kgf/cm²)]	N·m(kgf·m)	450(45.9)	600(61.2)	1100(112.2)	2600(265.1)
	Clamping torque [Hydraulic 3.5MPa (35.7kgf/cm²)]	N·m(kgf·m)	450(45.9)	600(61.2)	1100(112.2)	2600(265.1)
9	Allowable workpiece diameter	mm	φ165	φ200	φ250	φ320
10	Allowable mass of workpiece	kg	80	100	125	180
11	Allowable work inertia	Kg·m²(kgf·cm·sec²)	0.26(2.6)	0.50(5.1)	0.98(10.0)	2.24(22.9)
12	Total reduction ratio		1/72	1/90	1/120	1/180
13	Max. rotation speed	min^{-1}	41.6	33.3	25.0	16.6
14	Mass of rotary table	kg	About70	About74	About135	About220

IMPORTANT

Max. rotation speed is the value when the motor rotates at 3000 min-1.Table clamp forces are values of air pressure 0.5MPa and hydraulic pressure 3.5MPa.

⚠ CAUTION

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

⚠ CAUTION

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

⚠ CAUTION

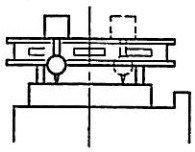
For the conditions for using the table, refer to the above specifications and caution items. Set each cutting condition so as not to exceed the allowance value.

4 Accuracy Standard

(Unit : mm)

	Inspection Item		Allowable Valve
1	Straightness of table top face	Per 300mm	0.010
2	Parallelism of table top face and reference plane for horizontal installation	Per 300mm	0.020
3	Parallelism of rotating axis center line and reference plane for vertical installation	Per 300mm	0.020
4	Run out of table top face during table rotation		0.010
5	Run out of table center hole		0.010
6	Parallelism of rotating axis center line and base guide block center line for reference plane for vertical installation	Per 300mm	0.020
7	Offset of rotating axis center line and base guide block center line on reference plane for vertical installation		0.020
8	Indexing accuracy	Cumulative	20sec
9	Repeatability		4sec

1



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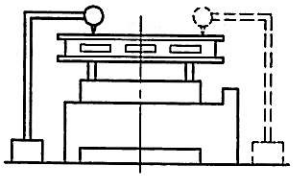

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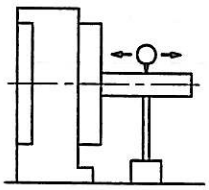

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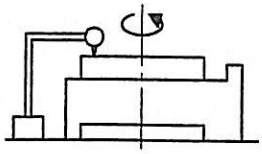

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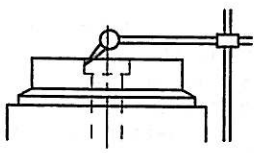

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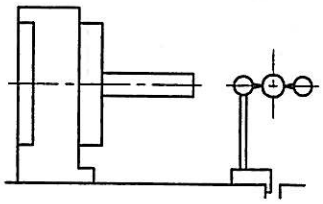

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Indexing accuracy is measured by an optical instrument.

5 Operation Ready

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

5-1 Table transfer and mounting to machine tool

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

5-2 Oiling of lubrication oil

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

⚠ CAUTION

Replace all lubrication and operation oil with a new one every 6-mouth. Completely drain before replacing. When filling the oil, wipe the oil filler so that chips and foreign matter are not entered into the tank. If the chips or foreign matter are entered, the important part such as bearings, etc., are seized or machining accuracy drops. In the air hydraulic system, clamp alarm occurs.

⚠ CAUTION

Supply the lubrication oil for worm gear part to the center position of the oil gauge. While, supply the hydraulic oil of air hydraulic booster part to near the upper part of oil tank. If oil volume is short or large, the machine does not function sufficiently.Use the lubrication oil recommended to 5-5 pages table.Use the hydraulic oil recommended to 5-6 pages table.

5-3 Required volume for lubrication oil

(Unit:Litter)

Type	TBX160	TBX200	TBX250	TBX320
Required lubrication oil volume	1.0	1.2	2.3	3.5

☆ Daphne Multiway 32MT or 68MT (IDEMITSU) was filled before shipping.

5-4 Required volume for operation oil
(For air hyd. booster in air hyd. system used)

(Unit:Litter)

Type	TBX160	TBX200	TBX250	TBX320
Required operation oil volume	0.07	0.08	0.11	0.15

☆ Daphne Neo Fluid (IDEMITSU) was filled before shipping.

5-5 Recommended lubrication oil

《TBX160》

(Viscosity grade ISO VG32)

Maker	Name	Maker	Name
IDEMITSU	Daphne Multiway 32MT	NIPPON OIL CORPORATION	Uniway 32
MOBIL	Vactra oil No. 1		
JOMO	Slidus HS32	COSMO	Dynaway 32
SHELL	Shell Tonna oil S32	ESSO	Unipower MP32

《TBX200、TBX250、TBX320》

(Viscosity grade ISO VG68)

Maker	Name	Maker	Name
IDEMITSU	Daphne Multiway 68MT	NIPPON OIL CORPORATION	Uniway 68
MOBIL	Vactra oil No. 2		
JOMO	Slidus HS68	COSMO	Dynaway 68
SHELL	Shell Tonna oil S68	ESSO	Fabis K68

5-6 Recommended operation oil(For air hyd. booster in air hyd. system used)

(TBX160、TBX200、TBX250、TBX320)

(Viscosity grade ISO VG32)

Maker	Name	Maker	Name
IDEMITSU	Daphne Neo Fluid 32	NIPPON OIL CORPORATION	Hyrando ATC 32
	Daphne Super Hydro 32A		Super Hyrando V32
MOBIL	Hydraulic Oil 32	SHELL	Shell Tellus Oil 32
	Mobil DTE XL32		Shell Tellus Oil S32
COSMO	Cosmo Hydro AW 32	ESSO	Nuto H32
	Cosmo Super Epoch ES32		Unipower SHT32

5-7 Supply of air pressure and hydraulic pressure for clamp

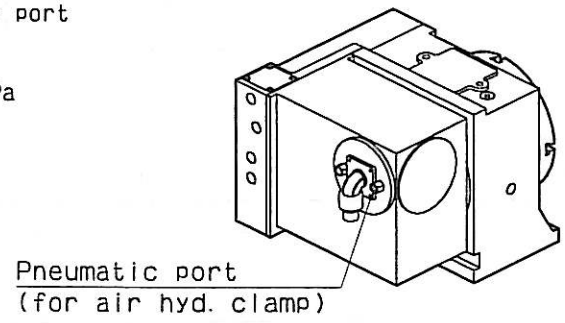
The clamp device for clamping the table is built-in the NC rotary table and two type of air hydraulic system and oil hydraulic system. In the air hydraulic system, the air hydraulic booster is built in the system.

5-7-1 Air hydraulic clamp system

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 air hose to the connection port (Connection port is Rc1/4).

3) Use the air at the range of 0.5 ~ 0.6MPa (5.1 ~ 6.1 kgf/cm²).



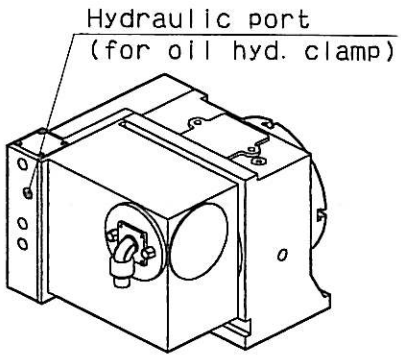
5-7-2 Oil hydraulic clamp system

1) Connect the hydraulic hose to the connection port (Connection port is Rc3/8).

2) Use the hydraulic pressure at 3.5 MPa (35.7kgf/cm²).

3) Securely perform air relief. If air is remained in the clamp cylinder, the chuck does not clamp sufficiently. When clamp and unclamp motions are repeated by loosening the air relief plug, residual air can be exhausted. For air relief components, see the outside view. In case of air hydraulic clamp specification, securely perform air relief, referring to item 6.

4) When the air relief plug is too loosened, there is a possibility that the air relief plug flies out. Slightly push the air relief plug with the hexagon bar spanner so as not to fly out.



⚠CAUTION

In the hydraulic clamp specification, though the connection port of different diameter socket is Rc3/8, use the hydraulic hose equivalent to 3/8 of different diameter.

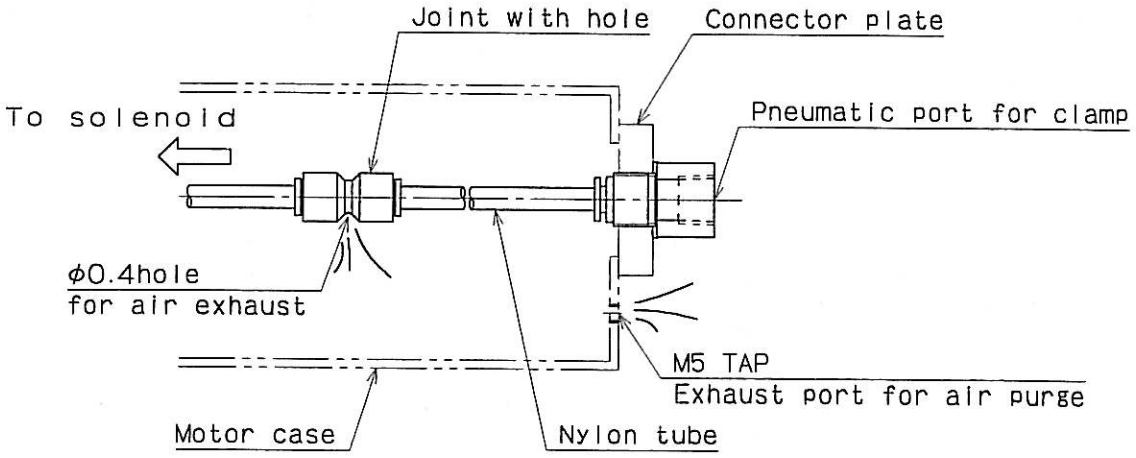
5-8 Air purge

⚠WARNING

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

(Air Hydraulic Specification)

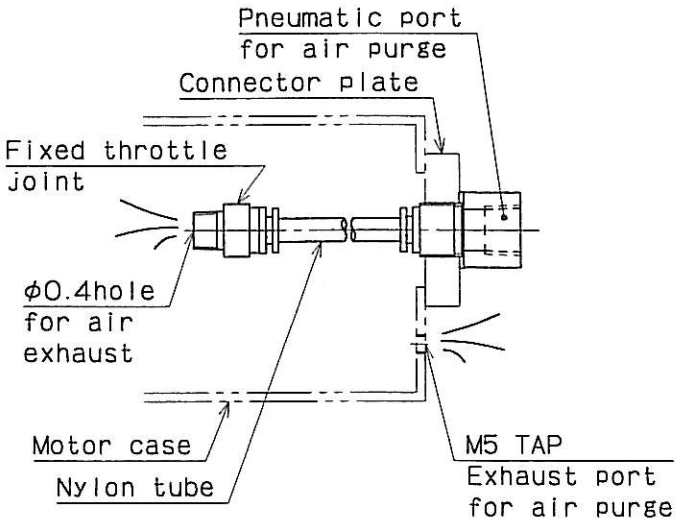
The air purge is performed from the joint with hole of φ0.4 inside of motor case by the part of air used for clamp. Be sure to supply clean air passing through the filter (air filter, mist separator, regulator and drain catcher).If there are moisture, oil content, etc., in the air, they are entered in the motor case, thus damaging the equipment. The air in the motor case is exhausted from the air purge exhaust port.If the air purge exhaust port is closed, condensed drops are not exhausted and pressure is still maintained in the motor cover, thus causing the motor or motor case damage. Consequently, do not close the exhaust port for air purge .When the air is exhausted, though any exhausting sound occurs, there is no unusual.



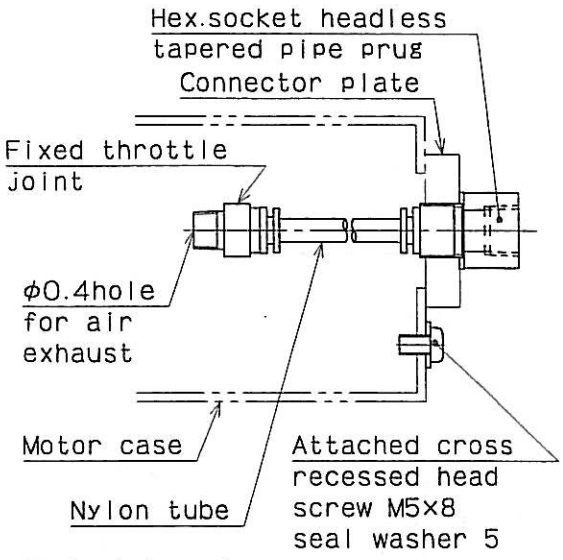
Outside view of air purge

(Hydraulic Specification)

Since the pneumatic port of special air purge is provided for the oil hydraulic pressure system, be sure to supply the clean air as well as the air pressure system.
(Air pressure: 0.5MPa)If the air purge cannot be performed because of no air, be sure to mount the attached cross recessed head screw M5 and seal washer 5 to the M5 tap of air purge exhaust port shown in the outside view. (Because coolant is entered in the motor case.)



Outside view
of air purge point used



Outside view
of air purge point unused

6 Air Relief

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

* *

Refer to the NC rotary table outside view (appendix 1) for an air relief plug position.

* *

6-1 For air hyd. system

1) Move the piston for air hydraulic pressure (hereinafter referred to as piston) to returned edge. When the air is suppiled with the solenoid valve ON at excitation unclamp specification and with the solenoid valve OFF at excitation clamp specifi -cation. the piston moves the returned edge. (See page 16)

2) Remove the tank cover on air hydraulic part of the top face of NC rotary table (hereinafter referred to as cover) and fill specified hydraulic oil to near the upper part of the tank.

3) Supply air and advance the piston in the opposite of item 1) to make clamp state. Loosen the air relief plug a little to bleed the air. Next. retighten the loosened air relief plug before moving the piston to returned edge as well as item 1). (If the plug is not tightened. exhausted air is sucked again.)

4) After that. repeat item 3). When the air mixed into oil is not exhausted from the air relief plug. tighten the air relief plug as it was and also. mount the cover after checking oil volume.

⚠ CAUTION

1) When the air relief plug is too loosened. there is a possibility that the air relief plug flies out. Slightly push the air relief plug with the hexagon bar spanner so as not to fly out.

2) For air relief. though unclamp time may be short. take a generous amount of a clamp time.

3) During air bleeding. since oil becomes short. bleed the air. filling the oil.

4) After finishing the air relief. cleanly wipe oil spilled around the unit with a waste cloth.

5) Fill the hydraulic oil to near the upper part of the tank.
However. please secure a space a little between a cover and the oil surface.

6-2 For oil hyd. system

1) Be applied hydraulic pressure to NC rotary table.

2) Loosen the air escape plug shown in figure a little to bleed the air.

3) Be not applied hydraulic pressure to NC rotary table after binding a plug tight again.

4) It carries out by repeating the work of 1 to 3 . When the air mixed into oil is not exhausted from the air escape plug. tighten the air escape plug as it was before. (If the plug is not tightened. exhausted air is sucked again.)

⚠ CAUTION

1) When the air relief plug is too loosened. there is a possibility that the air relief plug flies out. Slightly push the air relief plug with the hexagon bar spanner so as not to fly out.

2) For air relief. take enough time.

3) During air relief. since oil of pump unit becomes short. fill the oil into the pump unit.

4) After finishing the air relief. cleanly wipe oil spilled around the unit with a waste cloth.

5) During air relief. retain the hydraulic pressure.

6-3 Maintenance inspection

1) Air may infiltrate in oil during operation because the piping joint. each plug. etc.. are loosened. At this time. relief the air according to the procedure of the above.

2) The hydraulic oil is deteriorated when it is used for a long period of time.Replace the oil every year.

3) With the NC rotary table operated after ready for start-up. if a clamp failure occures. check the air relief in order to make sure.

7 Inspection

Daily inspection

1) Check the fixing condition of NC rotary table (including jig if mounted).

2) Check the electric connection cables and the air hoses are not damaged. and also. check the air pressure and hydraulic pressure.

3) Check the oil volume of air hydraulic system.(Check that the oil level of hydraulic oil is in the upper part of oil gauge.)

4) Check (machine) deceleration of zero return. indexing motion and position.

5) Check unusual vibration and noise do not occur. (Body. motor)

6) Check unusual heating. (Body. motor)

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

1) Check the dirt agree of lubrication oil. (In body . gear box)

2) Check the dirt degree of hydraulic oil. (In air hydraulic system)

3) Check connectors are well mounted and cables are not damaged.

4) Check wiring cables in the motor case are not corroded or do not come down.

8 Table CLAMP

8-1 Precautions of table clamp

⚠CAUTION

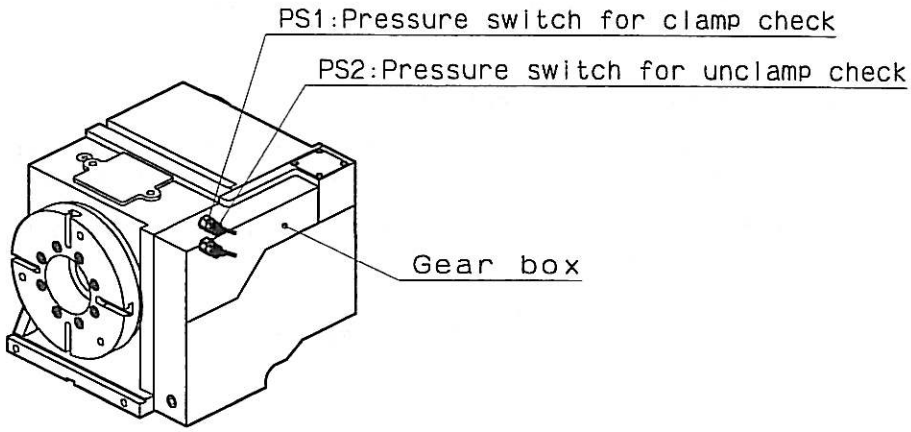
Be sure to rotate the table with the table unclamped and use the table with it clamped after positioning. If the table is operated in mistake. take care since the worm wheel may be damaged. Use the signals of pressure switch to check CLAMP/UNCLAMP operations.

⚠CAUTION

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

⚠CAUTION

If residual pressure is remained in table UNCLAMP. the table may be operated without releasing a clamp state completely. In this case. the worm gear part and clamp part are seized and damaged. Therefore. take extreme care about back pressure. Especially. when the table is clamped by hydraulic pressure. design the circuit so that the back pressure in UNCLAMP is 0.2MPa (2kgf/cm²) or less.



8-2 Check device for CLAMP/UNCLAMP

To proceed a secure workpiece. be sure to use CLAMP/UNCLAMP confirmation signals. (Please refer to the figure of 8-1 clause.)

Pressure switch setting pressure of an empty oil pressure clamp / oil pressure clamp is as shown in the following list according to each clamp system.

Clamp check(SP1)	Unclamp check(SP2)
2.16 MPa (22.0kgf/cm²) (176 112 200)	0.2 MPa (2.0kgf/cm²) (176 120 200)

The pressure switch is made by WILLY VOGEL .

8-3 Solenoid valve for CLAMP/UNCLAMP

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

Refer to 16-2 and outside view

[Excitation Unclamp Spec.]

Solenoid:ON ··· Table UNCLAMP
Solenoid:OFF ··· Table CLAMP

[Excitation Clamp Spec.]

Solenoid:ON ··· Table CLAMP
Solenoid:OFF ··· Table UNCLAMP

⚠CAUTION When mounting the solenoid valve to the outside of NC rotary table (NC rotary table of hydraulic clamp specification), connect the cable at the above specification.

9 Mounting of Workpiece

Securely mount the workpiece for high accuracy machining.

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

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

⚠CAUTION Clamp the workpiece in equipartition on the rotary table as much as possible.

10 Backlash Adjustment of Worm Gears

The worm shaft and worm wheel are made of the special material and accurately machining. The dual lead worm system is adopted for eliminating backlash of worm gear. It changes leads of right and left tooth flanks of worm shaft a little and adjusts the backlash for the worm wheel by shifting this worm shaft in the axis direction.
This dual lead worm system adjust the backlash finely without changing a ideal engagement state and it is theoretical and most secure backlash adjustment method.
Though the backlash of worm gear has already been adequately adjusted before shipping, it may be necessary to adjust it after using for a long period of time. The adequate values of backlash are as follows. These values were measured when the machine is cooled. Thus, they are values assumed after interrupting for a long period of time. Consequently, when operating the machine for a long period of time, the backlash values become smaller than the following table due to thermal expansion.

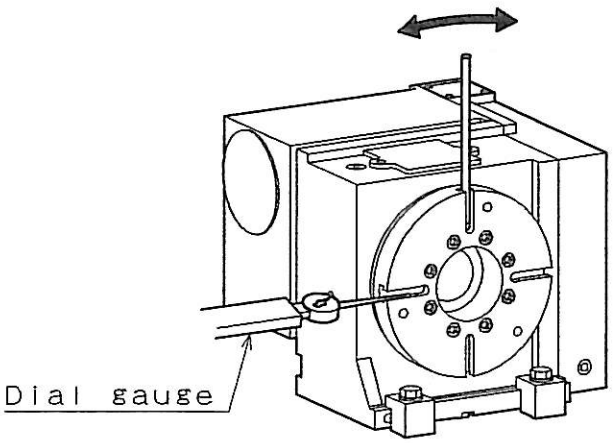
IMPORTANT	If backlash is too small, the worm gears will be seized.

O Adequate Backlash

Table type	TBX160	TBX200	TBX250	TBX320
Circular arc length at peripheral table position (μm)	14～43	14～43	14～43	15～45
Converted angle (sec.)	35～106	29～89	23～70	19～58

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

10-1 Measuring method for backlash of worm gears on table

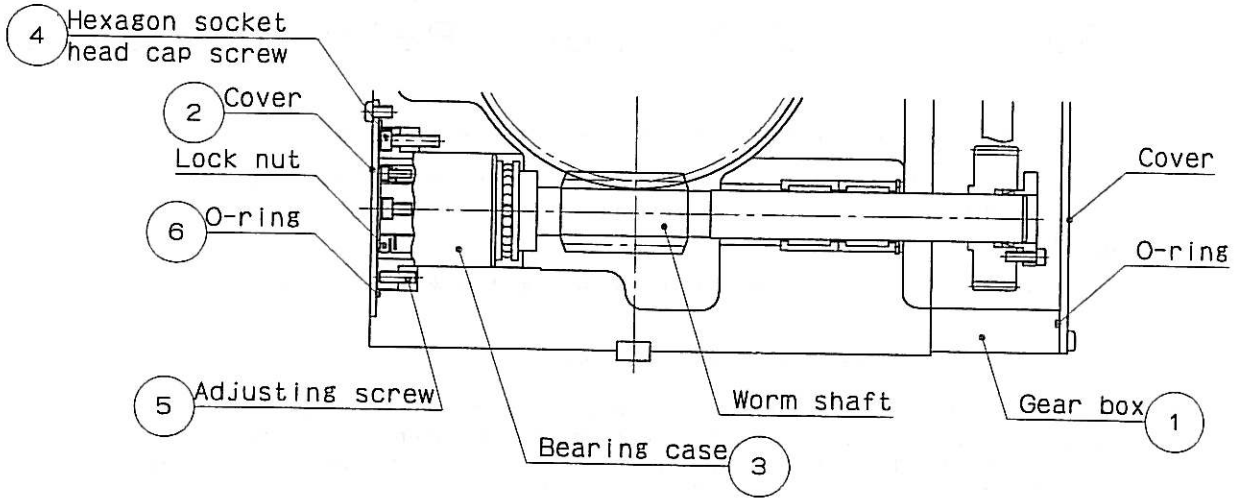


1) Set the dial gauge the periphery of T-slot on table top face or periphery of table top face.

2) Slowly turn the table with the flat steel or round bar by using the tap on the top face of table or T-slot and release your hand where the worm wheel tooth is touched before reading the value of dial gauge. Next. turn the table under the same condition in the reverse direction. At this time. the difference of measured values is the backlash.

3) Perform the above measurement at 8 equipartition of outer periphery by turning the table and compare them with the above adequate values. When deviated from the adequate values. adjust the backlash by the following procedure so that the minimum value of backlash will be the adequate value previously described.

10-2 Backlash adjusting method of worm gears



⚠ DANGER

Be sure to turn OFF the power source of control unit or unclamp the NC rotary table before removing the gear case cover.If your hands or clothes touch the rotating gears. there is a danger to cause a serious accident by winding to the gears.

1) Drain the lubrication oil from the drain port.

2) Remove the cover ② located on the reverse side of gear box ①.

3) Loose hexagon socket head cap screws ④ which fix the bearing case ③ a little. Next. loosen four adjusting screws ⑤ uniformly a little. When tightening hexagon socket head cap screws ④ again. the bearing case ③ advances. thus reducing the backlash of worm gears.

IMPORTANT

Since the pitch of adjusting screw is 1.25mm (TBX160/320) or 1.0mm (TBX200/250). when returning one revolution. the backlash becomes small as shown in the following list.

Table type	TBX160	TBX200	TBX250	TBX320
Circular arc length at peri-pheral table position (μm)	ABOUT58	ABOUT47	ABOUT31	ABOUT41

When finishing the adjustment, reassemble the table in reverse steps as item 10-2 and tighten bolts securely. After reassembling, measure the backlash at table periphery again at the same positions before adjusting and check the backlash is adequate. If the backlash is inadequate, adjust it again by the above method.

⚠ CAUTION

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

⚠ CAUTION

When reassembling the cover ②, take extreme care so that the O-ring ⑥ will not be damaged. If the O-ring ⑥ are damaged, coolant may be entered.

11 Built-in ZRN (Zero Return) Device

* *

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

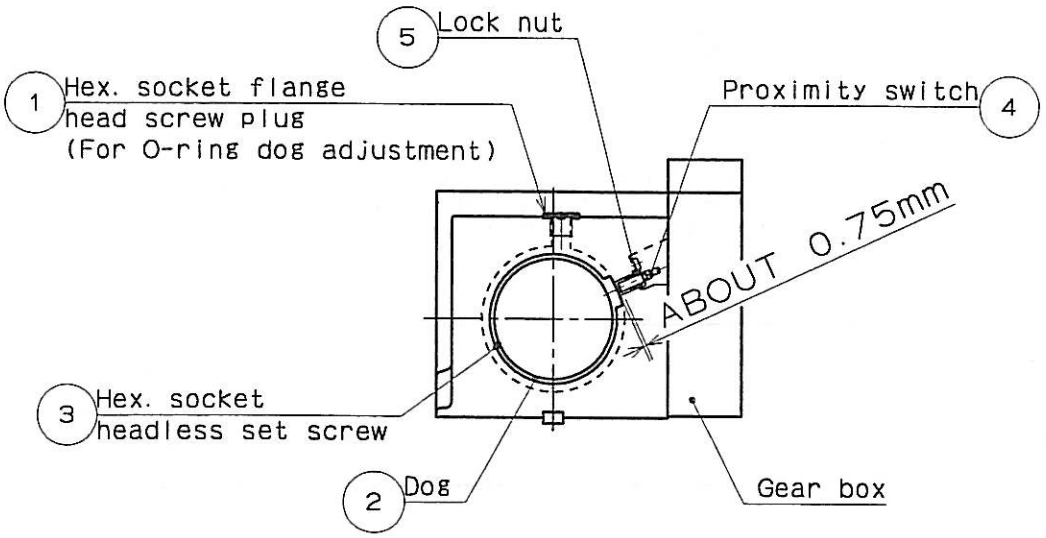
* *

11-1 Dog position for ZRN deceleration

The rotational direction for ZRN is clockwise (CW).The dog for ZRN deceleration is mounted under the table and it cannot be found except when the dog position is adjusted. Though the dog can be mounted on the optional periphery position under the table, the table reference slot has been set so that it is parallel for the reference plane for vertical installation.Fine adjustment of the ZRN position may be required at the customer at the customer at the time of interface with the NC controller of the machine.

11-2 Adjusting method of dog position (TBX160)

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

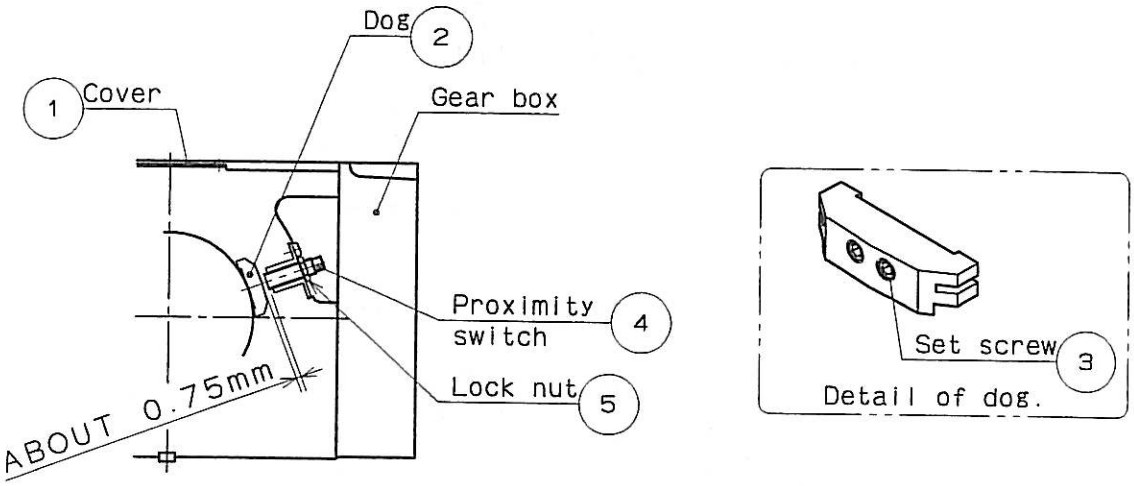


1) Drain the lubrication oil. Remove the plug ① with collar for origin dog adjustment and loosen set screws ③ which fix the dog ② to the table spindle from the origin dog adjustment hole.

2) Move the dog ② to the proper position.

3) When adjusting completely, securely tighten hexagon socket head less set screws ③ to mount the hexagon socket flange head screw plug ① of origin dog adjustment.

11-3 Adjusting method of dog position (TBX200, TBX250, TBX320)



1) Drain the lubrication oil.

2) Remove the cover ①.

3) Turn the table and stop it at the place where the dog ② can be found from the window when the cover ① is removed.

4) Loosen the set screws ③ that fix the dog ②.

5) Move the dog to the proper position.

6) When the dog adjustment is finished, securely tighten the set screws ③.

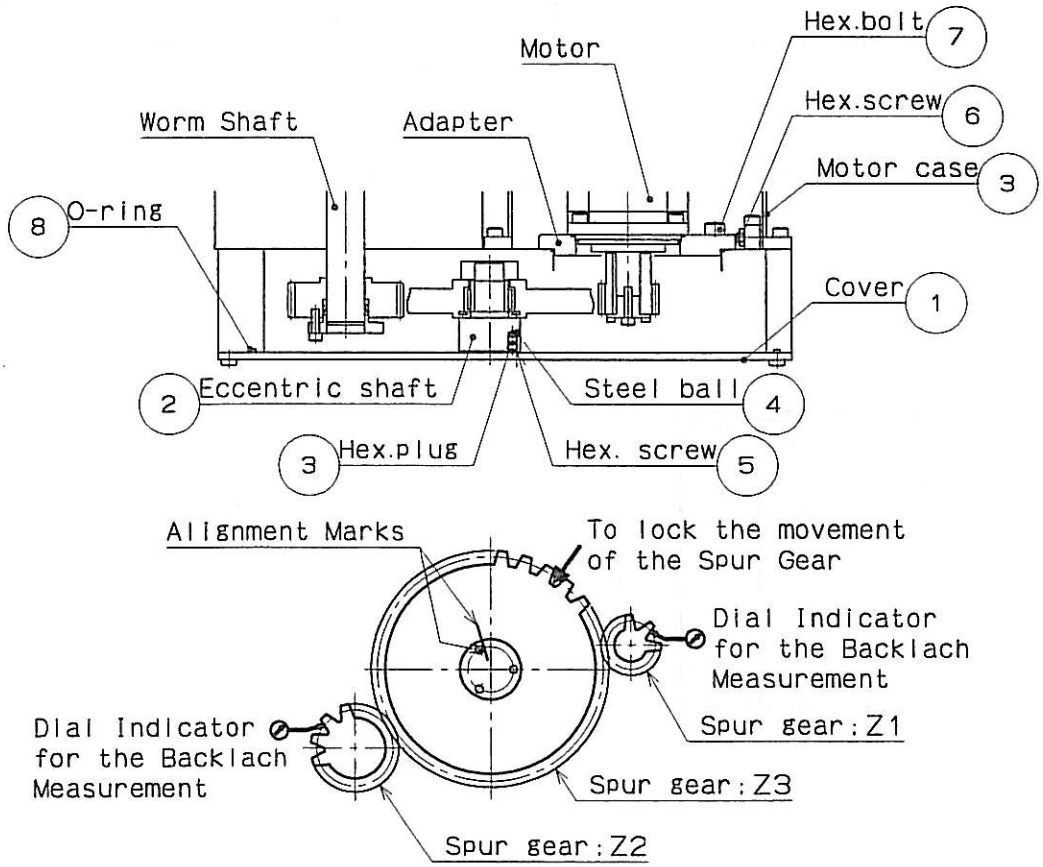
7) Set the cover ① to the original position.

11-4 Structure of sensor part

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

12 Backlash Adjustment of Super Gears

12-1 Adjusting method of backlash of super gears



12-1-1 Measuring the Backlash of the Spur Gears Z2 and Z3

1) Completely drain the lubrication oil through the drain port.
2) Remove the cover ①.
3) Lock the movement of the spur gear Z3 with an appropriate tool such as a screw driver.
4) Set a dial indicator at the pitch circle on the tooth face of the spur gear Z2.
5) Read the total movement of the dial indicator by manually rotating the spur gear Z2 in both clockwise and counterclockwise directions. This total movement of the dial indicator will be the backlash.

12-1-2 Measuring the Backlash of the Spur Gears Z1 and Z3

1) Completely drain the lubrication oil through the drain port.
2) Remove the cover ①.
3) Lock the movement of the spur gear Z3 with an appropriate tool such as a screw driver.
4) Set a dial indicator at the pitch circle on the tooth face of the spur gear Z1.
5) Read the total movement of the dial indicator by manually rotating the spur gear Z1 in both clockwise and counterclockwise directions. This total movement of the dial indicator will be the backlash.

Backlash between each gear engagement should be between 0.02 and 0.04mm.
Backlash adjustment is required if the measurement is much smaller or larger than these figures.

12-2 Adjustment of Backlash of the Spur Gears

12-2-1 Backlash Adjustment of the Spur Gears Z2 and Z3

Backlash can be adjusted by rotating the eccentric ring which has a maximum of 0.3mm of eccentricity.

1) Measure the backlash by following the procedure in section 12-1-1.

2) Set and leave a dial indicator at the pitch circle on the tooth face of the spur gear Z2 for further backlash measurement needed.

3) The eccentric shaft ② is positioned securely by the hex. plug ③ and the steel ball ④. Remove the hex. plug ③. Then. adjust the amount of eccentricity as measuring the backlash with a dial indicator by slowly turning the hex. screw ⑤ in either clockwise or counterclockwise directions.

Backlash can be increased by rotating the eccentric shaft ② in clockwise direction. and decreased in counterclockwise direction.
Alignment marks indicating the proper backlash position is engraved at hte factory on both the eccentric shaft and the gear box for your convenience.

12-2-2 Backlash Adjustment of the Spur Gears Z1 and Z3

1) Measure the backlash by following the procedures in section 12-1-2.

2) Loosen the hex. screw ⑥.

3) Loosen the four hex. bolts ⑦ mounting the servo motor. then eliminate the backlash to nearly zero by slowly tightning the hex. screw ⑥.

4) Loosen and adjust the position of the hex. screw ⑥ to have the flange of the motor sit against the hex. screw ⑥ with sufficient amount of backlash.

5) Securely tighten the four hex. bolts ⑦. and measure the backlash by following the procedure in section 12-1-2.

Repeat the procedure 2) through 5) if the backlash measurement is not between 0.02 and 0.04mm.

IMPORTANT

The hex. bolt has 1.00mm pitch thread. Backlash can be adjusted approximately 0.033mm by turning the hex. screw ⑥ by 10 degrees.

⚠ CAUTION

Avoid any damage such as nicks and dents to the tooth face of the spur gear when backlash measurement or adjustment are performed. Damage on the tooth face may prevent smooth rotation resulting in poor indexing accuracy and abnormal gear noise.

⚠ CAUTION

When reassembling the motor case ③ and the cover ①. take extreme care so that the O-ring ⑧ will not be damaged. If the O-ring ⑧ are damaged. coolant may be entered.

13 Motor Case

13-1 Removing of motor case

Go by the following point when you must remove a motor case by the maintenance and so on.

1) Remove the cover ② on the motor case ① and remove the wiring of electric apparatuses of the motor, solenoid value, etc., and also, remove all piping between the solenoid valves and the motor case. (For piping, see the piping diagram of item 16.)

2) Loosen hexagon socket head cap screws ④ which fix the motor case ① on the gear box ③ and remove the motor case slowly with its motor case ① raised.

13-2 Counter measure for waterproof

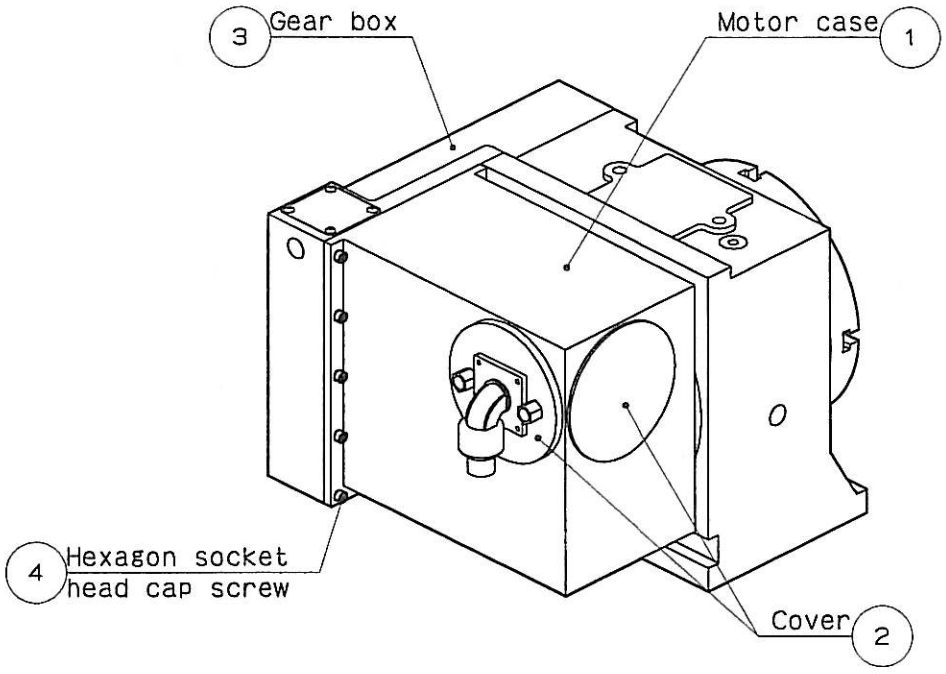
To prevent the motor from coolant penetration, O-rings are used to the mounting face on the motor case ① and the connection part between the motor case ① and the cover ②.

⚠CAUTION

In removing a motor, please extract lubrication from the lubrication port first.

⚠CAUTION

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



14 Storage

⚠ CAUTION

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.

15 Conversion of Peripheral Length and Angle

IMPORTANT

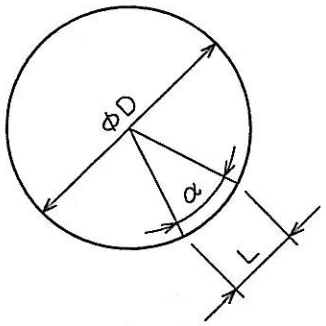
- What is the linear length at the table circumference with 30 seconds cumlative indexing accuracy ?"
- What is the angle with a cumlative pitch error of 0.05mm ?"

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)



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

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

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

(Examples)

Assuming the diameter of the workpiece is 100mm, and by using formula (3), the cumulative indexing accuracy of 30 seconds as linear length at table circumference will be:

$L = 2.424 \times 30 \times 100 \times 10^{-6} = 0.007272\text{mm} \approx 0.0073\text{mm}$

Therefore, the length is approximately 0.0073mm.

And converting the cumulative pitch error of 0.05mm to an angle, use formula (2):

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

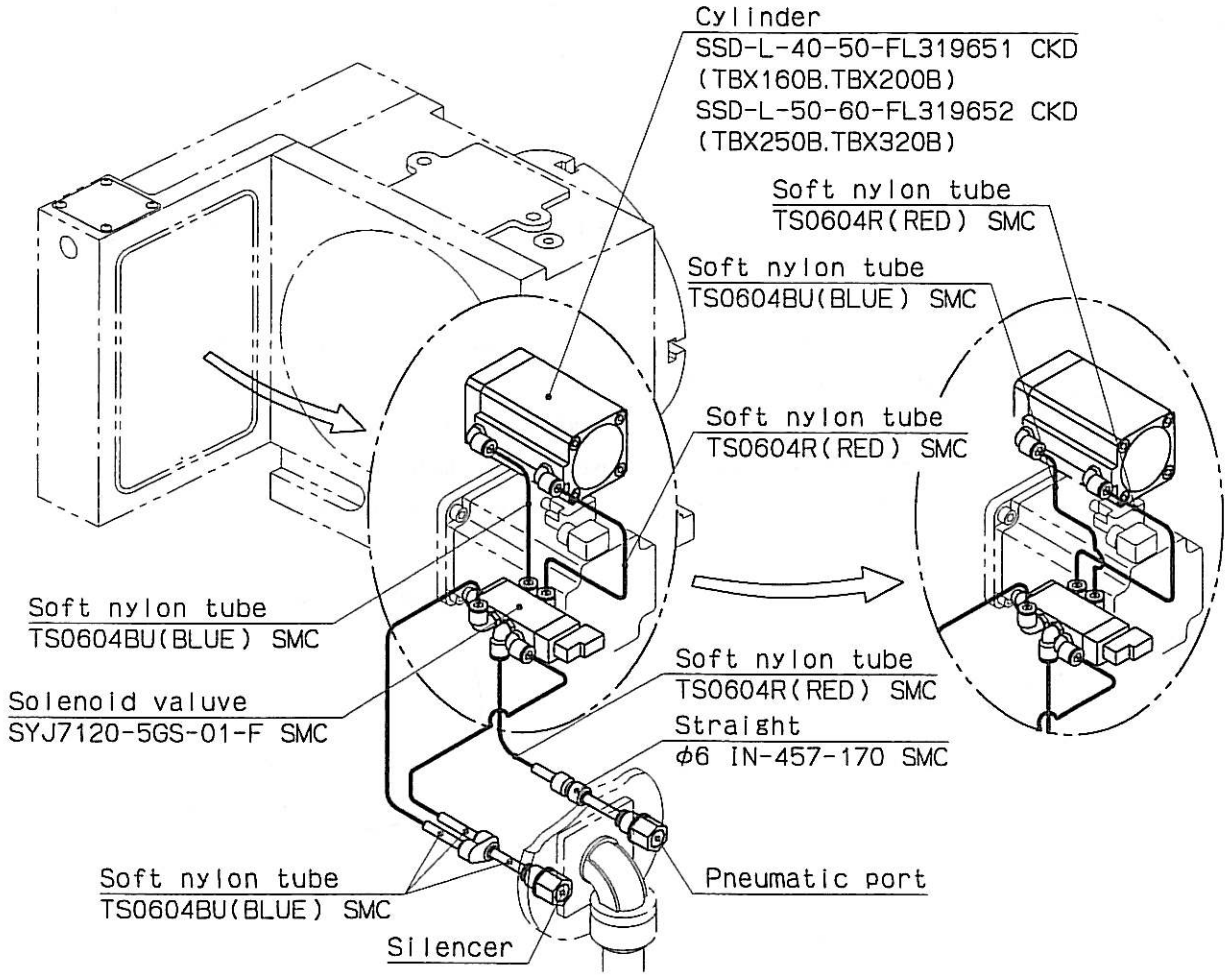
Therefore, the angle is approximately 206.25 seconds equal to 3 minites 26 seconds.

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

16 Piping Diagram of Air Hydraulic System

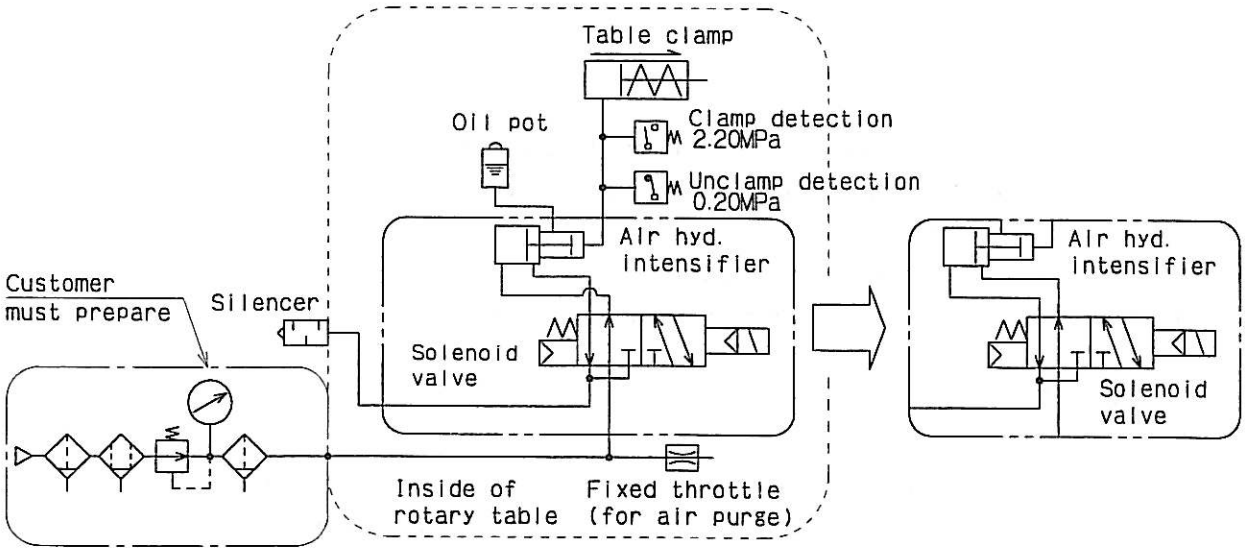
When removing the piping to remove the motor case. refer to the following outside view and diagram.

16-1 Outside view of connection piping system



Excitation Unclamp Spec. Excitation clamp Spec.

16-2 Air hydraulic circuit diagram

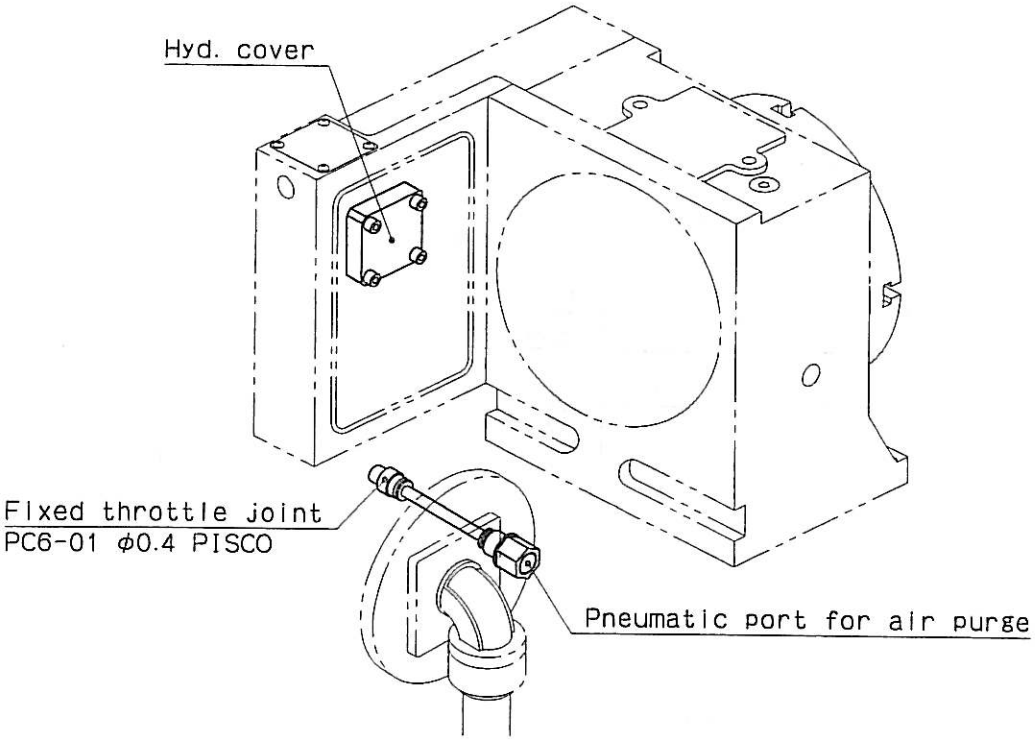


Air combination
(Air filter+Mist separator+regulator)+ Drain catcher

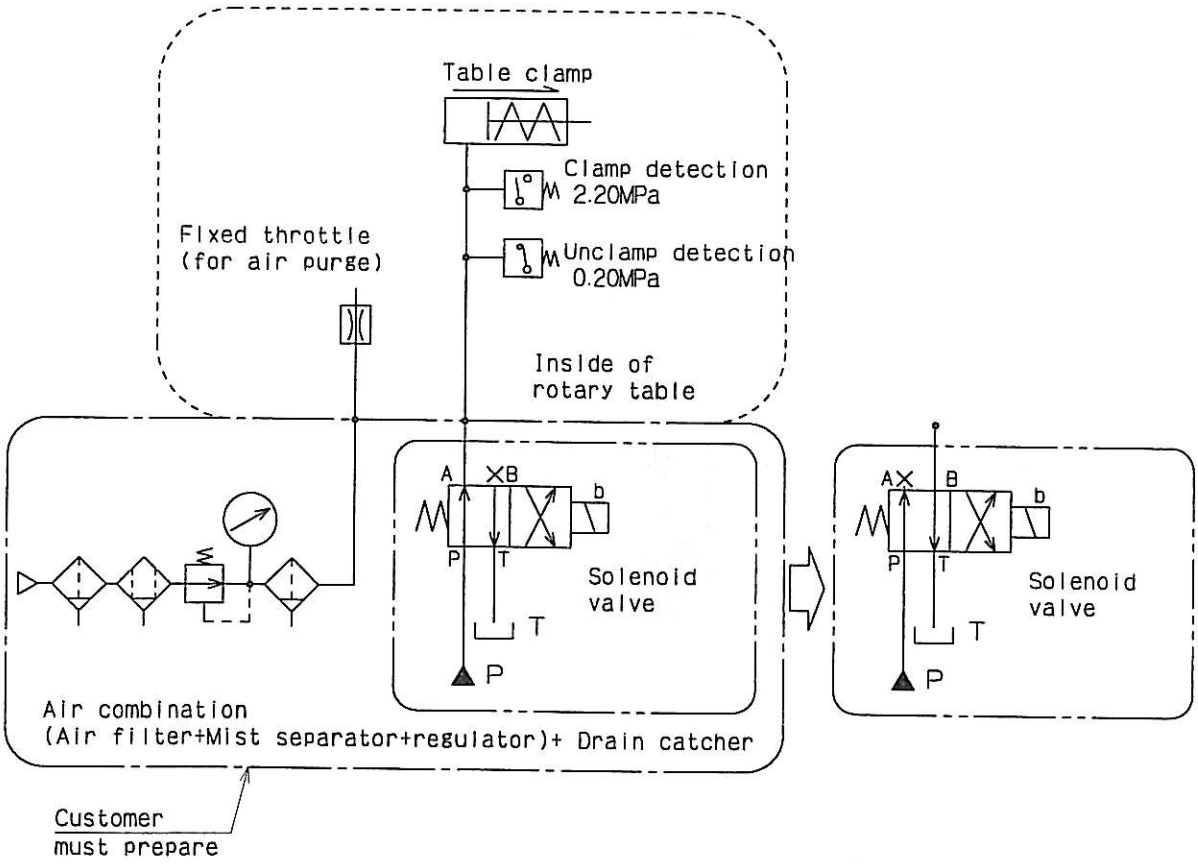
Excitation Unclamp Spec. Excitation clamp Spec.

17 Piping Diagram of Oil Hydraulic System

17-1 Connection piping system sketch



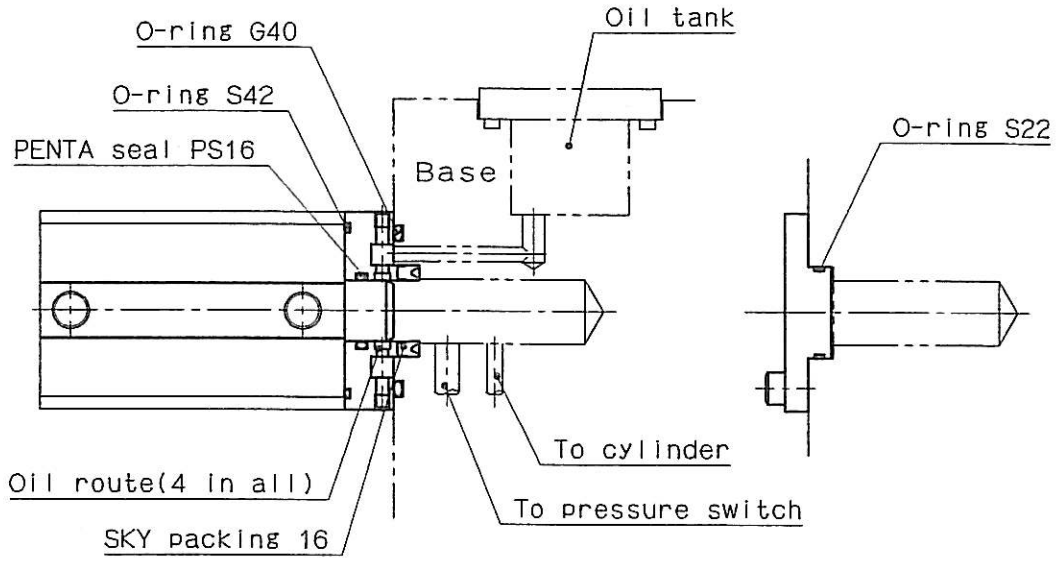
17-2 Hydraulic pressure circuit diagram



18 Outside View of Air Hydraulic Part

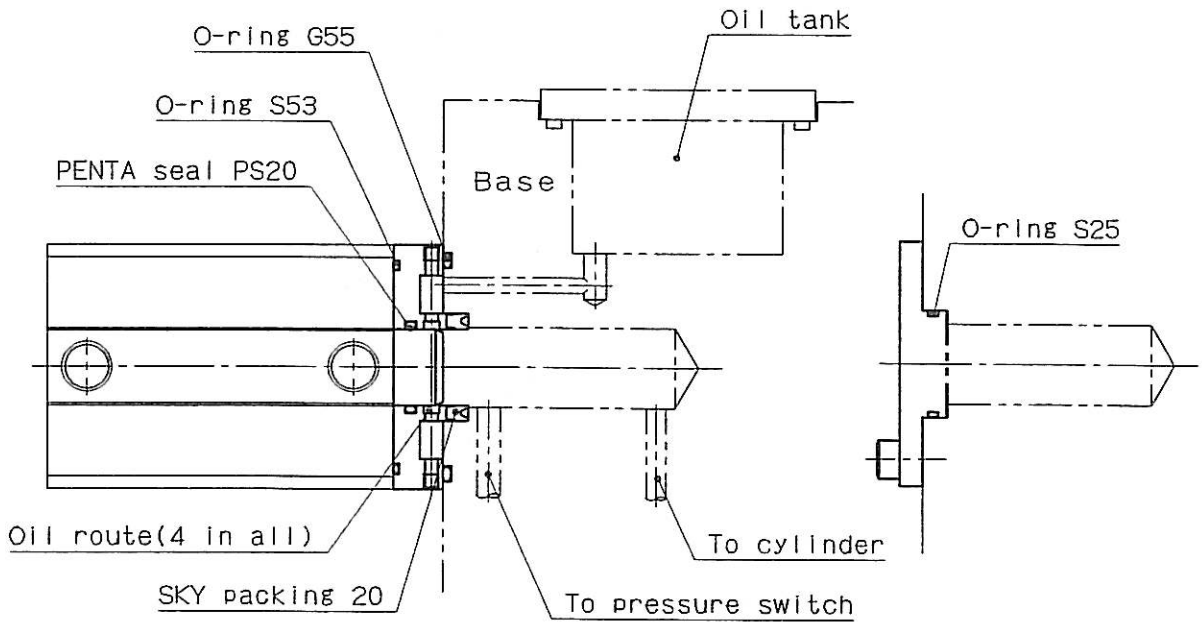
When removing the cylinder to remove the motor case, refer to the following outside view.

18-1 Outside view of air hyd. part 〈TBX160、TBX200〉



Air Hyd. Spec.　　Oil hyd. Spec.

18-2 Outside view of air hyd. part 〈TBX250、TBX320〉



Air Hyd. Spec.　　Oil hyd. Spec.

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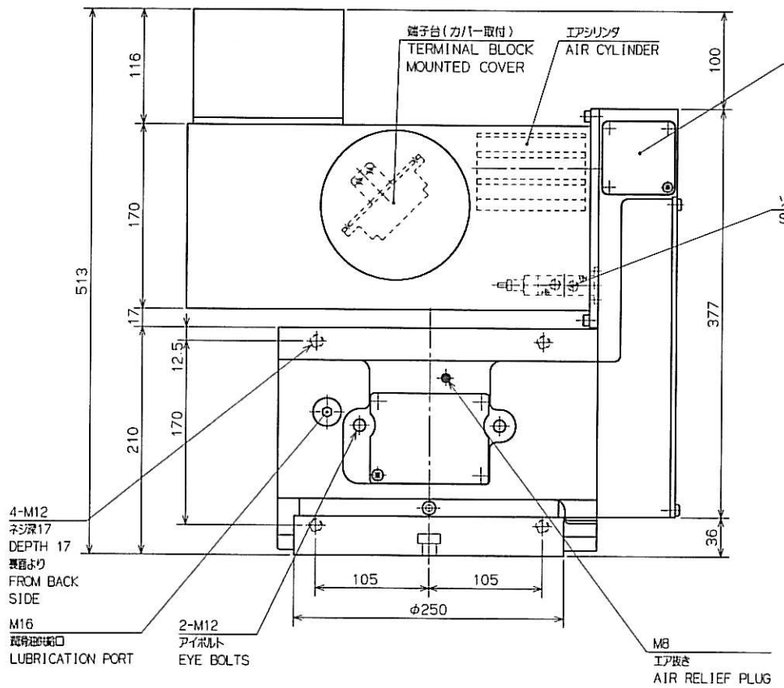
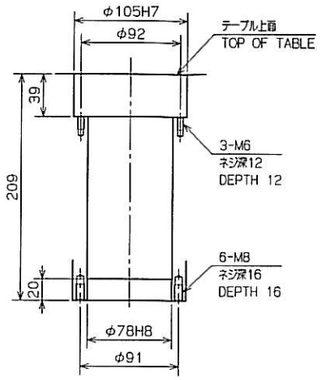
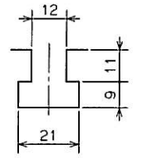
D.2005.04

CUSTOMER		
MOF.NO.	D A T E	REASON OF REVISION





スピンドル穴
SPINDLE THRU-HOLE



テーブルT溝
T-SLOT FOR ROTARY TABLE
(S=2:3)

仕様 SPECIFICATIONS	
割出精度 INDEXING ACCURACY	20 sec以内
再現精度 REPEATABILITY	4 sec以内
テーブル最高回転速度 MAXIMUM ROTATION SPEED	33.3 min⁻¹ (モータ MOTOR 3000 min⁻¹)
クランプトルク CLAMPING TORQUE	1100N·m (空圧 PNEUMATIC 0.5MPa)
許容最大空圧力 MAXIMUM PNEUMATIC PRESS	0.6 MPa
許容積載質量 ALLOWABLE MASS OF WORK	125 kg
許容積載ワーク径 ALLOWABLE WORK DIA.	φ250 mm
総減速比 TOTAL REDUCTION RATIO	1/90
製品質量 MASS OF ROTARY TABLE	135 kg
慣動系モータ軸換算イナーシャ MACHINE INERTIA (REFLECTED TO MOTOR SHAFT)	0.001219kgm² (0.01243kgfcms²)

注記 NOTE

※□ 1) ACサーボモータ:客先にて手配及び取付願います。
WITHOUT MOTOR (SETTING WORKS OF MOTOR AT KEL OR CUSTOMER)
取付可能モータ:SIEMENS 1FT5066-0AF71-1-Z (Z=K93+K18+G44)
MOUNTING POSSIBLE MOTOR:SIEMENS 1FT5066-0AF71-1-Z (Z=K93+K18+G44)

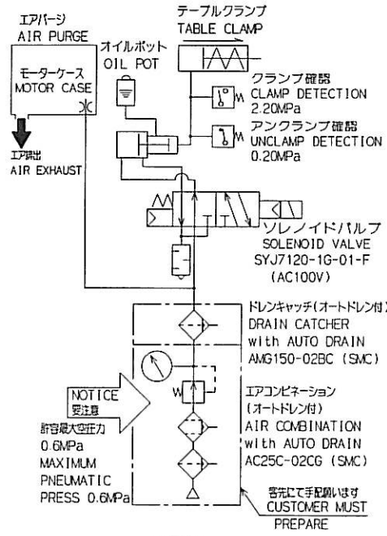
2) 図中に記載のない精度規格は、カタログ記載の値とします。
ACCURACY STANDARDS EXCEPT STATED IN THIS DRAWING SHOULD BE APPEALED TO THAT IN CATALOGUE.

3) 原点復帰設定は 22.2min⁻¹ 以下、爬クリープ速度は 0.6min⁻¹ 以下に設定して下さい。
ZERO RETURN SHOULD BE SET LESS THAN 22.2min⁻¹. AND ITS CREEP SPEED SHOULD BE SET LESS THAN 0.6min⁻¹.

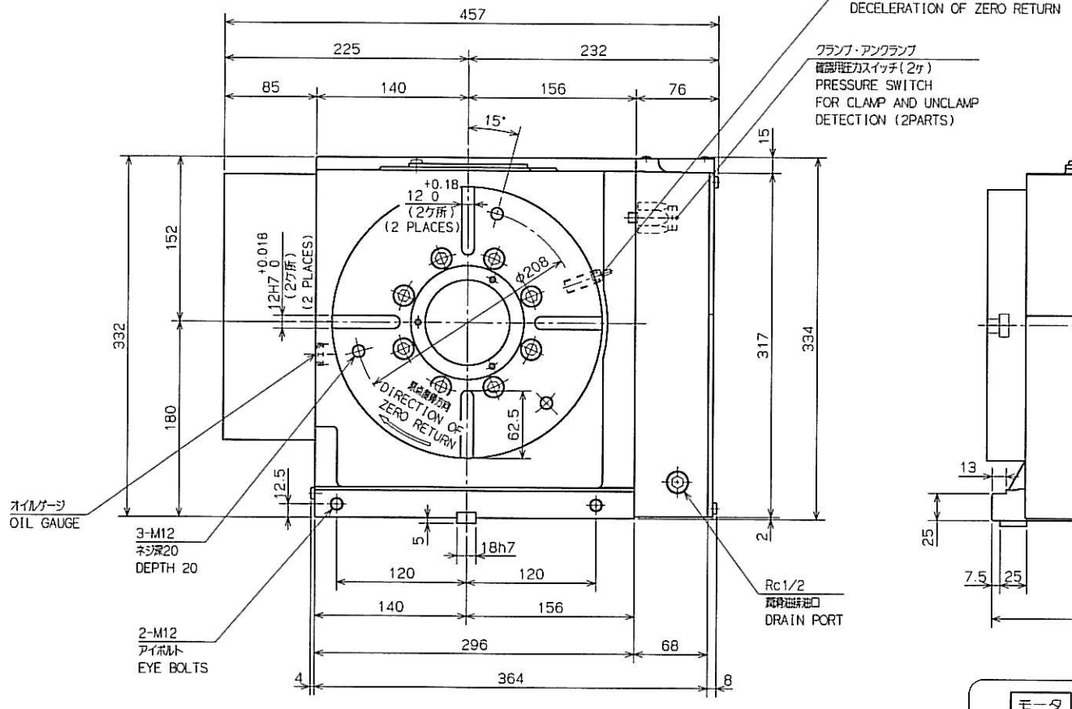
4) 本機はエアパージ仕様ですので空圧供給口からクリーンエアを供給して下さい。
THIS ROTARY TABLE IS DESIGNED UNDER THE CONDITION OF AIR PURGE. ACCORDINGLY CLEAN AIR FROM PNEUMATIC PORT HAVE TO BE SUPPLIED.

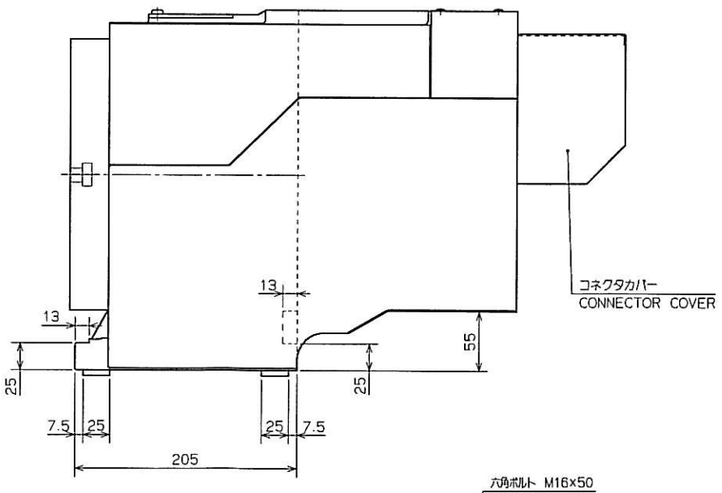
※□ 5) ケーブル接続は背面出し専用です。
THIS MACHINE IS BACK CABLE CONNECTION ONLY.

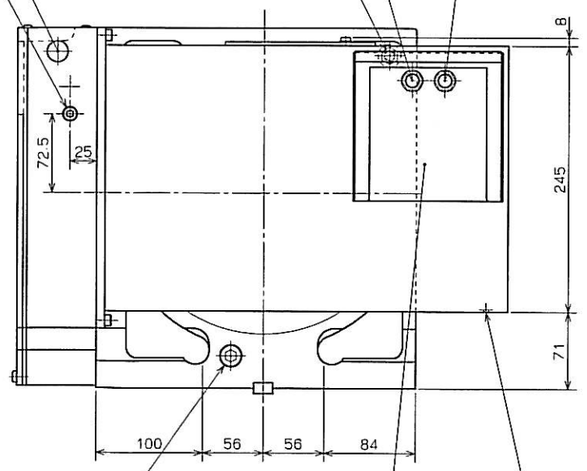
※□ 6) このNC円テーブルはモータ装着されていませんので動作確認をしておりません。
御手数をお掛けしますがお客様にご確認お願いします。
MOVEMENT CONFIRMATION IS NOT DONE. BECAUSE A MOTOR WITH THIS NC ROTARY TABLE IS NOT SUPPLIED.
THE CUSTOMER MUST CONFIRM THE MOVEMENT AFTER MOTOR MOUNTED.

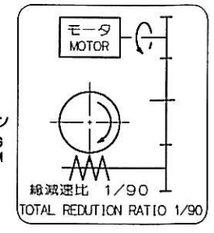


エア回路図
AIR DIAGRAM

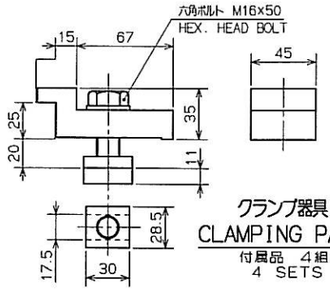








駆動系スケルトン
SKELTON DRAWING OF DRIVE SYSTEM



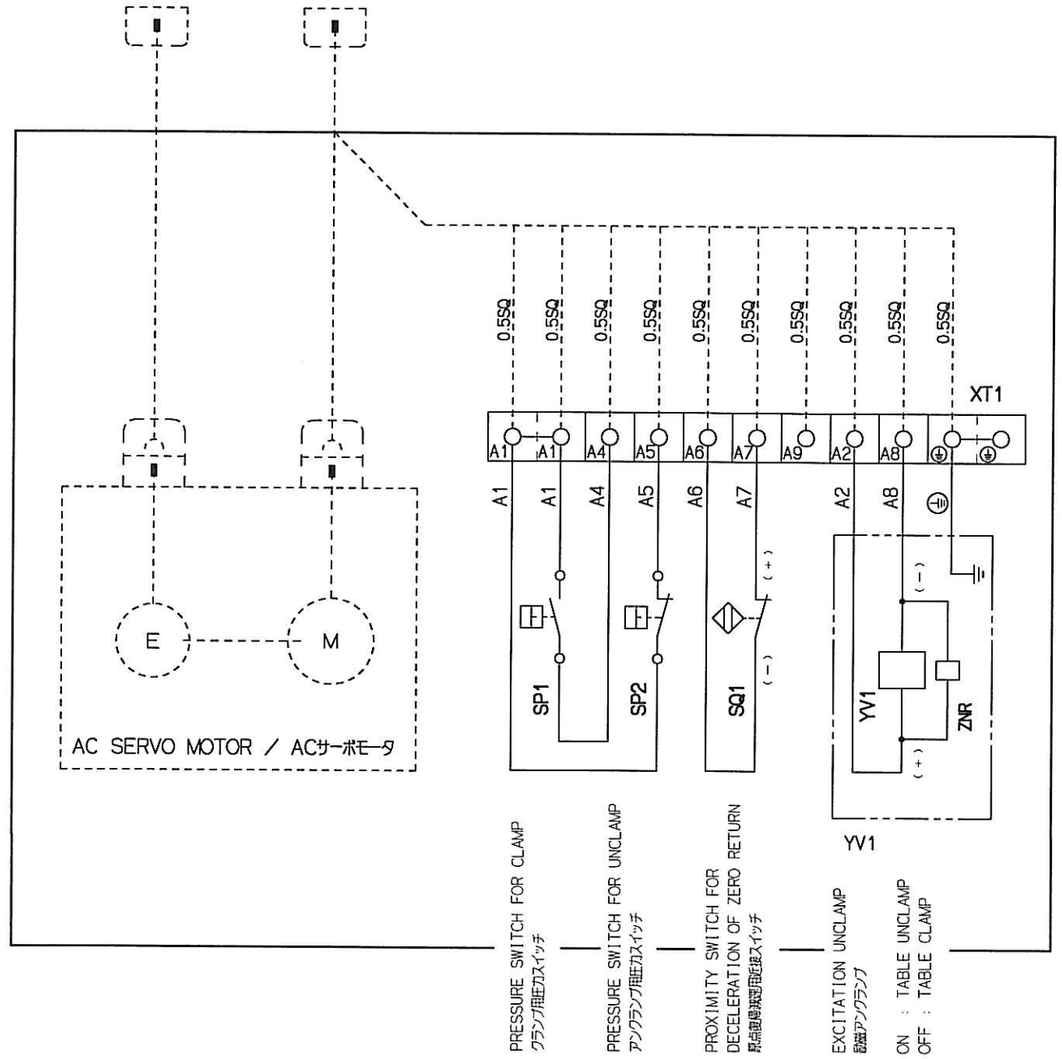
クランプ器具
CLAMPING PARTS
付属品 4組
4 SETS

注記 NOTE

モータ回転方向が、出力軸側から見てCCWのとき
テーブル回転方向は、CW
WHEN DERECTION OF MOTOR SHAFT REVOLUTION IS CCW.THAT OF TABLE REVOLUTION IS CW.

CAREER			SCALE	TYPE	TBX250BE05	WEIGHT	kg
W.D.	61E377559		1:3	NAME	NCテーブル NC ROTARY TABLE		
MANAGER	CHIEF	DRAWN BY J.TAKAHASHI	3RD ANGLE		TBX250BE05 ガイケイ OUTSIDE VIEW		
KITAGAWA IRON WORKS CO.,LTD.		DATE 05.07.21		DRW NO.	61E 25 1130		0

CUSTOMER		
MDF.NO.	D A T E	REASON OF RIVISION
1	05.06.21	ADJUSTMENT(誤記訂正Δ1ヶ所)



※□
(電圧/VOLTAGE)

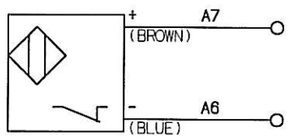
MARK 記号	NAME 品名	MAKER メーカー	TYPE 型式	Q'ty 個数	REMARKS 備考
SP1	PRESSURE SWITCH プレッシャスイッチ	WILLY VOGEL ウイリーホーゲル	176 112 200	1	2.2 MPa 1a
SP2	PRESSURE SWITCH プレッシャスイッチ	WILLY VOGEL ウイリーホーゲル	176 120 200	1	0.20MPa 1b
SQ1	PROXIMITY SWITCH 近接スイッチ	YAMATAKE	FL7M-3K6H-Z	1	DC10~30V
YV1	SOLENOID VALVE ソレノイドバルブ	SMC	SYJ7120-1G-01-F	1	AC100V
XT1	TERMINAL BLOCK 端子台	WAGO	264-701	7	
	TERMINAL BLOCK 端子台	WAGO	264-727	1	
	TERMINAL BLOCK 端子台	WAGO	264-721	1	
	END PLATE エンドプレート	WAGO	264-368	1	
	END STOP エンドストップ	WAGO	249-101	2	
	CARRIER RAIL キャリアレール	WAGO	210-111	1	

ソレノイドバルブ 仕様
SOLENOID VALVE SPEC

コイル定格電圧 RATED COIL VOLTAGE	AC100V
消費電力 CONSUMPTION ELECTRIC POWER	0.78VA

~~1.4VA~~ ⚠1

近接スイッチ接続要領
CONNECTION OF PROXIMITY SWITCH



近接スイッチ仕様
SPECIFICATIONS

電源電圧	POWER SUPPLY	DC10~30V
負荷容量	LOAD CURRENT	3~100 mA
漏れ電流	LEAK CURRENT	max.0.55 mA
残留電圧	RESIDUAL VOLTAGE	max.3.0 V
出力機能	OUT PUT TYPE	NC

NOTE 注意

1) '⏚' IS EARTH.
'⏚' はアース.

CAREER	61E371060		SCALE	TYPE	TBX200BE02	WEIGHT	kg
MANAGER	CHIEF	DRAWN BY H. OCHI	3RD ANGLE	NAME	NCテーブル NC ROTARY TABLE テンキシヨウ WIRING DIAGRAM		
KITAGAWA IRON WORKS CO..LTD.		DATE 04.08.24		DRW NO.	61E 37 7559 ⚠1		