KITAGAWA

NC ROTARY TABLES

OPERATION MANUAL

MODEL: RS200RAF10

IMPORTANT

Please ensure that these instructions are read
and understood by machine operators before
using the NC Rotary Indexing Table.

Please Read and Save This Manual

KITAGAWA IRON WORKS CO.,LTD.

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

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

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

SAFETY ALERT SYMBOL

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

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1. For Your Safety

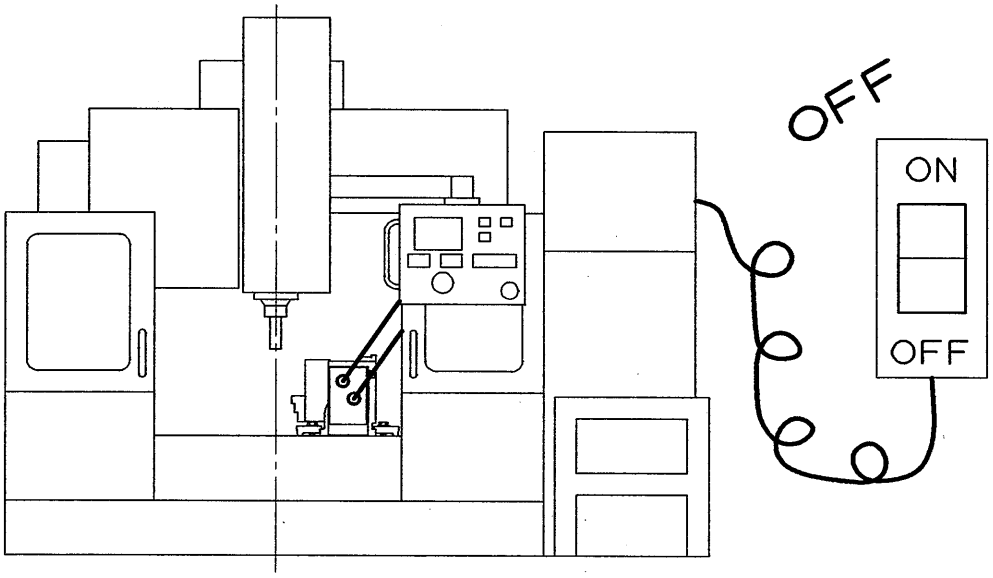
Basic Safety Tips

Please read this manual and follow instructions carefully.

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

DANGER

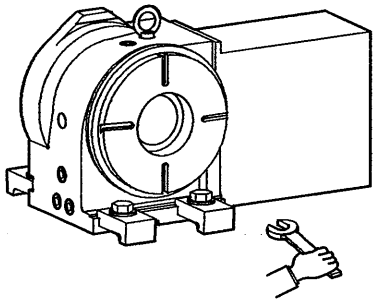
SWITCH OFF power before setting.inspecting and repairing NC rotary indexing table.



Failing to do so could cause bodily harm to the operator.

WARNING

Secure clamp bolts to correct torque.



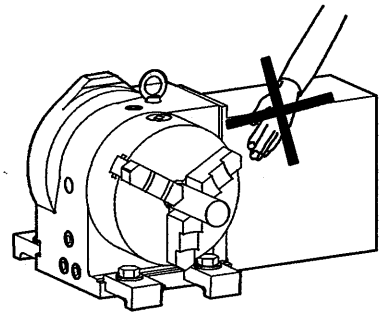
There is a danger of disturbance of NC rotary table and release of work piece.

Tighten to correct torque

Bolt size	Clamping torque [N·m(kgf·m)]
M8	38(3.9)
M10	73(7.4)
M12	108(11.0)
M16	250(25.5)

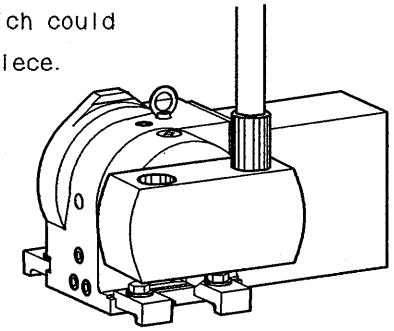
When rotating the table.ensure your hand is out of the rotatiog area.

Failing to do so could cause injury.



Never apply excessive cutting force.

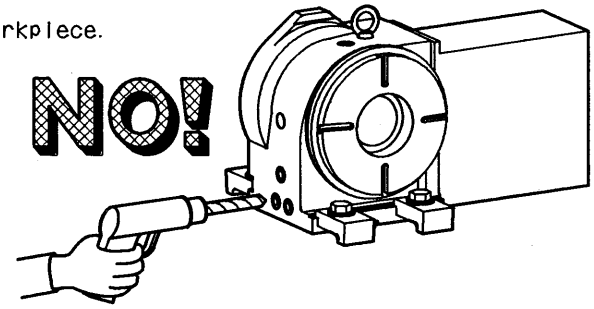
Failing to do so could result in damage to the NC rotary table, which could cause release of the workplece.



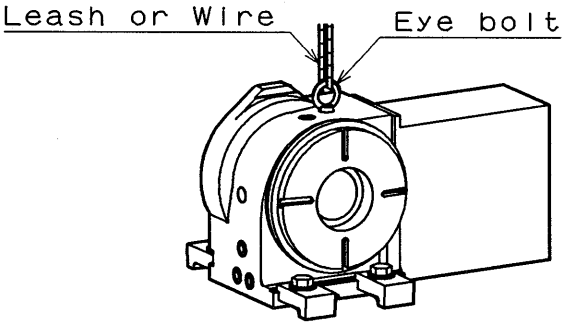
WARNING

Do not attempt to modify the NC rotsry indexing table.

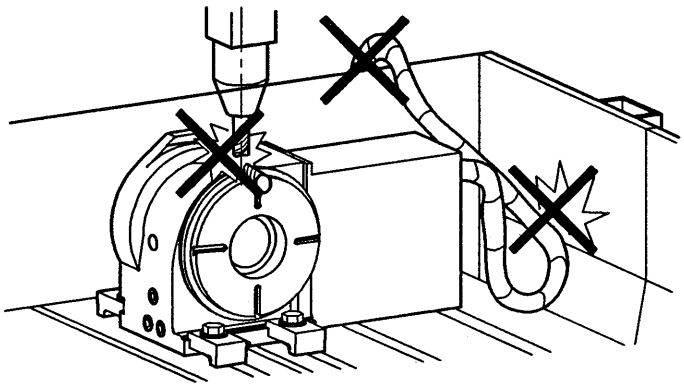
Failing to do so could result in damage to the NC rotary table, which could cause release of the workpiece.



When lifting the NC rotary table.use an eye bolt and wire. (See page 8)



Avoid interference between NC rotary indexing table and surrounding equipment.(See page 8)



Interference and extreme bending of cable and hose should be avoided.

There is a possibility that you receive an electric shock in case of damaging the cable.

Minimum bending radius of the cable(CB1)

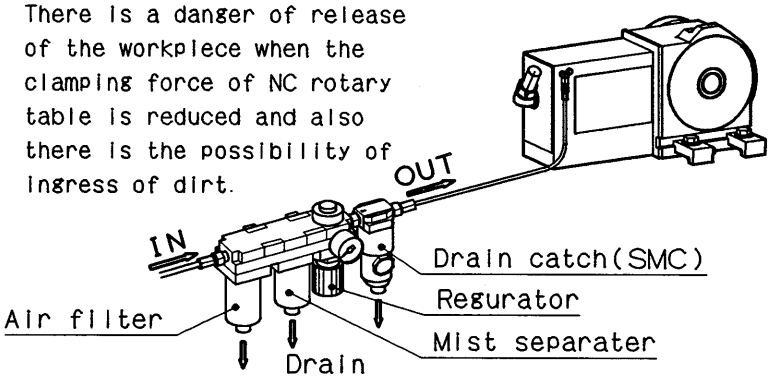
Fixed portion:R65

Movable portion:R150

CAUTION

Air must be supplied through air control unit (Air filter.Mist separater.Regulator)+ Drain catch. (See page 9)

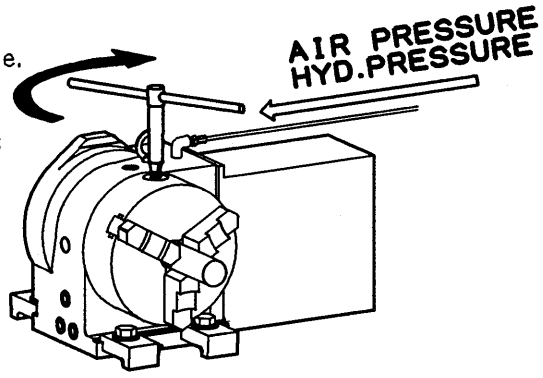
There is a danger of release of the workpiece when the clamping force of NC rotary table is reduced and also there is the possibility of ingress of dirt.



Periodically drain water collected in the air filter section.

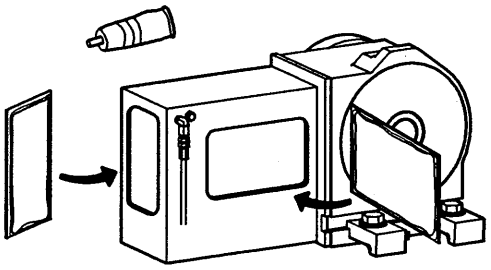
When clamping or unclamping workpieces ensure the table is properly clamped to the machine table.

Failing to do so could result in damage to the NC rotary table, which could cause release of the workpiece and also there is a possibility of deterioration of accuracy.



The cover plate should be sealed with a silicon rubber compound.(See page 15)

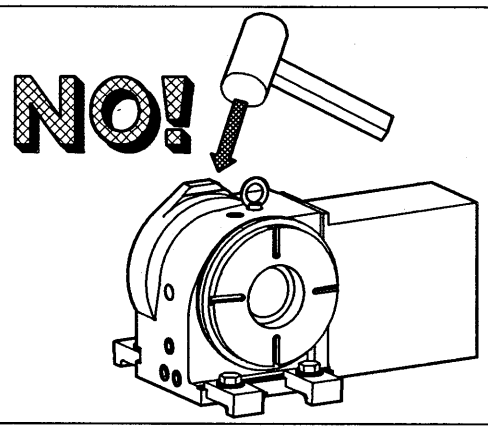
Failing to do so could cause release of the workpiece and miss-operation of the table by ingress of oils.



⚠ CAUTION

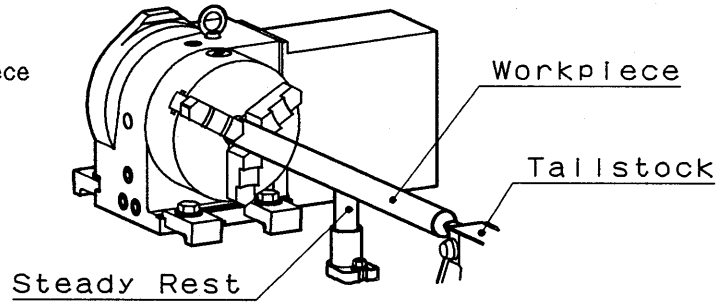
Never use a hammer on the NC rotary indexing table or the clamped workpiece.

Failing to do so could result in damage to the NC rotary table, which could cause release of the workpiece.

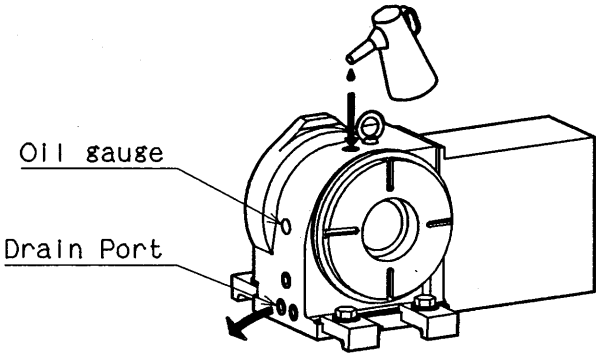


When machining a long or heavy workpiece, support with a tailstock or steady rest.(See page 6)

In case that workpiece is too long or too heavy, it is dangerous as the workpiece may release.



Replace lubricating oil every 6 months. (see page 8)



2. Specifications

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

MODEL		RS200
Table Diameter (mm)		φ200
Table Height in vertical (mm)		185
Center height (mm)		140
Center hole (mm)		φ40
Thru. Hole Diameter (mm)		φ40
Width of T-Slot (mm)		12
Guide block width (mm)		18h7
Clamping torque (Air Press at 0.5 Mpa (5.1kgf/cm²) N·m(kgf·m)		150(15.3)
Allowable work diameter (mm)		φ200
Allowable work weight	In vertical position kg	80
	In vertical position with tailstock kg	160
	In horizontal position kg	160
Allowable workpiece inertia kg·m²(kgf·cm·sec²)		0.81(8.2)
Total reducation ratio		1/90
Maximum table speed min^{-1}		33.3
Body weight kg		61
Tailstock weight (kg)		16

IMPORTANT Max. Table Revolution is at 3000min^{-1}(rpm) of motor rotation.

⚠ CAUTION Be sure to remain within Allowable workpiece inertia even though workpicee weight is within the maximum quoted.

⚠ CAUTION A tailstock may be required according to the weight, shape and cutting conditions or the workpeice.

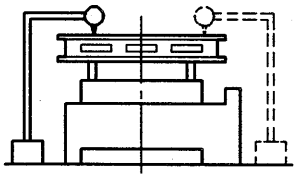
⚠ CAUTION See adove specification and precautions for operation. Set each machining condition so as not to exceed allowabke value.

3. Accuracies

(Unit : mm)

	Inspection items		Allowable value
1	Parallelism Between Table Face and Base	Per 150mm	0.015
2	Parallelism Between Center of Face and Base	Per 150mm	0.02
3	Run-out of Table Face in Rotation		0.02
4	Concentricity of Center Hole		0.01
5	Parallelism Between Center of Table and Center of Guide Blocks	Per 150mm	0.02
6	Indexing accuracy	Accumulation	40sec
7	Repeatability		±2sec

1



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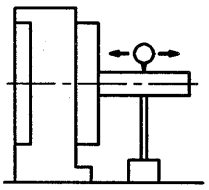

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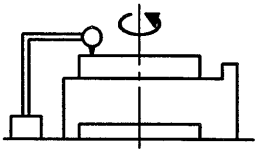

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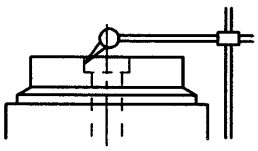

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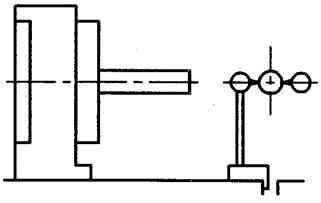

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Indexing accuracy should be measured with an optical measuring gauge.

4. Prepare for operation

The following procedures are recommended for preparing the NC rotary indexing table and for the trialrun.

4-1 Carry and mounting onto the machine tool

1) Carefully carry the table with a strong wire rope though the attached eye bolt.
2) Ensure mounting surface of machine tool is clean and free of burrs. If burrsor flaws are found, repair them with oil stone, etc., before mounting.
3) Install the table to the optimum position for work. Fit the guide block bottom face into T-groove on the machine tool table. If the clearance between T-groove and the guide block is large, move the table aside before installing.
4) Securely fix the NC rotary indexing table onto the machining tool with the attached clamp device.

⚠ WARNING Check mounting space before mounting NC rotary indexing table on the machine tool. Take care so that the NC rotary indexing table body, cable and air hose do not interferewith the splash guard or ATC device, spindle head, etc., of the machine tool when the machine tool table, spindle head, etc., are moved.

⚠ WARNING Do not scratch nor give stress nor load a'heavy matter nor pinch a cable. There is a possibility that you may receive an electric shock in case of damaging the cable.

⚠ WARNING Use the mounting seat effectively and tighten the bolts of clamp equipment to co rrect torque.(See page 2)

4-2 Lubrication

The NC rotary indexing table has already been filled with lubrication before shipping. Chack that the lubricant is filled to center level of the oil gauge.

⚠ CAUTION NOrmally the lubricant should be replaced every six mounths. Drain the old oil thoroughly before replacing with clean oil. Clean the oil supply port so that no swarf or foreign matter can enter during re-filling. Should any foreing matter enter, the unit may seize or be severely damaged.The following lubricants are recommended.

Recommended lubricant(viscocity grade ISO VG32)

Maker	Brand	Maker	Brand
MOBILE OIL	BACTRA OIL NO.1	COSMO OIL	DAINAWAY 32
NIPPON OIL	UNIWAY 32	IDEMITSU KOSAN	DAFUNIMULTIWAY 32MT
JOMO	SLIDUS HS32	ESSO OIL	UNIPOWER MP32
SHOWA SHELL OIL	SHELLTONA OIL S32		

Necessary oil quantity is **0.6 (RS200)**

DAFUNIMULTIWAY (IDEMITSU KOSAN) is provided in the unit before shipping.

4-3 Air supply for clamp

1) Supply air through air control unit (air filter, mist separater, regulator and drain catch).
(See page 4)

2) The air supply port of Rc1/8 is as shown in Fig.1. Connect the air hose to this port.

3) The air supply pressure used is within 0.5~0.6MPa(5.1~6.1kgf/cm²)

⚠ WARNING

4-4 Referring to Air-purge

According to the circumstance of use, the dew may be occurred in the motor case.
Air is exhausted from the portion of the air exhaust so that it causes the obstacle of electric parts or each part.

The air purge is performed by air branched inside of NC table that uses air for clamp.
Be sure to use the clean air (passing through air filter, mist separator, regulator and drain catch) passing through the filter. If the air contains water content (moisture), oil content, etc., it is entered in the motor cover, thus causing in equipment damage. The air inside of motor case is exhausted from the air exhaust port.
In case that the portion of the air exhaust is closed, motor case or motor etc.may be damaged so that the dew cannot be exhausted and that air pressure is kept in the motor case. Therefore the portion of exhaust should not be closed.

5. Table Clamping

5-1 Precautions of table clamp

⚠ CAUTION Always turn the table with the brake unclamped. Always ensure table has the brake clamped prior to machining except when milling.

⚠ CAUTION never subject the table to more than the recommended braking force. Such action will cause excessive wear to the clamp and also damage the wormwheel.

⚠ CAUTION It is important to ensure no residual pressure remains in the unit during unclamping as this can result in damage of the worm gear and clamping parts.

5-2 Clamp/unclamp check device

To preform correct procedure, be sure to check clamp/unclamp. (See Fig.1)

The check signal for clamp/unclamp is generated by the pressure switches. These pressure switches have been set as follows.

Clamp check(SP1) ———— 0.3 MPa (3.0 kgf/cm²)

Unclamp check(SP2) ———— 0.05 MPa (0.5 kgf/cm²)

5-3 Solenoid Valve for Clamp/unclamp

The solenoid valve is incorporated as shown in Fig.1.

Standard specification is as follows.

Solenoid ON ———— Table Unclamp

Solenoid OFF———— Table Clamp

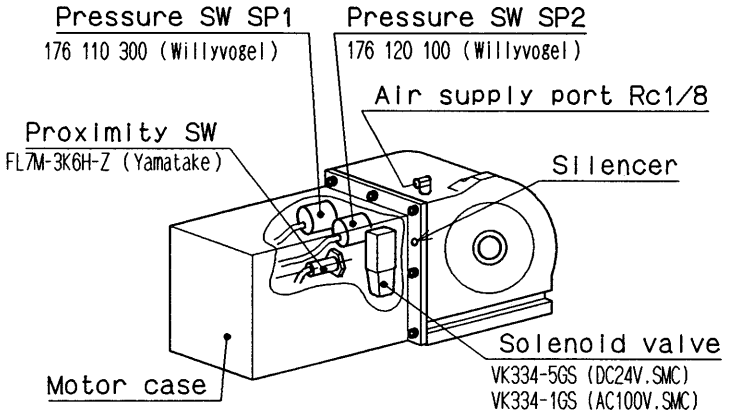


Fig. 1

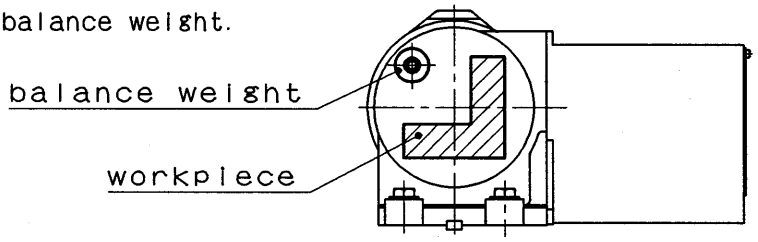
6 Workpiece clamping

Clamp the workpiece securely to ensure high accuracy and precision.

WARNING Always ensure that the workpiece is firmly clamped. Failure to do this will cause damage and accidents.

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

CAUTION Set the work so as there is no eccentric load for the table rotation center by compensating with balance weight.



7 Daily Inspection

The following procedures are recommended before operation.

1) Check the fixed condition of NC rotary indexing table(jig:if jig is mounted onto the face plate).
2) Check electric and air connection cables and air hose.
3) Check air supply pressure.
4) Check zero return,indexing and position.

8 Backlash adjustment of worm gear

The worm and worm wheel are made of special material and designed to maintain excellent accuracy. The backlash has been already adjusted before shipping. However, adjustment may be required when operating your unit over long periods. To obtain the optimum values of backlash the unit must be properly cool. If the unit is continursly operated over long periods the backlash will be smaller due to thermal expansion.

CAUTION If the backlash is too small,the worm gear may seize.

O Optimum values of backlash

Model	Measuring position	Angle(sec)	Circular length(μm)
RS200	Face plate periphery(φ165)	31~92	12~37

Measure backlash with the following methods before adjusting.

8-1 Measuring method of backlash (See Fig.2)

1) Pleace a dial indicator close to the table circumference on one of the T-Slot.
2) Insert a steel rod into another table T-Slot and move it in a clockwise direction with approximately 150 N·m (15.3 kgf·m) of force. Release and read the dial indicator.
   Next, apply force in a counter-clockwise direction on the steel rod. Release and read the dial indicator. The amount of backlash is the difference between the two dial indicator readings.
3) Chack the amount of backlash at eight equally divided positions by repeating the procedures avobe. If the amount of backlash is not within the appropritate range, adjust the amount using following procedures.

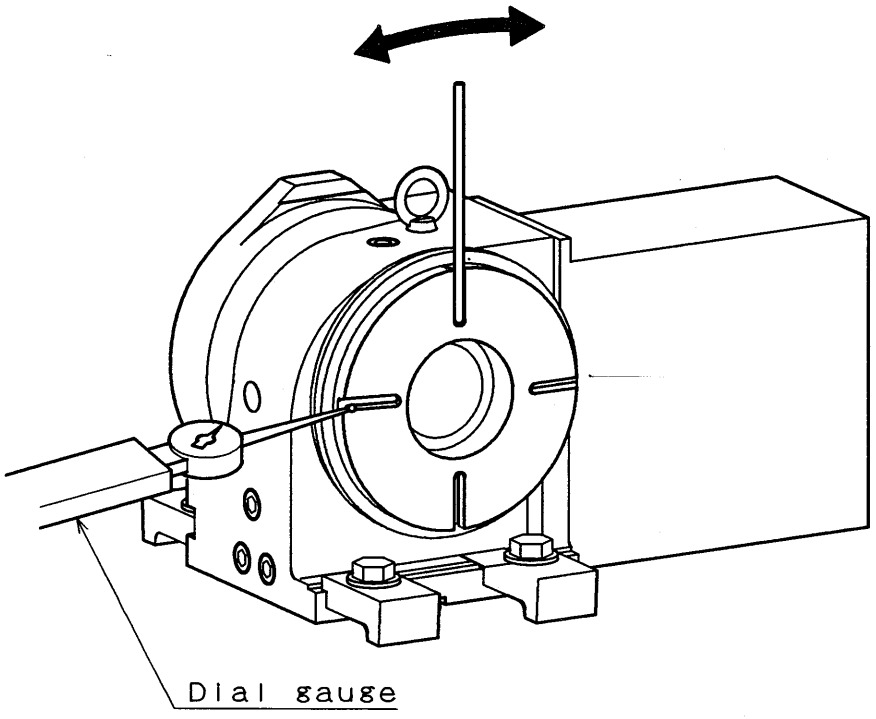


Fig.2

8-2 Adjusting method of backlash (See Fig.3.)

The worm is supported by the worm housing. Also, the motor is fixed by this worm housing. The backlash is adjusted by varying the engagement of the worm and the worm wheel, moving the worm housing along body mounting face.

1) Remove the motor case and drain hydraulic oil in the table from the drain port. (See page 15 to remove the motor case.)
2) Slightly loosen the hexagon head bolt ① for the stopper.
3) Slightly loosen three hexagon socket head cap screws ③ little which fix the worm housing ②.
4) Insert the round bar ④ (about ϕ6 or bar spanner) into ϕ8 hole of body through ϕ7 hole of the worm housing.
5) Approach the worm wheel side carefully to return the backlash to almost zero(0), operating the round bar.
6) Tighten the hexagon head bolt for the stopper and move the worm away from the worm wheel. Since the thread pitch of this bolt is 0.8 the backlash becomes larger by 0.036 with each 1/12 turn (30°degrees).
7) Securely tighten the hexagon socket head cap screws ③ before measuring the backlash as indicated in 8-1.
8) If optimum value isn't found, repeat items 2) to 7).

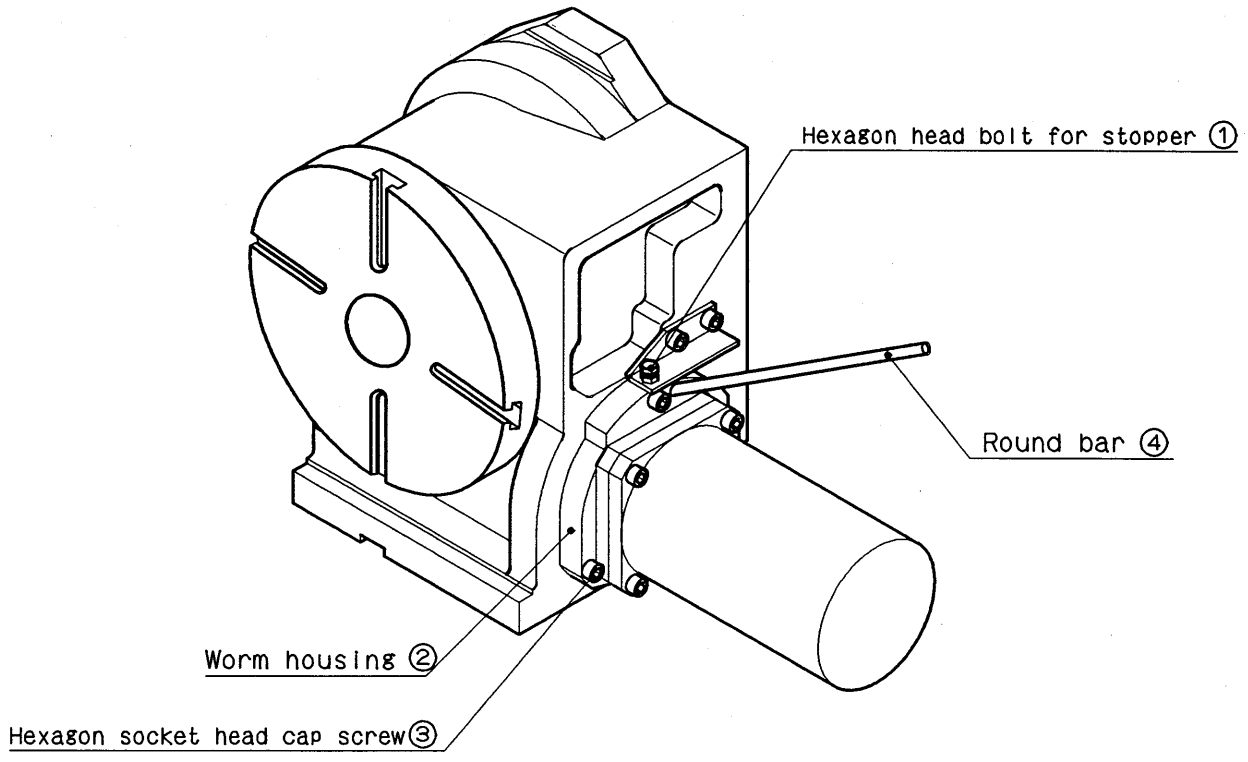


Fig.3

9 Built-in zero return device

The proximity SW ① detects the zero return.

9-1 Dog position of zero return reduction

On standard specification the zero return device turn clockwise (CW).

The ring type dog is set to the table spindle and it is possible to fix to optional periphery position. It is set where T-groove is horizontal before shipping.

To change the home position and dog position when marking return rotary direction counterclockwise, the following procedures are recommended.

9-2 Adjusting method of dog position(See Fig 4.)

1) Remove hexagonal hole plug ② located on the lubricant supply oil port and loosen two hexagon socket head cap screws ④ which fix the dog ③ to the table spindle through this oil supply port.
2) Move the dog ③ to proper position.
3) Securely tighten the hexagon socket head cap screws ④ after adjusting position.

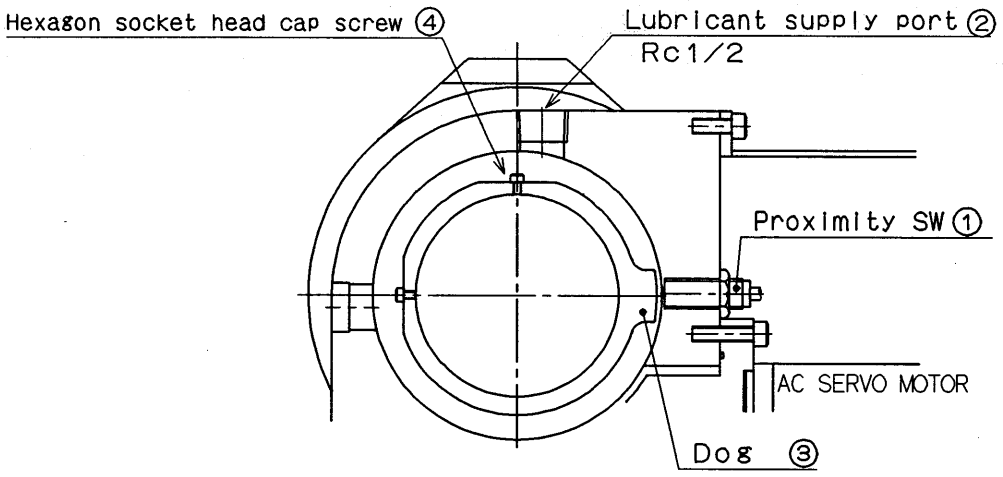


Fig.4

10 Motor case

10-1 Removing

When removing the motor, the following procedures are recommended only when the motor case must be removed. (See Fig.5)

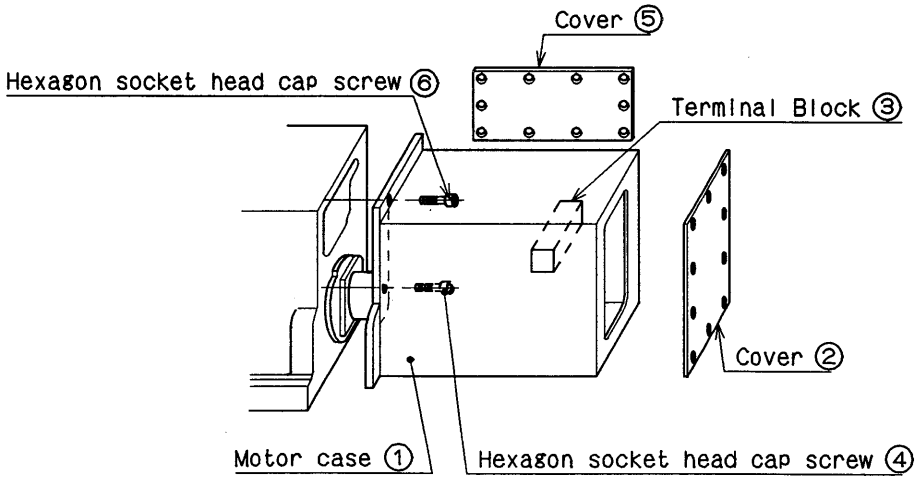
1) Remove the cover of the motor case (RS200:②) and reconnect all the wise from the NC table of the terminal block ③. And also referring to the cables from the motor, remove a connector.
2) The motor case is fixed with seven hexagon socket head cap screw. One ④ among them is located inside motor case. Therefore, remove the cover ⑤ before loosening it.
3) Since the motor case can be removed as it is, carefully separate the body and the motor case.

10-2 Waterproof

In order to protect the unit from any leaking of coolant, liquid sealant is coated on the junction face of the motor case ① and covers ② and ⑤.
Furthermore for the measures for waterproof of the in side of the motor case, the air supply port (Rc1/8) is prepared.
In case of the air-purging, clean air of 0.02MPa (0.2kgf/cm) of rated air pressure should be supplied. (Note:When products are delivered, this portion is plugged by a plug.)

⚠ CAUTION

When reassembling the unit scrape off any hardened liquid sealant thoroughly and recoat with fresh sealant. (Three bond 1216).
If cutting oil etc. is to be invaded into the motor case because of the break of a cable etc. It is urgently needed to be replaced a new cable so that electrices (motor, solenoid valve etc.) are to be damaged.



RS200 Type

Fig. 5

11 Storage

CAUTION When removing the NC rotary indexing table from the machine for storage, remove swarf and foregin matter before placing it on stable wooden base to maintain table accuracy. Also, coat it with rust-prevention oil and provide a wooden box or cover to protect from water and dust. Never use green fresh cut wooden case or box. Use treated timber.

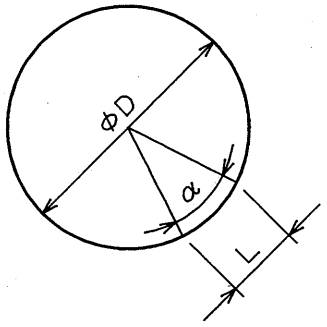
12 Conversion of circumference length and angle

IMPORTANT To calculate the circumference length when accumulated indexing accuracy is 30 sec or what is the angle when the accumulative pitch error is 0.05 use the following formula from relationship of the angle to the circumference length.

D: Work diameter (mm)

α: Angle (seconds)

L: Circumference length (mm)



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

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

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

(Examples)

Regard the work diameter as 100mm and use previous "for cumulative index accuracy, the time of 30 seconds is indicated as circumference length." and formula (3). As a result, the following is found.

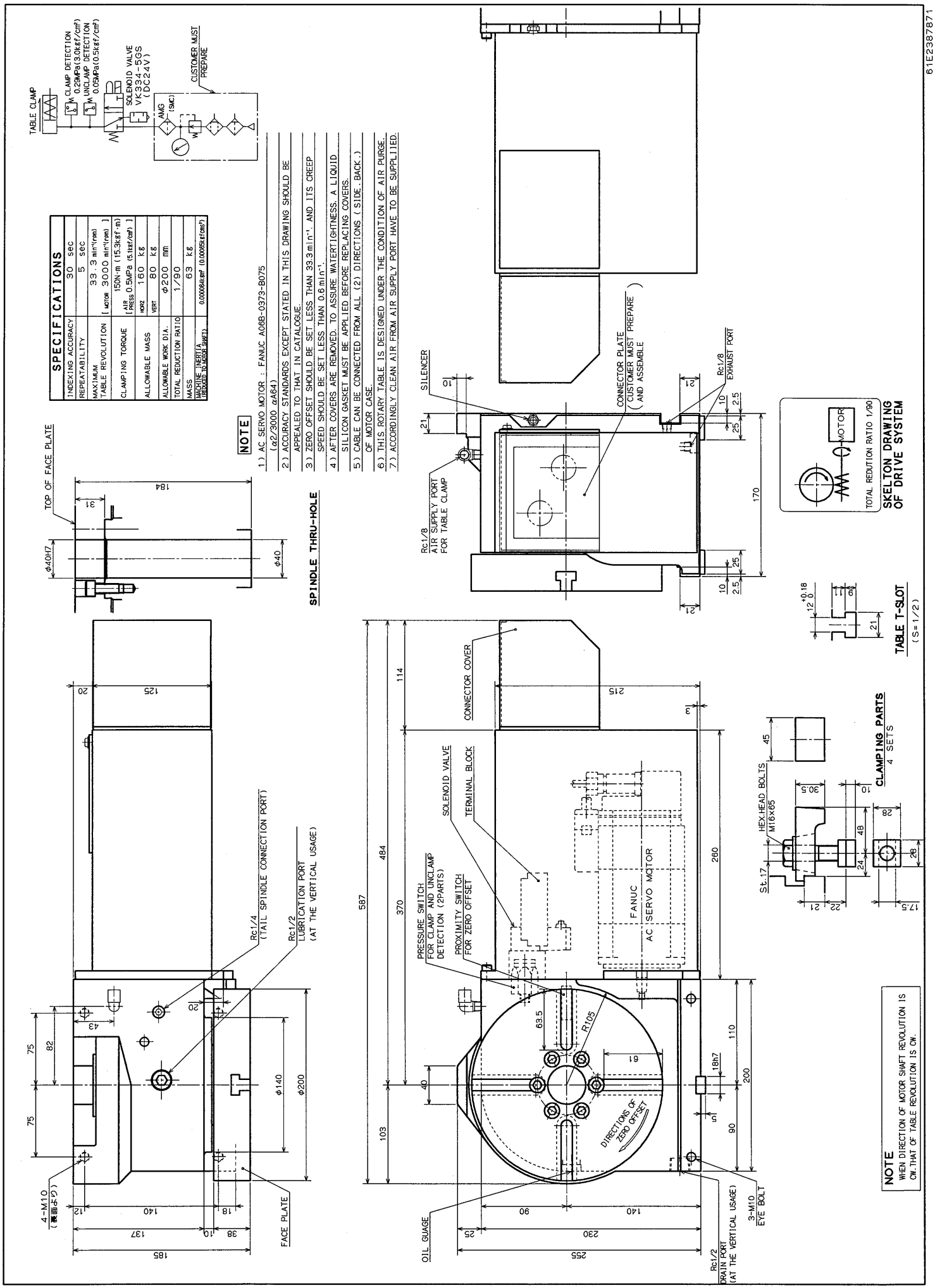
$L = 2.424 \times 30 \times 100 \times 10^{-6} = 0.007272\text{mm} \fallingdotseq 0.0073\text{mm}$

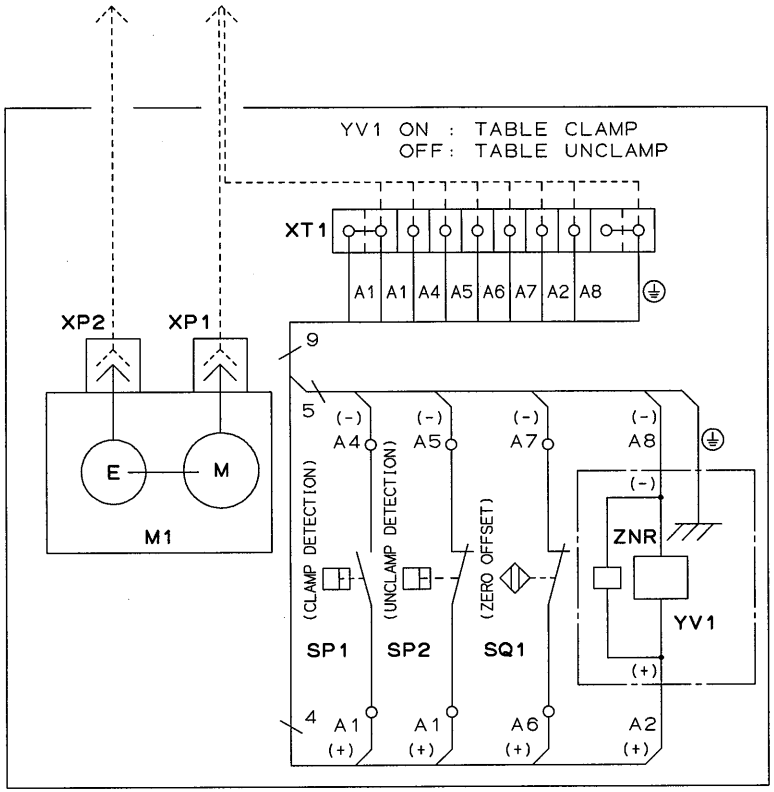
Consequently, circumference length is about 0.0073mm.

Also, use "Cumulative pitch error is indicated with angle of 0.05." and formula (2), the following is found.

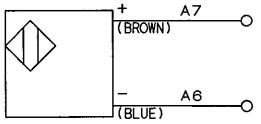
$$\alpha = \frac{4.125 \times 0.05 \times 10^{5}}{100} = 206.25''$$

Therefore, the angle is 206 seconds or 3 min., 26 sec. As shown above, the circumference length and angle can be converted by formulas (2) and (3).


SPECIFICATIONS
INDEXING ACCURACY 30 sec
REPEATABILITY 5 sec
MAXIMUM TABLE REVOLUTION [MOTOR 3000 min⁻¹(rpm)] 33.3 min⁻¹(rpm)
CLAMPING TORQUE [AIR PRESS 0.5MPa (5.1kgf/cm²)] 150N·m (15.3kgf·m)
ALLOWABLE MASS HORZ 160 kg
VERT 80 kg
ALLOWABLE WORK DIA. φ200 mm
TOTAL REDUCTION RATIO 1/90
MASS 63 kg
MACHINE INERTIA (REDUCED TO MOTOR SHAFT) 0.00008kgm² (0.0008kgfcms²)
NOTE
1) AC SERVO MOTOR : FANUC A06B-0373-B075 (α2/3000 αA64)
2) ACCURACY STANDARDS EXCEPT STATED IN THIS DRAWING SHOULD BE APPEALED TO THAT IN CATALOGUE.
3) ZERO OFFSET SHOULD BE SET LESS THAN 39.3 min⁻¹. AND ITS CREEP SPEED SHOULD BE SET LESS THAN 0.6 min⁻¹.
4) AFTER COVERS ARE REMOVED, TO ASSURE WATERTIGHTNESS, A LIQUID SILICON GASKET MUST BE APPLIED BEFORE REPLACING COVERS.
5) CABLE CAN BE CONNECTED FROM ALL (2) DIRECTIONS (SIDE, BACK.) OF MOTOR CASE.
6) THIS ROTARY TABLE IS DESIGNED UNDER THE CONDITION OF AIR PURGE.
7) ACCORDINGLY CLEAN AIR FROM AIR SUPPLY PORT HAVE TO BE SUPPLIED.
TABLE CLAMP
CLAMP DETECTION 0.2MPa (3.0kgf/cm²)
UNCLAMP DETECTION 0.05MPa (0.5kgf/cm²)
SOLENOID VALVE VK334-5GS (DC24V)
AMG (SMC)
CUSTOMER MUST PREPARE
TOP OF FACE PLATE
SPINDLE THRU-HOLE
SILENCER
CONNECTOR PLATE (CUSTOMER MUST PREPARE AND ASSEMBLE)
Rc1/8 EXHAUST PORT
Rc1/8 AIR SUPPLY PORT FOR TABLE CLAMP
TOTAL REDUTION RATIO 1/90
MOTOR
SKELTON DRAWING OF DRIVE SYSTEM
TABLE T-SLOT (S=1/2)
CLAMPING PARTS 4 SETS
HEX-HEAD BOLTS M16×65
CONNECTOR COVER
SOLENOID VALVE
TERMINAL BLOCK
PRESSURE SWITCH FOR CLAMP AND UNCLAMP DETECTION (2PARTS)
PROXIMITY SWITCH FOR ZERO OFFSET
FANUC AC SERVO MOTOR
DIRECTIONS OF ZERO OFFSET
Rc1/4 (TAIL SPINDLE CONNECTION PORT)
Rc1/2 LUBRICATION PORT (AT THE VERTICAL USAGE)
4-M10 (裏面より)
FACE PLATE
OIL GUAGE
Rc1/2 DRAIN PORT (AT THE VERTICAL USAGE)
3-M10 EYE BOLT
NOTE
WHEN DIRECTION OF MOTOR SHAFT REVOLUTION IS CW. THAT OF TABLE REVOLUTION IS CW.
61E2387871



CONNECTION OF PROXIMITY SWITCH



SPECIFICATIONS

POWER SUPPLY	DC10～30V
LOAD CURRENT	3～100 mA 4
LEAK CURRENT	max.0.55 mA
RESIDUAL VOLTAGE	max.3.0 V
OUT PUT TYPE	NC

MARK	NAME	MAKER	TYPE	NO.	REMARKS
M	AC SERVO MOTOR	FANUC	A06B-0373-B075	1	
			(α2/3000 αA64)		
SP1	PRESSURE SWITCH	WILLY VOGEL	176 110 300	1	0.3 MPa (3kgf/cm²) N.O.
SP2	PRESSURE SWITCH	WILLY VOGEL	176 120 100	1	0.05 MPa (0.5kgf/cm²) N.C.
					(CAPACITY 42V.30VA)
SQ1	PROXIMITY SWITCH	YAMATAKE	FL7M-3K6H	1	DC10～30V
YV1	SOLENOID VALUVE	SMC	VK334-5GS	1	DC24V
XT1	TERMINAL BOX	WAGO	264-701	6	
	TERMINAL BOX	WAGO	264-721	1	
	TERMINAL BOX	WAGO	264-727	1	
	END PLATE	WAGO	264-368	1	
	END STOP	WAGO	249-101	2	
	CARRIER RAIL	WAGO	210-111	1	
XP1	RECEPTACLE	HRS	H/MS3102A18-10P(10)	1	A CANNON CONEEECTOR EQUIPPED ON MOTOR
XP2	RECEPTACLE	HRS	H/MS3102A20-29PCW4(10)	1	A CANNON CONEEECTOR EQUIPPED ON MOTOR

XP1

PIN NO.	WIRE NO.
A	U
B	V
C	W
D	⏚

XP2

PIN NO.	WIRE NO.	PIN NO.	WIRE NO.
A	SD	S	0VA
B		T	0V
C			
D	*SD		
E			
F	REQ		
G	*REQ		
H	SHLD		
J	+5V		
K	+5V		
L			
M			
N	0V		
P			
R	+6VA		

WIRE NO.				WIRE DIA.
A1	A4	A5		
A6	A7			0.5 mm²
A2	A8	⏚		
U	V	W	⏚	0.75 mm²
				mm²

SPECIFICATIONS OF SOLENOID VALVE

RATED COIL VOLTAGE	24V
CONCONSUMPTION EIECTRIC POWER	4W

NOTE

1) 0.75mm² wires must be used for "A1","A4","A5","A6","A7","A2","A8",and "⏚".

2) "⏚" IS EARTH. "SHLD" IS SHIELDEARTH.

3) DOT LINE PORTION MUST BE PREPARED BY CUSTOMER

Model : RS200RAF10

KITAGAWA

株式会社 北川鉄工所

本　社／広島県府中市元町77－1
〒726－8610／電 話〈0847〉45－4560(代)
FAX〈0847〉45－8911

仙 台 支 店／仙台市若林区大和町4－15－13　〒984－0042／電 話〈022〉232－6732(代)
FAX〈022〉232－6739
東 京 支 店／埼玉県さいたま市吉野町1－405－1　〒330－8634／電 話〈048〉667－3469(代)
FAX〈048〉663－4678
横 浜 支 店／神奈川県横浜市港北区新横浜3－19－11　〒222－0033／電 話〈045〉476－5666(代)
FAX〈045〉476－5667
名古屋 支 店／名古屋市中川区高畑 1－238　〒454－0911／電 話〈052〉363－0371(代)
FAX〈052〉362－0690
大 阪 支 店／大阪市住之江区加賀屋 3－2－9　〒559－0011／電 話〈06 〉6685－9065(代)
FAX〈06 〉6684－2025
中四国 営業課／広島県府中市元町77－1　〒726－8610／電 話〈0847〉40－0541(代)
FAX〈0847〉45－8911
広 島 支 店／広島市南区東雲本町2－13－21　〒734－0023／電 話〈082〉283－5133(代)
FAX〈082〉285－8830
九 州 支 店／福岡市博多区板付 7－6－39　〒816－0088／電 話〈092〉501－2102(代)
FAX〈092〉501－2103
浜 松 営 業 所／静岡県浜松市上島3－29－23　〒433－8122／電 話〈053〉468－7880(代)
FAX〈053〉468－7881
工　　場／本山・下川辺・中須・甲山・東京・和歌山

PRODUCTION PLANT

KITAGAWA IRON WORKS CO.,LTD.
Head Office:77-1 Motomachi, Fuchu-City, Hiroshima-Pref. 726-8610 Japan

Tel:(0847)45-4560 Telex:6457-51 KIWJ Fax:(0847)45-8911
Cable:KITATETSU, FUTHU, HIROSHIMA

KITAGAWA USA, INC.
301E. Commerce Drive, Schaumburg, IL 60173 USA
Tel:(708)310-8198 Fax:(708)310-9791

KITAGAWA MANUFACTURING EUROPE LTD.
7 Dolphin Industrial Estate, Southampton Road,
Salisbury, Wiltshire SP1 2NB UK
Tel:(01722)414809 Fax:(01722)414819

REPRESENTATIVE

TECNARA TOOLING SYSTEMS, INC.

12535 McCANN DRIVE, SANTA FE SPRINGS, CALIFORNIA 90670
Tel:310/941-2000 Fax:310/946-0506

415 W. GOLF ROAD, SUITE 12, ARLINGTON HEIGHTS, ILLINOIS 60005
Tel:708/956-8600 Fax:708/956-8660

146 SCHOOLHOUSE ROAD, UNIT H, SPRING VALLEY, NEW YORK 10977
Tel:914/735-1280 Fax:914/735-1254

NORTH AMERICA REPRESENTATIVE
NORTH TECH WORKHOIDING, INC
301 E. Commerce Drive, Schaumburg, IL 60173 USA
Tel:(708)310-8787 Fax:(708)310-9484

EUROPE REPRESENTATIVE KITAGAWA EUROPE LTD.
7 Dolphin Industrial Estate, Southampton Road,
Salisbury, Wiltshire SP1 2NB UK
Tel:(01722)421155 Fax:(01722)421071

TAIWAN REPRESENTATIVE DEAMARK LIMITED
No. 6, Lane 5, Lin Sen North Road, Taipei, Taiwan R.O.C.
Tel:(02)393-1221 Fax:(02)395-1231

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