INVERTED VERTICAL TURNING CELL

CS20

INSTRUCTION MANUAL

MAINTENANCE

SEIKI - SEICOS $\sum$21L

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HSD *Hitachi Seiki Deutschland*
Werkzeugmaschinen GmbH

Introduction

Thank you for your having purchased the machine, favoring our product lines for your use.

This manual contains fundamental information on the maintenace. Please read and fully understand the contents for your safe machine operation.

In particular, the contents of the items concerning safety in this manual and the descriptions on the "caution plates" attached to the machine are important. Please follow the instructions contained and keep them always in mind to ensure safe operation.

The reference record papers on adjusting setting values such as a parameter list are attached to the machine unit and enclosed in the packing. These are necessary for maintenance and adjustment of the machine later on. Please keep them safely not to be mislaid.

The design and specifications of this machine may be changed to meet any future improvement. As the result, there may arise some cases where explanations in this manual could become partly inconsistent with the actual machine. Please note this point in advance.

In this manual, items on the standard and optional specifications are handled indiscriminately. Please refer to the "delivery note" for the detailed specification of your machine confirmation.

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1. INSTALLATION

1-1 Machine Installation

When installing NC machine, solid foundation is essential. It is also most important for maintaining the best condition of cutting accuracy of the machine. The nature of the ground condition of the factory site, for example, rock base or reclaimed land, makes a big difference. It is, therefore, difficult to give any definite rules generally applicable to the installation of this machine. It will be quite all right if you pay a reasonable attention, based on the knowledge that you have on the general foundation of machine tools. (Refer to "Foundation and Layout".)

The followings are the concrete items to be carefully attended when installing this machine.

1) The bearing capacity of soil should be 5 ton/m^2 or larger and thickness of the foundation should be 300mm or thicker.

2) The area of the foundation should be extend to at least 300mm outer circumference of the machine bed.

3) When digging vibration proof drains, they should be dug along the circumference of the foundation.

4) Placing separate concrete blocks underneath each machine leg instead of a real foundation is often seen, which is just not adequate. Such is no value as proper foundation,

As this machine yields large volumes of chip during machining, carts are often used for chip disposal. The traffic of carts and detaching covers in maintenance work need free space so that the operators can move around without touching other machines. This factor should be considered when selecting the installing position of the machine.

1-1-1 Environment of the Machine

Pay full attention to a room temperature, dust, vibrations, etc. in order to make use of the primary performance of the machine. High accuracy cannot be obtained in the environment where the room temperature greatly changes. Just a slight change of the room temperature partly affects the machine. Be fully careful of effects heat transfer from the direct sunshine, vent, heating unit, and so on.

Under the environment where the air is polluted so much by dust, etc., the sliding sections and electric devices of the machine are greatly effected in their service lives.

Particularly, electronic devices related to controls are susceptible to dust and humidity. Install the machine in the environment as clean as possible.

1. Installation Environment of NC Machine

In case that electric machines and appliances generating high frequency noise are installed or newly erected near by NC machines, keep to the following precautions.

1) Example of the electric machines and appliances generating high frequency noise.

[1] Arc welding machine

[2] Resistance welding machine

[3] High frequency drying machine

[4] Electric discharge machine

[5] Others

2) Installation form of NC machine

[1] Power supply line

The power supply line (AC400V) of NC machine must be separated line with that for electric machines and appliances.

If impossible, connect the line at the point more than 20m apart from the point where the power supply for electric machines and appliances is connected.

[2] Installation place of NC machine

NC machine must be installed more than 20m apart from electric machines and appliances.

[3] Earth of NC machine

The earth of NC machine must be grounded within 5m from NC machine separating from the ground of electric machines and appliances, and make a ground work with not more than 100Ω or comply with the laws and regulations of the country.
Or the earth wire size must be not less than 6mm^2.

3) Example of earth of NC machine

The earth state of NC machine and electric machines and appliances illustrated as under.

Power receiving equipment

To be separated system wiring

3 pase

AC400V

3 pase

AC400V

Powersupply

Electric machine and appliance

More than 20m

NC
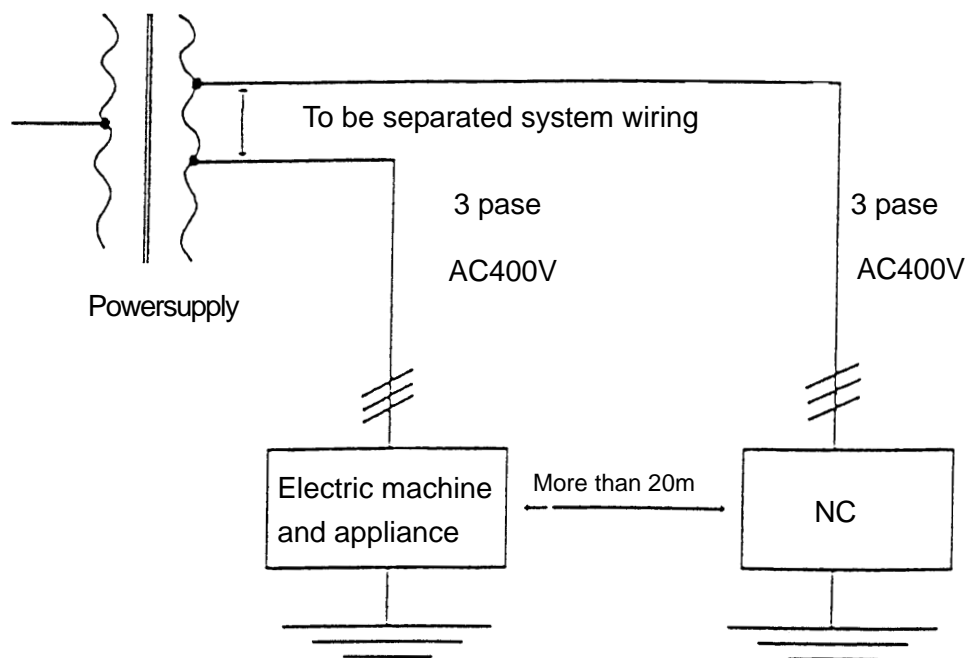
Grounding:Class 3 grounding work within 5m

[Grounding resistance of 100Ω or below. Wire size of 6mm^2 or above.]

1682-01-404-

1D12

Leveling details

4B1250

1682-01-405-

1970 (77.5")

Leveling position
(4 places)

300 | 135 (5.3") | 1100 | (5.3") | 135 | 300
(11.8") | | (43.3") | | | (11.8")

850 (33.5")

300 (11.8")

80 (3.1")

1830 (72.0")

1080 (42.5")

2175 (85.6")

1240 (48.8")

70 (2.8")

300 (11.8")

85 (3.3")

115

51 (2.0")

(5.3") 134
(4.5")

2838 (111.7")

Vibration proof
drain

300
(11.8")

Dimention : metric (mm)
inch (”)

Note)

1. The bearing capacity of soil should be 5 ton/m^2
   (1000lbs/ft^2) or larger and thickness of the foundation
   should be 300mm (11.8") or thicker.

2. The area of the foundation should be 1840x1970mm
   (72.4"x77.6") or larger.

3. When digging vibration proof drains, they should be
   dug along the circumference of the foundation.
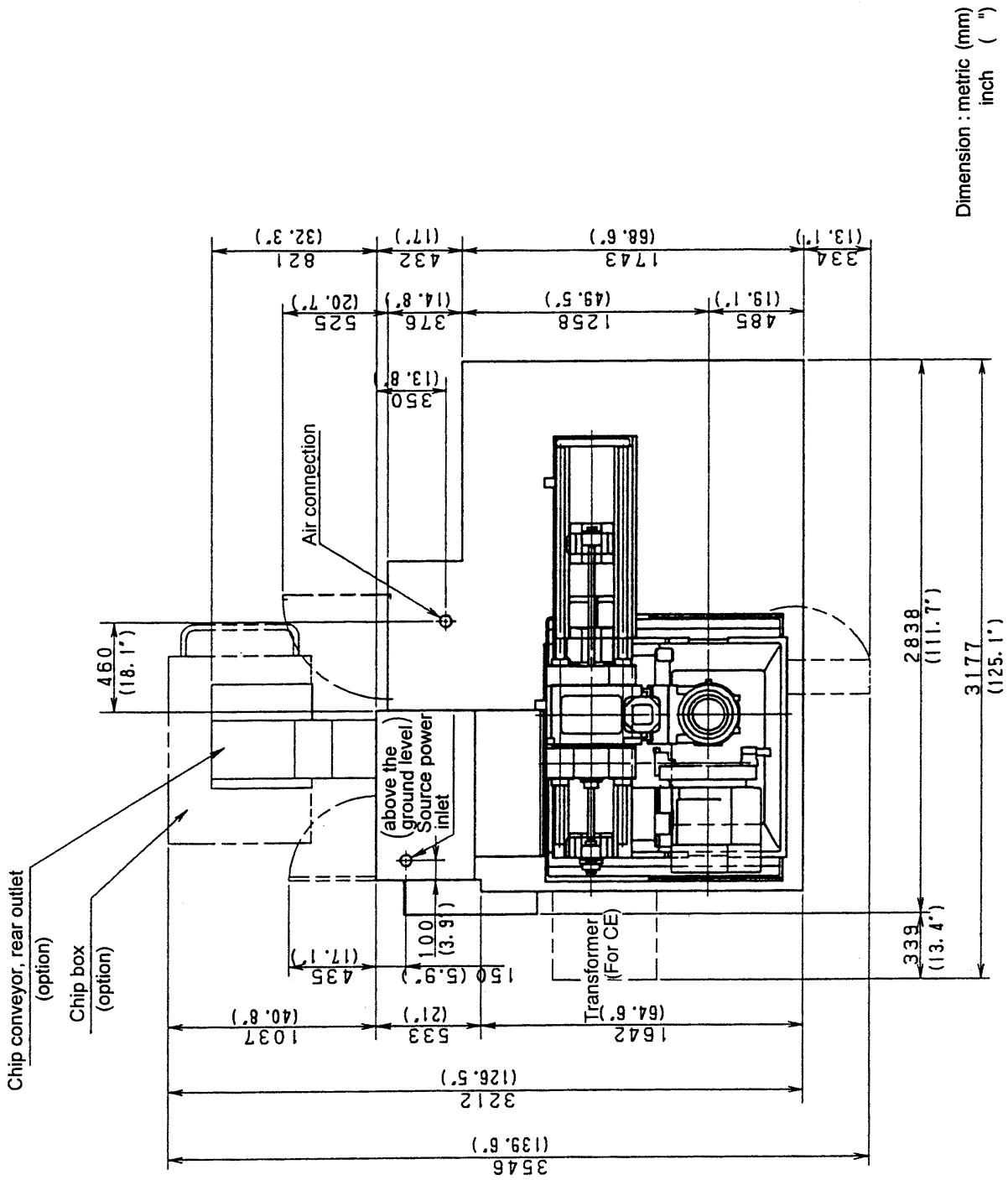
Dimension : metric (mm)
           inch (")

Fig. 1-2 Machine arrangement

Air connection

Chip conveyor, rear outlet
(option)

Chip box
(option)

(above the ground level)
Source power inlet

Transformer
(For CE)

460
(18.1")

435
(17.1")

1037
(40.8")

533
(21")

1642
(64.6")

150 (5.9")

100
(3.9")

3212
(126.5")

3546
(139.6")

339
(13.4")

3177
(125.1")

2838
(111.7")

821
(32.3")

432
(17")

1743
(68.6")

334
(13.1")

525
(20.7")

376
(14.8")

1258
(49.5")

485
(19.1")

350
(13.8")

1 - 4

1-1-2 Slinging Operation

The slinging work is one of the important operations when transporting the machine, which requires careful attention. When machine is transported, cranes or chain blocks are used for lifting, which includes slinging work. The following points should be carefully attended to for this work.

1) As the machine weighs 4900kg, the diameter of the wire used should be 14mm or thicker.

2) Draw out the coolant tank.

3) Prepare the slinging hook as illustrated in Diagram 1-3.

4) Adjust the gravity center of the machine by moving the saddle and the cross slide, so that it comes on the center line of the sling angle.

5) Sling angle should be smaller than 90°, proper angle being 60°.

6) Do not use rusted wire ropes, those with unwound twists or with broken lines.

7) Lift the machine gradually. Stop it once when the wire rope become strained, and check a lifting conditions. When the machine is lifted up from the floor, check again that there are no abnormalities with the lifting rope, and proceed with the lifting rope. When lowering the machine, it is necessary to be careful that it is lowered down slowly. Stop lowering the machine immediately before it reaches the floor to check.

Then, lower it down completely.

1-1-3 Forklift Operation

Attention should be paid to the following points when conducting forklift operations.

1) Use a forklift capable of lifting the machine weight.

2) In order not to damage the protruding portion of the machine, a watchman should be attached to help the forklift operator to undertake cooperative work.

3) When inserting the fork, apply the fork blades to the cast iron draw grooves on the left and right sides of the base of the machine main body designed for fork blade insertion.

4) Before set to lifting work, make a trial lifting in order to ensure the best stability of the load, considering the balance of front/rear, left/right and machine gravity center.
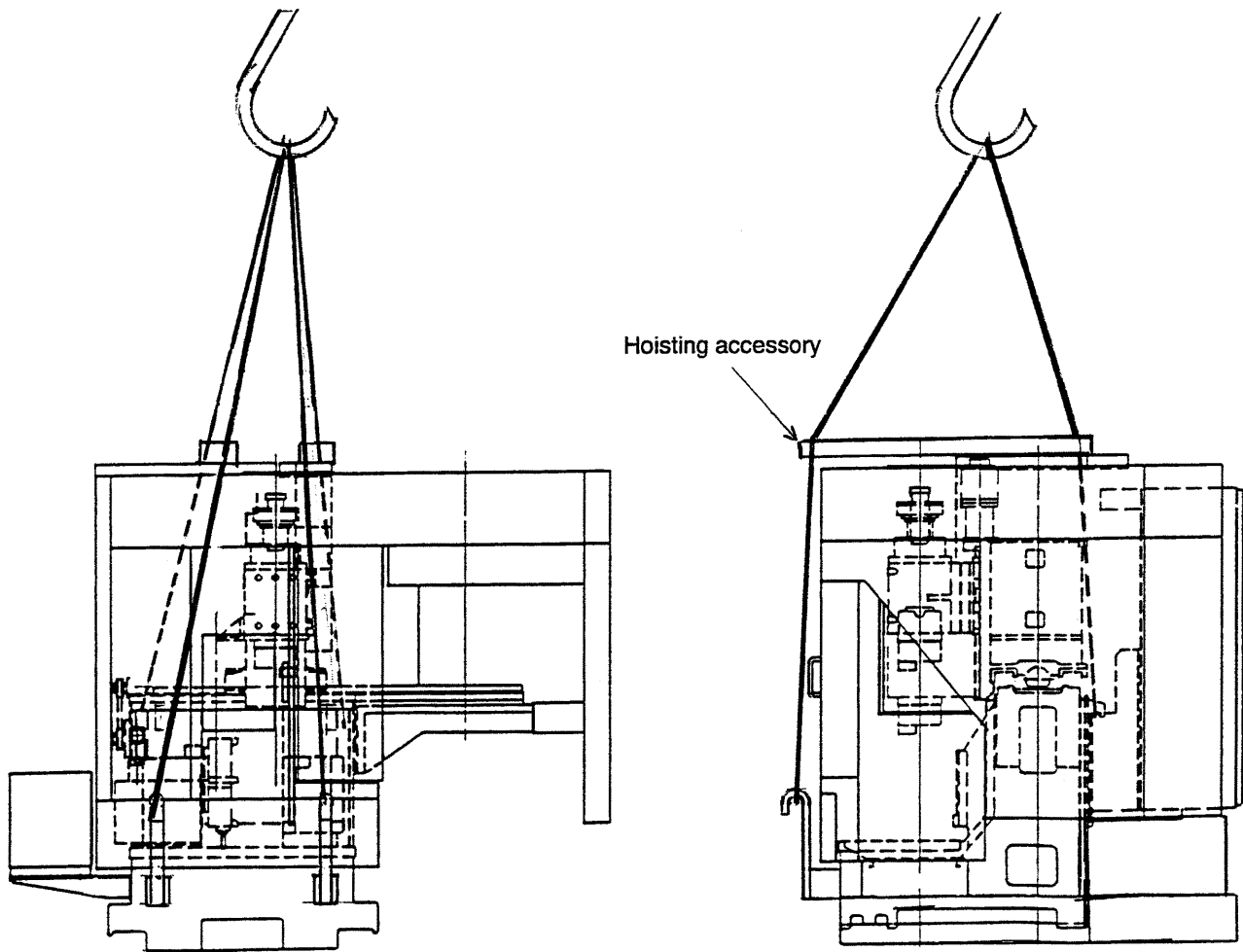
Fig. 1-3 Slinging

1-1-4 Cleaning of Machine

Do not move saddle and cross slide before cleaning, as the anticorrosive paint is often contaminated with dust during transportation.

Upon shipment from our factory, each section of the machine has been tightened. Before cleaning the machine, Loosen respective section.

For cleaning, use waste soaked with refined petroleum product (neutral) and wipe off the anticorrosive paint thoroughly.

Avoid using compressed air for cleaning, as foreign matters existing at opening portion of the fitting part may be blown into the depth of the slit by air pressure and may damage the fitting face. After cleaning, apply high quality lubricating oil specified in "Lubrication and Oil Supply" on the finished surface thinly.

1-1-5 Power Source and Pneumatic Source

1) Main switch for source power should be installed at a place close-by the machine site so that switch opening/closing can be handled by the operator with his own responsibility. The switch should be exclusively for this machine separated from the line used for other machines. For fuse capacity, refer to the table below.

2) Wiring from source power switch to the machine

   The line connection is to be arranged as shown in the following diagram.

[2] Grounding line connecting bolt

[1] Circuit Breaker (CB-1)

Electric wire pull-in hole 1

Electric wire pull-in hole 2
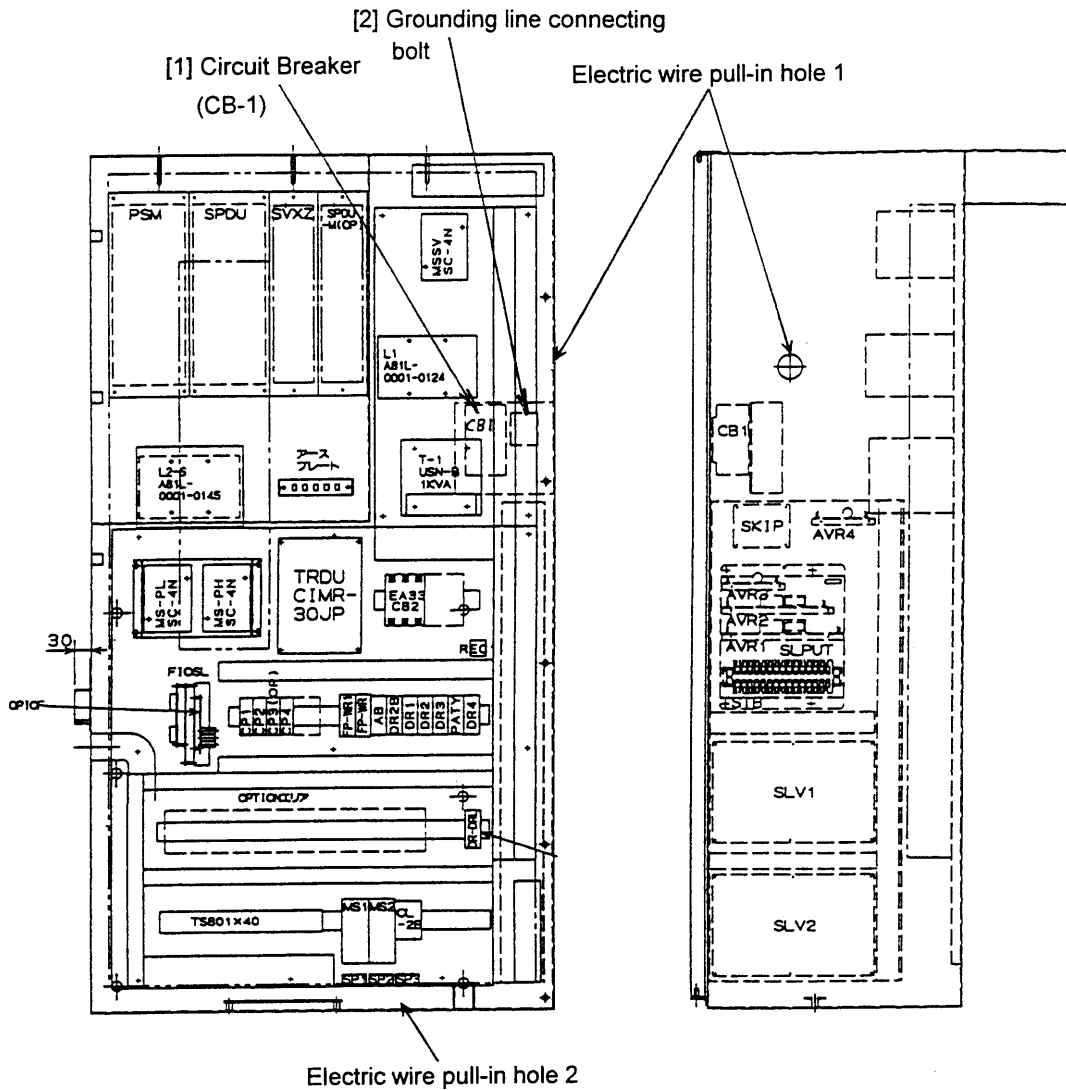
At the time of machine installation, the wiring arrangement to the primary side of the high power circuit breaker CB-1 ([1] in above diagram) is to be taken care of by the customer.

As for power source wire and grounding wire, refer to the table below.

The grounding wire is to be connected with grounding bolt [2].

Machine type	Total capacity	Wire thickness		Fuse
		R.S.T	Grounding	(Capacity)
CS20	23kVA	□22	□5.5	75A

1-1-6 Change of Electric Specification Machining Source Power
Volt age and Cycle

Depending of the voltage and cycle of the source power, the setting of electric system has to be changed. Before the setting, confirm on these points.

Source power voltage   400V ±10%

Source power cycle   50/60Hz ±1Hz

[5] Control Circuit Transformer

[1] Circuit Breaker (CB-1)
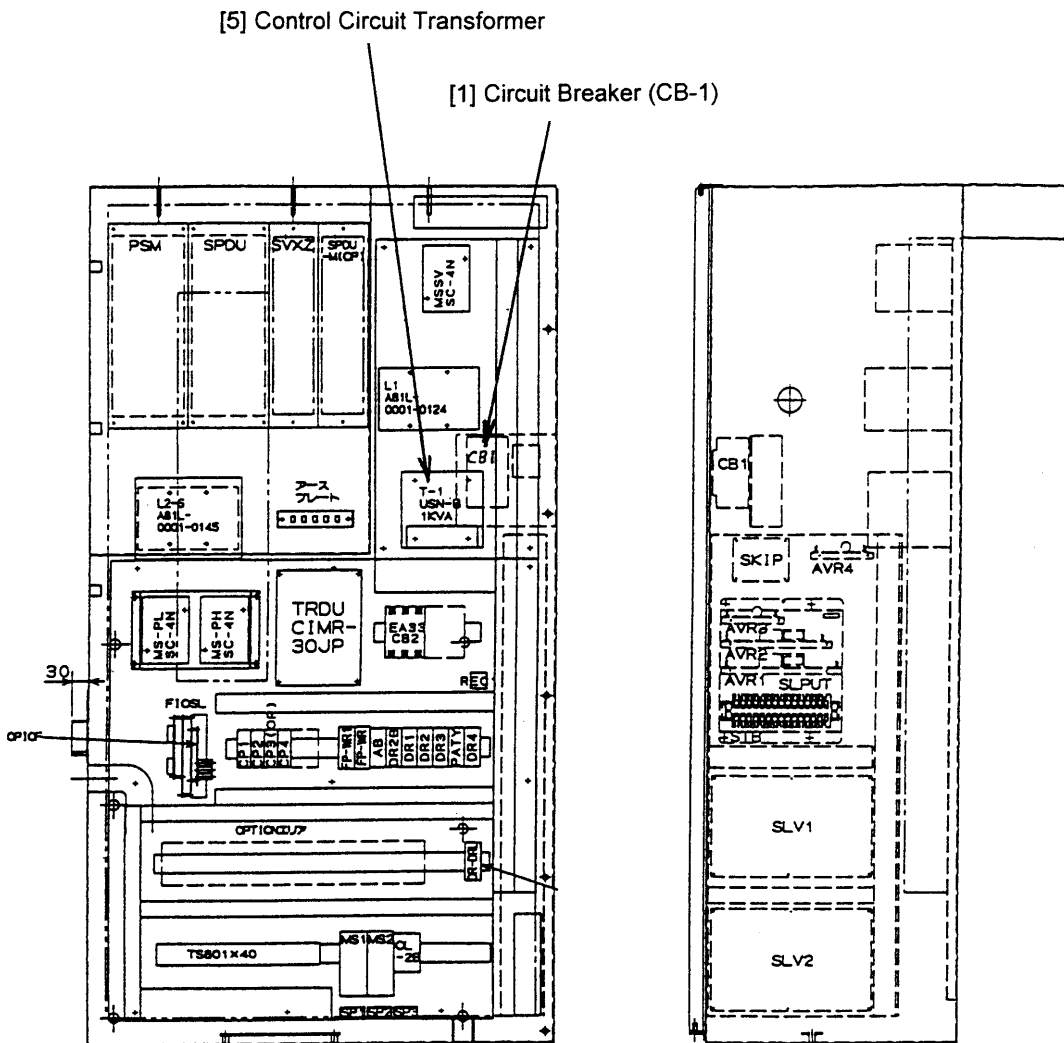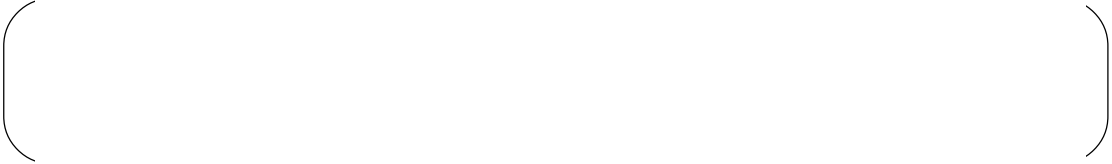
1-1-7 Connection of Chip Conveyor

[1] In order to enable the machine running before installing the chip conveyor, the machine ex factory attaches short circuit wire on CN2 connector. When installing the chip conveyor, pull off this wire by hand then connect CN2 wiring. <u>Before doing this wiring, make absolutely sure that the main source power of the machine be switched off.</u>

Note) *Emergency stop circuit of chip conveyor*

When chip conveyor emergency stop button is pressed, the machine proper is also brought into the condition of emergency stop. Of the machine with chip conveyor attached, if the connector CN2 is disconnected (see illustration on the left), the machine will come to an emergency stop, just in the same manner as emergency stop button is pressed.

CN1
CN2

CNM2
CNM2B

(Left side view of Control Board)

1-1-8 Installation and Leveling

One of the factors deciding the machining accuracy is how to install the machine on level. Correct leveling is the most fundamental requirement in machine installation, which affects the accuracy of products as well as the service life of the machine itself.

For this reason, please follow the undermentioned steps of leveling.

At first, place a block (shown in Fig.1-1) at the installing place on the floor, and install the machine so that the leveling bolt (the jack bolt) of the machine may be placed on this block. Next, install a block around the chuck, and put on a level as shown in Fig.1-4. Let X fully stroke. Pay full attention not to interfere with the tool post.

Make adjustment so that difference of reading of the level back and forth shall be within 0.04mm/m.

The sensitivity of leveling instrument recommendable is 1m long with 0.02mm graduations. When applying the leveling instrument, the instrument should always be kept with the same end to the same direction.

The surface on which the leveling instrument is placed should be kept clean, and proper attention should be paid so that there is no dust getting in between the surface and instrument during level measurement.

When locking the leveling bolt, attention should be paid that the bolt does not to turn. For the convenience of regular maintenance of the machine level, do not solidify the bolt by mortar. When the machine generates vibration by unbalanced workpiece, fix it with an anchor bolt.

Check the machine level periodically. For 2-3 days after the initial installation, check it daily. During subsequent 6 months check it monthly, and thereafter in every 3 months.

Leveling instrument

Block for leveling instrument

1682-49-338-∗∗

Move X direction in full stroke
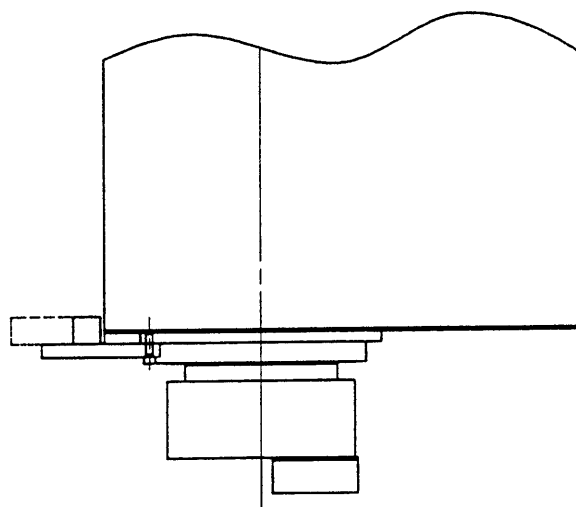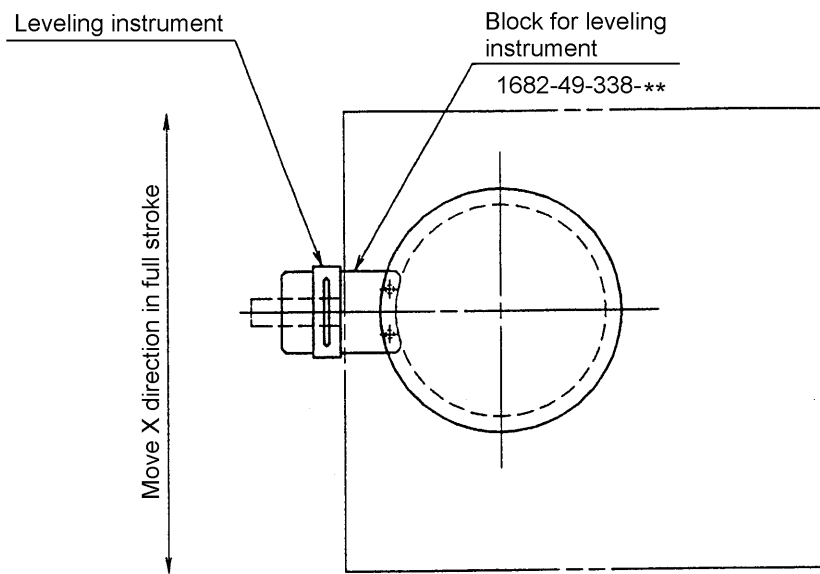
Fig. 1-4 Leveling Method

1-2 Lubrication and Oil Supply

When supplying oil, sufficient care must be taken to the following:

1. Supply specified oil by the specified amount. Do not supply a different type of oil or over the specified amount. Otherwise the machine may cause to a trouble.

2. Clean the oil inlet port etc. in advance, and pay close attention lest dust etc. should enter inside.

3. When supplying oil, use a filter in order to prevent foreign substances such as dust from entering into the tank. When the filter is not available, use a wire net of 150 mesh or more.

4. Whenever you supply oil, use new one. Do not mix with reproduced or old oil.

5. Even when a new oil can is opened, don't use all the oil in it, but leave some unused. This is necessary to eliminate moisture and deposits.

* As to oil supply spots, supply frequency, oil amounts and oil types, refer "List of Lubrication Oil".

Front view
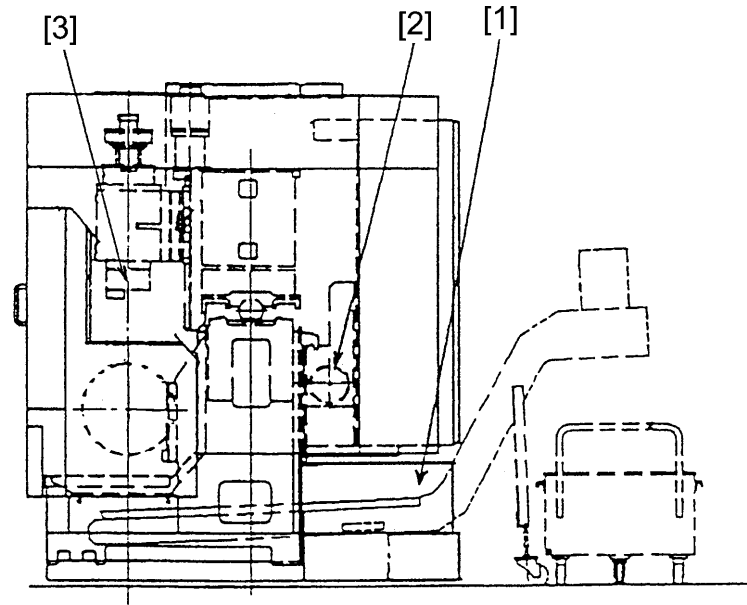
	Supply spot	Method	Frequency	Q'ty	Nisseki	Idemitsu	Shell	Mobil	Mitsubishi	ESSO	MOK Clewbar	ISO symbol
1	Spindle cooling unit	Trochold pump	Replace every 6 month; replenish occasion	28l	Nisseki Multi-purpose 32	Daphne Multi-way 32ER	Tetra oil 32	MOBIL DTE oil light	Diamond Tetrat 32	UNI-POWER MP32		CB32
2	Hydraulic unit	Piston pump	Replace every 6 month; replenish occasionally	10l								
3	Hydraulic chuck	Manual	Supply oil fully every day		Molynock grease 2	Daphne grease M2	Retina AM	MOBIL grease special	Diamond Multi-purpose M grease 2	BICON Q2	R-temp Q NB50	

1-3 Coolant

1) How to control coolant fluid

The consistency of coolant fluid is changed depending upon the quality of water used, mixture of chips or foreign substances and evaporation of moisture. And unless the maintenance of the coolant fluid is made for a long time, germs may be generated, that causes to break the filters, the piping and the pump. Check the density of the fluid, and pH timely, replace the coolant fluid, and also clean the inside of the coolant tank in consideration of using conditions.

Since contaminated muddy clods may be generated when a different kind of coolant fluid is mixed up, remove completely the previous fluid through flushing the piping, the tank and the equipment sufficiently, when changing the coolant fluid.

●**Items to be checked periodically**

It is advised to check the following items periodically.

1. Liquid color check

Observe the color eyes.

When the color is changed to blown, it is presumed that rust may generate. In case of FC and FCD, chips happen to become blown. When the coolant fluid becomes block, it is presumed that it has been corroded. When the fluid becomes block and gives out a putrid smell on Monday morning or after a long period of holidays, the color of the fluid may happen to return to the original color in the afternoon. It is phenomena that the fluid changed through extinction of bacteria (anaerobic germs) by touching the fluid with air.

When it is not returned, it is required to replace the fluid, since the fluid is too putrid. In this case, replace all the coolant fluid and make flushing sufficiently. The remaining bacteria will cause to repeat the putrid consequently.

2. Check of the putrid smell

Special care must be taken to smell.

When the fluid is filled with putrid smell, the ingredient of the cutting fluid be destroyed by breeding of bacteria or eaten by bacteria as nutritive substance, that causes the change of its density, lowering of pH and outbreak of rust.

When the putrid smell is not faded away even after half a day in the status of operation, it is required to replace the coolant fluid.
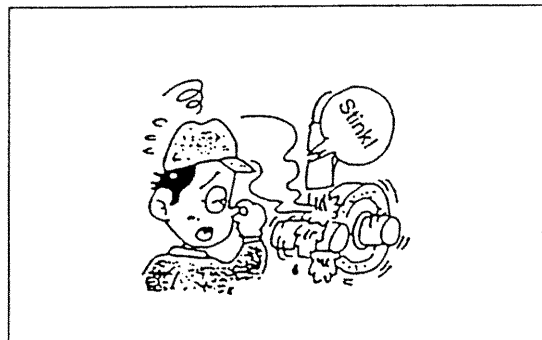
3. Check of the filthiness of the fluid

Observe the filthiness of the fluid by eyes.

The filthiness of the fluid has influence on the machining accuracy, the dirt of the machined work and the dirt of the machine.

And the dirt of the machine makes hard to observe the state of machining from the outside.

4. Check of the quantity

Check the level of the rank periodically.

Shortage of the fluid quantity causes to form bubbles or to disable the fluid to supply sufficiently to the machining point.

And also it will hasten the progress of the putrefaction.

5. Control of the density

It is the most important procedure to control the density of the fluid when soluble cutting oil is used.

It is the best way to measure the density by a refractometer.

If not available, it is possible to control to some extent the density of the fluid by calculating precisely the magnification at the time of dilution and also by calculating the magnification without fail when pouring some more fluid.

It is the most desirable method to check periodically the density by a density-meter, since there are various factors such as change of the ingredients by bacteria, decrease by taking out with the workpieces or vaporization of the fluid. When the density of the cutting fluid is low, serious problems such as bad smell by putrefaction, lowering on the pH and rust promotion will occur. Generally the density of the cutting fluid is within the extent of 20

Read a scale watching through eye piece.

times through 30 times, but it will be different depending on the kind of cutting fluid. Comply with the maker's recommending value. Since it becomes impossible to measure the fluid when lots of rust preventive oil or lubrication oil is mixed.
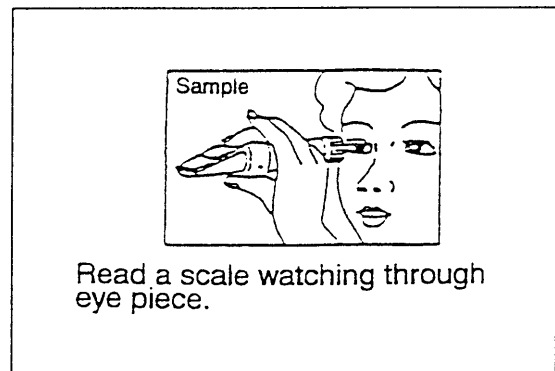
6. Control of the pH

Measure the pH by using either a litmus test paper or a simple pH measuring instrument.

When the pH value of the fluid is 7, the fluid is neutral. When the value is larger than 7, the fluid is alkaline and when it is smaller than 7, the fluid is acidic.

Generally pH8.5 through 9.5 is an ideal value. When the value becomes lager than this, alkaline

pH checker   Litmus test paper

becomes stronger, that causes the chapping of the skin of the hands.
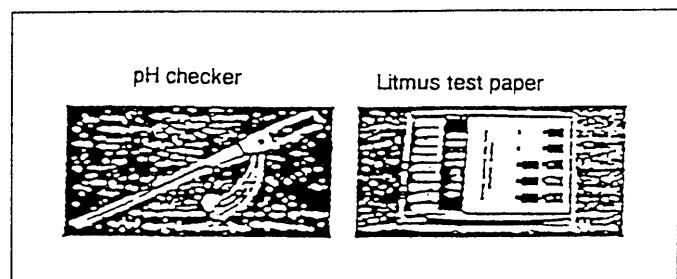
When it becomes smaller, the fluid is acidulate, that causes hastening of rust. Especially when the pH value of the fluid becomes less than 8, care must be taken since rust is hastened rapidly. In this case, replace the fluid.

7. Check of the stagnant sludge

Check whether chips and/or sludge stagnate in the tank and the piping.

Remove chips and/or sludge from the tank and the piping by flushing as occasion calls.

And mixture of rust preventive oil and lubrication oil may become the nutritive elements, and the surface of the tank is covered with them, that causes the breeding of anaerobic germs. Remove the adulterated oil periodically.

It is recommendable to employ an eliminator such as skimmer.
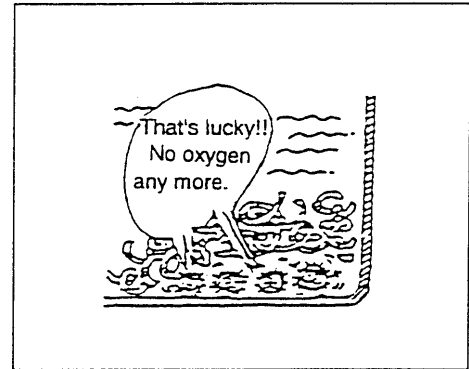
2) Control of the waste oil

"Water Pollution Control Law" and "Sewage Water Law" are adapted to the waste oil of cutting fluid.

The substances more than 10 items of ingredients contained in the cutting fluid are designated as organic substance, and they become the object of regulation items. Therefore, appropriate disposition such as disposal by the waste oil disposing system in the factory or taking-over by the waste oil treating trader is required.

The cost for waste oil disposal at the time of replacement of the fluid is directly related to the life of fluid, and 50% of cost-down can be attained by replacing the fluid once a year instead of twice a year.

Accordingly, conclusive control of the using fluid will mean development as a whole.

3) Types and selection of water-soluble cutting agents

Though there are various purposes of cutting agents, the following two points are the most important basically.

Lubrication: The cutting agents reduces friction, prevents generation of heat, and smoothens .... (Deposition-resistant property).

Cooling: The cutting agent cools generated heat.

In addition to the above-mentioned matters, enviroment- and safety-related metters such as washing property and swarf disposal must be taken into enough consideration. Water-soluble cutting agents are divided into an emulsion type, soluble type, and chemical solution type. Their characteristics are shown in the following table. Do not use the chemical solution type in particular, because it causes detachment of coating and affects seal materials and resin materials adversely.

Type	Emulsion Type	Soluble Type	Chemical Solution Type
Characteristics	* This type has been used widely in the cutting field, because it is relatively large in particle diameter (4 to 7 μm) and high in lubricating property. * It is the soluble cutting agent that was made first. * It decomposes easily due to lack of stability.	* This type is excellent in permeability because it is small in particle diameter (0.1 to 0.03 μm). * It has been used mainly for grinding purposes, but it is used also for cutting purposes due to the development of the extreme pressure agent. * Since it uses much surface-active agent, it is likely to affect coating adversely.	Do not use this type.
Form	* Dissolving this in water, it becomes milky. This is because particles dissolved in water are large, reflecting light.	* Dissolving this in water, it becomes semi-transparent. This is because particles dissolver in water are very fine, passing light.	

Maintenance of Coolant Tank

In case of delivery of coolant from the tool post get worse,

1. Check level and fill it up if required.

2. Clean a filter in the coolant tank.

   This filter can be mounted or dismounted in one touch.

   Pay a full attention as the coolant will easily drip down on the floor when chips in the bucket are removed.

3. Piling up the bucket with chips may cause overflowing. Check on the bucket at least once a day.
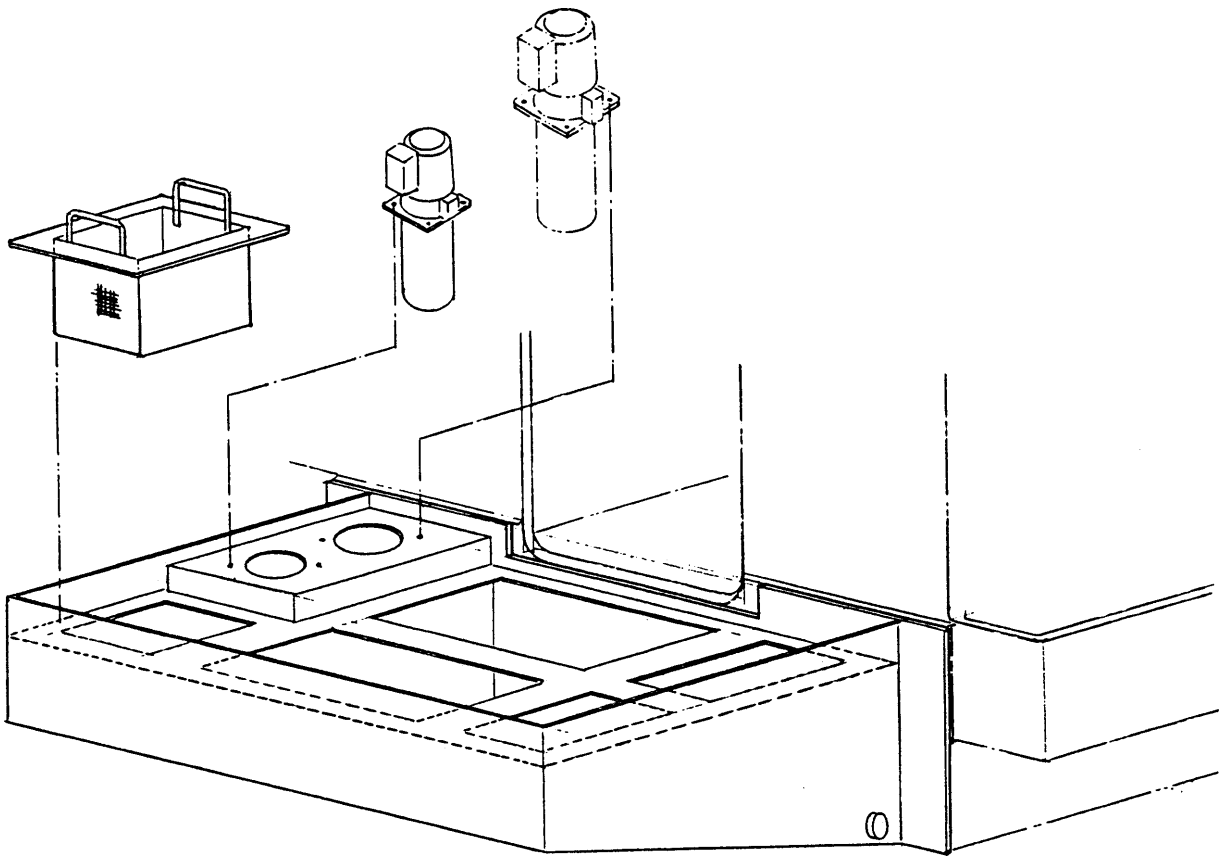
1-4 Check Before Trial Operation of the Machine

Before operating the machine at first, be sure to check each item in accordance with the following order.

1. Check the voltage of the power source. The power source is different depending on the district.

   Three-phase, 200V, 50Hz: Mostly in Kanto and Tohoku regions.

   Three-phase, 220V, 60Hz: Mostly in Kansai, Chubu, Hokuriku and Chugoku regions.

   Three-phase, 200V 50-60Hz: For future power supply and not available at present.

   When checking the power source, measure the voltage between 3 phase respectively and the difference between each phase must be within a few voltage.

2. Turn on the breaker CB-1 in the power control cabinet and then check the phase rotation of the power source in accordance with the following.

   Press the movable contact operating button in the magnetic switch (MS-1) for hydraulic motor with a driver and check that the pressure gauge for hydraulics turns up. When it doesn't turn up even pressing it for 5 to 10 seconds, turn off the barker (turn off the power on the factory side) because of different phase rotation and change the connection of either 2 of the power supply 3 lines.

3. Turn on the power source for the NC unit and check that the screen (TITLE) is displayed on the Display.

4. Set the mode selection switch to the manual (HANDLE or FEED).

5. Check of the rotating direction of every motor.

   Rotate every motor by respective switch and check the rotating direction in accordance with the instruction of the rotating direction.

   When the rotating direction is reverse, change the connection of either 2 of the power supply 3 lines.

[1] Cooling fan	: Start/stop is operated by the breaker on the high power control board.
[2] For hydraulic	: To start by the [STANDBY] button.
	To stop by the [POWER OFF] button.
[3] For spindle	: To jog rotation by the [SPINDLE JOG] button.
[4] For cutting fluid	: To start by the [COOLANT] button
	To stop by pressing the button again.

6. Adjust the pressure of the hydraulic unit to the setting pressure, 3.5MPa {35kg/cm^2}

2. MAINTENANCE AND CHECKING

2-1 Daily Checking Items

The following are maintenance items to be checked by operators. These maintenance items are important to prevent machine trouble and to perform efficient operation. Perform maintenance according to the following daily check list.

Daily check list

	Checking part	Check item	Details of checks
1.	Hydraulic unit	a) Check for normal set pressure.	⇒ Normal value: 3.4 MPa, 4.4 MPa and 6.8 MPa (It depends on the model.)
		b) Check hydraulic unit for faults.	⇒ Checks for abnormal noise and oil leakage.
		c) Check hydraulic unit for sufficient quantity of oil.	⇒ Oil level check
		d) Check that oil temperature is 60°C or less.	⇒ Oil temperature check: Proper temperature is 60°C or less.
		e) Check for oil leakage.	⇒ Check for oil leakage
2.	Main cooling unit	a) Check main cooling unit for operation.	⇒ Check for sound of fan running
		b) Check cooling unit for sufficient quantity of oil. (Checks before starting work)	⇒ Oil level check
		c) Check that air filter is thoroughly cleaned.	⇒ Checks for clogging and cleaning
		d) Check for oil leakage.	⇒ Check for oil leakage
3.	Pneumatic unit	a) Check for normal set pressure.	⇒ Normal value: 0.5 MPa
		b) Check pneumatic unit for faults such as air leakage.	⇒ Check for air leakage
4.	Coolant unit	a) Check coolant unit and piping for faults.	⇒ Checks for coolant leakage and abnormal noise
		b) Check coolant unit for sufficient quantity of coolant.	⇒ Oil level check
		c) Check that air filter is thoroughly cleaned.	⇒ Checks for clogging and cleaning
		d) Check for discharge.	⇒ Visual check
		e) Check for oil leakage.	⇒ Check for oil leakage
5.	High-pressure coolant	a) Check high-pressure unit and piping for faults.	⇒ Checks for coolant leakage, abnormal noise and abnormal vibration.
		b) Check for discharge.	⇒ Visual check
		c) Check pump for discharge pressure. (Pressure gage)	⇒ Normal value: 3.4 MPa or 6.8 MPa (It depends on the specifications.)
		d) Check that air filter is thoroughly cleaned.	⇒ Checks for clogging and cleaning
		e) Check high-pressure pump for sufficient quantity of oil.	⇒ Oil level (cap oil filling) check and replenishment
		f) Check for high-pressure pump oil fouling.	⇒ Checks for oil degradation and oil color
		g) Check for sufficient quantity of coolant.	⇒ Check through main tank
6.	Operation panel and control panel	a) Check that alarm is not displayed on the screen. (Battery alarm, etc.)	⇒ Visually check it to determine the cause for corrective action.
		b) Check that cooling fan is running.	⇒ Visually check it to determine the cause for corrective action.

	Checking part	Check item	Details of checks
7.	Chuck/cylinder (Turning machine)	a) Check that chuck is filled with sufficient grease. (Once a day)	⇒ Check that specified grease is filled.
		b) Check that chuck pressure can be regulated smoothly.	⇒ Check pressure regulation for each workpiece change.
		c) Check that coolant recovery port at the rear of chuck cylinder is cleaned and that chips are removed.	⇒ Clean as necessary.
		d) Check master jaw for actuation.	⇒ Check actuation by foot switch operation.
		e) Check that running-in is performed.	⇒ Perform running-in by low rpm of about 10% of the model's maximum rpm for 30 minutes before starting work.
8.	Spindle head	a) Check for abnormal noise. (M/C, NCL)	⇒ Check for abnormal noise during spindle running
9.	Feed unit	a) Check for abnormal noise.	⇒ Check for abnormal noise when operating feed unit
10.	Tool post unit	a) Check for coolant discharge.	⇒ Visual check
		b) Check that tool pots and tapered portion of QCT, KV and KM are cleaned.	⇒ Check for removal of dust, fouling and foreign matter such as chips (Wipe with a clean cloth.)
		c) Check tool layout for imbalance.	⇒ Check that tools are placed in balance and that turret turns smoothly.
		d) Check that chips on the turret swiveling portion are removed.	⇒ Check that foregin matter including chips on the turret swiveling portion and its vicinity are removed.
11.	Chip conveyor	a) Check for obstructions on the conveyor.	⇒ Check for removal of obstructions such as workpiece, tool and square bar
		b) Check the quantity of chips in the chip box and that of coolant.	⇒ Check the quantity of chips and that of coolant, and dispose of them as necessary.
		c) Check that a large quantity of chips collect on the chip conveyor. (Inclusive of screw conveyor)	⇒ Prevent a large quantity of chips from collecting on the conveyor. Check that conveyor operates to discharge chips.
		d) Check for abnormal noise.	⇒ Check for abnormal noise when operating chip conveyor
12.	Covers	a) Check that covers are not detached.	⇒ Check that covers are not detached. If any cover is detached, attach it.
		b) Check that window is cleaned.	⇒ Check for cleaning
		c) Check that nameplate and caution plate are cleaned.	⇒ Check for cleaning
13.	Interlocking device	a) Check door interlocking function.	⇒ Check that spindle does not run when opening door.

	Checking part	Check item	Details of checks
14.	Mist collector	a) Check that mist does not remain in the hose.	⇒ Visual check Provide angular hose route.
		b) Check that filter is thoroughly cleaned.	⇒ Checks for clogging and cleaning
		c) Check that oil is properly drained.	⇒ Visual check for proper oil drainage
		d) Check mist for leakage.	⇒ Visual check

2-2 Periodic Check Items

Periodic checks by maintenance personnel are essential for assuring continued machine accuracy. Perform maintenance at regular intervals according to the following periodic check list.

Periodic check list

	Checking part	Check item	Checking interval(Month)				Details of checks
			1	3	6	12	
1.	Hydraulic unit	a) Check piping for faults.			O		⇒ Check for oil leakage, and tighten connector securely if necessary.
		b) Change hydraulic fluid.			O		⇒ Clean the inside of tank and strainer, and change hydraulic fluid as necessary.
		c) Check that strainer is thoroughly cleaned.			O		⇒ Checks for clogging and cleaning (Shorten checking intervals depending on working environment.)
		d) Check oil for discoloration (fouling).			O		⇒ Check oil color with oil gage. When color is getting brown, change oil.
2.	Main cooling unit	a) Check piping for faults.			O		⇒ Check for oil leakage, and tighten connector securely if necessary.
		b) Change hydraulic fluid.			O		⇒ Clean the inside of tank and strainer, and change hydraulic fluid as necessary.
3.	Pneumatic unit	a) Check piping for faults.			O		⇒ Check for oil leakage, and tighten connector securely if necessary.
		b) Check that filter is thoroughly cleaned.			O		⇒ Checks for clogging and cleaning (Shorten checking intervals depending on working environment.)
4.	Coolant unit	a) Check for conspicuously dirty coolant unit.	O				⇒ Refer to Coolant section in the instruction manual. (NCL)
		b) Check for foul smell.	O				
		c) Check piping for faults.			O		⇒ Check for oil leakage, and tighten connector securely if necessary.
5.	High-pressure coolant	a) Check piping for faults.			O		⇒ Check for oil leakage, and tighten connector securely if necessary.
		b) Check that filter is thoroughly cleaned.	O				⇒ Checks for clogging and cleaning
		c) Check high-pressure pump for sufficient quantity of oil.	O				⇒ Oil level (cap oil filling) check and replenishment
		d) Check for high-pressure pump oil fouling.	O				⇒ Checks for oil degradation and oil color

	Checking part	Check item	Checking interval(Month) 1	3	6	12	Details of checks
5.	High-pressure coolant	e) Check high-pressure pump suction and discharge valves for damage or wear.				O	⇒ Replace if damage or wear is found.
		f) Check for damaged or dirty high-pressure pump diaphragm.				O	⇒ Replace or clean if necessary.
		g) Check gas charging pressure of accumulator.				O	⇒ Recharge if charging pressure is dropped. (Charging pressure:4.9Mpa)
6.	Operation panel and control panel	a) Check for conspicuously dirty operation panel and control panel. (Cleaning)			O		⇒ Visual check and cleaning
		b) Check for foreign matter in the control panel.			O		⇒ Removal of foreign matter
		c) Check that air filter is thoroughly cleaned.			O		⇒ Checks for clogging and cleaning (Shorten checking intervals depending on working environment.)
		d) Check that cooling fan is cleaned.	O				⇒ Check for dirty cooling fan
		e) Check power supply and voltage.			O		⇒ Check that secondary voltage of main breaker is set within ±10% of the specified value.
7.	Feed unit	a) Check ball screw and guide for lubrication (oil and grease).			O		⇒ Visually check oil film.
8.	Chip conveyor	a) Check that chip conveyor is oiled.			O		⇒ Apply grease to sprocket area as necessary.
9.	Belt,Timing belt(Tool post, and X axes,)	a) Check belt for deflection.			O		⇒ Check deflection amount with tension meter. (Normal value:3.5 mm/kg)
		b) Check surface for damage and heights for deterioration.			O		⇒ Visual checks and degreasing
10.	Level	a) Check the level of bed and table with level vial.		O			⇒ Level check and adjustment with level vial
11.	LS and SOL	a) Check that LS and SOL are not moistened with oil.		O			⇒ Determine the cause to take corrective action.
		b) Check for oil fouling.		O			⇒ Cleaning

	Checking part	Check item	Checking interval(Month)				Details of checks
			1	3	6	12	
12.	Cover	a) Check mounting bolts for looseness.		O			⇒ Check cover clamping bolts for tightness, and tighten securely if necessary.
13.	Wiper and brush	a) Check wiper and brush for deterioration and damage.		O			⇒ Visual checks
		b) Check for jamming of chips and foreign matter.		O			⇒ Visual checks
14.	Interlocking device	a) Check spindle speed limiting interlocking function.			O		⇒ Check spindle speed limiting interlocking set value (parameter) when using special chuck and jig.
15.	Cable	a) Check for damaged appearance (tears, crushes, stripped conductor, etc.).	O				⇒ Visual checks Replace if there is something wrong.
		b) Check connector for looseness.	O				⇒ Visual check Tighten securely if necessary.
		c) Check for caught cable.	O				⇒ Visual check Return to normal. Appearance check Replace if there is something wrong.
		d) Check that cable is not moistened.	O				⇒ Visual check and cleaning Determine the cause.
16.	OT (Over-travel)	a) Check LS for actuation.	O				⇒ Operate the machine to check function.
17.	Earth leakage breaker	a) Check breaker for operation.		O			⇒ Press test button to check breaker for operation.

3-1 Adjusting Method of X and Z Axes Backlash

Procedure 1   How to cancel the compensation amount previously entered

To cancel the compensation amount entered before measuring backlash

1) Put the machine to a stop status. (This setting irrelevant to the machine status.)

2) Change the parameter according to the parameter setting method under "OPERATION MANUAL", Item 16.

3) Call up the backlash parameter 1851 and make the X and Z axes value 0.

4) Turned OFF, Turned ON again

Procedure 1   Measuring the backlash amount

1) Put the dial indicator contact to the check from the turret side.

2) Measure a backlash amount with a X-axis and Z-axis handle in the order of (a) through (c).

（a）

Dial indicator
(0.002mm Per graduation)
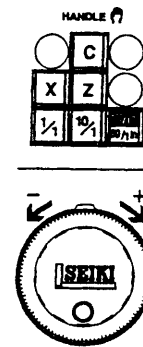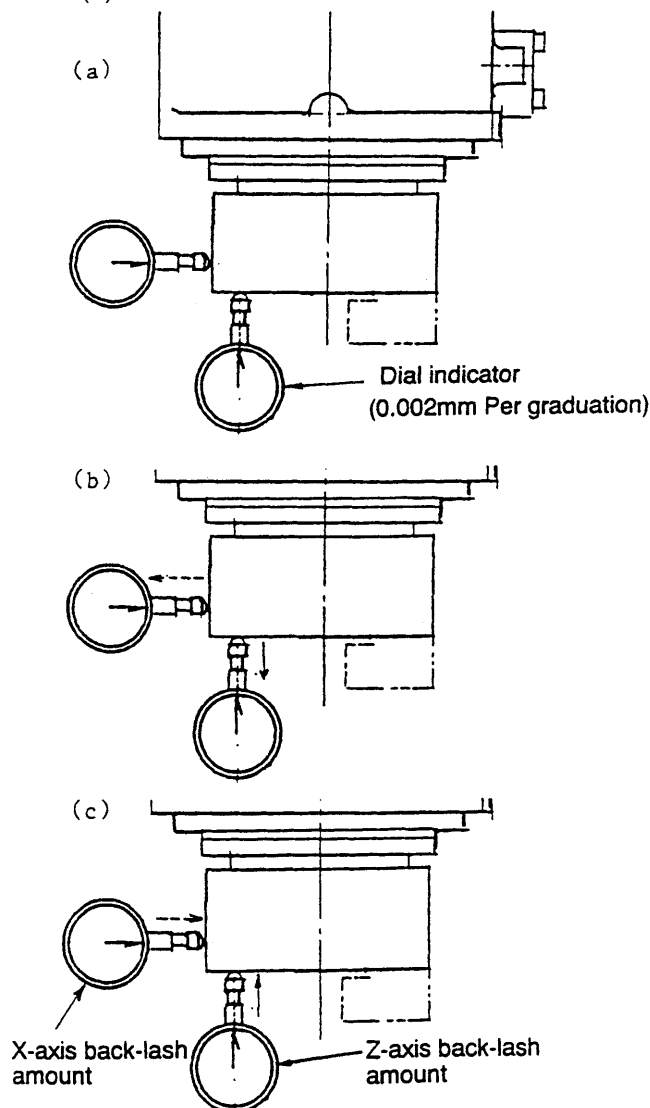
Turn the handle counterclockwise and set the handle and indicator to 0.

Turn the handle further counter-clockwise by another 20~30 graduations.

（b）

（c）

X-axis back-lash amount

Z-axis back-lash amount
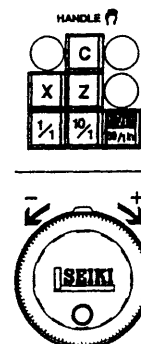
Turn the handle clockwise until a pointer points to 0. At this time, the difference of the indicator represents the backlash amount.

Procedure 3   Setting of backlash amount

1) According to the parameter setting method under "OPERATION MANUAL", call up the backlash parameter 1851 and set the compensation amounts of X and Z axes.

$$\text{X-axis compensation amount} = \frac{\text{Backlash amount}}{\text{Compensation unit}} = \frac{0.012}{0.0005} = 24$$

$$\text{Z-axis compensation amount} = \frac{\text{Backlash amount}}{\text{Compensation unit}} = \frac{0.015}{0.001} = 15$$

2) Switch OFF the source power once, they switch ON again.

Procedure 4   Confirmation of backlash amount

1) Confirm that the setting values are correct, according to Procedure 2.

NO	PART NUMBER	PART NAME	Q'ty	MAKER
17	BLOCKING BLOCK		1	Shonan
16	19001-68-001-00	Manifold	1	Shonan
15	9001-68-002-00	Manifold	1	Shonan
14	OPG-DF-T-R1/4-6´7^{MPA}	Pressure Gauge	1	ASK
13	SL-G01-E3X-GR-C	Solenoid Valve	1	Fujikoshi
12	ETB69-1.8	Orifice	1	Shonan
11	SL-G01-E3X-GR-C1-11	Solenoid Valve	1	Fujikoshi
10	OCP-G01-B1-20	Pilot Check Valve	1	Fujikoshi
9	OG-G01-PC-K-5871A	Reducing Module	1	Shonan
8	CT-T03-0-4044A	Check Valve	1	Fujikoshi
7	VDS-0B-1A2-1249K	Variable Pump	1	Fujikoshi
6	OPG-AT-R1/4-60´7MP-G	Pressure Gauge	1	ASK
5	C-30-4043A	Oiling Hole	1	Fujikoshi
4	KD-0A (N)	Oil Level Indicator	1	Kyowa
3	VBBA-0A4A04-1156A	Electric Motor w/ Cooler	1	Meidensha
2	MSN-03-150	Strainer	1	Masuda
1	TNK-10L-H	Oil Tank	1	Fujikoshi

SOL27A (SOL a)

SOL27B (SOL b)

LS27B

UN CLAMP   CLAMP

SOL19A (SOL a)

SOL19B (SOL b)

For Ø120

LS19A LS19B

CLOSE   OPEN

3/8

P
T

Green mark 34 ~ 36K/c

0.4KW×4P

M

10ℓ

Rc3/8 (P)   Rc3/4 (D)   Rc3/8 (D)   Rc3/8 (T)

Inside tubing not allowed

3-3 Hydraulic Chuck

This chuck is hydraulically opened and closed. With this chuck employed, a work piece setup time can be reduced, manpower can be also saved and the workpiece can be powerfully and equally gripped.

Specifications

    Hydraulic chuck diameter   : ϕ210 (8")
    Hydraulic tank unit   : Commonly used for the machine proper

Operation

1. Select a chuck gripping direction by using the WORK GRIP INT/EXT Selector switch located on the main operation panel.

2. Open and close the jaw by the chuck open/close switch on the main operating board.

3. Adjusting the chuck pressure

   Adjust pressure of the hydraulic chuck by the dial on the manifold section at the left end of the machine.

   - Turning the knob clockwise (direction of INC) increases the pressure.
   - Turning the knob counterclockwise (direction of DEC) decreases the pressure.
   - Adjust the chuck pressure within a range of a pressure gauge.

pressure gauge
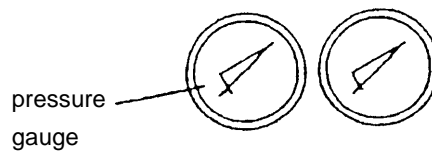
Note *1) Due to an interlocking mechanism, the chuck cannot be opened or closed while the spindle is rotating.*

2) While the spindle is stopped, the chuck is loosened immediately by operating the chuck open/close switch. Pay attention, therefore, even on other occasions than when a workpiece is loaded or unloaded, or when gripping direction of the chuck is changed.

3) When changing the gripping directions of the chuck, be sure to unload the workpiece from the chuck without fail.

Hydraulic Chuck and Cylinder

Solid-Chuck (made by KITAGAWA)

	Type
Hydraulic chuck	HG-715-210
Hydraulic cylinder	Y1230RE25

With cylinder mounting adapter

Measuring
Instrument

[A]
[B]

[D]
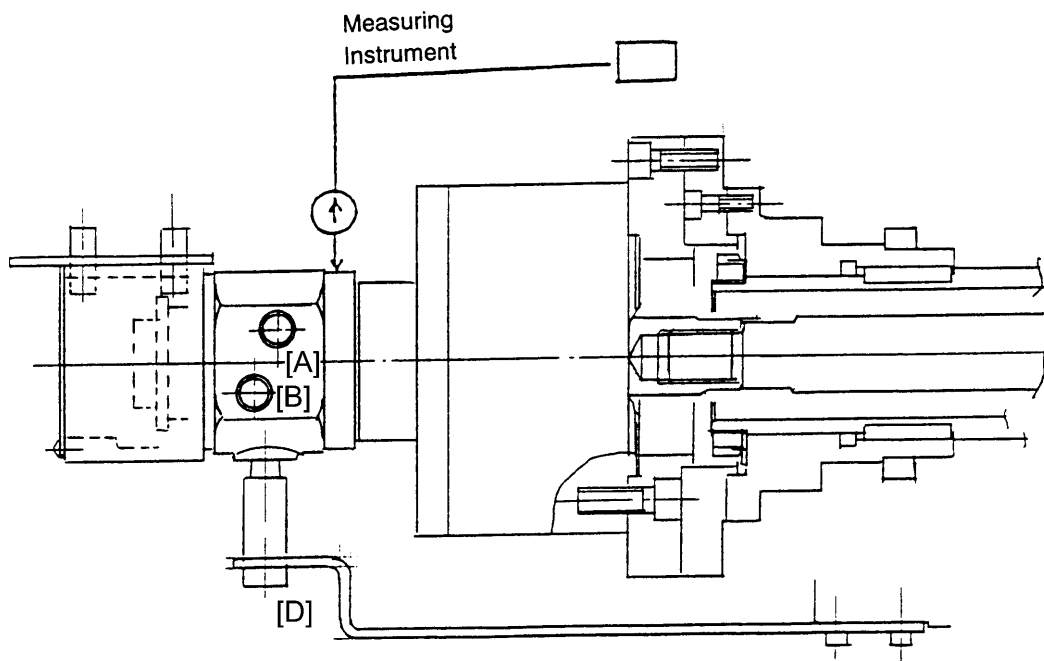
Mounting of Hydraulic Cylinder

1. Mount the hydraulic cylinder to the adapter of the spindle with M12 bolt.

2. Set a measuring instrument to the rear of the cylinder. With the rear of the cylinder fixed, rotate the spindle (about 30min^{-1}) and check the runout of the cylinder.

   Note 1) Fix a part to which the measuring instrument is set.

3. Adjust the runout of the cylinder within 0.02 mm and tighten each bolt.

4. Provide piping to [A] , [B] and [D].

3 - 6
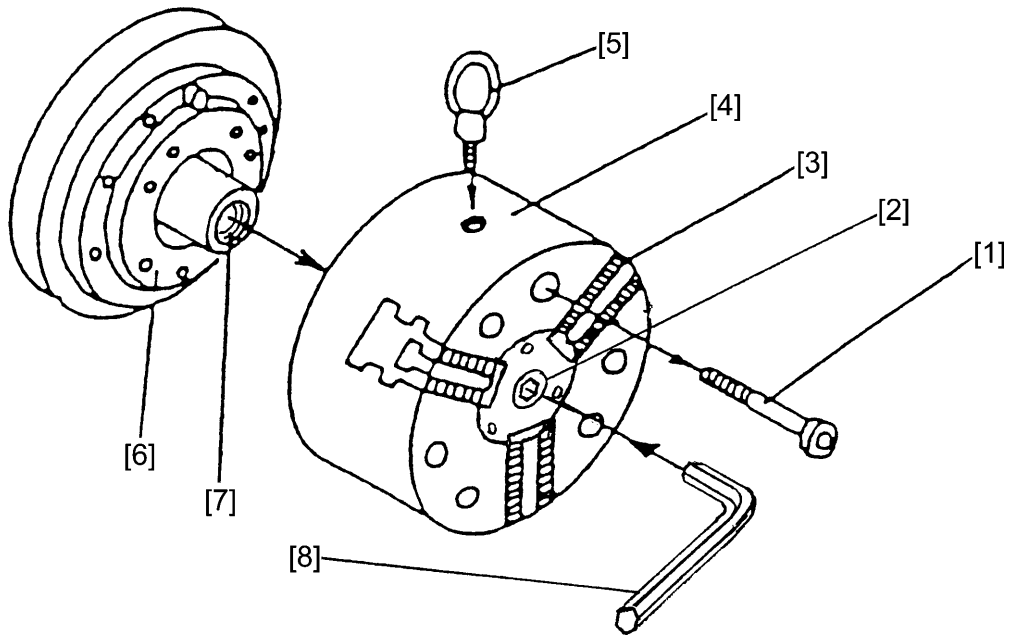
1	Bolt
2	Connecting bolt
3	Master jaw
4	Chuck body
5	Eye bolt
6	Spindle
7	Draw rod
8	Wrench

1. Procedures for removing the chuck body

   1) Turn off the power in the status of chuck closing.

   2) Screw in eye bolt [5] and pull up the chuck [4] naturally with wire.

   3) Loosen the bolt [2] connecting the draw-rod [7] by turning counter-clockwise with the attached wrench [8].

   4) Loosen the bolts [1] and remove the chuck body [4].

2. Procedures for installing the chuck body

1) Set pressure of the hydraulic chuck to 0.5MPa {5kgf/cm}, and put forward the draw rod by the chuck open/close button.

2) Thrust the wrench [8] into the bolt [1], and turn it right softly until it isn't turned.

3) Mount the chuck [4] on the spindle.

4) As the draw rod is at the forwarding end, loosen the bolt [1] by left turn until the shifter inside the chuck touches slightly the inside of the chuck front cover.

From this status, thrust it by a quarter right turn for final adjustment.

(Clearance between the shifter and the front cover shall be about 0.6mm.)

Note 1) *Use attached parts of the machine for the bolts to mount the chuck and jaws.*

2) *When preparation of these bolts newly, prepare the bolts with the following material or equivalent.*

- *Chrome-molybdenum steel*
<SCM435H>

Tensile strength: 115 ~ 140Kgf/cm^2

Hardness after heat treatment: HRC34 ~ 44

Thread class: 2nd class

- *Keep strictly a protruded length L1 and L2 of mounting bolts.*
3) *Regarding a bolt to mount the collect chuck and other fixture requires above item 1) and 2) as well.*
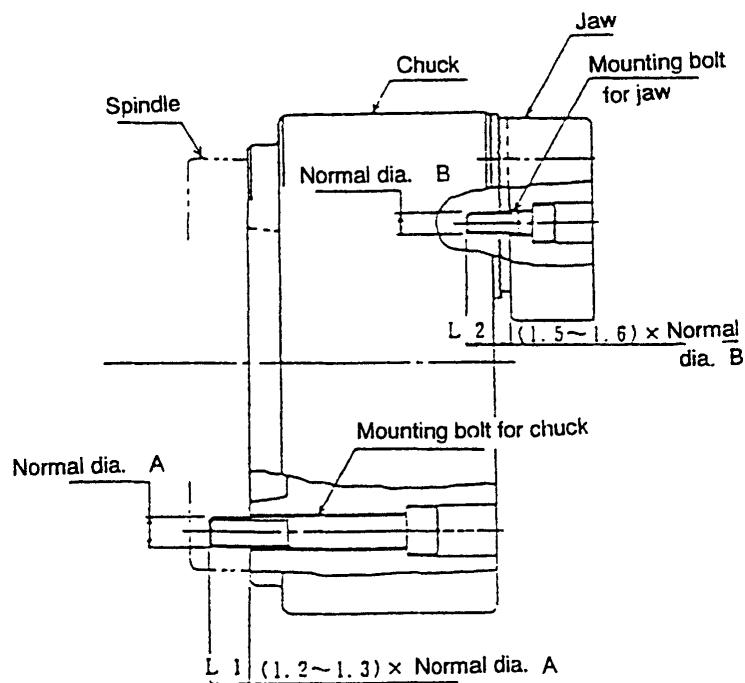
3-4 Layout of Electric Apparatus and Pneumatic Circuit Diagram
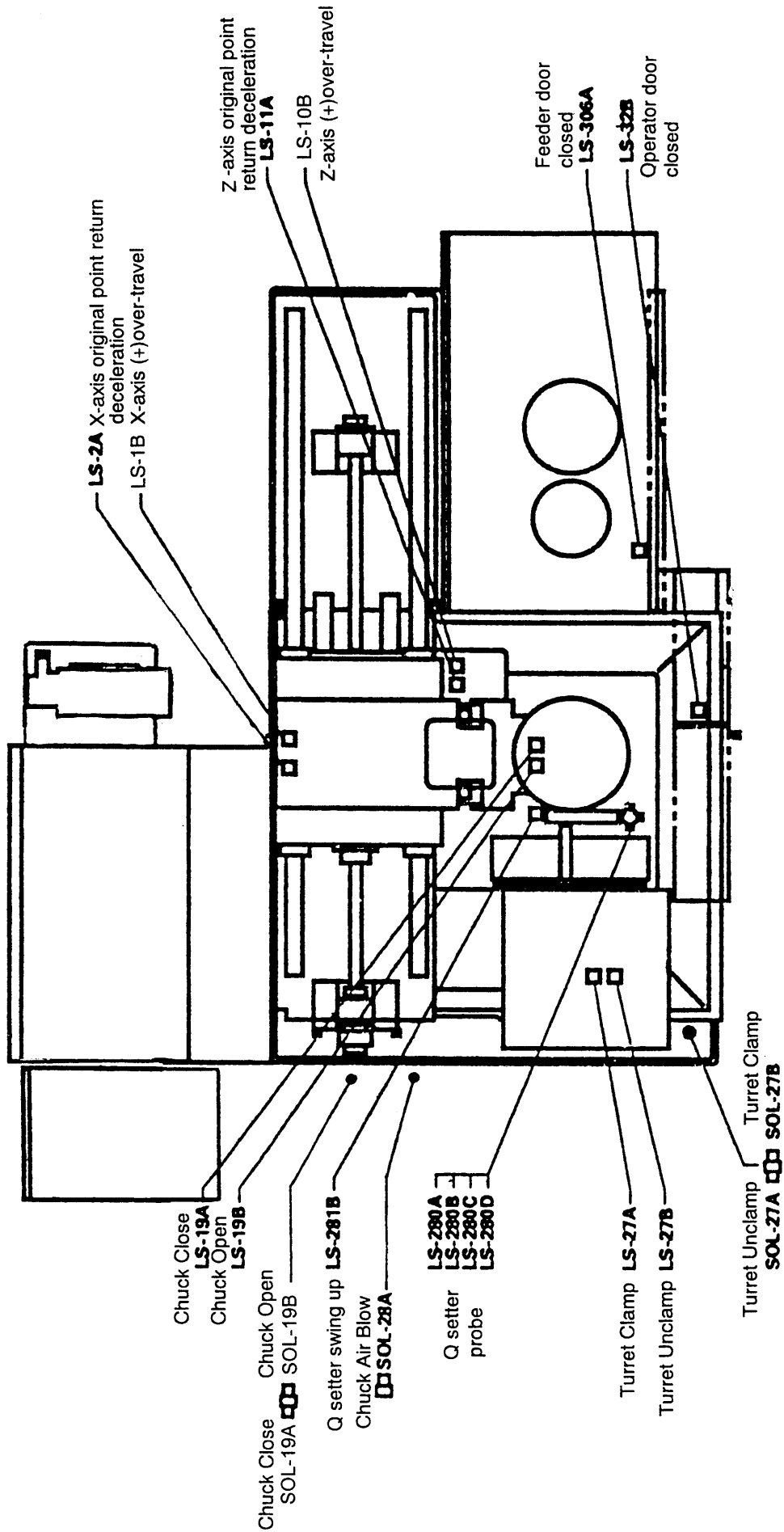
Turn equipment

180°Turn   Arm up/down   Air blow

LS898A (Turn to 180°)
LS898B (Turn to 0°)
RC1/4
φ8
VZ5420-1GS-01 A B RC1/8
SOL898A
SOL898B
ASN2-01-S

LS899B
LS899A
RC1/8
LS901
φ8
VZ5420-1GS-01 A B RC1/8
SOL899A
SOL899B
ASN2-01-S

VXD2130-02-1DS-B
SOL900
RC1/4

From the machine

LS List
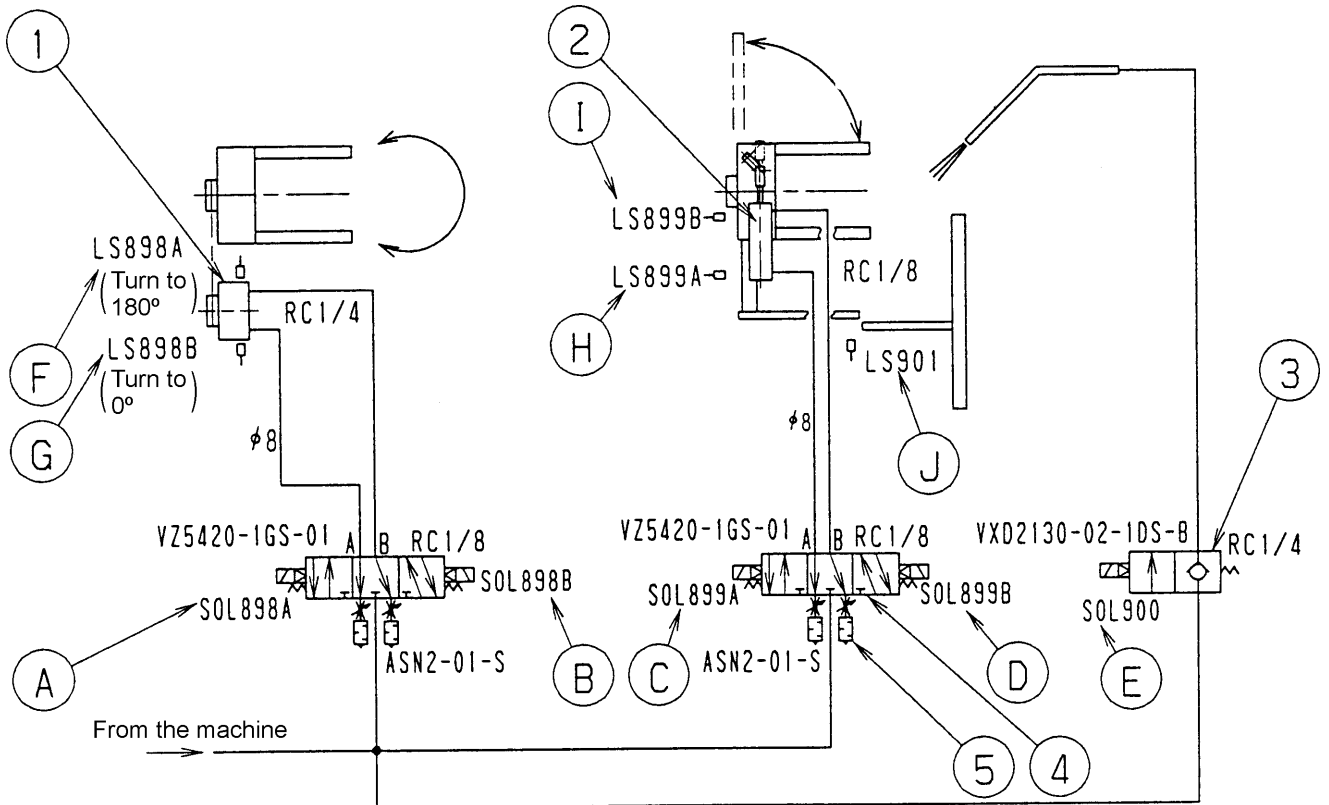
Sin	LS symbol	Use	Q'ty	Maker	Remarks
J	LS901	Over thrust detection	1	METROL	BP101
I	LS899B	Arm up	1	CKD	
H	LS899A	Arm down	1	CKD	
G	LS898B	Turn to 0°	1	SMC	
F	LS898A	Turn to 180°	1	SMC	

SOL List

Sin	SOL symbol	Use	Maker
E	SOL900	Air blow	SMC
D	SOL899B	Arm up	SMC
C	SOL899A	Arm down	SMC
B	SOL898B	Turn to 0°	SMC
A	SOL898A	Turn to 180°	SMC

Pneumatic unit List

No.	Part number	Use	Q'ty	Maker
5	ASN2-01-S	Flow valve	4	SMC
4	VZ5-ASK420-1GS-01	Elect magnetic valve	2	SMC
3	VXD2130-02-1DS-B	Elect magnetic valve	1	SMC
2	CMK2-C-TB-40-75-R05-DYB2	Cylinder	1	CKD
1	CORA1BW80-180C-A57	Rotary cylinder	1	SMC

3-5 Restoration of NC Torque Limiter

1. Explanation of function

This function is to detect the torque load on the feed axis and, if the detected torque is abnormally larger than the value set by the parameter, to exert an emergency stop of the spindle based on the judgement that there is an interference

2. Alarm

Alarm No.   1036   NC torque limiter alarm

    F409   Servo alarm: (X, Z axes) Axis abnormal load

3. Method of restoration

The alarm status is normally restored by switching OFF the NC source power.

3-6 Returning Method from face declination of turret index

This manual describes the procedures when a following alarm occurred by shut off the power or by collision, etc. while indexing.

Alarm 1020 The turret face number set up is defective.

[Procedure]

(1) NC power [ON].

(2) Make operation preparation [ON] (hydraulic ON).

(3) Press [EMERGENCY STOP] button.

(4) Every time you press the sheet key spindle [STOP] button and the [TAPE] button simultaneously, clamping and unclamping of the turret are repeated alternately. Under the clamping condition, [TURRET INDEX] button lamp is turned off.

(5) While putting the turret under unclamping condition, turn the turret by hand and make indexing face No.1 face (align the marking-off line of the turret neck section with the line for the outer circumference phase marking.)

(6) Put the turret in clamping condition, and confirm that the turret index button lamp is turned off.

(7) Reset [EMERGENCY STOP].

(8) Make operation preparation [ON]

(9) Press following three buttons simultaneously (No.1 face set) [SPINDLE STOP] + [EFFECTIVE] + [PAUSE]

　　　　　for dry running and program checking

  "Alarm 1020 The turret face number set up is defective." disappeared.

(10) Perform turret indexing by MDI, and confirm that NC command and indexing face conform.

3-7 Alarm Diagnosis

This screen display is used for trouble shooting and taking counter-measures when various alarms occur.

3-7-1 When the Warning Lamp (Call Light) Lights ON.

The call light becomes ON, in either of the following cases.

1) When the machine comes to a stop (suspension) status, by program stop or program suspension code (M00, M01, M02, M30, etc.) during executing a program.

2) When an alarm status occurs and the alarm lamp (red) on the operating panel lights ON.

   When the alarm lamp becomes ON, the machine is brought into the status of "Operation stop", which indicates that some trouble has occurred with the machine.

3-7-2 Alarm Display

1) Pressing the

$\boxed{\text{OPER/MAINTE}}$ key on the general screen, maintenance relevant function keys are listed up on the display.

```
                                                          O5000
MAIN (JOG)                                                N0004
O5000;                                                    X
(TL01/03 TL02/28 TL06/482) ;
N01 G50 S4000 ;
N02 G28 U0 ;                                              └─
N03 G28 W0 ;
N04 M01 ;
:
N100 ;
G30 U0 W0 M40 ;

Tool T 0 1 0 0      ( )(     )      ABSOLUTE        G    G00   G18
OFST X      100.000       Turn S  800  X      19.781   G98  G40  G80
     Z      300.000                    Z  16777.216    G198 G97  G
                          min. F   0.0                 M03  M08  M
NOSE R         0.000                                   M    M    M
WID. H         0.000      TOOLS 5000                   M    M    M
POINT T   0                            DIST TO GO
     (%) 0        50         100       X       0.000   SET END    0:00:00
S   123                                Z       0.000   CYCLE     10:35:43
X     2                                               RAP T     180:29:38
              ALARM  SYSTEM                       MAINTENA DISPLAY
         /1   /2 DIAG. /3     /4   /5      /6     /7 NCE  /8 CLEAR/9      /0
```

2) Pressing the $\boxed{\text{F3/ALARM DIAG.}}$ key, the alarm diagnosis screen is obtained and the alarm contents are displayed. Press the item which is to be processed.

3) Also, when an alarm is issued, the screen changed to the alarm screen and the contents are displayed with alarm relevant function keys.

```
                                                          O5000
ALARM  DIAG.                                              N
                              CNC  ALARM


                              PMC  ALARM




              REPAIR  ALARM
         /1   /2 ADJUST/3 HIST. /4   /5      /6     /7    /8      /9      /0
```

[1] NC unit relevant alarm (CNC Alarm)

The alarm No. and alarm message are displayed on the screen.

Check the alarm cause by referring to the list of NC alarm message and remove the cause of the trouble.

[2] Alarm relevant to machine equipment and PC control (PMC Alarm)

The alarm No. and alarm message are displayed on the screen.

Check the alarm cause by referring to the list of PC alarm message and remove the cause of the trouble.

3-7-3 Display of Switch Status

1) After getting the alarm diagnosis screen by pressing the | F3/ALARM DIAG. | key, press the
| F2/SWITCH STATUS DISPLAY | key, then the status of each switch is displayed on the screen.

2) On the switch status display screen, press the | F2/ARRANGEMENT DIAGRAM | key, then the ON/OFF status of each switch is shown on the diagram. Those marked with   indicate ON status and those without   mark indicate OFF.

3) On the switch status display screen, press the | F3/LIST | key, then a list of each switch ON/OFF status. Use the page key to scroll the page, as the list extends over plural pages.

4. REFERENCE MATERIALS FOR MENTENANCE AND ADJUSTMENT

4-1 Servo Unit

4-1-1 Alarm Concerning Power Supply Unit (Source Power of Spindle/Servo Amplifier)

When an alarm is generated, the alarm LED (red) lights up on the status display and the alarm code is indicated in two figures on the 7-segment LED.

STATUS

PIL

ALM   01

↑   Alarm code is displayed. (01~)

Alarm LED (red) lights up.
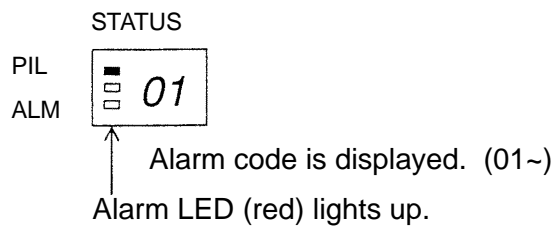
1) Alarm code 01

* Contents

The main circuit power module (IPM) detected abnormality. (PSM-5.5, -11)

Excessive current flowed at the main circuit power input part. (PSM-15~-30)

* Cause and trouble-shooting

(a) IGBT (or IPM) is defective.
    ⇒Replace the IGBT (or IPM).

(b) Mismatch of AC reactor specification.
    ⇒Confirm the PSM and AC reactor.

2) Alarm code 02

* Contents

The cooling fan of the controlling circuit part stopped.

* Cause and trouble-shooting

The cooling fan is out of order.

Confirm the condition of the cooling fan rotation.
    ⇒Replace the cooling fan.

3) Alarm code 03

* Contents

The temperature of the main circuit radiator went up abnormally.

- Cause and trouble-shooting

  (a) The cooling fan is out of order.

    Confirm the condition of the cooling fan rotation.
    ⇒Replace the cooling fan.

  (b) Dust contamination

    ⇒Clean up the cooling system by factory air blower or by vacuum cleaner.

  (c) Overload overation

    ⇒Re-examine the operating conditions.

4) Alarm code 04

- Contents

  The voltage at the main circuit DC part (DC link) came down.

- Cause and trouble-shooting

  (a) Instantaneous power down was generated.

    Confirm the source power.
    ⇒Replace the cooling fan.

  (b) Voltage down of input source power.

    Confirm the source power specification.

  (c) This trouble could occur, when the main circuit source power is cut off while the emergency stop is released.

5) Alarm code 05

- Contents

  Power charge to the main circuit was not made within the specified time.

- Cause and trouble-shooting

  (a) The number of SVM, SPM connecting units is in excess.
    ⇒Confirm the PSM specification.

  (b) DC link is in short-circuit.
    ⇒Confirm the connection.

  (c) Charging current restricting resistance is defective.
    ⇒Replace the distribution board.

6) Alarm code 06

- Contents

  Input source power is abnormal. (Phase defect)

- Cause and trouble-shooting

  (a) Input source power phase is lacking.

    Confirm the connection.

7) Alarm code 07

- Contents

  The voltage at the main circuit DC part (DC link) became abnormally high.

- Cause and trouble-shooting

  (a) Excessive regenerating power.

  Regeneration is not possible. PSM capacity is insufficient.
  ⇒Confirm the PSM specification.

  (b) Impedance on the AC source power side is high.
  ⇒Clean up the cooling system by factory air blower or by vacuum cleaner.

  (c) Regenerating circuit is abnormal.

  Check the terminal and confirm the voltage at IR, IS is normal.
  ⇒Replace the distribution board and/or controlling PCB.

  (d) IGBT (or IPM) is defective.
  ⇒Replace IGBT (or IPM).

4-1-2 Spindle Amplifier Status Display

Item	Status Display Light ON — Light OFF LED lit on is indicated by ▬	Contents
1.	PIL ☐ ALM ☐ ERR ☐	Source power ON indicating LED "PIL" is OFF. Controlling source power is not yet thrown in. Source power circuit is defective. Refer to item 4.3.2.
2. ↓ 3.	PIL ▬ ALM ☐ *00* ERR ☐	The last two digits of the ROM series is displayed for about 1.0 second after control source power ON. Example) "00": ROM Series 9D00
	PIL ▬ ALM ☐ *04* ERR ☐	ROM Version display for about 1.0 second. 01, 02, 03, • • • correspond A, B, C, • • • Example) "04": ROM Version No. D
4.	PIL ▬ ALM ☐ -- ERR ☐	Blinking CNC source power is not yet thrown in. Waiting serial communication and completion of parameter loading.
5.	PIL ▬ ALM ☐ -- ERR ☐	Parameter loading is completed. The motor is not excited.
6.	PIL ▬ ALM ☐ *00* ERR ☐	The motor is excited.
7.	PIL ▬ ALM ▬ *01* ERR ☐ Alarm code display 01~	Alarm status SPM is not operable condition. Refer to item II. 3.3.
8.	PIL ▬ ALM ☐ *01* ERR ▬ Alarm code display 01~	Error status Wrong parameter setting. Sequence is not proper. Refer to parameter setting manual.

4-1-3 Spindle Amplifier Alarm

When the "ERR" LED on the indicating window of the spindle amplifier lights up, the number indicated next right to the LED reading "ER-**" will tell the alarm contents. In the same way, when the "ALM" LED lights on, "AL-**" tells the alarm contents. List of alarm codes are given in the following.

> **NOTE**
>
> Er-xx is not displayed on CRT.

Message	Contents	Countermeasure
Er-01	*Although EPS (there are 2 types: connection signal and PMC→CNC) and MRDY (machine ready signal) are not input, SFR/SRV is input. However, regarding MRDY, pay attention to the setting of use/not use spindle parameter MRDY.	*Confirm the sequence of EPS and MRDY.
Er-02	If spindle motor is not integrated with spindle in system with high-resolution magnetic pulse coder, speed detector of spindle motor is set to 128 p/rev. Attempt to excite motor fails if value other than 128 p/rev is set.	Set the spindle motor speed detector parameter to 128 p/rev.
Er-03	Parameter for high-resolution magnetic pulse coder is not set, but Cs contouring control commands is entered. In this case, motor is not excited.	Check parameter setting for high-resolution magnetic pulse coder.
Er-04	Although parameter setting for using position coder was not performed, commands for servo mode and synchronous control are input. In this case, the motor will not be excited.	Confirm the parameter setting of the position coder.
Er-05	Although option parameter for orientation is not set, the orientation command (ORCM) is input.	Confirm the parameter setting of orientation.
Er-06	Although option parameter for output switchover is not set, LOW winding is selected.	Confirm the parameter setting for output switching and power line status signal.
Er-07	Although Cs contouring control command was entered, SFR/SRV is not entered.	Confirm the sequence.
Er-08	Although servo mode control command was input, SFR/SRV is not input.	Confirm the sequence.
Er-09	Although synchronous control command was input, SFR/SRV is not input.	Confirm the sequence.
Er-10	Cs control command was entered, but another mode (servo mode, synchronous control, orientation) is specified.	Never set another mode when Cs contouring control command is being processed. Before changing to another mode, clear Cs contouring control command.
Er-11	Servo mode command was entered, but another mode (Cs contouring control, synchronous control, orientation) is specified.	Do not command other modes during servo mode command. When moving to other modes, perform after releasing the servo mode command.
Er-12	Synchronous control command was entered, but another mode (Cs contouring control, servo mode, orientation) is specified.	Do not command other mode during synchronous control command. When moving to other modes, perform after releasing the synchronous control command.
Er-13	Orientation command was entered, but another mode (Cs contouring control, servo mode, synchronous control) is specified.	Do not command other modes during orientation command. When moving to other modes, perform after releasing the orientation command.
Er-14	SFR/SRV are simultaneously commanded.	Command one or the other.
Er-15	Cs contouring control command is entered when differential speed control function is enabled by parameter setting (No. 6500#5=1).	Check parameter setting and control input signal.

Message	Contents	Countermeasure
Er-16	Differential mode command (DEFMDA) is entered when differential speed function is disabled by parameter setting (No. 6500#5=1).	Check parameter setting and control input signal.
Er-17	Parameter setting (No. 6511#0, 1, 2) for speed detector is incorrect. (Specified speed detector is not present.)	Check parameter setting.
Er-18	Spindle orientation command of position coder type is entered when use of position code signal is disabled by parameter setting (No. 6501#2=0).	Check parameter setting and control input signal.
Er-19	Although the command for orienting the magnetic sensor system was entered, another mode was issued.	Do not issue another mode while the orientation command is executed. Before issuing another mode, cancel the orientation command.
Er-20	Both the slave mode and the high-resolution magnetic pulse coder were enabled.	These two settings are incompatible. Check the parameter settings.
Er-21	The slave mode command (SLV=1) was entered under position control (servo mode, orientation, etc.).	Enter the salve mode command in the normal operation mode.
Er-22	The position control command (servo mode, orientation, etc.) was entered in the slave operation mode (SLV=1).	Enter the position control command in the normal operation mode.
Er-23	A slave mode command was entered when the slave mode is disabled.	Enable the slave mode.
Er-24	To perform continuous indexing in the mode for orienting the position coder system, incremental operation (INCMD=1) was first performed, then the absolute position command (INCMD=0) was entered.	Check the control input signal (INCMD). To execute the absolute position command continuously, be sure to perform orientation with the absolute position command first.
Contact signal of *ESP	Between ESP1 and ESP2 of spindle control printed circuit board	Contact is open : emergency stop Contact is close : normal operation

Alarm No.	Meanings	Description	Remedy
AL-01	Motor overheat	Detects internal motor temperature: exceeding specified temperature.	Check load status. Cool motor, then reset alarm.
AL-02	Excessive speed deviation	Detects motor speed exceeding specified speed excessively.	Check load status. Reset alarm.
AL-03	DC link section fuse blown	Detects that fuse F4 in DC link section is blown (models 30S and 40S).	Check power transistors, and so forth. Replace fuse.
AL-04	Input fuse blown. Input power open phase.	Detects blown fuse (F1 to F3), open phase or momentary failure of power (models 30S and 40S).	Replace fuse. Check open phase and power supply regenerative circuit operation.
AL-05	Control power supply fuse blown	Detects that control power supply fuse AF2 or AF3 is blown (models 30S and 40S).	Check for control power supply short circuit. Replace fuse.
AL-07	Excessive speed	Detects that motor rotation has exceeded 115% of its rated speed.	Reset alarm.
AL-08	High input voltage	Detects that switch is set to 200 VAC when input voltage is 230 VAC or higher (models 30S and 40S).	Set switch to 230 VAC.
AL-09	Excessive load on main circuit section	Detects abnormal temperature rise of power transistor radiator.	Cool radiator, than reset alarm.
AL-10	Low input voltage	Detects drop in input power supply voltage.	Correct cause, then reset alarm.
AL-11	Overvoltage in DC link section	Detects abnormally high direct current power supply voltage in power circuit section.	Correct cause, then reset alarm.
AL-12	Overcurrent in DC link section	Detects flow of abnormally large current in direct current section of power circuit.	Correct cause, then rest alarm.
AL-13	CPU internal data memory abnormality	Detects abnormality in CPU internal data memory. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL-15	Spindle switch/output switch alarm	Detects incorrect switch sequence in spindle switch/output switch operation.	Check sequence.
AL-16	RAM abnormality	Detects abnormality in RAM for external data. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL-18	Program ROM sum check error	Detects program ROM data error. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL-19	Excessive U phase current detection circuit offset	Detects excessive U phase current detection circuit offset. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL-20	Excessive V phase current detection circuit offset	Detects excessive V phase current detection circuit offset. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL-24	Serial transfer data error	Detects serial transfer data error (such as NC power supply turned off, etc.)	Correct cause, then reset alarm.
AL-25	Serial data transfer stopped	Detects that serial data transfer has stopped.	Correct cause, then reset alarm.
AL-26	Disconnection of position detection signal for Cs contouring control	Detects abnormality in speed detection signal for Cs contouring control (such as unconnected cable and adjustment error).	Correct cause, then reset alarm.
AL-27	Position coder signal disconnection	Detects abnormality in position coder signal (such as unconnected cable and parameter setting error).	Correct cause, then reset alarm.

Alarm No.	Meanings	Description	Remedy
AL-28	Disconnection of position detection signal for Cs contouring control	Detects abnormality in position detection signal for Cs contouring control (such as unconnected cable and adjustment error).	Correct cause, then reset alarm.
AL-29	Short-time overload	Detects that overload has been continuously applied for some period of time (such as restraining motor shaft in positioning).	Correct cause, then reset alarm.
AL-30	Input circuit overcurrent	Detects overcurrent flowing in input circuit.	Correct cause, then reset alarm.
AL-31	Speed detection signal disconnection motor restraint alarm	Detects that motor cannot rotate at specified speed (but rotates at very slow speed or has stopped). (This includes checking of speed detection signal cable.)	Correct cause, then reset alarm.
AL-32	Abnormality in RAM internal to LSI for serial data transfer	Detects abnormality in RAM internal to LSI for serial data transfer. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL-33	Insufficient DC link section charging	Detects insufficient charging of direct current power supply voltage in power circuit section when magnetic contactor in amplifier is turned on (such as open phase and defective charging resistor).	Correct cause, then reset alarm.
AL-34	Parameter data setting beyond allowable range or values	Detects parameter data set beyond allowable range of values.	Set correct data.
AL-35	Excessive gear ratio data setting	Detects gear ratio data set beyond allowable range of values.	Set correct data.
AL-36	Error counter over flow	Detects error counter overflow.	Correct cause, then reset alarm.
AL-37	Speed detector parameter setting error	Detects incorrect setting of parameter for number of speed detection pulses.	Set correct data.
AL-39	Alarm for indicating failure in detecting 1-rotation signal for Cs contouring control	Detects 1-rotation signal detection failure in Cs contouring control.	Make signal adjustment. Check cable shield status.
AL-40	Alarm for indicating 1-rotation signal for Cs contouring control not detected	Detects that 1-rotation signal has not occurred in Cs contouring control.	Make 1-rotation signal adjustment.
AL-41	Alarm for indicating failure in detecting position coder 1-rotation signal.	Detects failure in detecting position coder 1-rotation signal.	Make signal adjustment for signal conversion circuit. Check cable shield status.
AL-42	Alarm for indicating position coder 1-rotation signal not detected	Detects that position coder 1-rotation signal has not occurred.	Make 1-rotation signal adjustment for signal conversion circuit.
AL-43	Alarm for indicating disconnection of position coder signal for differential speed mode	Detects that main spindle position coder signal used for differential speed mode is not connected yet (or is disconnected).	Check that main spindle position coder signal is connected to connector CN12.

Alarm No.	Meanings	Description	Remedy
AL-46	Alarm for indicating failure in detecting position coder 1-rotation signal in thread cutting operation.	Detects failure in detecting position coder 1-rotation signal in thread cutting operation.	Make 1-rotation signal adjustment for signal conversion circuit. Check cable shield status.
AL-47	Position coder signal abnormality	Detects incorrect position coder signal count operation.	Make signal adjustment for signal conversion circuit. Check cable shield status.
AL-48	Position coder 1-rotation signal abnormality	Detects that occurrence of position coder 1-rotation signal has stopped.	Make 1-rotation signal adjustment for signal conversion circuit.
AL-49	The converted differential speed is too high.	Detects that difference between a spindle speed and another spindle speed has exceeded allowable limit in differential speed mode.	Calculate differential speed by multiplying speed of other spindle by gear ratio. Check if calculated value is not greater than maximum speed of motor.
AL-50	Excessive speed command calculation value in spindle synchronization control	Detects that speed command calculation value exceeded allowable range in spindle synchronization control.	Calculate motor speed by multiplying specified spindle speed by gear ratio. Check if calculated value is not greater than maximum speed of motor.
AL-51	Undervoltage at DC link section	Detects that DC power supply voltage of power circuit has dropped (due to momentary power failure or loose contact of magnetic contactor).	Correct cause, than reset alarm.
AL-52	ITP signal abnormality I	Detects abnormality in synchronization signal (ITP signal) with CNC (such as loss of ITP signal).	Correct cause, than reset alarm.
AL-53	ITP signal abnormality II	Detects abnormality in synchronization signal (ITP signal) with CNC (such as loss of ITP signal).	Correct cause, than reset alarm.
AL-54	Overload current alarm	Detects that excessive current flowed in motor for long time.	Check if overload operation or frequent acceleration/deceleration is performed.
AL-55	Power line abnormality in spindle switching/output switching	Detects that switch request signal does not match power line status check signal.	Check operation of magnetic contractor for power line switching. Check if power line status check signal is processed normally.

4-1-4 Detail of Spindle Amplifier Alarm Contents

AL-01 **Motor overheat**

Item	Cause of trouble	Check procedure	Remedy
1	Defective fan motor of motor	Check if fan motor is rotating.	Replace fan motor.
2	Overload operation	Check cutting conditions and how tools are worn. Check load meter for cutting.	Review cutting conditions and tools.
3	Dirty motor cooling system	Check motor cooling system for dirt.	Clean motor cooling system with an air gun or vacuum cleaner.
4	Disconnection or loose contact of motor overheat signal line	Check signal line connection status.	Connect signal line correctly.

AL-02 **Excessive speed deviation**

Item	Cause of trouble	Check procedure	Remedy
1	Overload operation (overload)	Check with load meter.	Review cutting conditions and tools.
2	Defective transistor module	Check if transistor collector-emitter is open.	Replace transistor module.
3	Fuse for protecting drive on PCB blown or not inserted correctly (disconnection, loose contact, etc.)	Check if fuses F3A to F3M (models 1S to 26S) or FA to FG (models 30S and 40S) are blown or removed.	Insert fuse4s firmly. Replace any blown fuse.
4	Speed feedback signal abnormality	Check level of speed feedback signal.	Check motor speed detector and signal cable connection.
5	Wiring failure (disconnection, loose contact, etc.)	Check that cables are connected correctly.	

NOTE

How to check the speed feedback signal

Observe the speed feedback signal with an oscilloscope after turning on power and setting the rotation command off (motor stopped and drive power set off).

Observe the test points indicated below, while turning the motor slowly by hand.

Test point	Normal wave form
PA-0V	Vp–p=0.36–0.5V About 2.5V 0V
PB-0V	Same as above
RA-0V	DC2.5V±0.2V
RB-0V	Same as above
PAA-0V PBA-0V (CW rotation)	PAP ON OFF 0V PBP ON OFF 4.5V 0V 0.4V Check that the ON/OFF duty cycle is 50%. (The PAP and PBP signals are inverted in CCW direction.)

AL-03 **Blown fuse in DC link section**

This alarm indicates that the fuse (F4) in the DC link section is blown.

In this case, the transistor module may have failed.

AL-04 **Input fuse blown Input power open phase**

Item	Cause of trouble	Check procedure	Remedy
1	High impedance on AC power supply side. Example: Two transformers are connected in series, or variable autotransformer is connected.	Alarm No. 04 is on only at time of deceleration from high speed operation. Alarm No. 04 can be on when F1 to F3 are not blown.	Change power supply to one with low impedance.There may be loose connection of input power cable Example: Open phase due to screws not tightened firmly.
2	Defective transistor module		Replace transistor module and fuse.
3	Defective diode module or thyristor module	Disconnect diode modules DM1 to DM3 and thyristor modules SM1 to SM3, then check A-K connection with multimeter. (Defective modules are usually short-circuited.)	Replace defective part.Replace blown fuse.
4	Defective surge absorber or capacitor	Check surge absorbers Z1 to Z3 and capacitors C4 to C6.	Replace defective part.Replace blown fuse.
5	When input fuse is not blown	Check if Item 1 is applicable.	When Item 1 is not applicable, replace PCB.

AL-05 **Control power supply fuse blown**

Item	Cause of trouble	Check procedure	Remedy
1	Defective PCB	Check AC input voltage. See (5) above.	Replace PCB.
2	Abnormal power supply voltage		

AL-07 **Excessive speed (Detection by digital value)**

Item	Cause of trouble	Check procedure	Remedy
1	Incorrect setting of parameter for number of speed feedback pulses (No. 6511)	Check if number of speed feedback pulses matches parameter setting.	Set correct value in parameter.

> **NOTE**
>
> See Chapter 6.

AL-08 **High input voltage**

Item	Cause of trouble	Check procedure	Remedy
1	AC power supply voltage 10% higher than rated voltage.	Check power supply voltage.	
2	Incorrect setting of toggle switch for voltage switching.	Check power supply voltage.	Change setting from 200V to 230V.

AL-09 **Heat sink is overheated**

Item	Cause of trouble	Check procedure	Remedy
1	Cooling fan is defective.	Check if fan is rotating. Check load by using a load meter.	Replace fan.
2	Overload operation.		Re-examine the cutting condition.
3	Dusty and dirty.		Clean using compressed air or vacuum cleaner.

AL-10 **Input power voltage drops**

This alarm indicates abnormally low AC power voltage (-15% or less).

This alarm may be generated even during momentary power failures.

AL-11 **Overvoltage of DC link circuit (Regenerative circuit is faulty ... Regeneration failure)**

Item	Cause of trouble	Check procedure	Remedy
1	High power impedance.		Examine AC power specification.
2	PCB is defective.		Replace PCB.
3	Defective transistor module (TM1).		Replace transistor module.

AL-12 **Overcurrent flows to DC link circuit**

Item	Cause of trouble	Check procedure	Remedy
1	Output terminals or internal circuit of motor is shorted.	Check connections.	
2	Transistor module is defective.	Check the transistor module.	Replace transistor module.
3	PCB is defective.		Replace PCB.

AL-13 **CPU internal data memory alarm**   Replace PCB.

AL-16 **RAM abnormality**

Item	Cause of trouble	Check procedure	Remedy
1	External data memory (RAM) defective		Replace memory (RAM).
2	PCB defective		Replace PCB.

AL-18 **Program ROM sum check error**

Item	Cause of trouble	Check procedure	Remedy
1	Program memory data (ROM) defective	Compare data displayed when power is turned ON with ROM labels.	Replace program memory (ROM).

AL-19 **Excessive U phase current detection circuit offset**

Item	Cause of trouble	Check procedure	Remedy
1	A/D converter defective		Replace A/D converter.
2	U-phase current detector circuit defective.	After power is turned on, check if offset voltage on check terminal IU is beyond range of about ±100mV.	Replace PCB.
3	Loose contact of connectors between PCB and power circuit	Check connector connection between PCB and power circuit.	Ensure that PCB and power circuit are securely connected with each other.

AL-20 **Excessive V phase current detection circuit offset**

Item	Cause of trouble	Check procedure	Remedy
1	v-phase current detector circuit defective.	After power is turned on, check if offset voltage on check terminal IV is beyond range of about ±100mV.	Replace PCB.
2	Loose contact of connectors between PCB and power circuit	Check connector connection between PCB and power circuit.	Ensure that PCB and power circuit are securely connected with each other.

AL-24 **Serial transfer data error**

AL-25 **Serial data transfer stopped**

Item	Cause of trouble	Check procedure	Remedy
1	CNC power supply is OFF.	Check that CNC power is ON.	Turn CNC power ON. Connect securely.Replace optical cable.Clean optical cable transmission/ reception surfaces.
2	Defective optical cable for serial data transmission	Check that optical cable is fitted securely to the connector. Check that the cable is not broken.Check that transmission/reception surfaces of the cable are clean.	
3	Defective data transmission/ reception elements in LSI used in serial data transmission		Replace LSI.Replace PCB.

AL-26 **Disconnection of speed detection signal for Cs contouring control**

Item	Cause of trouble	Check procedure	Remedy
1	Signal level of spindle motor for Cs contouring control is invalid.	Check the signal, and if necessary adjust to the normal level using the variable resistor for signal level adjustment in the preamp.	
2	Signal line of spindle motor for Cs contour control is defective.	Check that signal cable is connected securely to connector.Check that signal cable is not broken.	Connect signal cable securely.Replace signal cable.
3	Defective detector circuit for Cs contour control		Replace detector circuit.
4	Incorrect parameter setting	Check that the parameter setting does not indicate that the Cs contour control detector is used when actually it is not.	Parameter CAXIS1=0 No.4001#5

AL-27 **Position coder signal disconnection**

Item	Cause of trouble	Check procedure	Remedy
1	Position coder signal line defective	Check that signel cable is connected securely to connector.Check that signal cable is not broken.	Connect signal cable securely.Replace signal cable.
2	Incorrect parameter setting	Check that the parameter setting does not indicate that the position coder signal is used when actually it is not.	Parameter MRDY2=0 No. 4001#2

AL-28 **Disconnection of position detection signal for Cs contouring control**

Item	Cause of trouble	Check procedure	Remedy
1	Signal level of spindle detector for Cs axis control is defective	Check the signal level, and if necessary adjust to the normal level using the variable resistor for signal level adjustment in the preamp.	
2	Signal line of spindle detector for Cs axis control is defective	Check the signal cable is connected securely to connector.Check that signal cable is not broken.	Connect signal cable securely. Replace signal cable.
3	Defective detector circuit for Cs axis control		Replace detector circuit.

AL-29 **Short-time overload**

Item	Cause of trouble	Check procedure	Remedy
1	Overload operation (Overload)	Use loadmeter to check that a load close to the load resistance limit is not imposed continuously for 30 seconds or more.	Re-examine cutting conditions and tools.

AL-30 **Input circuit overcurrent**

Item	Cause of trouble	Check procedure	Remedy
1	Defective of power transistor used for power	Check power transistor.	Replace power transistor.
2	Defective of power regeneration circuit		Replace PCB.

AL-31 **Speed detection signal disconnection motor restraint alarm**

Item	Cause of trouble	Check procedure	Remedy
1	Motor constrained	Check that nothing is preventing the motor from accelerating.	Remove cause.
2	Defective motor speed feedback signal	Check signal waveform. (Alarm No.2)	Remove cause.
3	Defective motor speed feedback signal cable	Check that cable is connected securely to connector.Check that cable is not broken.	Connect cable securely.Replace cable.

AL-32 **Abnormality in RAM internal to LSI for serial data transfer**

Item	Cause of trouble	Check procedure	Remedy
1	Defective LSI used in serial data transmission		Replace LSI. Replace PCB.

AL-33 **Insufficient DC link section charging**

Item	Cause of trouble	Check procedure	Remedy
1	Defective relay used in DC link recharging. Disconnection of resistor used in limiting re-charge current	Check relevant parts.	Replace amp.

AL-34 **Parameter data setting beyond allowable range of values**

Item	Cause of trouble	Check procedure	Remedy
1	Incorrect parameter setting	Check if specified parameter value is beyond allowable range of values	Specify value within allowable range.

AL-34 and F-XXX are alternately displayed in the spindle amplifier indicator section if an AL-34 alarm is raised.

"XXX" indicates the data number internal to the spindle for a parameter where a value beyond the allowable range is specified.

AL-35 **Excessive gear ratio data setting**

Item	Cause of trouble	Check procedure	Remedy
1	Parameter data of gear ratio and position gain are too large.	Check gear ratio and position gain data.	Change to suitable values.

AL-37   **Speed detector parameter setting error**

Item	Cause of trouble	Check procedure	Remedy
1	Incorrect setting of parameter for number of speed feedback pulses (No. 6511)	Check if number of speed feedback pulses matches parameter setting.	Set correct value in parameter.

AL-39   **Alarm for indicating failure in detecting 1-rotation signal for Cs contouring control**

Item	Cause of trouble	Check procedure	Remedy
1	Incorrect data ROM type for Cs contouring control detector circuit, or incorrect setting	Check data ROM type for Cs contouring control detector circuit and setting.	Install correct type of ROM. Perform setting correctly.
2	Low level of Cs contouring control feedback signal, or noise on same feedback signal	Check feedback signal level and also check if feedback signal waveform includes noise.	Adjust feedback signal. Check shielding status.

AL-40   **Alarm for indicating 1-rotation signal for Cs contouring control not detected**

Item	Cause of trouble	Check procedure	Remedy
1	No occurrence of 1-rotation signal among Cs contouring control feedback signals, or 1-rotation signal offset adjustment error	Check 1-rotation signal among Cs contouring control feedback signals.	Make 1-rotation signal offset adjustment. Check cables.

AL-41   **Alarm for indicating failure in detecting position coder 1-rotation signal**

Item	Cause of trouble	Check procedure	Remedy
1	Incorrect setting of parameter for number of position coder signal pulses (No. 4003#4, 6, 7).	Check number of position coder signal pulses and parameter setting.	Set correct value in parameter.
2	Incorrect amplitude and offset of position coder feedback signal. or noise on same feedback signal.	Check feedback signal level and also check if feedback signal waveform includes noise.	Adjust feedback signal. Check shielding status.

AL-47   **Position coder signal abnormality**

Item	Cause of trouble	Check procedure	Remedy
1	Incorrect setting of parameter for number of position coder signal pulses (No. 4003#4, 6, 7).	Check number of position coder signal pulses and parameter setting.	Set correct value in parameter.
2	Incorrect amplitude and offset of position coder feedback signal. or noise on same feedback signal.	Check feedback signal level and also check if feedback signal waveform includes noise.	Adjust feedback signal. Check shielding status.

4-2 Inverter for Turret

4-2-1 Status Indication (on the Point Module)

Status indication is also possible on the 7-segment indication on the point module board.

Table 4-5 shows the contents of the status indication.

This indication is continuously lit. (A flickering indication is an alarm indication.)

Table 4-1 Status Indication of Juspoint III

Continuous indication	Operation status
0	Just after turning ON (without setup operation) Non at ABS mode
1	During zero-point offset automatic setup operation
2	During jog operation
3	During zero-point return operation
4	During setup operation (confirmation seems impossible because of 15 msec)
5	During stopped (setup operation completion)
6	During automatic operation
7	During manual operation
8	
9	
A	
B	
C	
D	
E	
F	Memory storage in ABS mode completed. (ABS.READY CLOSED being output) Just after turning ON in ABS mode (ABS.READY CLOSED being output)

[Status indication of inverter (Juspeed-F X3000)]

Whether or not the inverter is in the normal operating state can be monitored with the LED (7 segments) on the printed circuit board in the inverter main body (the LED is continuously lit in the normal operating state).

Table 4-6 shows the indication of the normal operating state.

Table 4-2 State Indication of Juspeed-F X3000

State	LED indication	Description
Stopped	———	Servo OFF condition, ready for operation. After the power is turned OFF, the inverter carries out self-diagnosis and displays "-" if no error is found.
Running	0	Servo ON condition and normal operation is continued.

4-2-2 Troubleshooting

- Cause and remedy of alarms for Juspoint Ⅲ

  Table 4-3 is a list of alarms. The indications refer to those made on the 7-segment LED on the point module board.

  These indications are blinking indications (continuously lit indication indicates normal operation).

Table 4-3 Cause and remedy of alarm

Blinking Indication	Alarm description	Cause and remedy
0	Driver alarm was detected (description is displayed on the driver).	Check the alarm on the driver. The alarm description is displayed on the amplifier board.
1	PG fault (including poor wiring)	PG fault, PG poor wiring, or motor locked may be the cause. Check them.
2	Emergency stop operation was occurred.	Emergency stop operation was occurred to stop the motor. Inputting OPEN for the EMG signal executes the emergency stop operation. After resetting the alarm, zero-point return or setup operation is not required.
3	Operation was commanded without setup operation after turning ON the power (except for ABS mode 1 and 2)	Automatic or manual operation was performed with state "0" (without setup). Perform the setup operation and then the automatic or manual operation.
4	Zero-point LS was not detected during zero-point offset automatic setup operation.	The zero-point LS was not detected after turning the motor for 40000 pulses (10 rotations) during the zero-point offset automatic setup operation. Check that the zero-point LS is correctly wired and that the signal is input to Juspoint Ⅲ. Or, mount the zero-point LS at a position within 40000 pulses (10 rotations) from the zero-point.
5	Zero-point LS was not detected during zero-point return operation.	The zero-point LS was not detected after turning the motor for all set stations during the zero-point return operation Check that the zero-point LS is correctly wired or that the signal is input to Juspoint Ⅲ.
6	Undefined station number was commanded.	Command a station number within the range set by [C0-00: number of stations] (for setup or automatic operation).
7	Operation mode was not set correctly.	Underfined operation mode was input. Set the correct operation mode input (MODE0-MODE2)
8	Zero-point offset automatic setup operation was commanded when the zero-point offset setup mode is set to parameter mode.	[C0-04=0] is set (zero-point offset setup is set to parameter mode). To perform the zero-point offset automatic setup operation, set [C0-04=1].
9	Zero-point LS position error (the zero-point LS position is too close to the Z-phase position, within ±120 pulses)	The Zero-point LS position and the Z-phase pulse position of PG is too close (±120 pulses). Change the LS position or Z-phase position.
A	Zero-point offset is out of allowable range (out of the range set by parameter [C0-10].)	The Zero-point offset detected during the zero-point offset automatic setup operation is out of the range of 120-40000. Change the zero-point LS position correctly.
b	The following occurred when the backlash compensation was other than "0". •Setup operation was commanded without zero-point return (except for ABS mode 1 and 2). •Zero-point offset automatic setup operation was commanded. The backlash compensation is larger than the unit station pulses. (Set a value smaller than the unit station pulses.)	A value larger than the minimum value of station interval pulses is set for the backlash compensation or zero-point return was not carried out before the setup operation. Check the two possibilities and correct the setting or sequence.
C	Station numbers are not arranged in order in the case of the absolute position setting [C0-01=4]. Arrange the station numbers in the order of station numbers.	Stations are not arranged in the order of station numbers in the case of the absolute coordinate axis [C0-01=4]. Set the parameters or carry out teaching so that the stations will be in the order of station numbers.
d	In the ABS mode, the memory storage was not completed. Reset and perform zero-point return.	In the case of the ABS mode [C0-09=1 or 2], the information required for the ABS operation was not stored in the nonvolatile memory before the power was turned OFF. To execute ABS operation, first change the ABS.ST signal from CLOSED to OPEN and make sure that the ABS.READY signal becomes CLOSED before turning OFF the power. This alarm is also issued when the motor shaft is forced to rotate by external force while the power is turned OFF. When the ABS mode 1 is to be used, the motor must have a brake.
Blank	MCU error	Malfunction of the microcomputer (out of control). It is possible that noise has entered from the control signal line or 24 VDC power line. Take measures to prevent noise from entering these lines; shield the cables or separate the lines from the power lines carrying large currents. It is also possible that the control unit is faulty. If the error does not disappear by eliminating the noise, replace the control unit and return it to the factory.

Reset the alarms using the reset signal (RESET). The alarms can also be reset by the power supply (24 VDC). Reset the power supply in the case of the MCU error.

[Cause and remedy of alarms for the inverter (Juspeed-F X3000)]

Error indication (Errors are indicated by blinking indication.)

Errors of the inverter can be monitored on the LED (7 segments) on the printed circuit board in the inverter main body.

Table 4-4 Cause and remedy of alarms for Juspeed-F X3000

State	LED indication	Contents	Cause and remedy
Overcurrent	1	Overcurrent or short-circuit current was detected and the inverter output was shut-off.	It is possible that the torque limit is too high or the output has a short-circuit. If no change can be seen after changing the torque limit to 200% or smaller, check for a short-circuit of the output.
Overvoltage	2	Regeneration overvoltage was detected and the inverter output was shut-off. DC bus voltage: 450V	The torque limit may be too high or the regeneration resistor may be burned out. If no change can be seen after changing the torque limit to 200% or smaller, return the regeneration resistor to the factory for investigation.
Overspeed	3	The motor speed exceed 1.1 times max. speed (10% increase) was detected and the inverter output was shut-off.	When the motor speed gets up to 1980r/min, the motor is being forced to rotate by an external force. Check for the cause and eliminate it.
Under-voltage	4	A voltage drop was detected and the inverter output was shut-off. DC voltage: 213V	The power supply voltage has dropped (180 VAC or lower) during operation or instantaneous power failure was detected. If the cause cannot be eliminated, add a sequence that will input the reset signal after the voltage drop or momentary power loss.
PG error	5	Encoder error was detected and the inverter output was shut-off. Note that not all the PG errors can be detected.	PG fault, PG wiring fault, or motor-lock can be considered. Check for the cause of these faults.
Exceeding temperature	6	The temperature inside the motor has risen above the regulated value and the inverter output was shut-off.	The temperature inside the motor has become high or the temperature detection line (inside the PG cable) is faulty. Check the motor temperature. If the temperature is normal, check the temperature detection line (PG cable).
CPU error I	7	CPU error was detected during the self-diagnosis carried out after power was supplied and the inverter output was shut-off.	Since the error was detected during self-diagnosis carried out after power was supplied, it is a hard ware error. Replace and return it to the factory.
CPU error II	8	CPU error (WDT) was detected during operation and the inverter output was shut-off. This error is detected for external noise.	Malfunction of the microcomputer (out of control). It is possible that noise has entered from the control signal line or 24 VDC power line. Take measures to prevent noise from entering these lines; shield the cables or separate the lines from power lines carrying large currents. It is also possible that the control unit is faulty. If the error does not disappear after eliminating the noise, replace the control unit and return it to the factory.
CT error	9	CT (current detector) error was detected and the inverter output was shut-off.	Since the CT error for current detection was detected, it is a hardware error. Replace and return it to the factory.
Ground Fault	b	Ground fault was detected in the output at the start of operation and the inverter output was shut-off.	The ground fault was detected in output lines (U, V, W) upon servo ON. Check whether the output side being grounded. If this alarm is not reset after the grounding state was reset, replace and return it to the factory.
Others	0	An error (alarm) other than those listed above was detected and the inverter output was shut-off.	An error other than those listed above was detected. It is possible that it is alarm 8 above. Take the corrective action listed in the column for alarm 8, and if no improvement is made, replace and return it to the factory.

Notes: *1 When more than one alarm is detected, they are indicated cyclically.*

Example: When alarms 3,4 and 7 are detected, the LED will display 3 → 4 → 7 → 3 → 4 → 7 → 3 and so on.

2 The alarm state is retained unless the power supply is reset or th reset signal is used.

3 The indications blink.

4-3 Replacing Method of Battery

The CNC unit provides a battery to hold a memory which is stored programs, offset amount and parameter etc. When the battery voltage drops, a warning [794 BATTERY ALARM] is displayed on the screen. If a warning is displayed, replace the battery as soon as possible. The memory may be lost when the power source keep off for one week or more without replacing a battery.

Caution	
	Since the life of battery is about one year, replace it once a year periodically even if above alarm is not occurred.

(1) Replacing procedure of battery for CNC memory back up
Get a lithium battery (A02B-0200-K102) ready.

⚠WARNING	
	A battery may be exploded unless replaced properly. Use only the specified batteries (A02B-0200-K102).

[1] Turn ON the machine (CNC) about 30 minutes, then turn it OFF.

[2] Remove the battery on the top of the CNC unit.

At first, remove the connector, and remove the battery from the battery case.

[3] After replacing, connect the connector.

Note) *The battery case is located,*

• *On the middle part of the upper section of the unit as per a following diagram, in case of with the option slot.*
• *On the right end of the upper section of the unit in case of without the optionslot.*

battery case

connector

Lithium battery
A02BB-0200-K102
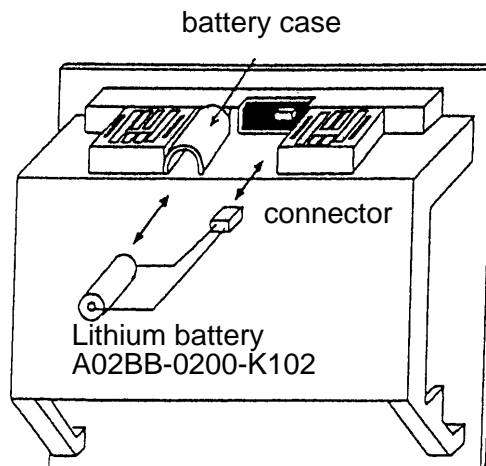
Caution	
	Battery changing work [1] ~ [3] should be completed within 30 minutes.
	If the machine is left any longer without battery, data memory in store would be lost.
	When there is a possibility of the work not being completed within 30 minutes, save the SRAM memory on the memory card in the lump. This facilitates restoration of memory even if the data is once lost. For an operating method, see "APPENDIX : BOOT SYSTEM."

4-4 Alarm Display

4-4-1 NC Alarm

No.	Content
100	G10 command error
101	Zero-point return not complete
102	F command error
103	Tapping command error
106	Plane selection command error
107	Offset No. error
112	Tool No. error
113	Polar coordinates compensation command error
114	Polar coordinates compensation mode error
115	Tool diameter/Nose R offset error
117	Tool diameter/Nose R offset interference error
118	Tool diameter/Nose R offset intersection error
119	Tool diameter/Nose R offset mode error
120	Tool length measurement command error
121	Tool length measurement command error
123	Tool length measurement operating error
124	Arbitrary angle chamfer corner R error
126	Cylinder compensation command error
127	Cylinder compensation mode error
128	G68 error
130	Block command error
131	Ark radius R designation error
132	Ark compensation error
133	Fixed cycle command error
134	Boring pattern cycle command error
135	rue circle cutting command error
136	Square cutting command error
137	Pocket cutting command error
138	Direct tap command error
139	Virtual axis command error
140	Program restart error
142	Scaling command error

No.	Content
143	Scaling mode error
144	G511/G501 program format error
146	G53 error
149	Helical cutting command error
158	3-dimension tool offset error
159	3-dimension tool mode error
160	Tool length offset error
161	Tool position offset error
163	Multiple M code command error
175	Compound type fixed cycle error
176	Single type fixed cycle error
177	Angle designated straight line compensation error
178	Chamfer, corner R error
179	Groove width offset error
180	G41, G42 command not possible
182	T command error
183	G128 error
184	Rear face processing command error
188	No option in address to write
189	Incorrect parameter setting
191	Option command
196	Reverse move error [Warning]
201	G25/G26 command error
210	Oscillation command error
211	Oscillation mode error
260	HPCC command error
261	HPCC mode error
262	Previous control command error
263	Previous control mode error
270	Soft jaws forming error
271	Soft jaws forming operation error
272	Pre-machining graphics-drawing error
500	Program character number exceeds permissible maximum
501	Command data digit exceeds permissible maximum
502	Non-existent character string variable

No.	Content
503	Character string variable not possible to construct
504	Undefined G code
505	SETVN command format incorrect
506	Command exceeds permissible value of system variable
507	Search of variable value not possible
508	Overflow of logical operation
509	Improper argument assignment of a macro call
510	Format of macro sentence incorrect
511	Use of decimal point "." improper
512	Use of minus sign "-" improper
513	Data following address non-existent
514	Description of formula incorrect
515	Variable No. not permitted to use
516	False character
517	Input of data to variable which does not accept data
518	Faulty variable value
519	Opening and closing parentheses do not correspond
520	Mixed existence of NC sentence and Macro sentence
521	Non-existence of corresponding sequence No.
522	Non-existence of corresponding program
523	Division with divisor "0"
524	Negative square root
525	Function BCD/BIN with negative number
526	BIN function in the data not belonging to BCD
527	Overflow during calculating formula
528	DO/END recognition No. improper
529	Branch destination included in the DO loop.
530	DO/END loop intersects
531	Non-existence of POPEN command
532	Duplicate call up of subprogram-macro does not function
533	Duplicate call up of macro does not function
534	Multiple call up command with same program
535	DO/END command in DNC program
536	No designation of subprogram
538	Non-existent function

No.	Content	
539	Error in writing function	
540	ADP function error	
541	Non-existence of END corresponding DO	
542	Non-existence of IF sentence corresponding ENDIF	
543	Non-existence of ENDIF corresponding block IF sentence	
544	Ineffective calculation	
545	Macro in compound type fixed cycle form	
546	Wrong G code in high precision contouring control	
560	External output open error	
561	External output communication error	
570	DNC operation start error	
701	No.1 axis Zero-point return deceleration signal is abnormal	
⟨	⟨	
708	No.8 axis Zero-point return deceleration signal is abnormal	
710	W setter mode error	
711	W setter mode error	
712	Q setter mode error	
713	Q setter mode error	
714	Q setter interlock	
715	Measurement error	
716	Tool setter measurement error	
721	Start in automatic operation does not function	[Warning]
724	Q setter repeat error	
729	Setting of jaw end face position not completed	[Warning]
730	External No. search error	
732	External data I/O error	
733	External data I/O error	
734	External data input error	
735	External data input error	
736	External data output error	
738	Q setter repeat error	
739	Q setter repeat error	
770	Spindle overload alarm	[Warning]
772	X axis overload alarm	

No.	Content	
773	Y axis overload alarm	
774	Z axis overload alarm	
775	Swivel tool overload alarm	
771	non-load alarm	[Warning]
780	Damaged tool was selected	[Warning]
781	Lifeover tool was selected	[Warning]
782	Pre-processing tool check error	[Warning]
783	Surveillance program format error	[Warning]
784	Tool on demand registration error	[Warning]
790	System table error	
791	Executed data conversion error	
794	Battery exhaustion	[Warning]
795	Emergency stop	[Warning]

No.	Content
F000	Switch off the source power
F085	Communication error
F086	Operation preparation signal is OFF
F087	Buffer overflow
F092	Zero return is not complete
F205	Rigid mode DI 1s OFF
5000	Illegal command code (HPCC)
5003	Illegal parameter (HPCC)
5004	HPCC not ready
5006	Too many words in one block
5007	Too large distance
5009	Parameter zero (Dry run)
5010	End of recode
5011	Parameter zero (Cut max)
F300	Request for n-axis zero return
F301	APC alarm: n-axis communication
F302	APC alarm: n-axis overtime
F303	APC alarm: n-axis framing
F304	APC alarm: n-axis parity
F305	APC alarm: n-axis pulse error
F306	APC alarm: n-axis battery voltage 0

No.	Content
F307	APC alarm: n-axis battery low voltage 1
F308	APC alarm: n-axis battery low voltage 2
F309	APC alarm: n-axis zero return disable
F350	SPC alarm: n-axis pulse coder
F351	SPC alarm: n-axis communication
F400	Servo alarm: n-axis overload
F401	Servo alarm: n-axis V ready OFF
F404	Servo alarm: n-axis V ready ON
F405	Servo alarm: (Zero return abnormal)
F407	Servo alarm: Excessive error
F409	Servo alarm: n-axis abnormal load
F410	Servo alarm: n-axis excessive error value
F411	Servo alarm: n-axis excessive error value
F413	Servo alarm: n-axis LSI overflow
F414	servo alarm: n-axis detecting system error
F415	Servo alarm: n-axis excessive move amount
F416	Servo alarm: n-axis broken wire
F417	Servo alarm: n-axis parameter improper
F420	Servo alarm: n-axis excessive torque difference
F421	Servo alarm: n-axis excessive error value
F500	Over travel: +n
F501	Over travel: -n
F502	Over travel: +n
F503	Over travel: -n
F504	Over travel: +n
F505	Over travel: -n
F506	Over travel: +n
F507	Over travel: -n
F510	Over travel: +N
F511	Over travel: -N
F700	Over heat: Control unit
F701	Over heat: Fan motor
F704	Over heat: Spindle
F740	Rigid tap alarm: Excessive error value
F741	Rigid tap alarm: Excessive error value
F742	Rigid tap alarm: LSI error

No.	Content
F749	S-spindle LSI error
F750	Spindle serial link starting fault
F751	1st spindle alarm detected
F752	1st spindle mode switching abnormal
F754	1st spindle abnormal load detected
F761	2nd spindle alarm detected
F762	2nd spindle mode switching abnormal
F764	2nd spindle abnormal load detected
F771	3rd spindle alarm detected
F772	3rd spindle mode switching abnormal
F774	3rd spindle abnormal load detected

4-4-2 PC Alarm

ALARM No.	COMMENT	Details/Counter-measures
1000	HYDRAULIC MOTOR OVER LOAD	Thermal MS1 is tripped. Reset the thermal.
1001	COOLANT MOTOR OVER LOAD	Thermal MS2 is tripped. Reset the thermal.
1004	SPINDLE COOLER UNIT ALARM	Spindle cooler unit alarm is issued. Check the spindle cooler unit.
1007	CHIP CONVEYOR ALARM	Thermal in chip conveyor control box is tripped. Reset the thermal.
1011	TURRET DRIVE UNIT ALARM	Turret drive unit alarm is issued. Check the turret drive unit.
1017	TURRET INDEX CYCLE POWER OFF	Indexing is suspended. Put back the turret position according to the restoring method.
1020	TURRET INDEX SET UP ERROR	Station number setting is wrong. Put back the turret position according to the restoring method.
1021	TURRET INDEX CONDITION FAULT	The conditions of turret are incomplete. Put back the Q-setter arm.
1022	SPINDLE ALARM	Check the spindle drive unit.
1023	CIRCUIT PROTECTOR TRIP	Circuit protector in control box is tripped. CP-1-
1024	TURRET INDEX TIME OVER	Turret index was not completed within the specified time. Put back the turret position according to the restoring method.
1026	Q-SETTER ARM ALARM	Put back the Q-setter arm.
1027		
1030	NC ALARM	NC alarm is issued.
1036	NC TORQUE LIMITER ALARM	Check which axis is the cause of alarm by referring NC alarm history and review the processing conditions.
2043	AIR PRESSURE ALARM	Air pressure of the machine proper has dropped. Check the air pressure source.
1044	MEASURING ARM OPERATION ALARM	Work measurement is abnormal.
1046	DOOR CLOSE NOT DETECTED	Close the door then start operation.
1047	CHUCK CLOSE NOT DETECTED	Close the chuck then start operation.

ALARM No.	COMMENT	Details/Counter-measures
1050	NOT OPTION	Key not usable was pressed.
1056	SPINDLE ORIENTATION ALARM	Spindle orientation was not completed within the specified time.
1060		
1061	FEEDER PALLET SINK LIMIT (Z-AXIS-0T)	Feeder side pallet is pressed to hard.
1062	FEEDER ALARM	Feeder alarm is being issued. Check the feeder.
1063	SPINDLE BRAKE NOT RELEASED	Release the spindle brake then start the spindle operation.
1064	C AXIS CONNECTION ALARM	C axis connection/disconnection was not completed within the specified time.
1065	AUTO PRESETTER ARM OPERATING TIME OVER	Auto presetter action is not completed.
1066	AUTO DOOR OPERATING TIME OVER	Auto door open/close action is abnormal.
1067		
1070	CHUCKING FAULT	Chucking is abnormal.
1073	M FUNCTION CYCLE TIME OVER	M function execution was not completed within the specified time.
2075	COUNTER COUNT UP	Count number has reached the setting value.
2076	M31 STOP ALARM	Material work has exhausted.
1077		
1080		
1081	ZERO TETURN INCOMPLETE	Complete all axes zero return.
1082	Z-SETTER ARM RETURN NOT DETECTED	Z-setter arm is not returned to the position.
1084	AUTO PRESETTER ARM RETURN NOT DETECTED	Auto presetter is not returned to the position.
1085	MEASURING ARM RETURN NOT DETECTED	Work measuring arm is not returned to the position.
1086	SPINDLE STOP UNFINISH	During spindle rotation, action was commanded for operating chuck, center, etc.
1087	ROTATING TOOL RUNNING	Rotation tool is in motion.
1090	CHIP CONVEYOR MODE NOT AUTO	Make chip conveyor in auto mode on the operating panel.

ALARM No.	COMMENT	Details/Counter-measures
1091	ORIENTATION RELEASE UNFINISH	Release the spindle orientation.
1093	C AXIS MODE CANCEL UNFINISH	Release the C axis connection.
1094		
1095	TOOL CLAMP NOT DETECTED	Clamp the tool firm.
1100	POSITION INTERLOCK AREA C	This is the interlock in case of instrusion into the feeder area. During program operation, when the safety guard on the feeder side is opened and there is an instrusion into the feeder area, alarm stop takes place. Also, when the spindle is rotated within the feeder area, an alarm is issued.
1101	ALL AXIS ZERO RETURN INTERLOCK AREA D	At time of NC initial source power ON, one touch zero return does not work unless each axis is within the position area D.
1102	NO SPARE TOOL	There is not spare tool.
1103	POSITION INTERLOCK AREA E	Because of interference with the way cover, intrusion is prohibited.
1105	CHUCK UNCLAMP UNFINISH	Chuck is not unclamped.
1106	SAFETY GUARD OPEN ALARM	Close is not unclamped.
1110	I/O BOARD FUSE TRIP	Standard slave fuse has blown up.
1111	I/O BOARD FUSE TRIP	Option slave fuse has blown up.
1112		
1113	OIL SCHEMER MOROE OVER LOAD ALARM	Oil schemer is abnormal.
1117	PC PARAMETER SETTING ERROR	The setting of PC parameter is abnormal.
1120	ROTATING TOOL CONNECT UNFINISH	Rotating tool is not connected.
1121	ROTATING TOOL CONNECT TIME OVER	Rotating tool is connection/disconnection action was not completed.
1122	C AXIS CONNECT TIME OVER	C-axis is not connected.
1123	ROTATING TOOL INDEXING UNIFINISH	Rotating tool indexing is not finished.
1124		

5. EXPENDABLE PARTS LIST

5-1 Expendable Parts List of CS20

No.	CODE NO.	PRODUCT NAME	MODEL (Type of machines applied)	VOLUME	REMARKS
SADDLE.ROSS SLIDE & Z FEED					
1	03999006026	Angular ball bearing	25TAC62BSUC10PN7B	2	NSK
2	02341201450	Limit switch	SL1-A	2	YAMATAKE
HEADSTOCK					
1	06-16LZ50	O-ring	16L250	2	
2	04999097874	O-ring	GS270 (φ3.1)	1	
3	06315100600	O-ring	15L6	2	
4	06-16LZ20	O-ring	16L220	1	
BED & X FEED					
1	02341201450	Limit switch	SL1-A	2	YAMATAKE
2	03999006026	Angular ball bearing	25TAC62BSU C10 PN7B	4	NSK
3	05141000330	STS belt	250S8M800	1	BANDO
TOOL POST					
1	04999105618	X-ring	R-60	2	NIHON BULKER
2	06-16L80	O-ring	16L80	1	
3	06-15L16	O-ring	15L16	2	
4	06-15L12	O-ring	15L12	12	
5	17450041700	Seal ring	OVO-240*250*5 (Fluorine)	1	SHORITSU
6	05999062529	Timing belt	250KPS8M1032	1	BANDO
7	02341201470	Limit switch	SL1-H	1	YAMATAKE
POWER SOURCE					
1	04999001239	Solenoid valve	SL-G01-E3X-GR-C1-9560B	2	FUJIKOSHI
COOLANT					
1	02172200500	Coolant pump	VKP073A (180kW)	1	FUJI Electric
SPLASH GUARD					
1	02712100920	Limit switch	D4D-2120	1	OMRON
2	02921111400	Fluorescent lamp	PM1115S-G10W	1	Hitachi, Ltd.
3	02921220900	Fluorescent lamp	FL-10D	1	Hitachi, Ltd.
4	05902200010	Bearing	NBM-6 6×24×12	2	Ochiai Shoten
5	1682-75-368-00	Wiper	(WP-34-20S)	1	NITTA
6	1682-75-367-00	Wiper	(WP-34-20S)	1	NITTA

No.	CODE NO.	PRODUCT NAME	MODEL (Type of machines applied)	VOLUME	REMARKS
SPLASH GUARD					
7	1682-75-452-00	Wiper	(WP-34-20S)	1	NITTA
8	1682-75-451-01	Wiper	(WP-34-20S)	1	NITTA
9	1682-75-440-01	Wiper	(WP-34-20S)	1	NITTA
10	1682-75-441-00	Wiper	(WP-34-20S)	1	NITTA
11	1682-75-316-21	Wiper	(WP-34-20S)	1	NITTA
12	1682-75-376-00	Wiper	(WP-34-20S)	1	NITTA
13	1682-75-353-00	Wiper	(WP-34-20S)	1	NITTA
14	1682-75-384-00	Wiper	(WP-34-20S)	1	NITTA
15	1682-99-368-00	Wiper	(WP-34-20S)	1	NITTA
Q SETTER					
1	02999074574	Proximity switch	FL7M-7J6HD-EL05	1	YAMATAKE
2	04849000040	Seal	GD40×25×5	1	NTN
3	9100-00-006-00	Probe	L4P01	1	AZUMA
4	06315101200	O-ring	15L12	1	
5	06316203000	O-ring	16L30	1	
6	06326045000	Seal	26L45	1	
TURN EQUIPMENT					
1	03660064000	Deep grove ball bearing	6006ZZ	2	NTN
2	03913112100	Drymet bush	70B-1210	2	OILES
3	03999029014	Cam follower	KRV13XLLH	8	NTN
4	03999029090	Cam follower	KRVU16XLLH	9	NTN
5	05999067337	Geared belt	150KPS8M848	1	BANDO