
MACHINING CENTER
MODEL V G (45.55), V K II (45.55)

INSTRUCTION MANUAL

SEIKI-SEICOS M-MULTI

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MORI SEIKI
THE MACHINE TOOL COMPANY

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SAFETY PRECAUTIONS

In this chapter, the following precautions are provided to help protect an operator against accidents, as well as to protect the machine against damage. These precautions are applicable not only to this machine, but also to other machines, especially in their installation and operation. Please read this chapter carefully and observe its contents.

1. Important Information

- (1) Most NC machine operation and maintenance accidents are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs.
- (2) Read and understand all safety precautions and warnings before operation and maintenance.
- (3) Basic safety precautions are outlined in the SAFETY section and description of operation and maintenance of this manual.
- (4) Operations that may cause bodily injury or machine damage are identified by WARNING signs on the machine and in the manual.
- (5) Hitachi Seiki cannot anticipate all possible circumstances that might involve a potential hazard. The warnings in this manual and on the machine are therefore not inclusive.
- (6) If a procedure, tool, work method or operating technique not specifically recommended Hitachi Seiki is used, you must satisfy yourself that it is safe for you and others.
- (7) Observe the provisions of federal, state and local regulations when operating or installing the machine.
- (8) Save the document for the repairing job.
- (9) As far as this manual is concerned, all proprietary rights are vested in Hitachi Seiki.
- (10) It is assumed that this machine will be operated and served by English speaking personnel. If this is not the case, the customer should add safety precautions, warnings in the native language of the operator on this machine.
- (11) Hitachi Seiki will not responsible for any incidental or consequential damages or other costs resulting from any abuse or misapplication of the NC machine supplied by Hitachi Seiki.
- (12) Hitachi Seiki will not be responsible for any damages or consequential damages resulting from any modifications, without prior written permission of Hitachi Seiki.

2. Safety

2-1 General Safety Rules

The following DOs and DON'Ts are general rules that apply to this machine.

DOs	DON'Ts
<ol style="list-style-type: none">1. Read understand and follow all instruction manuals and warning signs before operating this machine.2. Be familiar with this machine's safety rules and practices.3. Always keep the machine clean.4. Wear approved eye protectors or goggles at all times.5. Wear a hair net or an approved protective shop cap to protect long hair.6. Wear approved footwear at all times.7. Keep a high illumination level.8. Always stop the machine before attempting to clean it.9. Be sure that the safety covers are in place.10. Use a strong and anti-slip surface working platform, if necessary.	<ol style="list-style-type: none">1. Don't remove safety devices.2. Don't use compressed air to clean the control cabinet, NC unit and the floor around them.3. Don't use this machine in the presence of flammable liquids or gases.4. Don't wear loose clothing or jewelry.5. Don't operate the machine with gloves.6. Don't leave the machine unattended in an unsafe condition.7. Don't modify the machine without the manufacture's written permission.8. Don't place a tool, workpiece and other things on the machine.

2-2 Specific Safety Rules for This Machine

In addition to the General Safety Rules for this machine, there are rules specifically applicable to this machine.

These rules apply at all times.

1. Never touch the moving parts.
2. Stop operation immediately if any abnormality is detected.
3. Improper operation, lubrication or maintenance of this machine can be dangerous and could result in injury.
- 4* Observe the provisions of federal, state and local regulations, including OSHA and NFPA to reduce personnel injuries.
- 5* Material Safety Data Sheet (MSDS) is to be submitted by material suppliers in accordance with 29 CFR (Code of Federal Regulation) of OSHA.

The recommended precautions and procedures of the manufacturers must be followed.

Note)

Items 4 and 5 with mark * are stated the application in the U.S.A., however, for the other country must comply with the laws and regulations of the specific country.

1. OSHA
Occupational Safety and Health Act
2. MSDS
Material Safety Data Sheet
3. NFPA
National Fire Protection Association

Electric Equipment and NC Unit

When operating the machine or carrying out maintenance checks, pay special attention to the following points, concerning the electric equipment and NC unit.

1. Do not give shocks to the NC unit, power control cabinet and other machine parts.
2. For the primary wiring of the machine, use the cable size specified in the operation manual. Do not use an excessively long cable. When the primary wiring has to be put on the floor, protect it with a cover against damage by cutting chips and other sharp objects.
3. While test running the machine, be sure the setting parameter of the NC unit coincides with the parameter sheet attached to the machine.
4. Do not change the current set values of thermal relays in the power control cabinet, various control knobs or the parameter data.
5. Do not apply excessive force, e.g. bending force etc., to the connector portion of plugs, flexible conduits (tubes) or cable cables etc.
6. When carrying out maintenance checks on the electric equipment, turn off the EMERGENCY STOP button on the operation panel, the power of the NC unit, the main switch of the power control cabinet and the power switch installed in your factory, in this order.
Start maintenance work after making sure that these switches are turned off. Lock the power switches in the OFF state as much as possible or put up warning signs. In addition, place a "DO NOT TOUCH !" tag near the operation buttons of the machine to forbid other personnel from operating the machine.
7. Handle electric equipment of the machine with particular care and exercise extreme caution not to allow the machine to get wet.
8. For equipment inside the power control cabinet, use those specified by Hitachi Seiki. Use always specified fuses. Never use fuses with a higher capacity.
9. Never leave the control cabinet door open, because direct sunshine or camera's strobo flash rays may enter the cabinet and damage internal equipment.
10. In case of turning on the power again, execute power on wait by equal to or more than two seconds after power turned off. If the power is turned on during discharge from control devices by power off, pay attention to the alarm of the machine is displayed some time, due to normal process is not available.

MAINTENANCE

1. An operator and maintenance personnel should read the precautions on the caution plate fitted to the machine and observe them.
Don't stain, damage or remove the caution plate. If the caution plate becomes hard to read, contact Hitachi Seiki.
2. Close all the doors and covers except when adjusting work is made.
As for the doors of the NC unit and the power control cabinet, be sure to close them with special care.
3. Don't remove or modify the limit switches for the stroke end, for the traveling axes and the mechanism, or the electric circuit employed for safety.
4. Use regular wrenches and spanners for adjusting or repairing work.
5. During repair work, a warning signs such as "keep out of the area" or "keep hands off the switch" must be posted to prevent operation of the main power switch.

2-3 Meaning of Warning Signs

Signal words (DANGER, WARNING, CAUTION) in this manual and warning signs attached to the machine are classified in the following categories.

1) Classification of danger

DANGER indicates an immediate hazardous situation which, if not heeded, will result in severe personal injury or death.
WARNING indicates a potentially hazardous situation which, if not heeded, could result in death or serious injury to you or other persons.
CAUTION indicates hazardous situations which, if not heeded, may result in minor or moderate injury to you or other persons, or may result in machine damage.

2) Frequency of accident occurrence

Warning indication	Extent of potential damage	Frequency (In case of disregard of warning)
DANGER	Serious	Surely occur
WARNING	Serious	May occur
CAUTION	Not serious	Surely occur May occur

Chapter 1 INTRODUCTION

We are obliged to you for using our VG, VKII -type machining center.

This manual describes the installation, operation, daily maintenance and inspection, etc. of this machine in order for you to be able to properly operate the machine and make full use of its performance. Prior to its installation and test run, read this manual throughly to understand the contents provided for handling the machine.

To secure safe operation, follow the safety precautions described in this manual and the instructions given on the warning signs attached to the machine. For your general understanding of this machine, the following documents are provided other than this instruction manual. Refer to them when necessary:

1. Extra Specification. Instruction Manual for Extra Accessories
2. Programming Manual
3. Instruction Manual and Maintenance Manual for NC Unit
4. Electric Circuit Diagram

For adjustment/setting values data sheets such as the "Parameters List" which are packed together with this machine, keep them carefully because they are necessary for later maintenance and adjustment work.

A design is subject to change due to remodeling of this machine. Note that part of explanations in these manuals may not apply as a result.

1. General Precautions

1. OPERATION

1. Be aware of the position of the push button for emergency stop so that the operator may be able to press it instantly.
2. As for the operation of the machine, proceed in accordance with the procedure described later.
3. During operation, keep hands away from the rotating sections and movable sections.
4. When disposing of chips that wound round tooling or fell onto the table, it is dangerous to grasp and pull them. Further, when disposing of chips, be sure to do it after stopping the machine.
5. When adjusting the position of the coolant nozzle, do it after stopping the machine.

2. OPERATION FINISH

1. After operation of the machine is over, be sure to switch the power OFF in the prescribed order, clean the machine and apply rust preventive oil to each section of the machine such as the slide ways. When soluble cutting fluid is used; perform these jobs with special care.

3. LUBRICATION

Since lubrication oil exerts a great influence on machine durability and accuracy, extreme care must be taken for maintenance of the whole lubricating system. Perform the following check and maintenance precautions.

1. Fill with the oil specified in the manual to the specified amount.
2. Clear the oil port in advance and be careful that foreign substances such as dust, water and chips do not enter the tank.
3. Check the bottom of the oil jug to see if there is any debris, water or cutting chips, etc. inside. Sufficient care is required to distinguish the oil jug by appropriate color coding and fixed stock location to avoid mixed use of different kinds of oil.

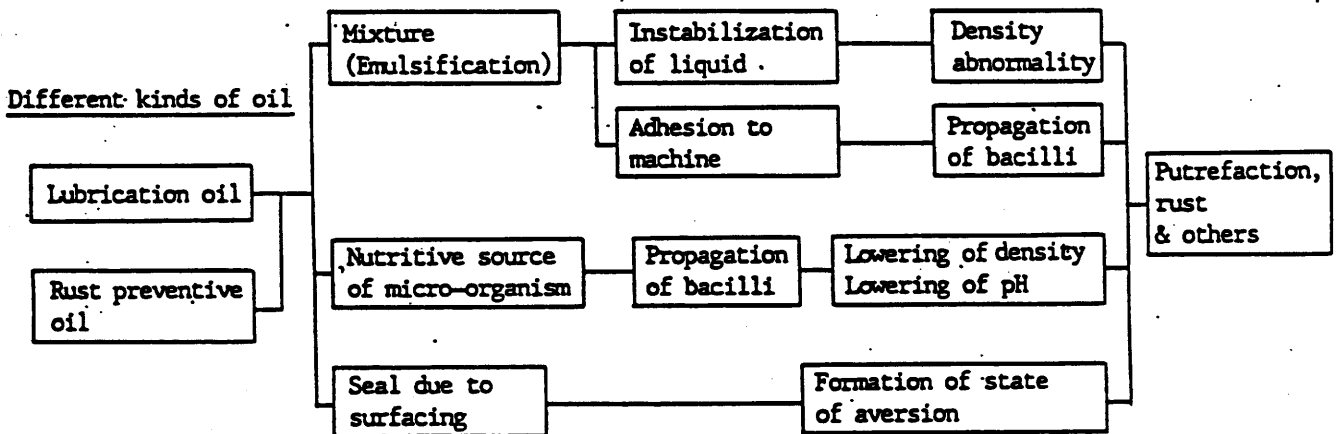
4. Check the oil periodically and if foreign substances are found, clean the inside of the tank promptly and replace it with new oil.
Don't use all of the oil, even from a new can. This is necessary in order to remove water and sediment etc.
5. Although low levels in the lubrication oil tank are detected by a float switch that flashes an alarm signal, check to see if discharging is normal. There are two possible problems:
Oil in the tank decreases extraordinarily fast, or it is decreasing too slowly.
6. As for the suction filter fitted to the pump and the in-line filter in the piping circuit, replace them with new ones once a year as a rule.
7. Air in the main lubrication pipes has been bled when the machine is delivered, but when the piping is removed for maintenance, bleed air completely at the time of reassembly and operate the machine after checking the state of discharging at the end.

4. COOLANT

The soluble cutting fluid is decomposed due to factors such as mixture of lubrication oil and propagation of micro-organisms that lower cutting and rust prevention efficiency. This causes various troubles to occur. When using soluble cutting fluid, care must be taken of the following points.

1. When selecting soluble cutting fluid, carefully consider lubrication, infiltration, rust prevention, bubble prevention, separability against oil and safety needs.
2. Before operation starts and after operation ends, not only remove chips, but also wipe off soluble cutting oil adhered to each slideway, the rotating parts, the saddle and cross-slide of the machine and then be sure to apply lubrication oil thinly to those parts.
3. Replace soluble cutting fluid immediately if it becomes vitiated.
4. Remove the covers every three months and clean each slideway, X, Y, Z axes ball-screws, each limit switch and feed motors etc.
5. As soluble cutting oil is considered for rust prevention, it may be no problem when the workpiece is wet. However, when dry, it is apt to rust. Therefore, it is recommendable to apply rust preventive oil before the workpiece dries after finished machining.

6. Since soluble oil is alkalescent and has a strong degreasing action, the operator is apt to develop dermatitis.
Therefore, the operator should take appropriate precautions.
7. As for the diluting method and soluble cutting fluid, diluting water they are different depending on the type of soluble cutting oil, so use it in accordance with the recommendations of the cutting fluid manufacturer.
8. Since there are instances where extensive micro-organisms are detected in industrial water, it is recommendable either to check it before use as water for dilution or to use service water.
9. The influences of difference kinds of oil on coolant are as follows:
Carefully monitor the condition the coolant fluid.



5. WEIGHTS and MEASURES TABLE

(Metric and English Conversion)

1. Linear measure

1m(meter) = 39.37 inches = 3.2808 feet = 1.0936 yards

1cm(centimeter) = 0.3937 inch

1mm(millimeter) = 0.03937 inch

2. Square measure

1m²(square meter) = 10.764 square feet = 1.196 square yards

1cm²(square centimeter) = 0.155 square inch

1mm²(square millimeter) = 0.00155 square inch

3. Cubic measure

1m³(cubic meter) = 35.315 cubic feet = 1.308 cubic yards

= 264.2 U.S. gallons = 220.0 U.K. gallons

1l(liter, cubic decimeter) = 0.0353 cubic foot = 61.023 cubic inches

= 0.2642 U.S. gallon = 1.0567 U.S. quarts

= 0.2200 U.K. gallon = 0.02745 bushel

1cm³(cubic centimeter) = 0.061 cubic inch

4. Weight

1 ton (metric ton) = 0.9842 U.S. (long)ton = 2204.6 pounds

= 1.1023 U.K. (short)ton

1 kg (kilogram) = 2.2046 pounds = 35.274 ounces avoirdupois

5. Others

1 kg/cm²(kilogram per square centimeter) = 14.223 pounds per square inch

1 kg-m(kilogram-meter) = 7.233 foot-pounds

Chapter 2 SPECIFICATIONS <VG>

1. Outline of Machine

This machine constructs a balanced basic configuration to move toward realization for heavy duty stable cutting with T-shape high rigid bed, solid tool lock and double wall column etc..

This is a vertical machining center coexists high rigidity and high accuracy by symmetric configuration and countermeasure of thermal deformation.

● Features of machine

1. Realization of stable heavy duty cutting and high rigidity

This machine make possible cutting capacity two times of existing machine incorporated originality move toward realization of heavy duty stable cutting and make the best use of technology of super high rigidity of HG series.

2. Adoption of guide way of steel integrated casting with preeminent durability

There are guide way as one of the point to ensure the reliability. This machine adopts a steel integrated casting on the guide way of Y axis (Column back and force) in use of severe environment and relatively high frequency in use and ensure to maintain the accuracy of straightness and durability.

3. Succession of easy operation as kind to human

This machine adopts column traverse system and ensure the accessibility to the table with one axis movement of X axis only at the table movement.

The operation panel is designed with inclination 10° to the main operating section and whole panel rotates 60° horizontally and can be used it with fix as easy to look at the CRT.

Needless to say, the UTS is provided as standard equipment and set up saving function is available such as W setter as usual.

4. We keep a rich assortment of goods to widen selection of customer.

● Outline of machine structure

Standard specification consist of T shape bed, column, spindle head, table, ATC, power cabinet (Including controller), splash guard and hydraulic-pneumatic devices and also it is integrated structure of machine, electric and hydraulic components. (Refer to nomenclature of each section)

1. Bed

As the result of T-shape box type sealed structure and also thicker wall makes high rigidity bed.

Chip disposal is fully considered with spiral conveyor on X axis direction of column and APC side respectively.

2. Column

Another one more wall is provided inside of feed guide surface as double wall build structure and ensure the rigidity and excellent in thermal symmetry with symmetrical structure as well.

Column traverse system is applied on the column to move back and furth (Y axis).

The guide way of column movement adopts steel integrated guide way move toward high reliability.

3. Spindle head

Spindle drive uses built-in type direct drive with wide range constant power motor and adopts a new spindle head cooling system so that prevent a heat transmission of spindle bearing and built-in motor to the machine and control a heat deformation as small as possible.

4. Table

Make the height from the table to guide rail surface higher and increase thickness and improve rigidity and realize a stable heavy duty cutting.

Concerning the table size, optimize the length of sliding area of bed and ensure the accuracy in regard to overhang of table movement.

5. Sliding area and feed mechanism

Each movement section of X, Y and Z axes adopts a slide guide with guarantee the high rigidity and accuracy and increase the feed rigidity by large diameter ball screw with support by double anchor system then heavy duty cutting and high accuracy is available.

6. ATC (Automatic tool changer)

Tool change is executed at the top end of the spindle head.

20 tools can be stored in the tool magazine as standard and fixed address system is applied to secure tool change with easy operation. Because of simple and compact structure, interference with workpiece at the time of tool change is very rare.

● Production support system (STAF function)

Review a developed system to improve a productivity for the customer and provide the production support system (STAF) with more easy use. STAF consist of the following items.

1. Tool management

Tool life, cutting monitor, management of ID tool etc.

2. Scheduler (Option)

Pallet management such as PPL, VWC, VPS etc.

3. Periodical check

Maintenance of lubricant or battery etc.

4. Alarm diagnosis

Display of alarm

5. System

Display of various data, maintenance of PC (Program controller)

6. Information of instruction manual

G code, M code list

7. User function

Clock setting, memorandum function

SPECIFICATIONS <VK II >

1. Outline of Machine

This is a high-rigidity high-accuracy vertical machining center with symmetric structure and thermal symmetry. It does not have its axes piled one on another, its moving parts are free from overhang which is consequent upon a move of each axis, thus providing stable operating accuracy.

● Features of machine

1. Stable Operating Accuracy

In addition to the above-mentioned axial structure which does not have the axes piled one on another, the guide block uses a rigid high-speed rolling guide to assure good operating accuracy.

2. Doubled Rapid Traverse Rate

In order to reduce a non-cutting time, a rapid traverse rate has been doubled to 30 m/min.(X- and Y-axes), compared with conventional machines.

3. Succession of easy operation as kind to human

This machine adopts column traverse system and ensure the accessibility to the table with one axis movement of X axis only at the table movement.

The operation panel is designed with inclination 10° to the main operating section and whole panel rotates 60° horizontally and can be used it with fix as easy to look at the CRT.

Needless to say, the UTS is provided as standard equipment and set up saving function is available such as W setter as usual.

4. We keep a rich assortment of goods to widen selection of customer.

● Outline of machine structure

Standard specification consist of T shape bed, column, spindle head, table, ATC, power cabinet (Including controller), splash guard and hydraulic-pneumatic devices and also it is integrated structure of machine, electric and hydraulic components. (Refer to nomenclature of each section)

1. Bed

The bed has a box-type enclosed structure and high rigidity. A spiral conveyor has been installed in the X-axis direction on the column side to fully dispose of cutting chips.

2. Column

In addition to high rigidity secured by a box-type structure, the machine has been designed symmetric to assure high thermal symmetry. The column, which is of traverse system, moves in the longitudinal direction (Y-axis direction).

3. Spindle head

Spindle drive uses built-in type direct drive with wide range constant power motor and adopts a new spindle head cooling system so that prevent a heat transmission of spindle bearing and built-in motor to the machine and control a heat deformation as small as possible.

4. Table

The table has sufficient thickness to secure rigidity. When moving the table to the left and right, stable operating accuracy can be obtained because there is no overhang.

5. Guide Block and Feed Mechanism

Each of the moving parts, X-, Y-, and Z-axes, uses a rigid rolling guide, and a 12mm-lead ball screw, both allowing for high-speed operation.

6. ATC (Automatic tool changer)

Tool change is executed at the top end of the spindle head.

20 tools can be stored in the tool magazine as standard and fixed address system is applied to secure tool change with easy operation.

Because of simple and compact structure, interference with workpiece at the time of tool change is very rare.

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2. Scheduler (Option)

Pallet management such as PPL, VWC, VPS etc.

3. Periodical check

Maintenance of lubricant or battery etc.

4. Alarm diagnosis

Display of alarm

5. System

Display of various data, maintenance of PC (Program controller)

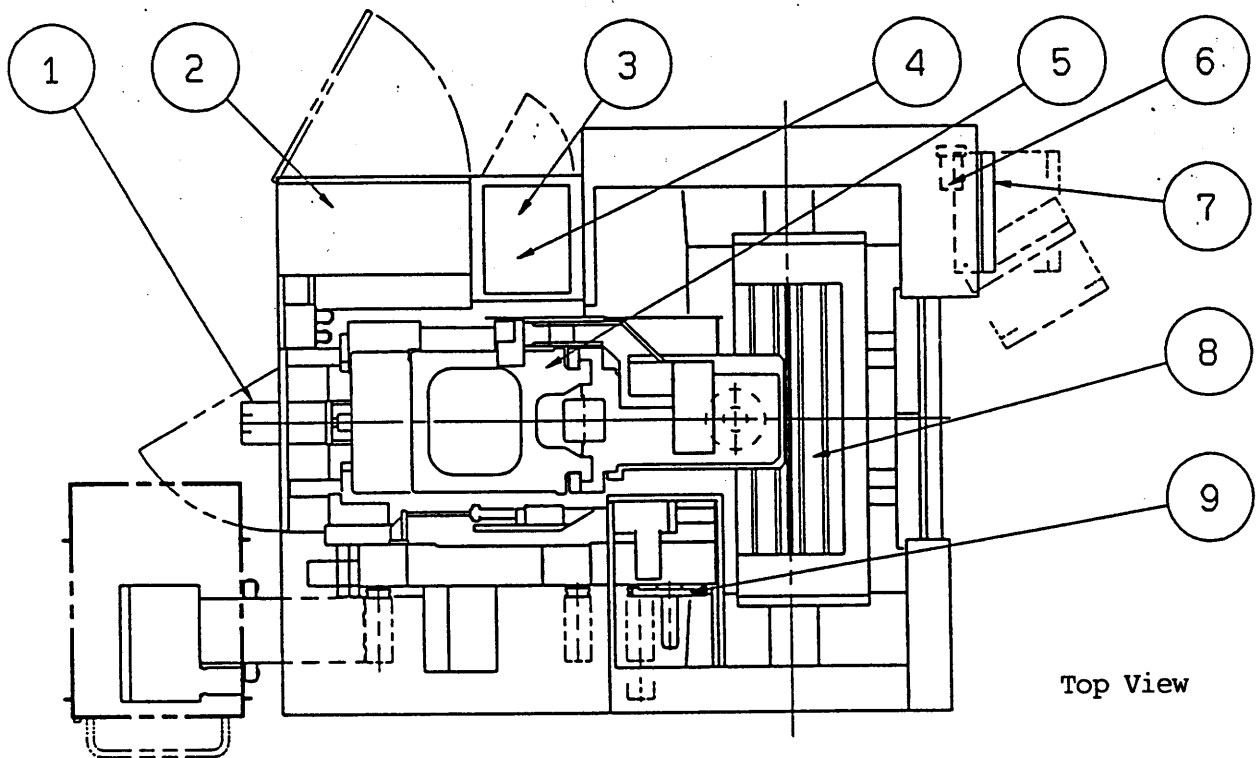
6. Information of instruction manual

G code, M code list

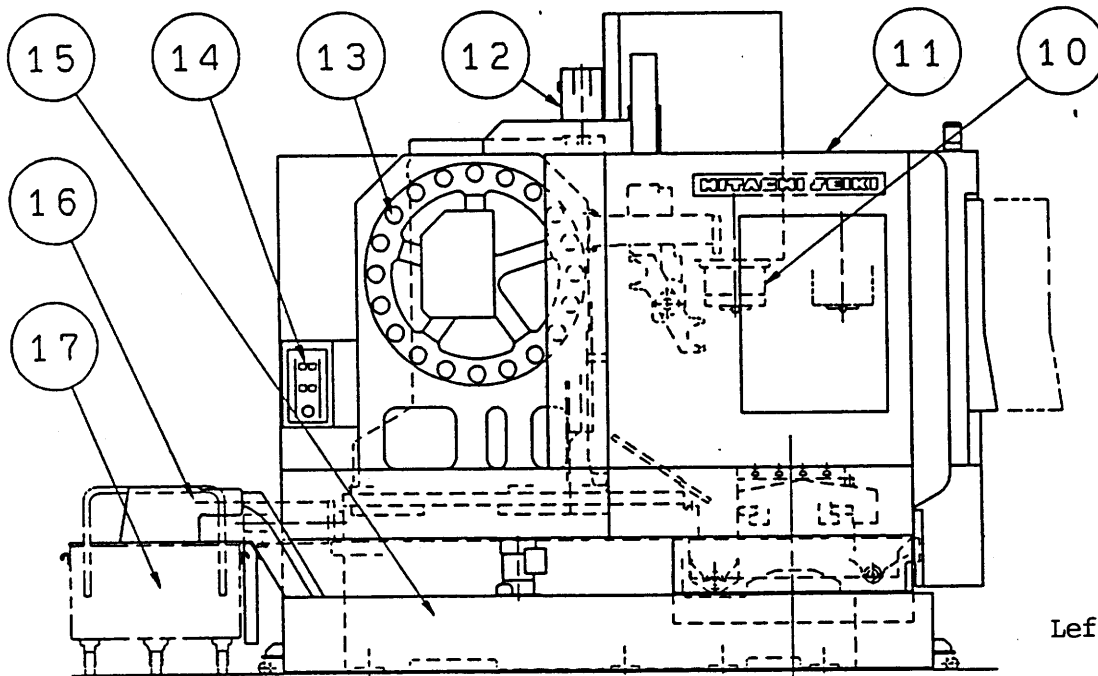
7. User function

Clock setting, memorandum function

2. Names of Components <VG>



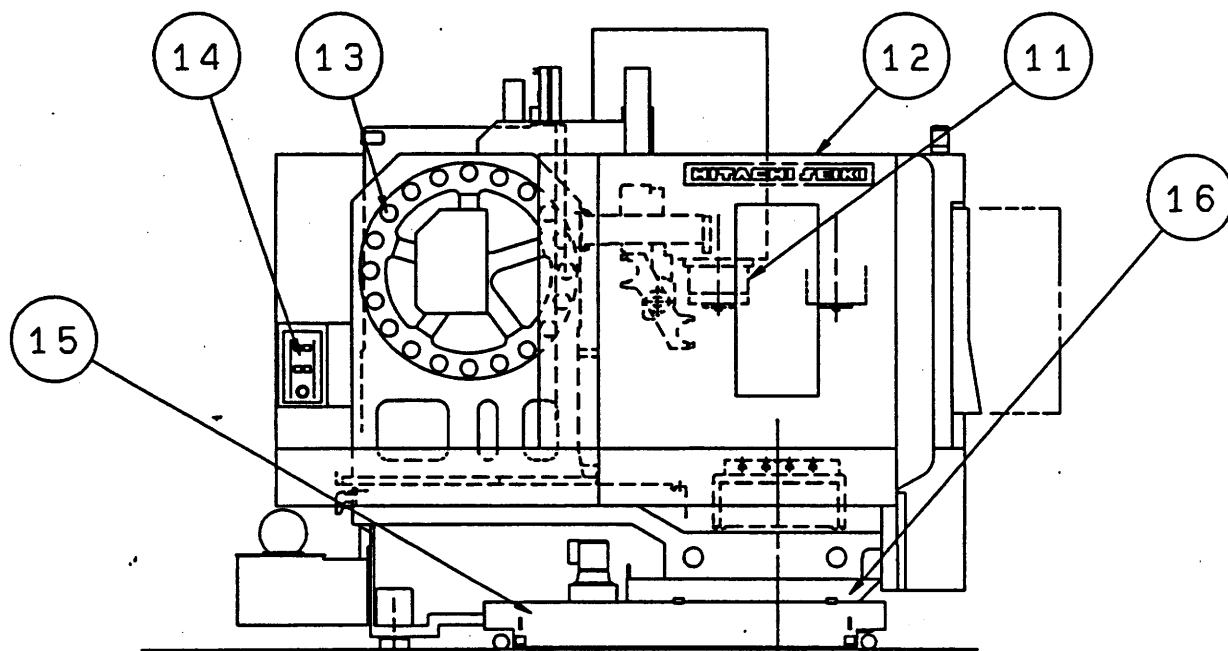
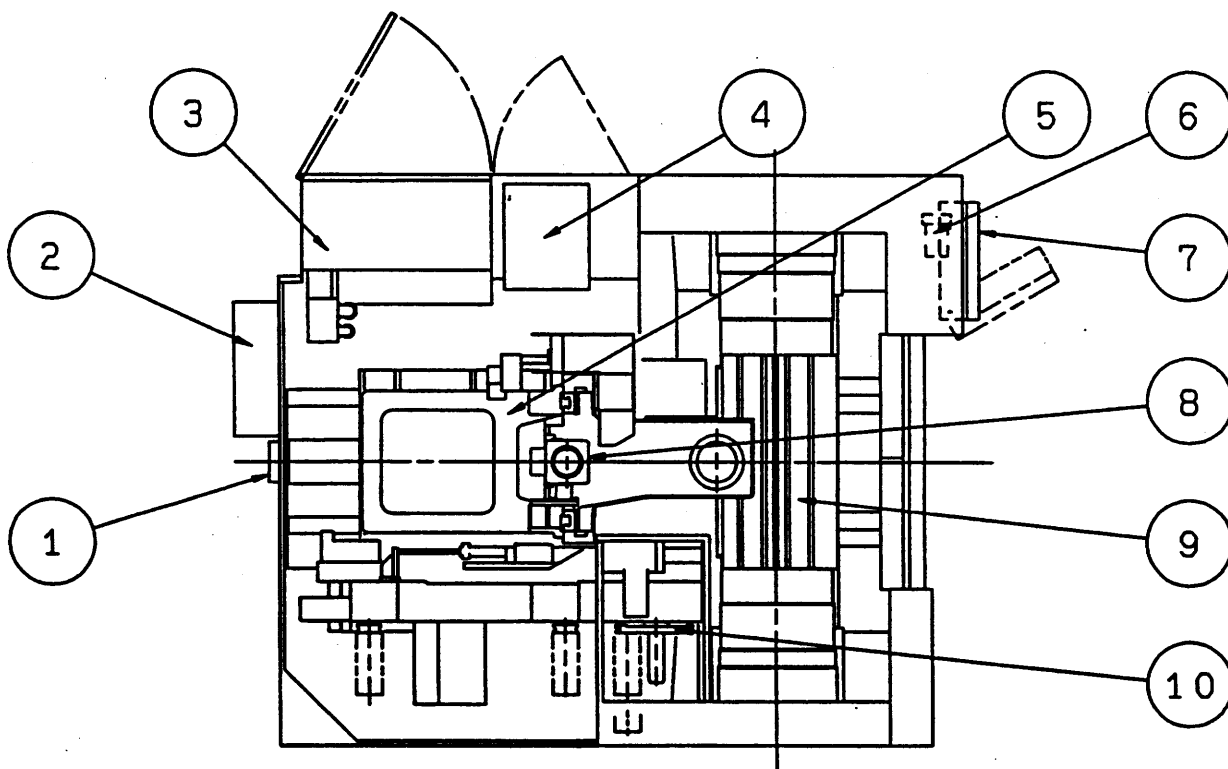
Top View



Left Side View

1	Y axis feed motor	6	Lubrication oil tank	11	Splash guard	16	Chip conveyor (OP)
2	High-power panel	7	Main operation panel	12	Z axis feed motor	17	Chip box (OP)
3	Hydraulic unit	8	Table	13	ATC magazine	18	
4	Spindle cooler	9	ATC twin arm	14	ATC independent operation panel	19	
5	Column	10	Spindle head	15	Coolant tank	20	

Name of Component Unit <VKII >



1	Y-axis feed motor	7	Main operation panel	13	ATC magazine
2	Hydraulic unit	8	Z-axis feed motor	14	ATC independent box
3	Electric cabinet	9	Table	15	Coolant tank
4	Spindle cooling unit	10	ATC twin arm	16	Chip box
5	Column	11	Spindle head		
6	Lubricating tank	12	Splash guard		

3. Specifications of Machine <VG>

	Specifications	Unit	VG45
A	Stroke		
	1) X-axis stroke Table right & left	mm	760
	2) Y-axis stroke (Column crosswise)	mm	450
	3) Z-axis stroke (Spindle head up & down)	mm	450
	4) Distance from the table surface to the spindle nose	mm	200~650
	5) Distance from the column front to the spindle center line	mm	540
B	Table		
	1) Table working surface	mm	1120×450
	2) Max. table loading capacity	kg	750
	3) Shape of table surface		18mm T-slot 4 lines
	4) Work size (length×width×height)		1120×450×450
C	Spindle		
	1) Spindle speed	min ⁻¹ {rpm}	45~4500
	2) Spindle speed change		Stepless
	3) Spindle hole taper		7/24 Taper No. 50
	4) Spindle bearing ID	mm	φ 100
D	Feed rate		
	1) Rapid traverse rate	mm/min	X/Yaxis 2000
		mm/min	Z axis 1500
	2) Cutting feed rate	mm/min	1~5000
	3) Jog feed rate	mm/min	0 ~ 5000 (21 steps)
	4) Minimum setting unit	mm	0.001

	Specifications	Unit	VG45
E	Automatic tool changer		
	1) Tool shank		MAS403-BT50
	2) Pull-stud		MASP50T-0°
	3) Tool storage capacity		20
	4) Max. tool diameter (): When no adjacent tool exists.	mm	φ 110
	5) Max. tool length	mm	300
	6) Max. tool weight	kg	20
	7) Tool selection system		Memory random T4 digits
F	Motor		
	1) Spindle driving motor	AC KW	11 (50%ED) / 7.5 (CONT)
	2) Feed motor	AC KW	X,Y:2.3 Z:4.5
	3) Hydraulic motor Standard spec.	KW	1.5
	4) Lubrication motor	W	20
	5) Coolant motor	W	400
	6) Spindle cooler motor (compressor)	KW	0.6
	7) Spindle cooler motor (pump)	KW	0.4
	8) In-machine screw conveyor motor (column side, worker side)	KW	0.1
G	Power supply		
	1) Power source Standard Spec.		30KVA
	2) Air source	Mpa {kg/cm ² } ℓ/min	0.5 (5) 750 (Atmospheric pressure)
H	Tank capacity		
	1) Hydraulic tank capacity	ℓ	15 (up to upper limit graduation)
	2) Lubrication oil tank capacity	ℓ	1.5 (up to upper limit graduation)
	3) Cutting fluid	ℓ	400 (up to upper limit graduation)
	4) Spindle cooling tank capacity		20 (up to upper limit graduation)
I	Machine dimension		
	1) Height of the machine	mm	2735
	2) Floor space Standard	mm	2400X3140
	3) Machine weight (Including NC Standard unit)	kg	7500

	Specifications	Unit	VG55
A	Stroke		
	1) X-axis stroke Table right & left	mm	1000
	2) Y-axis stroke (Column crosswise)	mm	560
	3) Z-axis stroke (Spindle head up & down)	mm	560
	4) Distance from the table surface to the spindle nose	mm	200~ 800
	5) Distance from the column front to the spindle center line	mm	650
B	Table		
	1) Table working surface	mm	1500× 56
	2) Max. table loading capacity	kg	1000
	3) Shape of table surface		18mm T-slot 5 lines
	4) Work size (length×width×height)		1500× 560× 560
C	Spindle		
	1) Spindle speed	min ⁻¹ {rpm}	45~4500
	2) Spindle speed change		Stepless
	3) Spindle hole taper		7/24 Taper No. 50
	4) Spindle bearing ID	mm	φ 100
D	Feed rate		
	1) Rapid traverse rate	mm/min	X/Yaxis 2000
		mm/min	Z axis 1500
	2) Cutting feed rate	mm/min	1~5000
	3) Jog feed rate	mm/min	0 ~ 5000 (21 steps)
	4) Minimum setting unit	mm	0.001

	Specifications	Unit	VG55
E	Automatic tool changer		
	1) Tool shank		MAS403-BT50
	2) Pull-stud		MASP50T-0°
	3) Tool storage capacity		20
	4) Max. tool diameter (): When no adjacent tool exists.	mm	φ 110
	5) Max. tool length	mm	300
	6) Max. tool weight	kg	20
	7) Tool selection system		Memory random T4 digits
F	Motor		
	1) Spindle driving motor	AC KW	11 (50%ED) / 7.5 (CONT)
	2) Feed motor	AC KW	X,Y:2.3 Z:4.5
	3) Hydraulic motor Standard spec.	KW	1.5
	4) Lubrication motor	W	20
	5) Coolant motor	W	400
	6) Spindle cooler motor (compressor)	KW	0.6
	7) Spindle cooler motor (pump)	KW	0.4
	8) In-machine screw conveyor motor (column side, worker side)	KW	0.1
G	Power supply		
	1) Power source Standard Spec.		30KVA
	2) Air source	Mpa {kg/cm ² } ℓ/min	0.5 (5) 750 (Atmospheric pressure)
H	Tank capacity		
	1) Hydraulic tank capacity	ℓ	15 (up to upper limit graduation)
	2) Lubrication oil tank capacity	ℓ	1.5 (up to upper limit graduation)
	3) Cutting fluid	ℓ	400 (up to upper limit graduation)
	4) Spindle cooling tank capacity	ℓ	20 (up to upper limit graduation)
I	Machine dimension		
	1) Height of the machine	mm	2890
	2) Floor space Standard	mm	3000× 3620
	3) Machine weight (Including NC Standard unit)	kg	8000

Machine Specification <VK II >

Specification		VK45II-40	VK45II-50
Travel	Travelling distance of X axis (Tabled, longitudinal)	760mm	
	Travelling distance of Y axis (Column, cross)	500mm	
	Travelling distance of Z axis (Spindle head, up and down)	500mm	
	Distance from table top to spindle nose	150~650mm	
	Distance from column front face to center line of spindle	508mm	
Table	Size of table working surface	1120 x 485mm	
	Maximum load capacity on table	750kg	
	DConfiguration of table top	18mm T groove x 4	
	Size of workpiece (Length x Width x Height)	1120 x 485 x 500	
Spindled	Spindle speed Standard * High speed	60~8000min ⁻¹ 120~12000min ⁻¹	45~4500min ⁻¹ 80~8000min ⁻¹
	No. of range of spindle speed change	Full automatic, stepless	Full automatic, stepless
	Spindle tapered hole	7/24 Taper No.40	7/24 Taper No.50
	ID of spindle bearing	75mm	90mm
Feedrate	Rapid traverse	X/Y axes 30000mm/min Z axis 20000mm/min	
	Cutting feedrate	1~10000mm/min	
	Jog feedrate	0~5000mm/min	
	Minimum increment	0.001mm	
Auto- matic tool changer	Type of tool shank	MAS-BT40	MAS-BT50
	Type of pull stud	MAS type P40T-1 (45°)	MAS type P50T-°
	Tool storage capacity	20pcs.	20pcs.
	Max. diameter of tool	110mm	110mm
	Max. length of tool	300mm	300mm
	Max. weight of tool	10kg	20kg
	Tool selection system	Fixed address, random memory, T-4 digits	

Specification		VK45II-40	VK45II-50
Motor	Main spindle motor Standard * High speed	AC7.5/5.5KW (50% ED/Continuous) AC11/7.5KW (50% ED/Continuous)	AC7.5/5.5KW (50% ED/Continuous) AC7.5/5.5KW (50% ED/Continuous)
	Feed axis motor	X, Y axes:AC2.3KW, Z axes:AC3.3KW	
	Hydraulic motor	1.5KW	
	Lubrication motor	20W	
	Coolant motor	180W	
	Motor for spindle cooling device (Compressor)	0.5KW	
	Motor for spindle cooling device (Pump)	0.2KW	
	Motor for screw conveyor in machine (Column side, operator side)	0.1KW	
Required power source	Electric power source	22 KVA (Standard specification)	
	Pneumatic power source	0.5 MPa { 5kg / cm ² } 750 Nl/min	
Tank capacity	Capacity of hydraulic tank	40L (Up to upper limit)	
	Capacity of lubrication tank	1.5L (Up to upper limit)	
	Capacity of coolant tank	180L (Up to upper limit)	
	Capacity of Spindle cooling tank	20L (Up to upper limit)	
Size of machine	Height of machine	2628mm	
	Floor Space	2400 x 3150mm	
	Machine weight (Including NC unit)	6500kg	

Machine Specification

Specification		VK55-40	VK55-50
Travel	Travelling distance of X axis (Tabled, longitudinal)	1000mm	
	Travelling distance of Y axis (Column, cross)	600mm	
	Travelling distance of Z axis (Spindle head, up and down)	600mm	
	Distance from table top to spindle nose	200~800mm	
	Distance from column front face to center line of spindle	610mm	
Table	Size of table working surface	1400 x 560mm	
	Maximum load capacity on table	1000kg	
	DConfiguration of table top	18mm T groove x 5	
	Size of workpiece (Length x Width x Height)	1400 x 560 x 600	
Spindled	Spindle speed Standard * High speed	60~8000min ⁻¹ 120~12000min ⁻¹	45~4500min ⁻¹ 80~8000min ⁻¹
	No. of range of spindle speed change	Full automatic, stepless	Full automatic, stepless
	Spindle tapered hole	7/24 Taper No.40	7/24 Taper No.50
	ID of spindle bearing	75mm	90mm
Feedrate	Rapid traverse	X/Y axes 30000mm/min Z axis 20000mm/min	
	Cutting feedrate	1~10000mm/min	
	Jog feedrate	0~5000mm/min	
	Minimum increment	0.001mm	
Auto- matic tool changer	Type of tool shank	MAS-BT40	MAS-BT50
	Type of pull stud	MAS type P40T-1 (45°)	MAS type P50T-°
	Tool storage capacity	20pcs.	20pcs.
	Max. diameter of tool	110mm	110mm
	Max. length of tool	300mm	300mm
	Max. weight of tool	10kg	20kg
	Tool selection system	Fixed address, random memory, T-4 digits	

Specification		VK55-40	VK55-50
Motor	Main spindle motor Standard * High speed	AC7.5/5.5KW (50% ED/Continuous) AC11/7.5KW (50% ED/Continuous)	AC11/7.5KW (50% ED/Continuous) AC18.5/15KW (50% ED/18.5/15 Continuous)
	Feed axis motor	X, Y axes:AC2.3KW, Z axes:AC3.3KW	
	Hydraulic motor	1.5KW	
	Lubrication motor	20W	
	Coolant motor	180W	
	Motor for spindle cooling device (Compressor)	0.5KW	
	Motor for spindle cooling device (Pump)	0.2KW	
Motor for screw conveyor in machine (Column side, operator side)	0.1KW		
Required power source	Electric power source	22 KVA (Standard specification)	
	Pneumatic power source	0.5 MPa { 5kg / cm ² } 750 Nl/min	
Tank capacity	Capacity of hydraulic tank	40L (Up to upper limit)	
	Capacity of lubrication tank	1.5L (Up to upper limit)	
	Capacity of coolant tank	180L (Up to upper limit)	
	Capacity of Spindle cooling tank	20L (Up to upper limit)	
Size of machine	Height of machine	2890mm	
	Floor Space	3000 x 3475mm	
	Machine weight (Including NC unit)	8000kg	

Standard accessories <VG>

1. Direct tapping function
2. Spindle cooling device (1500 Kcal/H)
3. Chip conveyer in machine (Column side, operator side one pc. each)
4. Splash guard (Totally closed)
5. Flood coolant device (Including coolant tank 400ℓ)
6. Movable manual pulse generator (Changeover each axis of X, Y, Z, A, C)
7. Lighting device (Inside of splash guard)
8. Call light (Yellow)
9. Automatic power shut off device (With leak breaker)
10. Leak breaker
11. Automatic memorization of override (Available both spindle and feed)
12. W setter
13. Easy setter
14. Hand tools (Spanners & wrenches one set)
15. Spindle hole cleaner 1 pc.
16. Installation patrs for foundation
17. Melodia

Extra accessories < VG >

1. Tool storage capacity of ATC 30, 60, 90, 120 tools
2. High speed spindle 8000min⁻¹
3. APC system (Parallel shuttle type)
4. NC rotary table
5. A pallet itself
6. Pallet pool line (6PPL, 8PPL)
7. Pull stud bolt (45° MAS-1 type BT50, 30° MAS-2 type BT50)
8. Coolant device Jet coolant Coolant gun
 Oil hole coolant Spindle through coolant
9. Oil mist device Oil mist coolant, continuous type
 Needle coolant, one shot type
10. Mist collector
11. Tool nose air blow
12. Spindle through air blow
13. External chip conveyor, flat type, scraper type, for aluminum chips
14. Magnet roller conveyor (For anti-sludge)
15. Chip wagon (With caster)
16. Closed loop
17. Automatic measuring equipment, automatic centering
18. Measuring equipment on machine
19. Printer equipment for automatic measuring
20. Cleaning tool for automatic measuring
21. Tool length measuring equipment
22. Spindle load meter
23. Spindle tachometer
24. Additional call light
25. Buzzer alarm unit
26. Integrating timer
27. Work counter (Total 6 digits)
28. Weekly timer
29. Automatic extinguisher
30. Sub table for additional axis
31. Standard fixture (Box type, angle block, sub table)
32. Clamping metal
33. External power transformer 32KVA 65KVA

Note 1. Contents of accessories and optional equipments are subject to change without notice by reasons of production and usage, contact HITACHI SEIKI if any doubt about it.

Extra accessories < VKII >

1. Tool storage capacity of ATC 30, 60, 90, 120 tools
2. High speed spindle NT50:8000min⁻¹, NT40:12000min⁻¹
3. APC system (Parallel shuttle type)
4. NC rotary table
5. A pallet itself
6. Pallet pool line (6PPL, 8PPL)
7. Pull stud bolt (45° MAS-1 type BT50, 30° MAS-2 type BT50, 30° MAS-2 type BT40)
8. Coolant device Jet coolant Coolant gun
 Oil hole coolant Spindle through coolant
9. Oil mist device Oil mist coolant, continuous type
 Needle coolant, one shot type
10. Mist collector
11. Tool nose air blow
12. Spindle through air blow
13. Internal chips conveyor (Operator side)
14. External chip conveyor, flat type, scraper type, for aluminum chips
15. Magnet roller conveyor (For anti-sludge)
16. Chip wagon (With caster)
17. Closed loop
18. Automatic measuring equipment, automatic centering
19. Measuring equipment on machine
20. Printer equipment for automatic measuring
21. Cleaning tool for automatic measuring
22. Tool length measuring equipment
23. Spindle load meter
24. Spindle tachometer
25. Additional call light
26. Buzzer alarm unit
27. Integrating timer
28. Work counter (Total 6 digits)
29. Weekly timer
30. Automatic extinguisher
31. Sub table for additional axis
32. Standard fixture (Box type, angle block, sub table)
33. Clamping metal
34. External power transformer 32KVA 65KVA

Note 1. Contents of accessories and optional equipments are subject to change without notice by reasons of production and usage, contact HITACHI SEIKI if any doubt about it.

Standard accessories < VK II >

1. Direct tapping function
2. Spindle cooling device (1250 Kcal/H)
3. Chip conveyer in machine (Column side)
4. Splash guard (Totally closed)
5. Flood coolant device (Including coolant tank 180ℓ)
6. Movable manual pulse generator (Changeover each axis of X, Y, Z, A, C)
7. Lighting device (Inside of splash guard)
8. Call light (Yellow)
9. Automatic power shut off device (With leak breaker)
10. Leak breaker
11. Automatic memorization of override (Available both spindle and feed)
12. W setter
13. Easy setter
14. Hand tools (Spanners & wrenches one set)
15. Spindle hole cleaner 1 pc.
16. Installation patrs for foundation
17. Melodia

4. Specifications of NC unit

Cl.	No.	Item	Specifications
S t a n d a r d S p e c i f i c a t i o n s	1	Controlled axes	3 axes, simultaneously 3 axes
	2	Interpolation	Positioning, Linear interpolation, Circular interpolation
	3	Programming system	Absolute/incremental programming
	4	Increment system	0.001 mm / 0.0001 inch
	5	Tape code	EIA/ISO automatic recognition
	6	Functions	Preparatory G 3-digit, Miscellaneous M 3-digit, Tool T 4-digit
	7	Spindle speed command	Direct designation of spindle speed by S code
	8	Feed rate command	Direct designation of feed by F code
	9	Feed rate override	0 ~ 200%
	10	Override cancel	
	11	Rapid override	0, 1, 25, 50, 100%
	12	Manual feed functions	Rapid traverse, Jog feed, Handle feed
	13	Manual pulse generator	3-step magnification changeover of x1, x10 and x100
	14	Cutter compensation	
	15	No. of tool offsets	Max. 240 pairs (diameter, length)
	16	Tool length compensation, No. of multiple offsets	44 pairs (diameter, length), 1 tool, 3 pairs in total (including one pair of tool offsets)
	17	Tool offset	58
	18	CRT display	14 inch color
	19	Part program storage & editing	80 m (266 ft)
	20	Background editing	
	21	Canned cycle	G73, G74, G76, G77, G80 ~ G89
	22	2-step canned cycle	G181, G182, G185 ~ G187, G189
	23	Drilling pattern cycle	G70 ~ G72
	24	Reference point return B	Manual/auto G27 ~ G30
	25	Mirror image	X, Y and additional axis
	26	Optional block skip	1 set
	27	Stored stroke check	Type A and B

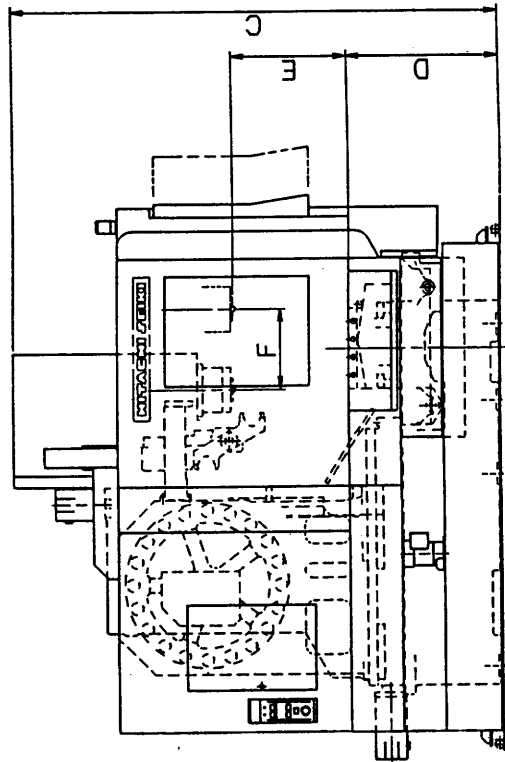
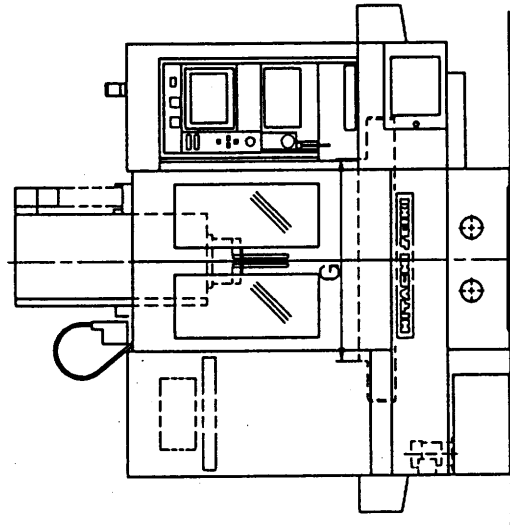
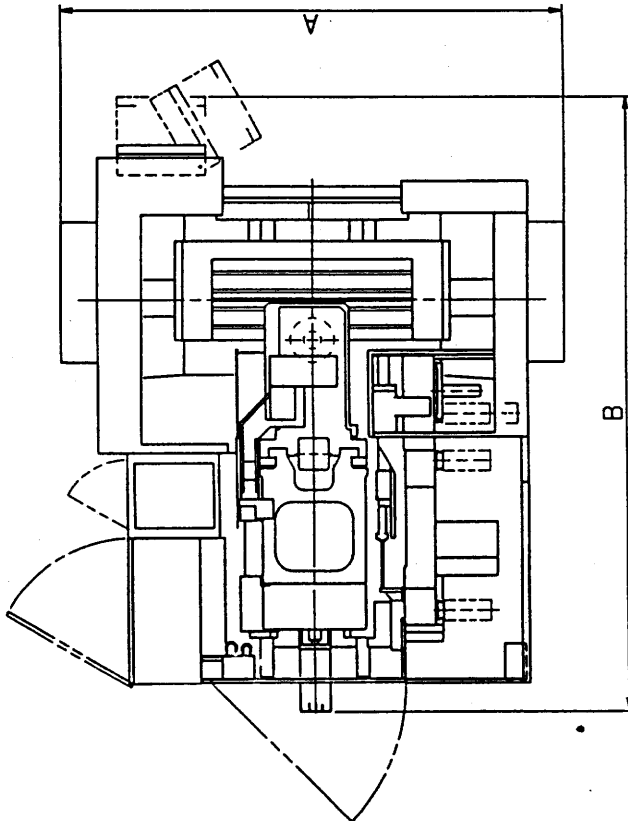
Cl.	No.	Item	Specifications
S t a n d a r d S p e c i f i c a t i o n s	28	User macro A	#100~#149 #500~#559
	29	Stored pitch error compensation	
	30	Programming of absolute zero point	
	31	Automatic coordinate system setting	
	32	Work coordinate system setting	G54 J1 ~ G59 J9, 54 sets
	33	Tool length measurement (manual)	
	34	I/O interface	RS232C
	35	Registered programs	99
	36	Part program collation	
	37	Radius designation on arc	
	38	Dwell	
	39	Memory lock key	
	40	Buffer register	
	41	Single lock	
	42	Feed hold	
	43	NC self diagnostic function	
	44	Z-axis command cancel	
	45	Exact stop	Exact stop
	46	Decimal point programming	
	47	Dry run	
	48	Backlash compensation	
	49	Program No. search	
	50	Sequence No. search	
	51	Label skip	
	52	Machine lock, Auxiliary function lock	
	53	Manual absolute "ON" fixation	
	54	Optional stop	
	55	offset data, Work coordinate shift amount	G10
56	True circular cutting		

Cl.	No.	Item	Specifications
S t a n d a r d S p e c i f i c a t i o n s	57	Run hour display	
	58	Playback function	
	59	Sequence No. comparison and stop	
	60	Canned cycle editing	Screen-guided type
	61	Tool nose coordinate system	
	62	Alarm display in English	
	63	User macro A	#100~#149, #500~#559

Cl.	No.	Item	Specifications
O p t i o n a l S p e c i f i c a t i o n s	1	Part program storage & editing	160m, 320m, 640m, 1280m, 2560m, 5120m in total (532ft, 1064ft, 2128ft, 4256ft, 8512ft, 17024ft)
	2	Helical cutting	
	3	Registered programs	299 sets, 999 sets in total
	4	Program restart	
	5	Optional block skip	9 sets in total
	6	External data input	
	7	Skip function	
	8	User macro B, C, D	B #100~#199, #500~#599, C #100~#199, #500~#699, D #100~#299, #500~#999,
	9	Tape reader	
	10	Inch/metric conversion	
	11	F 1-digit feed	
	12	Scaling function	
	13	Program interrupt function	
	14	Program copy function	
	15	Tool life management	
	16	Manual pulse generator	3 sets attached (independent for each axis)
	17	High-speed cutting function	
	18	Multi-active register	7-block preread
	19	Coordinate rotation	G68
	20	External memory	SEIKI DON
	21	Addition of 1 axis	
	22	Addition of 2 axes	
	23	Override memory editing	F, S
	24	Automatic corner override	
	25	One-dimensional positioning	
	26	DNC run	
	27	Rapid mode run	

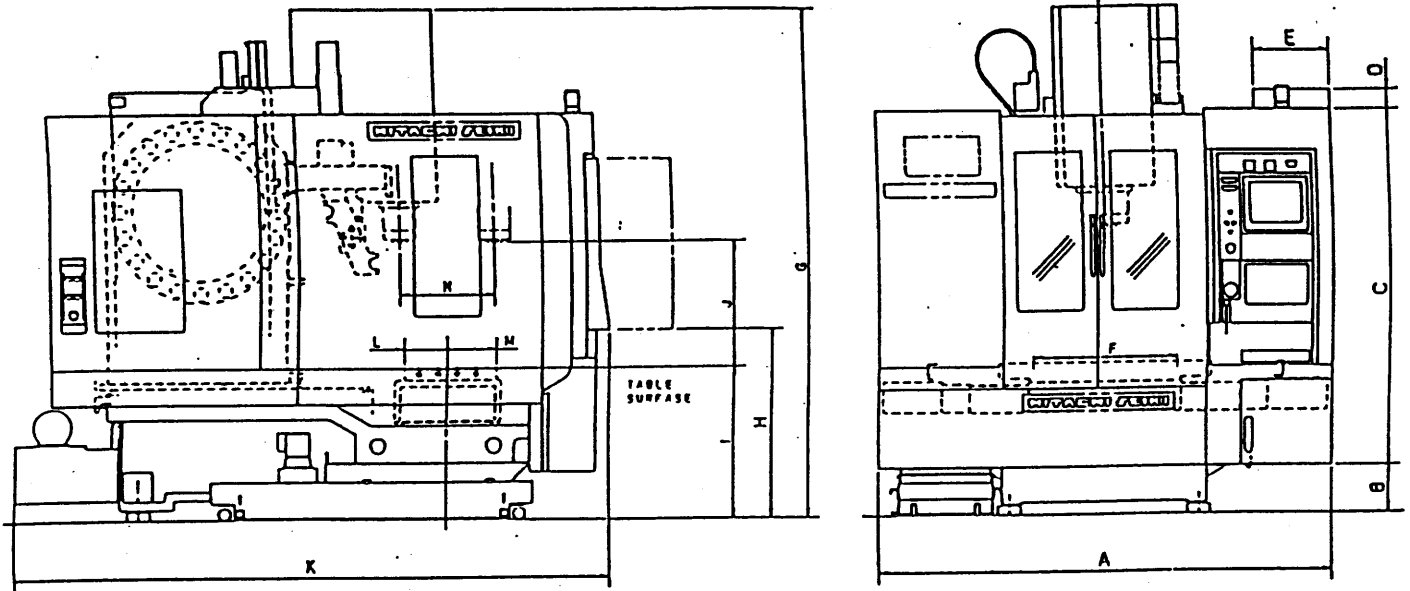
5. Major Dimensions <VG>

	VG45	VG55	VG65
A	2810	3620	3700
B	3410	3790	3800
C	2735	2890	3115
D	850	850	900
E	200~650	200~760	200~870
F	450	550	650
G	1120	1500	1500



*: At MULTI SPECIFICATION

< VK II >



	VK 4 5 II	VK 5 5 II		VK 4 5 II	VK 5 5 II
	mm (INCH)				
A	2400 (94.5")	3000 (118")	H	—	—
B	250 (9.84")	250 (9.84")	I	800 (31.5")	900 (35.4")
C	1850 (72.8")	1900 (74.8")	J	150~650(5~26")	200~800(8~31")
D	100 (3.94")	100 (3.94")	K	3150 (124")	3475 (137")
E	400 (15.7")	400 (15.7")	L	225 (8.86")	L + M
F	760 (29.9")	1000 (39.4")	M	260 (10.2")	560 (39.4")
G	2658 (105")	2890 (114")	N	500 (19.7")	600 (23.6")

Chapter 3 INSTALLATION

1. Transport of Machine

This machine can be transferred only disconnect power code because integrated construction of machine and electric is adopted.

Refer to the following page for fixed method of moving element and slinging.

1) Note of lifting work

Pay full attention for lifting work because one of the important procedure for transportation of machine.

Transportation of machine is executed by crane or chain block, so, noteworthy point for lifting is as follows:

- (1) Wire rope should be used over 16mm dia..
- (2) Protect wire rope and machine by putting soft pad on acute angle area.
- (3) Sling the center of gravity should be located the center line of lifting angle.
- (4) Do not use a wire rope which is rusted, untwisted or broken element.
- (5) Lift gradually and stop once when wire rope becomes tight and check slinging. Lift it after recheck when apart from ground.
Down slowly and check just before touch the ground and down it.

2) Note of fork lift work

- (1) Select the fork lift having enough capacity to the machine weight.
- (2) To protect the projected parts of circumference of the machine should be cooperated with supervisor.
- (3) At the time to insert the fork, use casting groove for fork located left and right of the machine base.
- (4) At the time of lifting, consider lifting to be executed at the most stable place of the center of gravity both cross and longitudinal direction by tentative lifting.

Position of each axis at transport

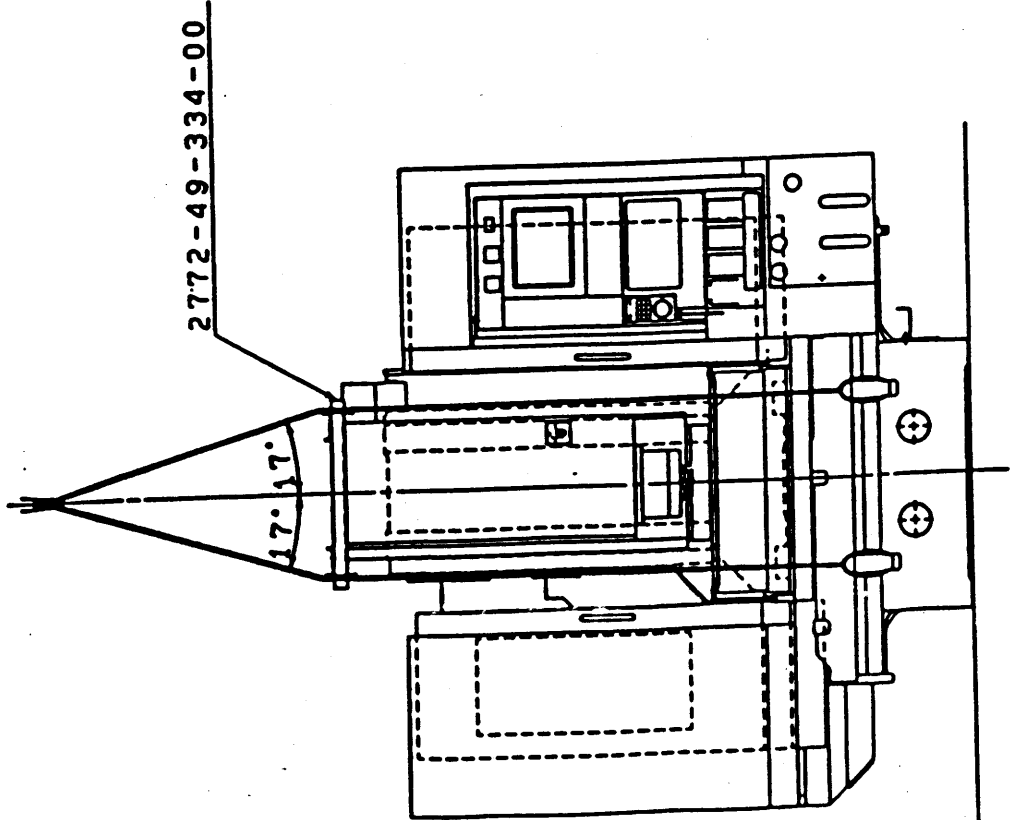
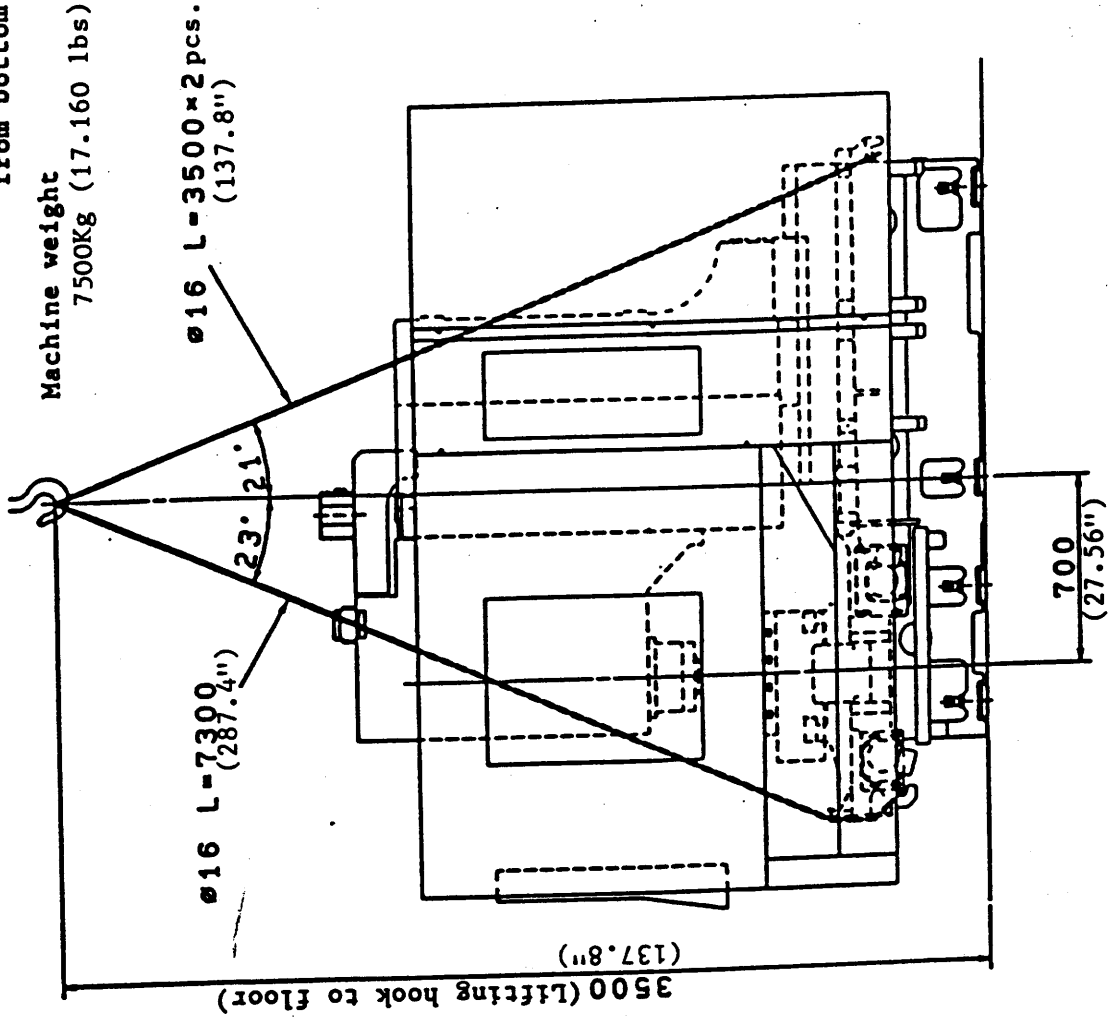
X (Table) : Center

Y (Column) : Center

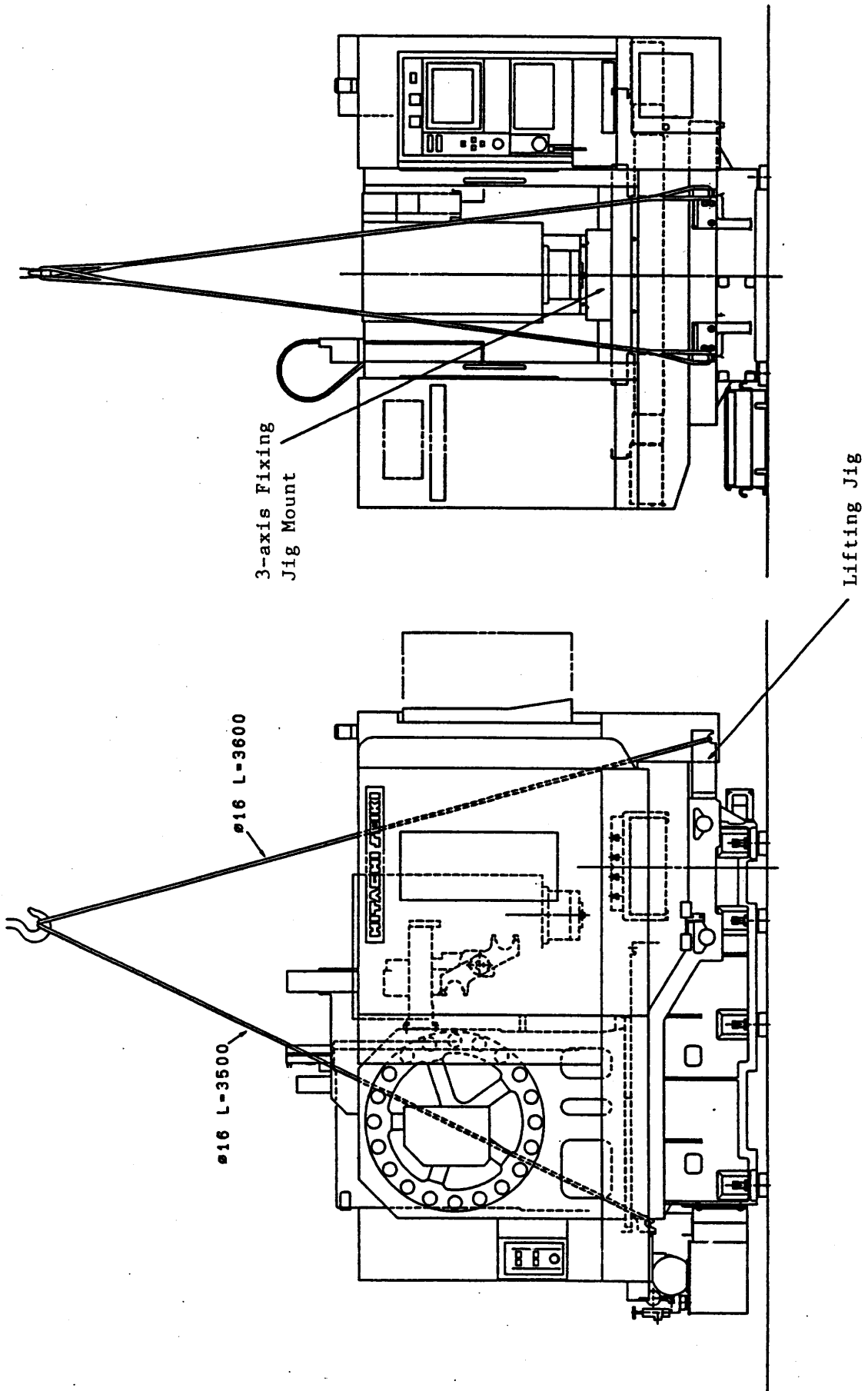
Z (Head) : Plus 50mm (2") from bottom

Machine weight

7500Kg (17.160 lbs)



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2. 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, electric 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 (AC200V) 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

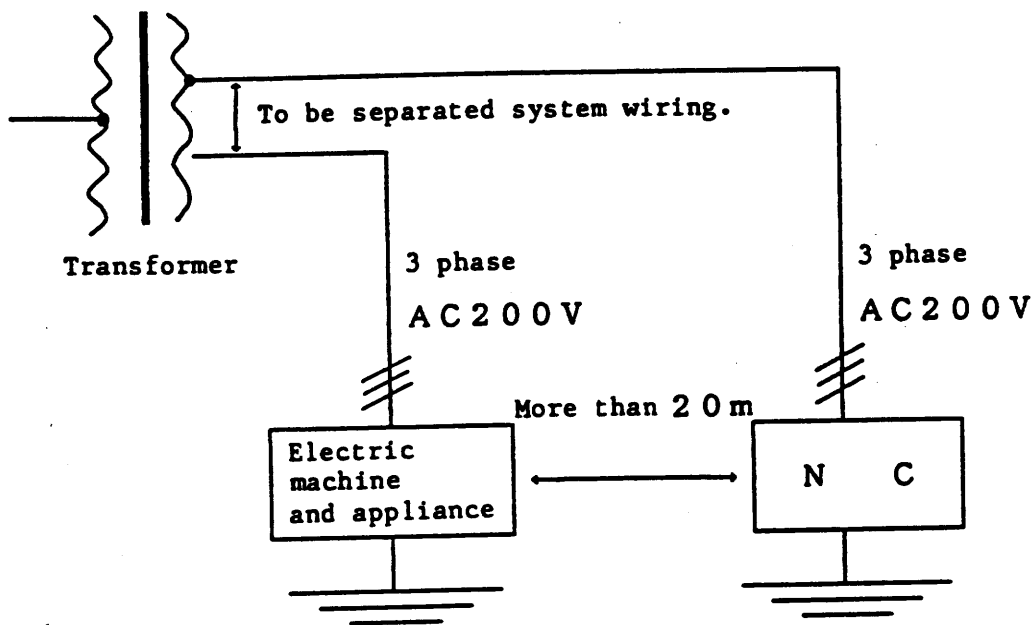
make a ground work with not more than 100 or comply with the laws and regulations of the country.

Or the earth wire size must be not less than 14mm^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



3. Power Source and Pneumatic Source

1. Electric wiring

As the wiring provided for this machine connects between the machine proper and its attachments only, the user is requested to prepare the wiring from the supply power source to the control cabinet.

Though an electric wire used for this purpose is slightly different depending upon a distance from the power source to the control cabinet, it is necessary to connect with wire of which sectional area is more than 38mm^2 .

Power source : 200/220V(50/60Hz) \pm 10%

Earth wire : More than 14mm^2

Power capacity : 22KVA (Standard specifications)

2. Pneumatic source

Provide pneumatic source for this machine, because it uses clean air to clean the spindle hole, tool, pallet coupling or oil mist device.

Pneumatic pressure : 0.5MPa { $5\text{kg}/\text{cm}^2$ } (72 PSI)

Rate of flow : 350 N ℓ /min.

Connecting port on the machine side : PT1/4 female thread

An air filter/regulator is provided on the machine proper, that ensure to remove dust contained in the air and overstaturated moisture.

Due to the nature of the air, as the air temperature of the pneumatic source increases higher than the temperature of the machine proper, it is cooled on the machine side and causes water drops more easily.

If moist air is injected, it may rust the spindle hole and the tool shanks, thus its effects on machining accuracy and cutting surfaces.

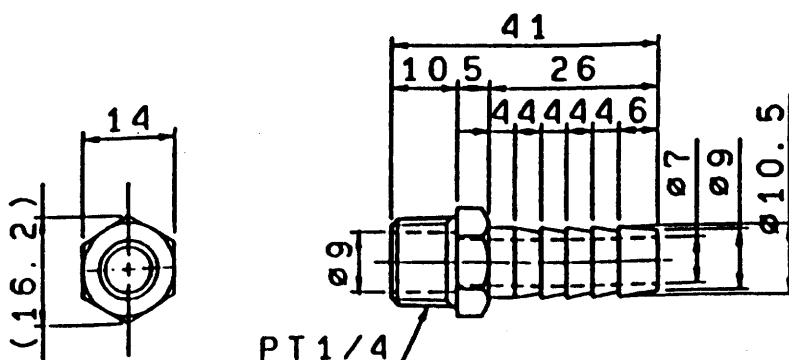
Therefore, the lower air temperature of the air source is, the better.

(Water and dust accumulating in the air filter is automatically drained.

To manually drain them, see the descriptions on mechanical drain operation.)

When the temperature difference is bigger, attach an air dryer between the pneumatic source and the machine.

The following figure illustrates an example of an air inlet joint.



(It is required to manufacture an air inlet joint in accordance with the piping diameter of your factory.)

Principle of the movements of the automatic drain with manual discharger
(W3000-8-F)

When no pressure acts upon the inside of the bowl, the valve ② is forced up by the spring ⑩ to be in the state detached from the stem packing ⑤.

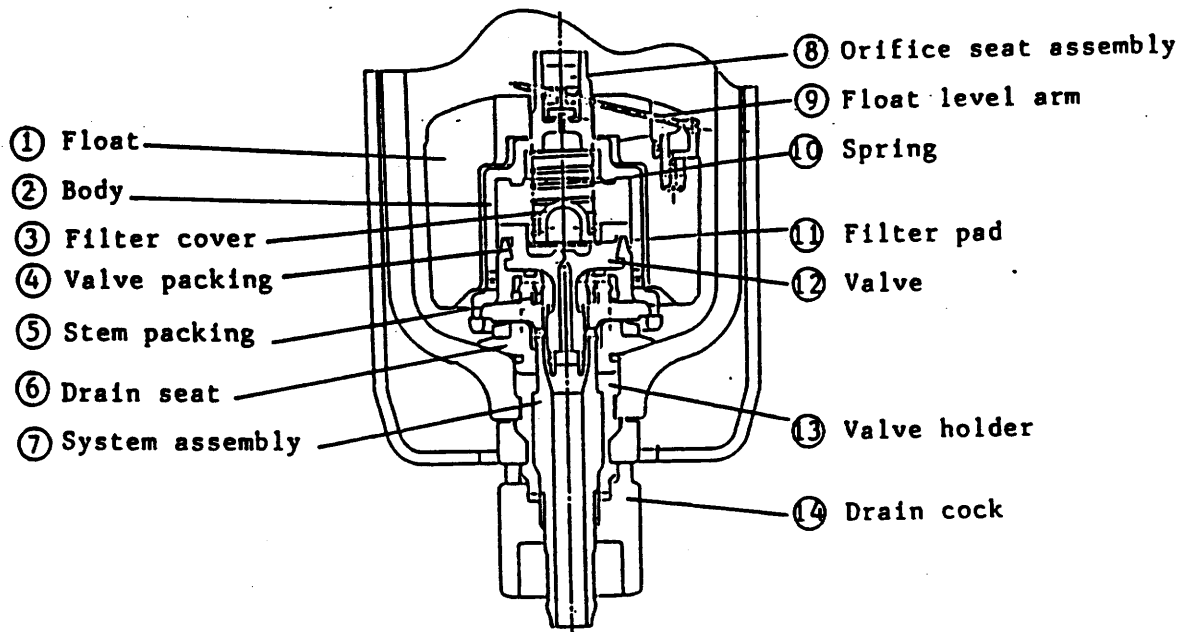
If more than 1 Kgf/cm² of pressure acts upon the inside of the bowl, the receiving pressure of the valve ② becomes larger than the force of the spring ⑩, and the valve ② is forced up and sealed with the stem packing ⑤. Next, when drain is accumulated in the bowl, the float ① is elevated and the Orifice seat assembly ⑧ is opened by the float level arm ⑨. Then, pressed air is guided into the upper chamber of the valve ②, and the valve becomes pressurized state. And the valve ② is forced down, and when it parts from the stem packing ⑤, drain is discharged into the atmosphere through following the arrow mark.

When drain is discharged, the float ① is lowered and the Orifice seat assembly ⑧ is closed by the float level arm ⑨.

Then, pressurized air is discharged into the atmosphere through the Orifice of the valve ②.

Whereupon, the receiving pressure of the valve ② from the lower part exceeds the force of the spring ⑩ and the valve ② is lifted up and sealed with the stem packing ⑤. As a manual discharging device is built in this model of machine, it can be used as a manual drain.

The tube connected to the drain line shall be of ID ϕ 6mm and within 5m long.

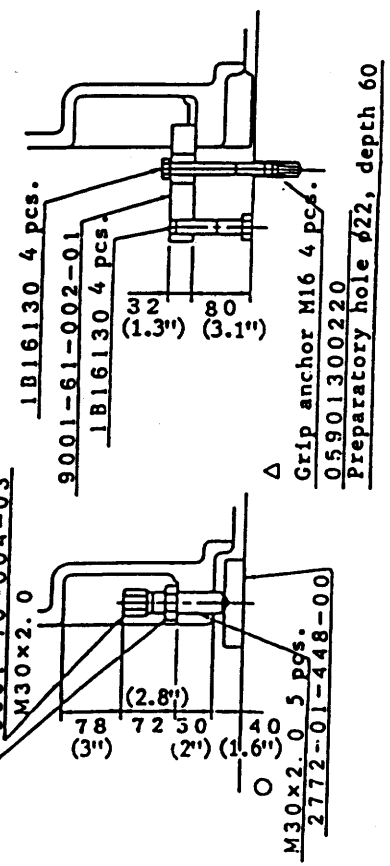
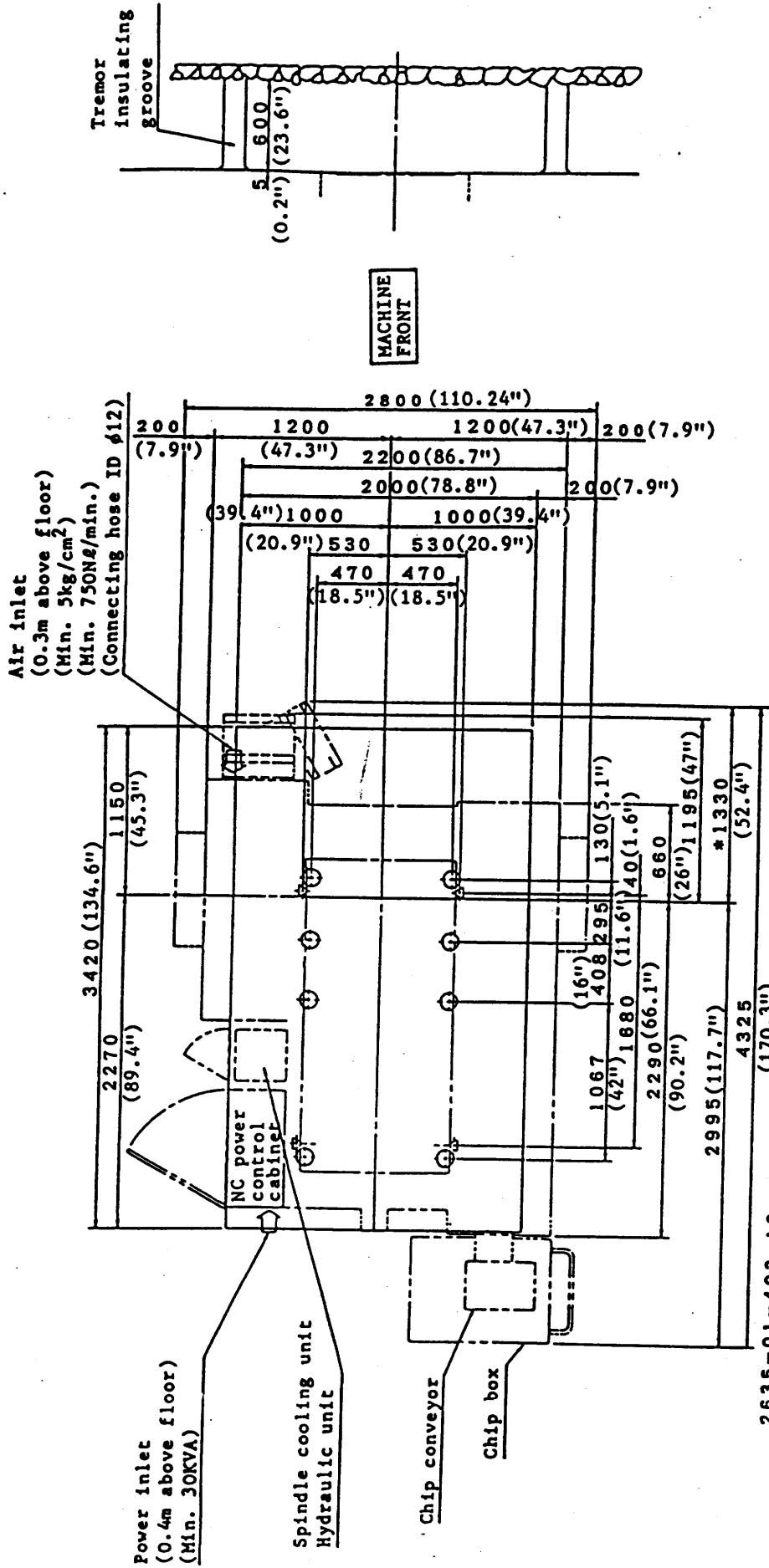


When the phenomena such as the below occur, replace it with a new parts (Bowl assemble F4-550178).

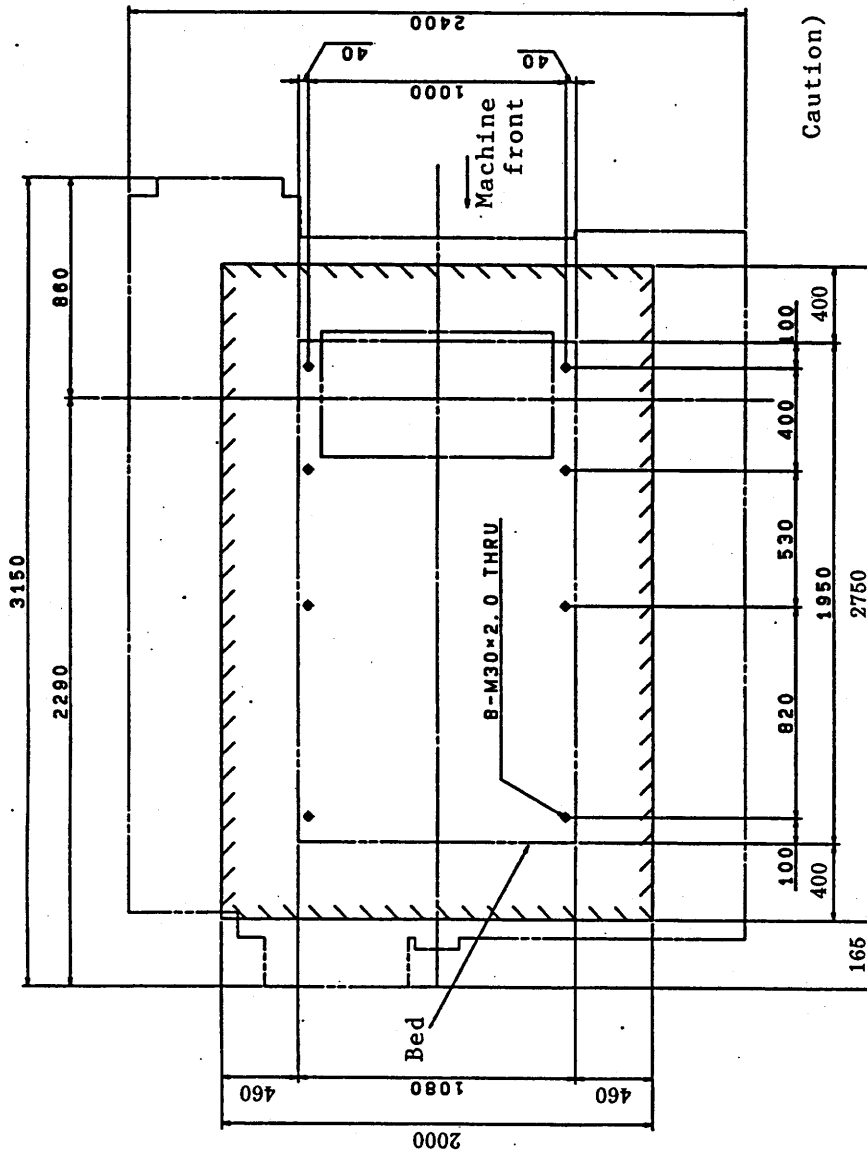
- a. Drain is not discharged automatically.
- b. Air is leaking ceaselessly from the drain port.

4. Foundation Plan <VG>

VG45 ATC 20 tools foundation plan



- Caution) 1. Ground bearing force should be 5 ton/m² or more, and foundation thickness should be at least 600mm.
2. The foundation area should be at least 2000 x 3420mm.
3. Install the tremor insulating groove along the outer periphery of the foundation.
4. Drive four (4) M16 grip anchors into foundation before installing machine.
5. *: At MULTI specification

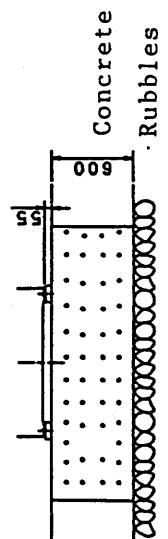
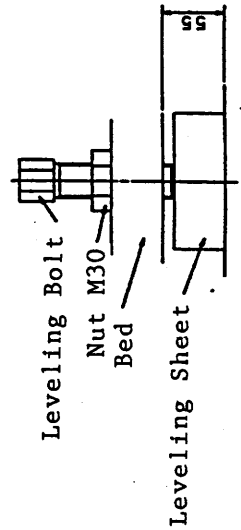


Caution) 1. A ground bearing force should be 5 tons/m² or more and thickness of the foundation should be 300mm or more.

2. An area of the foundation should be 2,000×2,750mm or more.

3. Vibration-proof grooves, if any, should be installed along the outer periphery of the foundation.

4. When installing the APC, drill holes for M16 anchors before installing the machine.

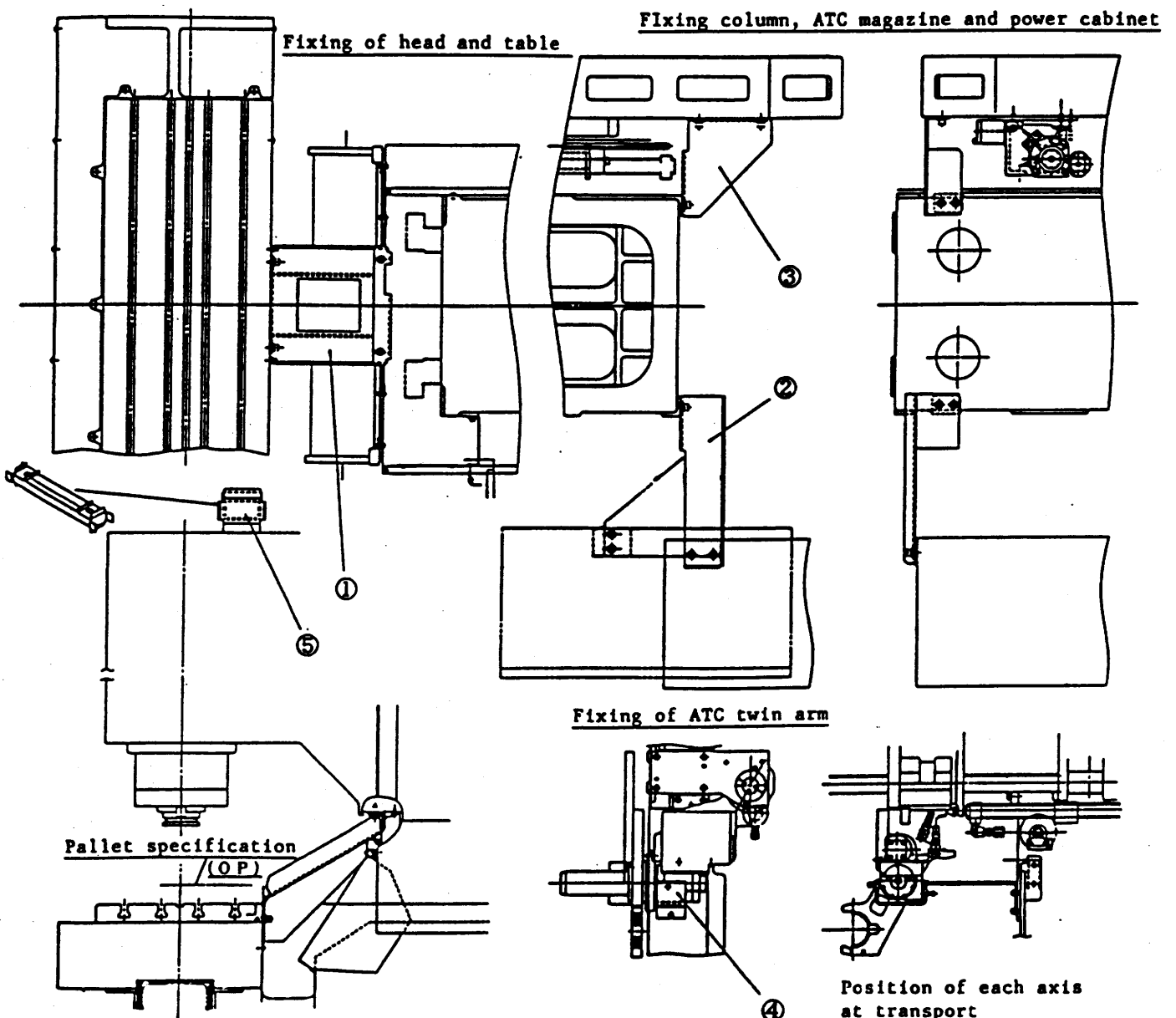


Procedure of Installation Work <VG>

(1) Remove of fixture for transfer

The following fixtures should be removed after the machine installed at decided position.

- ① For head, column, table
- ② For column, power cabinet
- ③ For column, ATC magazine stand
- ④ For ATC arm, ATC magazine stand
- ⑤ Fixture for slinging



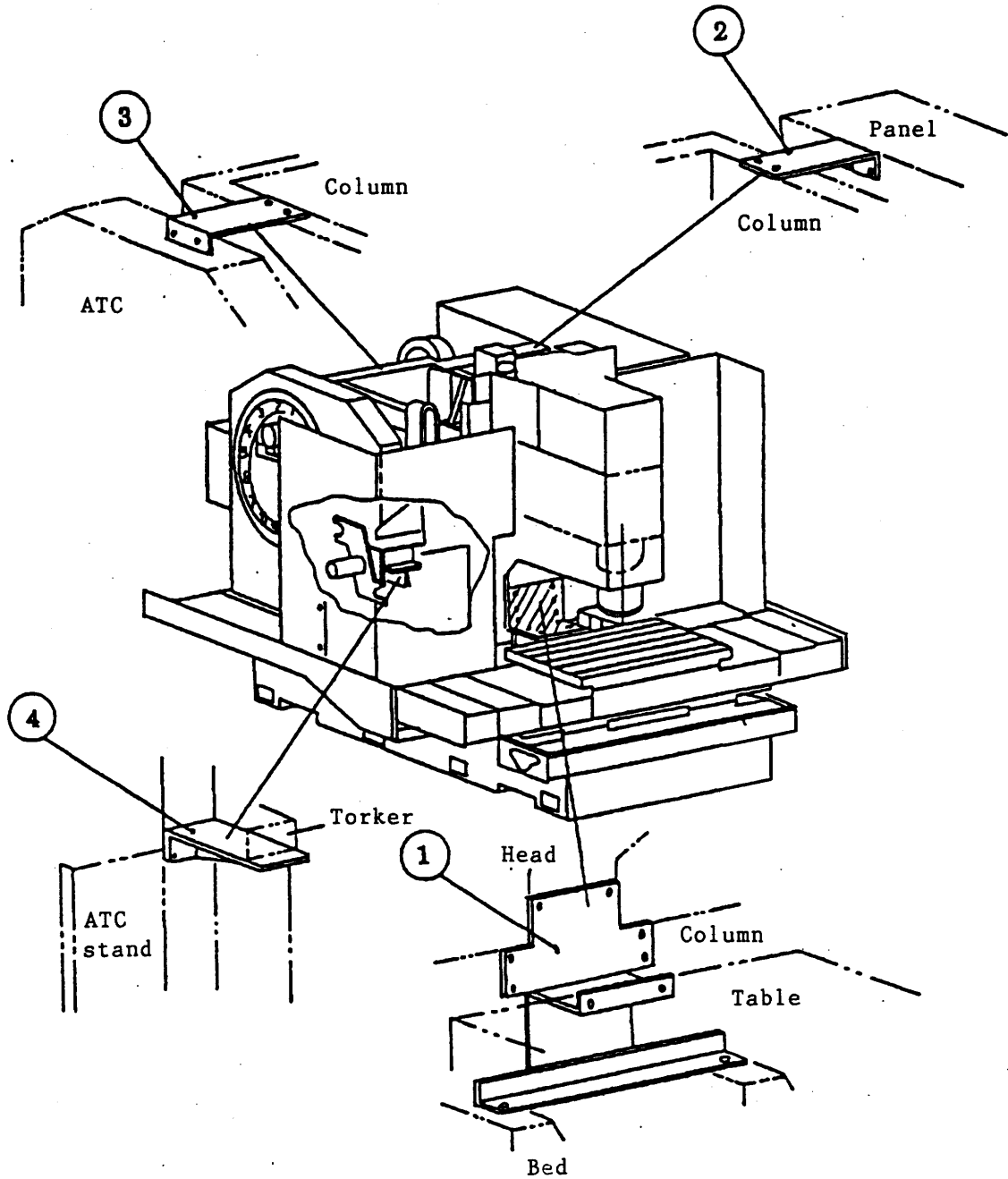
Position of each axis at transport
 X (Table) : Center
 Y (Column) : Center
 Z (Head) : Plus 50mm from bottom
 Machine weight : 7500Kg

< VK II >

(1) Remove of fixture for transfer

The following fixtures should be removed after the machine installed at decided position.

- ① For head, column, table
- ② For column, power cabinet
- ③ For column, ATC magazine stand
- ④ For ATC arm, ATC magazine stand



(2) Installation

One of the element to decide the accuracy of the machine is a leveling. Since proper leveling of the machine is the most basic work not only the accuracy of machining part but also life of the machine, proceed carefully.

First of all, place leveling sheets at setting place and install the machine to put the leveling adjust bolts located machine leg.

Use the level with sensitivity of 0.02mm per meter (Length of level is about 200mm), the level for wordwork or construction is not sufficient.

Handle the level to keep the same direction keep the surface to be placed the level clean and avoid dust between the level and the surface.

● Procedure of installation and outline

① Adjustment of absolute level

Put the level on X and Z direction of the table as shown Fig. 3-1

Ⓐ and measure at three places on each axis respectively.

Adjust by leveling bolt to keep the difference of reading within 0.04mm/m both X and Y directions.

② Adjustment of table motion level

Put the level at the center of the table and move X axis in full stroke.

At this time, adjust the difference of reading of the level within the following target value.

. By the level at X axis direction: 0.04mm/m

. By the level at Y axis direction: 0.02mm/m

③ Adjustment of column motion level

Move the spindle to the lowest limit of stroke and remove a cover on top of the spindle head.

Put the level on the horizontal surface of the spindle head shown in Fig. 3-1 Ⓐ.

Move Y axis nearly full stroke and measure the X and Y direction of the difference of reading of the level and adjust to satisfy the target value. In case of putting the level on the fixture mounted on the spindle (Fig. 3-1 Ⓑ), execute the same procedure.

- . By the level at X axis direction: 0.02mm/m
- . By the level at Y axis direction: 0.04mm/m

- ④ Recheck above procedure 1 to 3 and execute fine adjustment if required.
- ⑤ In case of motion level above procedure 2 and 3 is not stable, possibly floor condition of machine installation is not sufficient, refer to foundation plan and execute check and improvement.

Fig. 3-1 ⑧

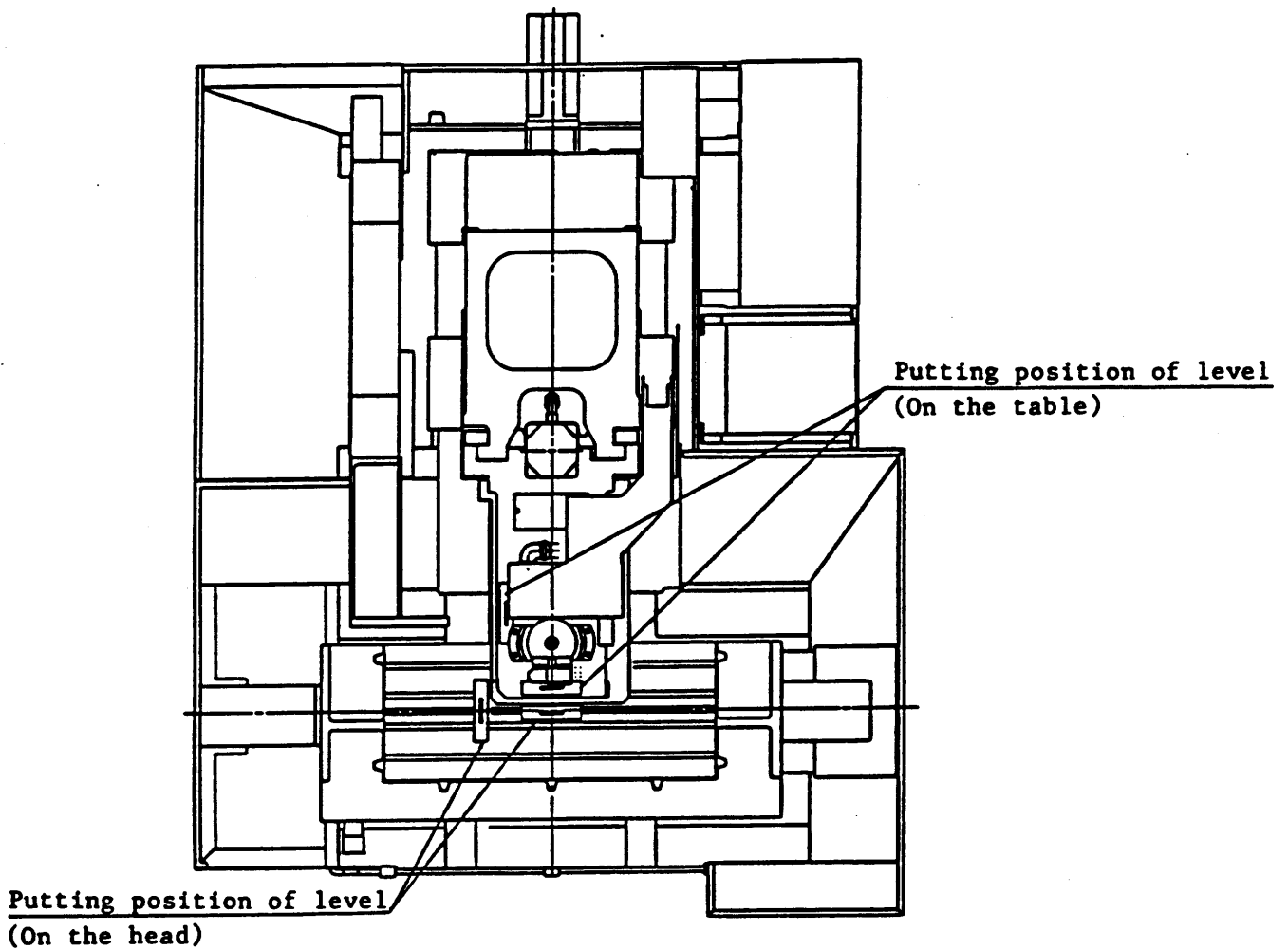
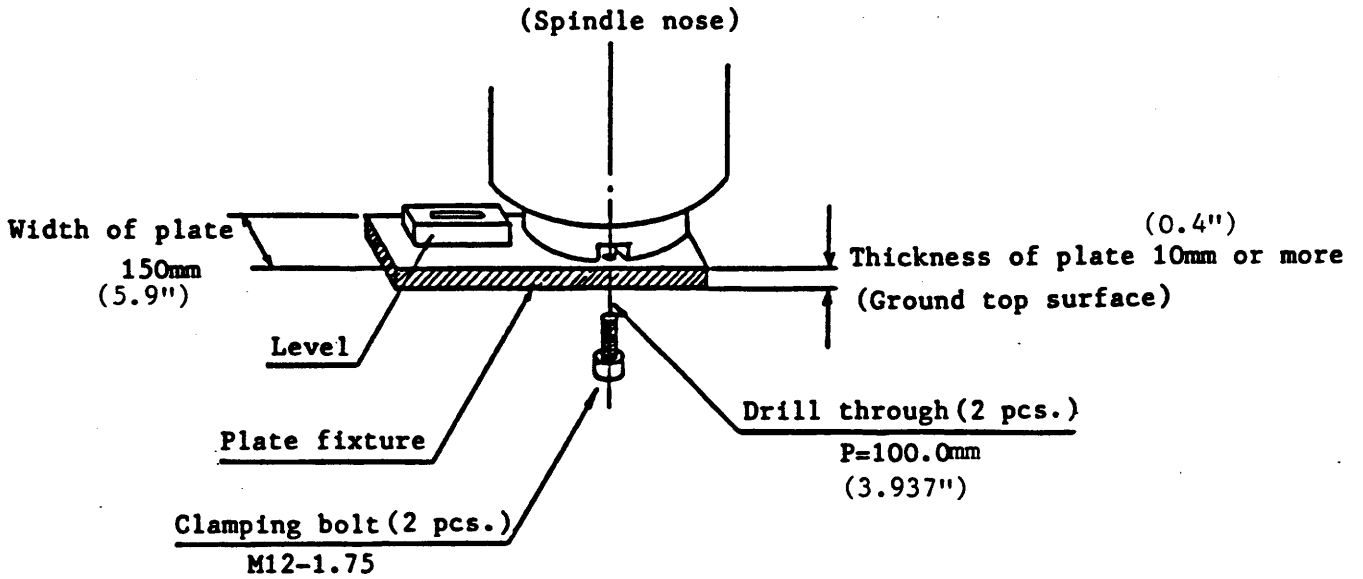


Fig. 3-1 (b) Application example for leveling fixture
(Measurement of column motion level)

Warning! Never rotate the spindle while fixture is used.



6. Lubrication and Oil Supply

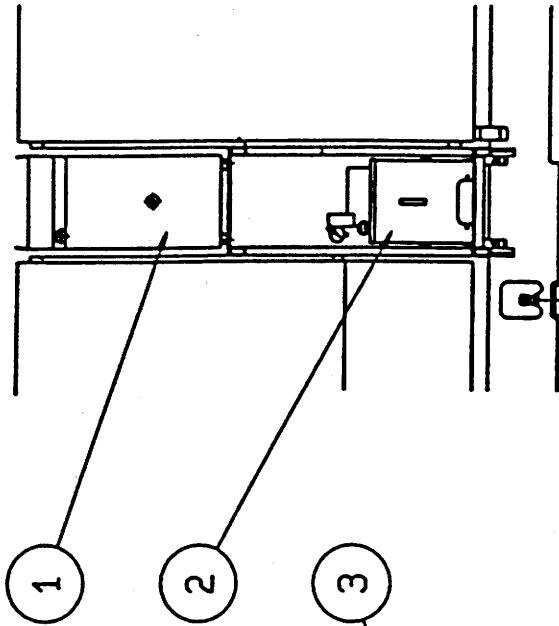
When supplying oil, sufficient care must be taken to the following:

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, do not 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 Fig. 3-1 and Table 3-1.

1. List of Lubrication Oil <VG>

Right side view



Front view

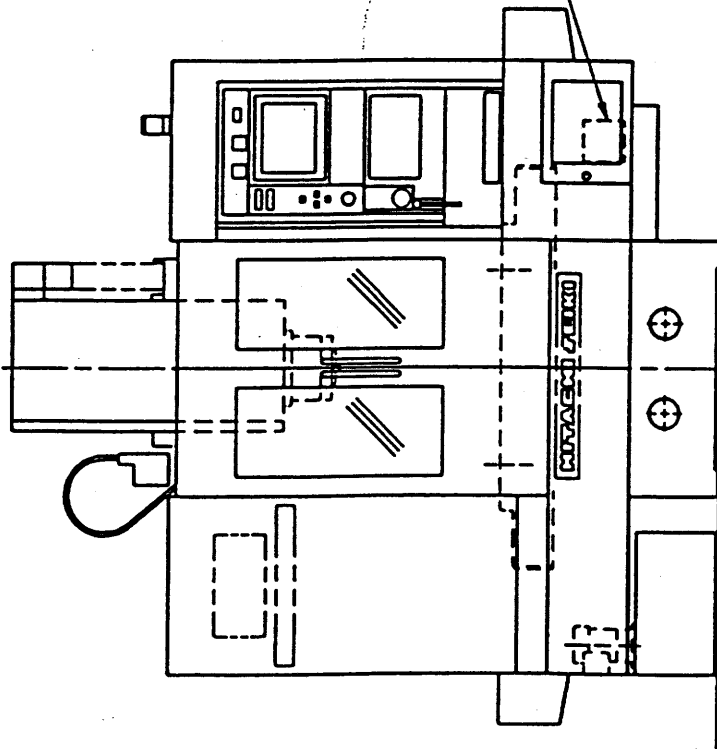
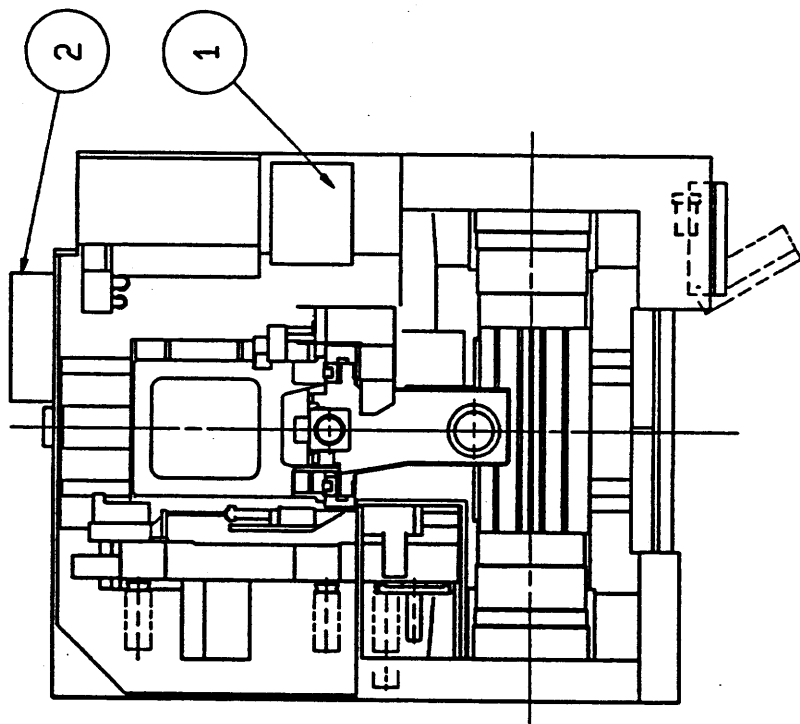


Fig. 3-2

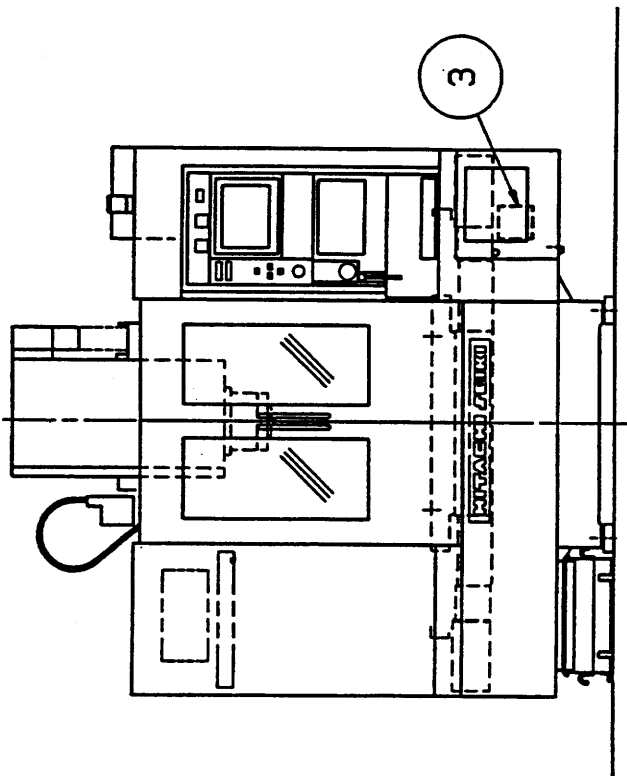
	Supply spot	Method	Frequency	Q'ty	SHELL	MOBIL	ESSO	ISO symbol
1	Spindle cooling	Trochoid pump	Replace every 6-month; replenish occasionally	20ℓ (5.2gal)	Tetra oil 32	Mobil DTE oil light	Unipower MP32	CB32
2	Hydraulic unit	Piston pump	Replace every 6-month; replenish occasionally	15ℓ (3.9gal)	Tetra oil 32	Mobil DTE oil light	Unipower MP32	CB32
3	Lubricating oil tank (Each slide way spindle bearing)	Gear pump	Replenish occasionally	1.5ℓ (0.4gal)	Tona oil T68	Mobil vacetra oil No.2	Febis K68	G-68

Table 3-1

Right side view



Front view



	Supply spot	Method	Frequency	Q'ty	NIPPON OIL	IDEMITSU OIL	SHELL	MOBIL	MITSUBISHI OIL	ESSO	NOK CREMBA	ISO symbol
1	Spindle cooling	Trochoid pump	Replace every 6-month; replenish occasionally	20ℓ	NISSEKI MULPASS 32	DAPHNI SUPER MULTIOIL 32	Tetra oil 32	Mobil DTE oil light	DIAMOND TETRAT 10	Unipower MP32		CB32
2	Hydraulic unit	Piston pump	Replace every 6-month; replenish occasionally	40ℓ	NISSEKI MULPASS 32	DAPHNI SUPER MULTIOIL 32	Tetra oil 32	Mobil DTE oil light	DIAMOND TETRAT 32	Unipower MP32		CB32
3	Lubricating oil tank (Each slide way spindle bearing)	Gear pump	Replenish occasionally	1.5ℓ	NISSEKI MULPASS 68	DAPHNI SUPER MULTIOIL 68	Tetra oil T68	Mobil vacetra oil No.2	DIAMOND TETRAT 68	Febis K68		G-68

Table 3-1

2. Handling of Coolant Equipment < VG >

- 1) Maintenance such as check or clean for coolant tank and accessories are as following procedure.

In case of side or rear discharge type external chip conveyor is attached, make clearance between the floor by turning leveling bolt of the chip conveyor.

Coolant tank can be pulled out to left side of the machine.

There is no overlap if move the chip conveyor 560mm.

- 2) About use of skimmer/since separate lubricant mixed in coolant and dispose it to waste oil box (b) , dispose collected oil by closing valve (a) and remove b before overflow.

Open (a) after setting (b) as empty.

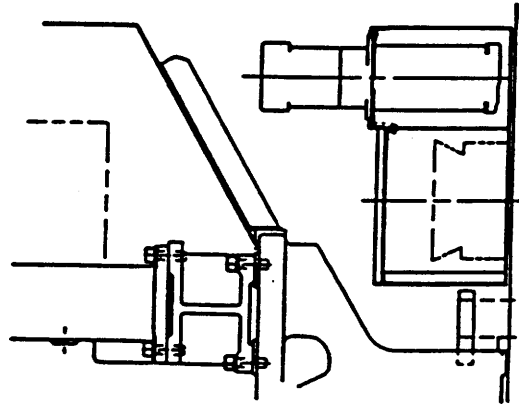
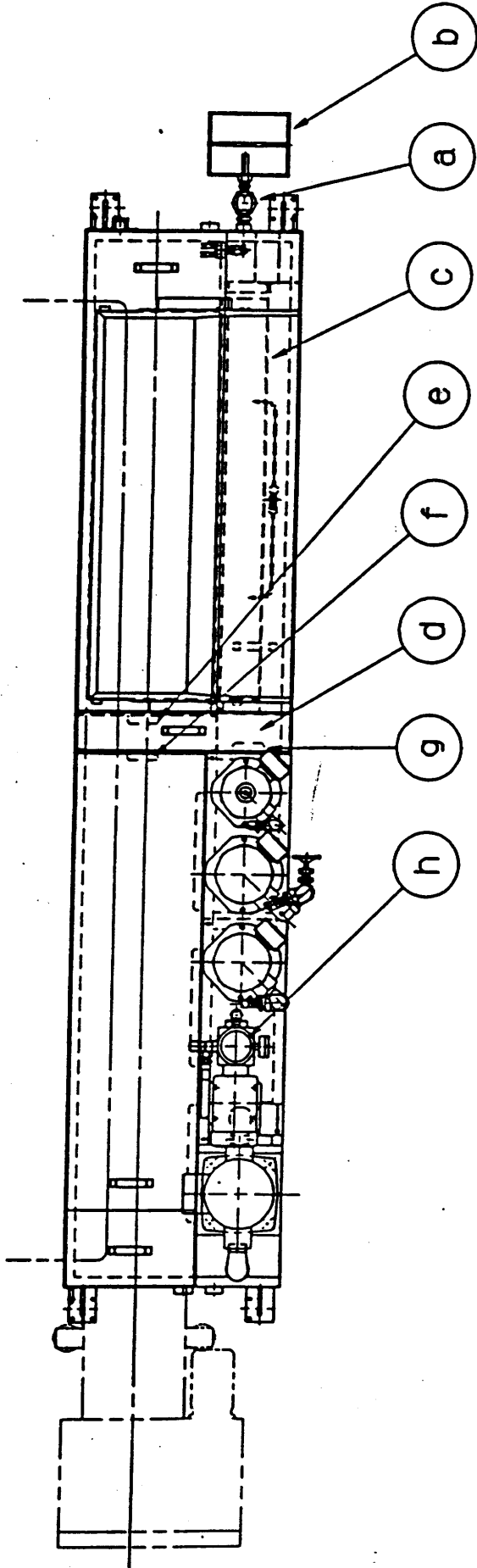
- 3) Cleaning of filter and replacement of element

Remove the tank cover (d) and clean mesh filter (c) (f) (g) in the tank if oil level seems overflow.

Take out by handle of filter, mount again after cleaning chips.

In case of trochoid pump or high pressure vane pump is used as optional accessories, the element should be replaced when indicating scale of suction filter (h) changes from blue to yellow or red.

Coolant tank



Handling of Coolant Equipment <VKII >

- 1) Maintenance(check, cleaning, etc.) of the coolant tank and accessories should be done in the following procedure:

When a side-discharge or back-discharge type external chip conveyor is attached, turn the leveling bolts of its legs to secure a clearance from the floor.

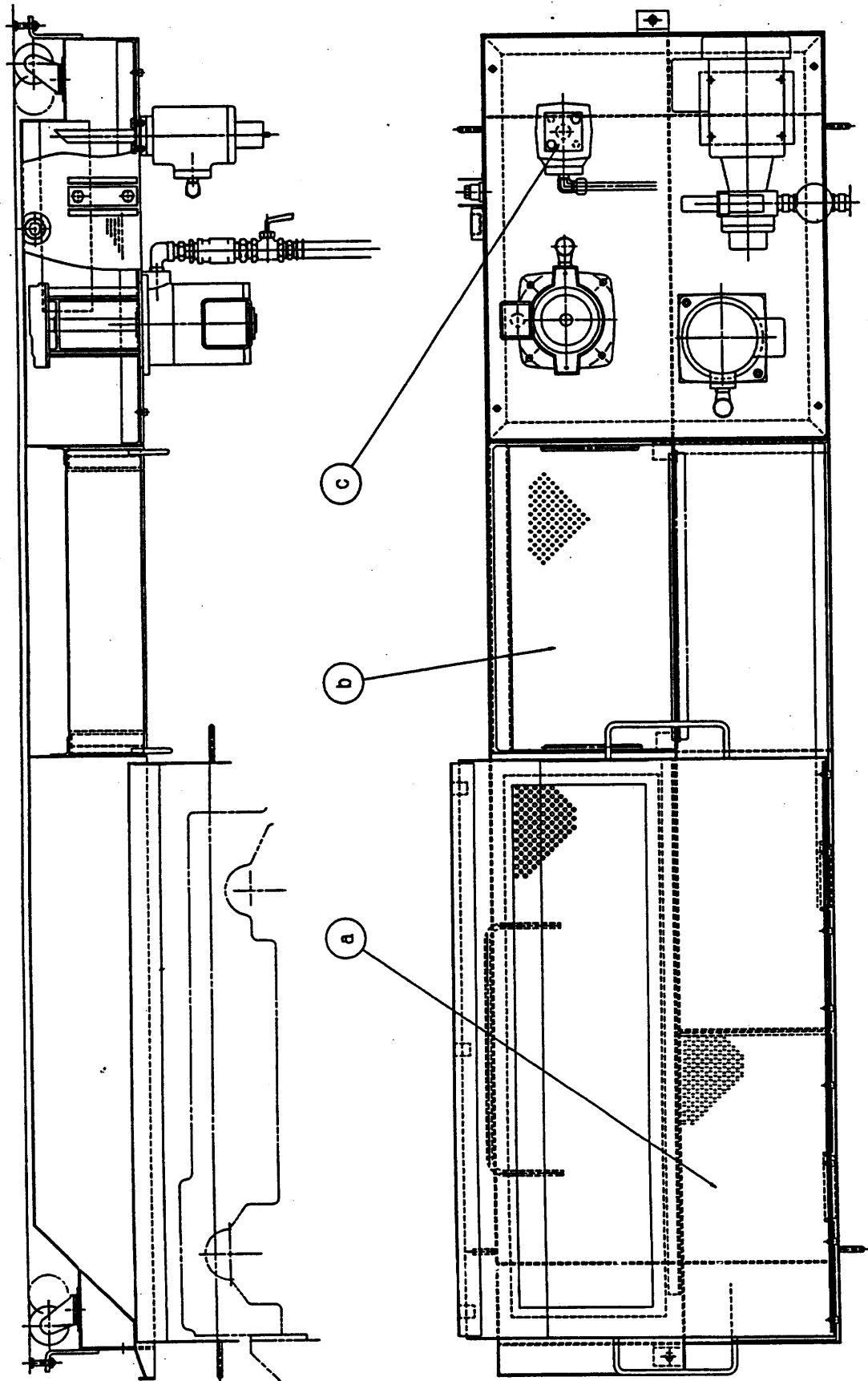
This allows you to pull out the coolant tank to the left side of the machine. At a stroke of approx. 600mm, there will be no overlap with the machine side.

- 2) Cleaning of the filters and replacement of the elements

When cleaning the mesh filter in the tank, remove the chip box ① and take out the filter ②. Also, hold the handle of the filter ③ and detach, eliminate the cutting chips, and then, remount the filter.

When a trochoid pump for oil hole is attached as an option, it is necessary to replace the suction filter ④.

Coolant tank



4) 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 pipings 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 pipings, 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 colour check

Observe the colour eyes.

When the colour is changed to brown, it is presumed that rust may generate. In case of FC and FCD, chips happen to become brown.

When the coolant fluid becomes black, it is presumed that it has been corroded. When the fluid becomes black and gives out a purrid smell on Monday morning or after a long period of holidays, the colour of the fluid may happen to return to the original colour 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 purrid. In this case, replace all the coolant fluid and make flushing sufficiently. The remaining bacteria will cause to repeat the purrid consequently.

2. Check of the purrid smell

Special care must be taken to smell.

When the fluid is filled with purrid 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 purrid 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 tank 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

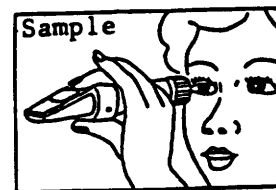
It is the most important procedure to control the density of the fluid when soluble cutting oil is used.

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 of the pH and rust promotion will occur. Generally the density of the cutting fluid is within the extent of 20 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.

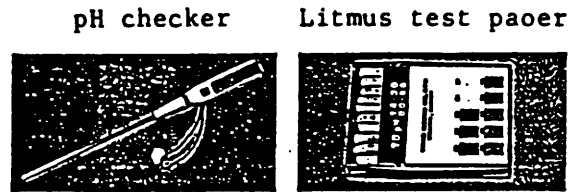


Read a scale watching through eye piece.

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 larger than this, alkaline becomes stronger, that causes the chapping of the skin of the hands.

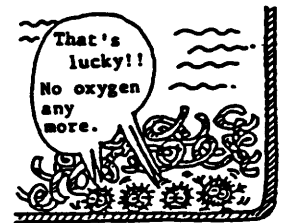
When it becomes smaller, the fluid is acidulated, that causes hastening of rust. Especially when the pH value of the fluid becomes less than 8, care must be taken since rust is hastened rapidly. In this case, replace the fluid.

7. Check of the stagnant sludge

Check whether chips and/or sludge stagnates in the tank and the pipings.

Remove chips and/or sludge from the tank and the pipings 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.

5) 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.

6) Kinds and selection of water soluble cutting fluid

Though the cutting fluid is used for various kinds of purposes, the following 2 points are basically important.

Lubrication: To diminish friction and prevent heat generation

.... To smooth (Anti adhesion)

Cooling : To cool generated heat

Besides, stress tends to be laid on the problems of environments such as washability and chip removal, and it becomes necessary to take the safety factor into sufficient consideration.

The water soluble cutting fluid can be roughly classified to 3 kinds; emulsion type, soluble type and chemical solution type,

The following is a comparison table of respective features.

Type	Emulsion type	Soluble type	Chemical solution type
Feature	<p>A) Since the particle diameter is comparatively large, 4 through 7um and the lubricity is good, it has been used widely and generally for cutting field.</p> <p>B) This type is the water soluble cutting fluid.</p> <p>C) Since it is lacking in safety factor, it is easy to be petrefied and sheds bad smell, that are week points.</p>	<p>A) Since the particle diameter is small, 0.1 through 0.03um, it is excellent in permeability.</p> <p>B) Though this type has been mainly used for grinding, it is currently used for cutting as well owing to development of extreme pressure agent.</p> <p>C) It began to be used for system machines etc. by reason of washability and easy-to-deal.</p> <p>D) Since a lot of surface active agent is used, it is a problem that it is apt to exert a bad influence upon painting.</p>	<p>A) Though this type is mainly used grinding, it began to be used for cutting.</p> <p>B) Since it is excellent in permeability and washability, it is guessed that a chance to be used cutting will be increased.</p> <p>C) Low lubricity is defect in this type.</p> <p>D) Since it is apt to act upon painting agent chemically, it is problem that it is apt to exert a bad influence upon painting.</p>
Configuration	When dissolving it in water, it becomes milk-ly. (Resulted from the reflection of light due to large particle of oil in solution.)	When dissolving it in water, it becomes almost semitransparent. (Resulted from light passage due to extremely small particle of oil in solution.)	Though it is generally transeparent as water, there are various kinds of oil according to maker's specification.
Lubricity	○	○	×
Coolant power	△	○	○
Rust prevention	○	○	○
Putrefy resistance	×	○	○
Washability	△	○	○
Paint resistance	○	×	×
Nonferrous	○	○ (Some other time X)	×
Permeability	△	○	○
Environment	△	○	○

Cutting fluid bringing results in HITACHI SEIKI

Name	Type	Manufacturer	Feature
S2000	Emulsion	Mitsui Oil Handling	Hard-to machine, Deep holes, Rolled tap
NEOS 45H	Emulsion	Neos	General cutting (Cast iron, Steel)
ML 0731	Emulsion	Dularon	General cutting, Serves for lubrication oil
UNISOBLE SC	Soluble	Nippon Sekiyu	General cutting
CEMICOOL SR5	Soluble	Chemica	Cast iron, Rust, Dirt
LUSOL 84	Chemical solution	Mitsui oil Handling	Wash, Dirt

Cutting fluid desired to contact at usage

Name	Type	Manufacturer	Feature
LUSOL 84	Chemical solution	Mitsui oil Handling	Sufficient control is required.
MICROCUT 5551-LH	M-emulsion	Nippon quaker chemical	Rust is apt to generate.
DUFFNY SEMICOOL ME	Anit-emulsion	Idemitsu Kosan	Influence to painting.

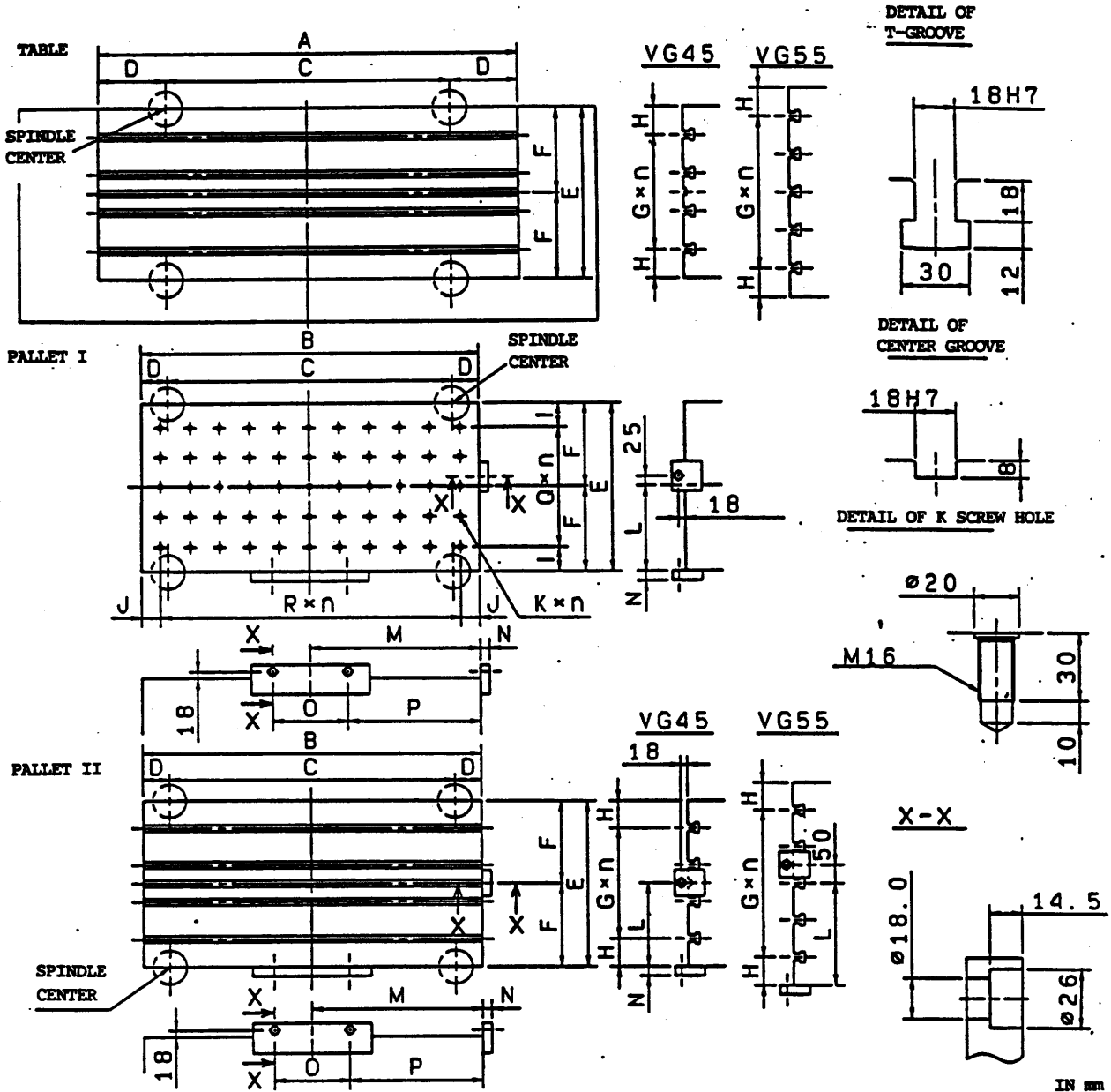
7. Check Before Trial Operation of the Machine

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.
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 breaker (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 CRT.
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) For hydraulic : To start by the "Standby" button.
To stop by the "Power source" button OFF.
 - (2) For lubrication oil: To start by the "Standby" button.
 - (3) For spindle : To start by the spindle "Start" button.
To stop by the "Stop" button.
 - (4) For cutting fluid : To start by the coolant button.
To stop by pressing the button again.
 - (5) For chip conveyor : To start by the chip conveyor button.
To stop by pressing the button again.
6. Adjust the pressure of the hydraulic unit to the setting pressure, 5Mpa { 50kg /cm² } .

Chapter 4 REQUIRED DIMENSION FOR MACHINING

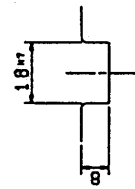
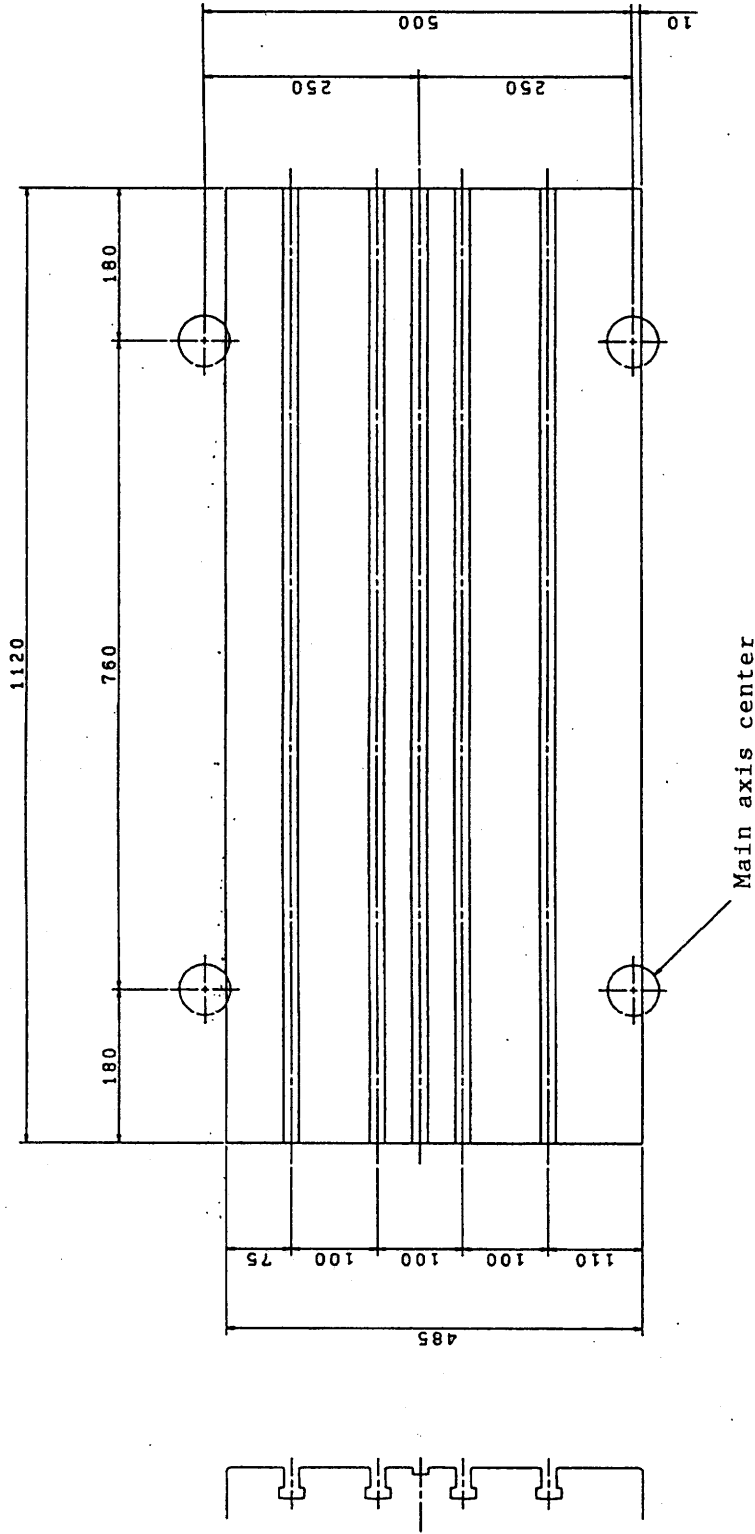
Table Dimension and Work Area Drawing <VG>



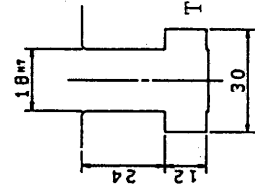
	VG 45	VG 55	REMARKS	
TABLE	A	1120	1500	
	C	760	1000	STANDARD STROKE
		900	1200	LONG STROKE
	D	180	250	STANDARD STROKE
PALLET I	B	110	150	LONG STROKE
	B	900	1200	
	C	760	1000	
	D	70	100	
PALLET II	B	900	1200	
	C	760	1000	
	D	70	100	
	E	450	560	
F	225	280		
G × n	100 × 3	100 × 4		
H	75	80		
I	65	80		
J	50	100		
K × n	M16 × 55	M16 × 55		
L	225	280		
M	450	600		
N	25	30		
O	200	270		
P	350	465		
Q × n	80 × 3	100 × 4		
R × n	80 × 10	100 × 10		

< V K II (45) >

1. Table



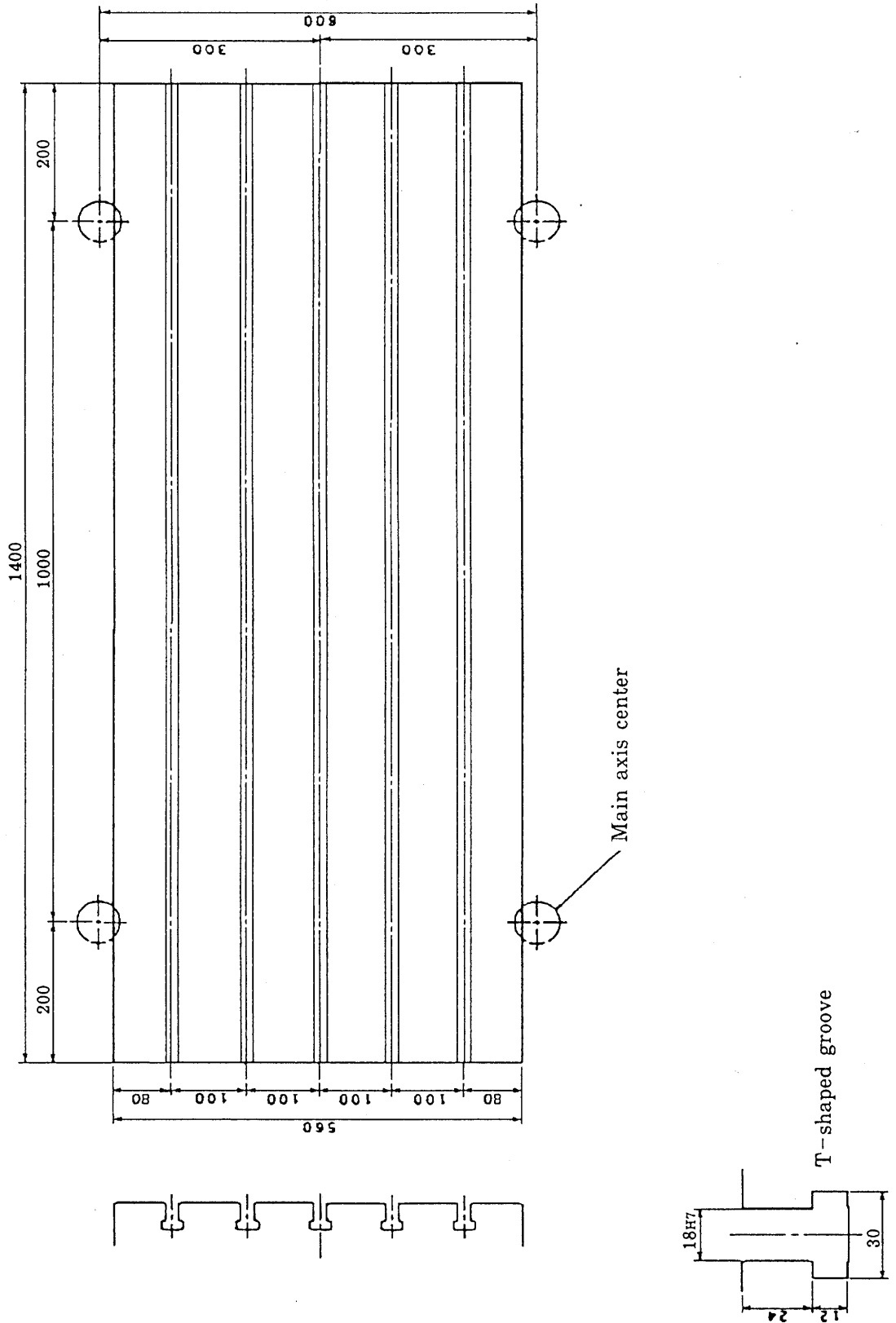
Key-shaped groove



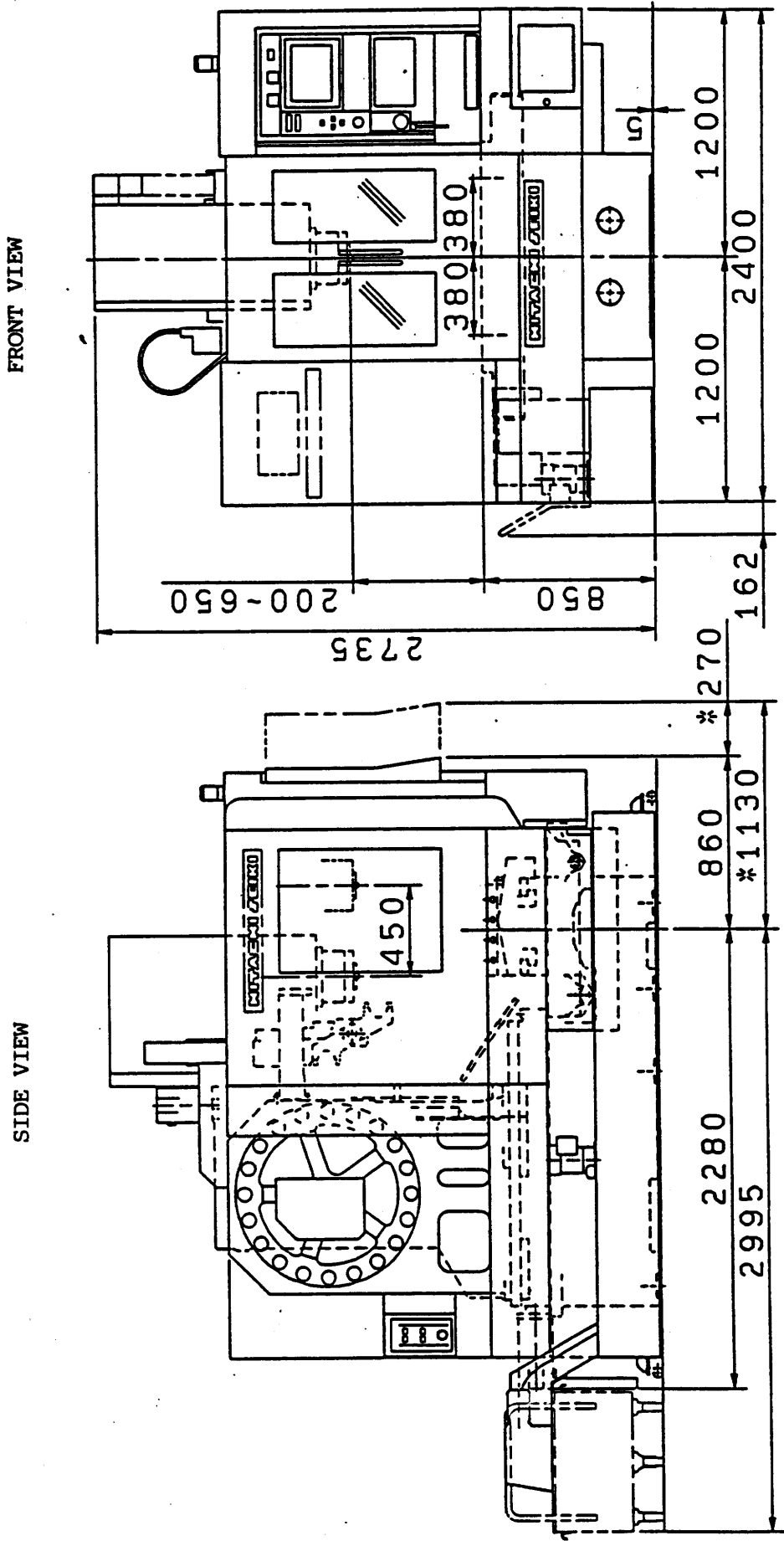
T-shaped groove

< V K II (55) >

Table



2. Stroke of Each Axis and Machine Original Point <VG>

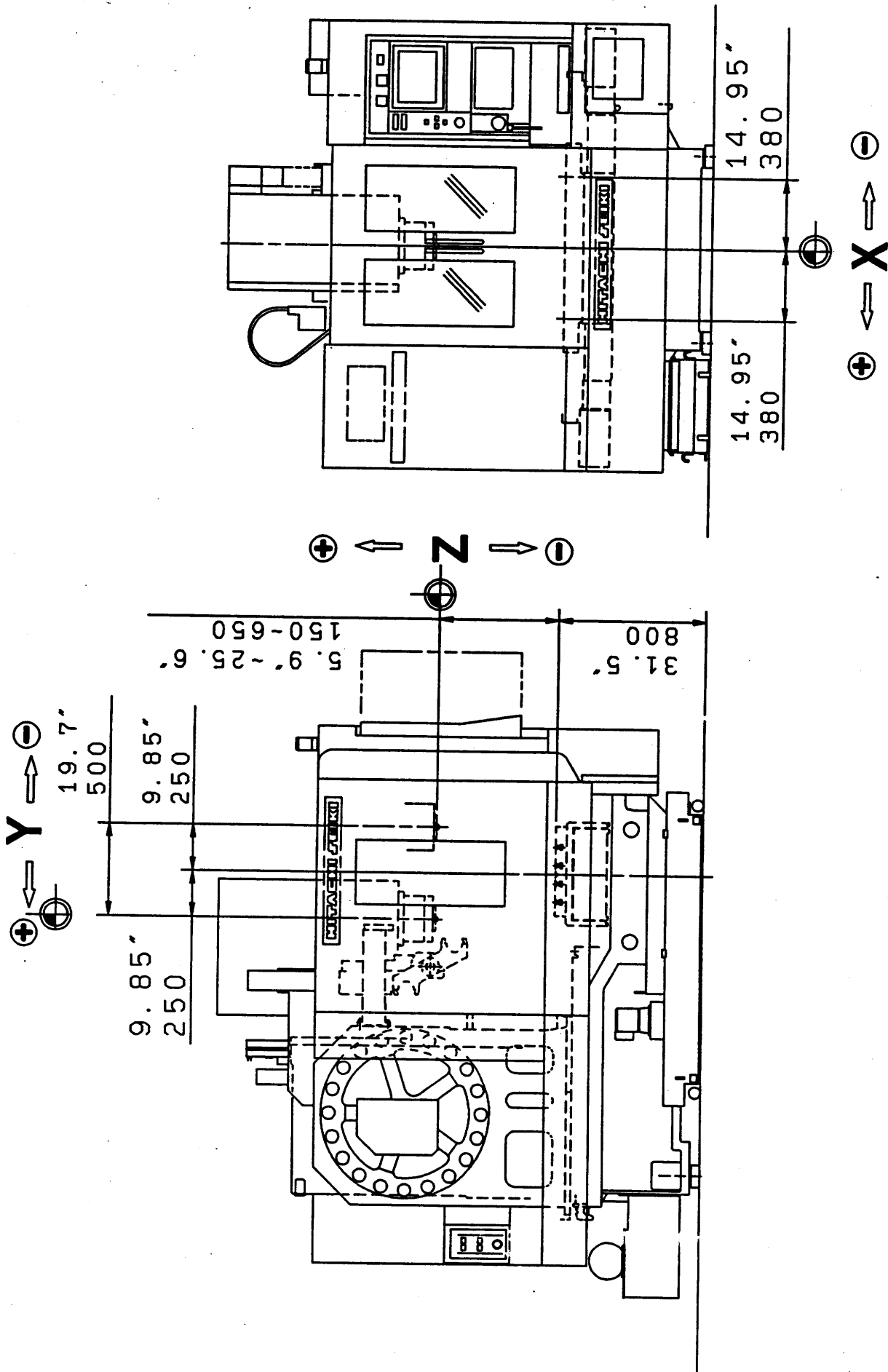


FRONT VIEW

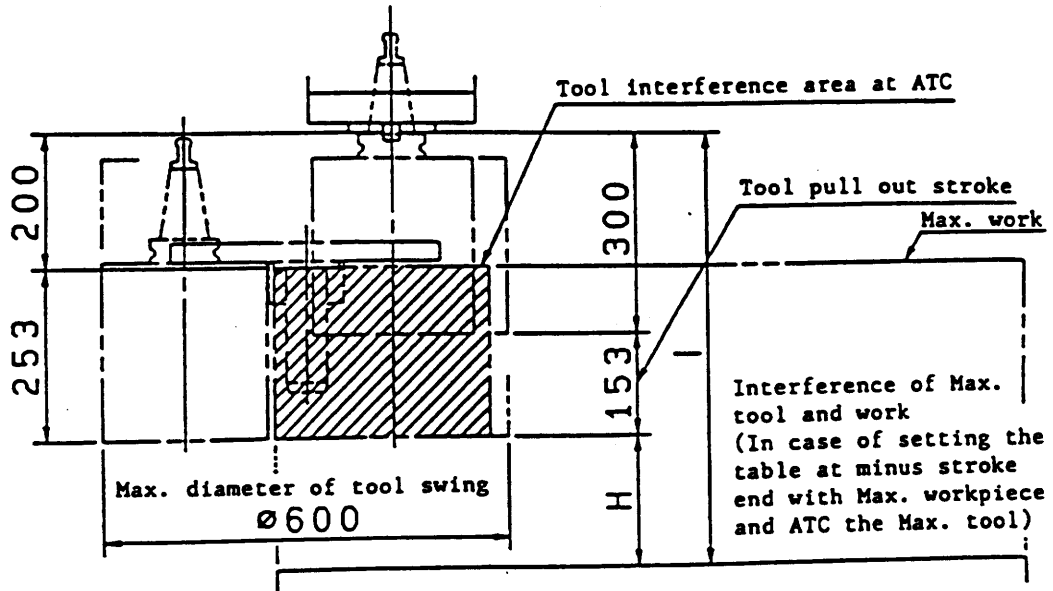
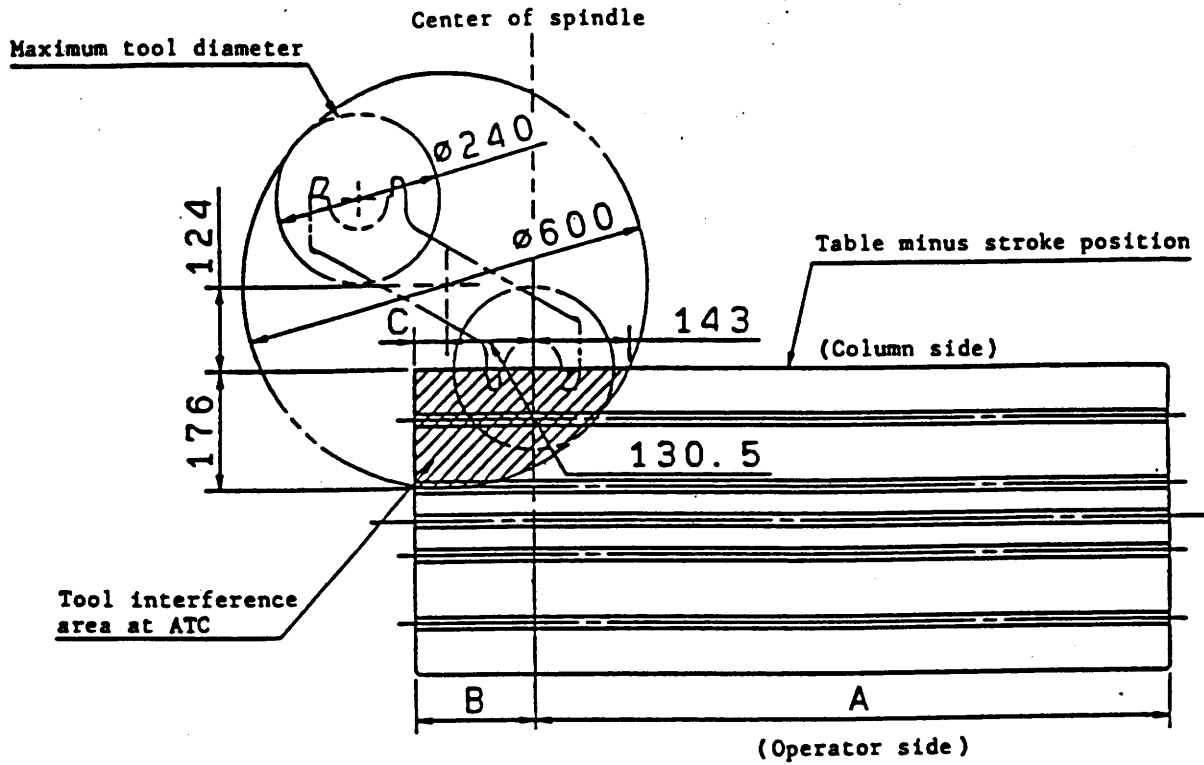
SIDE VIEW

Major Dimension Drawing

Stroke of Each Axis and Machine Original Point <VKII >

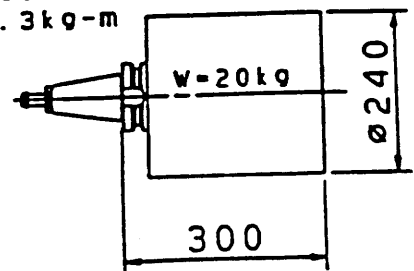


Relative Drawing of Work and ATC <VG>



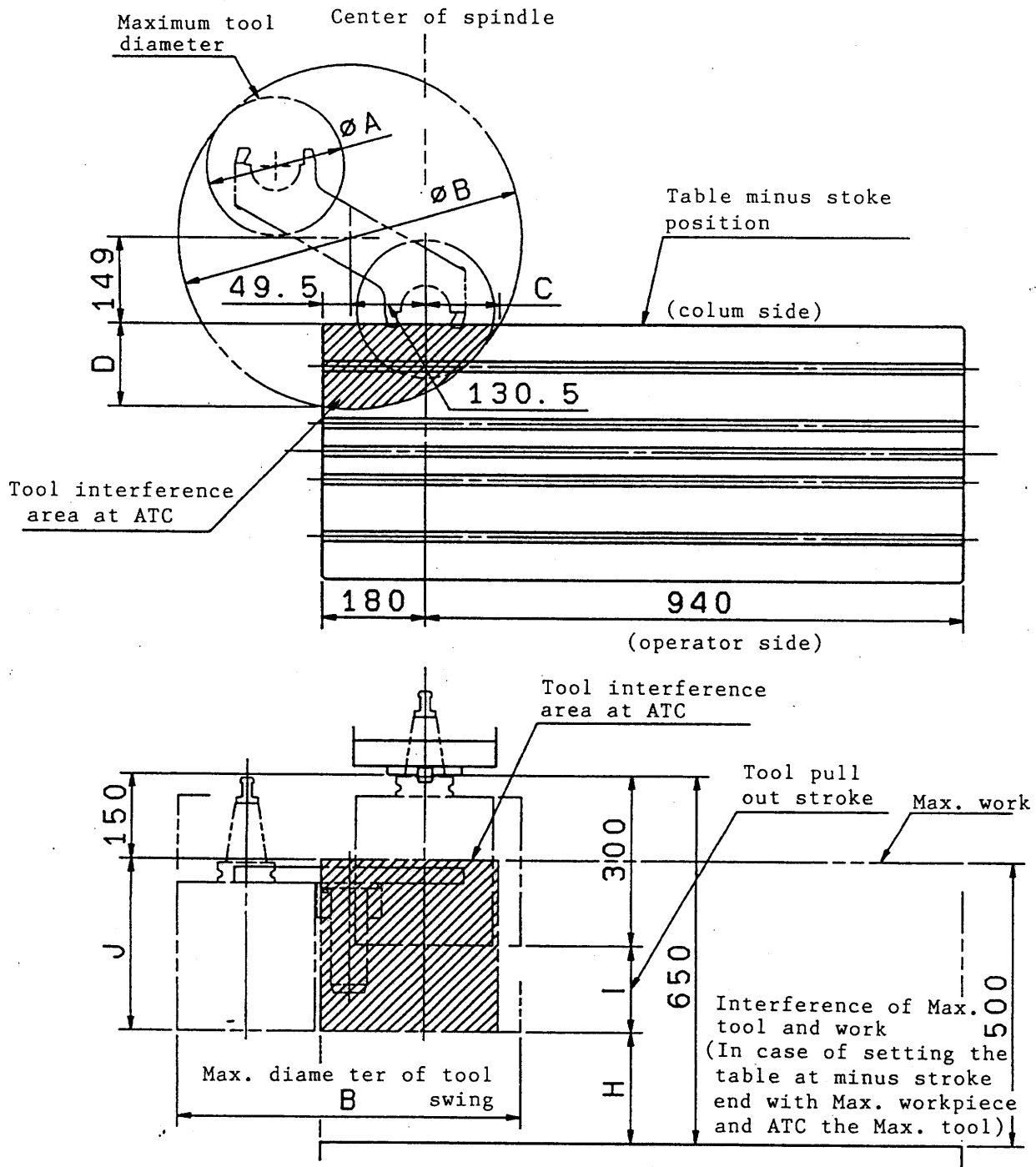
	VG45	VG55
A Maximum	940	1250
B Minimum	180	250
C	49.5	119.5
H Minimum	197	307
I From table top to spindle nose at ATC	650	760

Max. moment of tool
NT50
2.3 kg-m



3. Relative Drawing of Work and ATC

< V K II (45) >



	VK45-40	VK45-50
A Maximum	180	180
B Minimum	540	540
C	95	95
D	121	121
H Minimum	240	197
I From table top to spindle nose at ATC	110	153
J Tool and work interference area	260	303

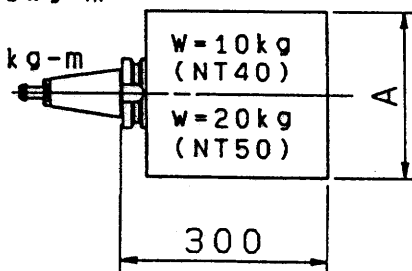
Max. moment of tool

NT40

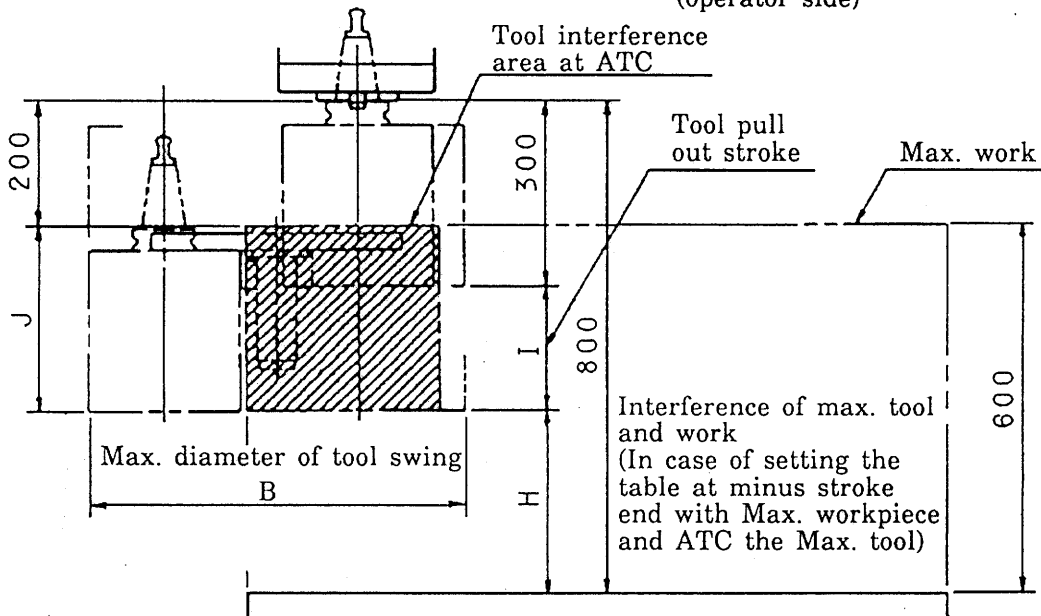
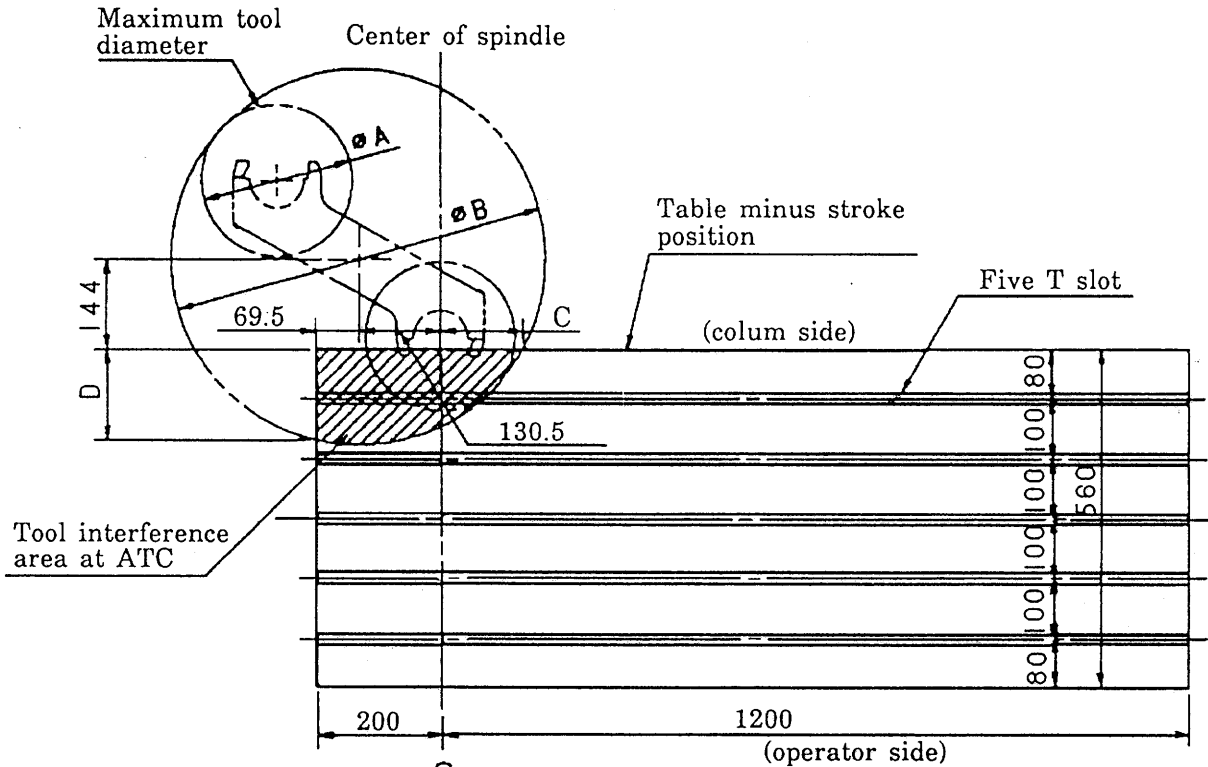
1.35 kg-m

NT50

2.3 kg-m



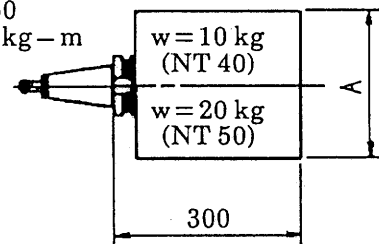
< V K II (55) >



	VK55-40	VK55-50
A Maximum	240	240
B Maximum	600	600
C	133	133
D	156	156
H Minimum	390	347
I From table top to spindle nose at ATC	110	153
J Tool and work interference area	210	253

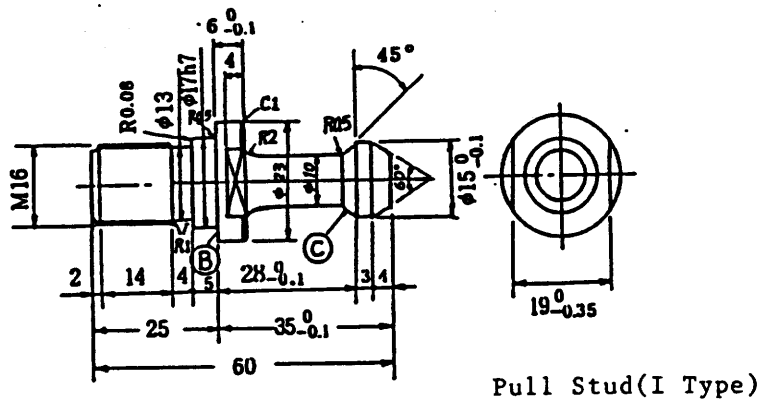
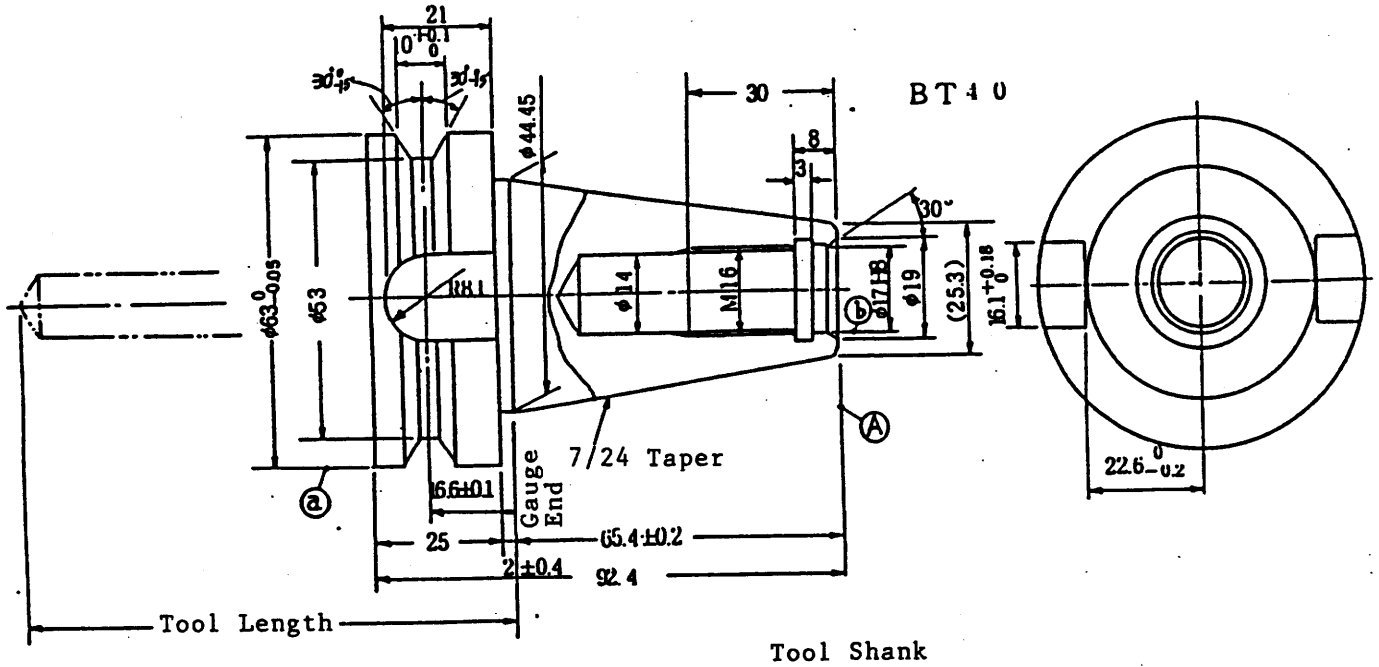
Max. moment of tool

- NT 40
1.35 kg-m
- NT 50
2.3 kg-m



4. Tool Shank (BT40, 50)

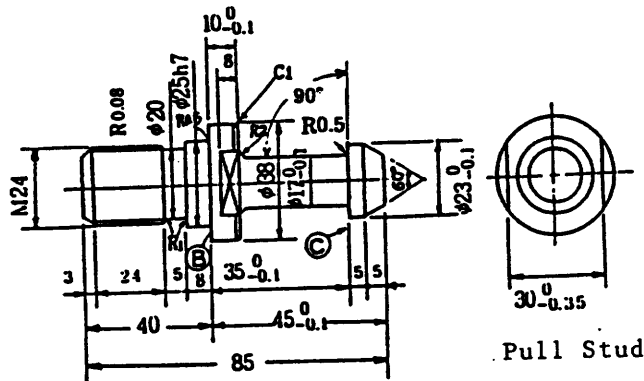
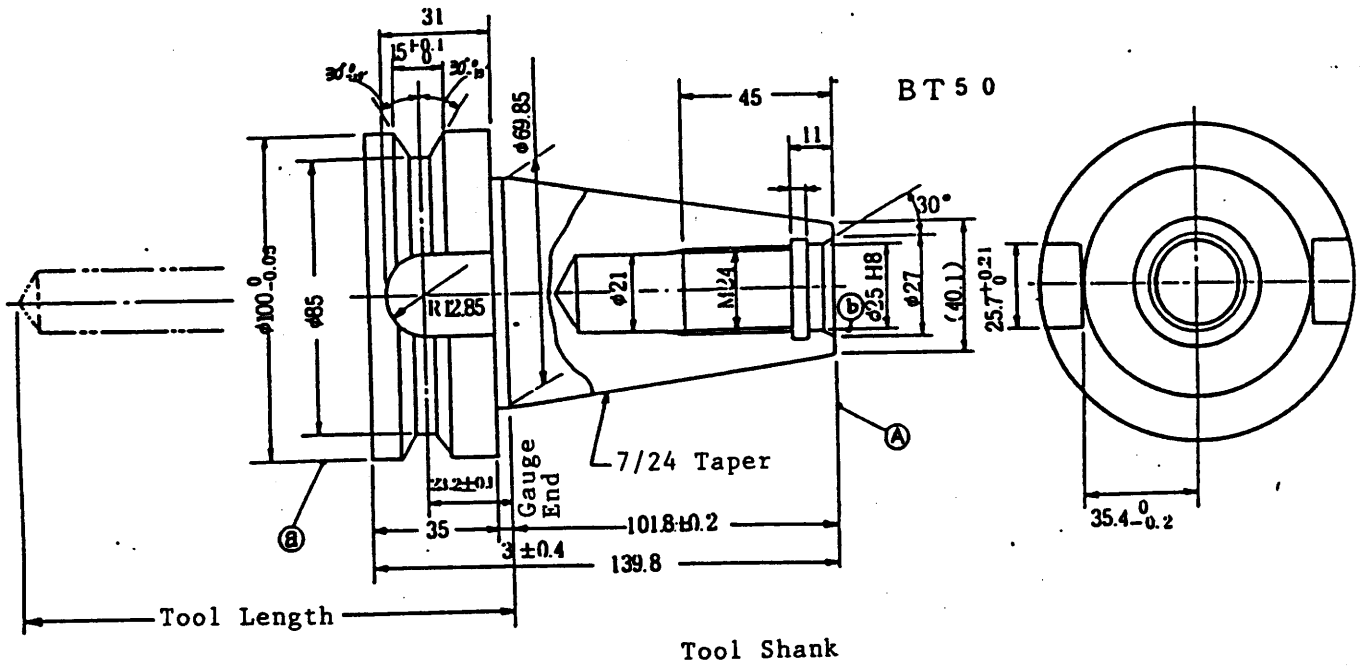
Tool Shank(BT-50) and Pull Stud Bolt



1. Concentricity of the taper shank to (a) and (b) should be 0.025mm.
2. Squareness of the taper shank to the surface A should be 0.015/100.
3. Offset to the center of the 16.1 groove should be 0.06mm.
4. Taper tolerance should be +0.000063 or 0(JIS B0612-1965, 4T).
5. Threads should conform to the JIS B0205-1968 and their accuracy should be Grade-2 of the JIS B0209-1968.
6. Squareness of the surface B and concentricity of the surface C to the center line of $\phi 17 h7$.

4. Tool Shank (BT40, 50)

Tool Shank(BT-40) and Pull Stud

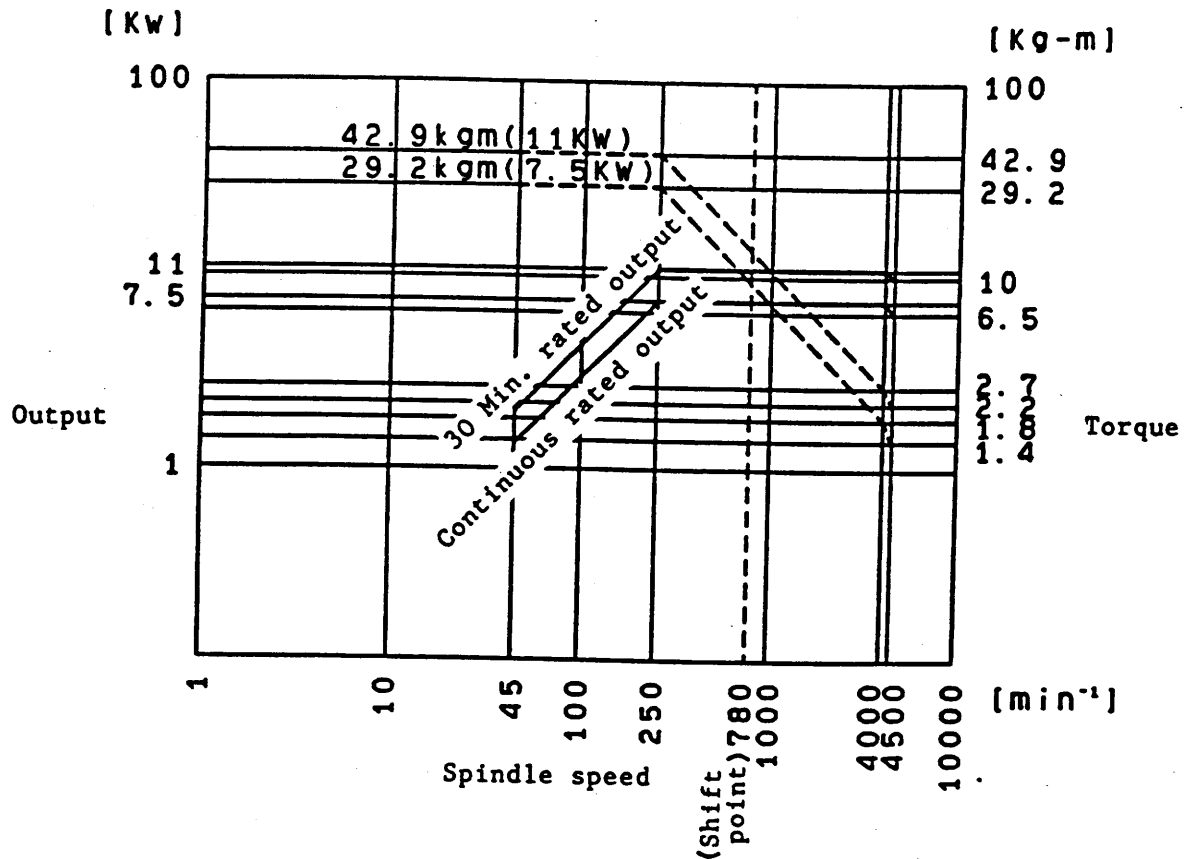


1. Concentricity of the taper shank to (a) and (b) should be 0.025mm.
2. Squareness of the taper shank to the surface A should be 0.015/100.
3. Offset to the center of the 25.7 groove should be 0.06mm.
4. Taper tolerance should be +0.000063 or 0 (JIS B0612-1965, 4T).
5. Threads should conform to the JIS B0205-1968 and their accuracy should be Grade-2 of the JIS B0209-1968.
6. Squareness of the surface B and concentricity of the surface C to the center line of $\phi 25$ h7.

5. Spindle Speed-Torque Diagram <VG>

Standard type [45~4500 min⁻¹{rpm}]

Spindle speed . output-torque diagram



How to read the diagram

Read the spindle speed to be used on the bottom scale and trace from the point to above and read the intersection with thick line by left side scale, the maximum output (KW) is known at this spindle speed.

Read the spindle speed to be used on the bottom scale and trace from the point to above and read the intersection with thick line by right side scale, the maximum output torque (Kg-m) is known at this spindle speed.

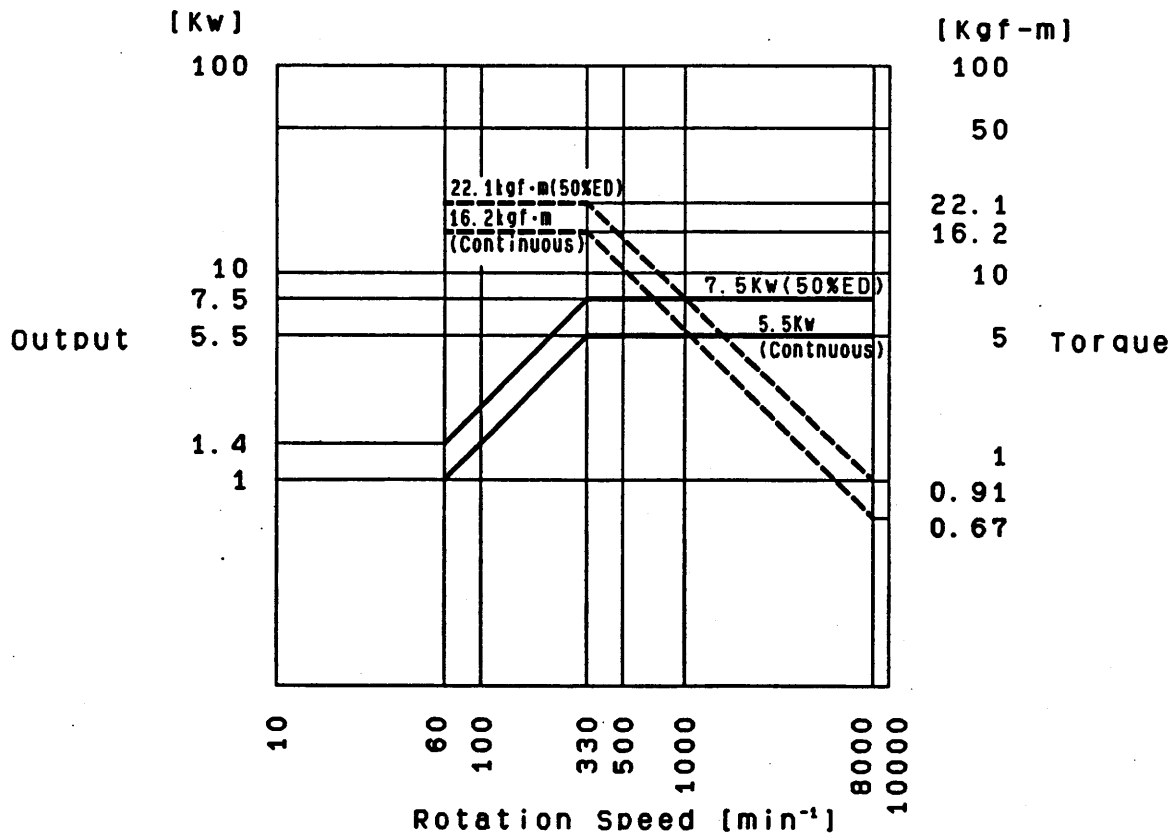
Maximum output is smaller than 75KW at the spindle speed is slower than 250 min⁻¹{rpm}.

Upper line on the diagram is short time rating.

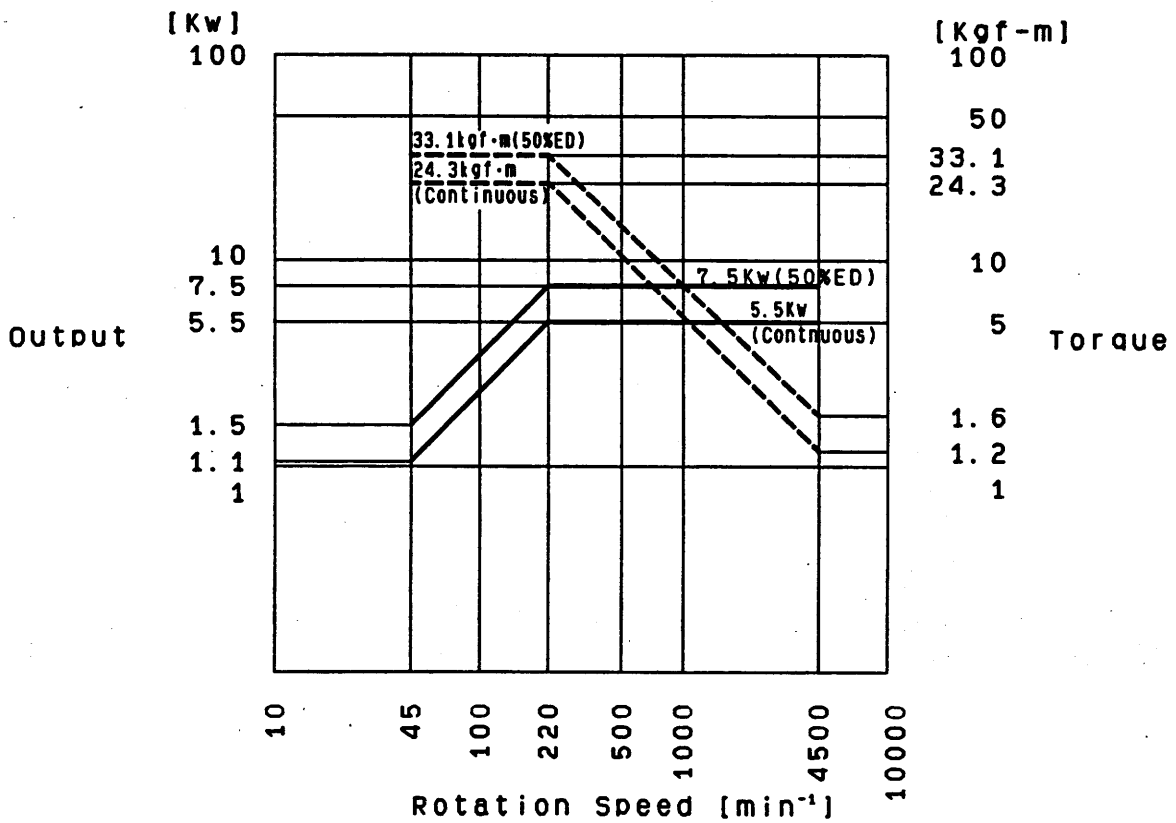
Use lower line at continuous machining.

Spindle Speed-Torque Diagram <VK II >

NT40 Spindle [60~8000(min⁻¹)]



NT50 Spindle [45~4500(min⁻¹)]



Chapter 5 OPERATION OF MACHINE

5-1 Operation panel

5-1-1 Machine Operation Panel

Group No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
<p>No Note: When you operated a function which the specifications do not allow, the lamp of that push button switch blinks, and the alarm lamp ⑧ and call light are turned on. Also, "THIS OPTION IS NOT PREPARED" is displayed on the CRT.</p>						
①	Mode selector switches	These are used for selecting operation modes: "MDI", "PROGRAM EDITING", "MEMORY AUTOMATIC OPERATION" and "TAPE AUTOMATIC OPERATION".	o	o	o	
②	Function selector switches (Push a necessary function switch with the "SELECT" switch pressed.)	CANCEL Z ... A machine lock condition is applied to the Z axis only. It is convenient if used for a program test run.	o	o	o	o
		MACHINE LOCK ... Only a display proceeds omitting axial moves of the machine. This function enables checking of program coordinate values without moving the axes.	o	o	o	o
		DRY RUN ... A manual jog feed rate become valid instead of a feed rate specified by the program.	o	o	o	
③	Spindle rotation effective key	These push button switches start and stop the spindle. (It is necessary to specify a spindle speed in advance.)	o	o		o

Gropo No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
④	Mode selector switches	These are used for selecting operation modes: "FEED", "RAPID TRAVERSE" and "ZERO RETURN".				
		FEED ... This mode enables a manual continuous feed. A feed axis and its direction are selected by the axis move push button switches ⑥, and a feed rate by the FEEDRATE ② switches.	o	o		o
		RAPID ... This mode enables a rapid traverse. A rapid traverse axis and its direction are selected by the push button switches ⑥, and a rapid traverse rate (override) by the RAPID OVERRIDE push button switches ⑦.	o	o		o
		ZERO RETURN ... This mode enables zero return. An axis to be returned to the reference point is selected by the push button ⑥. An override of 25% is applied to the feed rate. In zero return operation, each axis shall be moved from its ⊖ direction to its ⊕ direction toward the reference point. When zero return is completed, the green lamp located at ⑥ lights up from flickering.	o	o		o

Grove No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
⑤	Program START /STOP switches	START ... IN the AUTO or MDI mode, this push button switch start the program. While this push button switch is pressed and the program is running, a green lamp located above lights up.	o	o	o	
		STOP ... This push button switch suspends a program's progress. An axis being operated stops and a red lamp located above lights up. During operation by an auxiliary command (M, S or T), the program's progress stops after executing the remaining action of respective command.	o	o	o	
⑥	Axis move switches	These push button switches move the X, Y, Z and A (optional) axes respectively. Axis selection and its moving direction abide by the indication given on the respective push button switches. For a feed rate, select among the FEEDRATE switches ②②. When performing zero point return, press the button for zero point direction (⊕).	o			o
⑦	Initial position check check	APC INITIAL POSITION ... This lamp indicates that each machine section is located at its specified position, when executing an automatic pallet change (APC) command.		o	o	

Grove No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
		ATC INITIAL POSITION ... This lamp indicates that each machine section is located at its specified position, when executing an automatic tool change (ATC) command. During T cycle operates, this lamp lights up.		o	o	
⑧	Status display lamp	ALARM ... A red lamp lights up when an alarm occurred.		o	o	o
		PROGRAM STOP ... When M00 or M01 is executed during operation in an automatic mode, a red lamp lights up. It is lit off by starting or continuing the program.		o	o	
⑨	Automatic power shut-off switch	This makes the automatic power shut-off function effective. After machining cycle is completed, the power is automatically shut-off by M30 when no pallet exists.	o	o	o	
⑩	Call right off switch	This switches off the lighting call light (yellow lamp) melody.	o		o	o
⑪	Work setter	Makes the following functions effective, making use of a reference touch tool:				
		TOOL SETTER ... Measures a tool length and a tool diameter and automatically sets their offset amounts in the offset memory.	o	o		o

Grove No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
		REF. SURFACE, REF. HOLE ... Measures the coordinate system shift amounts of the reference surface and hole against the machine coordinate system and sets them in the coordinate system shift memory.	o	o		o
		COORD ALIGN ... By measuring 3 points on the orthogonal or jig located on the X-Y plane, differences in rotation angle with the X and Y axes are calculated and stored, thus compensating X-axis and Y-axis program coordinate values.	o	o		o
⑭	Override (Option)	MEMORY: Stores optimum override values (feed rate, spindle speed which were found out at the time trial cutting, etc.), for each block correspondingly and corrects the program automatically after execution of M30.	o	o	o	
		AUTO: Enables the override memory function.	o	o	o	
⑮	Feedrate override switches	These push button switches apply an override (ranging from 0 to 200%) to a feed rate in automatic (cycle) operation. During a canned cycle for tapping, the override is ignored, resulting in 100%.		(Rotary switch)	o	

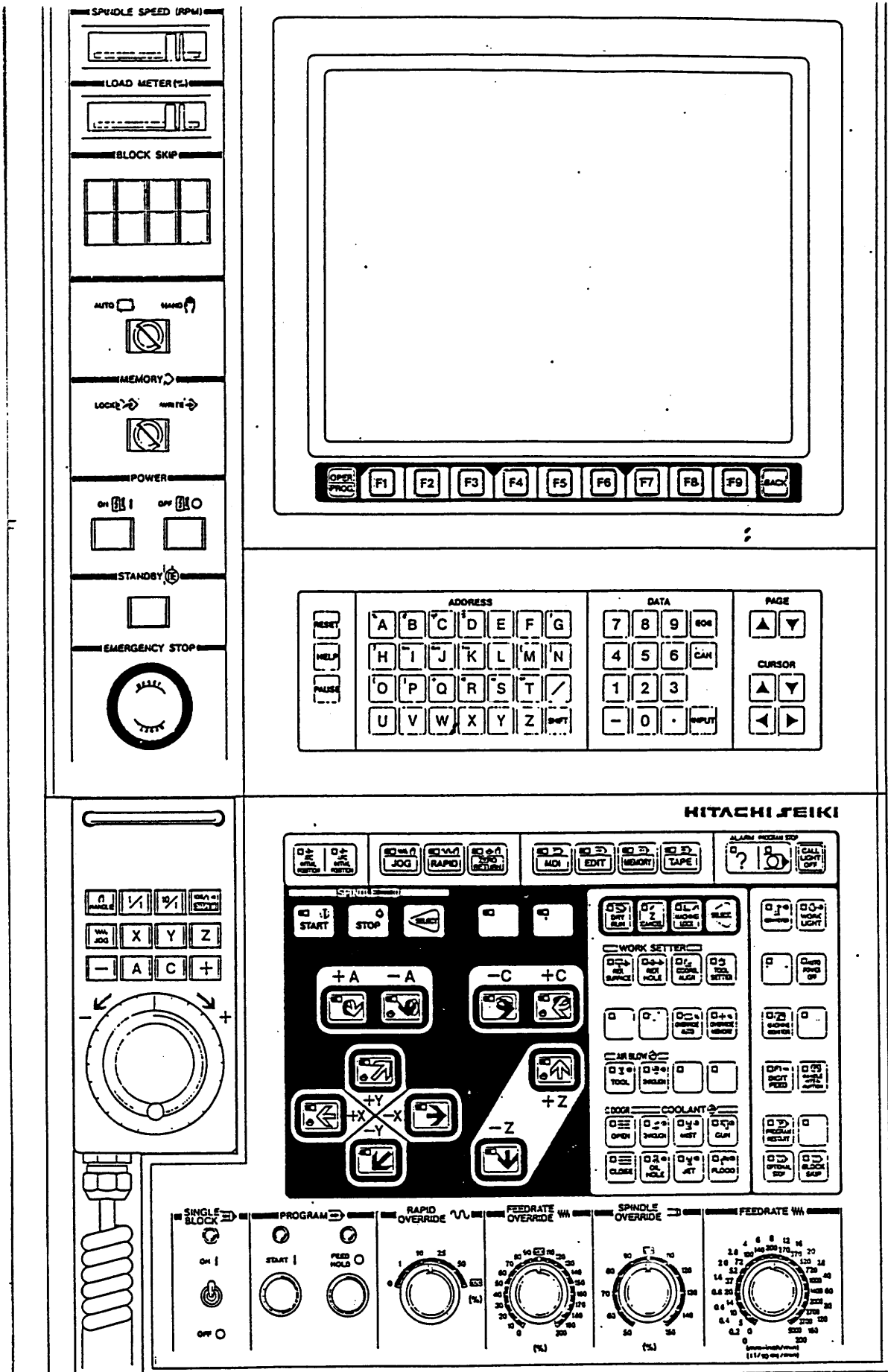
Grove No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
⑩	Spindle override switches	These push button switches apply an override (ranging from 50 to 150%) to a spindle speed command.	(Rotary switch)		o	o
⑪	Rapid override switches	These push button switches apply an override (ranging from 0 to 100%) to a specified rapid traverse rate. When the power is turned ON, the override value becomes less than 25%. In the manual operation, the rapid traverse rate becomes 0 ~ 25%. Note) The manual feed is not available in 0%.	(Rotary switch)		o	o
⑫	F1 digit feed switch (Option)	The "F1 DIGIT FEED" becomes effective by pressing this switch and the indication lamp lights up. This becomes ineffective by repressing this switch and the indication lamp puts out. When the F1 DIGIT FEED" is not provided as option, this switch becomes ineffective and the indication lamp puts out. While the F1 digit feed is effective, when 1 digit number of 1 ~ 9 succeeding F is commanded, feed rate set corresponding to its number is obtained.	o	o	o	
⑬	Conveyor switch	This push button switch runs the chip conveyor.	o	o	o	o

Grove No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
20	Work light switch	This push button switch turns on a work light.	o	o	o	o
21	Coolant switches	These push button switches work various kinds of coolant indicated on them respectively. Each kind of coolant can be turned ON/OFF manually even during automatic operation.	o	o	o	o
22	Feedrate switches	These push button switches select a manual jog feed rate between 0mm/min and 5,000 mm/min. (In case of the A-axis, it becomes between 10 deg/min and 1,400 deg/min.)		(Rotary switch)		o
23	Optional block skip	This switch makes the block skip function command by program effective. During programming, the slash "/" used.	o	o	o	
25	Power	ON ... turns on the main power to the NC unit.	o			o
		OFF ... Turns off the main power.	o			o
26	Standby	Turns on the hydraulic pump and lubricating oil pump to make the machine ready for operation.	o	o		o
27	Emergency stop (Main/Sub-operation panel)	Stops the machine completely. All motors are stopped and the NC unit is reset.	o		o	o

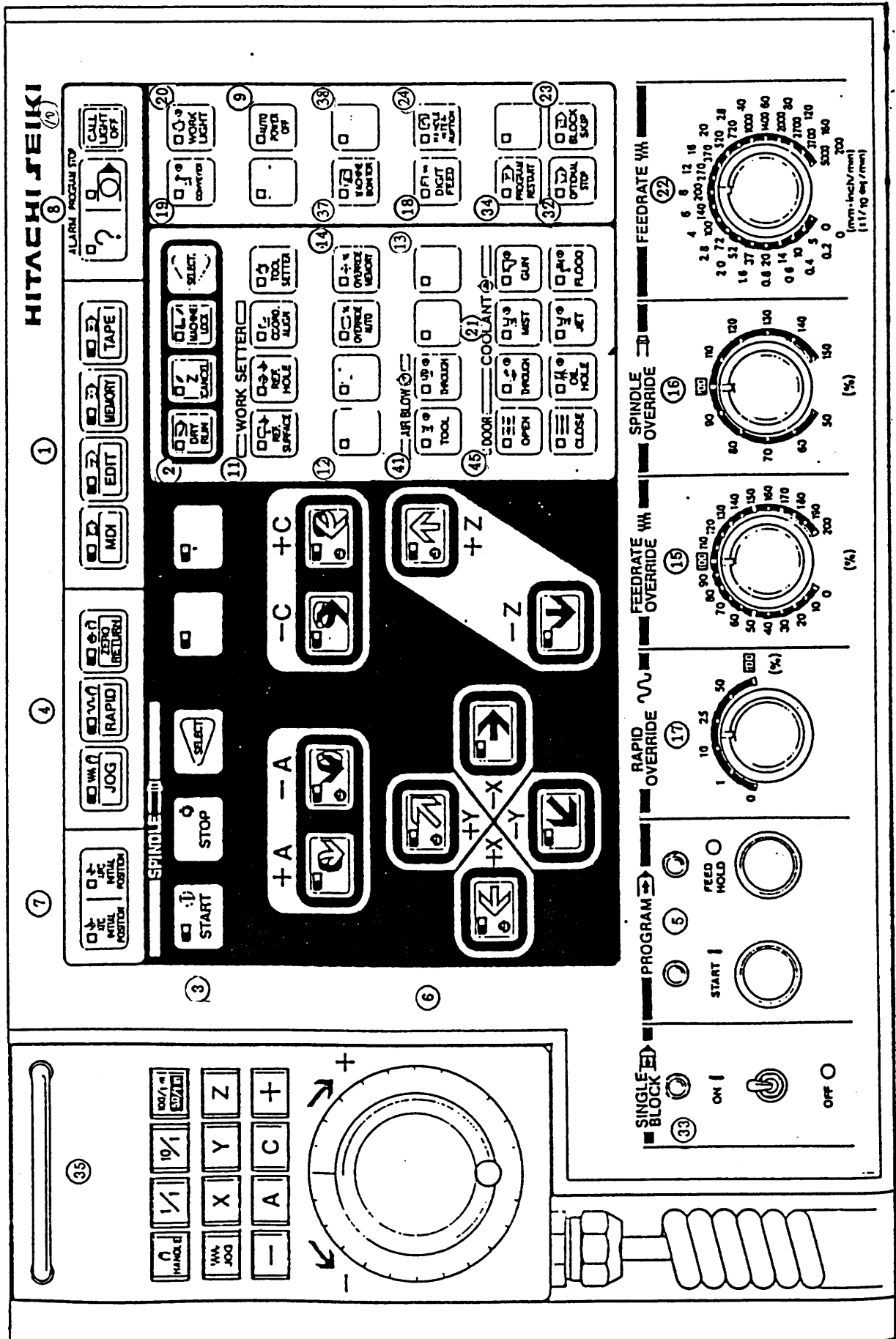
Groupe No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
28	Memory	LOCK ... Protects the information stored in the NC unit. Normally, shift this switch to "LOCK".	(Key)		o	
		WRITE ... Shift this switch to "WRITE" when writing or correcting memory information.	(Key)		o	
29	Speed meter (Option)	Indicates a spindle speed.	(Meter)		o	o
30	Load meter (Option)	Indicates a spindle load to a motor's rated power in terms of percentage.	(Meter)		o	o
31	Tool clamp/unclamp	CLAMP ... Clamp a tool to the spindle.	o			o
		UNCLAMP ... Unclamp the spindle tool. When the tool is unclamped, a yellow lamp lights up and you cannot run the spindle.	o	o		o
32	Optional stop	When M01 is commanded in the tape, tape operation stops after all the commands in the block are completed. The indication lamp lights up. This is released by repressing the START button and indication lamp puts out.	o	o	o	
33	Single block	Program commands are executed one block by one block. However, canned cycles are executed one by one.	Toggle switch	o	o	

Groupe No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
34	Program restart (Option)	The program restarts. The indication lamp lights up. This is released by repressing the button and the indication lamp puts out.	o	o	o	
35	Manual pulse generator (Fixed type)	Feed axis is selected by pressing the push button. The feed rate can be selected by either 1 pulse/graduation (1/1), 10 pulses/graduation (10/1) or 100 pulses/graduation (100/1).	o	o		o
40	Block skip (Option)	This makes the block skip 2 9 effective. "/(2 9)" is used in the program.	o	o	o	
41	Tool nose air blow (Option)	Air blows out from the nozzle directed to a tool nose. Even during operation, ON-OFF is available.	o	o	o	o
42	Magazine rotation (ATC)	The ATC magazine rotates to index tools. Forward rotation: CW Reverse rotation: CCW	o			o
43	Call selection (ATC)	In the manual mode, the CALL SELECTION lamp lights up.		o		o
44	Automatic return	Perform this action in the Maintenance (ATC Status Display screen).	o			o
45	Door (When ATC is provided.)	OPEN ... The ATC door is opened.	o			o
		CLOSED ... The ATC door is closed.	o			o

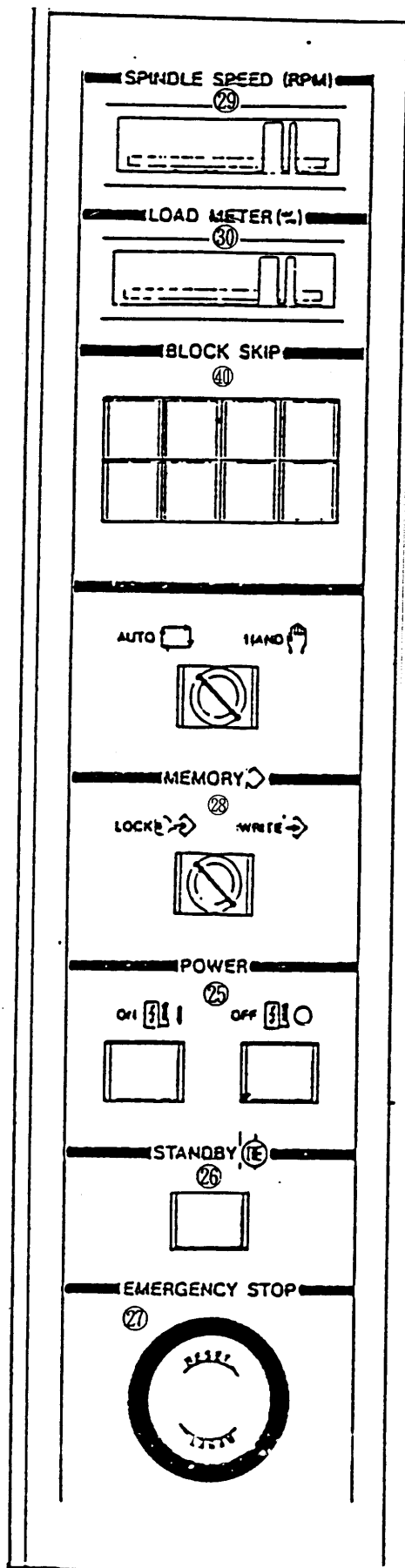
General View of Operation Panel



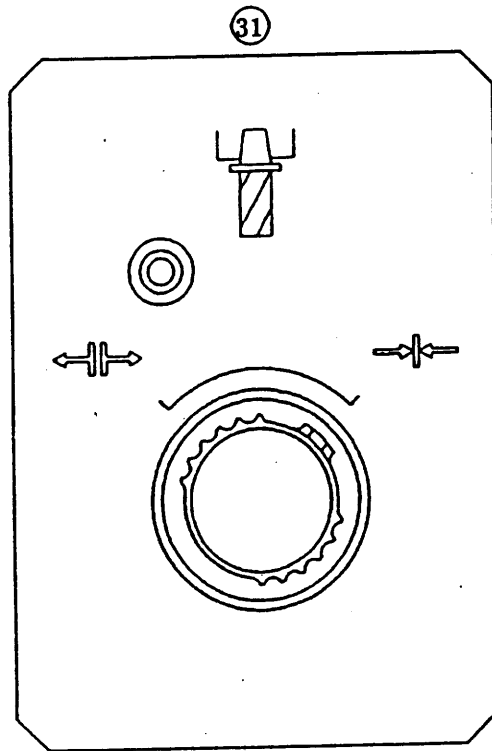
Main Operation Panel [I]



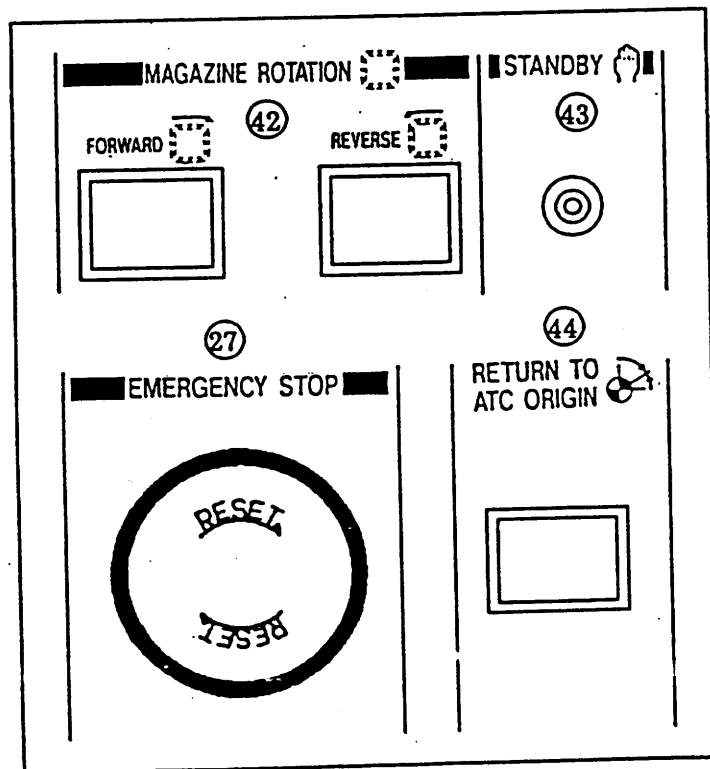
Main Operation Panel [II]



Auxiliary operation panel (I) Spindle tool clamp/unclamp

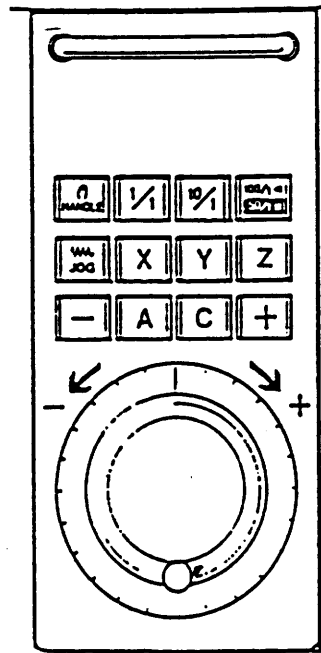


Auxiliary operation panel (II) --- ATC magazine



5-1-2 Manual Pulse Generator (Handle)

The manual pulse generator as shown in below figure is located on the left side of the machine operation panel.

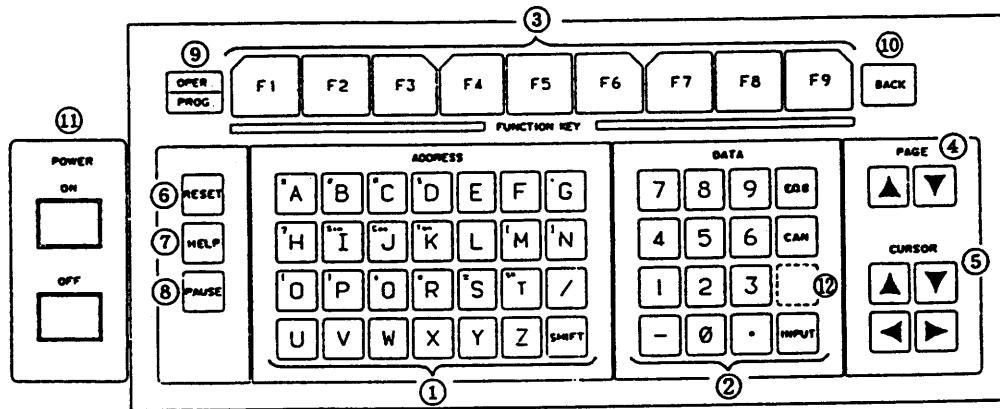


Manual Pulse Generator

Select the feed axes X, Y, Z and A with push buttons, respectively. For a feed rate, you can select 1 pulse/graduation (1/1), 10 pulses/graduation (10/1) and 100 pulses/graduation (100/1).

5-1-3 NC Unit Keyboard

The following figure shows the layout of the keyboard.



NC Unit Keyboard

Table 5-1 shows the name and use of each key on the keyboard.

Table 5-1 Names and Uses of Keys

No.	Name	Use	Method		Mode	
			P.B.	Lamp	Auto	Manu.
①	ADDRESS keys	Used for setting and editing a program and various data, together with the DATA keys ②.	o		o	o
②	DATA keys	Same as the above, used together with the ADDRESS keys ①.	o		o	o
③	FUNCTION keys	The FUNCTION keys F1 through F9 change their functions every time a screen or page is changed. Their functions are always displayed on the screen. Proceed with operation in accordance with a screen display.			o	o
④	PAGE keys	There are several pages selected by the FUNCTION keys. These keys select your desired page.	o		o	o
⑤	CURSOR keys	These keys move a cursor within the screen selected by the PAGE key.	o		o	o
⑥	RESET key	Resets the internal condition of the NC unit. This is used for cancelling a move command, clearing a buffer, removing an alarm, turning on a label skip function and rewinding the memory. This is invalid while executing an automatic program.	o		o	o

No.	Name	Use	Method		Mode	
			P.B.	Lamp	Auto	Manu.
⑦	HELP key	When HELP is displayed on the screen, pressing this key displays an operational procedure or description on the screen.	0		0	0
⑧	PAUSE key	Used for suspending creation of an automatic program, and also, for suspending canned cycle editing.	0		0	0
⑨	OPER./AUTO PROG. selector key	Selects between the Auto Programming screen and Operation screen.	0		0	0
⑩	BACK key	Use this key when returning the screen to a common function display. When automatic programming is performed, you are returned to processing immediately before it.	0		0	0
⑪	POWER ON/OFF buttons	ON Turns on the main power to the NC unit.	0			0
		OFF Turns off the main power.	0			0
⑫	(NEXT key)	Effective in the NC mode screen. Same as the BACK key for the multi screen.	0		0	0

5-2 Preparation for Operation and Procedure for Ending Operation

5-2-1 Starting Machine Operation


- (1) Turn on the main power switch.
- (2) Turn on the power switch of the power control cabinet.
- (3) Press the POWER ON button located on the left side of the keyboard.

Note) The main panel and the NC unit is of closed structure so that the open air will not directly enter inside. Therefore, do not leave each door, etc. opened for a long time when turning on the power. Check a display on the CRT and whether cooling fan motors inside and outside the cabinet are started.

- (4) Press the STANDBY button located at the lower right part of the operation panel. (A green lamp is lit up.)
Check that a hydraulic unit set pressure is at a specified value of 45 kg/cm².
- (5) Before starting the machine, make the X, Y and Z axes reciprocate several times to lubricate each slideway. (When this is done, be careful not to cause the axes to overtravel.)
- (6) Return each axis to the zero point (see 4.2.2 Zero Return Procedure).
By performing zero return, a basic machine coordinate system is set and stored stroke limits are put into effect.

5-2-2 Zero Return Procedure

After turning on the power, be sure to perform manual zero return to set the basic machine coordinate system. This is done on the Zero Return screen.

- (1) Select the mode selector push button switch "ZERO RETURN".
- (2) Of the push button switches for the axis you want to return to the zero point, press one indicated with a zero point mark ().
- (3) Move the axis to the zero point at a rapid traverse rate.
When the axis reaches the zero point, it stops and its zero return lamp is lit up.

Now, you are through with zero return.

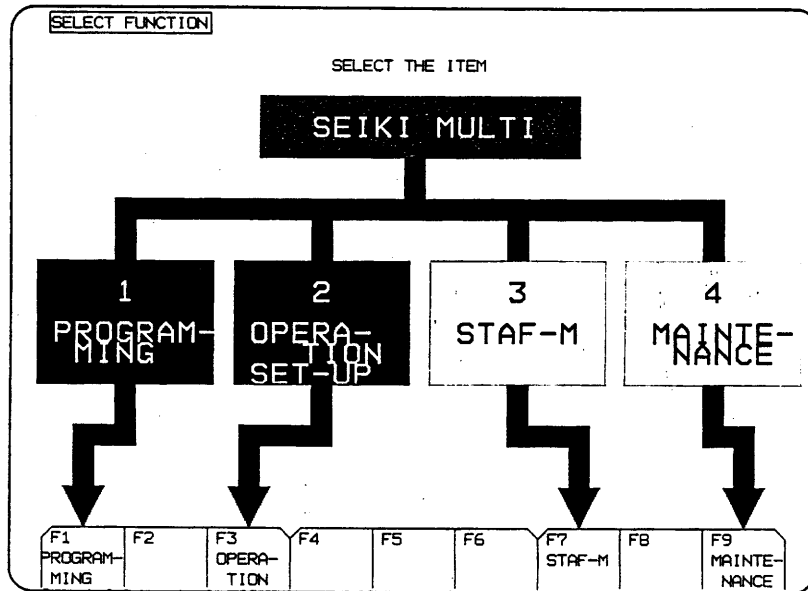
Note) Perform zero return for one axis each.

5-2-3 Ending Machine Operation

- (1) Clean the machine.
- (2) Move each axis to a stop position.
 - X axis Center of the stroke
 - Y axis Center of the stroke
 - Z axis Head ascent end
- (3) Check that the PROGRAM START lamp on the operation panel is lit off.
- (4) Press the EMERGENCY STOP button on the operation panel.
- (5) Press the POWER OFF button to the left of the keyboard to turn off the power of the control unit.
- (6) Turn off the power switch of the power control cabinet.
- (7) Turn off the main power switch.

5-3 Outline of Operation by MULTI Interactive System

Pressing the STANDBY button displays the MULTI Interactive System screen, and then, the Operation Selection screen shown in.



Operation Selection Screen

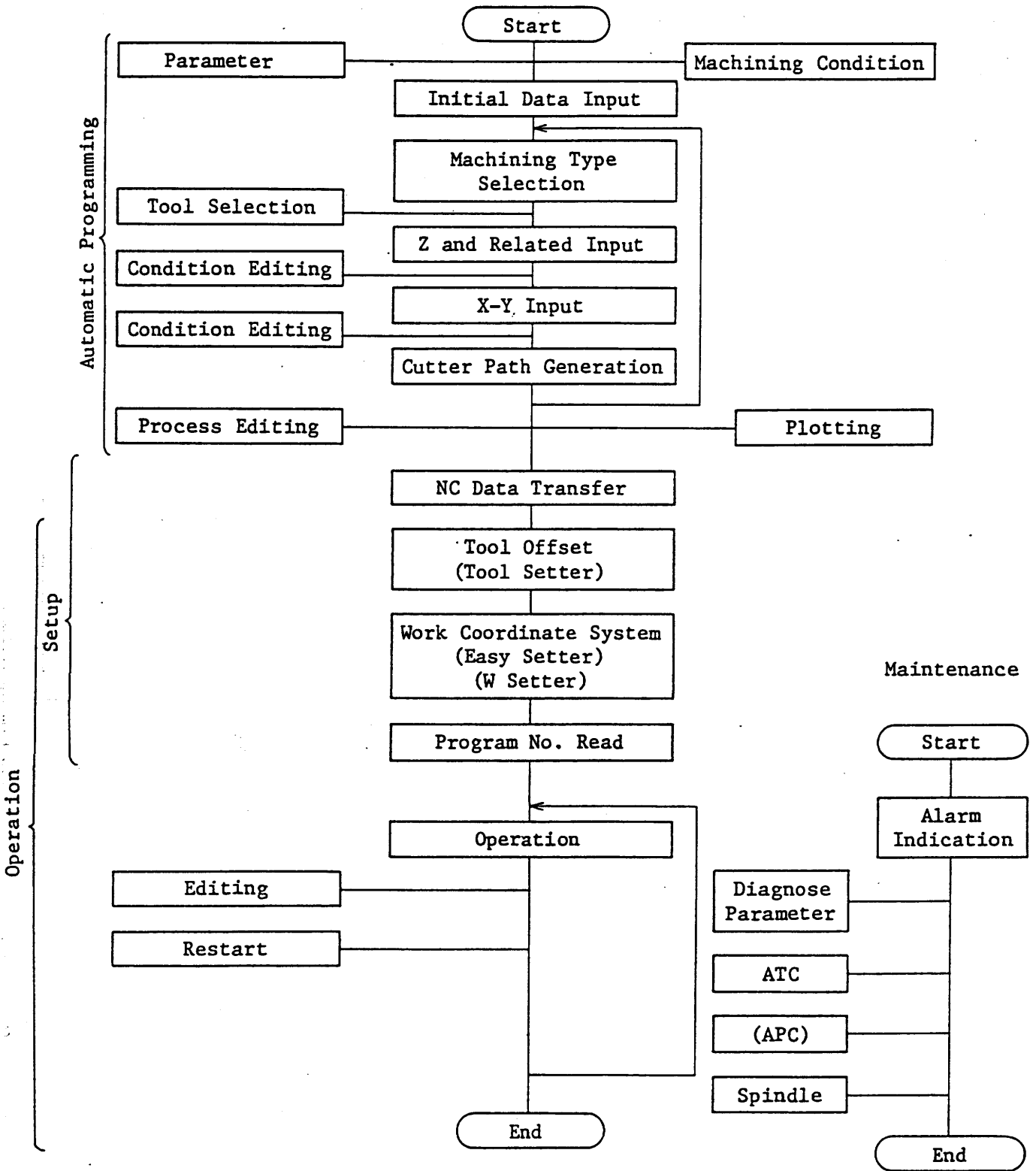
As you see, all functions of the MULTI Interactive System are classified into the following four categories:

- ① Interactive automatic programming function
- ② Interactive operating function
- ③ Interactive setup function
- ④ Interactive maintenance function

In this system, an operator is supposed to multiply converse with the machine in every aspect ranging from program creation to setup, operation and maintenance.

The operational procedures for ②, ③ and ④ are described in and respectively. For ①, see the instruction manual for automatic programming.

Below figure outlines an operational flow.



Operational Procedure Flow Chart

5-4 Operation

5-4-1 Description of Functions

When the **F3** (OPERATION) key is selected on the screen shown in Fig (5-20) and if zero return has not been performed yet, the screen in below figure is displayed. When this screen appears, perform zero return.

Items displayed on the lower part of this screen are the common function display for operation.

ZERO RETURN		002304 N00000	
RETURN TO ZERO POSITION ! MACHINE COORDINATE SYSTEM MACH POSITION			
⊙ X	.	0	① MOVE THE AXIS AWAY FROM ZERO. RETURN POSITION AT LEAST 5 INCHES ② SELECT ZERO RETURN MODE ③ DEPRESS AXIS KEY MARKED WITH ZERO RETURN
⊙ Y	.	0	
⊙ Z	.	0	
SELECT ZERO RETURN MODE			
F1 POSITION	F2 PROGRAM	F3 TOOL COMP.	JOG F4 WORK COORD.
		F5 PROGRAM LIST	LSK F6 MACHIN MONITOR
		F7	STP F8 STAF-M
			F9 MAINTENANCE

Zero return

After zero return is performed, the screen in below figure is displayed.

POSITION		002304 N00000								
ABS. POS. = G52 J										
X -	255.791	RELAT. POS.	MACH. POS.	DIST. TO GO						
Y -	136.405	X 157.245	X - 255.791	X - 157.245						
Z -	195.111	Y 430.889	Y - 136.405	Y - 430.889						
		Z 98.042	Z - 195.111	Z - 98.042						
		F	0. MM/MIN							
		F%	0. MM/MIN							
		S	0 RPM							
		S%	0 RPM							
SPINDLE T001 STANDBY T000										
F1	F2	F3	JOG	F5	F6	LSK	F7	F8	STP	F9
POSITION	PROGRAM	TOOL COMP.	WORK COORD.	PROGRAM LIST	MACHIN MONITOR			STAF-M	MAINTENANCE	

Common Function Display for Operation (Page 1)

Before starting execution of each of these functions, be sure to return the screen to the common function display for operation (press the **BACK** key and select each function.

When **HELP** is displayed on the screen, pressing the **HELP** key displays an operational procedure.

The contents of the function keys are changed and displayed every time the screen is changed. Proceed with operation, viewing them.

The following subsections describe the operational procedure for each screen.

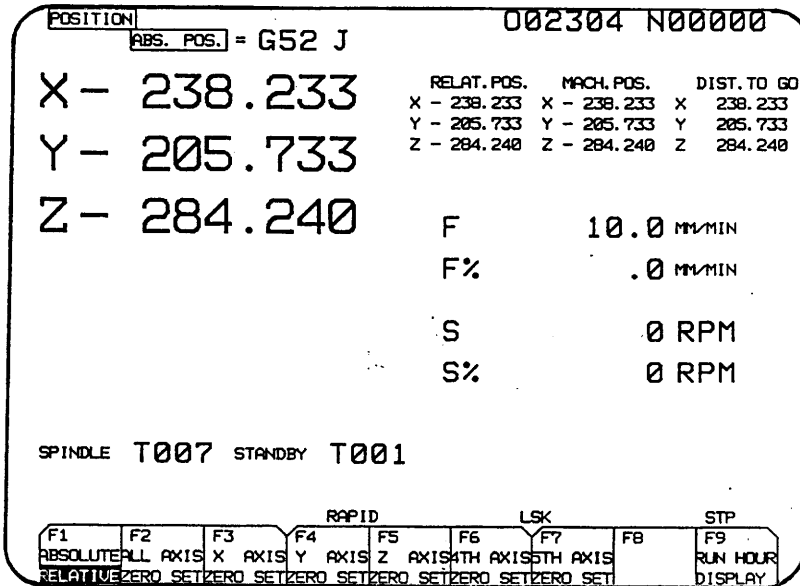
Table 5-2 describes common functions for operation.

Table 5-2 Description of Function Keys

Page	FUNCTION key	Name	Description
1	F1	POSITION	Zero setting of the relative coordinate system and work coordinate system
	F2	PROGRAM	Manual operation, playback editing, MDI operation, program editing, automatic operation, tape operation
	F3	TOOL COMP.	Tool length/diameter compensation input, multiple compensation input (automatic/manual)
	F4	WORK COORD.	Work coordinate system input (automatic/manual)
	F5	PROGRAM LIST	Listing of programs and their editing
	F6	MACHINE MONITOR	Operation panel status display
	F7		
	F8	STAF-M	Changes the screen to Management Menu
	F9		Changes the screen to Maintenance Menu

5-4-2 POSITION

To set X, Y and Z of the relative coordinate system and work coordinate system to zero, select the **F1** (POSITION) key on the screen in Fig (5-23). The following screen appears.



POSITION Screen

1. Relative coordinate system zero setting

- ① If **F1** (ABSOLUTE RELATIVE) key is pressed, either ABSOLUTE or RELATIVE is reversely displayed (white in black background). In this example, "RELATIVE" is reversely displayed.
- ② If the **F3** to **F7** key corresponding to the axis for zero setting is pressed, the value of each axis in the relative coordinate system is set to zero. To perform zero setting simultaneously for all the axes, press the **F2** (ALL AXIS ZERO SET) key.

2. Work coordinate system zero setting

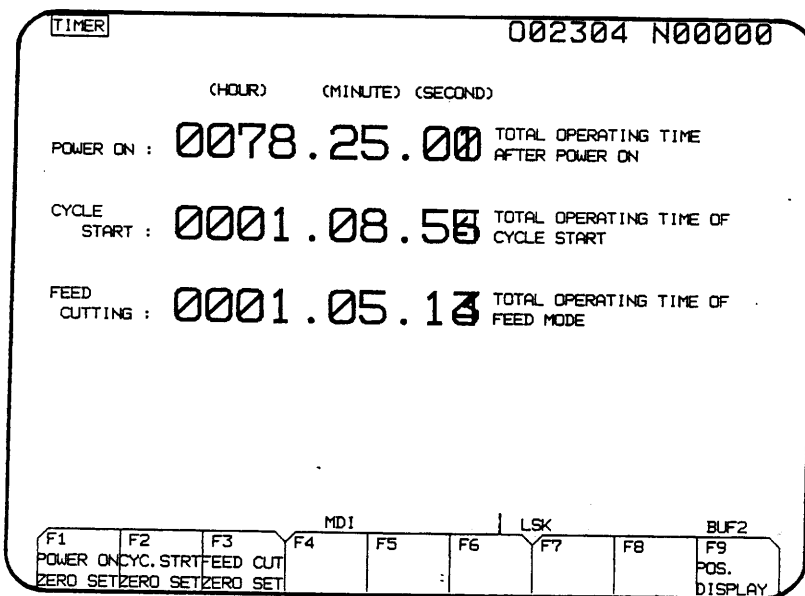
Press one of the mode selector keys (④ in Fig (5-11)) **HANDLE** , **JOG** and **RAPID** of the machine operation panel to select a manual mode first.

- ① Press the **F1** (ABSOLUTE RELATIVE) key to reversely display "ABSOLUTE".

- ② If the **F3** to **F7** key corresponding to the axis for zero setting is pressed, the value of each axis in the work coordinate system is set to zero. To perform zero setting simultaneously for all the axes, press the **F2** (ALL AXIS ZERO SET) key.

3. Run hour display

In Fig (4-25), pressing the **F9** (RUN HOUR DISPLAY) key displays the screen shown in below figure. To the contrary, pressing the **F9** (RUN HOUR DISPLAY) key in below figure displays the screen shown in Fig (4-25).



Run Hour Display

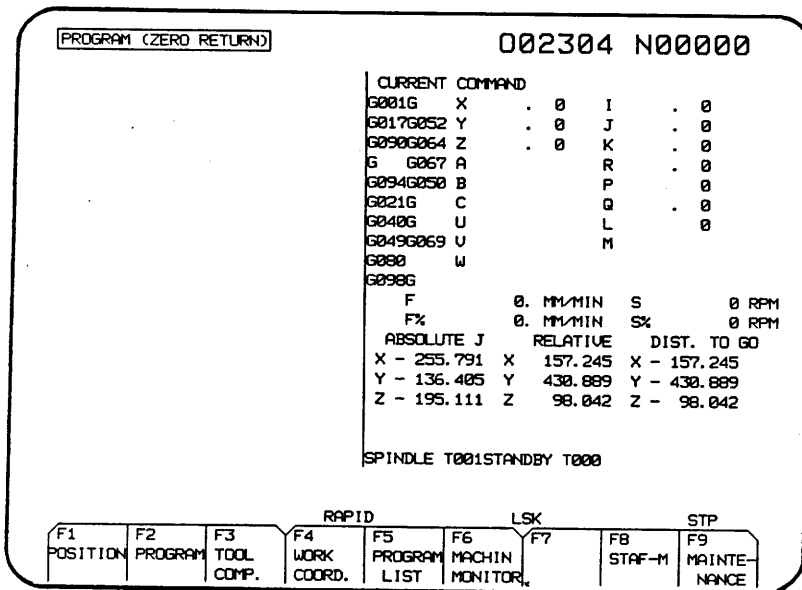
- ① **POWER ON**
Displays a total integrated time after turning on the power.
Pressing the **F1** key sets to zero.
- ② **CYCLE START**
Displays a total integrated time during automatic operation.
Pressing the **F2** key sets to zero.
- ③ **FEED CUTTING**
Displays a total integrated time during automatic cutting.
Pressing the **F3** key sets to zero.

5-4-3 PROGRAM

If the machine operation panel's any mode selector key is pressed and the **F2** (program) key is selected in the common function display (Fig 5-23) , the playback edit/origin reset/MDI/edit/automatic/tape screen is changed to. Each operation procedure is explained in the following items.

(1) ZERO RETURN

Selecting the mode selector key ZERO RETURN displays the following screen. On the screen, you can view current command values.

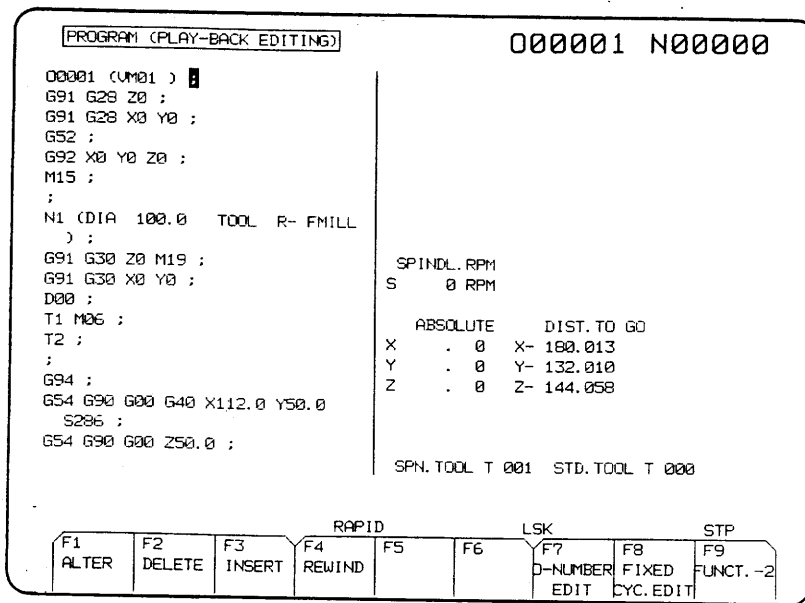


PROGRAM (ZERO RETURN)

(2) PLAY-BACK EDITING

This function stores current values in NC data as command values, moving each axis.

Press one of the mode selector keys **HANDLE**, **JOG** and **RAPID** to select a manual mode, and press the **F2** (PROGRAM) key among the common functions displayed. The following screen appears.



PROGRAM (PLAY-BACK EDITING)

<Playback Editing Procedure>

1. Inputting the 0 number (program No.)

- ① Pressing the **F7** (O-NUMBER EDIT) key displays "0=" on the lower left part of the screen.
- ② Using numerical keys, enter a program number. For example, when registering "01234", press **1** **2** **3** **4**.
Then, "0=1234" is displayed on the lower left part of the screen.
- ③ Pressing the **F3** (INSERT) enables newly creating a program of 01234.

2. Inputting the current value and other data

- ① Using the axis move selector buttons on the machine operation panel, move the axis to the position which you want to write as a command value.
- ② Specify the axis you want to write, using the ADDRESS key **X** **Y** or **Z**.
- ③ Press the **INPUT** key.
If a numerical value is entered before pressing the **INPUT** key, the command value will be a sum of that numerical value and a current value.

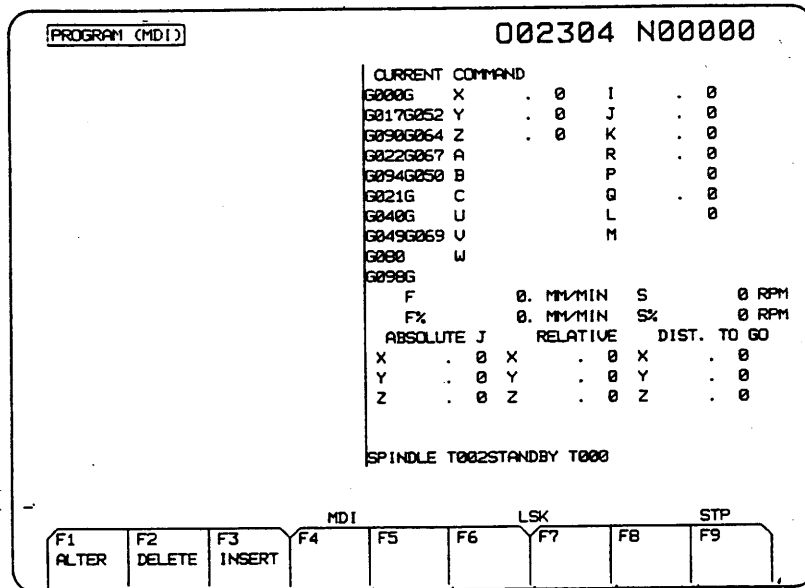
- ④ For data other than axial data, write them as one block worth of data in the same procedure as editing. However, do not change the mode.
- ⑤ Press the key.
- ⑥ Pressing the (INSERT) key stores one block worth of data in the NC data.
- ⑦ Repeat the steps ① through ⑥.
- ⑧ Write either M02; or M30; in a part program end block and store in the program.

- Notes)
1. The NC data stored by playback operation can be edited in either manual or EDIT mode. That is, for position data, the command value written by playback operation can be edited (deleted, inserted or altered) as it is.
 2. The current value written by the keys assumes the work coordinate system.
Therefore, start playback operation after setting up the machining zero point by G92, etc.
 3. There is no distinction between the NC data created by playback operation and ordinary ones. A maximum capacity of the part program memory is a total value of them.
 4. Editing operation in the EDIT mode is as usual.
 5. Inputting address and then numbers, following the key. The value of the key-in number plus the current value is displayed as a command value.

Example) When entering at a position of a current value X1.000, the value is X11.000.

(3) MDI

When the mode selector key **MDI** is pressed and the common function **F2** (PROGRAM) key is selected, the following screen is displayed.



PROGRAM (MDI)

On this screen, input, alter and delete data in the following manners:

1. Inputting the data

- ① Enter data, using the keyboard. It is possible to input max. 1024 characters of the MDI program. Data entered is sequentially displayed on the lower left part of the screen. When correcting it, press the **CAN** key and erase character by character backward, and then, re-enter data.
- ② Pressing the **F3** (INSERT) key moves the data displayed on the lower left to upper left. Pressing the **E.O.B** key displays ";" (semicolon) at an end of a line and allows you to enter up to 10 lines, assuming that length as one line.

2. Altering the data

- ① Moves the cursor (◀ or ▶) to the word you want to alter.
- ② Enter a new word. It is displayed on the lower left part of the screen.

- ③ Pressing the **F1** (ALTER) key replaces the cursor-indicated word with the new word entered in the step ②.

3. Deleting the data

- ① Moves the cursor to the word you want to delete.
- ② Pressing the **F2** (DELETE) key deletes the cursor-indicated word.
- * Pressing the **RESET** key deletes all data.

(4) PROGRAM (EDIT)

When the mode selector key **EDIT** is pressed and the common function **F2** (PROGRAM) key is selected, the following screen is displayed.

```

PROGRAM (EDIT)                                000001 N00000
00001 (UN01 ) █
G91 G28 Z0 ;
G91 G28 X0 Y0 ;
G52 ;
G92 X0 Y0 Z0 ;
M15 ;
;
N1 (DIA 100.0 TOOL R- FMILL
) ;
G91 G30 Z0 M19 ;
G91 G30 X0 Y0 ;
D00 ;
T1 M06 ;
T2 ;
;
G94 ;
G54 G90 G00 G40 X112.0 Y50.0
S286 ;
G54 G90 G00 Z50.0 ;

```

```

A) FUNCTION-1
1 F5(SPECIAL EDITING)
  YOU CAN WORD EDIT,ADRESSE EDIT,MIRROR
  EDIT,ROTATE EDIT
2 F7(O-NO.EDITING)
  ___+F1(ALTER)    ALTER THE PROG.NO.
  ___+F2(DELETE)   DELETE A PROGRAM
  ___+↓(CURSOR)    PROGRAM SEARCH
  ___+F3(INSERT)   CREATE NEW PROGRAM
3 F8(FIXED CYCLE EDITING)
  CURSOR AT FIX.CYC. G CODE = ALTER MODE
  CURSOR AT EOB = INSERT MODE
  ALTER SAME LINE/INSERT ON NEXT LINE
B) FUNCTION-2
1 F1(START)       START OF RANGE
2 F2(STORE)       STORE TO BUFFER
3 F3(DELETE).    DELETE DESIGNATED RANGE
4 F4(INSERT)     INSERT THE STORED DATA
5 F7(SUB-PRG.)   CONVERT TO A SUB PROGRAM

```

HELP

EDIT					LSK		STP	
F1	F2	F3	F4	F5	F6	F7	F8	F9
ALTER	DELETE	INSERT	REWIND	SPECIAL EDITING		D-NUMBER EDIT	FIXED CYC. EDIT	FUNCT. -2

PROGRAM (EDIT) Page 1

Notes) • Do not enter 10 or more alphabets (A-Z) successively.

On this page, the functions shown on the FUNCTION keys are available. However, word editing is described below first.

I. Editing the word

1. ALTER

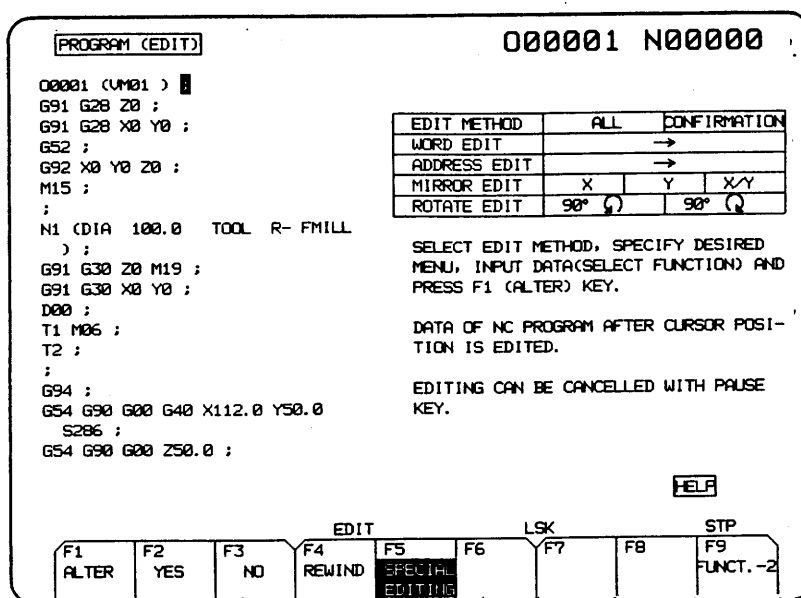
- ① Shift the MEMORY LOCK/WRITE key (Ⓚ in Fig (5-12)) to "WRITE".
- ② Using the CURSOR keys ↓, ↑, ← and →, move the cursor to the word you want to alter. The page is scrolled by the PAGE keys ↓ and ↑. (④ and ⑤ in Fig (5-15))
- ③ Enter data you want to alter to.
- ④ Press the F1 (ALTER) key.

2. DELETE

- ① Shift the MEMORY LOCK/WRITE key to "WRITE".
- ② Move the cursor to the word you want to delete. The page is scrolled by the PAGE keys.
- ③ When deleting a reversely displayed portion only, proceed to the step ④ immediately. When deleting from the reversely displayed portion through a specified word, enter the specified word.
- ④ Press the F2 (DELETE) key.

3. INSERT

- ① Shift the MEMORY LOCK/WRITE key to "WRITE".
- ② Move the cursor to immediately before the word where you want to insert. The page is scrolled by the PAGE keys.
- ③ Enter data you want to insert.
- ④ Press the F3 (INSERT) key.



Special Editing

1. Special Editing

Push **F5** (SPECIAL EDITING). The picture shown in Fig. (above figure) is displayed.

The editing method consists of two types; The all and the confirmation.

- **ALL** ; The designated words or addresses shown after the present position of cursor are totally edited.
- **CONFIRMATION**; The designated words or addresses shown after the present position of cursor are set one by one, and when any change is required, **F2** (Yes) or **F3** (No) is pushed for editing.

The editing consists of 4 types; the word edition, address edition, mirror edition and rotating edition.

Word edition ... The word means the address plus number.

Address edition ... The address is shown by X, Y, Z, etc.

Mirror edition ... Program is automatically edited by using this function when processing the words symmetric to X, Y and XY axis.

Rotating edition ... The program rotated 90° (clockwise, counterclockwise) can be made automatically.

• Word edition

- ① Set the memory key to "Write".
- ② Select the required editing method (All or confirmation) with the cursor ◀▶ .
- ③ Set the word edition with the cursor ▲▼ .
- ④ Key-in the designated address. Example; Change X 5.0 (designated) to X 10.0 (changed) X 5.0 → X 10.0
- ⑤ Key-in the address to be changed.
- ⑥ Push F1 (ALTER).

• Address edition

- ① Set the memory key to "Write".
- ② Select the required editing method (All or Confirmation) with the cursor ◀▶ .
- ③ Set the word edition with the cursor ▲▼ .
- ④ Key-in the designated address. Example; Change X (designated) to C (changed) X → C.
- ⑤ Key-in the address to be changed.
- ⑥ Push F1 (ALTER).

• Mirror edition

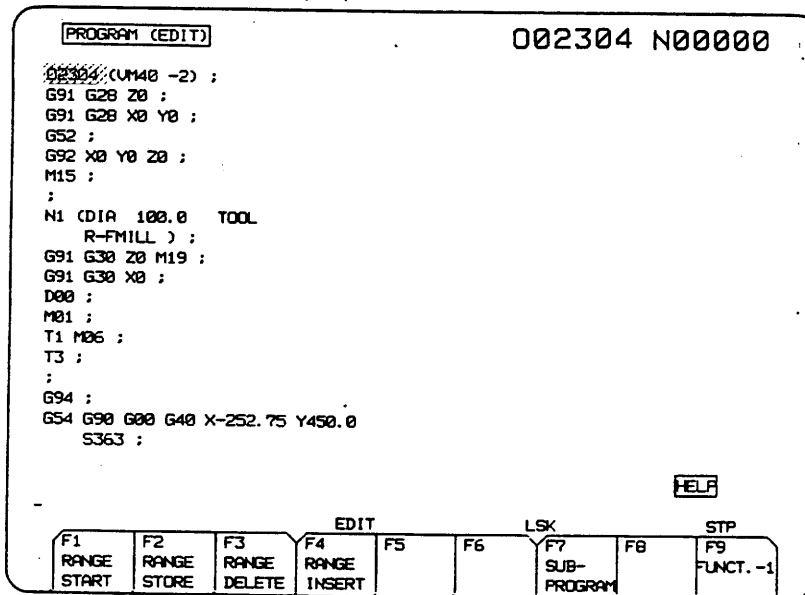
- ① Set the memory key to "Write".
- ② Select the editing method (All or Confirmation) with the cursor ◀▶ .
- ③ Set the mirror edition with the cursor ▲▼ .
- ④ Set X, Y or X/Y with the cursor ◀▶ .
- ⑤ Push F1 (ALTER).

• Rotating edition

- ① Set the memory key to "Write".
- ② Select the editing method (All or Confirmation) with the cursor ◀▶ .
- ③ Set the rotating edition with the cursor ▲▼ .
- ④ With the cursor ◀▶ , set either the clockwise turn or the counterclockwise turn.
- ⑤ Push F1 (ALTER).

II. Editing the range

On the screen in Fig (5-31), pressing the F9 (FUNCT.-2) key displays PROGRAM (EDIT) Page 2.



PROGRAM (EDIT) Page 2

On this page, you can edit up to 1,024 characters.

1. RANGE STORE

This function is used when storing a certain range of data.

Note) If the power is turned off due to a power failure or trouble, stored data will be lost. They may be also lost even if switched to automatic programming screen.

- ① Shift the MEMORY LOCK/WRITE key to "WRITE".
- ② Move the cursor to the top word of the range you want to store.
The page is scrolled by the PAGE keys.
- ③ Press the F1 (RANGE START) key.

- ④ Move the cursor to the last word of the range you want to store. The page is scrolled by the PAGE keys. (The very word is displayed in yellow.)
- ⑤ Pressing the F2 (RANGE STORE) stores a specified range.

2. RANGE INSERT

When inserting data after storing the range, use this function.

- ① Shift the MEMORY LOCK/WRITE key to "WRITE".
- ② Move the cursor to the word immediately before where you want to insert. The page is scrolled by the PAGE keys.
- ③ Press the F4 (RANGE INSERT) key.

3. RANGE DELETE

When deleting a certain range of data, use this function.

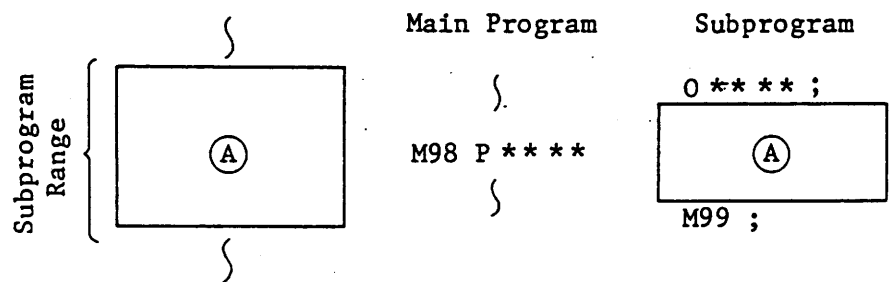
- ① Shift the MEMORY LOCK/WRITE key to "WRITE".
- ② Move the cursor to the top word of the range you want to delete. The page is scrolled by the PAGE keys.
- ③ Press the F1 (RANGE START) key.
- ④ Move the cursor to the last word of the range you want to delete. The page is scrolled by the PAGE keys. (The very word is displayed in yellow.)
- ⑤ Press the F3 (RANGE DELETE) key.

4. SUBPROGRAM

When changing a specified range into a subprogram for a displayed program (main), use this function.

- ① Shift the MEMORY LOCK/WRITE key to "WRITE".
- ② Move the cursor to the top word of the range you want to change into a subprogram. The page is scrolled by the PAGE keys.
- ③ Pressing the F7 (SUBPROGRAM) displays "0=" on the lower left part of the screen.
- ④ Move the cursor to the last word of the range you want to change into the subprogram. The page is scrolled by the PAGE keys. (The very word is displayed in yellow.)

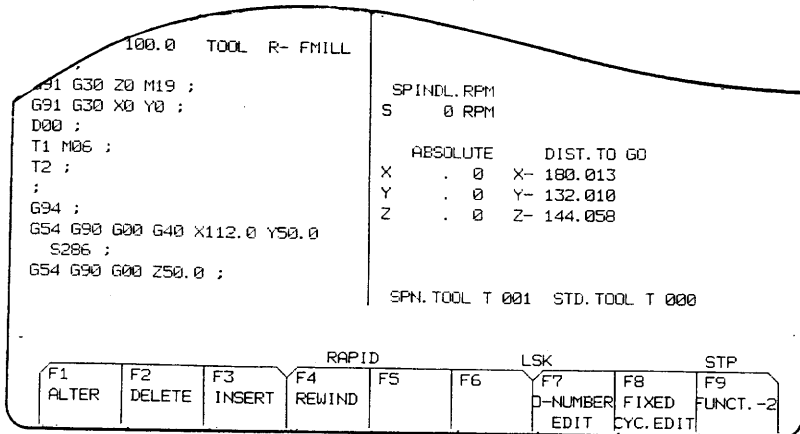
- ⑤ Enter a subprogram number.
- ⑥ Press the key. A specified range is created as the subprogram.



III. Others

On Page 2, pressing the **F9** (OTHERS) key returns you to the Page 1 screen (Fig. 5-31) again. The following describes the operational procedures for other functions on Page 1 which are not described in "I. Editing the word".

The FUNCTION keys on Page 1 are as follows:



1. BEGN. OF PROGRAM

This function displays the top portion of the program.

- ① Press the **F4** (REWIND) key.

2. Newly creating the program

- ① Shift the MEMORY LOCK/WRITE key to "WRITE".
- ② Pressing the **F7** (O-NUMBER EDIT) key displays "0=" in the lower corner of the screen.
- ③ Enter a program number within 5 digits (1-99999), using the numerical keys.
- ④ Press the **F3** (INSERT) key.

3. Altering the program number

- ① Shift the MEMORY LOCK/WRITE key to "WRITE".
- ② Pressing the **F7** (O-NUMBER EDIT) key displays "0=" in the lower corner of the screen.
- ③ Enter a new program number within 5 digits (1-99999), using the numerical keys.

④ Press the **F1** (ALTER) key.

4. Deleting the program

- ① Shift the MEMORY LOCK/WRITE key to "WRITE".
- ② Pressing the **F7** (O-NUMBER EDIT) key displays "0=" on the lower left part of the screen.
- ③ Enter the number you want to delete within 5 digits(1-99999), using the numerical keys.
- ④ Press the **F2** (DELETE) key.

In the step ③, entering -9999 deletes all programs.

5. FIXED CYC EDIT

- ① Shift the MEMORY LOCK/WRITE key to "WRITE".
- ② Move the cursor to the portion you want to edit. The page is scrolled by the PAGE keys.
 - When inserting, set the cursor to a semicolon(;).
 - When altering, set the cursor to the G code for a fixed (canned) cycle.
- ③ Pressing the **F8** (FIXED CYC.EDIT) key displays the following screen.

Note) To cancel editing, press the **PAUSE** key on the left side of the keyboard.

```
PROGRAM (EDIT)                                002304 N00000
O2304 (LEIDAI-1) ;
G91 G28 Z0 ;
G91 G28 X0 Y0 ;
G52 ;
G92 X0 Y0 Z0 ;
M15 ;
█
N1 (DIA 80.0 TOOL R-FMILL )
;
T1 ;
D00 ;
G91 G30 Z0 M19 ;
G91 G30 X0 ;
M06 ;
G91 G28 X0 ;
T2 ;
;
G94 ;
G54 G90 G00 G40 X117.0 Y54.0
```

HELP

EDIT				LSK			STP	
F1 DRILLING	F2 DEEPHOLE	F3 TAPPING	F4 HOLEPAT.	F5 HOLEPAT.	F6 HOLEPAT.	F7 ALTER	F8 INSERT	F9 OTHERS
G91, G181	G83	G84	CIRC. G70	ARC. G71	LINE G72			

On the screen in Fig (5-39), pressing the F9 (OTHERS) key takes you to Page 2.

PROGRAM (EDIT)
002304 N00000

```

02304 (LEIDAI-1) ;
G91 G28 Z0 ;
G91 G28 X0 Y0 ;
G52 ;
G92 X0 Y0 Z0 ;
M15 ;
█
N1 (DIA 80.0 TOOL R-FMILL )
;
T1 ;
D00 ;
G91 G30 Z0 M19 ;
G91 G30 X0 ;
M06 ;
G91 G28 X0 ;
T2 ;
;
G94 ;
G54 G90 G00 G40 X117.0 Y54.0
    
```

HELP

EDIT				LSK			STP	
F1	F2	F3	F4	F5	F6	F7	F8	F9
H. S. DEEP DRILL. G73	PREV. TAP- PING G74	BOR'G W/ SHIFT G76	BACK BO- RING G77	COUN. BOR- RING G78	BORING G79, G189	ALTER G80	INSERT	OTHERS

PROGRAM (EDIT) ; FIXED CYC EDIT Page 2

On the screen in above figure, pressing the F9 (OTHERS) key again takes you to Page 3.

PROGRAM (EDIT)
002304 N00000

```

02304 (LEIDAI-1) ;
G91 G28 Z0 ;
G91 G28 X0 Y0 ;
G52 ;
G92 X0 Y0 Z0 ;
M15 ;
█
N1 (DIA 80.0 TOOL R-FMILL )
;
T1 ;
D00 ;
G91 G30 Z0 M19 ;
G91 G30 X0 ;
M06 ;
G91 G28 X0 ;
T2 ;
;
G94 ;
G54 G90 G00 G40 X117.0 Y54.0
    
```

HELP

EDIT				LSK			STP	
F1	F2	F3	F4	F5	F6	F7	F8	F9
BORING G86, G186	BORING G87, G187	BORING G88	BORING G89, G189	CANCE L G80	ALTER	INSERT	OTHERS	OTHERS

PROGRAM (EDIT) ; FIXED CYC EDIT Page 3

- ④ Select a corresponding G code, using the FUNCTION key.
- When two G codes are displayed (for example, G81 and G181), the left one is selected for the first time, and the right for the second time. For G73 and G83, a fixed pitch is assumed for the first time, and a variable one for the second time. Pressing the key displays the screen the selected contents.
- For example, selecting G81 displays the following screen.

PROGRAM (EDIT)
002304 N00000

```

02304 (LEIDAI-1) ;
G91 G28 Z0 ;
G91 G28 X0 Y0 ;
G52 ;
G92 X0 Y0 Z0 ;
M15 ;
N1 (D1A 80.0 TOOL R-FMILL )
;
T1 ;
D00 ;
G91 G30 Z0 M19 ;
G91 G30 X0 ;
M06 ;
G91 G28 X0 ;
T2 ;
;
G94 ;
G54 G90 G00 G40 X117.0 Y54.0
          
```

FIXED CYCLE EDIT:G81(DRILLING)

X=10.
Y=20.
Z=-35.
R=2.
Q=
L=
F=
E=
W=

(X,Y) INITIAL PT.
W
R
Q
F FEED
Z
L=NO. OF REPETITION.

Q:PT. AT WHICH ENTRY FEEDRATE CHANGES
E:FEEDRATE AT ENTRANCE

EDIT				LSK		STP		
F1	F2	F3	F4	F5	F6	F7	F8	F9
DRILLING	DEEPTHOLE	TAPPING	HOLEPAT.	HOLEPAT.	HOLEPAT.	ALTER	INSERT	OTHERS
G81, G181	G83	G84	CIRC. G70	ARC. G71	LINE G72			

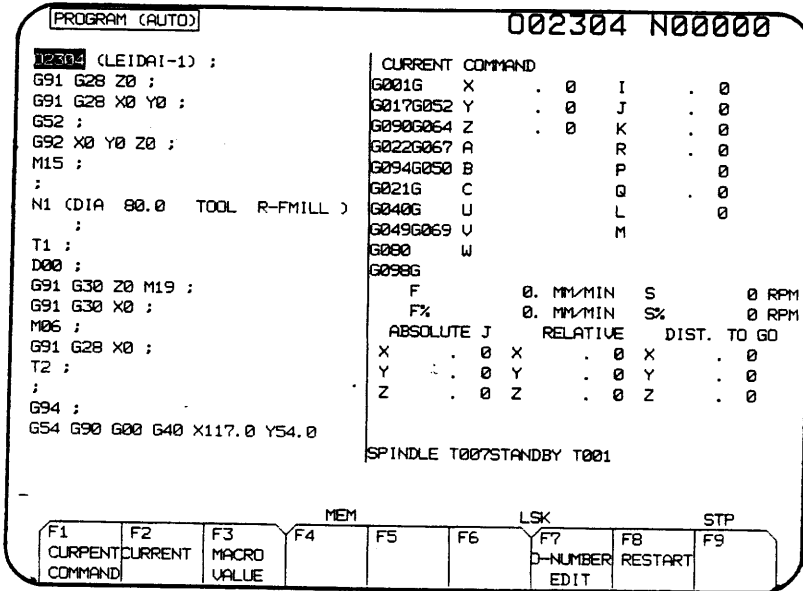
PROGRAM (EDIT) ; FIXED CYC EDIT Page 1, DRILLING G81

- ⑤ Enter required data (contents altered or inserted) and press the **INPUT** key.
- ⑥ When altering, press the **F7** (ALTER) key, and when inserting, press the **F8** (INSERT) key.
- If the **F7** key is pressed when fixed cycle editing starts at ";", ";" will become fixed cycle data "+;". When the **F8** is pressed, the fixed cycle data "+;" is inserted after ";".
- When fixed cycle editing starts at the G code for a fixed cycle, only the **F7** key is available. (The **F8** key is invalid.)
- ⑦ The altered or inserted data is displayed and the FIXED CYC EDIT screen disappears.
- ⑧ When Page 2 or Page 3 is displayed, you are returned to the FUNCTION Keys Display screen (Page 1).

Note) What can be edited are data displayed on the screen.

(5) AUTO

When the mode selector key **AUTO** is pressed and the common function **F2** (PROGRAM) key (Fig. 5-23) is selected, the following screen is displayed.



PROGRAM (AUTO)

1. Searching for the sequence (N) number

- ① Using the keyboard, enter **N** *** (**0** through **9** for ***).
- ② Press the CURSOR key **▼**. When cancelling a search, press the **CAN** key.

Start cycle operation after a mark "-" blinks at the lower left part of the screen.

2. Searching for the program (0) number

- ① Pressing the **F7** (0-NUMBER EDIT) key displays "0=" on the lower left part of the screen.
- ② Enter a program number within 5 digits(1-99999).
- ③ Press the CURSOR key **▼**.

3. Display of offset values

If you press the **F2** key, the screen in below figure appears and you can check the current tool length offset and diameter offset values. To return to the screen of the currently specified values, press the **F1** (CURRENT COMMAND) key.

Offset No. of plural diameter compensation (D1140 ~ D1197) and compensating amount of diameter can be confirmed.

PROGRAM (AUTO)
002304 N00000

<pre> 02304 (LEIDA1-1) ; G91 G28 Z0 ; G91 G28 X0 Y0 ; G52 ; G92 X0 Y0 Z0 ; M15 ; ; N1 (DIA 80.0 TOOL R-FMILL) ; T1 ; D00 ; G91 G30 Z0 M19 ; G91 G30 X0 ; M06 ; G91 G28 X0 ; T2 ; ; G94 ; G54 G90 G00 G40 X117.0 Y54.0 </pre>	<pre> CURRENT COMMAND G001G COMPENSATION NO T0007 G017G052 LT.COMP. 200.000 G090G064 RAD.COMP. . 0 G022G067 D 1140 5.000 G094G050 MAIN PROGRAM 002304 G021G 1 SUB PROG. REST L 00000000 G040G 2 SUB PROG. REST L 00000000 G049G069 3 SUB PROG. REST L 00000000 G080 4 SUB PROG. REST L 00000000 G098G F 0. MM/MIN S 0 RPM F% 0. MM/MIN S% 0 RPM ABSOLUTE J RELATIVE DIST. TO G0 X . 0 X . 0 X . 0 Y . 0 Y . 0 Y . 0 Z . 0 Z . 0 Z . 0 </pre>
---	--

SPINDLE T007STANDBY T001

F1	F2	F3	MEM		F4	F5	F6	LSK		F7	F8	F9	STP
CURRENT COMMAND	CURRENT VALUE	MACRO VALUE						D-NUMBER EDIT	RESTART				

PROGRAM (AUTO)

4. Displaying macro variables

In an ordinary program (auto) screen, the currently specified values are displayed in the right half of the screen. If the **F3** (MACRO VALUE) key is pressed, the screen in below figure appears and displays macro variables in the right half of the screen. For the local variables, only displaying of the contents is possible, but for the common variables, the contents can be altered. Set the cursor to the variable to be altered with the Page key and the Cursor key, and input a value. Moreover, if the variable No. is entered and the **F4** (MACRO V.SEARCH) key is pressed, the cursor search is available.

PROGRAM (AUTO)		002304 N00000	
02304 (LEIDAI-1) ;		MACRO VAR. (LOCAL VAR.)	
G91 G28 Z0 ;		1-A	
G91 G28 X0 Y0 ;		2-B	
G52 ;		3-C	
G92 X0 Y0 Z0 ;		4-I	
M15 ;		5-J	
;		6-K	
N1 (DIA 80.0 TOOL R-FMILL)		7-D(I)	
;		8-E(J)	
T1 ;		9-F(K)	
D00 ;		10- (I)	
G91 G30 Z0 M19 ;		11-H(J)	
G91 G30 X0 ;		12- (K)	
M06 ;		13-M(I)	
G91 G28 X0 ;		14- (J)	
T2 ;		15- (K)	
;		16- (I)	
G94 ;		17-Q(J)	
G54 G90 G00 G40 X117.0 Y54.0			

MEM		LSK		STP				
F1	F2	F3	F4	F5	F6	F7	F8	F9
CURRENT	COMP.	MACRO	MACRO-V.			D-NUMBER		
COMMAND		VALUE	SEARCH			EDIT		

PROGRAM (AUTO)

5. Editing the feed rate and spindle speed (option)

During automatic operation, machine may be performed using a feed rate or spindle speed override. There is a function for storing the then override and automatically editing the NC data upon completion of machining.

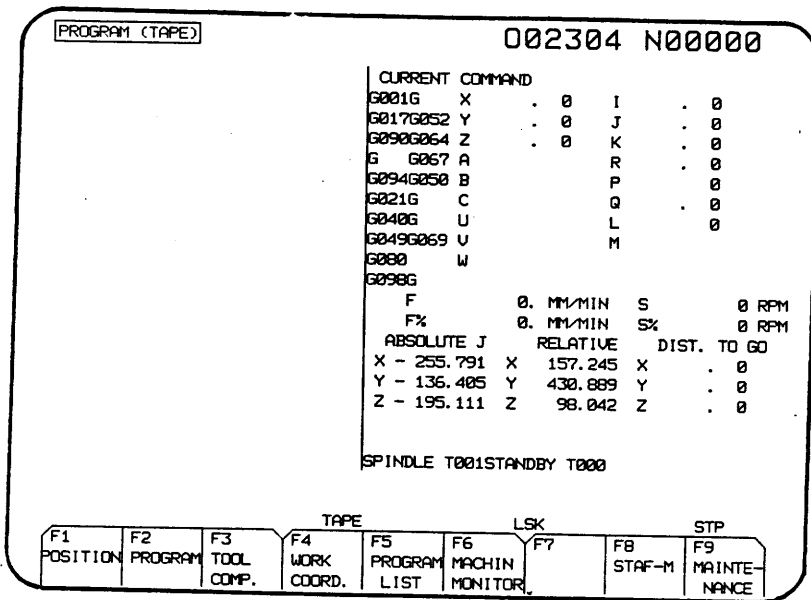
<Operational Procedure>

- ① Shift the MEMORY LOCK/WRITE key to "WRITE".
- ② Press OVERRIDE (⑭ in Fig (5-11)) on the machine operation panel to turn on a lamp.
- ③ Start automatic operation.
- ④ When cutting is performed with the spindle speed or feed rate override changed, pressing OVERRIDE (⑭ in Fig (5-11)) stores the then override. (up to 128 blocks allowed)
After an M30 command (PROGRAM END) is executed, the NC data currently executed are automatically edited with stored data.
- ⑤ Pressing OVERRIDE lights off the lamp.
From the next time on, the program is executed based on the edited NC data.

(6) Operation by the tape (option)

Operating method by setting a punched tape in the tape reader

- ① Press the mode selector key **TAPE**.
- ② Pressing the **F2** (PROGRAM) key displays the following screen.



PROGRAM (TAPE)

Operation is as usual.

5-4-4 TOOL COMPENSATION

To compensate a tool, select the **F3** (TOOL COMP.) key among the common functions displayed in Fig (5-23). The right screen is displayed.

If the machine operation panel's **TOOL SETTER** is pressed in the manual mode, the screen shown at the right is displayed.

TOOL COMPENSATION 002304 N00000

T NO.	TOOL NAME	RAD. COMP.	LT. COMP.	MULTIPLE COMP. (1)		MULTIPLE COMP. (2)	
				NO.	RAD. COMP.	LT. COMP.	NO.
0001		0	200.000				
0002		0	200.000				
0003		0	200.000				
0004		0	210.000				
0005		0	205.000				
0006		0	220.000				
0007		0	220.000				
0008		0	220.000				
0009		3.020	215.000				
0010		10.000	215.000				

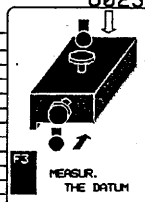
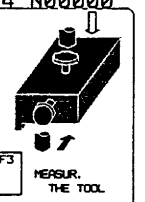
DISTANCE TO BLOCK MACHINE POS. POS. OF BLOCK SPINDLE T007
X-184.447 X 0 X 0
Y Y 0 Y 0
Z-446.762 Z 0

JOG LSK STP
F1 ABSOLUTE INPUT F2 INCREMENT INPUT F3 DATUM BLOCK CHANGE F4 TOOL CHANGE F5 CLEAR OFFSET F6 TOOL RAD. COMP. F7 MULTIPLE COMP. F8 TOOL COMP. RESETS F9 MAGAZINE DATA

TOOL COMPENSATION 002304 N00000

MEASURING FOR TOOL COMPENSATION

T NO.	TOOL NAME	RAD. COMP.	LT. COMP.
0001		0	200.000
0002		0	200.000
0003		0	200.000
0004		0	210.000
0005		0	205.000
0006		0	220.000
0007		0	220.000
0008		0	220.000
0009		3.020	215.000
0010		10.000	215.000

DISTANCE TO BLOCK MACHINE POS. POS. OF BLOCK SPINDLE T007
X-184.447 X 0 X 0
Y Y 0 Y 0
Z-446.762 Z 0

JOG LSK STP
F1 ABSOLUTE INPUT F2 INCREMENT INPUT F3 DATUM BLOCK CHANGE F4 TOOL CHANGE F5 CLEAR OFFSET F6 TOOL RAD. COMP. F7 MULTIPLE COMP. F8 TOOL COMP. RESETS F9 MAGAZINE DATA

TOOL COMPENSATION

There are two operating methods; manual input and automatic input.

I. Manual input

1. Inputting tool length and tool diameter compensation values

- ① Press the **F8** (PRESENT MAGAZINE) key to reversely display "PRESENT MAGAZINE".
- ② Search for the tool number you want to input. Enter a number and press the CURSOR key **▼**.
- ③ Using the CURSOR keys **◀** and **▶**, move the cursor to a relevant position.
- ④ Entering data displays its numerical value on the lower left part of the screen.
- ⑤ Pressing the **F1** (ABSOLUTE INPUT) key inputs the data of ④, and pressing the **F2** (INCREMENT INPUT) key inputs it added to (subtracted from) present data.

Note) For ②, it is also possible to move with the PAGE keys **▼**, **▲** or CURSOR keys **▲**, **▼**, **▶**, **◀**.

2. Diameter compensation input

TOOL COMP. (RAD. COMP. LIST)					002304 N00000				
D. NO.	RAD. VALUE	D. NO.	RAD. VALUE	D. NO.	RAD. VALUE	D. NO.	RAD. VALUE	D. NO.	RAD. VALUE
1140	0	1155	0	1170	0	1185	0		
1141	0	1156	0	1171	0	1186	0		
1142	0	1157	0	1172	0	1187	0		
1143	0	1158	0	1173	0	1188	0		
1144	0	1159	0	1174	0	1189	0		
1145	0	1160	0	1175	0	1190	0		
1146	0	1161	0	1176	0	1191	0		
1147	0	1162	0	1177	0	1192	0		
1148	0	1163	0	1178	0	1193	0		
1149	0	1164	0	1179	0	1194	0		
1150	0	1165	0	1180	0	1195	0		
1151	0	1166	0	1181	0	1196	0		
1152	0	1167	0	1182	0	1197	0		
1153	0	1168	0	1183	0				
1154	0	1169	0	1184	0				

F1	F2	F3	F4	F5	F6	F7	F8	F9
ABSOLUTE INPUT	INCREMENT INPUT			CLEAR OFFSETS	RADIUS COMP.	MULTIPLE COMP.	TOOL OFFSETS	MAGAZINE DATA

TOOL COMP. (DIA. COMP. LIST)

- ① Press the **F6** (RADIUS COMP.) key to reversely display "DIAMETER COMP."
- ② Move the cursor to a relevant field.
- ③ Enter data.
- ④ Pressing the **F1** (ABSOLUTE INPUT) key inputs the data of ③, and pressing the **F2** (INCREMENT INPUT) key inputs it added to (subtracted from) present data.

3. Multiple compensation input

TOOL COMPENSATION (MULTI OFFSET LIST)								002304 N00000	
T-NO.	RAD. COMP	LT. COMP	T-NO.	RAD. COMP	LT. COMP	T-NO.	RAD. COMP	LT. COMP	
1001	3.629	179.439	1016	17.829	199.739	1031	.0	.0	
1002	3.380	199.960	1017	.0	.0	1032	.0	.0	
1003	.0	.0	1018	3.529	199.539	1033	.0	.0	
1004	.0	.0	1019	.0	.0	1034	.0	.0	
1005	.0	.0	1020	.0	.0	1035	.0	.0	
1006	.0	.0	1021	.0	.0	1036	.0	.0	
1007	.0	.0	1022	.0	.0	1037	.0	.0	
1008	.0	.0	1023	.0	.0	1038	.0	.0	
1009	.0	.0	1024	.0	.0	1039	.0	.0	
1010	.0	.0	1025	.0	.0	1040	.0	.0	
1011	.0	.0	1026	.0	.0	1041	.0	.0	
1012	.0	.0	1027	.0	.0	1042	.0	.0	
1013	.0	.0	1028	.0	.0	1043	.0	.0	
1014	.0	.0	1029	.0	.0	1044	.0	.0	
1015	.0	.0	1030	.0	.0				

MDI									LSK		BUF2	
F1	F2	F3	F4	F5	F6	F7	F8	F9				
ABSOLUTE INPUT	INCREMENT INPUT			CLEAR OFFSETS	RADIUS COMP.	MULTIPLE COMP.	TOOL OFFSETS	MAGAZINE DATA				

TOOL COMPENSATION (MULTI OFFSET LIST)

- ① Press the **F7** (MULTIPLE COMP.) key to reversely display "MULTIPLE COMP."
- ② Move the cursor to a relevant field.
- ③ Enter data.
- ④ Pressing the **F1** (ABSOLUTE INPUT) key inputs the data of ③, and pressing the **F2** (INCREMENT INPUT) key inputs it added to (subtracted from) present data.

II. Automatic input

1. Measuring the datum block

- ① Select the screen shown in Fig (5-47). (When the screen in Fig (5-48) or (5-49) is presently displayed, press the (PRESENT MAGAZINE) key.
- ② Mount a reference tool to the spindle.
- ③ Press the button on the operation panel. Its lamp is lit up.
- ④ Pressing the (DATUM BLOCK) key reversely displays "DATUM BLOCK".
- ⑤ Using the axis move selector switches ⑥ in Fig (5-11), bring the X, Y and Z axes closer to a datum block position.
- ⑥ Press the mode selector key .
- ⑦ Select the switch () of the manual pulse generator.
- ⑧ Using the handle of the manual pulse generator, bring the tool into contact with the block. A reference value screen.
- ⑨ Retract the Z(X) axis.
- ⑩ Pressing the (DATUM BLOCK) turns off a reverse display of "DATUM BLOCK".
- ⑪ Press the button. The lamp is lit off.

2. Measuring the tool length and tool diameter

(when manually mounting the tool to the spindle)

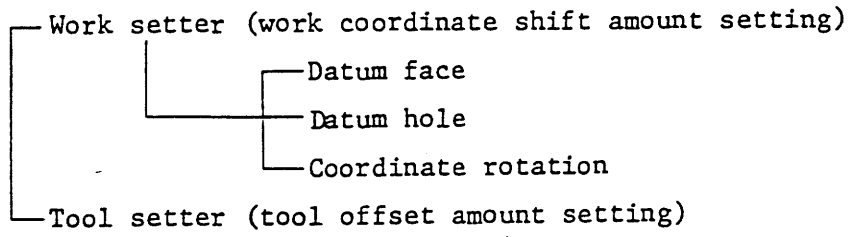
- ① Measure the datum block.
- ② Mount the spindle to the tool and bring each axis manually to the datum block.
- ③ Search for a tool number. Enter the number and press the CURSOR key.
- ④ Press the button. Its lamp is lit up.
- ⑤ Press the mode selector switch .
- ⑥ Using the switch of the manual pulse generator, select the Z(X) axis.

- ⑦ Bring the tool into contact with the block. A measured value is displayed on the screen.
 - ⑧ Retract the Z(X) axis.
 - ⑨ Press the button. The lamp is lit off.
3. Measuring the tool length and tool diameter (when mounting the tool in the magazine to the spindle through the ATC)
- ① Measure the datum block.
 - ② Pressing the (TOOL CHANGE) key reversely displays "TOOL CHANGE", and "T=" is displayed on the lower left part of the screen.
 - ③ Enter the tool number to be measured.
 - ④ Press the key. Then, the tool returns to the ATC zero point, the tool is changed, and the X, Y and Z axes move to a datum block position. The screen displays the page containing the input tool number, the cursor is set to DIA. CMP. of the input tool number, and a reverse display of "TOOL CHANGE" of the (TOOL CHANGE) key is turned off.
A melody for M30 execution sounds because M30 is executed inside the NC unit.
 - ⑤ Press the button. Its lamp is lit up.
 - ⑥ Press the mode selector switch .
 - ⑦ Using the switch of the manual pulse generator, select the Z(X) axis.
 - ⑧ Bring the tool into contact with the block. A measured value is displayed on the screen.
 - ⑨ Retract the Z(X) axis.
 - ⑩ Press the button. The lamp is lit off.

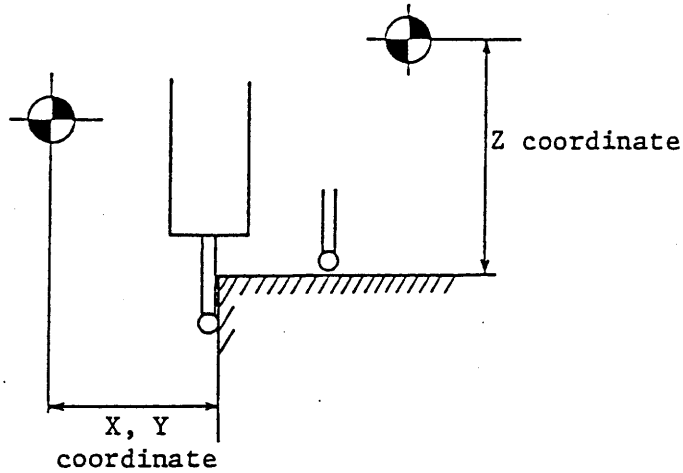
Note) Pressing the key interrupts operation.

* W setter

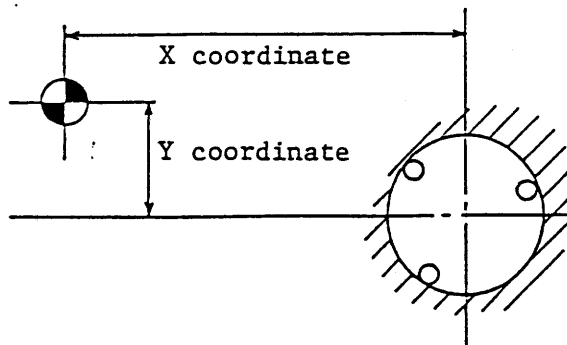
Using the touch sensor, it automatically writes a tool offset amount and a work coordinate shift amount by simple manual operation. It consists of the following combination of functions:



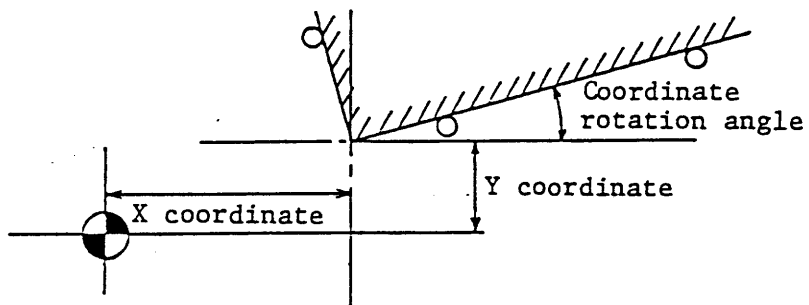
(a) Work setter datum face



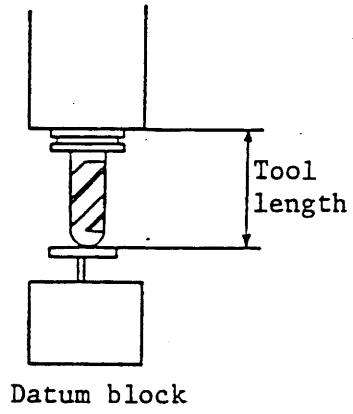
(b) Work setter datum hole



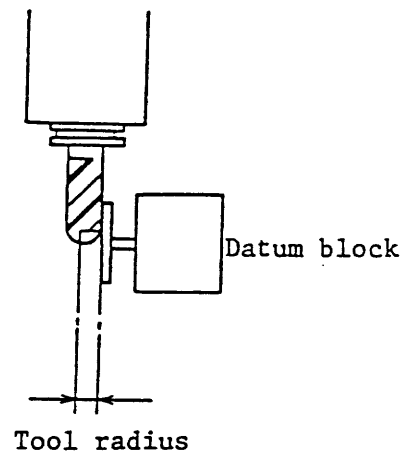
(c) Work setter coordinate rotation



(d) Tool setter
(tool length)



(e) Tool setter
(tool diameter)



III. Compensation value clear

1. PRESENT MAGAZINE

- ① Search for the top tool number to be cleared. Enter the number and press the CURSOR key .
- ② Enter the last tool number to be cleared.
- ③ Pressing the (CLEAR OFFSET) key displays "DELETING" blinking. When blinking disappears, a specified range (multiple compensation, too) is entirely set to 0.

2. TOOL DIA. COMP.

- ① Using the CURSOR keys , , , , set the cursor to the top number to be cleared.
- ② Enter the last number to be cleared.
- ③ Pressing the (CLEAR OFFSET) key sets all diameter compensation values within a specified range to 0.

3. MULTIPLE COMP.

- ① Set the cursor to the top number to be cleared.
- ② Enter the last compensation number to be cleared.
- ③ Pressing the (CLEAR OFFSET) key sets all compensation values in a specified range to 0.

IV. Magazine Data

This function edits the tool data in the current ATC magazine.

MAGAZINE DATA											
T-NO.	TOOL NAME	DIA.	LENGTH	TOOL MAT	TEETH	ANGL	PITCH		MULTI OFFSET		MATERIAL
							1	2	1	2	
0001	R. END MILL	15.000	120.000	H. S. S	2	90					1H. S. S
0002	F. SH. MILL	63.000	100.000	CARBIDE	4	90					2CARBIDE
0003	BACK C-BORE	5.000	100.000	CARBIDE	1	180					3CERMET
0004											4HSS-COAT
0005											5CC-COAT
0006											6HSS-COBL
0007											7CERAMIC
0008											8CBN
0009											9
0010											10

TOOLS FOR MACHINING OF HOLE			
1CENTER DRILL	6RH. TAP	11BACK C-BORE	16F. BACK BORE
2SPOT DRILL	7REAMER	12BACK CB/SHFT	17CHAMF. BAR
3DRILL	8SPIRAL REAM.	13ROUGH BORE	18HOLE CHMF CT
4DIL HOLE DR.	9BURNISH	14FINISH BORE	19DIR. -TAP-LH
5LH. TAP	10C-BORE	15R. BACK BORE	20DIR. -TAP-RH








F1 MILL REGISTER	F2 DRILL REGISTER	F3 DELETE	F4	F5	F6 MILL TOOLFILE	F7	F8	F9 END
------------------------	-------------------------	--------------	----	----	------------------------	----	----	-----------

Magazine Data

The tool data in the magazine is edited on this screen.

If F8 is pressed on this screen, the tool offset screen is returned to. The return key is turned off.

1. Editing the tool data

- ① Use the cursor keys  and  to move the blue cursor to the column TOOL NAME.
- ② Move the memory key to "WRITE".
- ③ Select the tool number to be edited.
 - Input the tool number and press the cursor key .
 - Use the page keys  and  to move the page and the cursor keys  and  to move the cursor.
- ④ Edit the tool name.

Registration of milling tool:

Input the number of the milling tool file and press the **F1** (MILLING TOOL REGISTER) key. This registration applies only to the milling tools in the tool file.

Registration of hole machining tool:

Input the number of the hole machining tool and press the **F2** (HOLE MACHINING TOOL REGISTER) key.

Deletion of hole machining tool:

Set the cursor to the tool name to be deleted and press the **F3** (DELETE) key.

Replacement of hole machining tool:

Input the number of the tool to newly be replaced and press the **F4** (REPLACE) key. The tool of the number currently displayed is then replaced with that of the specified number.

Note: The correction value of tool will also be replaced.

⑤ Edit the tool diameter.

Set the blue cursor to the column TOOL DIAMETER, use the numeric keys to input the tool diameter, and then press the **INPUT** key.

⑥ Edit the tool length.

Although the operating procedure is the same as that of ⑤, input the standard size value (different from the correction value of tool length). The value may not be input.

⑦ Edit the tool material.

Set the cursor to the column MATERIAL, check the material table displayed on the right side of the screen to input the desired number, and then press the **INPUT** key.

⑧ Edit the pitch and the number of tools.

Input the pitch for thread tool and the number of tools for other hole tools. The operating procedure is the same as the above.

⑨ Angle

Input the tool angle.

Note: ⑤ through ⑨ are available only for the hole tool.

⑩ Multiple correction

This correction is to set the correction number of more than one tool of different diameter and length in special tools (stepped tools). Two correction per tool number is made possible. (T1001 through T1044 can be specified.)

When using "multiple correction" in programming, input the number in the same procedure as the above.

* Milling tool file (F6)

The operating procedure for the milling tool file is the same as that for automatic programming. Refer to the instruction manual for automatic programming.

5-4-5 WORK COORDINATE SYSTEM SETTING

To set the work coordinate system, select the **F4** (WORK COORD.) key in Fig (5-23) of the Common Function Display for Operation screen. The following screen is displayed.

WORK COORDINATE SYSTEM SETTING				002304 N00000	
				SPINDLE T007 STANDBY T001	
				MACH. POSITION	
				X	. 0
				Y	. 0
				Z	. 0
				J1	
1	X - 200.000	4	X - 150.256		
	Y - 200.000		Y - 399.550		
	Z - 400.000		Z - 400.000		
G54		G57			
	R . 0		R . 0		
2	X - 50.256	5	X - 200.256		
	Y - 399.550		Y - 399.550		
	Z - 400.000		Z - 400.000		
G55		G58			
	R . 0		R . 0		
3	X - 100.256	6	X - 250.256		
	Y - 399.550		Y - 399.550		
	Z - 400.000		Z - 400.000		
G56		G59			
	R . 0		R . 0		
F1 ABSOLUTE INPUT		F2 INCREMENT INPUT		F3 ROTATION INPUT	
MEM F4 TOOL CHANGE		F5 CLEAR OFFSETS		LSK F6 F7 F8 F9	
STP					

WORK COORDINATE SYSTEM SETTING

There are two operating methods; manual input and automatic input.

I. Manual input

- ① With and PAGE and CURSOR keys, select the work coordinate system you want to set. There are pages J1 through J9. Set the cursor at any of X, Y, Z and R. (J can be changed to P by a parameter.) Numbers are sequentially given such as 1 for J1 of G54 and 54 for J9 of G59. You may enter that number and press the CURSOR key **▼**. For example, J1 of G59 is selected by pressing **0 6 ▼**, and J5 of G54 by pressing **2 5 ▼**.
- ② Enter set values.
- ③ Pressing the **F1** (ABSOLUTE INPUT) key sets the values in ② to a cursor-located position. Pressing the **F2** (INCREMENT INPUT) key adds (subtracts) the values in ② to (from) cursor-located values.

When the **F3** (ROTATION INPUT) key is pressed, the values in ② are treated as a cursor-indicated axis, calculated as follows and set by being added to X and Y.

(1) When the cursor is located at X

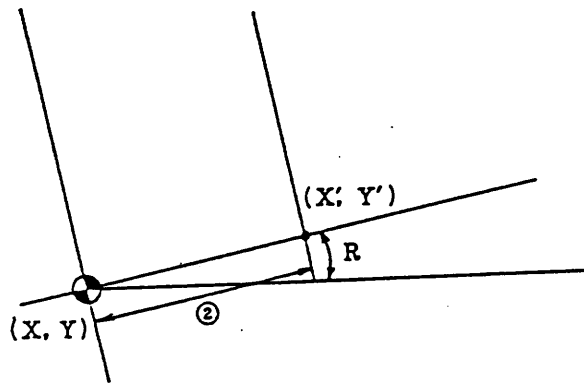
$$X' = \text{Value of "X"} + \text{Cos}(R) \times \textcircled{2}$$

$$Y' = \text{Value of "Y"} + \text{Sin}(R) \times \textcircled{2}$$

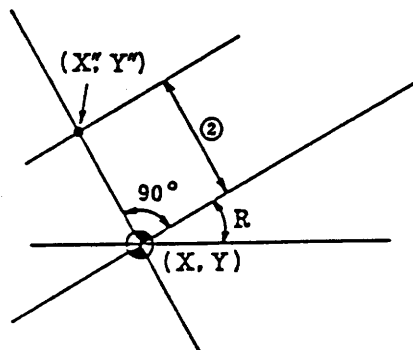
(2) When the cursor is located at Y

$$X'' = \text{Value of "X"} + \text{Cos}(R + 90) \times \textcircled{2}$$

$$Y'' = \text{Value of "Y"} + \text{Sin}(R + 90) \times \textcircled{2}$$



(1) When the cursor is located at X



(2) When the cursor is located at Y

II. Automatic input

After executing the step ① of the manual input method and mounting the reference tool to the spindle, operate as follows:

1. Setting the reference surface

WORK COORDINATE SYSTEM SETTING				002304 N00000																																	
MEASURING DATUM SURFACE				SPINDLE T007 STANDBY T001																																	
				MACH. POSITION																																	
				X	0																																
				Y	0																																
				Z	0																																
G54		G57		1. DATUM FACE																																	
1	X - 200.000	4	X - 150.256																																		
	Y - 200.000		Y - 399.550	2. DATUM HOLE (HOLE/BOSS)																																	
	Z - 400.000		Z - 400.000																																		
R . 0		R . 0		3. DATUM HOLE (WIDTH)																																	
G55		G58		4. COORD ALIGN																																	
2	X - 50.256	5	X - 200.256																																		
	Y - 399.550		Y - 399.550																																		
	Z - 400.000		Z - 400.000																																		
R . 0		R . 0																																			
G56		G59																																			
3	X - 100.256	6	X - 250.256																																		
	Y - 399.550		Y - 399.550																																		
	Z - 400.000		Z - 400.000																																		
R . 0		R . 0																																			
<table border="1"> <thead> <tr> <th colspan="4">JOG</th> <th colspan="2">LSK</th> <th colspan="2">STP</th> </tr> </thead> <tbody> <tr> <td>F1</td> <td>F2</td> <td>F3</td> <td>F4</td> <td>F5</td> <td>F6</td> <td>F7</td> <td>F8</td> </tr> <tr> <td>ABSOLUTE</td> <td>INCREMENT</td> <td>ROTATION</td> <td>TOOL</td> <td>CLEAR</td> <td></td> <td></td> <td></td> </tr> <tr> <td>INPUT</td> <td>INPUT</td> <td>INPUT</td> <td>CHANGE</td> <td>OFFSETS</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>						JOG				LSK		STP		F1	F2	F3	F4	F5	F6	F7	F8	ABSOLUTE	INCREMENT	ROTATION	TOOL	CLEAR				INPUT	INPUT	INPUT	CHANGE	OFFSETS			
JOG				LSK		STP																															
F1	F2	F3	F4	F5	F6	F7	F8																														
ABSOLUTE	INCREMENT	ROTATION	TOOL	CLEAR																																	
INPUT	INPUT	INPUT	CHANGE	OFFSETS																																	

WORK COORDINATE SYSTEM SETTING (Datum Surface)

- ① Press the mode selector key **JOG** or **HANDLE**.
- ② When pressing **REF.SURFACE** switch (① in Fig (5-11)) for the work setter on the machine operation panel, the lamp lights up, the screen on the ref. surface is displayed and the operation procedures are displayed on the right side of the screen.
- ③ Bring the reference tool into contact with the datum surface. Do it in a similar way for the X, Y and Z axes.
- ④ A value for a moved axis is displayed.
- ⑤ Shift the moved axis in an opposite direction.
- ⑥ Pressing the WORK SETTER **REF. SURFACE** switch turns off the lamp.

2. Setting the datum hole and datum groove

WORK COORDINATE SYSTEM SETTING				002304 N00000	
MEASURING DATUM BORE				SPINDLE T007 STANDBY T001	
MEASURING 1ST POINT				MACH. POSITION	
G54		G57		X	0
1	X - 200.000	4	X - 150.256	Y	0
	Y - 200.000		Y - 399.550	Z	0
	Z - 400.000		Z - 400.000		
R . 0		R . 0			
G55		G58			
2	X - 50.256	5	X - 200.256		
	Y - 399.550		Y - 399.550		
	Z - 400.000		Z - 400.000		
R . 0		R . 0			
G56		G59			
3	X - 100.256	6	X - 250.256		
	Y - 399.550		Y - 399.550		
	Z - 400.000		Z - 400.000		
R . 0		R . 0			

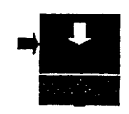



1. DATUM FACE	2. DATUM HOLE (HOLE/BOSS)
3. DATUM HOLE (WIDTH)	4. COORD ALIGN

JOG		LSK		STP	
F1	F2	F3	F4	F5	F6
ABSOLUTE INPUT	INCREMENTAL INPUT	ROTATION INPUT	TOOL CHANGE	CLEAR OFFSETS	
		F7	F8	F9	

WORK COORDINATE SYSTEM SETTING (Datum Hole, Groove)

- ① Press the mode selector key **JOG** or **HANDLE**.
- ② When pressing the **REF. HOLE** of the work setter, the lamp lights up, the screen of the ref. hole and groove is displayed and the operation procedures are displayed on the right side of the screen.
- ③ Bring the tool into contact with the first point (X, Y axes).
- ④ Shift a moved axis in an opposite direction.
- ⑤ Bring the tool into contact with the second point (X, Y axes).
- ⑥ Shift a moved axis in an opposite direction.
- ⑦ Pressing the **INPUT** key displays the center of a groove (X or Y).
- ⑧ Bring the tool into contact with the third point (X, Y).
- ⑨ Shift a moved axis in an opposite direction.
- ⑩ The center of a hole (X, Y and Z) is displayed on the screen.
- ⑪ Pressing the WORK SETTER **REF. HOLE** switch lights off the lamp.

3. Setting the coordinate rotation

WORK COORDINATE SYSTEM SETTING				002304 N00000	
MEASURING ROTATION ANGLE				SPINDLE T007 STANDBY T001	
MEASURING 1ST POINT				MACH. POSITION	
		J1		X . 0	
G54		1 X - 200.000		Y . 0	
		Y - 200.000		Z . 0	
		Z - 400.000		1. DATUM FACE	
		R . 0			
G57		4 X - 150.256		2. DATUM HOLE (HOLE/BOSS)	
		Y - 399.550			
		Z - 400.000		R . 0	
G55		2 X - 50.256		3. DATUM HOLE (WIDTH)	
		Y - 399.550			
		Z - 400.000		4. COORD ALIGN	
		R . 0			
G56		3 X - 100.256		①	
		Y - 399.550		②	
		Z - 400.000		③	
		R . 0			
G59		6 X - 250.256			
		Y - 399.550			
		Z - 400.000			
		R . 0			
				JOG	
F1	F2	F3	F4	F5	F6
ABSOLUTE	INCREMENT	ROTATION	TOOL	CLEAR	LSK
INPUT	INPUT	INPUT	CHANGE	OFFSETS	F7
				STP	
				F9	

WORK COORDINATE SYSTEM SETTING (Coordinate Rotation Angle)

- ① Press the mode selector key **JOG** or **HANDLE**.
- ② When pressing the **COORD ALIGN** of the work setter, the lamp lights up, the screen of the rotating angle is displayed and the operation procedures are displayed on the right side of the screen.
- ③ Bring the tool into contact with the first point (X, Y).
- ④ Shift a moved axis to the opposite direction.
- ⑤ Bring the tool into contact with the second direction (X, Y).
Do this with the same axis as one used for the first point.
After this, pressing the **INPUT** key displays an angle R obtained from two points.
- ⑥ Shift a moved axis to the opposite side.
- ⑦ Bring the tool into contact with the third point (X, Y).
For this, use the axis different from one used for the first and second points.
- ⑧ Shift a moved axis to the opposite side.
- ⑨ A rotation angle is displayed at R, and a reference point at X and Y.
- ⑩ Pressing the WORK SETTER **COORD ALIGN** switch lights off the lamp.

III. Tool Replacement (ATC)

ATC can be executed.

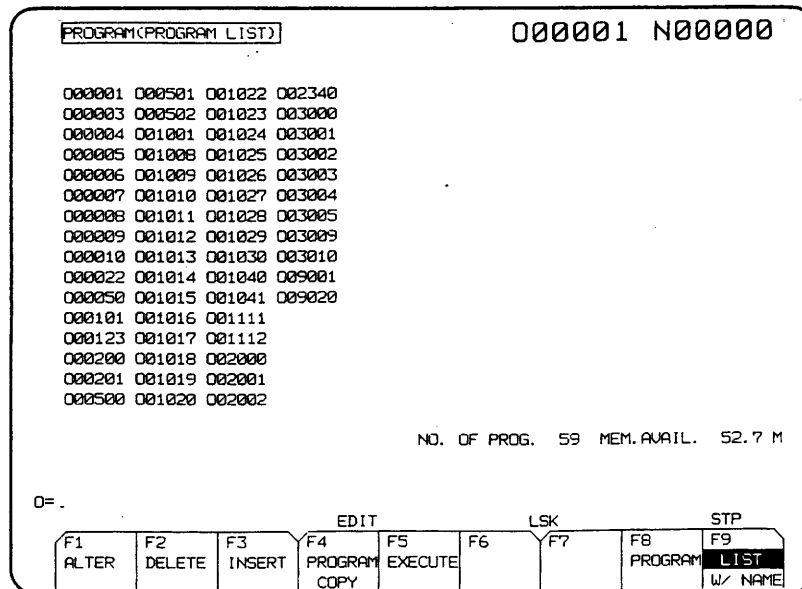
- ① When the (TOOL REPLACE) key is pressed, "TOOL REPLACE" is reversed and "T =" is displayed on the lower left part of the screen.
- ② Input the tool number to be called and press the key. ATC is executed and the reverse display of "TOOL REPLACE" for the key is released, entering the reset state.

IV. Clearing the work coordinate system data

- ① Search for the top work coordinate system number to be cleared.
1 ~ 54
(G54J1 = 1, G59J9 = 54)
Enter the number and press the CURSOR key .
- ② Enter the last work coordinate system number to be cleared.
- ③ Pressing the (CLEAR OFFSETS) key clears all of a specified range to 0.

5-4-6 LIST OF PROGRAMS

While the common function is displayed, select F5 (List of programs) key. The following picture is displayed;



PROGRAM (LIST OF PROGRAMS)

List of program numbers is displayed on the screen and with this picture, the editing in the unit of 0 such as the changing, deleting, copying of program number can be executed.

1. Changing program number

(Only the presently called program number is changed).

- ① Push Edit of mode select key.
- ② Set the memory key to "Write".
- ③ Key-in the program number to be changed.
- ④ Push F1 (ALTER) Key. The display changes to the picture of program (Edit) and the program number shown on the upper part of picture is changed.

2. Deleting program number

- ① Push the mode select key Edit .
- ② Set the memory key to "Write".
- ③ Key-in the program number to be deleted.
- ④ Push F2 (Delete) key.

3. Program copy

Push F4 (Program copy). The picture shown in below figure is displayed.

- ① Push the mode select switch Edit .
- ② Set the memory key to "Write".
- ③ Key-in the program number to be copied.
- ④ Key-in the new program number to be made.
- ⑤ Push F5 (Execute) key. → Copy is made with a new program number.

PROGRAM(PROGRAM LIST) 000001 N00000

```

000001 000501 001022 002340
000003 000502 001023 003000
000004 001001 001024 003001
000005 001008 001025 003002
000006 001009 001026 003003
000007 001010 001027 003004
000008 001011 001028 003005
000009 001012 001029 003009
000010 001013 001030 003010
000022 001014 001040 009001
000050 001015 001041 009020
000101 001016 001111
000123 001017 001112
000200 001018 002000
000201 001019 002001
000500 001020 002002
    
```

NO. OF PROG. 59 MEM.AVAIL. 52.7 M

0 ████ TO 0 ,COPIES
OF=

EDIT				LSK			STP	
F1	F2	F3	F4	F5	F6	F7	F8	F9
ALTER	DELETE	INSERT	PROGRAM COPY	EXECUTE			PROGRAM	LIST
								W/ NAME

LIST OF PROGRAMS (PROGRAM COPY)

4. Program display

When **F8** (Program) key is pushed, the present program number can be displayed.

(Identical to 5-4-3)

5. Display of program with name

When **F9** key is pushed while the "List" displayed by **F9** (List with names) key shown in the picture of below figure is turned reversely, the "with name" is reversely turned and the program name is displayed.

PROGRAM (PROGRAM LIST)							002304 N00000	
001111	(APC RUN)						
002222	(APC R IN)						
003333	(APC L IN)						
004444	(ATC RUN)						
005555	(ATC RUN SUB)						
006666	(RUNNING TAPE)						
007777	(CUTTING TAPE)						
							NO. OF PROG. 7 MEN. AVAIL. 78.0 M	
:0=								
EDIT			LSK			STP		
F1	F2	F3	F4	F5	F6	F7	F8	F9
ALTER	DELETE	INSERT	PROGRAM COPY				PROGRAM	LIST
								W/ NAME

LIST OF PROGRAMS (With Name)

5-5 Manual Operation

5-5-1 Each Axial Feed

1. Jog feed

- ① Press the mode selector key **JOG**.
- ② Set the FEEDRATE dial to your desired feed rate. Using the axis move selector switch for the axis you want to move, operate the machine in a desired direction.

When the machine comes to a specified position, release the switch.
(The axis moves only while the switch is pressed.)

Examples of use) • Warming-up operation
• When bringing closer to the zero point
• When manually cutting

2. Handle feed

- ① Press the mode selector key **HANDLE**.
- ② Select the axis with the axis selector switch (manual pulse generator).
- ③ Using the manual handle (manual pulse generator), the machine can be moved every 0.001 mm (0.0001 inch)/graduation (when 1/1 is selected), 0.01 mm (0.001 inch)/(when 10/1 is selected) or 0.1 mm (0.01 inch)/(when 100/1 is selected).

Examples of use : When moving the machine by a fine amount such as determining the zero point by centering a workpiece or fixture.

5-5-2 Rapid Traverse

- ① Press the mode selector key **RAPID**.
- ② Press the axis move selector switch (Ⓔ in Fig (5-11)) corresponding to the axis you want to feed at a rapid travers rate.
(The axis moves at a rapid traverse rate only while the switch is pressed.)
At this time, an override of 0, 1, 25, 50 or 100% can be applied to a specified rapid traverse rate.
- ③ Releasing the switch stops rapid traverse.

5-5-3 Tool Mounting/Dismounting

- ① Stop the spindle head at any desired position.
- ② Press any of the mode selector keys **JOG**, **RAPID**, **HANDLE** and **ZERO RETURN**.
- ③ Holding the tool firmly, shift the TOOL "UNCLAMP" button on front of the spindle head.

Notes) • When the tool has been already mounted, pressing the button causes draw bar nose to push a tool shank, thus dismounting the tool from a spindle tapered hole (hold the tool firmly not to drop it). When the tool is unclamped, a yellow push button lamp is lit up.

- When mounting the tool, completely get rid of dust from the tapered section of the tool shank. Using an accessory cleaner, clean well the spindle tapered hole.

- ④ Insert the tool shank into the spindle hole and press the TOOL "CLAMP" button. The tool is automatically clamped and mounted to the spindle, and the yellow lamp is lit off.

5-6 Automatic Operation

5-6-1 When Machining the First Workpiece, Checking the Newly Created Program

- ① Go through the steps ① through ⑥ in "4-6-2 Program Memory Operation".
- ② Turn on the SINGLE BLOCK switch.

Note) When this is done, it is safe to set the RAPID OVERRIDE dial to 25%.

- ③ Press the PROGRAM START button.
- ④ Check one block worth of operations, and press the PROGRAM START button again to make the program sequentially executed.

5-6-2 Program Memory Operation

- ① Check that the ALARM lamp on the machine operation panel is not lit up.
- ② Check tool length and tool diameter compensation data, and correct them if necessary.
- ③ Press the mode selector key AUTO.

Note) At this time, in normal operation, turn off the DRY RUN, OPTIONAL STOP, MACHINE LOCK, BLOCK SKIP and SINGLE BLOCK switches, and set the FEEDRATE OVERRIDE, SPINDLE OVERRIDE and RAPID OVERRIDE switches to 100%.

- ④ Press the RESET key on the keyboard.
- ⑤ On the Common Function Display for Operation screen, press the F1 key to display the POSITION screen, and set X, Y and Z relative position display values to 0.
When setting them to non-zero values, set desired values by machine lock operation.

Note) Return to the AUTO mode again after performing MDI or manual operation.

- ⑥ When suspending machine operation, press the PROGRAM STOP button on the operation panel or turn on the SINGLE BLOCK switch.
In case of emergency, press the EMERGENCY STOP button on the operation panel to immediately stop the machine.

5-6-3 When Intervening Automatic Operation with Manual Operation

- ① Press the PROGRAM **STOP** button.

Note) While program operation is suspended, a red lamp is lit up.
Or, turn on the **SINGLE BLOCK** switch to suspend it.

- ② Press the mode selector key **HANDLE** or **JOG** to perform manual operation.
- ③ After completing manual operation, press the mode selector key **AUTO**.
- ④ Pressing the PROGRAM **START** button restarts the program.

Note) When the PROGRAM **STOP** button is pressed, operations of M, S and T functions continue until their remaining operations are completed. Otherwise, manual operation cannot be performed.

5-6-4 When Intervening Automatic Operation with MDI Operation

- ① Turn on the **SINGLE BLOCK** switch on the machine operation panel.
- ② When the machine stops by single block operation, press the mode selector key **MDI**.
- ③ On the Common Function Display for Operation screen, press the **F2** key to display the PROGRAM (MDI) screen.
- ④ Enter required operations with the ADDRESS and DATA keys, and press the **F3** (INSERT) key.
- ⑤ Check MDI data and press the PROGRAM **START** button.
- ⑥ To restart automatic operation, press the mode selector key **AUTO** and turn off the **SINGLE BLOCK** switch.
- ⑦ Press the PROGRAM **START** button on the machine operation panel.

Note 1) When a tape command immediately before is of fixed cycle and when specifying a non-fixed cycle command from MDI, be sure to specify a required G code.

Note 2) When inserting MDI operation in the state of Note 1, if you want a tape command to be re-executed, it is necessary to specify hole machining data existing before MDI insertion.

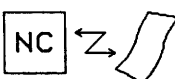
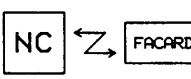
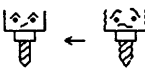
If data are only input by MDI operation and you continue automatic operation without executing them (forgetting, leaving the machine, etc.), the machine will function in an unexpected way because buffer contents by automatic operation have been replaced with unexecuted MDI buffer contents. Be fully aware of this.

5-7 STAF-M

5-7-1 Explanation of Menu Screen

When the **F7** (STAF-M) key is pressed on the Operation Selection screen (Fig. 5-20) or when the **F8** (STAF-M) key is selected on the common function display, the screen shown in below figure is displayed.

To display the common function during the execution of each management function, press the **RETURN** key. To select each function, use the NO + **INPUT** key or set the cursor to the corresponding item and then press the **INPUT** key.

STAF-M		002304 N00000	
SELECT WITH NUMBER + INPUT KEY			
1 NC-232C 	2 MULTI RS232C 	3 SETTING <input checked="" type="checkbox"/> INVALID YES <input type="checkbox"/>	
4 BACK GROUND EDIT CUTTING → 01111 WORK EDIT → 02222	5 TOOL LIFE 	6	
7	8	9	
F1 POSITION	F2 PROGRAM	F3 TOOL COMP.	F4 TAPE WORK COORD.
F5 PROGRAM LIST	F6 MACHIN MONITOR	F7 LSK	F8 STAF-M
			F9 STP MAINTENANCE

STAF-M Selection Screen

The explanation of functions for management is given in Table 5-3.

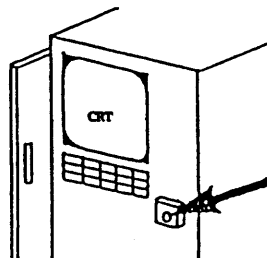
Table 5-3 Functions and Explanation of Function Keys

No.	FUNCTION	Explanation
1	NC-232C	Input and output data, such as NC data, NC parameters, and offsets, through the external connector.
2	I/O (Option)	Input and output data using the IC card. Input and output NC data, NC parameters, offsets, and magazine data.
3	Setting	Set and display data very frequently used out of NC parameter data.
4	Back ground edit	Edit other NC data during operation.
5	Tool life (Option)	Set the tool life (drilling count, cutting length, ATC count, etc.) and spare tools.
6		
7		
8		
9		

I. General

Data I/O between NC RS232C I/F for Multi M/C and an external device is performed. The RS232C connector is located at the following place.

Set up the external equipment before executing.



II. List of Functions

Data	Mode	Function	Code	Baud Rate	Control Codes
NC Data	1 Input	Several (Including 1 program) Changes '0' number	Code : ISO/EIA	Baud Rate : 1200 to 9600	Control Codes: Yes/No
	2 Output	1 program All			
	3 Verification	Several (Including 1 program) Specified			
	4 Deletion	Specified All			
Tool Offset Data	1 Input	All	Use the F7 (I/O DATA SET) key to change each data.		
	2 Output	All			
	3 Verification	All			
Parameter Data	1 Input	All			
	2 Output	All			
	3 Verification	All			

III. (F1) NC Data I/O

NORS232C					002304 N00000				
MODE	OUTPUT	INPUT	COLLAT.	DELETE	NO. OF PROG		8		
FUNC.	SINGLE	ALL			MEM. AVAIL.		50.7 M		
	000050	001111	002222	003333	004444	005555	006666	007777	
P R O G R A M L I S T									

IO=

F1	F2	F3	EDIT		LSK		STP	
N C PROGRAM	T. COMP DATA	PARA. DATA	F4	F5	F6	F7 I/O DATA SET	F8	F9 EXECUTE

If the **F1** (NC PROGRAM) key is pressed, function display turns to a reverse video state to be the NC Program I/O mode. Pressing the cursor key **▲** **▼** moves the cursor through the columns "Mode → Function → Program List" in this order and pressing **◀** **▶** enables selection of each mode, function and program No.

1. Output Mode

The following screen appears and the unit enters the output mode when the cursor is set to the column "Output" in the Mode.

MODE	OUTPUT	INPUT	COLLAT.	DELETE
FUNCTION	SINGLE		ALL	

• Outputting 1 program

- ① Set the cursor to the column "SINGLE" in the Function.
- ② Enter 0 No. to be output.
- ③ Press the **INPUT** key.
- ④ Press the **F9** (EXECUTE) key.
- ⑤ The program with the specified program No. will be output.

• Outputting all programs

- ① Set the cursor to the column "ALL" in the Function.
- ② Press the **F9** (EXECUTE) key.
- ③ All the programs in the memory will be output.

2. Input Mode

The following screen appears and the unit enters the input mode when the cursor is set to the column "Input" in the Mode.

MODE	OUTPUT	INPUT	COLLAT.	DELETE
FUNCTION	PLURAL PROG.		O NO. CHANGE	

• Inputting several programs (including 1 program)

- ① Set the cursor to the column "PLURAL PROG." in the Functions.
- ② Press the **F9** (EXECUTE) key.
- ③ All the programs to be input will be saved as they are.

• Inputting 1 program after renaming

- ① Set the cursor to the column "PLURAL PROG." in the Function.
- ② Enter the 0 No. to be renamed.
- ③ Press the **INPUT** key.
- ④ Press the **F9** (EXECUTE) key.
- ⑤ The 0 No. of the program to be input will be renamed to that entered and saved.

3. Verification Mode

The following screen appears and the unit enters the verification mode when the cursor is set to the column "COLLAT." in the Mode.

MODE	OUTPUT	INPUT	COLLAT.	DELETE
FUNCTION	PLURAL PROG.	SPECIFICATION		

- Verifying plural programs (including 1 program)

- ① Set the cursor to the column "PLURAL PROG." in the Function.
- ② Press the **F9** (EXECUTE) key.
- ③ All the programs to be input will be verified as they are.

- Verifying the contents of specified 1 program

- ① Set the cursor to the column "SPECIFICATION" in the Function.
- ② Enter the 0 No. to be verified.
- ③ Press the **INPUT** key.
- ④ Press the **F9** (EXECUTE) key.
- ⑤ The 0 No. of the program to be input and that entered will be verified.

4. Deletion Mode

The following screen appears and the unit enters the deletion mode when the cursor is set to the column "DELETE" in the Mode.

MODE	OUTPUT	INPUT	COLLAT.	DELETE
FUNCTION	SPECIFICATION		ALL	

- Deleting 1 program

- ① Set the cursor to the column "SPECIFICATION" in the Function.
- ② Enter 0 No. to be deleted.
- ③ Press the **INPUT** key.
- ④ Press the **F9** (EXECUTE) key.
- ⑤ The program with the specified program No. will be deleted.

- Deleting all programs

- ① Set the cursor to the column "ALL" in the Function.
- ② Press the **F9** (EXECUTE) key.
- ③ All the programs in the memory will be deleted.

IV. (F2) Tool Offset Data I/O

NCRS232C				002304 N00000					
MODE	OUTPUT	INPUT	COLLAT.						
FUNC.	ALL								
				EDIT		LSK		STP	
F1	F2	F3	F4	F5	F6	F7	F8	F9	
N C	T. COMP	PARA.				I/O DATA		EXECUTE	
PROGRAM	DATA	DATA				SET			

If the **F2** (T.COMP DATA) key is pressed, function display turns to a reverse video state to be the Tool Offset Data I/O mode.

Pressing **◀ ▶** enables selection of output, input or verification.

1. Output Mode

- ① Set the cursor to the column "Output" in the Mode.
- ② Press the **F9** (EXECUTE) key.
- ③ Tool offset data will be output.

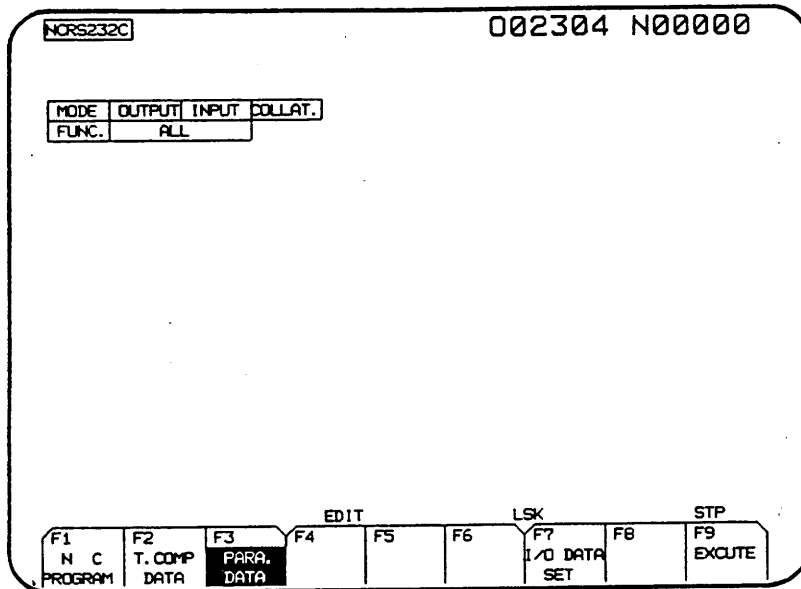
2. Input Mode

- ① Set the cursor to the column "Input" in the Mode.
- ② Press the **F9** (EXECUTE) key.
- ③ Tool offset data will be input.

3. Verification Mode

- ① Set the cursor to the column "COLLAT." in the Mode.
- ② Press the **F9** (EXECUTE) key.
- ③ Tool offset data will be verified.

V. (F3) Parameter Data I/O



If the **F3** (PARA DATA) key is pressed, function display turns to a reverse video state to be the Parameter Data I/O mode. Pressing **◀ ▶** enables selection of output, input or verification.

1. Output Mode

- ① Set the cursor to the column "Output" in the Mode.
- ② Press the **F9** (EXECUTE) key.
- ③ Parameter data will be output.

2. Input Mode

- ① Set the cursor to the column "Input" in the Mode.
- ② Press the **F9** (EXECUTE) key.
- ③ Parameter data will be input.

3. Verification Mode

- ① Set the cursor to the column "COLLAT." in the Mode.
- ② Press the **F9** (EXECUTE) key.
- ③ Parameter data will be verified.

VI. (F7) I/O Data Setting

If the **F7** (I/O DATA SET) key is pressed, the screen changes as follows and the I/O mode can be set. The blue cursor on the screen indicates the current setting status of the RS232C mode.

Move the pink cursor up and down by pressing the **▲ ▼** key to set to the item for changing the setting. Then, move the blue cursor by pressing the **◀ ▶** key. Confirm the location of the cursor and press the **F9** (SET END) key to return to the original screen.

NORS232C
002304 N00000

I/O INTERFACE DATA SETTING

I/O INTERFACE	TAPE READER		OUTPUT CONNECTOR	
I/O CODE	EIA		ISO	
BAUD RATE	1200	2400	4800	9600
CONTROL CODE	USED		NOT USED	
STOP BIT	1		2	

WHEN INPUTTING FROM TAPE READER

INTERFACE	TAPE READER
BAUD RATE	4800
CONTROL CODE	USED
STOP BIT	2

F1F2F3F4F5F6F7F8F9

EDIT LSK STP
SET
END

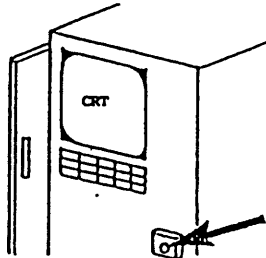
When this screen is appeared for input, collation and elimination, the input data are set, and when this screen is appeared for output, the output data are set.

5-7-3 Multi RS232C

I. General

Data I/O between Multi RS232C I/F for Multi M/C and an external device is performed. The RS232C connector is located at the following place.

Set the card before executing.



When the **RETURN** key is pressed, the Staf-m Menu screen is displayed.

II. List of Function

DATA	MODE	FUNCTION	CAPACITY	CODE	BAUD RATE	CONTROL CODES
NC Data	1 Input	Several (Including 1 program) Selected Changes '0' number	Not applicable	Fixed to ISO	Fixed to 4800	Fixed to Yes
	2 Output	Specified All Subprogram	Divided by the specified capacity			
	3 Verification	Several (including 1 program) Specified	Not applicable			
	4 Deletion	Specified All	Not applicable			
Magazine data	1 Input 2 Output 3 Verification	All All All	Capacity more than 80M is necessary.	* Binary data		
Tool Offset Data	1 Input 2 Output 3 Verification	All All All				
Parameter Data	1 Input 2 Output 3 Verification	All All All				

* Binary Data

Binary data is completely different from the ISO/EIA codes used to input and output NC data, etc. In general, it is impossible to input or output for a tape reader/puncher used for I/O. When binary data is to be input or output, be sure to use the exclusive SEIKI DON Card Reader/Writer.

III. (F1) NC Data I/O

MULTI RS232C				002304 N00000			
MODE	OUTPUT	INPUT	COLLAT.	DELETE			
FUNC.	SPECIFICATION		ALL	SUB PROGRAM		NO. OF PROG	8
LEN.	20M	80M	320M	MORE	MEM. AVAIL.		50.7 M
PROGRAM LIST	000050	001111	002222	003333	004444	005555	006666 007777

F1	F2	F3	EDIT		F5	F6	LSK	F8	STP
NC PROGRAM	SET-UP DATA	T. COMP DATA	PARA. DATA				I/O DATA SET		EXCUTE

If the **F1** (NC PROGRAM) key is pressed, function display turns to a reverse video state to be the NC Program I/O mode. Pressing the cursor key **▲** **▼** moves the blue cursor through the columns "Mode → Function → Capacity → Program List" in this order and pressing **◀** **▶** enable selection of each mode, function, capacity and program No.

1. Output Mode

The following screen appears and the unit enters the output mode when the cursor is set to the column "Output" in the Mode.

MODE	OUTPUT	INPUT	COLLAT.	DELETE			
FUNCTION	SPECIFICATION		ALL	SUB PROGRAM			
CAPACITY	20M	80M	320M	MORE			

• Outputting a specified program

- ① Set the cursor to the column "SPECIFICATION" in the Function.
- ② Select capacity in the Capacity. The output is made by the capacity unit specified here.

- ③ Move the cursor to the list of 0 No., set it to an 0 No. to be output and press the key.
- ④ The color of the 0 No. specified turns to pink. To cancel specification, set the cursor to the 0 No. and press the key. Up to 20 0 Nos. can be specified at a time.
- ⑤ Press the (EXECUTE) key.
- ⑥ The program with the specified 0 No. will be output.

• Outputting all programs

- ① Set the cursor to the column "ALL" in the Function.
- ② Select capacity in the Capacity. The output is made by the capacity unit specified here.
- ③ Press the (EXECUTE) key.
- ④ All the programs in the memory will be output.

• Outputting a program together with subprograms called from the main program

- ① Set the cursor to the column "SUBPROGRAM" in the Function.
- ② Select capacity in the Capacity. The output is made by the capacity unit specified here.
- ③ Move the cursor to the list of 0 No., set it to a main program No. to be output and press the key.
- ④ The color of the subprogram No. called from the specified main program turns to pink. To cancel specification, set the cursor to the 0 No. and press the key. If more than 20 main programs are specified or the 0 No. specified does not exist a message will be displayed and output will not be made.
- ⑤ Press the (EXECUTE) key.
- ⑥ The program with the specified 0 No. will be output.

2. Input Mode

The following screen appears and the unit enters the input mode when the cursor is set to the column "Input" in the Mode.

MODE	OUTPUT	INPUT	COLLAT.	DELETE
FUNCTION	PLURAL PROG.		SELECTION	O NO.CHANGE
CAPACITY	20M	80M	320M	MORE

- Inputting several programs (Including 1 program)

- ① Set the cursor to the column "PLURAL PROG." in the Function.
Any capacity will do.
- ② Press the (EXECUTE) key.
- ③ All the programs to be input will be saved as they are.

Note) Setting of NC parameter determines whether or not the input ends after a message is displayed when the input program already exists in the NC memory.

- Inputting a program by selecting from several programs

- ① Set the cursor to the column "SELECTION" in the Function.
Any capacity will do.
- ② Press the (EXECUTE) key.
- ③ Input operation will start and every time an O No. is detected, "O**** REGISTERED? (Y/N)" will be prompted. Press the "Y" key to save and the "N" key to cancel saving. When the "Y" key is pressed, a program with that O No. will be saved in the NC memory and when the "N" key is pressed, the search proceeds to the next O No. and the previous question will be asked again as another O No. is detected.

Note) Setting of NC parameter determines whether or not the input ends after a message is displayed when the selected program already exists in the NC memory.

• Inputting several programs after renaming

- ① Set the cursor to the column "0 NO. CHANGE" in the Function.
Any capacity will do.
- ② Press the **F9** (EXECUTE) key.
- ③ Input operation will start and every time an 0 No. is detected, "0**** TO BE MODIFIED? (IF NOT, ONLY ENTER INPUT KEY.)" will be prompted. To input a program after changing 0 No., enter the new 0 No. and press the **INPUT** key. If not changing the 0 No. and saving the program with its original 0 No., press the **INPUT** key only. The previous question will be asked for all the programs to be input.

3. Verification Mode

The following screen appears and the unit enters the verification mode when the cursor is set to the column "COLLAT." in the Mode.

MODE	OUTPUT	INPUT	COLLAT.	DELETE
FUNCTION	PLURAL PROG.		SPECIFICATION	
CAPACITY	20M	80M	320M	MORE

• Verifying plural programs (including 1 program)

- ① Set the cursor to the column "PLURAL PROG." in the Function.
Any capacity will do.
- ② Press the **F9** (EXECUTE) key.
- ③ All the programs to be input will be verified as they are.

• Verifying the contents of specified 1 program

- ① Set the cursor to the column "PLURAL PROG." in the Function.
Any capacity will do.
- ② Move the cursor to the list of 0 No., set it to a program No. to be verified and press the **INPUT** key. The color of the program No. turns to pink. To cancel specification, set the cursor to the 0 No. and press the **CANCEL** key.

- ③ Press the **F9** (EXECUTE) key.
- ④ The O No. of the program to be input and that entered will be verified.

4. Deletion Mode

The following screen appears and the unit enters the deletion mode when the cursor is set to the column "DELETE" in the Mode.

MODE	OUTPUT	INPUT	COLLAT.	DELETE
FUNCTION	SPECIFICATION		ALL	
CAPACITY	20M	80M	320M	MORE

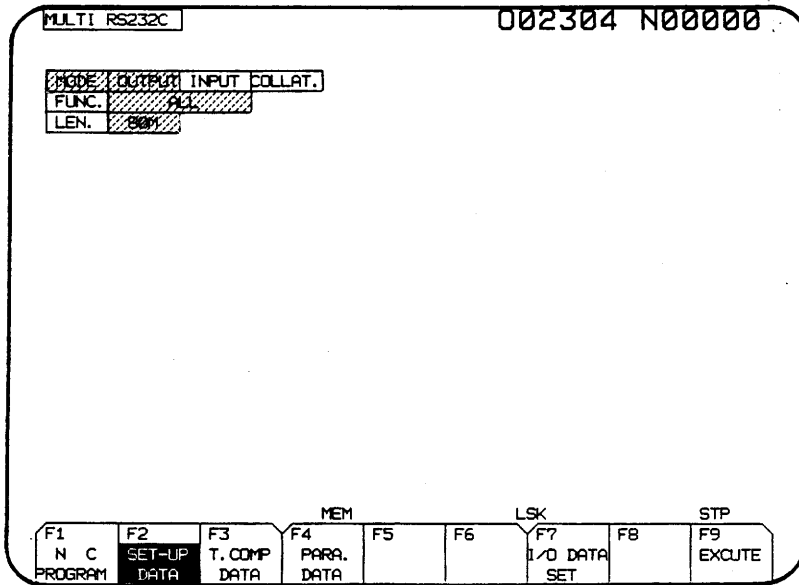
- Deleting the specified program

- ① Set the cursor to the column "SPECIFICATION" in the Function. Any capacity will do.
- ② Move the cursor to the list of O No., set it to a program No. to be deleted and press the **INPUT** key. The color of the program No. turns to pink. To cancel specification, set the cursor to the O No. and press the **CANCEL** key.
- ③ Press the **F9** (EXECUTE) key.
- ④ The program with the specified O No. will be deleted.

- Deleting all programs

- ① Set the cursor to the column "ALL" in the Function. Any capacity will do.
- ② Press the **F9** (EXECUTE) key.
- ③ All the programs in the memory will be deleted.

IV. (F2) Setup Data I/O



If the **F2** (SET-UP DATA) key is pressed, function display turns to a reverse video state to be the Setup Data I/O mode. Input or output cursor can be selected by the cursor keys **◀** and **▶**.

1. Setup Data Output Mode

- ① Set the cursor to "OUTPUT" in the column MODE.
- ② Press the **F9** (EXECUTE) key.
- ③ Magazine data is output.

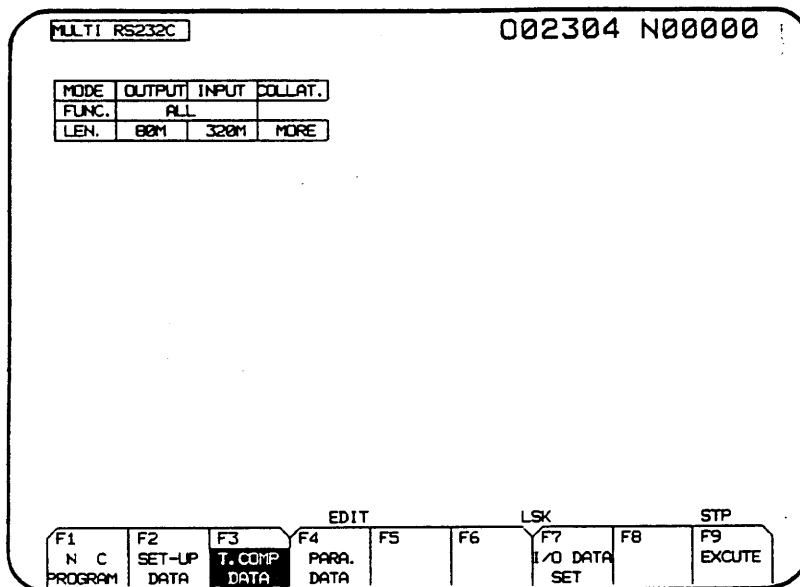
2. Setup Data Input Mode

- ① Set the cursor to "INPUT" in the column MODE. The cursor may be set to any item in the column CAPACITY.
- ② Press the **F9** (EXECUTE) key.
- ③ Magazine data is input.

3. Magazine Data Collating Mode

- ① Set the cursor to "COLLAT." in the column MODE.
- ② Press the **F9** (EXECUTE) key.
- ③ Magazine data is collated.

V. (F3) Tool Offset Data I/O



If the **F3** (T.COMP DATA) key is pressed, function display turns to a reverse video state to be the Tool Offset data I/O mode. Pressing the cursor key **▲** **▼** moves the blue cursor through the columns "Mode → Function → Capacity" in this order and pressing **◀** **▶** enables selection of each mode, function or capacity.

1. Output Mode

- ① Set the cursor to the column "Output" in the Mode.
Any capacity will do.
- ② Press the **F9** (EXECUTE) key.
- ③ Tool offset data will be output.

2. Input Mode

- ① Set the cursor to the column "Input" in the Mode.
Any capacity will do.
- ② Press the **F9** (EXECUTE) key.
- ③ Tool offset data will be input.

3. Verification Mode

- ① Set the cursor to the column "COLLAT." in the Mode.
Any capacity will do.
- ② Press the **F9** (EXECUTE) key.
- ③ Tool offset data will be verified.

VI. (F4) Parameter Data I/O

MULTI RS232C				002304 N00000			
MODE	OUTPUT	INPUT	COLLAT.				
FUNC.	ALL						
LEN.	80M	320M	MORE				

		EDIT		LSK		STP	
F1	F2	F3	F4	F5	F6	F7	F9
N C	SET-UP	T. COMP	PARA.			I/O DATA	EXECUTE
PROGRAM	DATA	DATA	DATA			SET	

If the **F4** (PARA. DATA) key is pressed, function display turns to a reverse video state to be the Parameter Data I/O mode. Pressing the cursor key **▲** **▼** moves the blue cursor through the columns "Mode → Function → Capacity" in this order and pressing **◀** **▶** enables selection of each mode, function or capacity.

1. Output Mode

- ① Set the cursor to the column "Output" in the Mode.
Any capacity will do.
- ② Press the **F9** (EXECUTE) key.
- ③ Parameter data will be output.

2. Input Mode

- ① Set the cursor to the column "Input" in the Mode.
Any capacity will do.
- ② Press the **F9** (EXECUTE) key.
- ③ Parameter data will be input.

3. Verification Mode

- ① Set the cursor to the column "COLLAT." in the Mode.
Any capacity will do.
- ② Press the **F9** (EXECUTE) key.
- ③ Parameter data will be verified.

VII. (F7) I/O Data Setting

If the **F7** (I/O DATA SET) key is pressed, the screen changes as follows and the screen indicates the current setting status of the RS232C mode. Press the **F9** (SET END) key to return to the original screen.

MULTI RS232C
002304 N00000

I/O INTERFACE DATA SETTING

FOR THE MULTI RS-232C INTERFACE, SETTINGS ARE FIXED AS FOLLOWS.

	INPUT CODE	BINARY DATA FOR NC DATA EXCEPT ISO: (NOTE)
I	BAUD RATE	4800
	CONTROL CODE	USED
	STOP BIT	2
	OUTPUT CODE	BINARY DATA FOR NC DATA EXCEPT ISO: (NOTE)
O	BAUD RATE	4800
	CONTROL CODE	USED
	STOP BIT	2

(NOTE) BINARY DATA
 THIS IS A CODE IN THE FORMAT COMPLETELY DIFFERENT FROM THE ISO/EIA CODE USED FOR INPUT/OUTPUT OF NC DATA, ETC.
 ITS INPUT/OUTPUT CANNOT BE EXECUTED WITH THE TAPE READER/PUNCHER GENERALLY CONNECTED AT INPUT/OUTPUT TIME.
 WHEN INPUTTING/OUTPUTTING THE BINARY DATA, YOU ARE REQUESTED TO USE AN EXCLUSIVE SEIKI FA CARD READER/WRITER.

F1 F2 F3

EDIT F4 F5 F6

LSK F7 F8

STP F9

SET
END

5-7-4 SETTING

Use this function when setting the setting data.

Press the **F4** (SETTING) key on Page 2 on the Common Function Display for Operation screen. The following screen is displayed.

SETTING		000000 N00000	
1	X-AXIS MIRROR IMAGE	VALID	INVALID
2	Y-AXIS MIRROR IMAGE	VALID	INVALID
3	Z-AXIS MIRROR IMAGE	VALID	INVALID
4	4TH-AXIS MIRROR IMAGE	VALID	INVALID
5	5TH-AXIS MIRROR IMAGE	VALID	INVALID
6	INPUT UNIT	INCH	METRIC
7	PROHIBIT EDITING OF PROGRAM NO. 8000-8999 ?	YES	NO
8	PROHIBIT DISPLAY OF PROGRAM NO. 8000-8999 ?	YES	NO
9	SINGLE BLOCK STOP AT USER MACRO	YES	NO
10	ACTION WHEN NO INPUT SKIP SIGNAL AT MOVE COMMAND IN G31	PROCEED	ALARM
11	PROHIBIT EDITING OF PROGRAM NO. 9000-9999 ?	YES	NO
12	PROHIBIT DISPLAY OF PROGRAM NO. 9000-9999 ?	YES	NO
13			
14			
15	OK MONITOR INTERLOCK	VALID	INVALID

F1	F2	F3	F4	F5	F6	F7	F8	F9	

SETTING (PAGE 1)

SETTING		000000 N00000	
16	BRAKE POINT 1 (NOT STOPPED WHEN 0)		0
17	BRAKE POINT 2 (NOT STOPPED WHEN 0)		0
18	INTERFERENCE CHECK FOR ADJACEMENT TOOLS ON T COMMAND	YES	NO
19	DWELL TIME AT G76.77 FIXED CYCLE UNIT: 0.001 SEC.		1000
20	RETRACT AMOUNT AT G73 FIXED CYCLE UNIT: 0.001MM/0.0001"		.870
21	RETRACT AMOUNT AT G83 FIXED CYCLE UNIT: 0.001MM/0.0001"		.871
22			
23	ANGLE AT G76.77 FIXED CYCLE UNIT: 0.001°		0
24			
25	RETRACT SPEED AT G76.77 FIXED CYCLE UNIT: INCH/MIN.MM/MIN		100
26			
27			
28			
29			
30			

F1	F2	F3	F4	F5	F6	F7	F8	F9	

SETTING (PAGE 2)

SETTING		000000 N00000
31	ECCENTRICITY COMP. OF PROBE CENTER +X DIR	3.000
32	ECCENTRICITY COMP. OF PROBE CENTER -X DIR	3.000
33	ECCENTRICITY COMP. OF PROBE CENTER +Y DIR	3.000
34	ECCENTRICITY COMP. OF PROBE CENTER -Y DIR	3.000
35	REFERENCE TOOL LENGTH	200.000
36	RETURN AMOUNT FOR RETOUCH	.300
37	MINIMUM ADJACENT DISTANCE 3-PT HOLE MEAS	.200
38	DROOP COMP. FOR WORKPIECE MEAS X	.0
39	DROOP COMP. FOR WORKPIECE MEAS Y	.0
40	DROOP COMP. FOR WORKPIECE MEAS Z	.0
41		
42		
43		
44		
45		

HELP

F1	F2	F3	F4	F5	F6	F7	F8	F9
----	----	----	----	----	----	----	----	----

SETTING (PAGE 3)

1. Setting the data

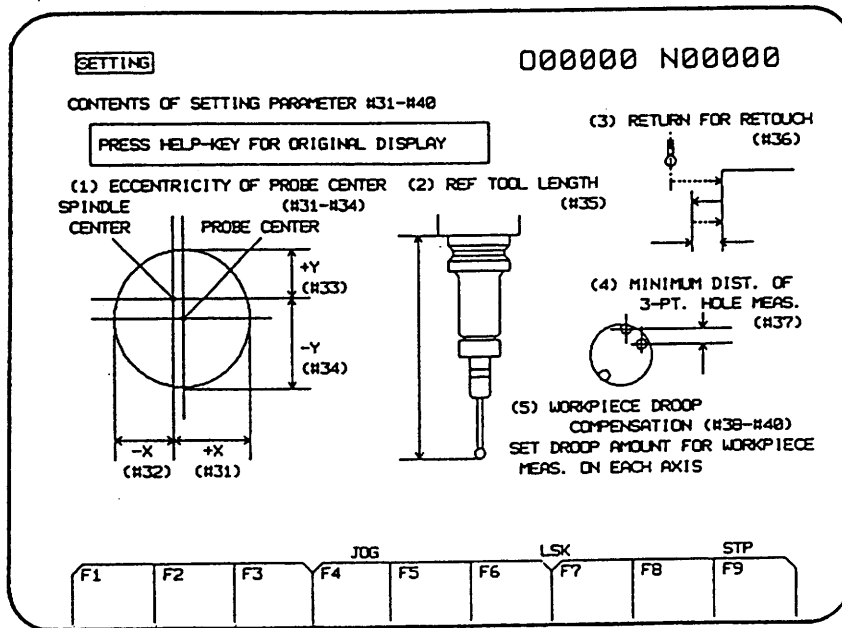
- ① Shift the MEMORY LOCK/WRITE key to "WRITE".
- ② Using the CURSOR keys , set the cursor to the item you want to set. The page is scrolled by the PAGE keys .
- ③ Set blue colored fields with the CURSOR keys . For the other fields, enter numbers and press the INPUT key.
- ④ Shift the MEMORY LOCK/WRITE key to "LOCK".

2. Specifying the ATC command through MDI operation

When an adjacent pot has a large-diameter tool, there is a parameter "Execution Yes/No" at No. 18. (See Fig (5-91))

3. Setting the reference tool

Pressing the **HELP** key on the screen of Fig (5-92) display the following screen.



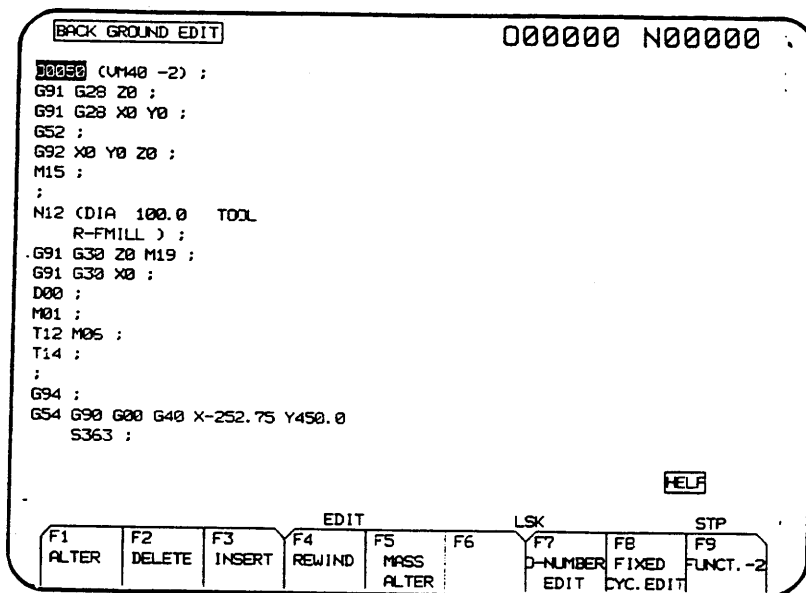
SETTING HELP SCREEN

On the screen above, pressing the **HELP** key returns you to the screen of Fig (5-92).

5-7-5 BACK GROUND EDIT

This function, which edits another program during automatic operation. Either main program or subprogram, a current machining program cannot be edited.

When BACK GROUND EDIT is selected on the Management Menu screen, the following screen is displayed.



BACK GROUND EDIT

- Enter the program number you want to edit. Editing operation is the same as in "5-4-3, (4) PROGRAM (EDIT)".

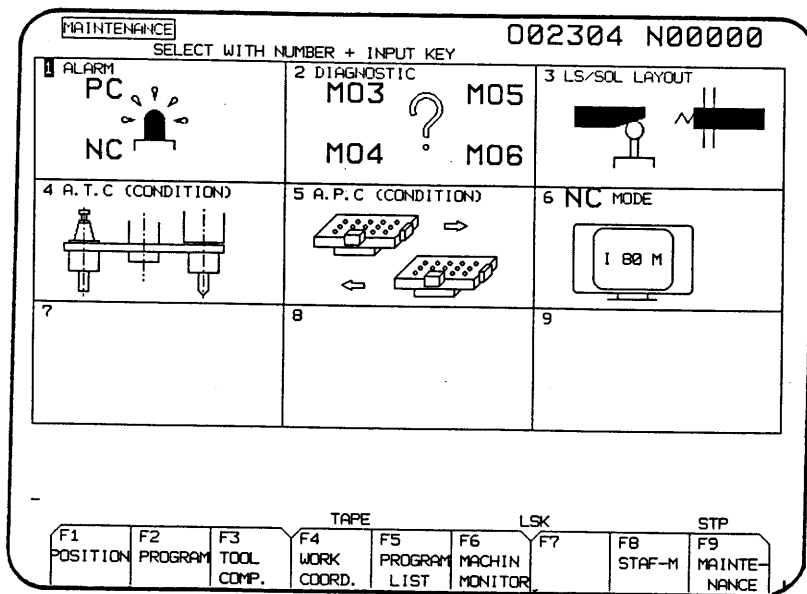
Note) To transfer a program, you just select either AUTO or EDIT mode, press the **F2** (PROGRAM) key on Page 1 of the Common Function Display for Operation screen, and then, press the **F7** (O-NUMBER EDIT) key.

5-8 Maintenance

5-8-1 Explanation of Menu Screen

When the **F9** (MAINTENANCE) key is pressed on the Operation Selection screen (Fig. 5-20) or when the **F9** (MAINTENANCE) key is selected on the common function display, the screen shown in below figure is displayed.

To provide the common function display during the execution of each maintenance function, press the **RETURN** key. To select each function, use the NO + **INPUT** key or set the cursor to the corresponding item and then press the **INPUT** key.



Maintenance Selection Screen, Page 1
(Common Functions for Maintenance, Page 1)

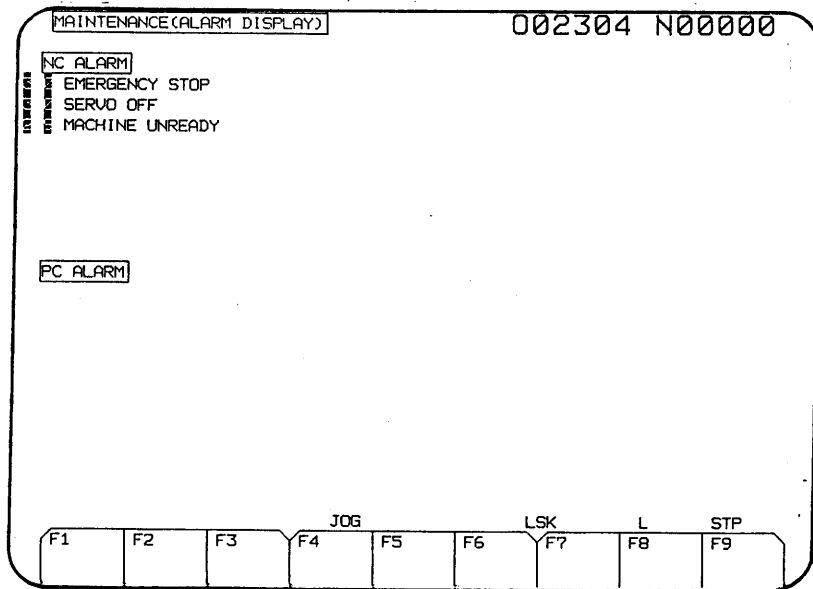
The explanation of functions for maintenance in Table 5-4.

Table 5-4 Function and Explanation

No.	FUNCTION	Explanation
1	Alarm	Display the contents of alarm currently output.
2	Diagnostic	Display the operating state of the main axis and ATC.
3	LS/SOL layout diagram	Display the ON/OFF state of LS/SOL.
4	ATC status display	Explain the ATC operation and execute operation one by one.
5	APC status display (Option)	Explain the ATC operation and execute operation one by one.
6	NC screen	Display the conventional 9" mode.
7		
8		
9		

5-8-2 ALARM

If alarm is selected (1 input) on the maintenance menu screen, the following screen is displayed.



MAINTENANCE (ALARM DISPLAY)

Upon occurrence of an alarm, this screen shows you what it is like.

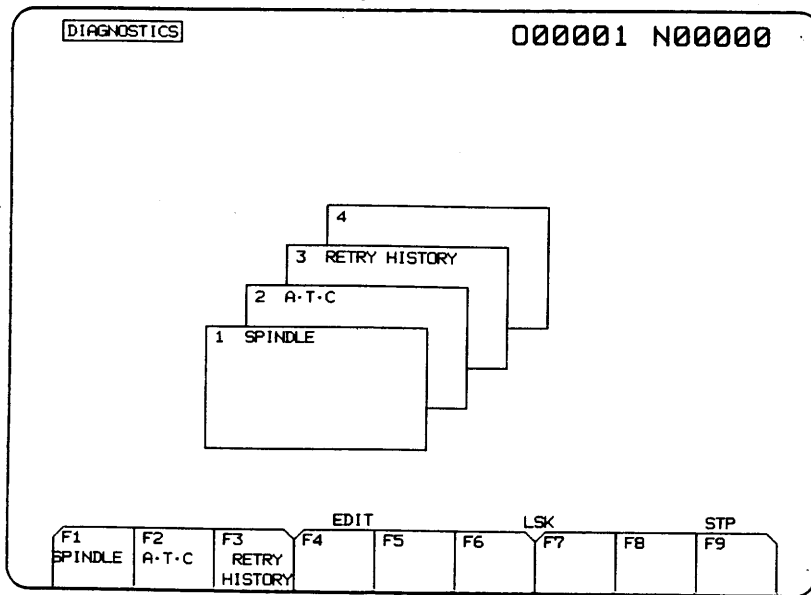
When the **RETURN** key is pressed, the Maintenance Menu screen is displayed.

Note)

A PC alarm is displayed same as a content of NC screen.

5-8-3 DIAGNOSTIC

When DIAGNOSTICS is selected on the Maintenance Menu screen, the following screen is displayed.

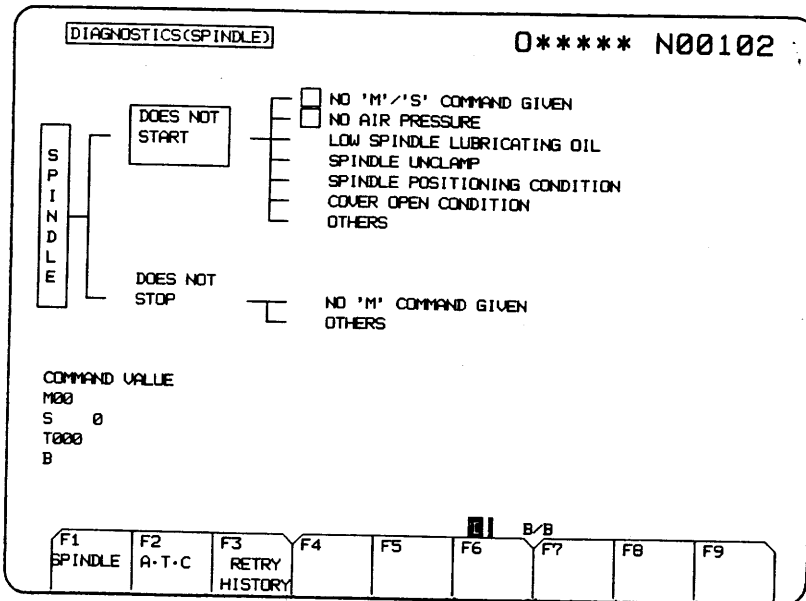


DIAGNOSIS (Selection Screen)

1. Diagnosing the spindle start/stop condition

When there is a trouble which disables the spindle to start or stop and you want to know its cause, press the **F1** (SPINDLE) key on the screen shown in Fig (5-98).

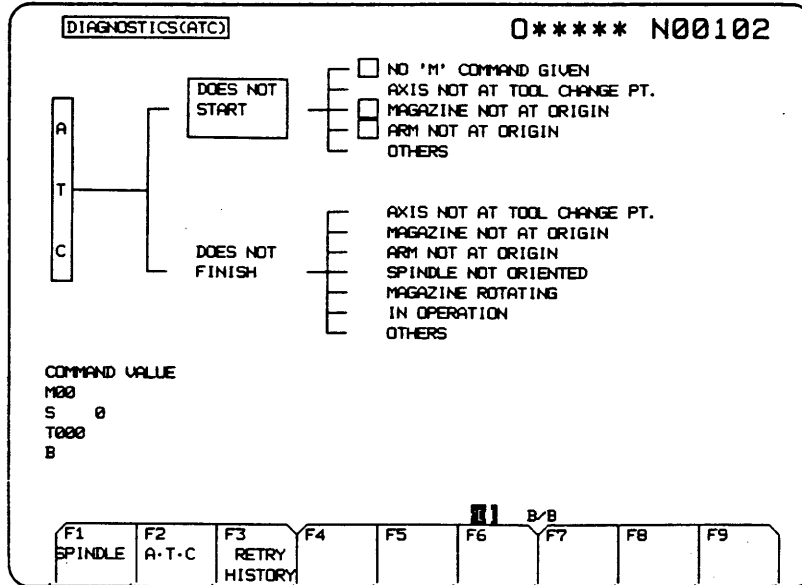
Then, the screen shown in the under figure appears with its cause enclosed in a red frame.



DIAGNOSIS (SPINDLE)

2. Diagnosing the ATC condition

When there is a trouble in ATC operation and you want to know its cause, press the **F2** (ATC) key on the screen shown in Fig (5-98). Then, the screen shown in the under figure appears, where the cause is indicated with a blue frame as to a T code, with a red frame as to M06, and with a pink frame as to both of T and M.



DIAGNOSIS (ATC)

Note) The APC and index table are optional.

3. History of re-try

RETRY HISTORY 000001 N00000

NO.	MENU	NO.	FUNCTION	1/2 TIMES
02	A-T-C	01	SWING ARM TO SPINDLE	0
03		02	SPINDLE ORIENTAT.	0
04		03	ARM SLIDE SPINDLE SIDE	0
05		04	SPINDLE TOOL UNCLAMP	0
06		05	W-ARM FORWARD	0
07		06	W-ARM TURN RIGHT	1
08		07	W-ARM TURN LEFT	0
		08	W-ARM RETRACT	0
		09	SPINDLE TOOL CLAMP	0
		10	ARM SLIDE POSITION	0
		11	SWING ARM TO MAGAZINE	0
		12	ARM SLIDE MAGAZ. SIDE	0
		13		
		14		
		15		
		16		

EDIT LSK STP

F1 ZERO SET ALL F2 F3 ZERO SET EACH F4 F5 F6 F7 F8 SETTING F9 END

- When the system does not operate even when the individual operation instruction is sent, the operation instruction is sent again.

The instruction to repeat the individual operation again is called the re-try.

How many times this re-try has been made is displayed.

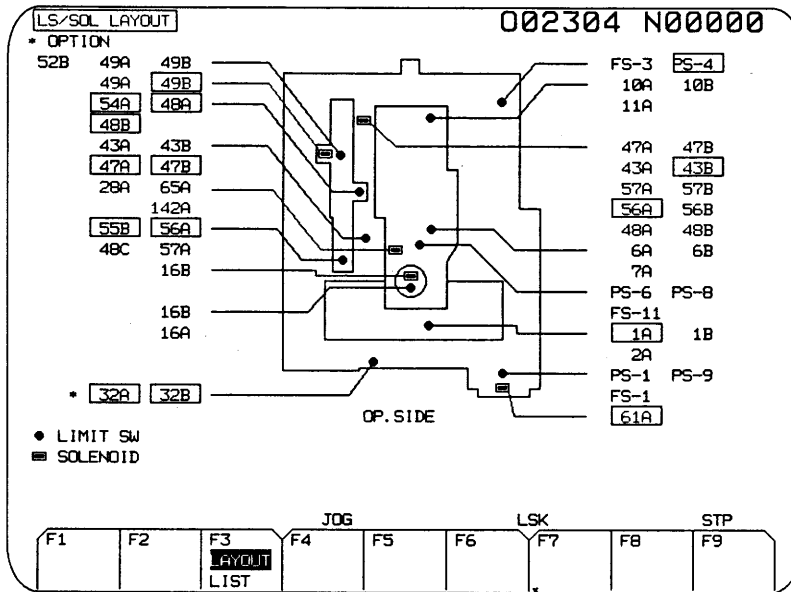
- Selection of menu

Set the cursor \blacktriangle at the required position and push F8 (SETTING).

The function of set menu is shown on the right side of screen.

5-8-4 Layout Diagram of the Limit Switches and Solenoids <VG>

If the LS/SOL layout drawing is selected (3 input) on the maintenance menu screen, the following screen is displayed. If the **RETURN** key is pressed, the maintenance menu screen is displayed.



LS/SOL Layout Drawing <VG>

This indicates the limit switch and solenoid ON/OFF status. If a number is framed in red, it is in the ON status.

If the **F3** (layout drawing list) key is pressed on this screen, "LIST" is contrast reversed and the following screen to show the function and application and the ON/OFF status is displayed. If a number is framed in red, it is in the ON status.

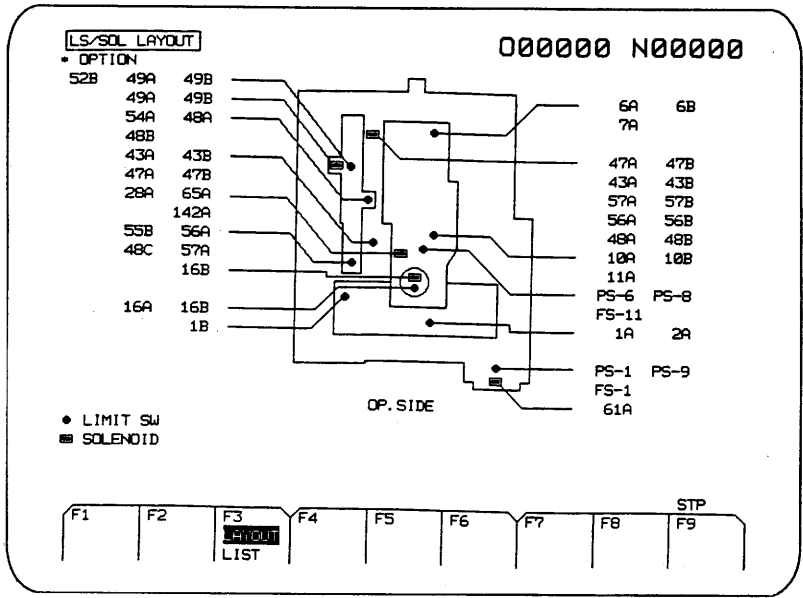
LS/SOL LIST				002304 N00000				1/2			
NO.	FUNCTION	STATUS		NO.	FUNCTION	STATUS		NO.	FUNCTION	STATUS	
		SOL	LS			SOL	LS			SOL	LS
01	SPINDLE TOOL UNCLAMP	16B	16B	19	X-AXIS(-) STROKE END	-	1A				
02	SPINDLE TOOL CLAMP		16A	20	X-AXIS(+) STROKE END	-	1B				
03	SPINDLE AIR BLOW, ON	28A		21	X-AX. SLOWDOWN/ZERO RET.	-	2A				
04	W-ARM TURN RIGHT	43A	43A	22	Y-AXIS(-) STROKE END	-	6A				
05	W-ARM TURN LEFT	43B	43B	23	Y-AXIS(+) STROKE END	-	6B				
06	W-ARM FORWARD	47A	47A	24	Y-AX. SLOWDOWN/ZERO RET.	-	7A				
07	W-ARM RETRACT	47B	47B	25	Z-AXIS(-) STROKE END	-	10A				
08	SWING ARM TO MAGAZINE	48A	48A	26	Z-AXIS(+) STROKE END	-	10B				
09	SWING ARM TO SPINDLE	48B	48B	27	Z-AX. SLOWDOWN/ZERO RET.	-	11A				
10	M06 COMPLETION	-	48C	28	OP.SIDE OPEN THE DOOR	-	32A				
11	MAGAZINE ROTATE RIGHT	49A	49A	29	OP.SIDE CLOSE THE DOOR	-	32B				
12	MAGAZINE ROTATE LEFT	49B	49B	30							
13	ARM SLIDE SPINDLE SIDE	56A	56A	31	SPNDL. COOL OIL FL. SW.		FS-11				
14		57B		32	LUBRICATE FL. SWITCH		FS-1				
15	ARM SLIDE POSITION	56B	55B	33	LUBRICATENG OIL P-SW.		PS-9				
16		57B		34	MOVE OIL FL. SWITCH		FS-3				
17	ARM SLIDE MAGAZ. SIDE	56B	57A	35	MOVE OIL P-SWITCH		PS-4				
18		57A		36	AIR SOURCE PRESSURE		61A				

LS/SOL List

If the **F3** (layout drawing list) key is pressed again, "LAYOUT DRAWING" is contrast reversed and the screen of Layout Drawing is returned to.

Layout Diagram of the Limit Switches and Solenoids < VK II >

If the LS/SOL layout drawing is selected (3 input) on the maintenance menu screen, the following screen is displayed. If the **RETURN** key is pressed, the maintenance menu screen is displayed.



LS/SOL Layout Drawing < VK II >

This indicates the limit switch and solenoid ON/OFF status. If a number is framed in red, it is in the ON status.

If the **F3** (layout drawing list) key is pressed on this screen, "LIST" is contrast reversed and the following screen to show the function and application and the ON/OFF status is displayed. If a number is framed in red, it is in the ON status.

LS/SOL LIST			000000 N00000			002304 N00000		
NO.	FUNCTION	STATUS		NO.	FUNCTION	STATUS		
		SOL	LS			SOL	LS	
01	SPINDLE TOOL CLAMP	-	16A	19	X-AXIS(-) STROKE END	-	1A	
02	SPINDLE TOOL UNCLAMP	16B	16B	20	X-AXIS(+) STROKE END	-	1B	
03	SPINDLE AIR BLOW, ON	28A	-	21	X-AX. SLOWDOWN/ZERO RET.	-	2A	
04	W-ARM TURN RIGHT	43A	43A	22	Y-AXIS(-) STROKE END	-	6A	
05	W-ARM TURN LEFT	43B	43B	23	Y-AXIS(+) STROKE END	-	6B	
06	W-ARM FORWARD	47A	47A	24	Y-AX. SLOWDOWN/ZERO RET.	-	7A	
07	W-ARM RETRACT	47B	47B	25	Z-AXIS(-) STROKE END	-	10A	
08	SWING ARM TO MAGAZINE	48B	48B	26	Z-AXIS(+) STROKE END	-	10B	
09	SWING ARM TO SPINDLE	48A	48A	27	Z-AX. SLOWDOWN/ZERO RET.	-	11A	
10	M06 COMPLETION	-	48C	28				
11	MAGAZINE ROTATE RIGHT	49A	49A	29				
12	MAGAZINE ROTATE LEFT	49B	49B	30				
13	ARM SLIDE SPINDLE SIDE	56A	56A	31	SPINDLE COOL OIL FL. SW.	FS-11		
14		57B		32	LUBRICATE FL. SWITCH	FS-1		
15	ARM SLIDE POSITION	56B	55B	33	LUBRICATING OIL P-SW.	PS-9		
16		57B		34				
17	ARM SLIDE MAGAZ. SIDE	56B	57A	35				
18		57A		36	AIR SOURCE PRESSURE	61A	PS-1	

F1 F2 F3 F4 F5 F6 F7 F8 F9 STP

F3 LAYOUT LIST

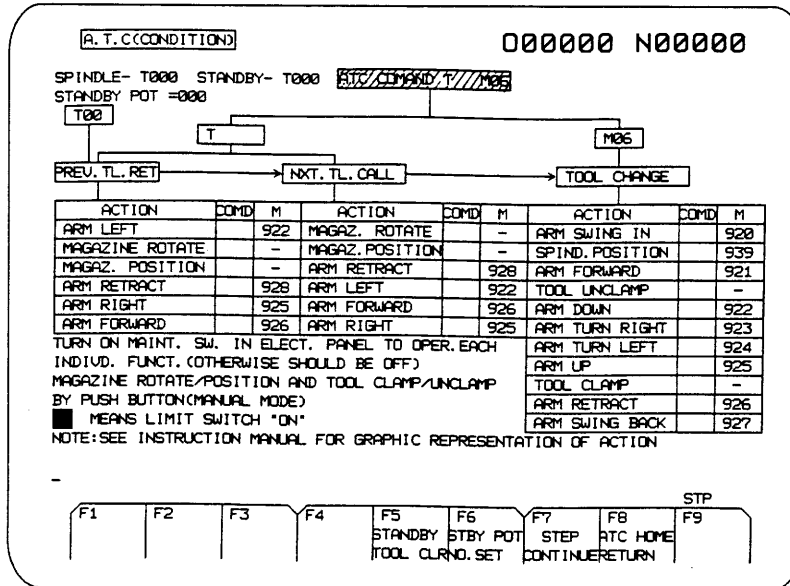
F6 LSK F7 F8 F9 STP

LS/SOL List

If the **F3** (layout drawing list) key is pressed again, "LAYOUT DRAWING" is contrast reversed and the screen of Layout Drawing is returned to.

5-8-5 ATC Status Display

If the ATC status diagram is selected (4 input) on the maintenance menu screen, the following screen to explain the ATC operation is displayed. If the **RETURN** key is pressed, the maintenance menu screen is displayed.



ATC Status Display

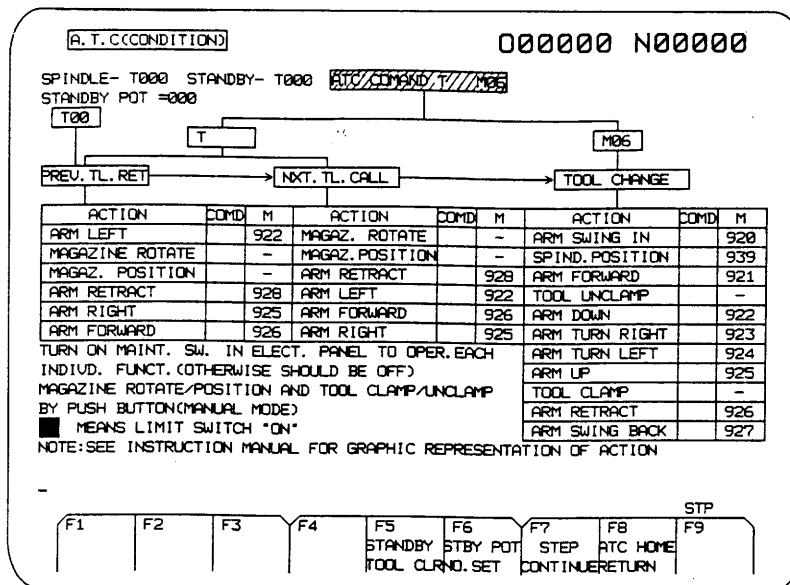
1. ATC Status Display

1) On this screen, tool change, tool call, changing operation, tool returning operation is checked. It is also possible to see the status per operation.

2) Tool changing operation check

- ① Press the mode selector key MDI.
- ② Set the cursor to "ATC COMMAND T M06".
- ③ Key in the tool number.
- ④ Press the input key. The blue cursor turns red.
- ⑤ If the machine operation panel's program "START" button is pressed, the ATC operates to set the tool of that number on the spindle. When ended, the red cursor returns to blue. The NC is reset.

Note) See the names of the ATC components and the figures of operation (Fig (5-107)).



ATC Status Display

3) Tool calling operation check

- ① Press the mode selector key MDI .
- ② Set the cursor to "T " .
- ③ Key in the tool number.

- ④ Press the key. The blue cursor turns red.
- ⑤ If the program "START" button is pressed, the tool of that number is called to the waiting position. When ended, the red cursor returns to blue. The NC is reset.

4) Changing operation check

- ① Press the mode selector key .
- ② Set the cursor to "M06".
- ③ Press the key. The blue cursor turns red.
- ④ If the program "START" button is pressed, the changing operation is performed. When ended, the red cursor returns to blue.
The NC is reset.

Note) If the spindle is not at its original position, press "START", and it will return automatically to its original position.

5) Tool return check

- ① Press the mode selector key .
- ② Set the cursor to "T00".
- ③ Press the key. The blue cursor turns red.
- ④ If the program "START" button is pressed, the tool is returned to the magazine. When ended, the red cursor returns to blue.
The NC is reset.

6) Check per operation

A function to locate the ATC trouble.

- ① Turn ON the maintenance switch on the high-power panel. A message is displayed and blinks on the screen.
- ② Set the cursor to the point to operate.
- ③ Press the mode selector key .
- ④ Press the key. The M code is displayed in a red frame.
- ⑤ If the program "START" button is pressed, the operation is performed.
If the status column is red, it means that the limit switch for that operation is ON.
- ⑥ Turn OFF the maintenance switch. The message on the screen disappears.

Note) For tool unclamp·clamp, magazine turn and spindle move, press the button after turning to the manual mode.

2. Spindle· Waiting Tool Memory Clear

(To be performed in the condition of the emergency stop button having been pressed.) If the (spindle waiting tool clear) key is pressed on the screen of Fig (5-107), the spindle and waiting tool number memory is cleared.

3. Waiting Pot Number Set

(To be performed in the condition of the emergency stop button having been pressed.)

- ① Key in the waiting pot number on the screen of Fig (5-107).
- ② Press the (waiting pot number set) key. The waiting pot number turns to the keyed-in value. (The magazine number is altered.)

4. ATC Original Position Reset

A function to reset to the ATC original position when the ATC operation was interrupted due to power failure, emergency stop, etc.

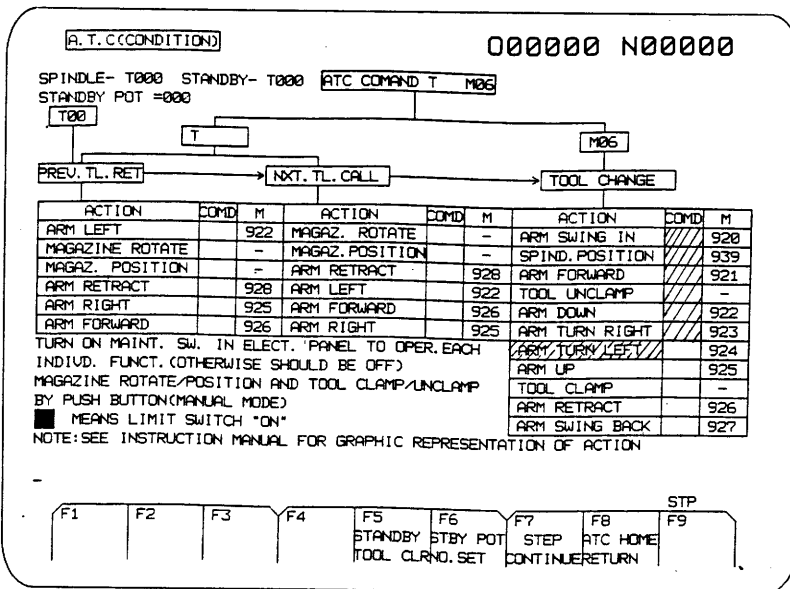
If the trouble is simple, it is easily possible to recover using this function. It is possible to select "STEP" or "CONTINUE". These are switched every time the key is pressed.

Operating Procedure

- ① Turn to the ready for operation status.
- ② Press the (original position reset) key. ... Displayed as contrast reversed.
- ③ The stopped status is automatically judged and the cursor(blue) is set to the point of next operation. ... A message is displayed.
- ④ If the key is pressed, that operation is executed.
If "CONTINUE", go to ⑥ after ending.
- ⑤ Repeat ③ , ④ until the original position is returned to.
- ⑥ After being reset to the original position, check the numbers of both the spindle and waiting tools.
- ⑦ Press the (original position reset) key. ... The reverse-contrast display disappears.

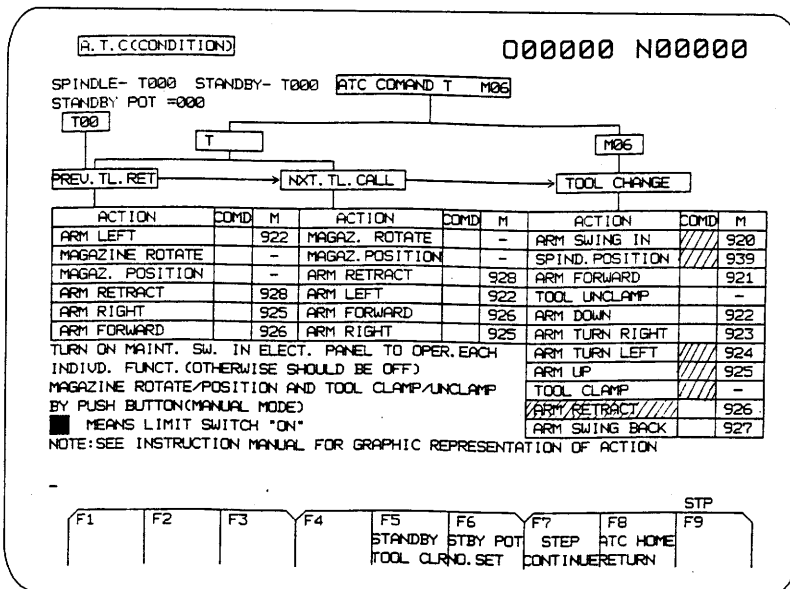
Notes)

1. If already at the original position in the status of ②, "ORIGINAL POSITION COMPLETE STATUS" is displayed and the operation of ③ and beyond is impossible.
2. If the X ~ Z axes are not at the ATC original position and if the W arm, etc. is at the original position, judged as the original position in ②.
3. If it is impossible to reset by this operation, turn on the maintenance switch and perform the individual operation to recover.



Condition of original position reset having been pressed

Arm turn Performed from the left.



Condition of arm having turned

5-8-7 N/C mode

When NC MODE is selected on the Maintenance Menu screen, the following screen is displayed.

- The following keys become ineffective in the N/C screen.

PAUSE key

HELP key

- In the N/C screen, a key functioning different from the function of the multi screen and a special key are used.

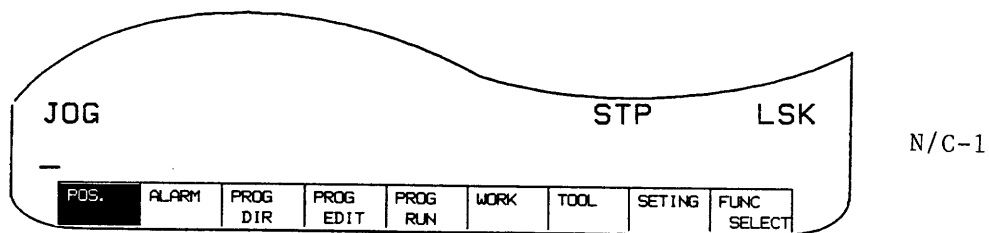
OPER./PROG. key and **BACK** key.

In the multi screen, though these keys were keys for changing the operation side over to the automatic program side, or for displaying the previous screen or the common function, in the N/C screen they are keys for getting away from the N/C screen to return to the multi screen.

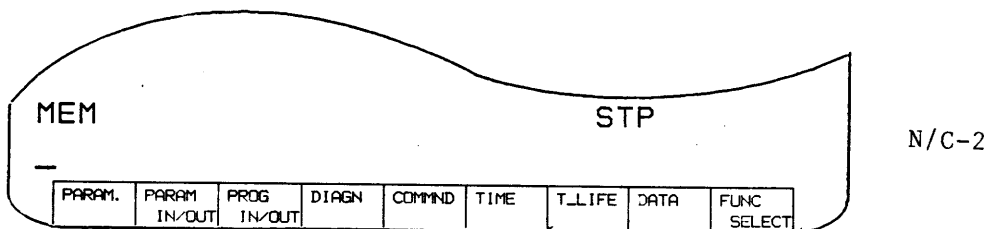
NEXT key

There is a key that nothing is written between the **CAN** key and the **INPUT** key. That is the **NEXT** key. This key performs the same role as that of the **BACK** key, and a key for displaying the previous screen or for changing the main function over to the sub-function in the multi screen.

- The main function is as follows:

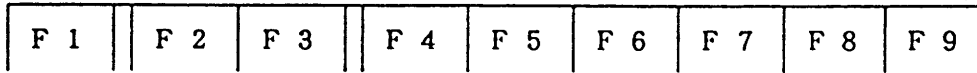


When pressing F9 (FUNC SELECT) in N/C-1, the menu in N/C-2 appears.



When pressing F9 (Front menu) in N/C-2, the menu in N/C-1 is returned.

- . The sub-function is changed depending on what is selected.
- . Pop-up menu
There are spots where 2 lines exist as shown in the below figure.

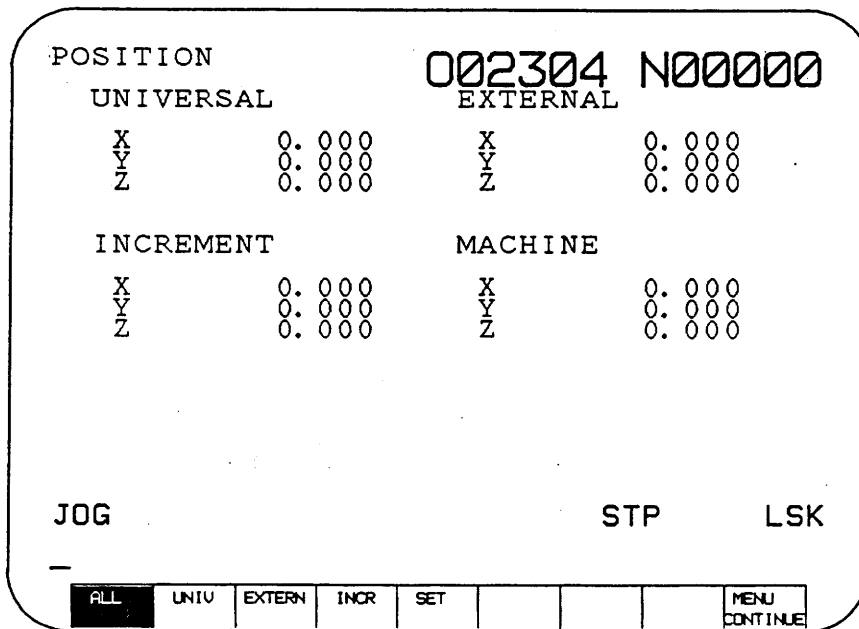


The above figure means that there are the pop-up menus in "F2 and F4". The pop-up menu is used for selecting a menu when plural menus exist in the function. In order to display the pop-up menu, press the function key twice. Thereupon, it is displayed on the right upper side of the screen, so select with the cursor and press the key.

* For details, please refer to the instruction manual for the YASNAC 180M.

1. POS. (F1)

When selecting F1 (POS.) key by the main function, the screen in N/C-3 is displayed.



N/C-3

- . ALL (F1) ----- N/C-3
4 coordinate systems of work coordinate system, external coordinate value, remained travel amount and machine coordinate system are displayed.

• UNIV (F2) ----- N/C-4

The coordinate systems selected by G54 through G59 are displayed. The coordinate system can be set by F5 (Coordinate system setting).

• EXTERN (F3) ---- N/C-5

Though this is fundamentally the same value as that of the machine coordinate system, the coordinate system can be set by F5 (Coordinate system setting).

• INCR (F4) ----- N/C-6

When a program starts, the remained travel amounts of the axes are displayed.

• SET (F5)

When pressing F5 (Coordinate system setting) on the screen of either the work coordinate system or the external coordinate system, the cursor appears at the place of each axis name. Set the cursor to the axis name desired to set, enter a numerical value by the key and press the **INPUT** key.

After the setting is completed, press F5 (Coordinate system setting) again.

• Error pulse (Reverse F1) ---- N/C-7

The error rate of the current position of each axis is displayed.

POSITION		002304	N00000
UNIVERSAL			
X		0.000	
Y		0.000	
Z		0.000	
JOG		STP	LSK
ALL	UNIV	EXTERN	INCR
	SET		
			MENU
			CONTINUE

N/C-4

POSITION		002304	N00000
EXTERNAL			
X		0.000	
Y		0.000	
Z		0.000	
JOG		STP	LSK
ALL	UNIV	EXTERN	INCR
	SET		
			MENU
			CONTINUE

N/C-5

POSITION	002304	N00000
INCREMENT		
X	0.000	
Y	0.000	
Z	0.000	
JOG		STP
ALL	UNIT	EXTERN
INCR		
		MENU
		CONTINUE

N/C-6

POSITION	002304	N00000
ERROR PULSE		
X	0.000	
Y	0.000	
Z	0.000	
JOG		STP
ERROR		
		MENU
		CONTINUE

N/C-7

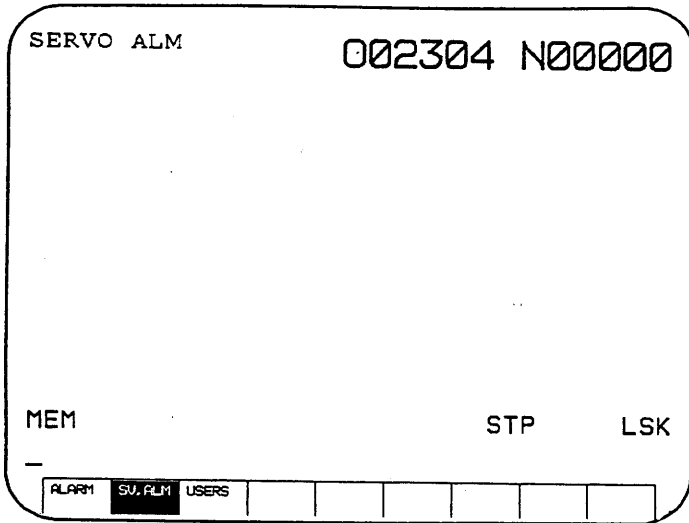
2. ALARM (F2)

When F2 (Alarm) key is selected in the main function, the screen of N/C-8 is displayed.

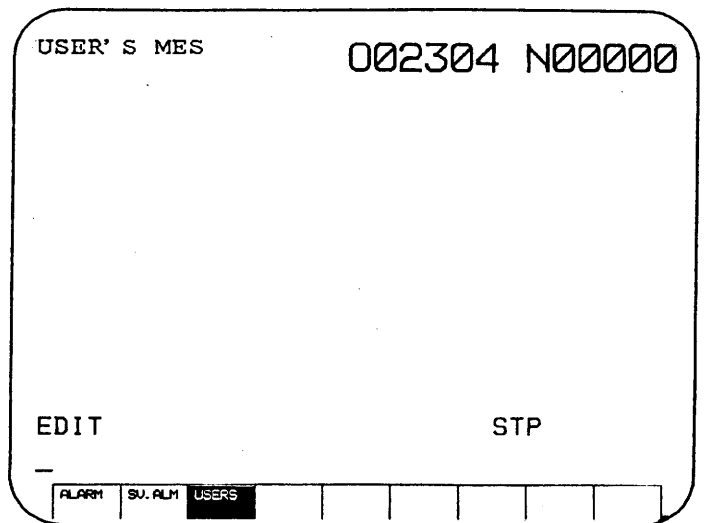
ALARM	002304	N00000
3002:	EMERGENCY STOP	
3000:	SERVO OFF	
2190:	MACHINE UNREADY	
3002	EMERGENCY STOP	
MEM		STP LSK
ALARM	SV. ALM	USERS

N/C-8

- ALARM (F1) ----- N/C-8
An alarm on the N/C side is displayed.
- SV.ALM (F2) ---- N/C-9
An alarm on the servo side is displayed.
- USERS (F3) ----- N/C-10
An alarm on the PC side or the alarm of macro is displayed.



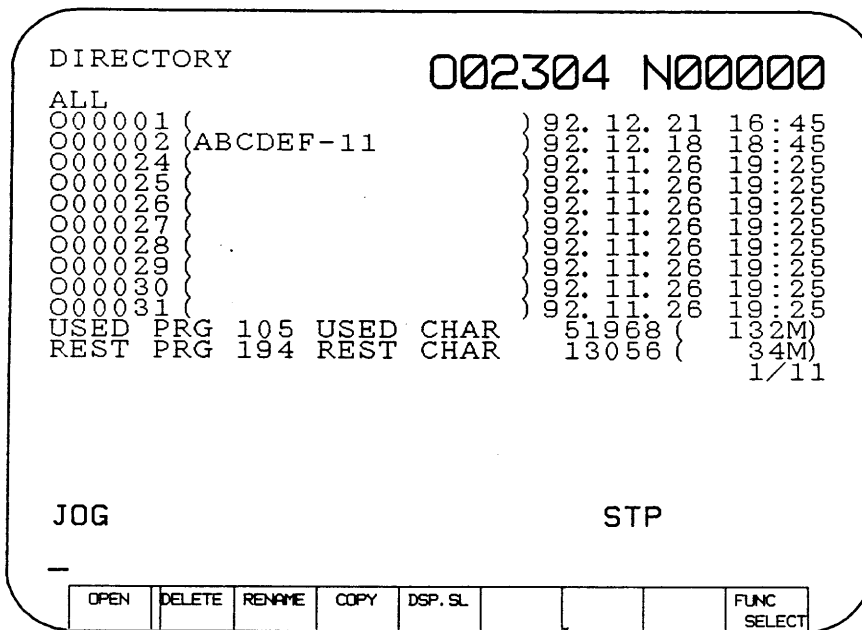
N/C-9



N/C-10

3. PROG DIR (F3)

When F3 (PROG DIR) key is selected in the main function, the screen of N/C-11 is displayed.



N/C-11

OPEN (F1)

It is possible here to newly register 0 number or to call the current 0 number.

When 0 number is newly registered.

When F1 (OPEN) is pressed, messages are displayed on near the center of the screen (N/C-12).

Enter the 0 number desired to register by the key here and press the **INPUT** key (Note: Be sure to apply "0" before the 0 number). Thereupon, the messages are changed.

Enter comments by the key here and press the **INPUT** key! The number has been registered by this procedure. The screen will be changed from the screen of the list of programs to the screen of the program editing.

When the current 0 number is called.

When F1 (OPEN) is pressed, messages are displayed on hear the center of the screen (N/C-13).

Enter the 0 number desired to call by the key here and press the **INPUT** key (Note: Be sure to apply "0" before the 0 number.). Thereupon, the program is called to change to the screen of the program editing.

DIRECTORY 002304 N00000

```

ALL
00000001 (ABCDEF-11) 00000000 02. 12. 21 16:45
00000002 00000000 02. 12. 18 18:45
00000004 00000000 11. 11. 22 06:55
00000005 00000000 11. 11. 22 06:55
00000007 00000000 11. 11. 22 06:55
00000008 00000000 11. 11. 22 06:55
00000009 00000000 11. 11. 22 06:55
00000010 00000000 11. 11. 22 06:55
00000011 00000000 11. 11. 22 06:55
00000012 00000000 11. 11. 22 06:55
00000013 00000000 11. 11. 22 06:55
00000014 00000000 11. 11. 22 06:55
00000015 00000000 11. 11. 22 06:55
00000016 00000000 11. 11. 22 06:55
00000017 00000000 11. 11. 22 06:55
00000018 00000000 11. 11. 22 06:55
00000019 00000000 11. 11. 22 06:55
00000020 00000000 11. 11. 22 06:55
00000021 00000000 11. 11. 22 06:55
00000022 00000000 11. 11. 22 06:55
00000023 00000000 11. 11. 22 06:55
00000024 00000000 11. 11. 22 06:55
00000025 00000000 11. 11. 22 06:55
00000026 00000000 11. 11. 22 06:55
00000027 00000000 11. 11. 22 06:55
00000028 00000000 11. 11. 22 06:55
00000029 00000000 11. 11. 22 06:55
00000030 00000000 11. 11. 22 06:55
00000031 00000000 11. 11. 22 06:55
USED PRG 105 USED CHAR 519588 (132M)
REST PRG 194 REST CHAR 130588 (34M)
INPUT O NO. 1/11
  
```

JOG STP

OPEN DELETE RENAME COPY DSP. SL FUNC SELECT

N/C-12

DIRECTORY 002304 N00000

```

ALL
00000001 (ABCDEF-11) 00000000 02. 12. 21 16:45
00000002 00000000 02. 12. 18 18:45
00000004 00000000 11. 11. 22 06:55
00000005 00000000 11. 11. 22 06:55
00000007 00000000 11. 11. 22 06:55
00000008 00000000 11. 11. 22 06:55
00000009 00000000 11. 11. 22 06:55
00000010 00000000 11. 11. 22 06:55
00000011 00000000 11. 11. 22 06:55
00000012 00000000 11. 11. 22 06:55
00000013 00000000 11. 11. 22 06:55
00000014 00000000 11. 11. 22 06:55
00000015 00000000 11. 11. 22 06:55
00000016 00000000 11. 11. 22 06:55
00000017 00000000 11. 11. 22 06:55
00000018 00000000 11. 11. 22 06:55
00000019 00000000 11. 11. 22 06:55
00000020 00000000 11. 11. 22 06:55
00000021 00000000 11. 11. 22 06:55
00000022 00000000 11. 11. 22 06:55
00000023 00000000 11. 11. 22 06:55
00000024 00000000 11. 11. 22 06:55
00000025 00000000 11. 11. 22 06:55
00000026 00000000 11. 11. 22 06:55
00000027 00000000 11. 11. 22 06:55
00000028 00000000 11. 11. 22 06:55
00000029 00000000 11. 11. 22 06:55
00000030 00000000 11. 11. 22 06:55
00000031 00000000 11. 11. 22 06:55
USED PRG 105 USED CHAR 519588 (132M)
REST PRG 194 REST CHAR 130588 (34M)
INPUT COMMENT 1/11
  
```

JOG STP

OPEN DELETE RENAME COPY DSP. SL FUNC SELECT

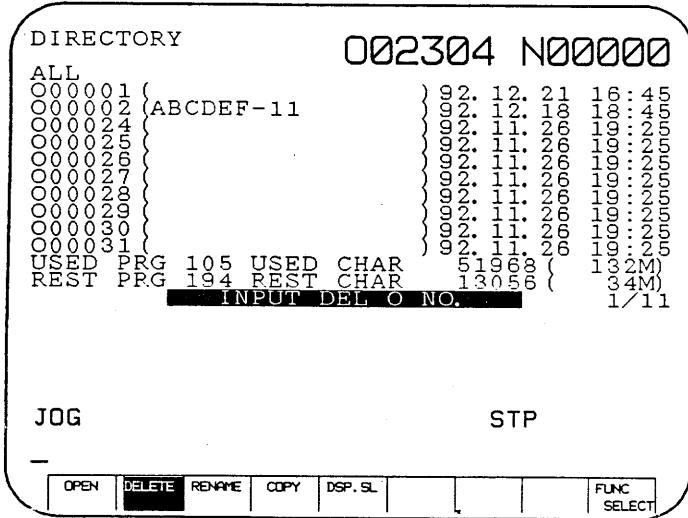
N/C-13

. DELETE (F2)

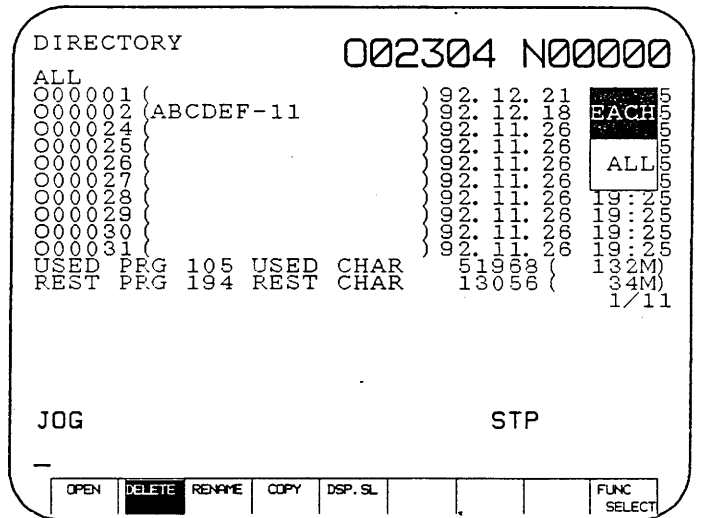
The 0 number can be deleted.

When F2 (DELETE) is pressed, messages are displayed. (N/C-14)

Further when F2 key is pressed once more, the pop-up menu is displayed (N/C-15) it is possible to select an individual and whole 0 numbers.



N/C-14



N/C-15

When an individual was selected.

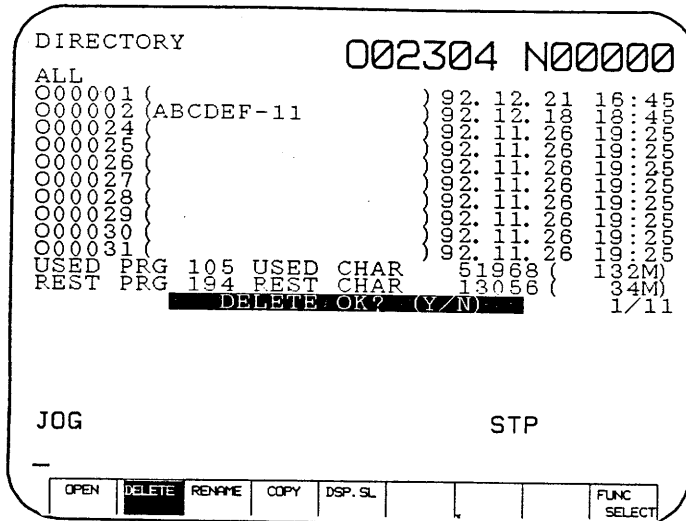
Enter the 0 number desired to delete by the key and press the

INPUT key. (Note: Be sure to apply "0" before the 0 number.)

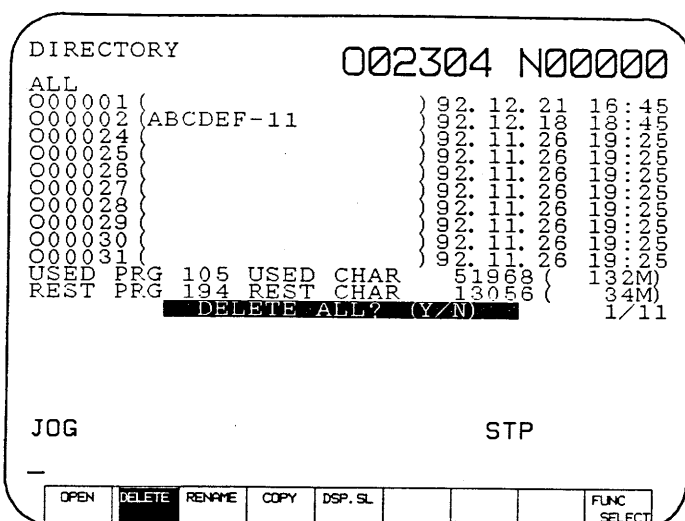
As the messages are changed (N/C-16), press the "Y" key, if all right, and if it is desired to alter, press the "N" key respectively.

When whole 0 numbers were selected.

As the messages are changed (N/C-17), press the "Y" key, if all right and if it is desired to alter, press the "N" key respectively.



N/C-16

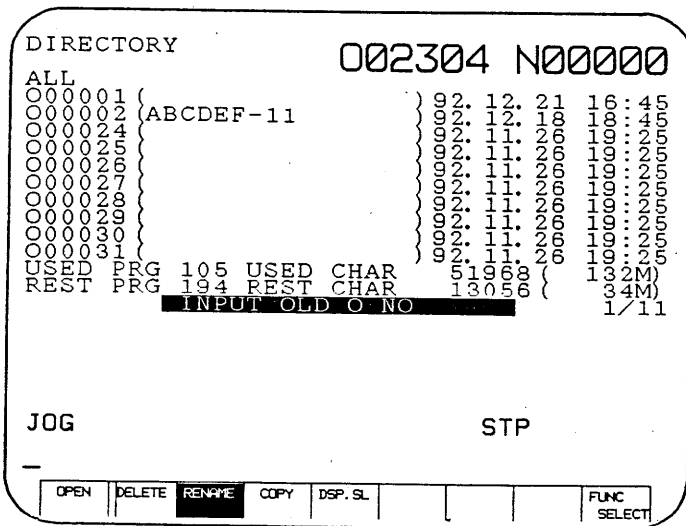


N/C-17

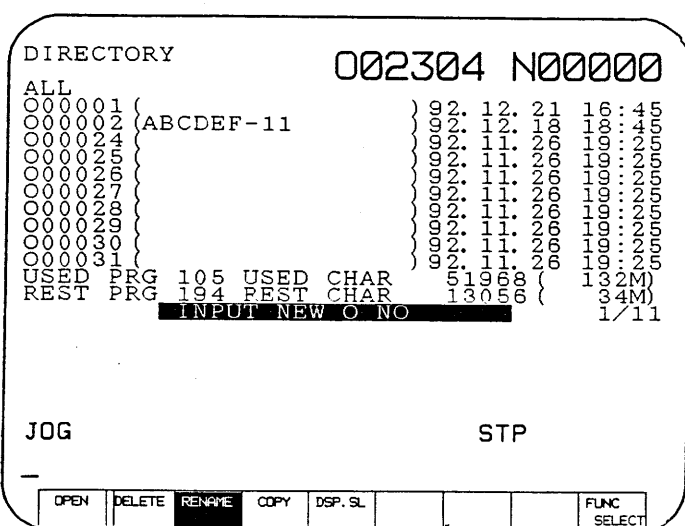
• RENAME (F3)

0 number can be changed.

When the F3 (RENAME) is pressed, messages are displayed on near the center of the screen (N/C-18). Enter the old program number by the key here and press the **INPUT** key. (Note: Be sure to apply "0" before the 0 number)). Thereupon, the messages are changed. (N/C-19). Enter the program number desired to alter by the key here and press the **INPUT** key here. The 0 number has been changed by this procedure.



N/C-18



N/C-19

. COPY (F4)

The contents of the program can be copied by changing the 0 number.

When F4 (COPY) is pressed, messages are displayed on near the center of the screen (N/C-20). Enter the former program number by the key here and press the **INPUT** key. (Note: Be sure to apply "0" before the 0 number.) Thereupon, the messages are changed. (N/C-21).

Enter the program number desired to alter by the key here and press the **INPUT** key. The program has been changed by this procedure.

DIRECTORY 002304 N00000

```

ALL
0000001 (
0000002 {ABCDEF-11
0000003
0000004
0000005
0000006
0000007
0000008
0000009
0000010
0000011
0000012
0000013
0000014
0000015
0000016
0000017
0000018
0000019
0000020
0000021
0000022
0000023
0000024
0000025
0000026
0000027
0000028
0000029
0000030
0000031
USED PRG 105 USED CHAR 51968 (132M)
REST PRG 194 REST CHAR 13056 (34M)
INPUT ORIG 0 NO 1/11
  
```

JOG STP

OPEN DELETE RENAME COPY DSP.SL FUNC SELECT

N/C-20

DIRECTORY 002304 N00000

```

ALL
0000001 (
0000002 {ABCDEF-11
0000003
0000004
0000005
0000006
0000007
0000008
0000009
0000010
0000011
0000012
0000013
0000014
0000015
0000016
0000017
0000018
0000019
0000020
0000021
0000022
0000023
0000024
0000025
0000026
0000027
0000028
0000029
0000030
0000031
USED PRG 105 USED CHAR 51968 (132M)
REST PRG 194 REST CHAR 13056 (34M)
INPUT COPY 0 NO 1/11
  
```

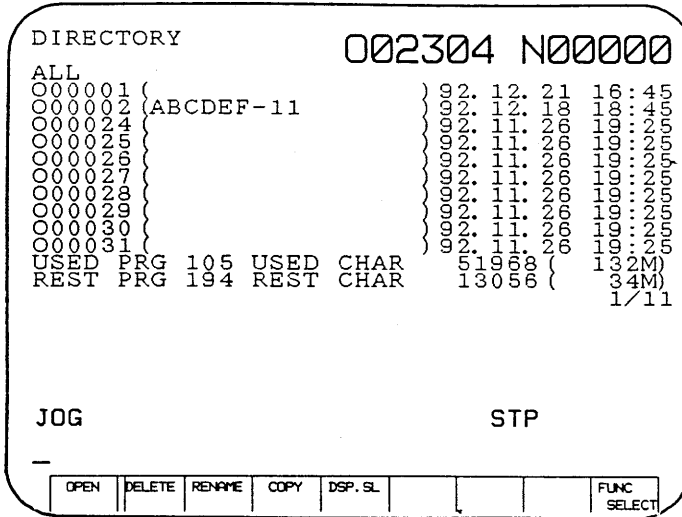
JOG STP

OPEN DELETE RENAME COPY DSP.SL FUNC SELECT

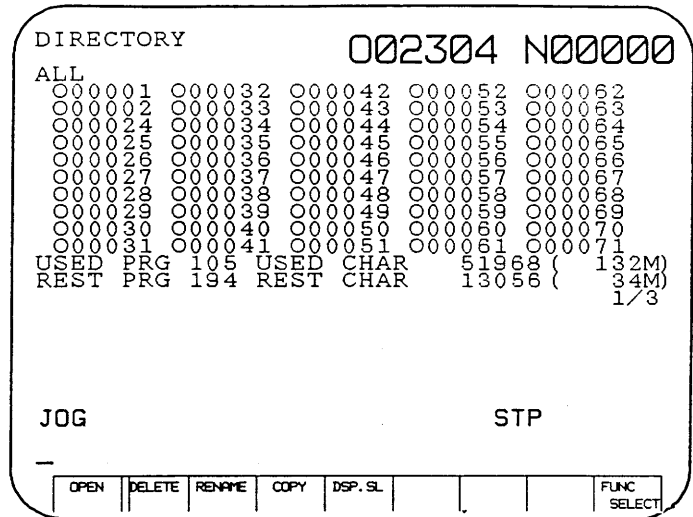
N/C-21

. DSP.SL (F5)

Through a program name and a date are displayed on N/C-11 in the ordinary display, when F5 (DSP.SL) is pressed once, actually used character number is displayed on N/C-22, and it is pressed once again, the 0 number is only displayed on N/C-23.



N/C-22



N/C-23

• SELECT (Reverse F1)

It is possible to specify the displaying method in the program list. In N/C-24, "*" is fitted to the left of the display of "ALL PROGRAMS", so all the programs are displayed. It is possible to move "*" by the up/down cursor key. (The cursor also moves together.) The displaying method includes the following 4 items.

All Programs

All the programs registered are displayed.

Designation of the program number range

Programs from Oxxxx to O++++ can be displayed.

Move the cursor to "0 NO. RANGE" enter

"Oxxxx" by the key and press the key. Thereupon, as the cursor moves to the right, enter "O++++" by the key as well and press the key.

Designation of the executing date range

Programs executing from xxxx year xx month xx day to ++++ year ++month ++day can be displayed. Move the cursor to the

designation of the executing date range, enter "xxxx. xx. xx" by the key and press the key. Thereupon, as the cursor moves to the right, enter "++++. ++. ++" as well and press the key.

Related programs

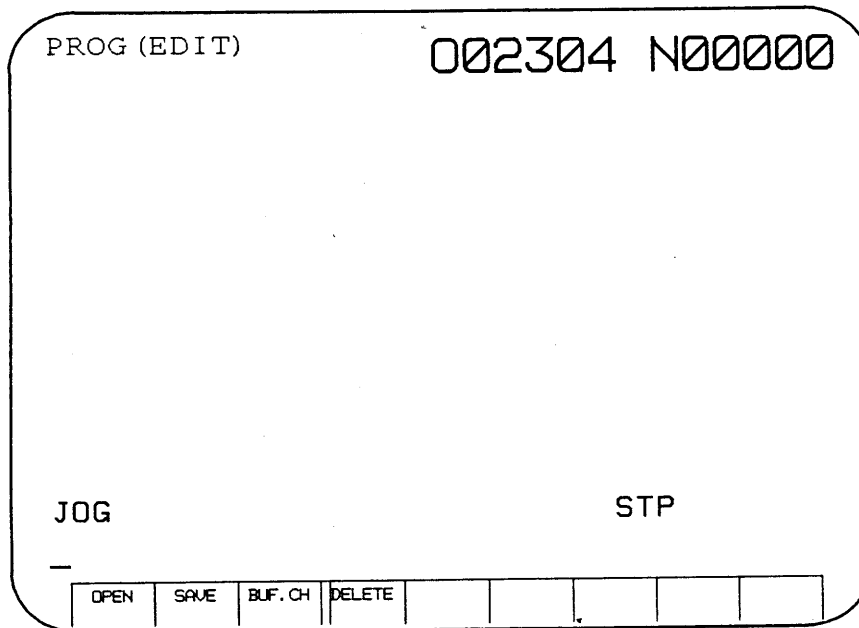
When the main program is designated here, the sub-programs related to that are displayed as a list. As to the operating procedure, only enter the main program number by the key and press the key.

DIRECTORY		002304 N00000	
*ALL			
O NO. RANGE			
000000 ~ 000000			
DATE RANGE			
0000Y M D ~ 0000Y00M00D			
COLLECT			
JOG		STP	
-		RETURN	

N/C-24

4. PROG (EDIT)

When F4 (PROG EDIT) key is selected in the main function, the screen of N/C-25 displayed.

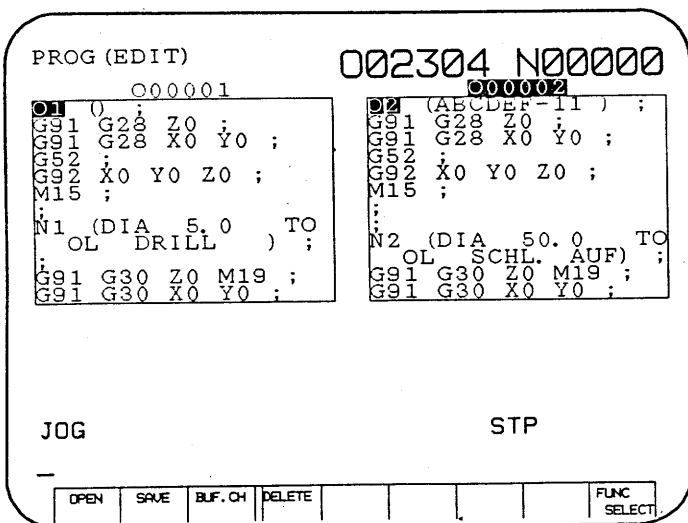


N/C-25

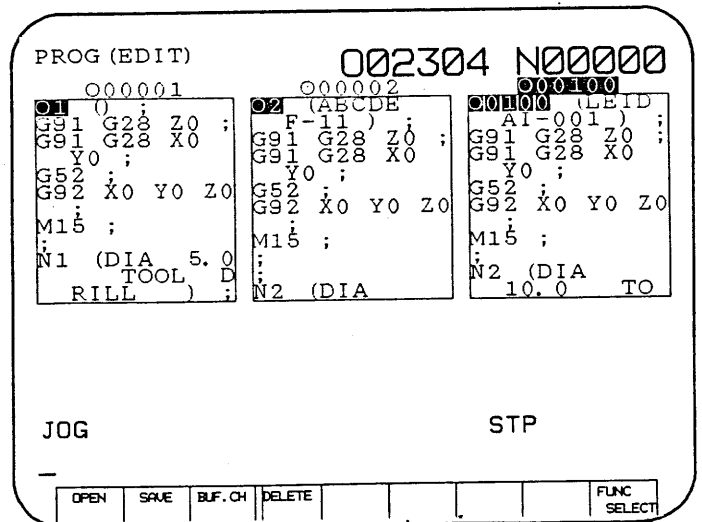
. OPEN (F1)

This is the same as the call of the program list screen (F1).

Up to max. 3 kinds of programs can be called. (N/C-26 and N/C-27)



N/C-26



N/C-27

• SAVE (F2)

It is necessary to store the program called and edited.

Set the cursor to the program desired to edit and press F2 (SAVE).

If the power is turned off without storing, it may cause an alarm, so be sure to store the program after editing.

• BUF.CH (F3)

When two or three programs are called, this is a function for designating which program is to be edited or stored. Though the 0 number is displayed outside the framework, the cursor moves to that 0 number when F3 (BUF.CH) is pressed. The place of the 0 number where the cursor is currently located is of a program enable to edit or store.

• DELETE (F4)

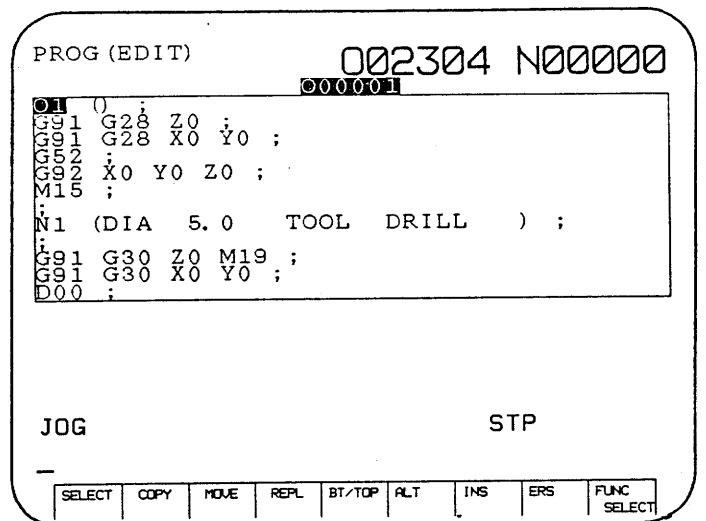
This is the same as deletion (F2) of the screen for the list of programs.

• COPY (Reverse F2)

It is possible to copy the data of the contents designated after the character at which the cursor is located.

• MOVE (Reverse F3)

It is possible to move the data of the contents designated after the character at which the cursor is located.



N/C-28

• Operation procedure of the copy and the move (hereinafter referred to as CP & MV)

First, move the cursor to the head of the data desired to perform CP & MV and press F1 (SELECT). Move the cursor to the end of the data desired to perform CP & MV by using the cursor key.

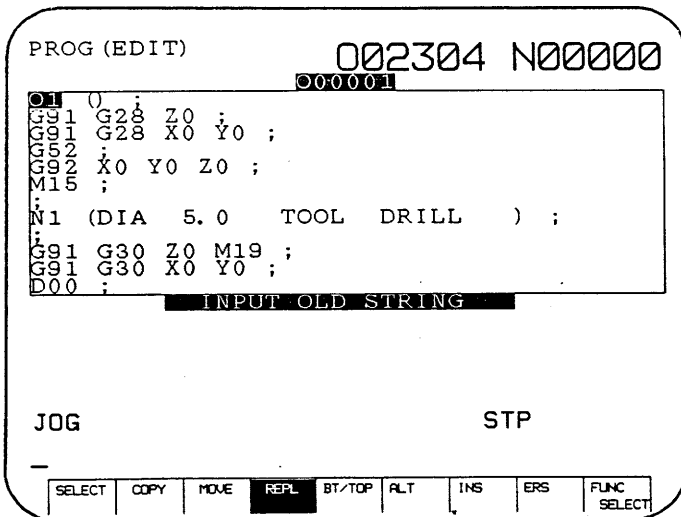
(N/C-28) Press F2 (Copy) or F3 (Move) here ("*" mark is attached inside the function of F2 or F3).

Next, move the cursor to the place where CP & MV are desired to perform and press F2 or F3. Thereupon, the data of the contents designated some time ago are copied or moved.

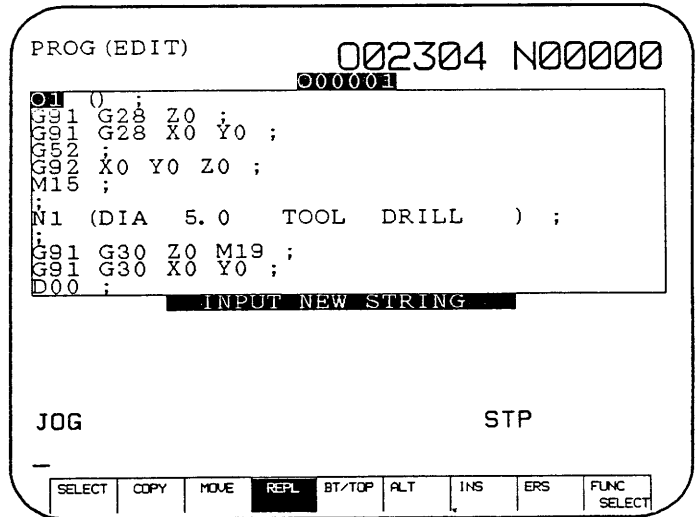
(So far as "*" mark is attached inside the function, it can be repeated any times. And "*" can be deleted by pressing F1 (SELECT).)

- REPL (Reverse F4)

It is possible to convert a specific character into the character designated after the character at which the cursor is located. Move the cursor to the front of the character desired to convert and press F4 (Replace). Thereupon, a message is displayed (N/C-29) Enter the former character by the key here and press the **INPUT** key. Thereupon, the message is changed (N/C-30) Enter the character desired to convert by the key here and press the **INPUT** key. Thereupon, as being asked "Yes/No/All", press the "Y" key if it is all right, the "N" key if it is not required to convert and the "A" key if all characters after that character can be converted, respectively.



N/C-29



N/C-30

- BT/TOP (Reverse F5)

When F5 (Lowest/Uppermost) is pressed, the cursor moves from the beginning to the end of the program.

- ALT (Reverse F6)

It is possible to insert the character designated next to the character at which the cursor is located.

- INS (Reverse F7)

It is possible to insert the specified character after the character at which the cursor is located.

- ERS (Reverse F8)

It is possible to delete the character at which the cursor is located.

5. PROG RUN (F5)

When F5 (PROG RUN) key is selected in the main function, the screen as shown in the following figure is displayed.

PROG (RUN) 002304 N00000

■

UNIVERSAL	INCREMENT	G/M	CODE
X 0.000	X 0.000	G01	G80
Y 0.000	Y 0.000	G17	G80
Z 0.000	Z 0.000	G90	G80
		G94	G87

T NO :T0000
FEED :F 0 COM. :S 0

MDI STP

DSP. SL	DELETE	SAVE	BT/TOP				
---------	--------	------	--------	--	--	--	--

When N/C-31 mode is of MDI.

PROG (RUN) 002304 N00000

02304 ;
G91 G28 X0 Y0 Z0 ;
G52 ;
G92 X0 Y0 Z0 ;

UNIVERSAL	INCREMENT	G/M	CODE
X 0.000	X 0.000	G01	G80
Y 0.000	Y 0.000	G17	G80
Z 0.000	Z 0.000	G90	G80
		G94	G87

T NO :T0000
FEED :F 0 COM. :S 0

MEM STP

DSP. SL		OPEN	EDIT				
---------	--	------	------	--	--	--	--

When N/C-32 mode is of MEM.

PROG (RUN) 002304 N00000

UNIVERSAL	INCREMENT	G/M	CODE
X 0.000	X 0.000	G01	G80
Y 0.000	Y 0.000	G17	G80
Z 0.000	Z 0.000	G90	G80
		G94	G87

T NO :T0000
FEED :F 0 COM. :S 0

TAPE STP

DSP. SL		OPEN					
---------	--	------	--	--	--	--	--

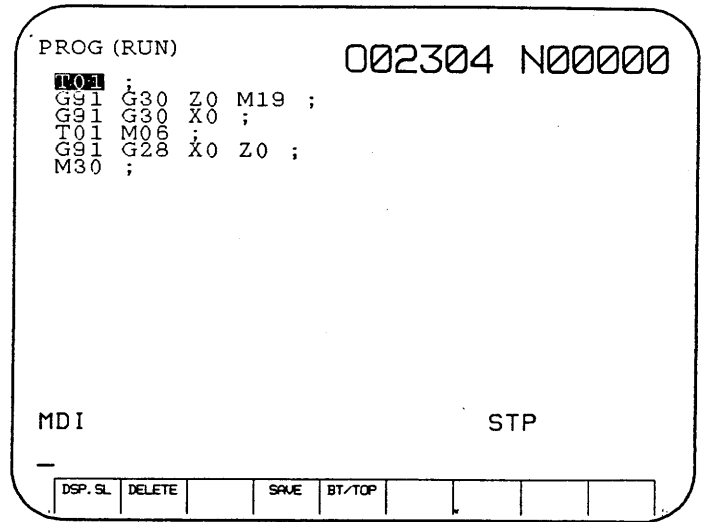
When N/C-33 mode is of TAPE.

Though the modes by which program can be started are the above three, the contents of operation is different depending on each move.

When the mode is of MDI.

- DSP.SL (F1)

When F1 (DSP.SL) is pressed in the screen of N/C-31, a screen as shown in N/C-34 appears and when it is pressed once again, it returns to the screen of N/C-31 again.



N/C-34

- DELETE (F2)

It is possible to erase all the programs made out.

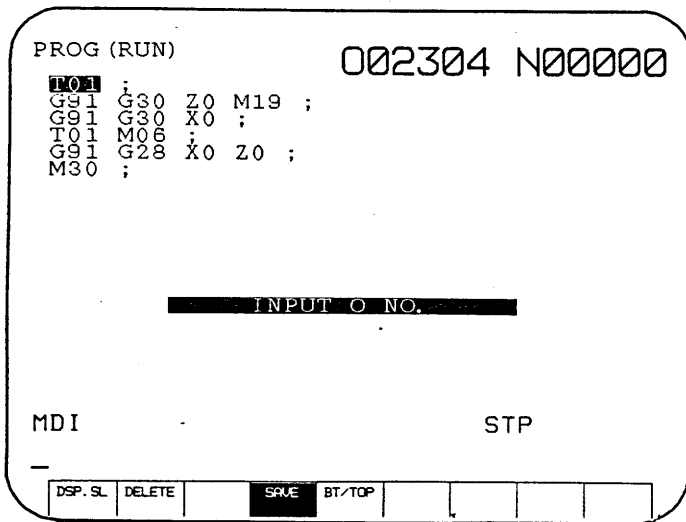
- SAVE (F4)

It is possible to store the program made out by the MDI through attaching the 0 number.

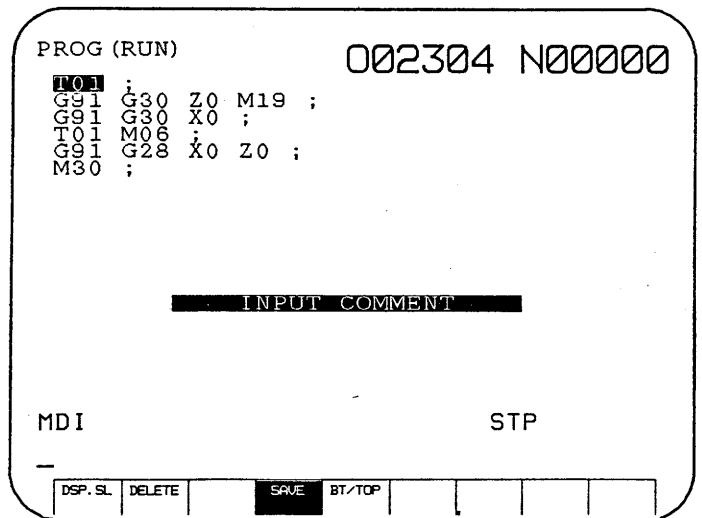
When F4 (SAVE) is pressed, a message is displayed (N/C-35).

Enter the 0 number desired to register by the key and press the **INPUT**. (Note: Be sure to apply "0" before the 0 number.)

Thereupon, the message is changed (N/C-36). Enter the comment by the key here and press the **INPUT** key. The program has been registered through this procedure.



N/C-35



N/C-36

- BT/TOP (F5)

This is the same as the lowest/Uppermost (Reverse F5) of the program editing.

When the mode is of MEM.

- DSP.SL (F1)

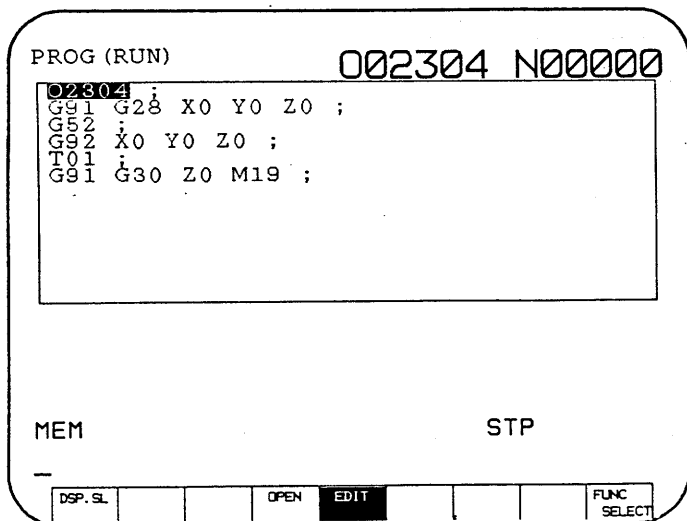
This is the same as F1 (DSP.SL) when the mode is of the MDI.

- OPEN (F4)

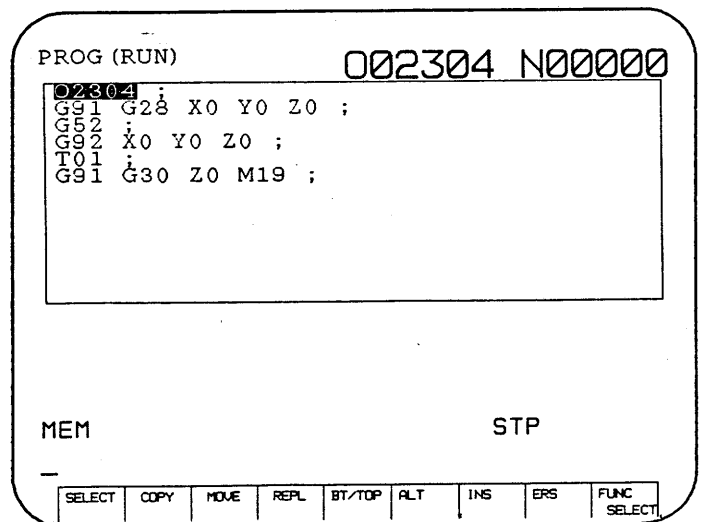
It is possible to call the O number currently registered. (It is impossible to make out a new O number.) the operation procedure is the same as that of F1 (OPEN) of the program list.

- EDIT (F5)

Though it is possible to call one O number and to operate a program on the screen for the program operation, when F5 (EDIT) is pressed, program display is enclosed by a square framework (N/C-37). It is possible to perform the program editing similar to the screen for the program editing here. And when F5 (EDIT) is selected, the "Reverse menu" is displayed in F9. When F9 is pressed, a function such as that of N/C-38 is displayed. The operation procedure is the same as that of the screen for the program editing.



N/C-37



N/C-38

When the mode is of TAPE.

- DSP.SL (F1)

This is the same as F1 (DSP.SL) in the case when the mode is of the MDI.

- OPEN (F4)

It is possible to call the 0 number written in the tape. (It is impossible to made out a new 0 number.) The operation procedure is the same that of F1 (OPEN) of the program list.

6. WORK (F6)

When F6 (Work coordinate system) key is selected in the main function, the screens of N/C-39 and N/C-40 are displayed.

(When moving the cursor by using the cursor left/right on the screen of N/C-39, the screen of N/C-40 appears.)

WORK SHIFT 002304 N00000

J01	G54	G55	G56
X	-200.000	-150.256	-100.256
Y	-200.000	-399.550	-399.550
Z	-400.000	-400.000	-400.000
R	0.000	0.000	0.000

POS. (MACHINE) < ABSO >

X	0.000
Y	0.000
Z	0.000

EDIT STP LSK

WORK UPD POS.WR ABS/IN

N/C-39

WORK SHIFT 002304 N00000

J01	G57	G58	G59
X	-150.256	-200.256	-250.256
Y	-399.550	-399.550	-399.550
Z	-400.000	-400.000	-400.000
R	0.000	0.000	0.000

POS. (MACHINE) < ABSO >

X	0.000
Y	0.000
Z	0.000

EDIT STP LSK

WORK UPD POS.WR ABS/IN

N/C-40

• WORK (F1)

It is possible to set the work coordinate systems from G54 through G59 on the screens of N/C-40 and N/C-39. As for the operation procedure, set the cursor to the item desired to set. (It is possible to change the pages from P01 through P10.) Then, enter a numerical value by the key, press the **INPUT** key. Thereupon, the value is entered on the screen.

• POS.WR (F4)

It is possible to write the current position value (Machine coordinate system). When F4 (POS.WR) is pressed, a message is displayed (N/C-41) on near the center of the screen. Press the "Y" key if writing is desirable and press the "N" key in case of stopping writing respectively.

WORK SHIFT 002304 N00000

J01	G57	G58	G59
X	-150.256	-200.256	-250.256
Y	-399.550	-399.550	-399.550
Z	-400.000	-400.000	-400.000
R	0.000	0.000	0.000

POS. (MACHINE) < ABSO >

X	0.000
Y	0.000
Z	0.000

ALL SET (Y/N)

EDIT STP LSK

WORK UPD POS.WR ABS/IN

N/C-41

• ABS/IN (F5)

Inputting method of value is displayed on the right of the screen.
When F5 (ABS/IN) is pressed, the "Absolute input" and the "Incremental input" are displayed by turns.

• UPD (F2)

It is possible to set a collection value in case of shifting all the work coordinate system. (N/C-42)
The inputting method is the same as that of F1 (Work shift).

W SHIFT (UPD)		002304	N00000
AXIS	U P D		
X		0.000	
Y		0.000	
Z		0.000	
R		0.000	
POS. (MACHINE)		< ABSO >	
X		0.000	
Y		0.000	
Z		0.000	
EDIT		STP	LSK
WORK	UPD	ABS/IN	

N/C-42

7. TOOL (F7)

When F7 (TOOL) key is selected in the main function, the screen of N/C-43 is displayed.

OFFSET

000001 N00000
< ABSO >

H (D) 0000					
H (D) 0001	0.000	POS. (UNIVERSAL)			
H (D) 0002	0.000	X	0.000		
H (D) 0003	0.000	Y	0.000		
H (D) 0004	0.001	Z	0.000		
H (D) 0005	200.000				
H (D) 0006	0.000				
H (D) 0007	0.000				
H (D) 0008	0.002				
H (D) 0009	200.000				

JOG STP

OFFSET
POT
ATC

FUNC SELECT

N/C-43

. OFFSET (F1)

It is possible to set offset values of tools.

H (D) 0000					
H (D) 0001				Unused	
H (D) 0002					
H (D) 0003					
H (D) 0004				Tool No. (No. 1)	
H (D) 0005				Tool length compensation	
H (D) 0006				Tool diameter compensation	
H (D) 0007				Spare	
H (D) 0008				Tool No. (No. 2)	
H (D) 0009				Tool length compensation	
H (D) 0010				Tool diameter compensation	
H (D) 0011				Spare	
H (D) 0012				Tool No. (No. 3)	
H (D) 0013				-	
H (D) 0014				-	

The data to be input to each address are as the above.

As for the operation procedure, set the cursor to the item desired to set. Enter a tool offset amount by the key and press the

INPUT key.

- ATC (F3)

It is possible to watch the current spindle tool, magazine tool and waiting tool. (N/C-44)

A T C		002304	N00000
SP	TL		07
MG	TL		01
WT	TL		01
JOG		STP	LSK
OFFSET	POT	ATC	

N/C-44

- Ø CLR (Reverse F3)

It is possible to erase the data at which the cursor is located. As for the operation procedure, set the cursor to the place of the data desired to erase. Then, when F3 (Zero clear) is pressed, the data are erased.

- ALLCLR (Reverse F4)

It is possible to erase all the offset data. As for the operation procedure, when F4 (ALLCLR) is pressed, a message is displayed (N/C-45). Press the "Y" key if erasure is desirable and press the "N" key if not erased respectively.

OFFSET		002304	N00000
		< ABSO >	
H (D)	0000		
H (D)	0001	0.000	POS. (UNIVERSAL)
H (D)	0002	0.000	X 0.000
H (D)	0003	0.000	Y 0.000
H (D)	0004	0.000	Z 0.000
H (D)	0005	200.000	
H (D)	0006	0.000	
H (D)	0007	0.000	
H (D)	0008	0.002	
H (D)	0009	200.000	
CLEAR ALL OFFSET (Y/N)			
JOG		STP	
	Ø CLR	ALLCLR	ABS/IN
			FUNC SELECT

N/C-45

- ABS/IN (Reverse F5)

This is the same as F5 (ABS/IN) of the work coordinate system.

8. Setting

When F8 (SETTING) key is selected in the main function, the screens of N/C-46 though N/C-49 are displayed.

SETTING		000001 N00000	
PARAMETER CHANG			
MIRROR IMAGE X	ON	OFF	
MIRROR IMAGE Y	ON	OFF	
MIRROR IMAGE Z	ON	OFF	
MIRROR IMAGE 4	ON	OFF	
MIRROR IMAGE 5	ON	OFF	
MIRROR IMAGE 6	ON	OFF	
MIRROR IMAGE 7	ON	OFF	
MIRROR IMAGE 8	ON	OFF	
MIRROR IMAGE 9	ON	OFF	
4 AXIS IGNORE	ON	OFF	
		1/4	
JOG	STP		
	MACRO	F1 DGT	SETTING
			FUNC SELECT

N/C-46 (1st page)

SETTING		000001 N00000	
5-AXIS IGNORE			
OUTPUT CODE (PORT1)	ON	OFF	
TV CHECK (PORT1)	EIA	ISO	
TV CHECK IN () (PORT1)	ON	OFF	
OUTPUT FEED (PORT1)	ON	OFF	
OUTPUT CODE OF EOB (PORT1)	CR, LF	LF	
EOB ADD IN ALL PRG OUT (PORT1)	ON	OFF	
OUTPUT CODE (PORT2)	EIA	ISO	
TV CHECK (PORT2)	ON	OFF	
TV CHECK IN () (PORT2)	ON	OFF	
OUTPUT FEED (PORT2)	ON	OFF	
		2/4	
JOG	STP		
	MACRO	F1 DGT	SETTING
			FUNC SELECT

N/C-47 (2nd page)

SETTING		000001 N00000	
OUTPUT CODE OF EOB (PORT2)			
EOB ADD IN ALL PRG OUT (PORT2)	ON	OFF	
PARAMETER 0 OUTPUT	ON	OFF	
INCH/MM	INCH	MM	
SINGLE STOP IN USER MACRO	ON	OFF	
SKIP SIGNAL ALARM	ON	OFF	
WORK SHIFT UPDATE ADDTION	ON	OFF	
TOOL LIFE CTRL OF T CODE	ON	OFF	
BUZZER	ON	OFF	
DWELL TIME OF G76, G77		0	
PITCH DWELL TIME OF G73, G8		0	
		3/4	
JOG	STP		
	MACRO	F1 DGT	SETTING
			FUNC SELECT

N/C-48 (3rd-page)

SETTING		000001 N00000	
N NUMBER OF BREAK POINT 1			
N NUMBER OF BREAK POINT 2			0
SCALING MAGNIFICATION 1			0
SCALING MAGNIFICATION 2			0
ANGLE OF G76, G77			180000
BIAS AMOUNT OF TLM			0
BOTTOM LEVEL OF TLM			0
RETRACTING AMOUNT OF G73			100
RETRACTING AMOUNT OF G83			1000
		4/4	
JOG	STP		
	MACRO	F1 DGT	SETTING
			FUNC SELECT

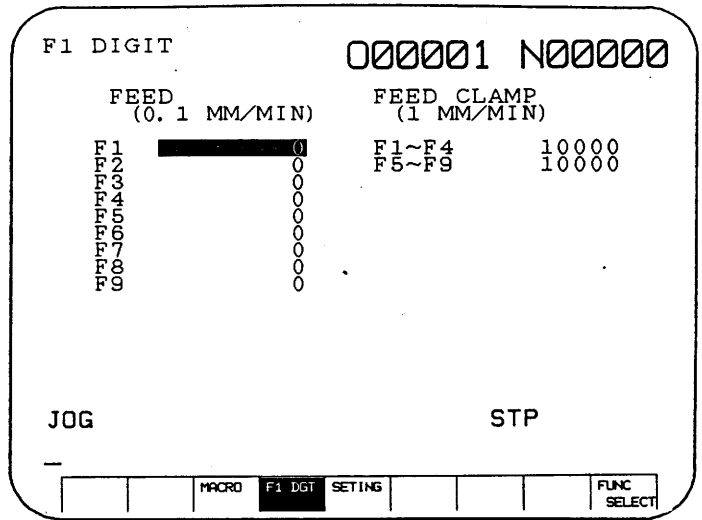
N/C-49 (4th page)

• SETING (G5)

It is possible to set the setting data in the above screens. As for the operation procedure, press the **INPUT** key for the place which item should be selected and move the cursor to the item desired to set. And enter a numerical value in the item that a value is to be input by the key and press the **INPUT** key.

F1 DGT (F4)

It is possible to set F1 digit of feedrate. As for the operation procedure, enter a numerical value by the key and press the **INPUT** key. (N/C-50)



N/C-50

9. PARAM (Reverse F1)

When F1 (PARAM) is selected in the reverse menu of the main function, the screen of N/C-51 through N/C-55 are displayed.

PARAMETER 000001 N00000

pm1000	7	6	5	4	3	2	1	0	64
pm1001	0	0	0	0	0	0	0	0	0
pm1002	0	0	0	0	0	0	0	0	0
pm1003	0	0	0	0	0	0	0	0	0
pm1004	0	0	0	0	0	0	0	0	0
pm1005	0	0	0	0	0	0	0	0	0
pm1006	0	0	0	0	0	0	0	0	0
pm1007	0	0	0	0	0	0	0	0	0
pm1008	0	0	0	0	0	0	0	0	0
pm1009	0	0	0	0	0	0	0	0	0

0:OFF 1:ON

JOG STP

PARAM.	SETTING	SECPRM	P.ERR	OPTION	INS	FUNC SELECT
--------	---------	--------	-------	--------	-----	-------------

N/C-51 (Parameter)

PARAMETER 000001 N00000

pm0000	7	6	5	4	3	2	1	0	16
pm0001	0	0	0	0	0	0	0	0	0
pm0002	0	0	0	0	0	0	0	0	0
pm0003	0	0	0	0	0	0	0	0	0
pm0004	0	0	0	0	0	0	0	0	0
pm0005	0	0	0	0	0	0	0	0	0
pm0006	0	0	0	0	0	0	0	0	0
pm0007	0	0	0	0	0	0	0	0	0
pm0008	0	0	0	0	0	0	0	0	0
pm0009	0	0	0	0	0	0	0	0	0

0:OFF 1:ON

JOG STP

PARAM.	SETTING	SECPRM	P.ERR	OPTION	INS	FUNC SELECT
--------	---------	--------	-------	--------	-----	-------------

N/C-52 (Setting)

PARAMETER 000001 N00000

#7100	7	6	5	4	3	2	1	0	01
#7101	0	0	0	0	0	0	0	0	0
#7102	0	0	0	0	0	0	0	0	0
#7103	0	0	0	0	0	0	0	0	0
#7104	0	0	0	0	0	0	0	0	0
#7105	0	0	0	0	0	0	0	0	0
#7106	0	0	0	0	0	0	0	0	0
#7107	0	0	0	0	0	0	0	0	0
#7108	0	0	0	0	0	0	0	0	0
#7109	0	0	0	0	0	0	0	0	0

0:OFF 1:ON

JOG STP

PARAM.	SETTING	SECPRM	P.ERR	OPTION	INS	FUNC SELECT
--------	---------	--------	-------	--------	-----	-------------

N/C-53 (Keep memory)

PARAMETER 000001 N00000

p0000	7	6	5	4	3	2	1	0	0
p0001	0	0	0	0	0	0	0	0	0
p0002	0	0	0	0	0	0	0	0	0
p0003	0	0	0	0	0	0	0	0	0
p0004	0	0	0	0	0	0	0	0	0
p0005	0	0	0	0	0	0	0	0	0
p0006	0	0	0	0	0	0	0	0	0
p0007	0	0	0	0	0	0	0	0	0
p0008	0	0	0	0	0	0	0	0	0
p0009	0	0	0	0	0	0	0	0	0

0:OFF 1:ON

JOG STP

PARAM.	SETTING	SECPRM	P.ERR	OPTION	INS	FUNC SELECT
--------	---------	--------	-------	--------	-----	-------------

N/C-54 (Pitch error)

PARAMETER 000001 N00000

opm00	7	6	5	4	3	2	1	0	0
opm01	0	0	0	0	0	0	0	0	0
opm02	0	0	0	0	0	0	0	0	0
opm03	0	0	0	0	0	0	0	0	0
opm04	0	0	0	0	0	0	0	0	0
opm05	0	0	0	0	0	0	0	0	0
opm06	0	0	0	0	0	0	0	0	0
opm07	0	0	0	0	0	0	0	0	0
opm08	0	0	0	0	0	0	0	0	0
opm09	0	0	0	0	0	0	0	0	0

0:OFF 1:ON

JOG STP

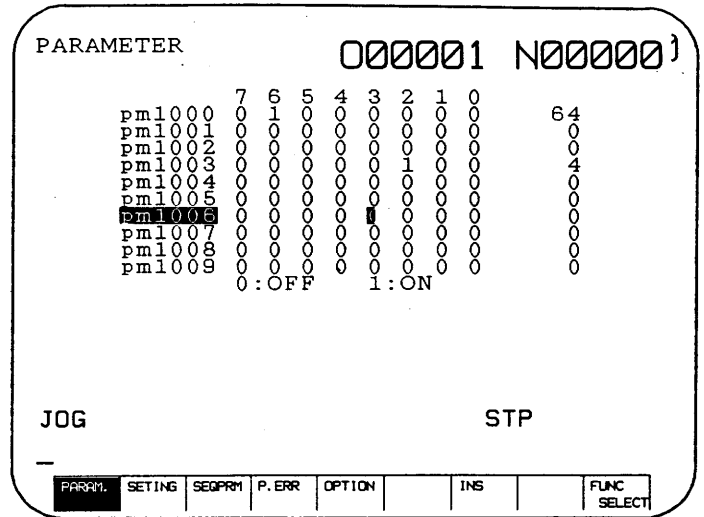
PARAM.	SETTING	SECPRM	P.ERR	OPTION	INS	FUNC SELECT
--------	---------	--------	-------	--------	-----	-------------

N/C-55 (Option)

• Operation procedure

Bit parameter

Display the screen of the parameter (F1 - F5) desired to set and search the number (Enter the parameter number by the key and press the cursor). Then, when F7 (INS) is pressed, the cursor is displayed as shown in N/C-56. Set the cursor to the bit desired to set and press the key. After the setting is finished, press F7 (INS) once again.



N/C-56

Real number value parameter

Display the screen of the parameter (F1 - F5) desired to set and search the number. (Enter the parameter number by the key and press the cursor .) Enter a numerical value by the key and press the key.

10. PARAM IN/OUT (Reverse F2)

When F2 (PARAM IN/OUT) is selected in the reverse menu of the main function, the screen of N/C-57 is displayed.

IN/OUT PARAM		002304 N00000	
INPUT			
<input type="checkbox"/> ALL PARAMETER	<input type="checkbox"/>	SETTING	
	<input type="checkbox"/>	PARAMETER	
	<input type="checkbox"/>	SEQ. PRM. & KEEP MEM	
	<input type="checkbox"/>	PITCH ERROR PRM	
	<input type="checkbox"/>	OPTION PARAMETER	
OFFSET			
TOOL LIFE			
MACRO·COMMON			
JOG		STP	
IN	OUT	VER	BGREST RS232C

N/C-57

IN/OUT PARAM		002304 N00000	
INPUT			
<input checked="" type="checkbox"/> ALL PARAMETER	<input type="checkbox"/>	*SETTING	
	<input type="checkbox"/>	*PARAMETER	
	<input type="checkbox"/>	*SEQ. PRM. & KEEP MEM	
	<input type="checkbox"/>	*PITCH ERROR PRM	
	<input type="checkbox"/>	OPTION PARAMETER	
OFFSET			
TOOL LIFE			
MACRO·COMMON			
INPUT OK? (Y/N)			
JOG		STP	
IN	OUT	VER	BGREST RS232C

N/C-58

• Input/output collation (F1 - F3)

Move the cursor to the item to collate input/output on the screen of N/C-57. If the input key is pressed there, the "*" mark is fitted at the head of the item (N/C-58). Then press F1~F3.

A message "INPUT (OR OUTPUT) OK? (Y/N)" is displayed in the center of the screen.

If the Y key is pressed, it is started to collate input/output and the "COMPLETE" message is displayed after execution. To interrupt the work during execution, press F4 (BG reset). To return to the screen of N/C-57 during execution, press F5 (return).

• Input/output device (F4)

It is possible to set the data regarding the I/O collation.

(N/C-59)

IN/OUT PARAM		002304 N00000	
I/O UNIT SET	IN	OUT	
PORT	NO. 2	NO. 2	
UNIT	RS232C	RS232C	
BPS	4800	4800	
STOP BIT	2BITS	2BITS	
BITS	8BITS	8BITS	
PARITY	OFF	OFF	
XON/OFF	ON	ON	
RTS CNTRL	OFF	OFF	
PARITY ISO	ON	ON	

JOG STP

IN	OUT	VER	BGREST	RS232C			FUNC SELECT
----	-----	-----	--------	--------	--	--	-------------

N/C-59

As for the operation procedure, set the cursor to the data desired to set. As the data coinciding with each item are displayed on the function when F9 (FUNC SELECT) is pressed, select respective data.

11. PROG IN/OUT (Reverse F3)

When F3 (PROG IN/OUT) is selected in the reverse menu of the main function, the screen of N/C-60 is displayed.

IN/OUT PROG		002304 N00000					
INPUT (EACH)							
INPUT 0 NO.							
JOG		STP					
IN	OUT	VER	BGREST	RS232C			

N/C-60

IN/OUT PROG		002304 N00000					
INPUT (EACH)							
INPUT 0 NO.		EACH ALL					
JOG		STP					
IN	OUT	VER	BGREST	RS232C			

N/C-61

• IN (F1)

When F1 (IN) is pressed on the screen of N/C-60, the pop-up menu is displayed (N/C-61)

Individuality (N/C-60)

Enter the 0 number desired to input by the key and press the **INPUT** key. (Note: Be sure to apply "0" before the 0 number.) Then, press F1 (IN). Thereupon, the "In inputting" is blinked and to start inputting.

All 0 numbers

When all 0 numbers are selected in the pop-up menu, a message is displayed. (N/C-62) Press the "Y" key if is desirable and the "N" key when erasing the input respectively.

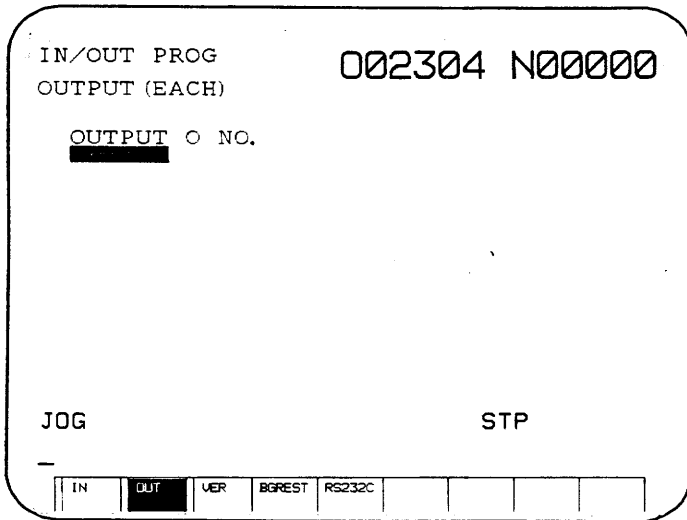
IN/OUT PROG		002304 N00000					
INPUT (ALL)							
ALL PROG. INPUT							
		INPUT OK? (Y/N)					
JOG		STP					
IN	OUT	VER	BGREST	RS232C			

N/C-62

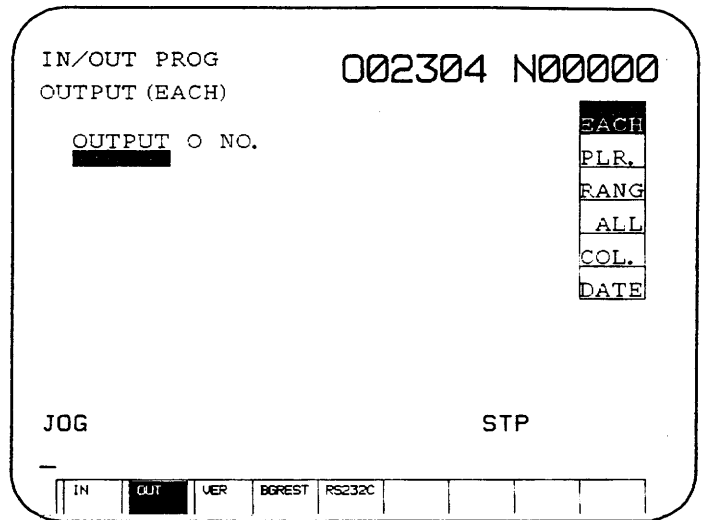
OUT (F2)

When F2 (OUT) is pressed on the screen of N/C-63, is displayed.

When F2 (OUT) is pressed once again, the pop-up menu is displayed (N/C-64)



N/C-63



N/C-64

Individuality and all 0 numbers

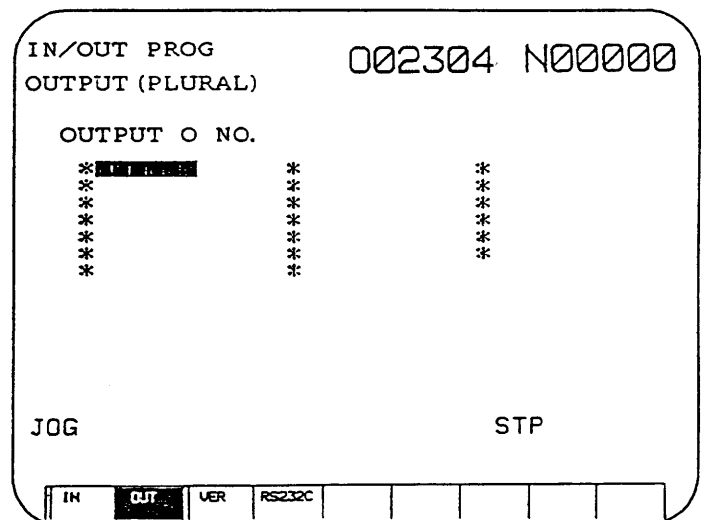
As for the operation procedure, it is the same as that of the individuality and all 0 numbers of F2 (OUT).

Plural (N/C-65)

Enter some numbers of 0 numbers desired to output one by one by the key and press the **INPUT** key.

(Note: Be sure to apply the "0" before 0 number.)

Then, when F2 (OUT) is pressed, the "In outputting" is blinked to start outputting.



N/C-65

Range designation (N/C-66)

It is possible to output
O***** - O+++++. Enter
O***** and O+++++ by the
key respectively and press
the **INPUT** key. Then,
when F2 (OUT) is
pressed, the "In
outputting" is blinked to
start outputting.

IN/OUT PROG		002304 N00000	
OUTPUT (RANG)			
START O NO.			
END O NO.			
JOG		STP	
IN	OUT	VER	BGREST RS232C

N/C-66

Relation (N/C-67)

When designating the main
program, it is possible to
output simultaneously the
sub-program related to it.
(Note: Be sure to apply
"0" before the 0 number.)
Then, when F2 (OUT) is
pressed, the "In
outputting" is blinked to
start outputting.

IN/OUT PROG		002304 N00000	
OUTPUT (COLLECT)			
COLLECT O NO.			
JOG		STP	
IN	OUT	VER	BGREST RS232C

N/C-67

Date (N/C-68)

Enter a date as "****, **, ***"
by the key and press the
INPUT key. Then, when F2
(OUT) is pressed, the "In
outputting" is blinked to
start outputting.

IN/OUT PROG		002304 N00000	
OUTPUT (DATE)			
DATE			
■■■■■ Y ■■ M ■■ D			
JOG		STP	
IN	OUT	VER	BGREST RS232C

N/C-68

- VER (F3)

When F3 (VER) is pressed, the screen of N/C-69 is displayed. When F3 (VER) is pressed once again, the pop-up menu is displayed. (N/C-70)

IN/OUT PROG		002304 N00000					
VERIFY (EACH)							
VERIFY O NO.							
JOG		STP					
IN	OUT	VER	BGREST	RS232C			

N/C-69

IN/OUT PROG		002304 N00000					
VERIFY (EACH)							
VERIFY O NO.							
JOG		STP					
IN	OUT	VER	BGREST	RS232C			

N/C-70

Individuality and all 0 numbers

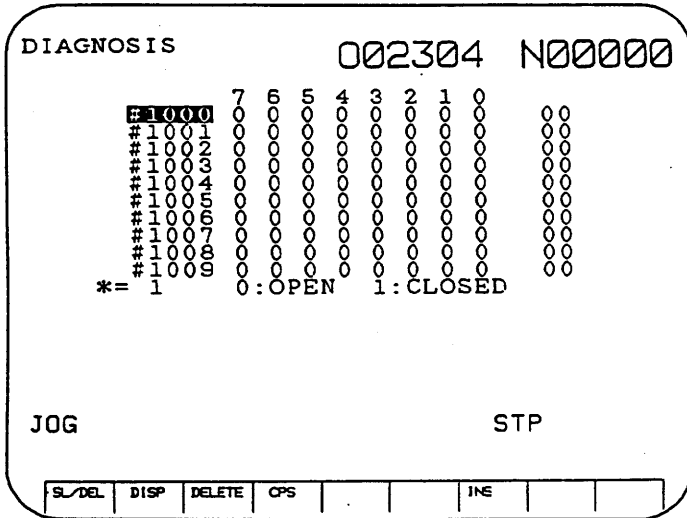
As for the operation procedure, this is the same as that of the individuality and all 0 numbers of F2 (OUT).

- RS232C (F5)

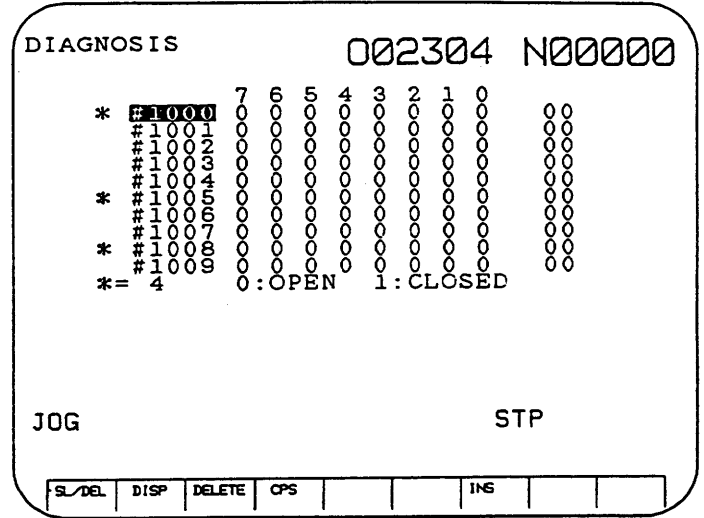
This is the same as F5 (I/O device) of the parameter input/output.

12. DIAGN (Reverse F4)

When F4 (DIAGN) is selected in the reverse menu of the main function, the screen of N/C-71 is displayed.



N/C-71



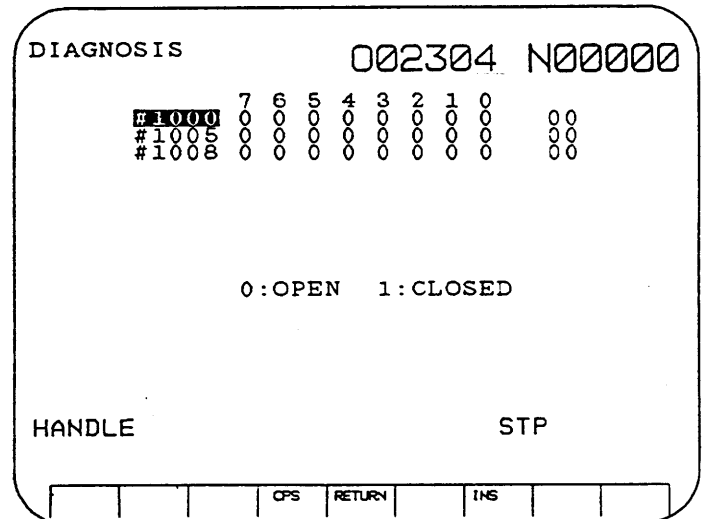
N/C-72

. F1 (SL/DEL)

When F1 (SL/DEL) is pressed, "*" mark is attached to the head of the I/O data. (N/C-72) and when F1 (SL/DEL) is pressed once again, the "*" mark can be deleted.

. F2 (DISP)

When F2 (DISP) is pressed, only I/O data with the "*" mark are displayed. (N/C-73)



N/C-73

. F3 (DELETE)

When F3 (DELETE) is displayed, all the "*" mark can be deleted.

F4 (CPS)

Display the cursor by pressing F7 (INS). (N/C-74)(As for the operation procedure, it is the same as the operation procedure of the bit parameter.) Then, when F4 (CPS) is pressed, the bit is enclosed with a square framework as shown in N/C-75. Next, press the **INPUT** key to set "1" or "0". After the setting is finished, press F7 (INS).

DIAGNOSIS 002304 N00000

	7	6	5	4	3	2	1	0	
#10000	0	0	0	0	0	0	0	0	00
#10001	0	0	0	0	0	0	0	0	00
#10002	0	0	0	0	0	0	0	0	00
#10003	0	0	0	0	0	0	0	0	00
#10004	0	0	0	0	0	0	0	0	00
#10005	0	0	0	0	0	0	0	0	00
#10006	0	0	0	0	0	0	0	0	00
#10007	0	0	0	0	0	0	0	0	00
#10008	0	0	0	0	0	0	0	0	00
#10009	0	0	0	0	0	0	0	0	00

*= 0 0:OPEN 1:CLOSED

HANDLE STP

SL/DEL	DISP	DELETE	CPS			INS		
--------	------	--------	-----	--	--	-----	--	--

N/C-74

DIAGNOSIS 002304 N00000

	7	6	5	4	3	2	1	0	
#10000	0	0	0	0	0	0	0	0	00
#10001	0	0	0	0	0	0	0	0	00
#10002	0	0	0	0	0	0	0	0	00
#10003	0	0	0	0	0	0	0	0	00
#10004	0	0	0	0	0	0	0	0	00
#10005	0	0	0	0	0	0	0	0	00
#10006	0	0	0	0	0	0	0	0	00
#10007	0	0	0	0	0	0	0	0	00
#10008	0	0	0	0	0	0	0	0	04
#10009	0	0	0	0	0	0	0	0	00

*= 1 0:OPEN 1:CLOSED

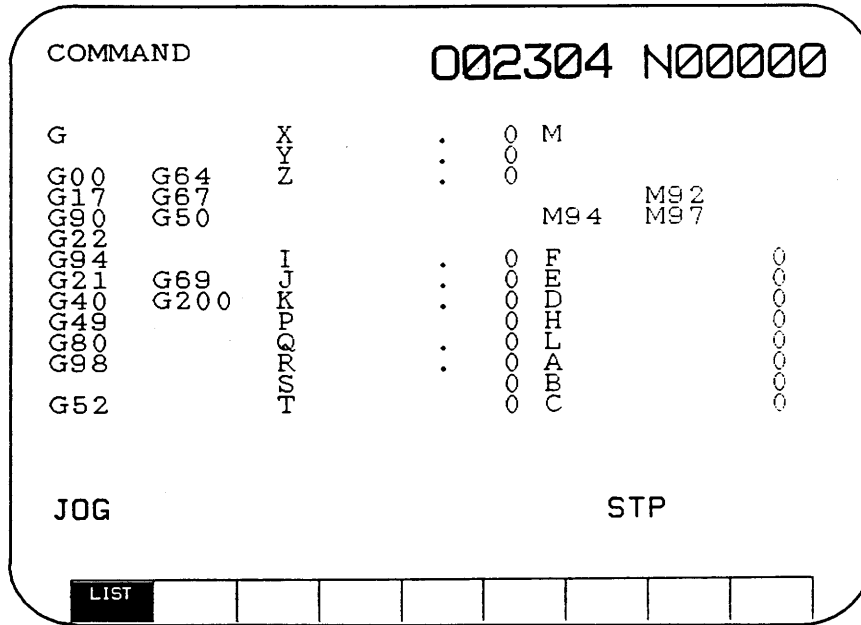
HANDLE STP

SL/DEL	DISP	DELETE	CPS			INS		
--------	------	--------	-----	--	--	-----	--	--

N/C-75

13. COMMND (Reverse F5)

When F5 (COMMND) is selected in the reverse menu of the main function, the screen of N/C-76 is displayed.



"G" and "M" codes currently commanded have been displayed here.

14. TIME (Reverse F6)

When F6 (TIME) is selected in the reverse menu of the main function the screens of N/C-77 and N/C-78 are displayed.

CALENDAR		.002304 N00000					
DAT	1990	^Y	.	07	^M	.	09 ^D
TIM	21	^H	:	33	^M	:	46 ^S
JOG				STP			
CALEN	W TIME						MENU CONTINUE

N/C-77

WORK TIME		.002304 N00000					
POWER ON	0023	^H	:	07	^M	:	40 ^S
CYCLE ST	0000		:	00		:	00
CUTTING	0000		:	00		:	00
JOG				STP			
CALEN	W TIME						MENU CONTINUE

N/C-78

Chapter 6 MAINTENANCE AND ADJUSTMENT
 1. List of Limit Switch Number

*Mark : Option

LS No.	Use	Model	Manu- facturer	Location
Machine				
LS 1A	X-axis - Over-travel	SL1-A	Yamatake	Head
LS 1B	X-axis + Over-travel	SL1-A	Yamatake	Head
LS 2A	X-axis reference point return deceleration	SL1-A	Yamatake	Head
* LS 75A	X-axis external deceleration	SL1-A	Yamatake	Head
* LS 75B	X-axis external deceleration	SL1-A	Yamatake	Head
LS 6A	Y-axis - Over-travel	LDV-5412	Yamatake	Head
LS 6B	Y-axis + Over-travel	LDV-5412	Yamatake	Head
LS 7A	Y-axis reference point return deceleration	LDV-5412	Yamatake	Head
LS 76A	Y-axis external deceleration	LDV-5412	Yamatake	Head
LS 10A	Z-axis - Over-travel	LDV-5412	Yamatake	Head
LS 10B	Z-axis + Over-travel	LDV-5412	Yamatake	Head
LS 11A	Z-axis reference point return deceleration	LDV-5412	Yamatake	Head
* LS 77A	Z-axis external deceleration	LDV-5412	Yamatake	Head
PS-1	Air source pressure	PE-2T	CKD	Front side of machine
PS-9	Lubrication oil pressure switch		LUBE	Lubrication tank
FS-1	Lubrication float switch		LUBE	Lubrication tank
* FS-3	Hydraulic oil float switch	OLV-2B-1	Noken	Hydraulic tank
* PS-4	Hydraulic oil pressure switch	JPB1	Sanyo keiki	Hydraulic tank
Head				
LS 16B	Tool unclamp	SL1-H	Yamatake	Head
LS 16A	Tool clamp	SL1-H	Yamatake	Head
PS-6	Air for OL lubricating	PE-4T	CKD	Head
PS-8	Oil for OL lubricating	SPS-8T	Showa	Head
FS-11	Reservoir for spindle cooling	OLV-2B-2	Showa	Head
* LS145A	Tool contact check		Wako	Head

* ... VG

*Mark : Option

LS No.	Use	Model	Manu- facturer	Location
Detection check				
LS 31A	Tool contact check	T-20B-14-16F	Metrol	Saddle
Splash cover				
* LS 32A	Operator side door Open (Safety measure)	1LS1-J	Yamatake	Splash cover
* LS 32B	Operator side door Closed (European safety measure)	DIN43694 31ZS1-C	Honeywel	Splash cover
* LS 32A	Operator side door Open (European safety measure)	DIN43694 31ZS1-C	Honeywel	Splash cover
* LS400A	Operator side door Closed (European safety measure)	TZFS-24VDC	SSR(Elan)	Splash cover
* LS400B	Operator side door Open Left door (European safety measure)	DIN43694 31ZS1-C	Honeywel	Splash cover
* LS400C	Operator side door Open Right door (European safety measure)	DIN43694 31ZS1-C	Honeywel	Splash cover
Coolant				
* FS-2	Coolant tank float switch			Coolant tank
* PS-7	Oil hole indicator	ED-02	Taisei	Coolant tank
LS-200	Clogging of line filter (Through coolant)	G-51-06 -20μW-EV	Taisei	Rear side of machine

2. List of Solenoid Valves

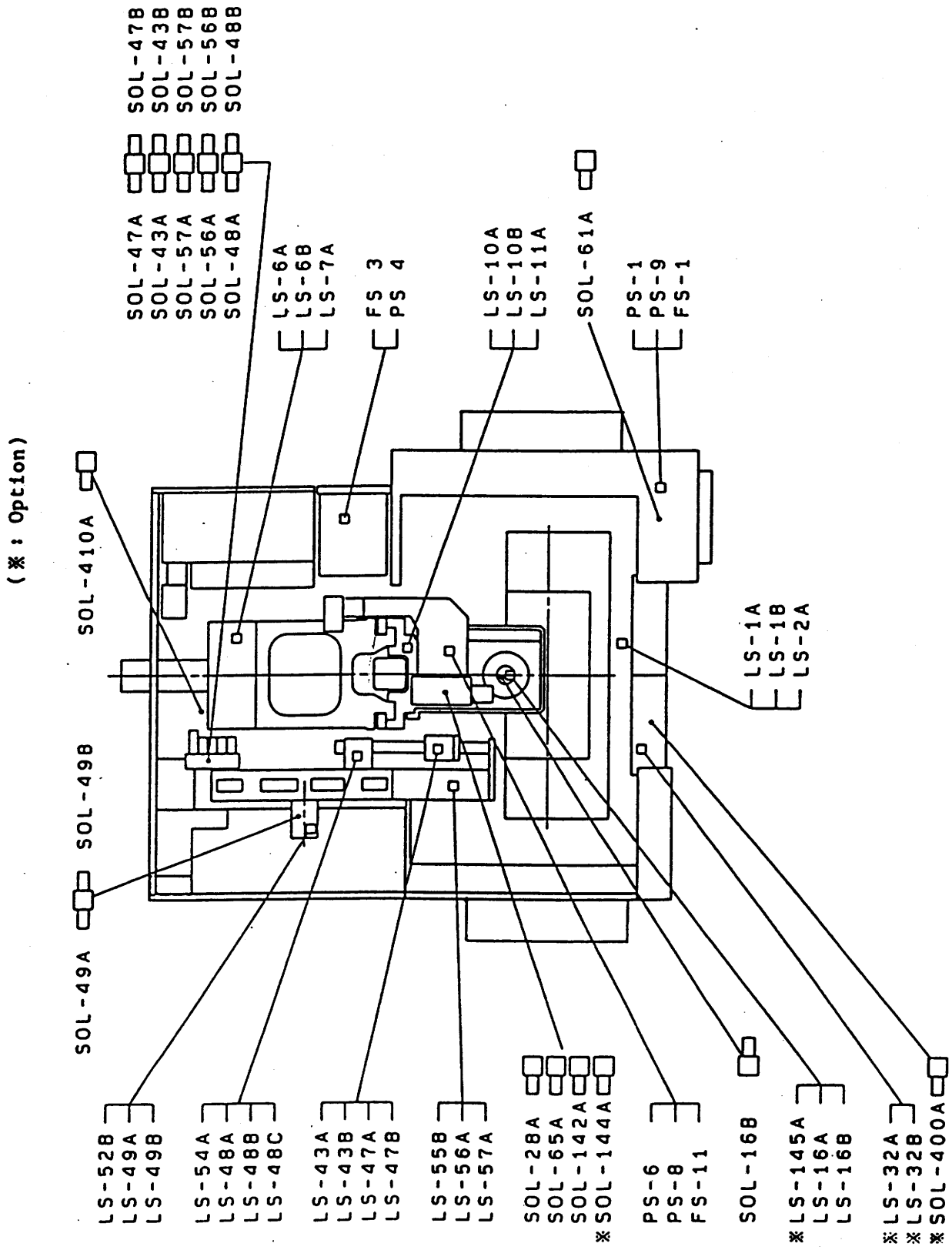
*Mark : Option

SOL No.		Use		Model	Manu- factur- er	Location
Machine						
SOL61	A	Air source pressure	IN	AB41-02-5-02G -AV100V	CKD	Front side of machine
*	A	RENISHAW receiving section Air blow	IN	AB41-02-5-02G -AC100V	CKD	Splash cover
*	A	Splash cover door Lock (European safety measure)	IN	TZFS-24VDC	SSR (Elan)	Splash cover
*	A	Air blow to prevent clogging of filter in the coolant tank (European safety measure)	IN	AB41-02-5-02G -AC100V	CKD	Rear side of machine
*	A	Air blow for air curtain at front door	OUT	AB41-02-5-02G -AC100V	CKD	Splash cover
Head						
SOL16	B	Tool	Un-clamp	KSO-G02-2BA-10-N (Single SOL)	Daikin	Head
	OFF		Clamp			
SOL28	A	Spindle air blow	OUT	AB41-02-5-02G -AC100V	CKD	Head
*	A	Needle One shot	OUT	AB21-01-1-02G -AC100V	CKD	Right side of machine
*	A	Spindle through Air blow	OUT	AB41-02-5-02G -AC100V	CKD	Head
*	A	DIN spindle through Air blow	OUT	AB41-02-5-02G -AC100V	CKD	Head
*	A	Measurement Air blow	OUT	AG43-02-4-02G -AC100V	CKD	Head
*	A	Mist coolant	OUT	AG31-01-1-02G -AC100V	CKD	Right side of machine
SOL65	A	Air for OL lubricating	OUT	AB41-02-5-02G -AC100V	CKD	Head

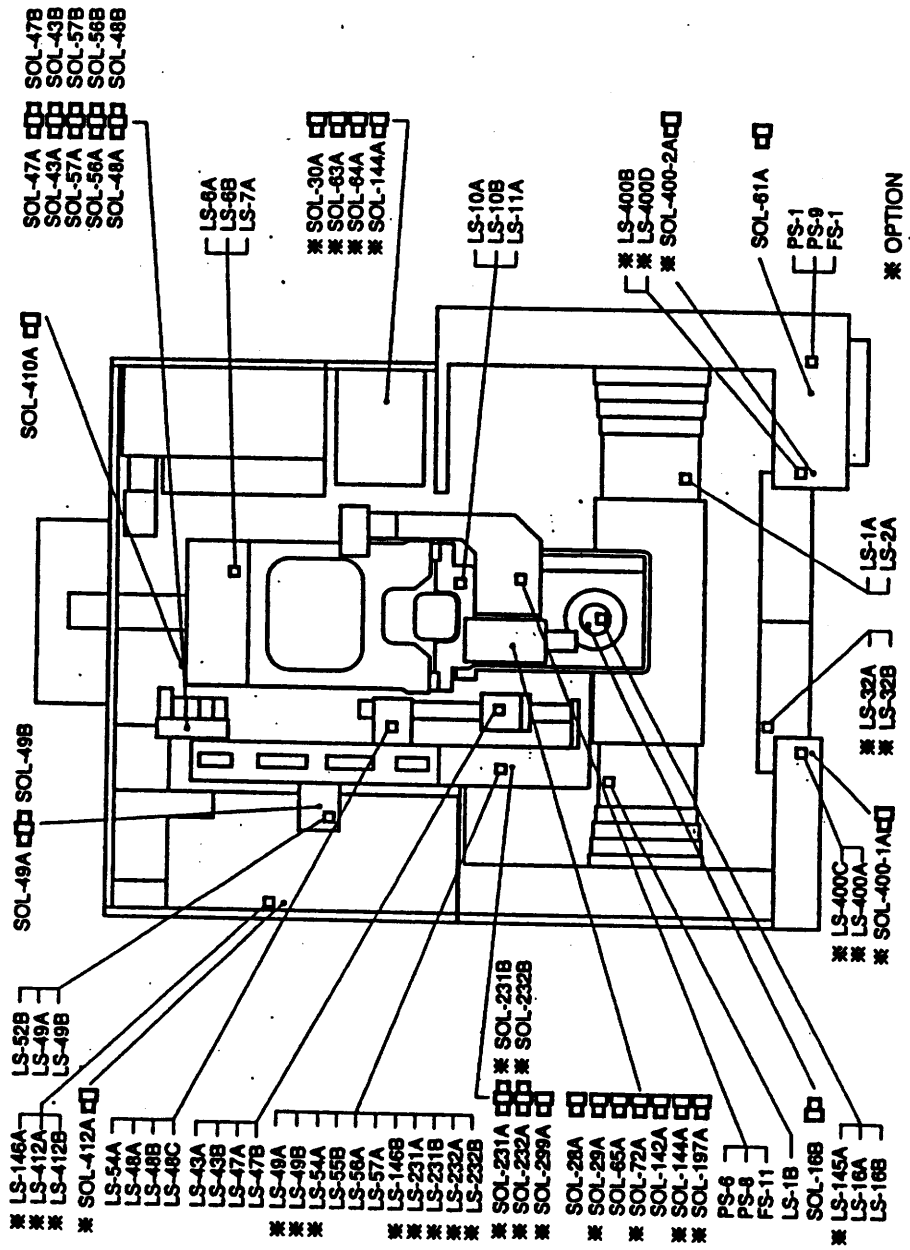
*Mark : Option

SOL No.		Use		Model	Manu- factur- er	Location
*	SOL63	2-position mist coolant nozzle direction limit upper		AG31-01-1-02G -AC100V	CKD	Right side of machine
*	SOL64	2-position mist coolant nozzle direction limit lower		AG31-01-1-02G -AC100V	CKD	Right side of machine
*	SOL72	Tool noze aie blow	OUT	AB41-02-5-02G -AC100V	CKD	Head
	A					
	SOL142	Air for OL lubricating	OUT	VXD2130-02-1DS-B	CKD	Head
	A					
ATC						
	SOL43	Double arm Turn	Forward	KSO-G02-2CA -10-N	Daikin	ATC
	A		Reverse			
	SOL47	Double arm Befor and behind	Advance	KSO-G02-2CA -10-N	Daikin	ATC
	A		Retract			
	SOL48	Arm swing-in	Spindle side	KSO-G-2-2CA -10-N	Daikin	ATC
	A		Magazine side			
	SOL49	Magazine Turn	Right	KSO-G02-4CA -10-N	Daikin	ATC
	A		Left			
	SOL56	Arm slide	Magazine side	KSO-G02-2CA -10-N	Daikin	ATC
	A		Original position			
	SOL57	Arm slide	Spindle side	KSO-G02-2CA -10-N	Daikin	ATC
	A					
	SOL412	ATC magazine interlock (European safety measure)	IN	TZFS-24VDC	SSR (Elan)	ATC
	A					
Detection checking device						
	SOL189	Breakage detection sensor air blow	OUT	AB41-02-5 -02G-AC100V	CKD	Saddle
	A					

3. Layout of Limit Switches and Solenoid Valves <VG>



Layout of Limit Switches and Solenoid Valves <VK II >



4. List of Motors <VG>

4-1

Use	Model	Output (KW)		Pole number Revolution	Voltage (V)	Frequency (Hz)	Location
		Continuous	%ED				
For spindle (Standard)	SJ-SK15XBM	7.5	11 50% ED	45~ 4500	AC 200		Head
For spindle (High speed)		15	18.5 50%ED	80~ 8000	AC 200		Head (Option)
For X-axis feed	DFSM-2020-502A NEC	2.0		Max. 2000	AC 200		X-axis head
For Y-axis feed	DFSM-2020-502A NEC	2.0		Max. 2000	AC 200		Y-axis head
For Z-axis feed	DFSM-4520B-502A NEC	4.5		Max. 1500	AC 200		Z-axis head

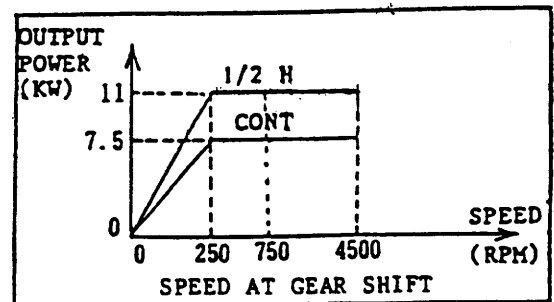
4-2 Spindle drive unit

Type FR-SF-2-11KP-DC/FR-SF-2-26KP-DC [STANDARD/HIGH SPEED(Option)]

Stationary time:

Output - Speed characteristics

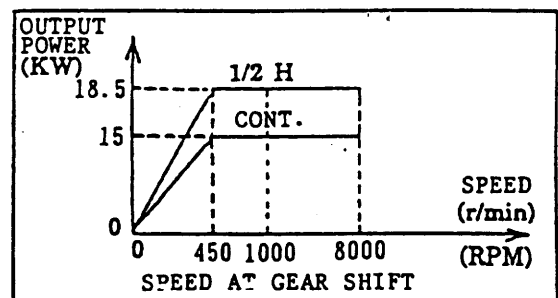
min ⁻¹	250/450	4500/8000
CONT (KW)	7.5/15	7.5/15
1/2H (KW)	11/18.5	11/18.5
VOLT	Max 200V	
AMP	Max 99A/173A	



Standard

4-3 Amplifier of axis drive

AC servo amplifier ADU-20F2S	1	X-axis, Y-axis 20A output
AC servo amplifier ADU-35F1X	1	Z-axis 35A output
Power source of direct device PCU05	1	5KW output
Resister of regene regeneration BPR-05L	2	



High speed (Option)

Model	Use Manufacture	Output (KW)		Pole number Revolution	Voltage (V)	Frequency (Hz)	Current (A)	Location	Remarks
		Cont.	%ED						
For outside machine chip conveyor	SM20GCED400-R Tsubakimoto- Emerson	0.1		4P	AC200 /200 220	50/60	0.65/ 0.6 0.6	Left side of machine	Option
For inside machine chip conveyor	GFM-18-30-010 Nissei Kogyo	0.1		4P	AC200 /200 220	50/60	0.63/ 0.57 0.58	Column, Worker side	
Magnetic separator	4IK25GKST2 4GK180K Oriental Motors	25W		4P	AC200 /200 220	50.60	0.25	Coolant tank	Option
For hydraulic tank	Daikin	1.5	CONT.	4P	AC200 /200 220	50/60	6.8 6.2 6.3	Hydraulic tank	
For lubricat- ing tank	Ryube	20W		2P	100	50/60	0.83/ 0/64	Lubricat- ing tank	
For spindle cooling compressor	RC27ATN Daikin	0.6		4P	AC200 /200 220	50/60	2.9/ 3.2 3.1	Right side of machine	
Circulation pump of cooling device	2.5MY-2516 LGVBA-A2 Daikin	0.4		4P	AC200 /200 220	50/60	2.2/ 1.93 1.95	Right side of machine	
For flood coolant	LSW25AO.4-280 Kyokuto	0.4		2P	AC200 /200 220	50/60	2.5/ 3.0	Coolant tank	
For oil hole coolant	TOP-2MY400 208HWMCP-VBESK -10 NOP	0.4		4P	AC200 /200 220	50/60	2.2/ 1.93 1.91	Coolant tank	Option
For gun coolant	LSW15AO.18-250	0.18		2P	AC200 /200 220	50/60	1.1/ 1.2	Coolant tank	Option
For jet coolant (cleaning in the machine)	LPS401A-0.75 Kyokuto	0.75		4P	AC200 /200 220	50/60	0.25	Coolant tank	Option

Listd of Motors <VK II >

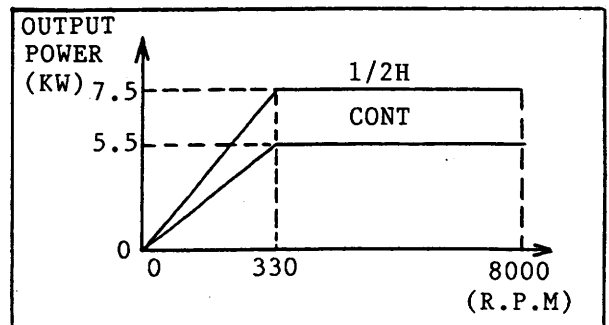
4-4

Use	Model	Output (KW)		Pole number Revolution	Voltage (V)	Frequency (Hz)	Location
		Continuous	%ED				
For spindle NT40	SJ-2B4606K	5.5	7.5 50% ED	60~8000	AC 200		Head
For spindle NT50	SJ-2B4606K	5.5	7.5 50% ED	45~4500	AC 200		Head (Option)
For X-axis feed	DFSM-2030 502A NEC	2.3		Max.3000	AC 200		X-axis head
For Y-axis feed	DFSM-2030 502A NEC	2.3		Max.3000	AC 200		Y-axis head
For Z-axis feed	DFSM-3020 502A NEC	3.3		Max.2000	AC 200		Z-axis head

4-5 Spindle drive unit

Type FR-SF-2-7.5KP-DC/FR-SF-2-11KP-DC [NT40/NT50]

min ⁻¹	330/220	8000/4500
CONT(KW)	5.5/5.5	5.5/5.5
1/2(KW)	7.5/7.5	7.5/7.5
VOLT	Max 200V	
AMP	Max 77A/97A	

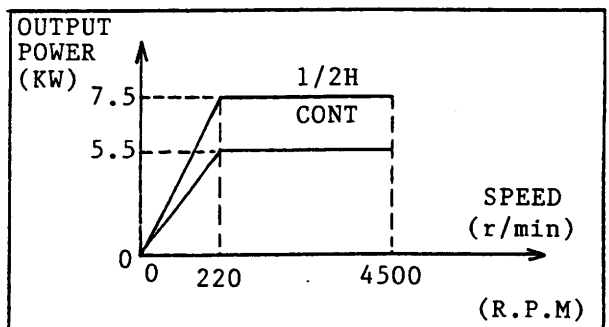


NT40 Stationary time:

Output - Speed characteristics

4-6 Amplifier of axis drive

AC servo amplifier ADU-20F2S	1	X-axis, Y-axis 20A output
AC servo amplifier ADU-20FIX	1	Z-axis 35A output
Power source of direct device PCU05	1	5KW output
Resister of regene regeneration BPR-05L	1	XY-axis 100W
Resister of regene regeneration BPR-05	2	Z-axis 200W



NT50 Stationary time:

Output - Speed characteristics

Motors

Model	Use Manufacture	Output(KW)		Pole number Revolution	Voltage(V)	Frequency (Hz)	Current (A)	Location	Remarks
		Cont.	%ED						
For outside machine chip conveyor	SM20GCED400-R Tsubakimoto- Emerson	0.1		4P	AC200 /200 220	50/60	0.65 /0.6 0.6	Left side of machine	Option
For inside machine chip conveyor	GFM-18-50-010 Nissei Kogyo	0.1		4P	AC200 /200 220	50/60	0.63 /0.57 0.58	Column, Worker side	
Magnetic separator	41K25GKST2 4GK180K Oriental Motors	25W		4P	AC200 /200 220	50/60	0.25	Coolant tank	Option
For hydraul tank	Daikin	1.5	CONT	4P	AC200 /200 220	50/60	6.8 6.2 6.3	Hydraulic tank	
For lubricat ing tank	Ryube	20W		2P	100	50/60	0.83 /0/64	Lubricat- ing tank	
For spindle cooling compressor	806 323 83 Kanto Seiki	0.3		2P	AC200 /200 220	50/60	MAX 2.4	Right side of machine	
Circulation pump of cooling device	2MY200-208 HAEMVK Kanto Seiki	0.2		4P	AC200 /200 220	50/60	MAX 1.6	Right side of machine	
For flood coolant	LSW15A0.18 Kyokuto	0.18		2P	AC200 /200 220	50/60	1.1 /1.2	Coolant tank	
For oil hole coolant	TOPO2MY400 208HWMCP-VBE5K -10 NOP	0.4		4P	AC200 /200 220	50/60	2.2 /1.93 1.91	Coolant tank	Option
For gun coolant	VKPO73A Fujidenki	0.18		2P	AC200 /200 220	50/60	0.85 /1.0	Coolant tank	Option
For jet coolant (cleaning in the machine)	LPS401A-0.75 Kyokuto	0.75		4P	AC200 /200 220	50/60	3.5 /3.3 3.2	Coolant tank	Option

5. How to Manage at Power Failure

(It is the same when charging an emergency stop during operating.)

When a power failure occurs while the machine is operating, the N/C unit and the main control cabinet of the machine are totally turned "OFF", and the commands stored in the N/C unit and the electric commands given by the manual operation button are totally cleared. And the machine stops instantly. Even after restoring from the status of power failure, the N/C unit and the control circuit of the machine cannot be operated, unless the power supply **ON** of the N/C unit and the **STANDBY** button are pressed again.

Be extremely careful when pressing the **STANDBY** button. Because the machine may operate to complete the remaining movements which were operating before the power failure, depending on the circuit hydraulic.

Operation or status immediately before power failure	Status or movements when the control circuit is energized after restoring from power failure	Operation after restoring from power failure
In spindle rotation	Stop	
In spindle stop	Stop	
In spindle change speed	Stop	Command S4 digits by MDI
In spindle orientation	Stop	Command M19 by MDI
Tool clamp	Tool clamp	
Tool unclamp	Tool clamp	
X. Y. Z axes	Stops in the status immediately before power failure	
In coolant discharging	Stop	
In mist discharging	Stop	
In chip conveyor	Stop	

1. Power failure or emergency stop while the ATC is operating.

● ATC reference point return function

This is a function for making easier to restore after an emergency stop or a power failure in ATC.

1) Operation method

① Set the mode of the main operation box to the manual.
(Feed, repaid traverse, reference point return and manual pulse generator etc.)

② Press the ATC reference point return" button on the ATC operation box.

The lamp lights up while the ATC return cycle is performing.

2) Status and moving procedures while it stops

Item	Stop status	Restoration procedure
ATC arm magazine side		
1	a Double arm right end b Arm slide between retract and original position c Arm swing-in magazine side	Arm slide original position
2	a Double arm left end/ Double arm between left and right b Arm slide retract end c Arm swing-in magazine side	Double arm left → Arm slide advance → Double arm right
3	a Double arm left end b Arm slide between retract and original position c Arm swing-in magazine side	Arm slide advance → Double arm right
4	a Double arm between left and right b Arm slide original position c Arm swing-in magazine side	Double arm right

Item	Stop status	Restoration procedure
ATC arm spindle side		
1	a Double arm ascent end b Arm slide original position c Arm swing-in between magazine and spindle d Double arm turn end	Arm swing-in magazine side
2	a Double arm ascent end b Arm slide advance end/ Arm slide between advance and original position c Arm swing-in spindle side d Double arm turn end	Arm slide retract → Arm swing-in magazine side
3	a Double arm descent end/ Double arm between descent and ascent b Arm slide advance end c Arm swing-in spindle side d Double arm turn end	Double arm descent → Tool clamp → Spindle positioning → Tool unclamp → Double arm ascent → Tool clamp → Arm slide retract → Arm swing-in magazine side
4	a Double arm descent end b Arm slide advance end c Arm swing-in spindle side d Double arm turning	Double arm turn → Tool clamp → Spindle positioning → Tool unclamp → Double arm ascent → Tool clamp → Arm slide retract → Arm swing-in magazine side

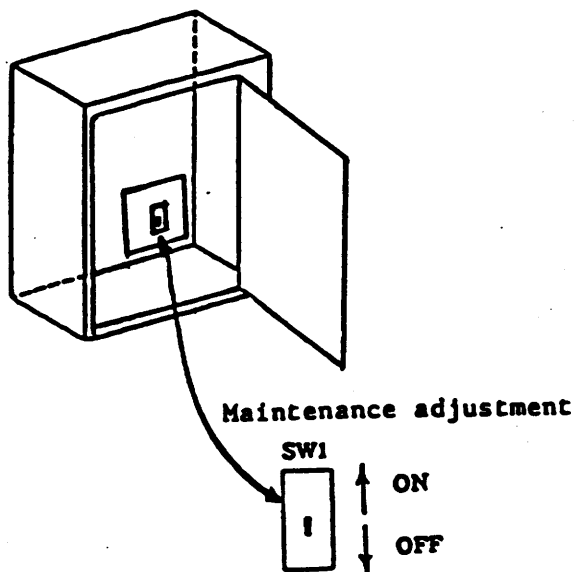
If ATC original position return is not executed completely, execute individual motion by maintenance M code.

(Refer to the movement diagram in page 6-15.)

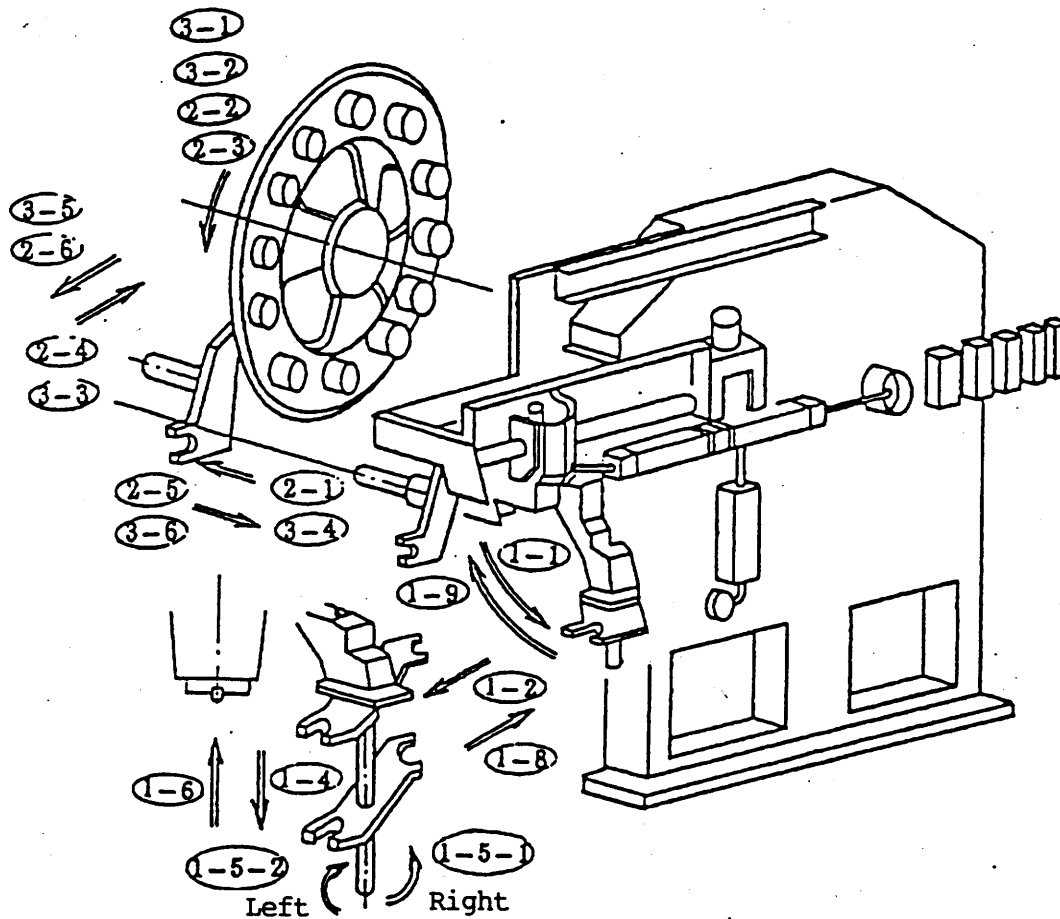
2. Adjustment switch on control cabinet

SW No.	Name	Use
SW 1	Maintenance	Individual motion of ATC or APC can be done by executing the maintenance M code at this switch is ON.

* As the switch 1 above is for adjustment, turn off unless it is required.

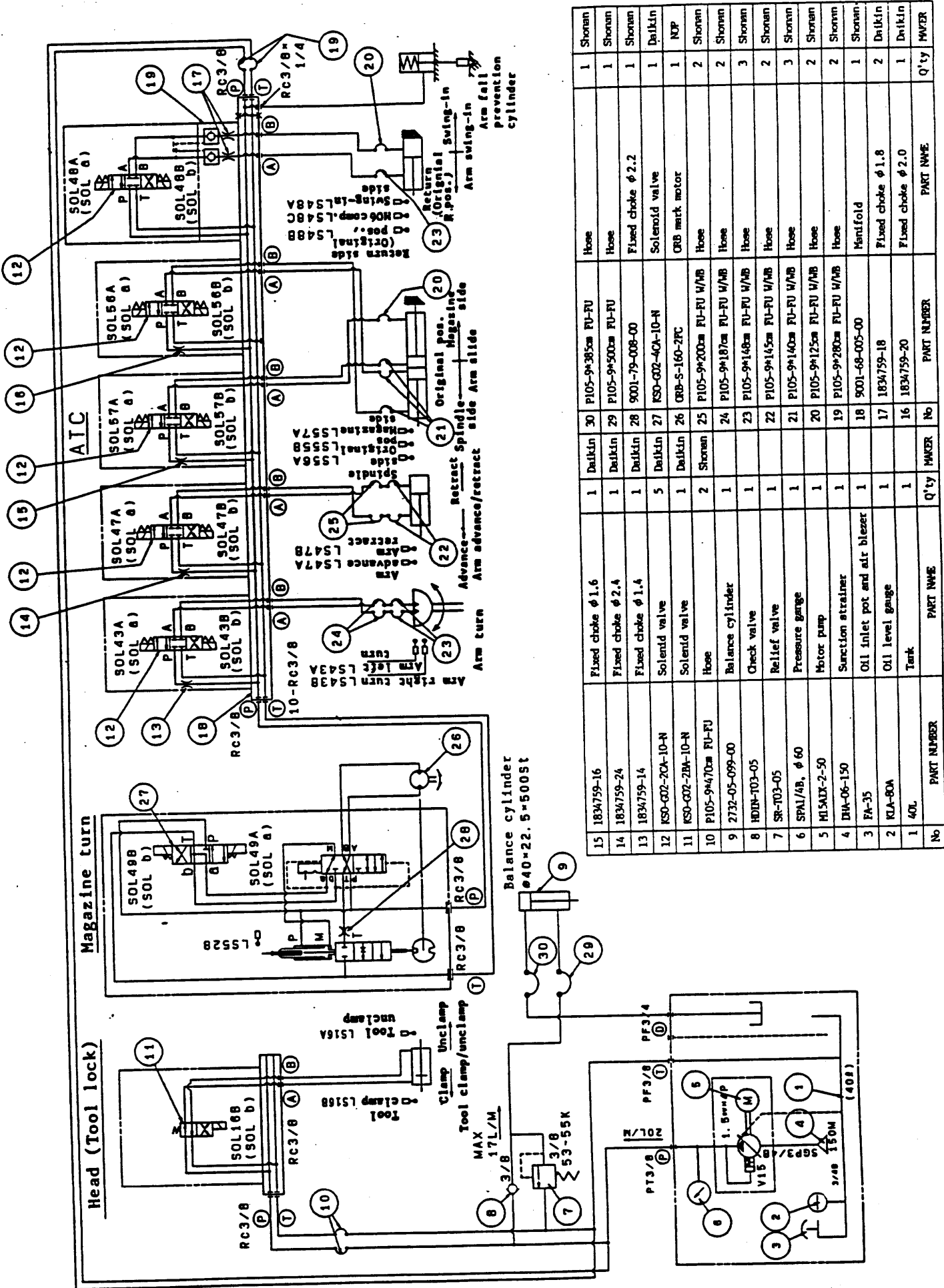


Description of ATC Operation



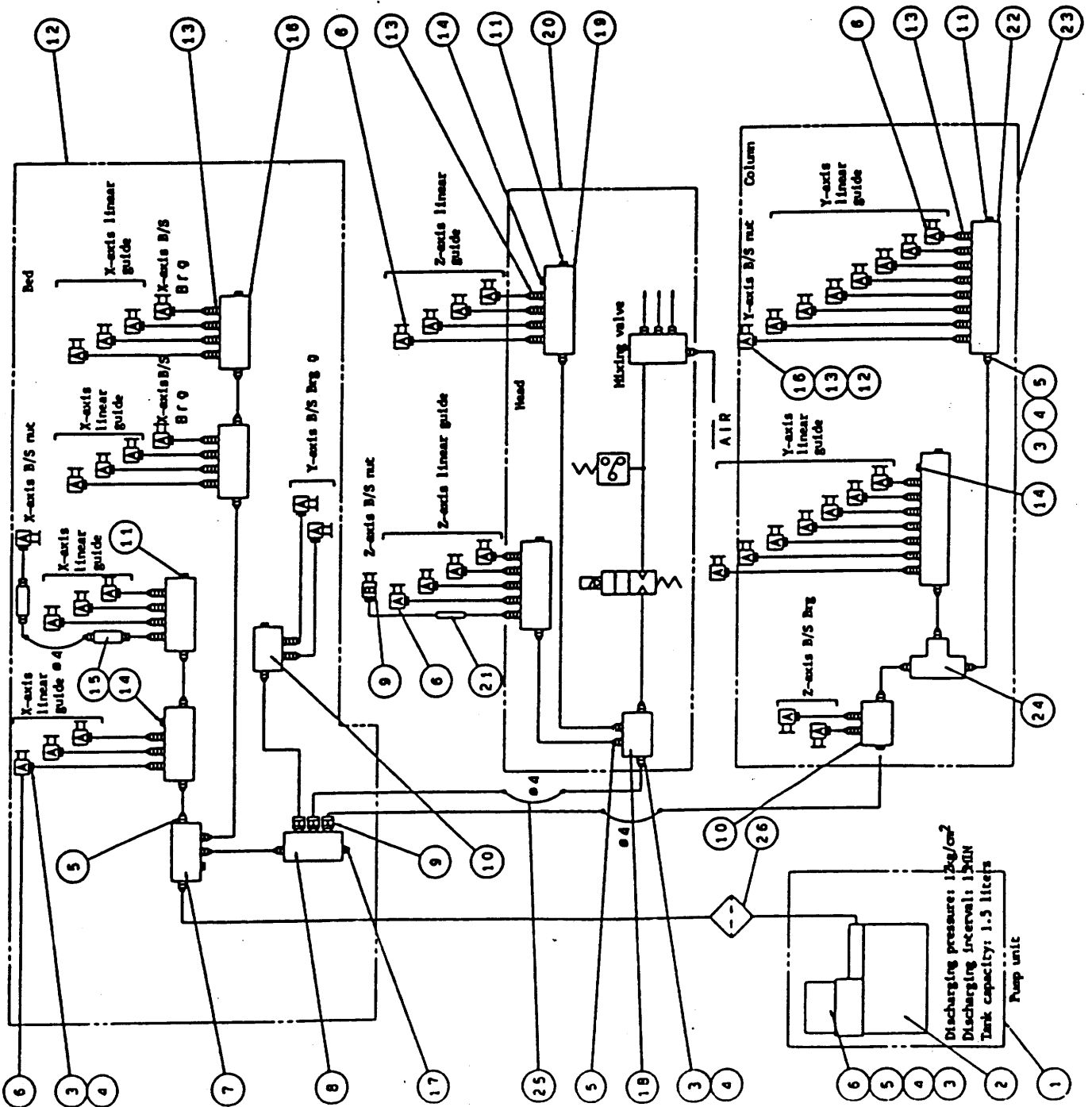
Function	Order	Operation	Function	Order	Operation	
Tool change (M06)	1-1	Arm swing		2-3	Magazine positioning	
	1-2	Arm slide forward		2-4	Arm slide retract	
	1-3	(Spindle tool unclamp)		2-5	W arm right going	
	1-4	W arm down		2-6	Arm slide original position	
	1-5	W arm turn 180°		Tool call	3-1	Magazine turn
	1-6	W arm up			3-2	Magazine positioning
	1-7	(Spindle tool clamp)	3-3		Arm slide retract	
	1-8	Arm slide original position	3-4	W arm left going		
	1-9	Arm swing-back	3-5	Arm slide original position		
Tool return	2-1	W arm left going	3-6	W arm right going		
	2-2	Magazine turn				

HYDRAULIC CIRCUIT DIAGRAM <VK II>



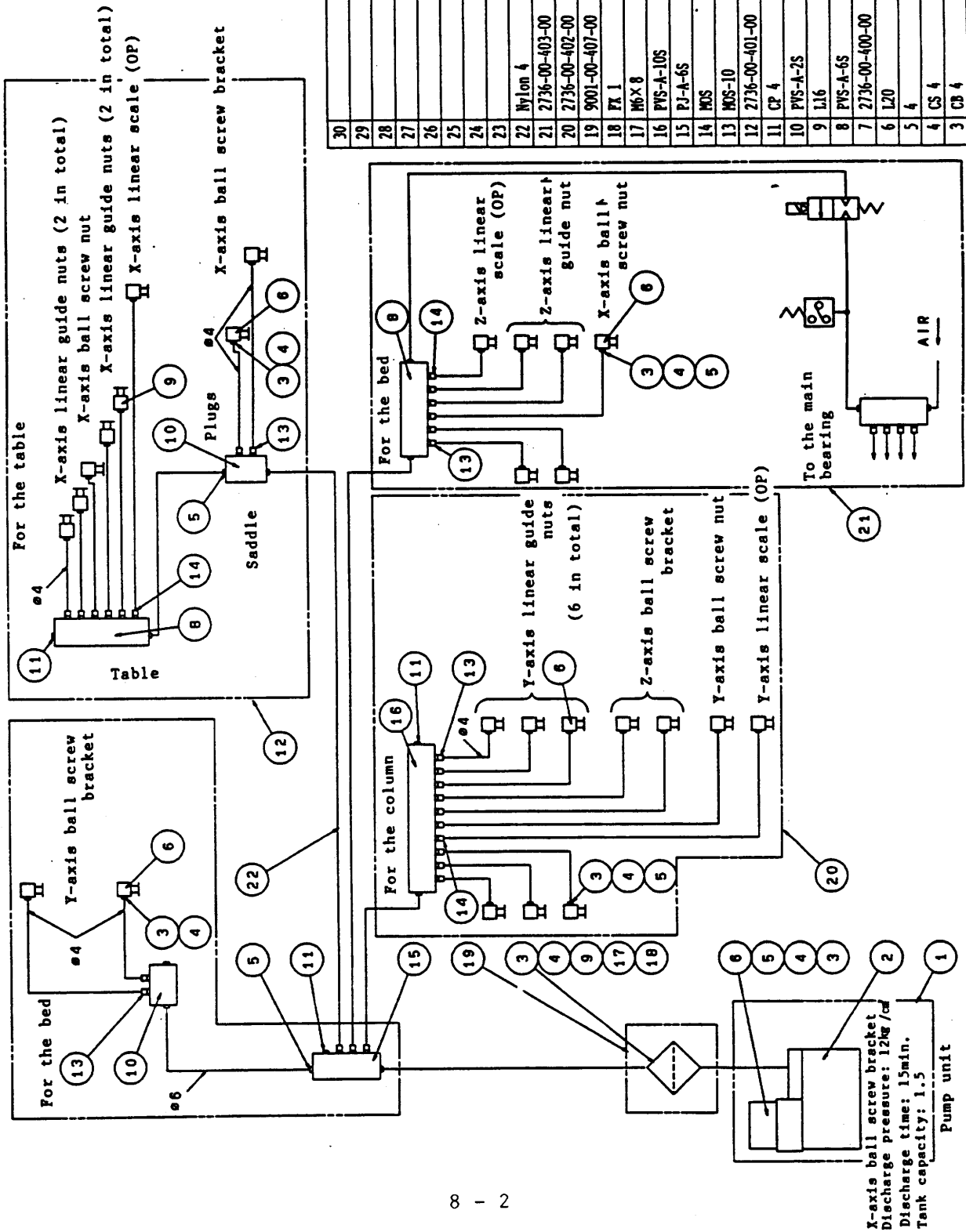
No	PART NAME	Q'ty	MAKER	No	PART NUMBER	PART NAME	Q'ty	MAKER	No	PART NUMBER	PART NAME	Q'ty	MAKER
15	1834759-16	1	Daikin	30	P105-9x385m	FU-FU	1	Shonan	1	Hose		1	Shonan
16	1834759-24	1	Daikin	29	P105-9x500m	FU-FU	1	Shonan	1	Hose		1	Shonan
13	1834759-14	1	Daikin	28	9001-79-008-00		1	Shonan	1	Fixed choke φ2.2		1	Shonan
12	K50-G02-20A-10-N	5	Daikin	27	K50-G02-40A-10-N		1	Daikin	1	Solenoid valve		1	Daikin
11	K50-G02-20A-10-N	1	Daikin	26	ORB-S-160-2FC		1	NJP	1	ORB mark motor		1	NJP
10	P105-9x470m	2	Shonan	25	P105-9x200m	FU-FU W/MB	2	Shonan	2	Hose		2	Shonan
9	2732-05-099-00	1	Daikin	24	P105-9x187m	FU-FU W/MB	1	Shonan	2	Hose		2	Shonan
8	HDIN-103-05	1	Daikin	23	P105-9x148m	FU-FU W/MB	1	Shonan	3	Hose		3	Shonan
7	SR-103-05	1	Daikin	22	P105-9x145m	FU-FU W/MB	1	Shonan	2	Hose		2	Shonan
6	SPAI/4B, φ 60	1	Daikin	21	P105-9x140m	FU-FU W/MB	1	Shonan	3	Hose		3	Shonan
5	MISAKI-2-50	1	Daikin	20	P105-9x125m	FU-FU W/MB	1	Shonan	2	Hose		2	Shonan
4	DWA-06-150	1	Daikin	19	P105-9x280m	FU-FU W/MB	1	Shonan	2	Hose		2	Shonan
3	FA-35	1	Daikin	18	9001-68-005-00		1	Shonan	1	Manifold		1	Shonan
2	KJA-80A	1	Daikin	17	1834759-18		1	Daikin	2	Fixed choke φ 1.8		2	Daikin
1	40L	1	Daikin	16	1834759-20		1	Daikin	1	Fixed choke φ 2.0		1	Daikin
No	PART NUMBER			No	PART NUMBER				No	PART NUMBER			

Chapter 8
LUBRICATING
SYSTEM DIAGRAM
<VG>



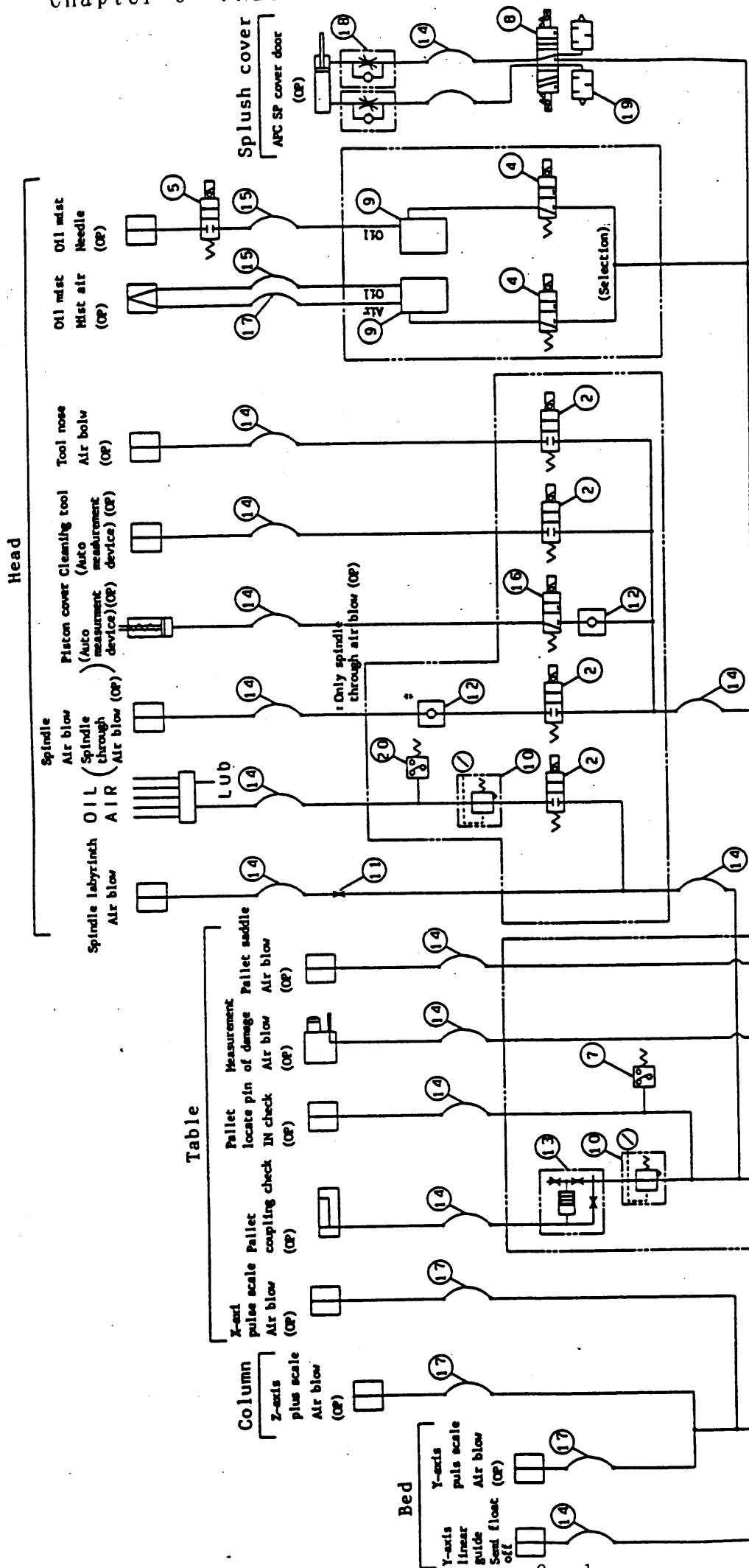
NO	PART NUMBER	PART NAME	QTY	MAKER
30				
29				
28				
27				
26	F3	Line filter	1	LUBE
25	SHOVA Nylon 4	Nylon tube	13	Shyom Yuki
24	PJ-3	Junction	1	LUBE
23	2772-00-404-10	Lubrication device	1	LUBE
22	PVS-A-85	Junction	2	LUBE
21	M8-M8	Coupling	1	LUBE
20	2772-00-406-10	Lubrication device	1	LUBE
19	PVS-A-55	Junction	2	LUBE
18	PJ-45	Junction	1	LUBE
17	1/8	Plug w/Hexagon hole	1	LUBE
16	PVS-A-45	Junction	1	LUBE
15	PJ-2	Junction	2	LUBE
14	MOS	Plug assembly	3	LUBE
13	MOS-10	Quantitative valve	43	LUBE
12	2772-00-403-10	Lubrication device	1	LUBE
11	CP 4	Closure valve	7	LUBE
10	PVS-A-25	Junction	2	LUBE
9	L16	Straight adapter	4	LUBE
8	JV-55	Junction	1	LUBE
7	PJ-55	Junction	1	LUBE
6	L20	Elbow adapter	44	LUBE
5	4	Tube insert	29	LUBE
4	CS 4	C. sleeve	121	LUBE
3	CB 4	C. bushing	121	LUBE
2	AM0-150SA-18CP-P	Pump	1	LUBE
1	9001-00-406-00	Lubrication device	1	LUBE

LUBRICATING SYSTEM DIAGRAM <VK II >



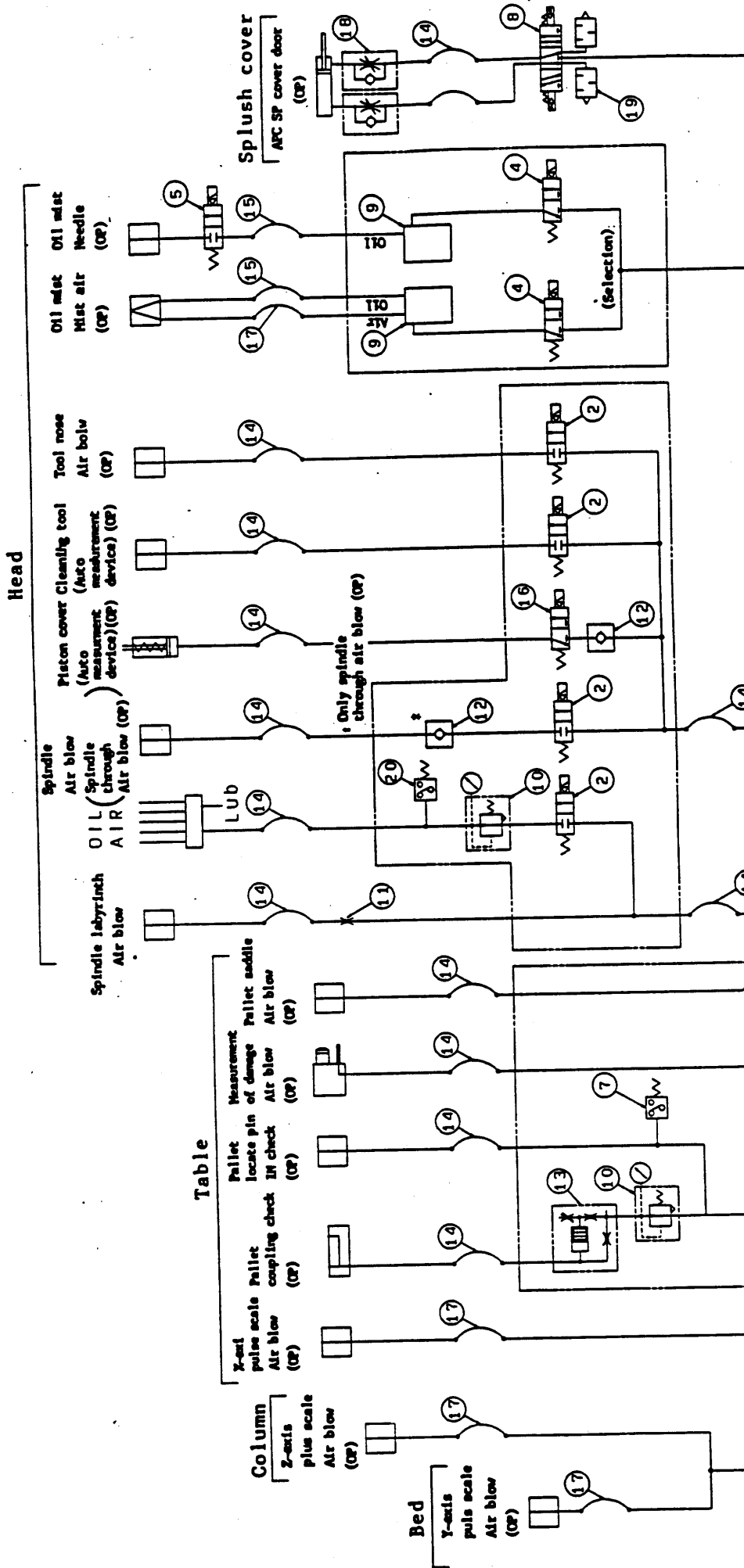
NO	PART NUMBER	PART NAME	Q'ty	MAKER
30				
29				
28				
27				
26				
25				
24				
23				
22	Nylon 4	Nylon tube	1	
21	2736-00-403-00	Lubrication device	1	LUBE
20	2736-00-402-00	Lubrication device	1	LUBE
19	9001-00-401-00	Line filter	1	LUBE
18	FX 1	Line filter fitting board	1	LUBE
17	M6X8	far-head machine screw (cross slot)	2	LUBE
16	PYS-A-10S	Junction	1	LUBE
15	PJ-A-6S	Junction	1	LUBE
14	M5S	Plug assembly	3	LUBE
13	M5S-10	Quantitative valve	26	LUBE
12	2736-00-401-00	Lubrication device	1	LUBE
11	CP 4	Closure valve	4	LUBE
10	PYS-A-2S	Junction	2	LUBE
9	L16	Straight adapter	6	LUBE
8	PYS-A-6S	Junction	2	LUBE
7	2736-00-400-00	Lubrication device	1	LUBE
6	L20	Elbow adapter	22	LUBE
5	4	Tube insert	59	LUBE
4	CS 4	C.sleeve	61	LUBE
3	CB 4	C.bushing	61	LUBE
2	AWO-150SA-18CP-P	Pump	1	LUBE
1	9001-00-406-00	Lubrication device	1	LUBE

Chapter 9 PNEUMATIC CIRCUIT DIAGRAM <VG>

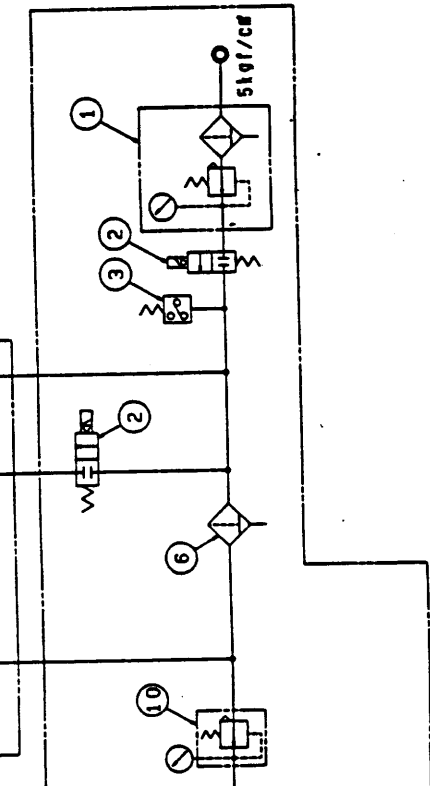


NO	PART NUMBER	PART NAME	MAKER
20	PE4T	Pressure switch	CKD
19	SLV-8A	Silencer	CKD
18	SC3G-6-8	Spcon tube	CKD
17	F-1506 70	Nylon tube	CKD
16	AG43-02-4-02G-AC100V	Solenoid valve	CKD
15	4-2.5	Nylon tube	LUBE
14	F-1508 70	Nylon tube	CKD
13	PL-1	Bell switch	CKD
12	CV-202J	Check valve	TACO
11	2741-45-431-00(4Y)	Plug	Hitachi Seiki
10	R1000-8-B	Regulator	CKD
9	MH-20H	Oil mist device	CKD
8	4K8240-08-L-AC100V	Solenoid valve	CKD
7	APE-8T	Pressure switch	CKD
6	M-103	Dry filter	Shell sev.
5	AB31-01-3-02G-AC100V	Solenoid valve	LUBE
4	AG31-01-1-02G-AC100V	Solenoid valve	LUBE
3	PE2T	Pressure switch	CKD
2	AB41-02-5-02G-AC100V	Solenoid valve	CKD
1	V3000-8-F-8	FR set	CKD
NO		PART NUMBER	MAKER

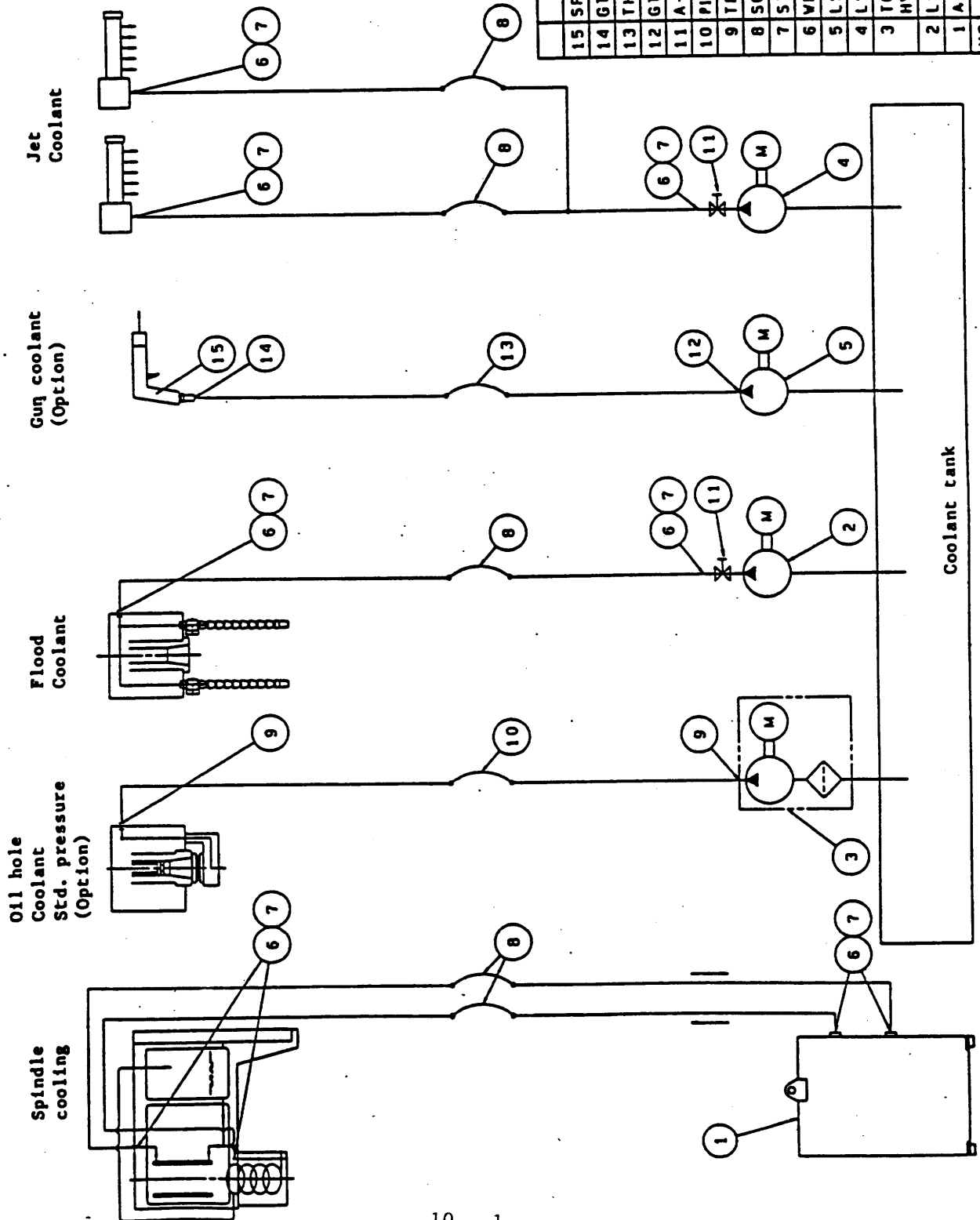
PNEUMATIC CIRCUIT DIAGRAM <VK II >



NO	PART NUMBER	PART NAME	QTY	MAKER
20	PE4T	Pressure switch	1	CKD
19	SLV-8A	Silencer	2	CKD
18	SC30-6-8	Spcon	2	CKD
17	F-1506-70	Nylon tube	1	CKD
16	AG43-02-4-02G-AC100V	Solenoid valve	1	CKD
15	04-02.5	Nylon tube	1	LUBE
14	F-1508-70	Nylon tube	1	CKD
13	PL-1	Ball switch	1	CKD
12	CV-202J	Check valve	2	IACO
11	2741-45-431-00(4Y)	Plug	1	Mitsub Selkti
10	R1000-8-B	Regulator	3	CKD
9	MH-20H	Oil mist device	1	LUBE
8	KB240-08-L-AC100V	Solenoid valve	1	CKD
7	APE-8T	Pressure switch	1	CKD
6	M-103	Dry filter	1	Shell sev.
5	AB31-01-3-02G-AC100V	Solenoid valve	1	LUBE
4	AG31-01-1-02G-AC100V	Solenoid valve	1	LUBE
3	PE2T	Pressure switch	1	CKD
2	AB41-02-5-02G-AC100V	Solenoid valve	6	CKD
1	W3000-8-F-8	PR set	1	CKD

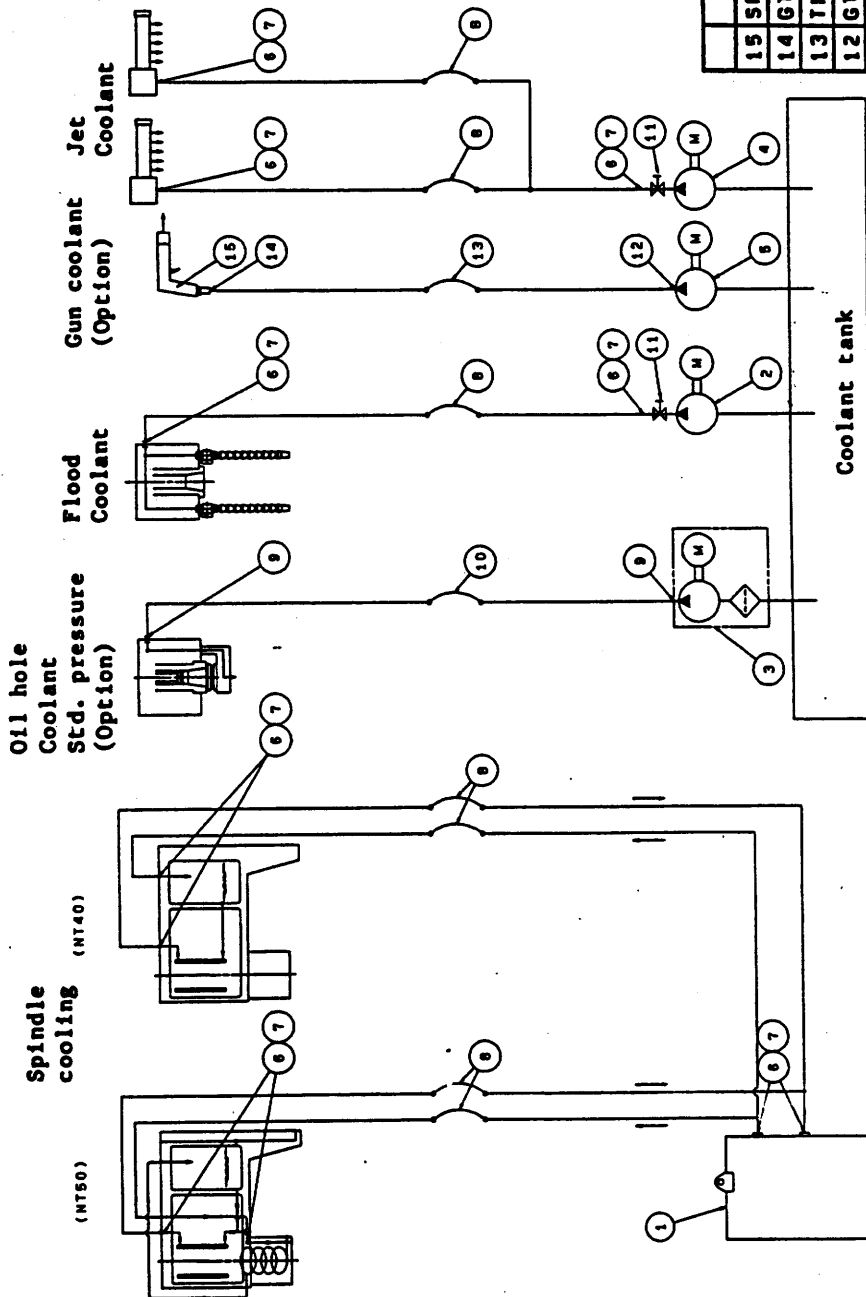


Chapter 10 COOLANT
 SPINDLE COOLING,
 PIPING SYSTEM DIAGRAM <VG>



NO	PART NUMBER	PART NAME	QTY	MAKER
15	SP100	Coolant gun	1	Kurita
14	GTO-92	Hose nipple	1	Chiyoda
13	TH-3(8+12)	Urethan hose	1	Chiyoda
12	GT-11	Hose socket	1	Chiyoda
11	A-1B	Stop valve	2	Kitazawa
10	PI05-19-700CM fu-fu w/MF	Hose	1	Shonan
9	TF-19	Stright	2	
8	SO-25	Vnyll hose	1	Toyok
7	STG-V2 25-40/9	Hose band	7	Noruna
6	VHN-36	Male thread connector	7	Niss Mfg.
5	LSV15A0. 18-250	Coolant pump?	1	Kyobuco
4	LSV25A0. 4-280	Oil pump	1	Kyobuco
3	TOP-2MY400-208 HVMCP-VBE15K-10	Torchid pump	1	NOP
2	LSV25A0. 4-280	Coolant pump	1	Kyobuco
1	ASK105K-FB9	Oil controller	1	Datkin

COOLANT
 SPINDLE, COOLING,
 PIPING SYSTEM DIAGRAM <VK II >

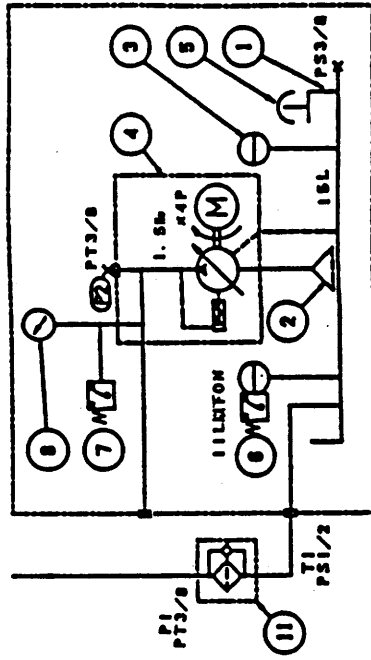


15	SP100	Coolant gun	1	Burita
14	GTO-92	hose nipple	1	Chiyoda
13	TH-3(8*12)	hose hoses	1	Chiyoda
12	GT-11	hose socket	1	Chiyoda
11	A-18	Stop valve	2	Kitazawa
10	PI05-19-700CH	Fl-fl w/MS hose	1	Shonan
9	90TF12	Elbow	2	
8	SO-25	Vynil hose	1	Toyok
7	STG-V2 25-40/9	Hose band	11	Norumi
6	WHN-36	Male thread connector	11	Niss Mfg.
5	LSW15A0.18	Coolant pump	1	Kyuzo
4	LSW25A0.4	Oil pump	1	Kyuzo
3	TOP-2MY400-208 HVMCP-YBE15K-10	Torochid pump	1	NOP
2	LSW15A0.18	Coolant pump	1	Kyuzo
1	KTC-5C-B3	Oil controller	1	Daitkin
NO	PART NUMBER	PART NAME	QTY	MAKER

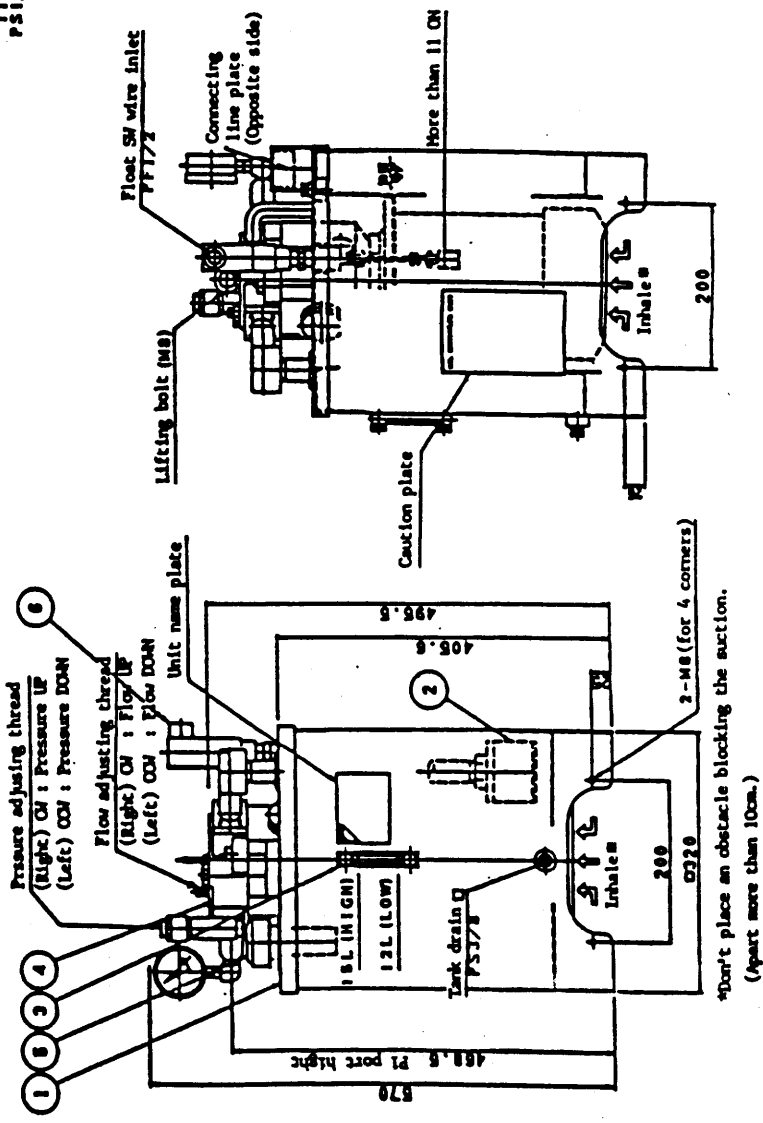
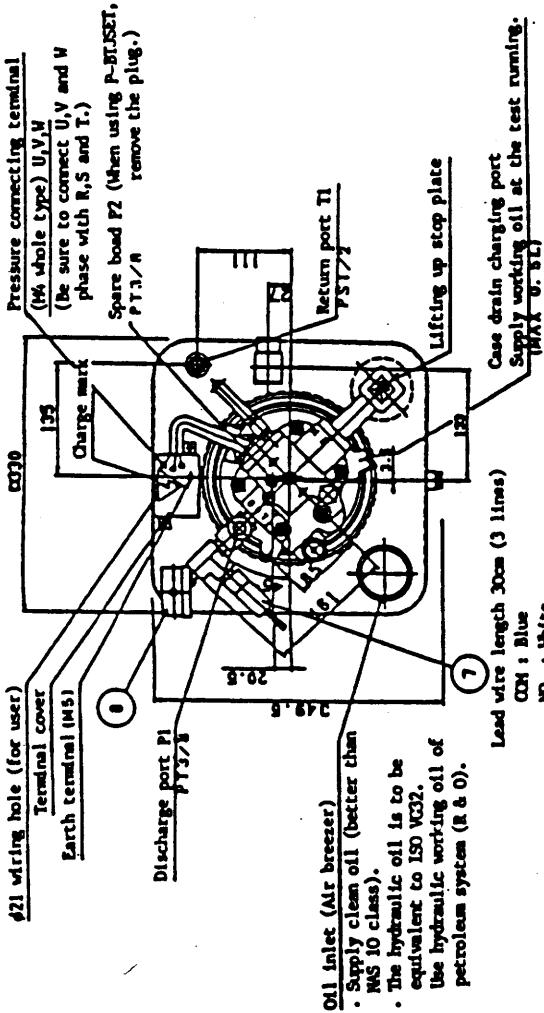
1. Hydraulic Tank <VG>

Specifications

Max. work pressure	D. H. 45kgf/cm ²
Pump discharge amount	20l/min at 42-38kgf/cm ² x 1450/1740rpm
Working oil viscosity area	15 - 88 cSt (15 - 60°C)
Oil to be used	Petro-hydraulic working oil ISO VG32 ISO
Power system	AC 3φ 200/200/220V 50/60/60Hz (Voltage regulation ±10%)
Control system	AC 3φ 100/100/110V 50/60/60Hz (Voltage regulation ±10%)
SOL system	
Painting color	Ivory-White (Hansel 577-5/1)
Atmosphere temperature	5-35°C Indoor installing type



No.	Part name	Q'ty	Maker	Model
12	Line filter	1	Hiyoshi	HBO5RA
11	Pressure gauge	1	Yodogawa	PCA φ50x100x1500lb/in ²
10	Pressure switch	1	Sanyo	JP-BJ More than 20 ON
9	Float switch	1	Nohken	OLV-2B-1
8	Oil Inlet/ Air breeder	1	Daisel	FA-35
7	Motor pump	1	Daikin	HI SAIY-05S14
6	Oil level gauge	1	KLA-ROSA	
5	Suction strainer	1	Hiyoshi	DNA-06-150
4	Oil tank	1	Daikin	15L
3	Part name			
2	Q'ty			
1	Maker			

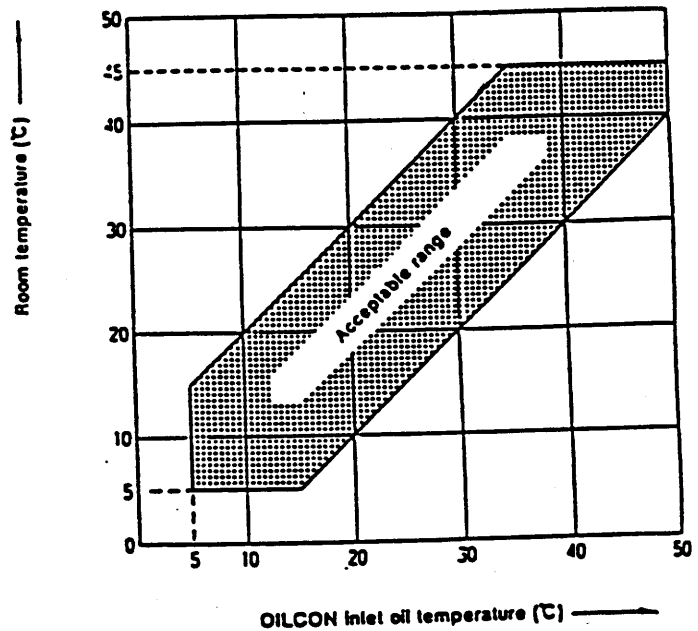


2. Spindle Cooling Device

1 General Cautions

1-1 Range of Use

There is a limit to using conditions.
Use it within the range shown below.



1-2 Acceptable oils

Hydraulic fluids (of mineral oil origin) and lubricating oil shall be used for this unit. Therefore, the following oil (fluid) shall not be used for this unit.

- 1) Fire-resistant hydraulic oil (hydraulic oils of phosphoric ester, chlorinated hydrocarbon oils, water/glycol hydraulic oils and W/O and O/W emulsion type hydraulic oils).
- 2) Water and water soluble liquids.
- 3) Liquid chemicals and foods.
- 4) Cutting oils (fluid) and grinding oils (fluid).
- 5) Fuel such as kerosene, gasoline. etc.

2. Cautions During Installation

2-1 Installation Location

• Install in the following locations.

- 1) On a solid, level floor.
- 2) Away from direct sunlight and heat.
- 3) Where there is good ventilation and little humidity.
- 4) Where the discharged gas will not be drawn in again.
- 5) A place convenient for piping and wiring.
- 6) Where there is little dust, dirt, powder, oil mist, etc.

• Do not place anything in the way of ventilation within 500 mm distance from intake and exhaust ports.

2-2 Oil Piping

- 1) • Suction (Oil inlet) side.....—230~0 mmHg
• Discharge side.....3 kg/cm² or less.

For details, please refer to the referential date (P. 12-18)

- 2) Do not use more valves than necessary in the piping. Valves, even if fully open, cause a considerable loss in pressure.
- 3) Use sealing tape when connecting the piping to prevent air infiltration and oil leakage.

2-3 Suction Strainer (Line Filter)

When dust blocks inside the cooler of the OILCON, it not only deteriorates cooling capacity, but also causes troubles to the compressor and oil pump. Therefore, clean up inside the oil piping system using a strainer (100~150 mesh) of less pressure loss and better efficiency when adjusting this unit for trial run. Check the strainer periodically.

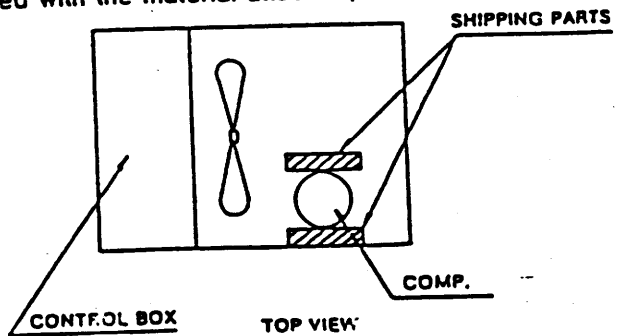
2-4 Oil Tank

Be careful with the partitions, piping layout, etc. in the tank so that the hot oil returning from the machine is uniformly mixed with the cool oil of the OILCON. Furthermore, keep the lowest oil level inside the oil tank over the oil inlet and oil outlet in order to prevent air mixing with the oil.

2-5 Shipping Parts for Transport

This unit is provided with shipping parts for transport. Remove shipping parts for transport by all means before operation.

(If operated with the material attached, it causes foreign noise.)



3. Electrical Wiring

- For electric wiring work, refer to the electric wiring plate attached to back side of the switch box cover.
- Do not change the wiring inside the OILCON nor operate the electromagnetic switches manually.

3-1 Power Source Capacity

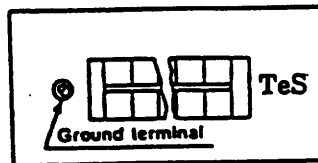
Rated voltage	AKS105K series
Triple phase, 200 Volts	2.3
Triple phase, 220 Volts	2.6

3-2 Circuit Breakers

Since there is no main power over-current circuit breaker in standard OILCON (EXcept for AKS105-S98), purchase one locally with current rating of 15A and install it.

3-3 Grounding and Power Source Connection

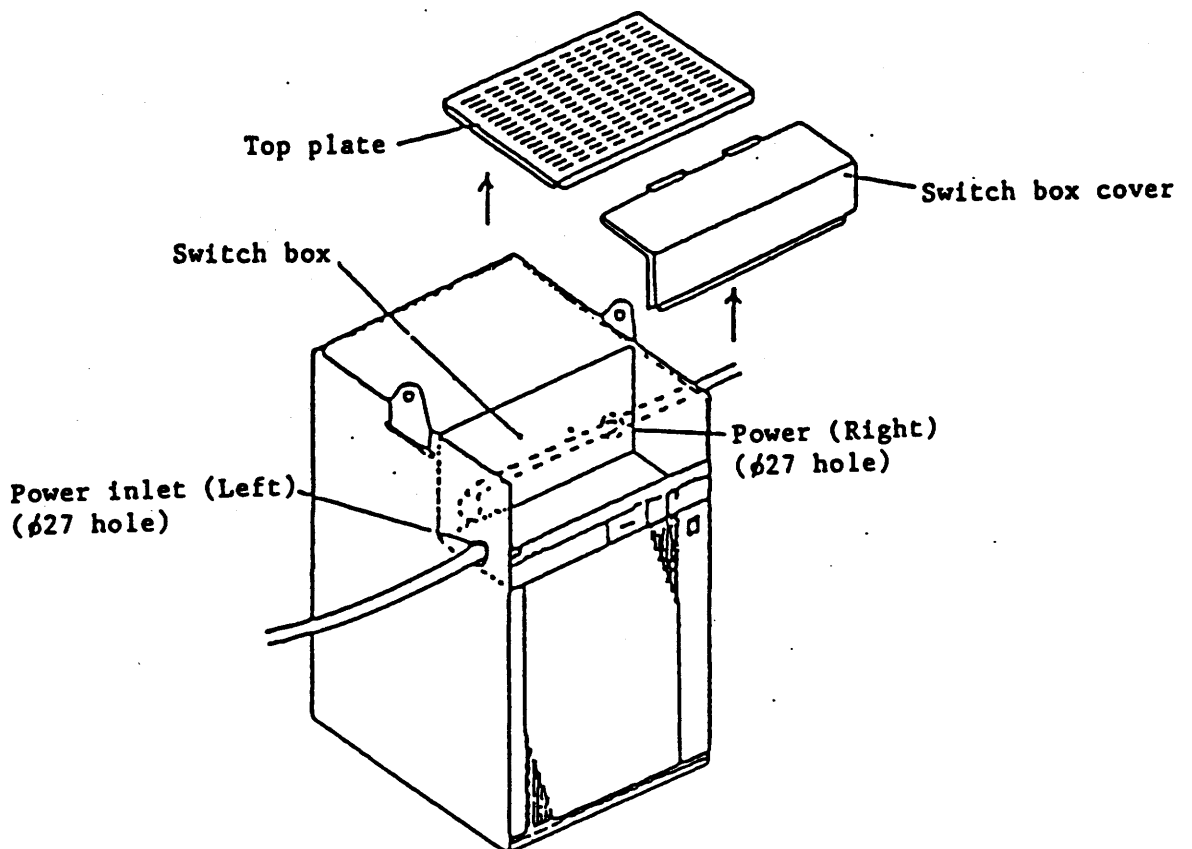
- 1) Remove the switch box cover.
Remove a top cover if right side lead in.
- 2) Pass the power wires and ground wire (600V PVC insulated power wire, 2mm² or more) through the power wiring hole (ϕ 27 mm) in the left or right side panel and into the switch box.
- 3) Connect the ground wire to the ground terminal.



- 4) Connect power source wires R, S and T to the corresponding R, S and T on the terminal strip (TeS).

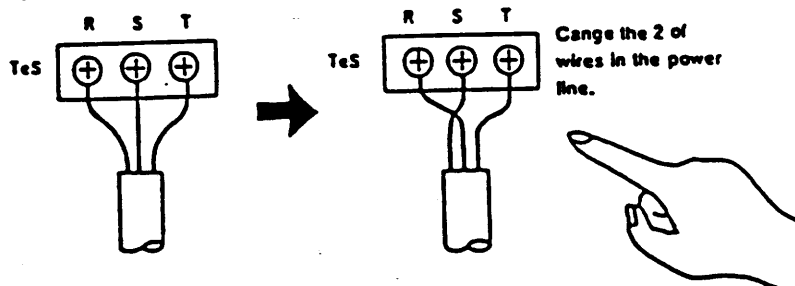
Main Point of Wiring

Wire can be lead in both left and right side. In case of right side lead in type, connect wire through side inlet and power inlet of bottom face of switch box.



Changing wires for opposite phase

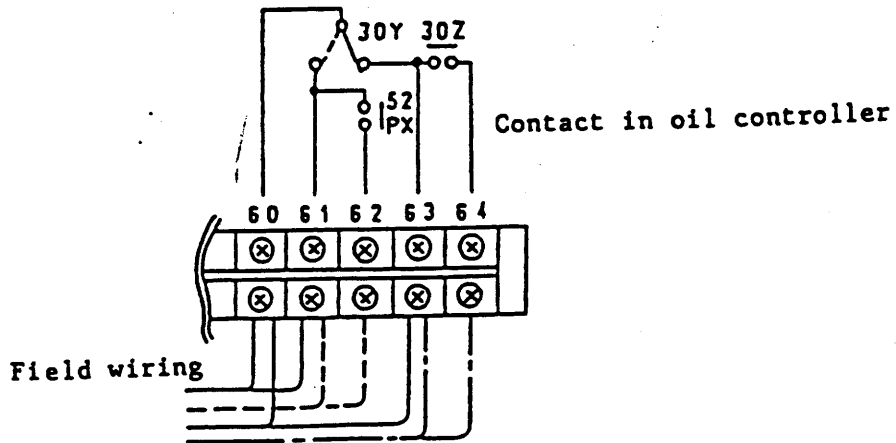
When the power source is connected in the opposite phase. Change the two wires, R and T, as shown in the Fig. below. If in negative phase, an alarm display is made on the control panel by the individual abnormality display function.



3-4 Connection of external output contactor

Motion of external output contactor is shown in the lower drawing, then use contactor terminal regarding to requirement.

Wiring symbol (Belm fig.)	Operation mode Operation switch (BS) Connecting terminals	Stop	Operation	Abnormal (Protection device is actuated.)	Operation	Power failure	Operation
			ON	Reset →	ON		ON
—	Between 60-61	DEF	ON				
—	60-63	ON	DEF				
- - -	61-62	DEF	ON	DEF			
				(Protection device against high oil temperature is actuated.) SIP actuates			
- - - -	63-64	DEF	ON				



3-5 About Remote Operation

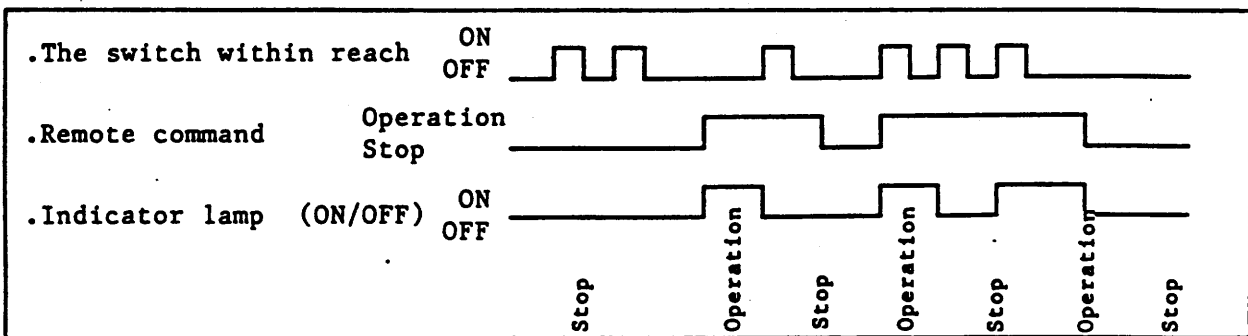
1) About automatic/manual switch

Operation system can be selected by the automatic/manual turn over switch on (SW1 ... Refer to P. 12-11.) on the control board (EC1).

Auto manual turn over switch	Automatic		Manual	
	Operating system	Power source ON/OFF	*1 Remote operation 1	*2 Remote operation 2

*1 In this case, stop/operation can not be executed by the switch within reach.

*2 In this case, operation command becomes remote operation priority. However, when remote command is ON, stop/operation is available by the switch within reach.

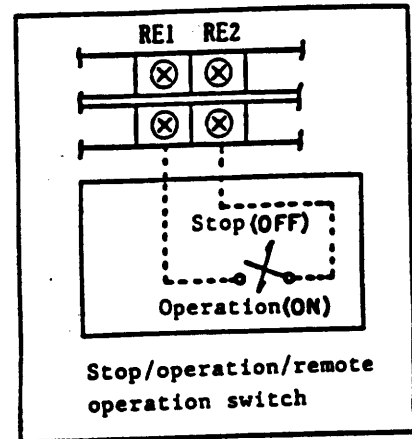
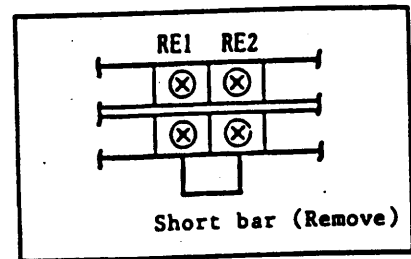


2) Main point of wiring

In case of execution of remote operation, connect wire as follows.
Parts to be prepared.

Parts	Wiring materials
One piece of remote operation switch with monopole and single throw in type or A contactor can be issued an operation command. (Minimum applicable load : less than 10mA (AC250V))	600V insulated wire with vinyl (IV) wire more than 2mm ² (Conduit work)

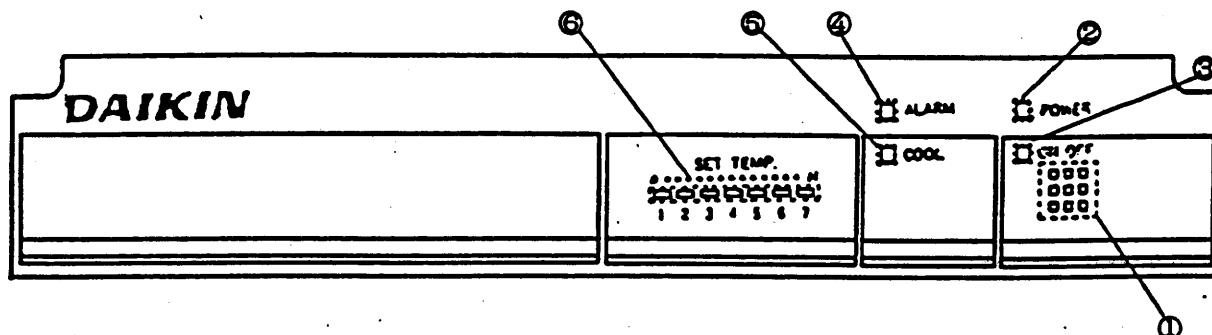
- ① Remove the switch box cover.
In case of right side lead in, remove the top cover.
- ② Remove a short bar (Terminal No. RE1 - RE2) on the terminal in the switch box.
Refer to the equipment arrangement plan in the name plate of electric schematic attached to rear side of front plate for the position of terminal.
(Refer to right sketch)
- ③ Connect a remote operation switch or A contactor can be issued an operation command between terminal RE1 and RE2. (Refer to right fig.)
- ④ Install the top cover and switch box cover.



4. Cautions During Operation

1. Never run without oil in the machine.
(Doing so will cause damage to the oil pump. etc.)
2. Avoid air from being mixed into inside the oil piping system.
(If air is mixed in, causes noise)
3. When viscosity of using oil is high and pressure loss of the outer oil piping of the oilcon is remarkably large, change the piping so that the pressure loss will be reduced.
(For a guide to the piping change, please refer to the referential data (P. 12-18).)
If this unit is used in such a way that exceeds its using limit, it may cause noise or troubles.
Please pay attention to this point.
4. There is a built-in delay timer, and refrigerator may not start again immediately after it has been stopped.
This is normal and does not indicate any problem with the oilcon.
5. The thermostat controller adjusts oil temperature at the oilcon inlet.
6. Install the drain pipe to the oil pan by all means.
Further, do not install a drain pipe to the oil drain since it is for servicing purpose.

5. Names, Functions and Operations of Control Panel



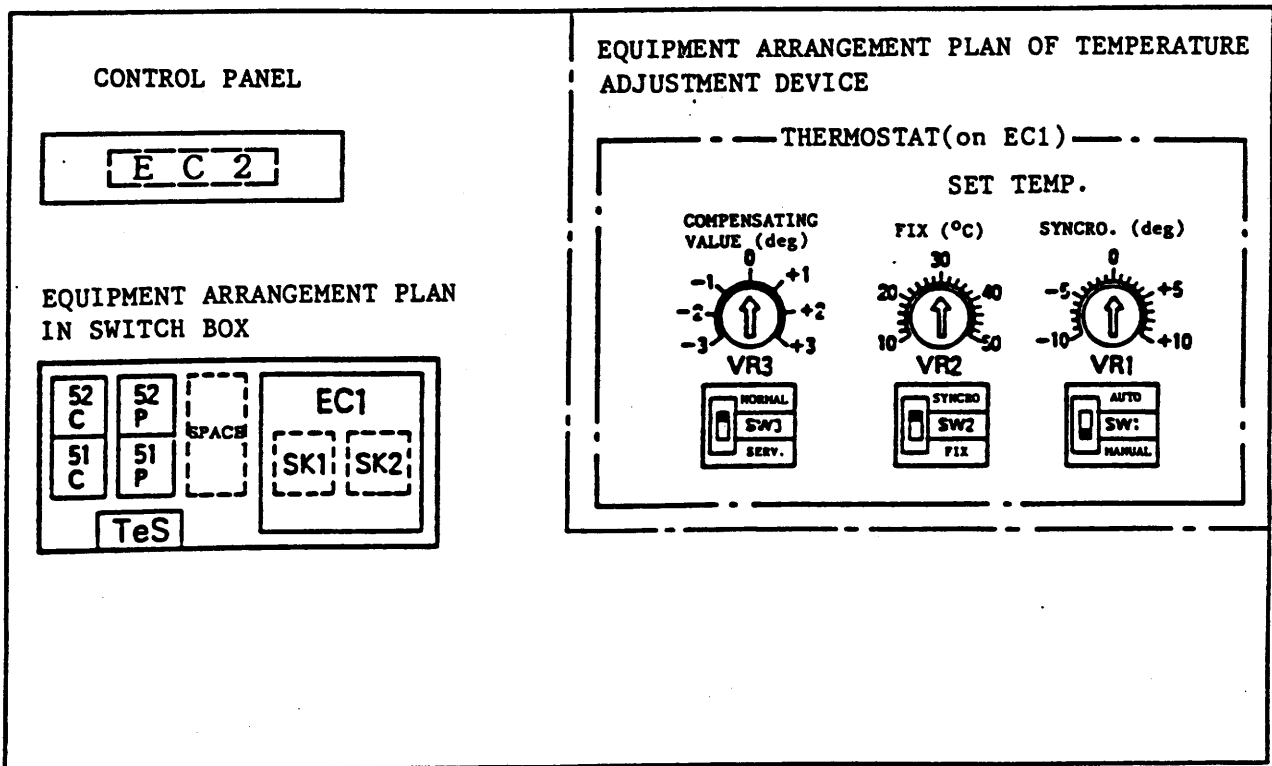
NO.	Name	Functions and actuations
①	Switch at hand (BS)	This is the ON/OFF switch of power supply for operating circuits. Operating manipulation can be made by this switch at hand when remote control command (between ① and ②) is ON. [When set in a factory, the remote control command is shortcircuited (under ON condition)]
②	Indicator lamp (power — white)	When power is supplied, this indicator lamp is lit. At this stage, the OILCON is not yet in operating condition.
③	Indicator lamp (operation — green)	When this indicator lamp is lit, it indicates that the OILCON is in normal operation. At this stage, the pump operates.
④	Indicator lamp (abnormality — red)	This indicator lamp lights up or flickers when an abnormality occurs. At this time, refer to Items of Troubleshooting Guide (P. 12 -14) and check various positions.
⑤	Indicator lamp (Compressor operation — green)	When this indicator lamp is lit, it indicates that the compressor is normal operation. (However, it does not relate to the pump's operation.)
⑥	Indicator lamp (oil temperature — green)	When the unit is under normal condition, this indicator lamp displays oil temperature level at the inlet. (This lamp is lit under normal condition.) If under an abnormal condition, this indicator lamp displays individual abnormality. (This lamp flickers under abnormal condition.) Refer to Items of Troubleshooting Guide (P. 12-14) and check various positions.

■ Setting Procedures of Thermostat

When the control box cover is removed, you will find the control circuit board (EC1) on right side of the front. Set temperature level by operating the SYNCHRO/FIX switch (SW 1) provided on the control circuit board (EC1) and the SET TEMP. volumes (VR 1 and VR 2) according to the following procedure.

ELECTRIC SIGN SETTING	SW2	VR1(deg)	VR2(°C)	*VR3(deg)
Synchronous oil temperature control type	Synchronous side	-10 ~ +10 (at any point)	(indifferent)	-3 ~ +3 (at any point)
Fixed oil temperature control type	Fixed side	(indifferent)	10 ~ 50 (at any point)	-3 ~ +3 (at any point)

* Setting value of the temperature adjusting volume (VR1, VR2) can be adjusted between -3 and +3°C by the temperature adjusting volume (VR3).



6. Maintenance and Inspection

1 Safe Place for Repair Work

This OILCON has been manufactured under strict quality control but if a need for repair (parts replacement, etc.) arises, the following cautions should be observed.

- 1) Turn off the operation switch and turn the normal/service change over switch (SW3) to service side on the control panel in the switch box then power source switch should be turned off.
- 2) If fire going to be used during maintenance, remove the oil controller from the machine and oil in the oil controller should be removed completely.

2 Casing

- 1) Wipe the casing surface with a dry cloth. In any case, do not pour water directly. (when it is wet, there is danger of electricity leakage and fire.)
- 2) Do not use a brush, polishing powder, acid or solvents such as benzene, hot water, etc. because they will damage the paint.

3 Oil Tank and Suction Strainer

- 1) Keep the oil inside the oil tank at the proper level to prevent sucking in of air, etc. Always keep the oil in the tank clean.
- 2) Periodically clean the suction strainer at the suction end of the OILCON oil piping to prevent a reduction in flow caused by clogging of the pump with dirt.

4 Air Filter

- 1) Wash the air filter once every two weeks in water below 40°C. (Not only is air flow reduced and performance lowered if the air filter is clogged with dirt and dust but the device to protect the compressor may be activated and smooth operation will not be possible)
- 2) If operated without the air filter engaged, it may cause troubles.
- 3) Clean the condenser with a brush, air gun, etc. if it is very dirty.

5 For a Prolonged Layoff

- 1) Set a cover over the OILCON to prevent dust or water from getting into the OILCON.
- 2) Turn off the operation switch and main power.
- 3) Be careful that oil dust and dirt do not build up on the surface of the OILCON condenser.

6 In Case of Safety
Device Works

- 1) In case of abnormality (Safety device works), it reset by turn off the power source switch or turn the normal/service change over switch (SW 3) to service side on the control panel in the switch box.
Refer to trouble and remedy (P. 12-14) and remedy of cause should be executed.
- 2) In case of circuit breaker (CB) (The model with CB)
When the CB works, since short circuit is created in the operation circuit, set the handle (gray) to "ON" side after check and remedy it.
- 3) In case of over current relay for fan-pump motors (51P) (51P Manual reset type)
When 51P is activated, press reset button (51P-Green) after cause of trouble is resolved.

7 Pressure Level check

- 1) Use the oil pressure gauge port PT1/8 (plug-in type with hexagonal hole) for checking inlet and outlet pressure levels of the oil controller.

7. Troubleshooting Guide

Check the following if the OILCON does not function properly.

If the OILCON still does not function properly, contact our office and give the following particulars :
(1) model, (2) Production No. (1 and 2 are on the machine nameplate), (3) condition of the machine
(as much detail as possible.)

Item	Condition	Cause	Remedy
1	Power is ON but power indicator (white) does not come on.	① Power indicator lamp is burnt out.	● Replace lamp
		② A fuse for operation circuit is blown.	● Replace a fuse. ● Check and remedy a short circuit section in the operation circuit.
		③ The circuit breaker for operation circuit is OFF. (The machine with circuit breaker)	● Turn ON circuit breaker. ● Check and remedy a short circuit section in the operation circuit.
2	When power source turn on, alarm lamp (red) flickers.	① Power source connects in wrong phase.	● Replace 2 phases out of 3.
3	Pump runs but no oil flow. Low oil circulation, with air suction and loud pump noise.	① Oil piping on suction side is loose.	● Check if the suction piping is tight. Tighten if-not tight.
		② Suction strainer is clogged.	● Clean the suction strainer. ● Change the oil in the oil tank if it is dirty.
		③ Tank oil level is too low.	● Eliminate the cause of the drop in oil level and add oil.
		④ Excessive pressure loss in the oil piping causes relief valve actuation and pump cavitation.	● Use larger diameter pipe and shorten the piping.
4	Pump runs but compressor does not.	① Thermostat functions properly and stops the refrigerator.	● Set the Thermostat to the low temperature side and check if the refrigerator starts. The refrigerator won't start if oil temperature is too low. Wait until oil temperature rises.
		② Thermostat (delay timer 105 ± 15 sec. setting) is activated.	● Reset the timer and check if the refrigerator starts.
		③ Thermostat is damaged.	● It must be replaced.

Item	Condition	Cause	Remedy
5	Compressor worked but the pump and compressor stopped without the power and abnormality display lamp lighting up.	① Power is off.	● Check the main power source.
	Compressor worked but an abnormality signal was output and the abnormality display lamp lit up. (1) An abnormality took place at the thermistor	① The thermistor is broken. ② Wiring of the thermistor is shortcircuited or dislocated.	● The thermistor must be replaced. Carry out wiring connections correctly.
6	(2) Protective device against high oil temperature actuated	③ Oil temperature is abnormally high	● Suspend operation until oil temperature goes down
	(3) Compressor protection thermostat (49C) is actuated.	④ The air filter is clogged.	● Clean the air filter.
		⑤ There are obstacles near the suction/exhaust ports.	● Remove the obstacles.
		⑥ Ambient (room) temperature is too high.	● Use the unit within its range. If there is a heat source, remove it.
	(4) Compressor motor overcurrent relay (51C) is actuated.	⑦ Oil temperature is too high.	● Use at low oil temperature.
	(5) High pressure switch (63C) is actuated.	⑧ Compressor does not run.	● Compressor must be replaced (service).
	(6) Fan and pump motor overcurrent relay (51P) is actuated.	⑨ Oil viscosity is too high.	● Replace with lower viscosity oil.
	⑩ Same as 3-④.	● Same as 3-④	
(7) An abnormality took place at the control circuit board (ECI)	⑪ The control circuit board is out of order.	● The control circuit board must be replaced.	

SET TEMP

1 2 3 4 5 6 7

ALARM

(Abnormality of (51P) is not displayed for AKS105K-N07.)

TROUBLE DIAGNOSIS FUNCTION												
		: LIGHTING			: FLICKER							
ALARM (RED)		1	2	3	5	6	7	6	7	5	6	7
No. OF PILOT (SET TEMP) LIGHTING	—	1	2	3	5	6	7	6	7	5	6	7
FAILURE MODE	POWER SOURCE	Th-A	Th-O	OIL TEMP MGH	49C	51C	63H	51P	EC I			
	Wrong phase											
	Disconnect or short circuit of thermistor for room											
	Disconnect or short circuit of thermistor for oil temp.											
	High oil temp. protecting thermostat works											
	Compressor protecting thermostat 49C works											
	Over current relay for motor of compressor 51C works											
	High pressure switch 63H works											
	Over current relay for fan pump motor 51P works											
	Abnormal condition occurs on control board ECI.											

Item	Condition	Cause	Remedy
7	Pump, compressor and fan run but oil is not cooled.	(1) Same as 6-④ to ⑦	● Same as 6-④ to ⑦.
		(2) Same as 3.	● Same as 3.
		(3) Over-loading	● Eliminate the cause of overloading
		(4) Setting of thermostat is too high.	● Set It properly.
		(5) Lack of refrigerant.	● Recharge (service).

8. Brief Specifications

Item	Model	AKS105K series
Outside dimensions (mm) (height) X (width) X (depth)		790X360X440
Power source		Three phase, 200/220, 220v, 50/60Hz
Refrigerate capacity (50/60Hz) (Kcal/h)		2000/2150
Pump capacity (50/60Hz) (ℓ /min)		24/29
Thermostat controller oil temperature controllable range		Select between the following 2 systems (factory set and temperature difference type controller) Temperature difference type controller (against room temperature, regulatable range : $-10 \sim +10^{\circ}\text{C}$) Fixed type controller (temperature setting range at the inlet : $10 \sim 50^{\circ}\text{C}$)
Connection piping size	Oil inlet	PT 1 (female)
	Oil outlet	PT 1 (female)
	Oil drain (for service)	PT 1/4 (male)
	Oil pan drain	PT 1/2 (female)
Oil viscosity range	(cSt)	4 ~ 300

Reference Data

■ Notice of external piping handling

1) Piping of suction side

Make a suctional vacuum pressure in the range of -230 ~ 0mmHg (About -0.3Kgf/cm²).

The suction filter is recommended about 100 ~ 150 mesh.

2) Piping of exhaust side

Execute the piping of exhaust side as pressure loss less than 3.0Kgf/cm².

3) Do not put the stop valve both of suction and exhaust side.

Unavoidably, if install a stop valve in the exhaust side a relief valve (Setting pressure 3.0Kgf/cm²) should be used at the same time.

4) Calculating method of piping resistance.

A piping size should be determined by calculating the piping resistance by the following formula.

$$\Delta P = 6.07 \times \nu \times Q \times \ell / D^4$$

(In case of General hydraulic oil or lubricant)

ν : Dynamic viscosity coefficient (cSt) - Viscosity/refer to temperatur diagram

Q : Flux (ℓ/min) ℓ : Length of piping (m) D : ID of piping (mm)

.Viscosity of oil varies much in the winter and summer. Consider the piping resistance under the viscosity at winter season.

Item/Season	Winter season (ISOVG32, Oil temperature 5°C)	(ISOVG32, Oil temperature 40°C)
Viscosity (Dynamic viscosity coefficient)	195cSt	29cSt

■ A table of piping size and maximum piping length (With low pressure hose)

(Suction piping)

Unit in (mm)

Model	Size	PT1 (φ25.4)	PT1 1/4 (φ31.8)
	AKS105K	50Hz	2.8
60Hz		2.3	5.5

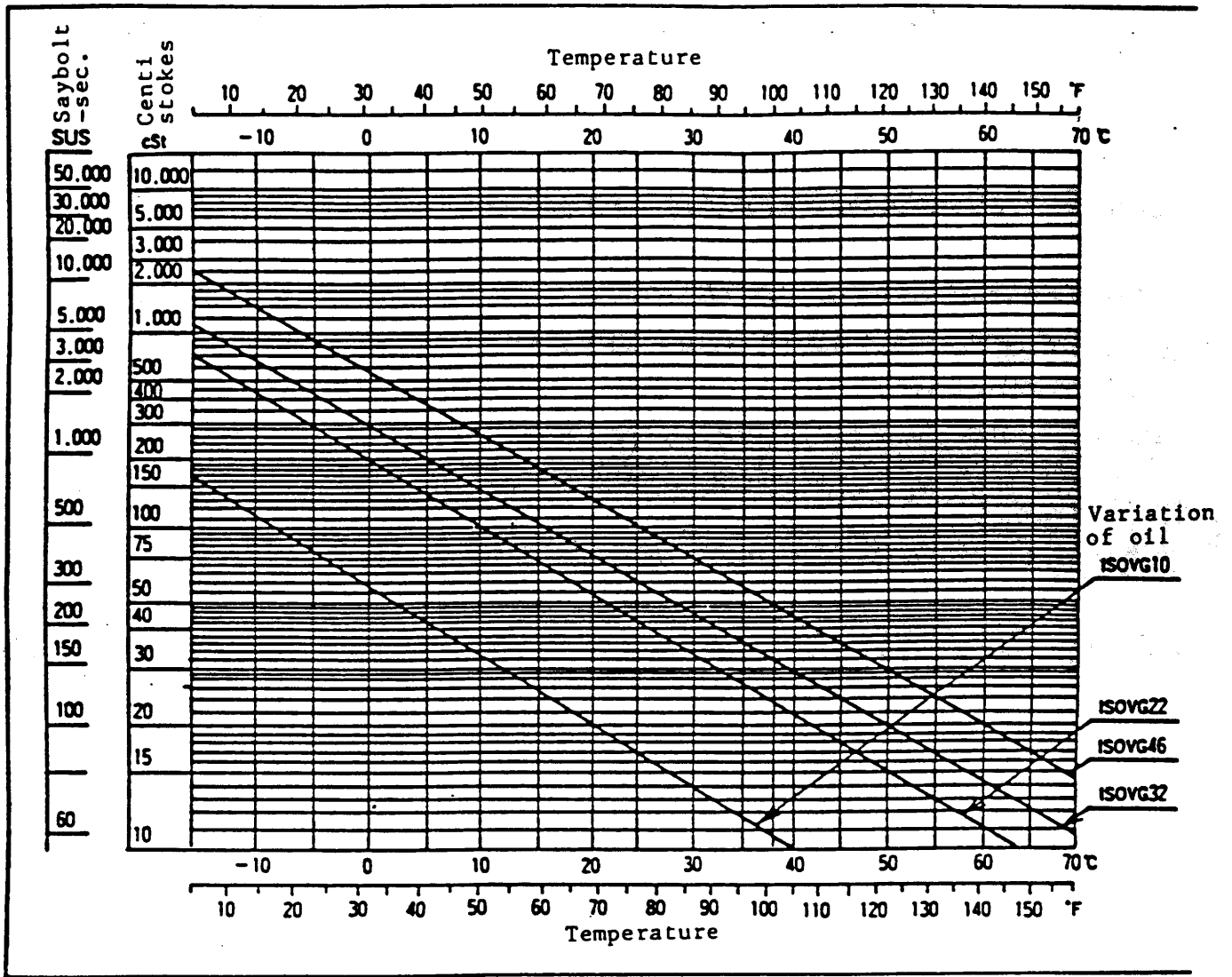
(Exhaust piping)

Unit in (m)

Model	Size	PT1/2 (φ12.7)	PT3/4 (φ19)	PT1 (φ25.4)
	AKS105K	50Hz	1.8	9
60Hz		1.4	7	23

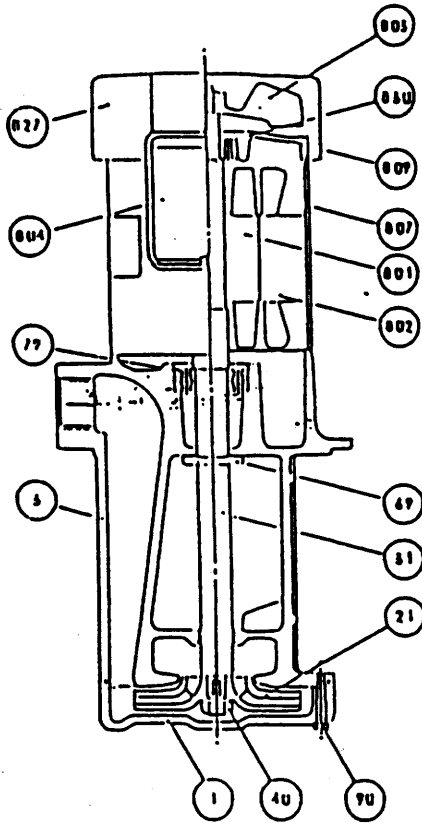
.Condition: ISOVG32 Viscosity 300cSt (Oil temperature 0°C)

Viscosity/Temperature Chart



3. Coolant pump

(1) Flood coolant pump (Standard accessory)

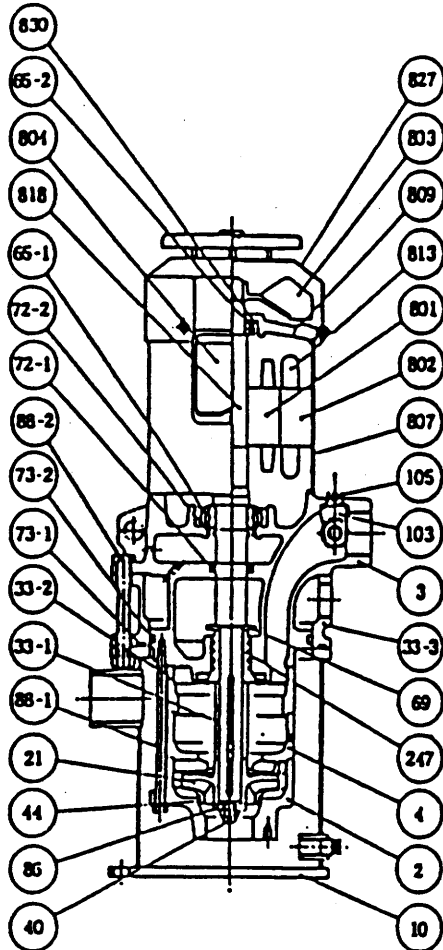


No.	Part name	Q'ty	Materials	
1	Casing	1	FC15	JISG5501
3	Discharge casing	1	FC15	JISG5501
21	Impeller	1	FC20	JISG5501
31	Spindle	1	S45C	JISG4051
40	Impeller nut	1	SS	JISG3101
69	Cutting edge	1	FRM	
79	Stopper	1	SK-5	JISG4401
90	Hexagon bolt	2	SS	JISG3101
801	Rotor	1	Al	
802	Stator	1	S60	JISC2554
803	Cooling fan	1	P.P	JISC2554
804	Terminal box	1	SPCE	JISG3141
807	Motor frame	1	SPPC	JISG3141
809	Upper bracket	1	FC15	JISG5501
827	Fan cover	1	SPPC	JISG3141
830	Wave form washer	1	SK-5	JISG4401

Table of the specifications

Pump model		LSW25AO.4-280		
Pump	Diameter (mm)	25		
	Discharging amount (L/min)	30 ~ 150		
	Total lift of pump (m)	11~3	16~7	
	Using viscosity limit (cSt)	150	75	
	Using liquid filtering accuracy	Middle class accuracy filtering (Max. length of chips possible in the pump: 2.5mm)		
	Quality of material	Impeller, casing, discharge casing FC		
Motor	Phase	3		
	No. of pole	2		
	Output (kW)	0.4		
	Voltage (V)	200	200/220	
	Max. permissible current (A)	1.1	1.2	
	Frequency (Hz)	50	60	
	Synchronous rotation speed (rpm)	3000	3600	
	Class of insulation	E		
	Ambient temperature (°C)	-15~40		
	Temperature rise (deg)	Not more than 75		
	Rating	Continuous		
	Protection method	All closed inner type		
	Bearing	Loading side	6204W	
		Opposite loading side	6203W	
Gross weight (kgf)	18.5			
Painting color	Mancel 7.5B5/7.5			

(2) Jet coolant pump (Option)

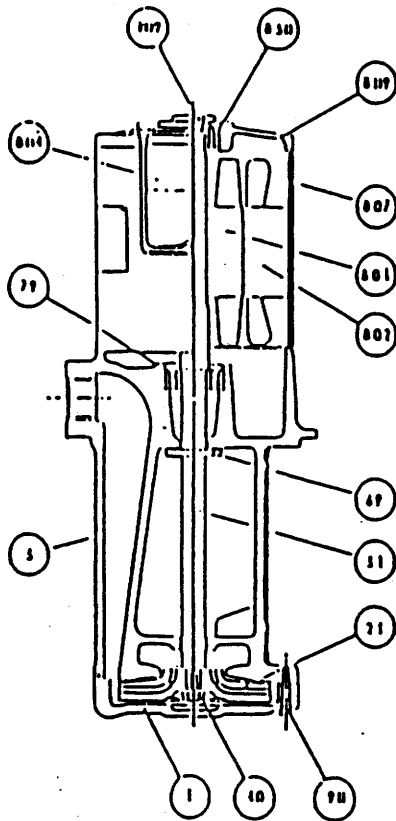


Symbol	Part name	Q'ty	Material
2	Casing	1	FC20 JISG5501
3	Discharge casing	1	FC20 JISG5501
4	Intermediate casing	1	FC20 JISG5501
10	Suction pipe	1	SS41 JISG3101
21	Runner	1	FCD45 JISG5502
33-1	Axial spacer	1	STS JISG3455
33-2	Intermediate spacer	1	FC20 JISG5501
33-3	Sunction spacer	1	FC20 JISG5501
40	Runner nut	1	SUS304 JISG4303
44	Liner ring	1	SUS304 JISG4303
65-1	Ball bearing	1	SUJ2 JISG4805
65-2	Ball bearing	1	SUJ2 JISG4805
69	Cutting edge	1	SS41 JISG3101
72-1	Oil seal	1	NBR
72-2	Oil seal	1	NBR
73-1	O ring	1	NBR
73-2	O ring	1	NBR
86	Washer	1	SUS420J1 JISG4401
88-1	Through bolt	4	SS41 JISG3101
88-2	Through bolt	4	SS41 JISG3101
103	Elbow	1	FOMD JISG5702
105	Plug	1	SS41 JISG3101
247	Labyrinth	1	FC20 JISG501
801	Rotor	1	S40 JISG2554
802	Stator	1	S40 JISG2554
803	Cooling fan	1	P.P
804	Terminal box	1	SPCC JISG3141
807	Motor frame	1	SPCC JISG3141
809	Upper bracket	1	FC15 JISG5501
813	Stator winding	1	Cu
818	Motor shaft	1	S35C JISG4051
827	Fan cover	1	SPCC JISG3141
830	Wavy washer	1	SK-5 JISG4401

Specification

Pump model		LPS401A-0.75	
Pump	Bore diameter (mm)	40	
	Discharge volume (L/min)	80 ~ 250	100 ~ 300
	Total head (m)	10 ~ 5	15 ~ 8
	Limit of applicable viscosity (cSt)	32	
	Filteration accuracy of applied fluid	Medium range filtration (Max. passable chip size in the pump:5mm)	
	Material	Runner, Casing, Discharge casingFC	
	Max. length of suction pipe (cm)	70	
Motor	Phase	3	
	No. of pole	2	
	Output (KW)	0.75	
	Voltage (V)	200	200/220
	Max. permissible current (A)	3.5	3.3/3.2
	Frequency (Hz)	50	60
	Synchronous speed (min)	3000	3600
	Insulation class	E	
	Peripheral temperature (°C)	Less than 40	
	Temperature rise (deg)	Less than 75	
	Rating	Continuous	
	Protection system	Totally closed external fan	
	Bearing	Load side	6306ZZ
Opposite side of load		6204ZZ	
Rough weight (Kgf)	40		
Painted color	Mancel 7.5BG5/1.5		

(3) Gun coolant pump (Option)

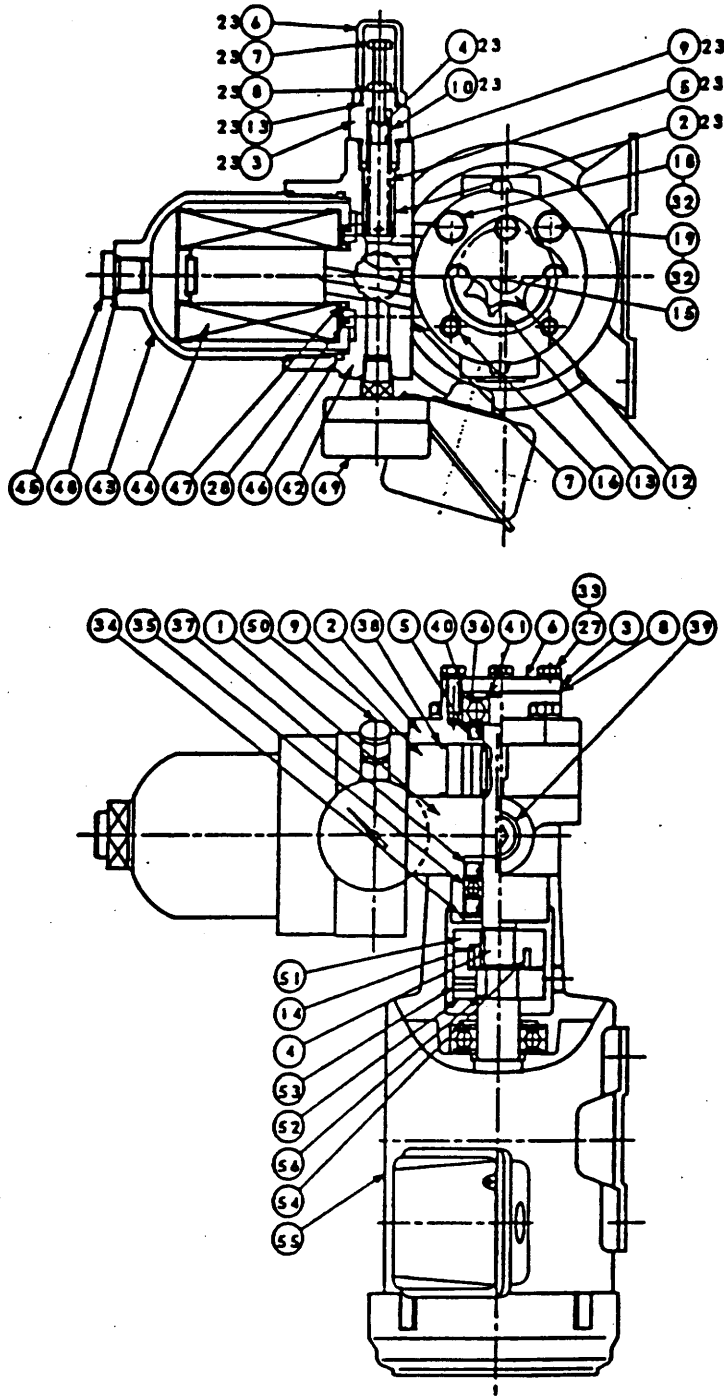


No.	Part name	Q'ty	Materials	
1	Casing	1	FC15	JISG5501
3	Discharge casing	1	FC15	JISG5501
21	Impeller	1	FC20	JISG5501
31	Spindle	1	S45C	JISG4051
40	Impeller nuc	1	SS	JISG3101
69	Cutting edge	1	FRM	
79	Stopper	1	SK-5	JISG4401
90	Hexagon bolt	2	SS	JISG3101
109	Cap	1	FRM	
801	Roter	1	Al	
802	Stator	1	S60	JISC2554
804	Terminal box	1	SPCE	JISG3141
807	Motor frame	1	SPCC	JISG3141
809	Upper bracket	1	FC15	JISG5501
830	Wave form washer	1	SK-5	JISG4401

Table of the specifications

Pump model		LSW15AO.18-250		
Pump	Diameter (mm)	15		
	Discharging amount (L/min)	10~60		
	Total lift of pump (m)	9~5	13~8	
	Using viscosity limit (cSt)	150	75	
	Using liquid filtering accuracy	Middle class accuracy filtering (Max. length of chips possible in the pump: 2.5mm)		
	Quality of material	Impeller, casing, discharge casing FC		
Motor	Phase	3		
	No. of pole	2		
	Output (kW)	0.18		
	Voltage(V)	200	200/220	
	Max. permissible current (A)	1.1	1.2	
	Frequency (Hz)	50	60	
	Synchronous rotation speed (rpm)	3000	3600	
	Class of insulation	E		
	Ambient temperature (°C)	-15~40		
	Temperature rise (deg)	Not more than 75		
	Rating	Continous		
	Protection method	All closed inner type		
	Bearing	Loading side	6203W	
		Opposite loading side	6202W	
Gross weight (kgf)	14			
Painting color	Mancel 7.5B5/7.5			

(4) Oil hole coolant pump
(Option)



Symbol	Part name	Material	Q'ty	Remarks
1	Pump body	FC250	1	
2	Bearing housing	FC250	1	
3	Top cover	ADC5	1	
4	Shaft	SCM415H	1	
5	Oil-seal	NBR	1	SC15327
6	Name plate	ALP1	1	
7	Packing	FIBBER	1	
8	Top cover packing	FIBBER	1	
9	Barrel	FC250	1	
12	Inner rotor	SCM415H	1	
13	Outer rotor	FC250	1	
14	Shaft key	S55C	1	
15	Inner key	SK4	1	
16	Pipe knock	S45C	2	
18	Clamping bolt for barrel	S45C	2	M8
19	Set bolt	S45C	2	M8
23-2	Valve plunger	S45C	1	
23-3	Spring bearing nut	S20C	1	
23-4	Spring bearing washer	S20C	1	
23-5	Relief spring	SWP-A	1	
23-6	Valve cup	ADC5	1	
23-7	Pressure adjust bolt	SS400	1	
23-8	Hexagon bolt	SS400	1	
23-9	O-ring	NBR	1	P18
23-10	O-ring	NBR	1	P10A
23-13	Valve packing	FIBBER1	1	
27	Set bolt for top cover	S45C	4	M6
28	Set bolt for relief	SCM435	4	M6
32	Spring washer	SWRH	4	M8
33	Spring washer	SWRH	4	M6
34	Snap ring	SUP	1	M35
35	Ball bearing		1	6202ZZ
36	Ball bearing		1	6301ZZ
37	Oil seal	NBR	2	SC15357
38	O-ring	NBR	2	S50
39	Plug	SCM435	1	
40	43 ring	SWP-A	1	
41	Snap ring	SUP	1	S12
42	Sub-plate	AC-4C	1	
43	Element case		1	
44	Element		1	
45	Plug		1	
46	O-ring	NBR	1	G75
47	O-ring	NBR	1	P25
48	O-ring	NBR	1	P14
49	Pressure gauge		1	
50	Air bleeder plug		1	
51	Coupling	ADC	1	
52	Coupling	ADC	1	
53	Set screw	SCM435	1	
54	Cushon rubber	NUBER	1	
55	Motor		1	
56	Motor shaft-key	S45C	1	

Model:
TOP-2NY400-208HWMCP-VBE-5K-10

Filter intergrated type 2nd trochoid pump

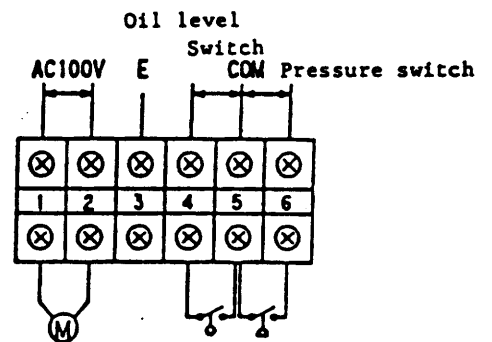
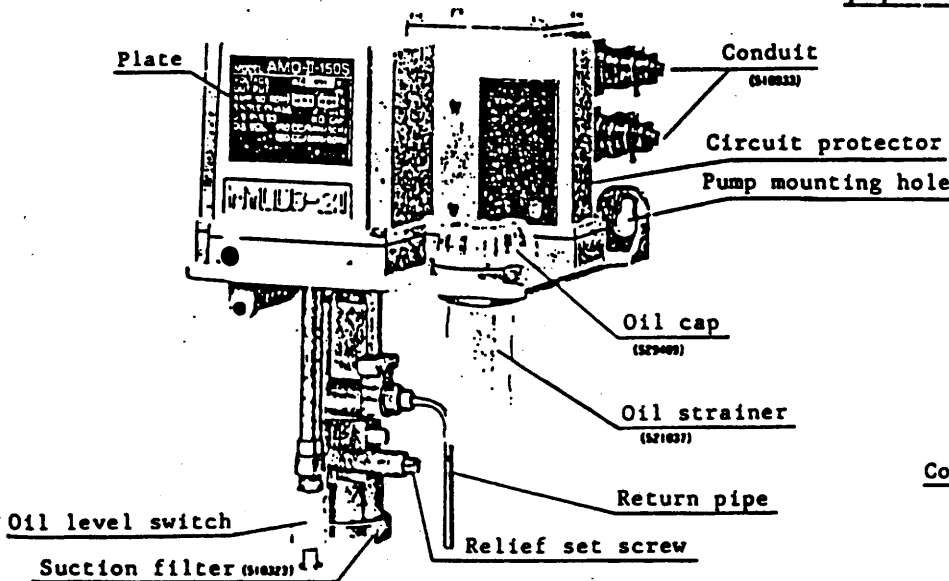
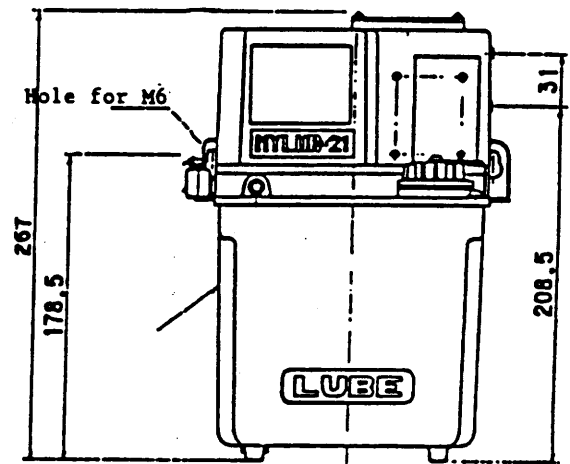
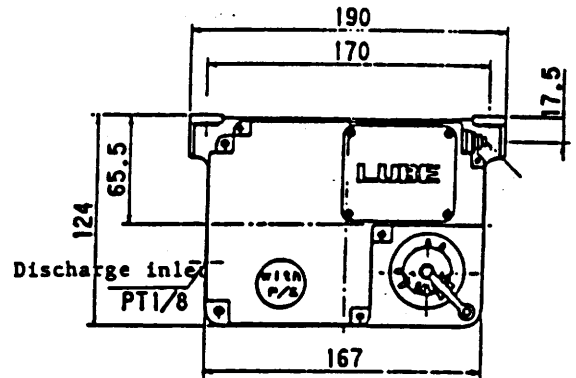
Specification table

Model of pump		TOP-208HWMCP-VBE5K-10		
Pump	Caliber(Inch)	IN PF1/2 OUT PF1/2		
	Discharge (ℓ/min) amount	1500min ⁻¹ /12.0ℓ/min 1800min ⁻¹ /14.41ℓ/min		
	Rated pressure (Kgf/cm ²)	1500min ⁻¹ /10.0Kgf/cm ² 1800min ⁻¹ /8.0Kgf/cm ²		
	Specification fluid	Water soluble coolant fluid Washing fluid (Alkaleacent)		
	Suction filter	100 mesh		
	Material	Inner rotor SMC415H Outer rotor FC250 Body FC250		
Motor	Phase	φ3		
	Pole number	4P		
	Output (Kw)	0.4		
	Voltage (V)	220V	200	220
	Max. permissible(A) current	2.2A	1.93	1.91
	Frequency (Hz)	50Hz	60	60
	Synchronous No. of rotation (min ⁻¹)	1420	1700	1720
	Insulation class	E class		
	Ambient temperature (°C)	40°C		
	Rating	Continuous		
Protection method	Totally enclosed outer fan interior type			
Rough weight (Kgf)	10Kg			
Painted color	Mansel 2.5PG5/2			

4. Lubrication Pump

AMO-II-150S Model pump

Model	AMO-150SA-18LP-P
Code No.	202562
Motor	AC100V 20W 50/60Hz 0.83/0.64 A (50/60Hz)
Discharge volume	150cc/min 50Hz 180cc/min 60Hz
Discharge pressure	12Kgf/cm ² (Relief setting pressure)
Range of applicable viscosity	68 - 1800cSt
Range of applicable temperature	-5°C - +40°C
Oil level switch	Applicable Max. voltage : AC, DC200V Contactor type : A (ON at lower limit) Contactor capacity : 30W or 0.5A (Resistance load) Whichever smaller one.
Pressure switch	Capacity : AC120/240V-125VA AC, DC28V-2A Model : A Operating pressure : 11Kgf/cm ² ON Resumed pressure : 6Kgf/cm ² OFF
Tank	Full capacity : 1.8 L Effective capacity : 1.5L (H-O/L)



Connecting diagram of terminal

- Note
1. Lubricant should be used recommended clean one.
 2. A suction filter should be replace or clean once a year or more.
 3. Avoid a use of this pump in the atmosphere with high produce of corrosive gas, dust, lmmidity (Within 35 ~ 85%HR).

5. Pneumatic Devices.

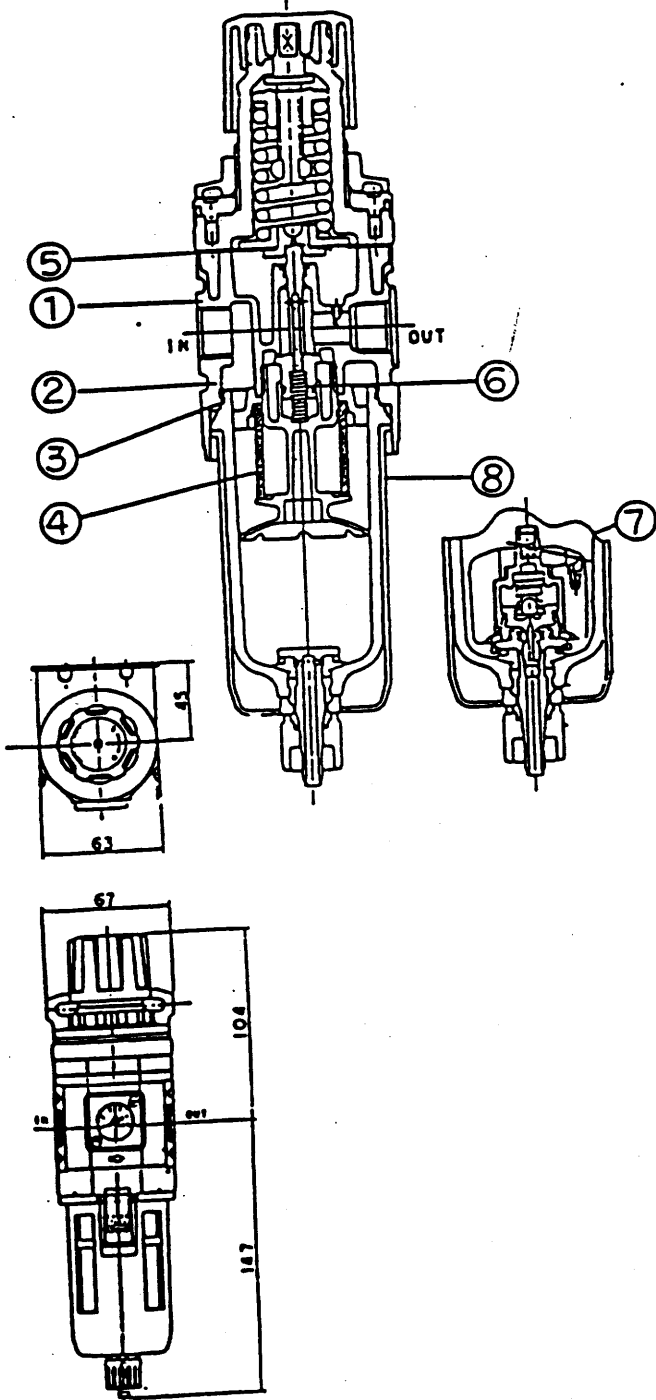
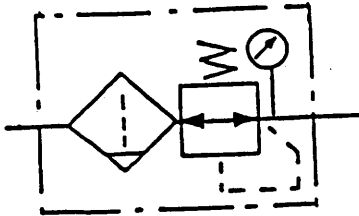
Air filter/regulator unit

Outline and features

SELEX FR unit (W3000) is a unit type combined with a filter F3000 which has high eliminating effect of drip and dust and a regulator R3000 which has accurate and steady pressure setting capability.

It is the most suitable at narrow space.

JIS symbol



No.	Part name	Material	Part No.
1	Plate cover	ABS	
2	Body	ADC	
3	O-ring	SP. NBR	F4-550349
4	Element	PP	F4-550350
5	Diaphragm assembly	ZDC.NBR	F4-550464
6	Valve assembly	C3604.NBR	F4-550477
7	Bowl assembly	PC.POM.PUR	F4-550478
8	Bowl guard	PA	F3-550425

Precaution of use

- .Keep away from direct sunlight.
- .Avoid use of chemicals and in the atmosphere such as thinner, carbon tetrachloride, alcohol, chloroform, ethylene trichloride, ester acetate, sulfuric acid or lye, because material of bowl is poly carbonate.
- .To clean a bowl element, use a neutral detergent for household then rinse it by fresh water.
- .Use a pipe with 6mm or more for inside diameter and less than 5m of length and avoid rise up piping.
- .Do not handle with adjusting knob to transfer the commodity or swing around.

Principle of the movements of the automatic drain with manual discharger
(W3000-8-F)

When no pressure acts upon the inside of the bowl, the valve ⑫ is forced up by the spring ⑩ to be in the state detached from the stem packing ⑤.

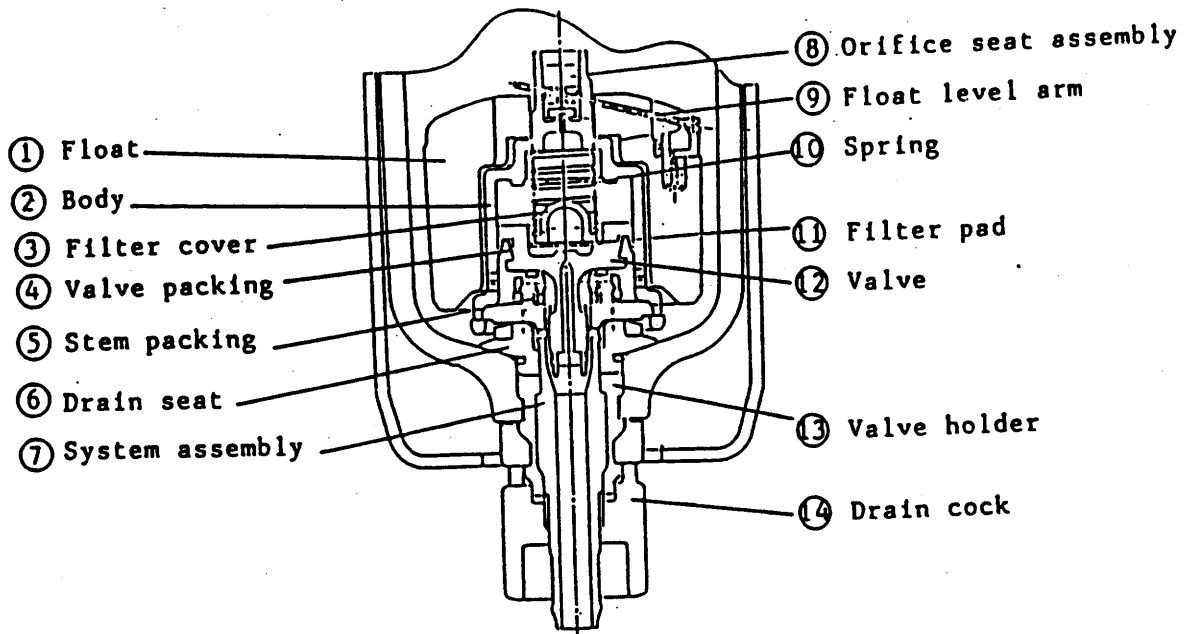
If more than 1 Kg/cm² of pressure acts upon the inside of the bowl, the receiving pressure of the valve ⑫ becomes larger than the force of the spring ⑩, and the valve ⑫ is forced up and sealed with the stem packing ⑤. Next, when drain is accumulated in the bowl, the float ① is elevated and the Orifice seat assembly ⑧ is opened by the float level arm ⑨. Then, pressed air is guided into the upper chamber of the valve ⑫, and the valve becomes pressurized state. And the valve ⑫ is forced down, and when it parts from the stem packing ⑤, drain is discharged into the atmosphere through following the arrow mark.

When drain is discharged, the float ① is lowered and the Orifice seat assembly ⑧ is closed by the float level arm ⑨.

Then, pressurized air is discharged into the atmosphere through the Orifice of the valve ⑫.

Whereupon, the receiving pressure of the valve ⑫ from the lower part exceeds the force of the spring ⑩ and the valve ⑫ is lifted up and sealed with the stem packing ⑤. As a manual discharging device is built in this model of machine, it can be used as a manual drain.

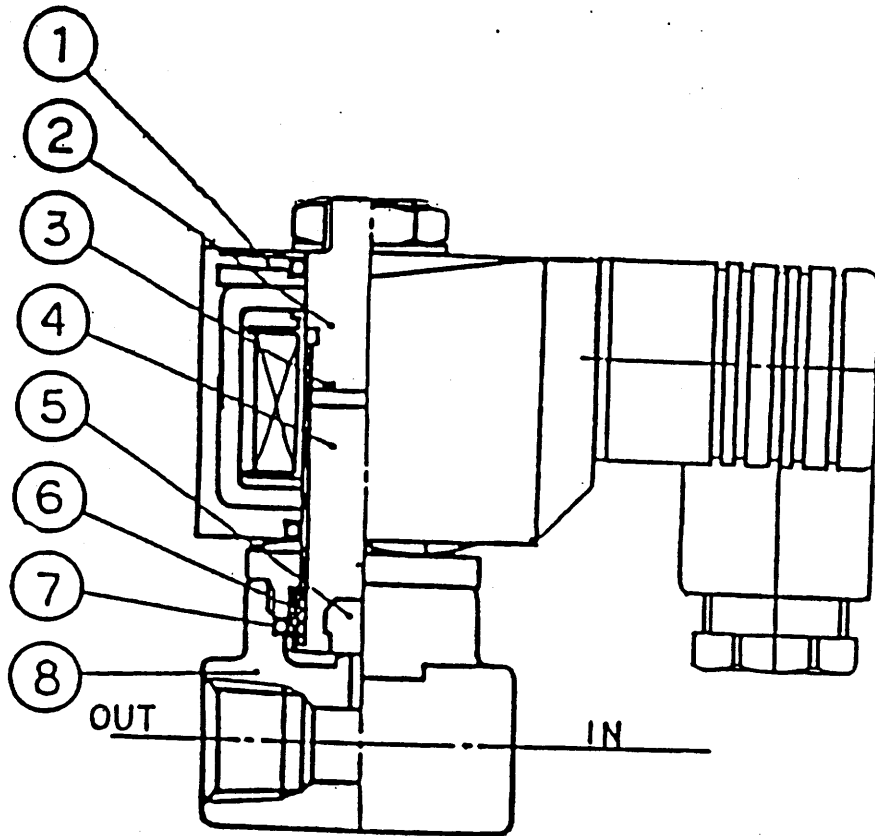
The tube connected to the drain line shall be of ID ϕ 6mm and within 5mm long.



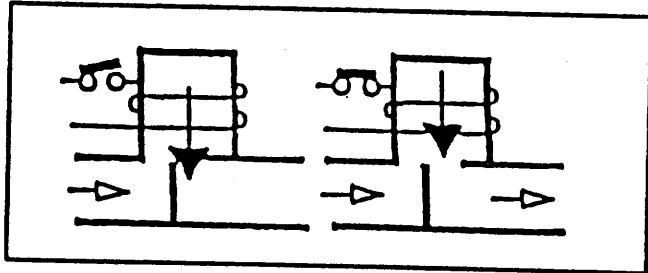
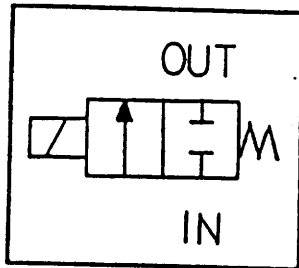
When the phenomena such as the below occur, replace it with a new parts (Bowl assemble F4-550178).

- a. Drain is not discharged automatically.
- b. Air is leaking ceaselessly from the drain port.

AB41-02-5-02G-AC100V



JIS symbol



No.	Part name	Material
①	Coil	Resin
②	Core assembly	SUS405, 316L, 403
③	Shudding coil	Cu
④	Plunger	SUS405
⑤	Seal	NBR
⑥	Spring	SUS304
⑦	O-ring	NBR
⑧	Body	C3771

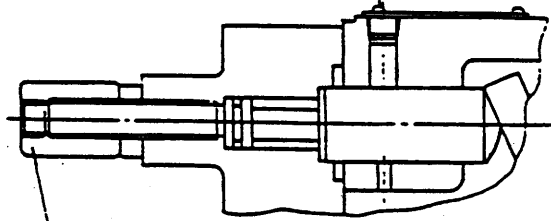
Chapter 11 REFERENCE DATA <VK II >

1. Hydraulic Tank

1.1 Construction

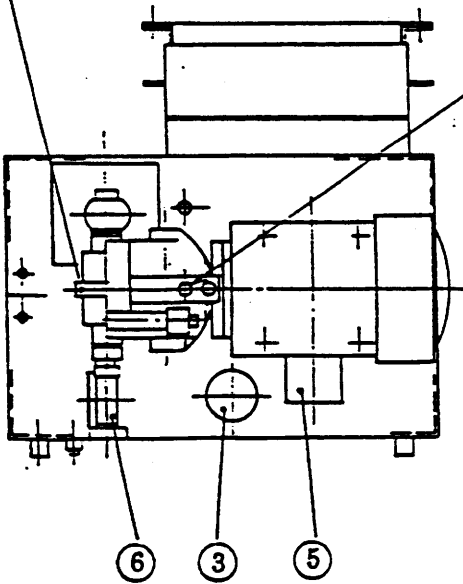
Details of Discharge Rate Control Shaft

No.	Part	Type	Q'ty
1	Oil tank	40ℓ	1
2	Oil gauge	KLA-80A	1
3	Oil inlet port-cum-breather	PA-35	1
4	Suction strainer	DHA-06-150	1
5	Motor pump	M15A1X-2-50	1
6	Pressure gauge	SPA1/4V φ 60 16/cm ² 49-51 green	1
7	Relief valve	SR-T03-1-10	1
8	Check valve	HDIN-T03-05	1



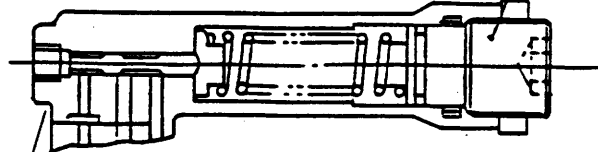
A discharge rate is decreased/increased by turning the adjusting screw to the right/left.

Prior to test run, remove the plug and supply working oil.



Discharge Pressure Adjusting Screw

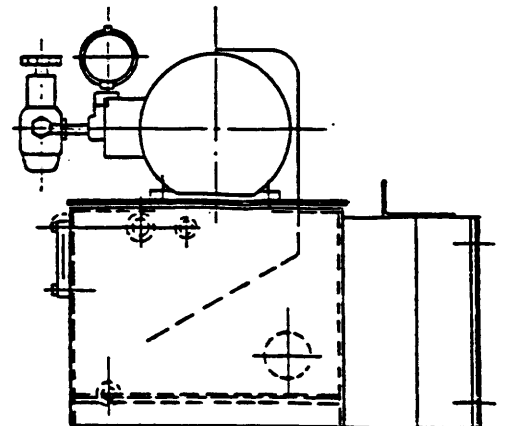
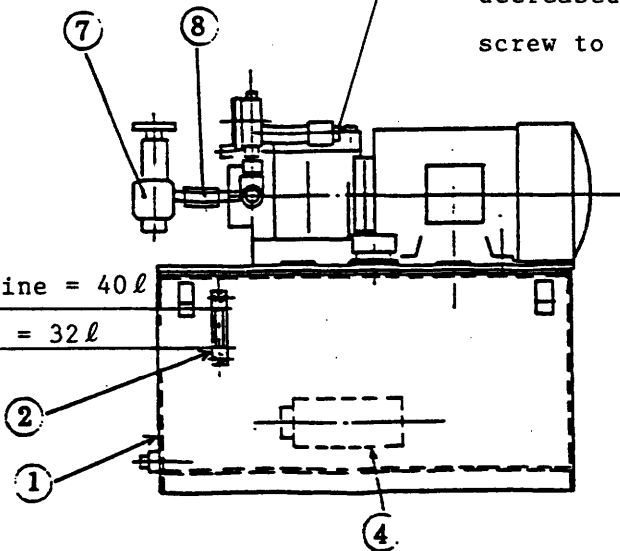
Details of Pressure Control Shaft



A discharge pressure is increased/decreased by turning the adjusting screw to the right/left.

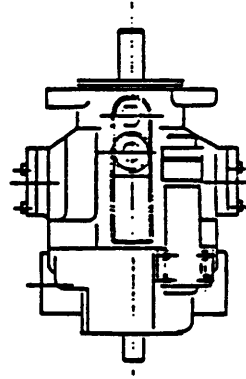
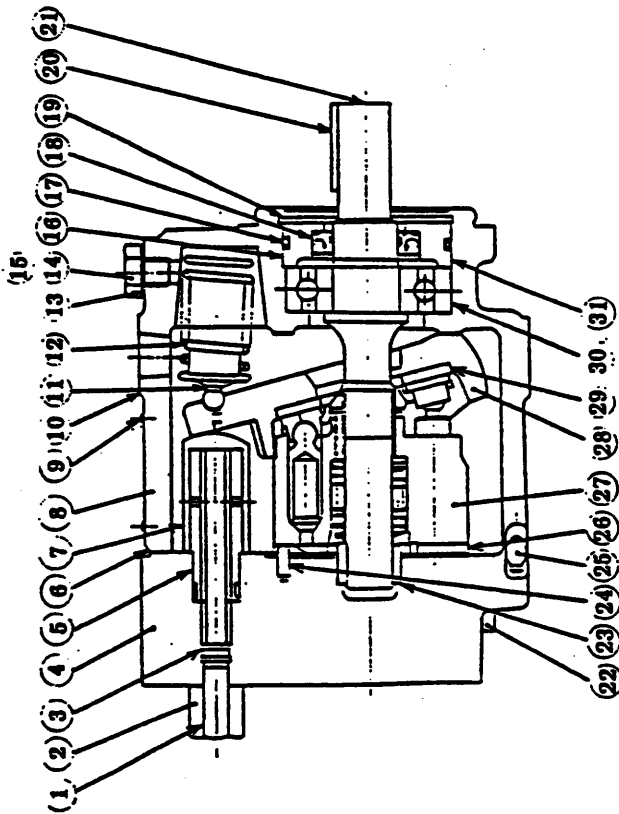
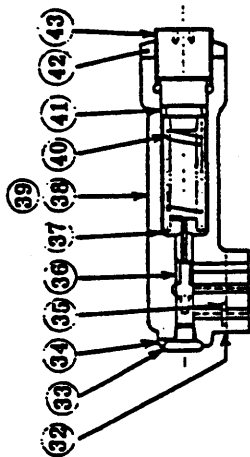
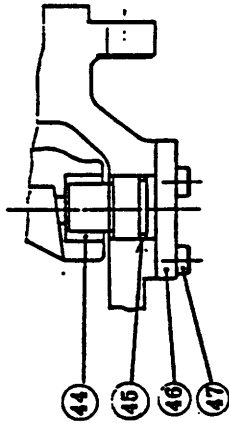
Yellow Line = 40ℓ

Red Line = 32ℓ



1.2 Piston Pump V15A

No.	Name	Q'ty	No.	Name	Q'ty	No.	Name	Q'ty
1	Discharge rate adjusting screw	1	21	Shaft	1	41	O-ring	1
2	Cap	1	22	Hexagon socket head bolt	4	42	Lock nut	1
3	O-ring	1	23	Bearing (needle)	1	43	Pressure adjusting screw	1
4	End cap	1	24	Pin	2	44	Journal bearing	2
5	Cylinder rod	1	25	Pin	1	45	O-ring	2
6	Gasket	1	26	Plate (valve)	1	46	Trunion	2
7	Control cylinder	1	27	Cylinder block kit	1	47	Hexagon socket head bolt	6
8	Hex plate	1	28	Seash plates	1			
9	Hex plate mounting	2	29	Plate (thrust)	2			
10	Housing	1	30	Bearing (ball)	1			
11	Spring holder	1	31	C-type retainer ring (for shaft)	1	No.	Size	Q'ty
12	Tube spring	1	32	Gasket	1	3	JISB2401 one kind A 1/8	1
13	Seal washer	1	33	Plug	1	17	JISB2401 one kind A G55	1
14	Plug	1	34	O-ring	1	34	AMI 5509-303 3/8-24	1
15	Fasting non plate	1	35	O-ring	1	35	JIS B2407 one kind B FG	1
16	Seal holder	1	36	Spool	1	41	JIS B2407 one kind B P14	1
17	O-ring	1	37	Spring holder	1	45	JIS B2407 one kind A P18	2
18	Oil seal	1	38	Valve body	1		Oil seal	
19	C-type retainer ring (for hole)	1	39	Hexagon socket head bolt	4	4	TOT type 2/4x08	1
20	Key	1	40	Spring	1			



Theoretical discharge rate 14.8cc/rev.

Maximum pressure 210kgf/cm²

Rated pressure 140kgf/cm²

Rotation frequency range 500~1800r.p.m

Allowable degree of vacuum -125mmHg

Applicable filter Return line 25μ

Suction line 150 meshes

Hydraulic oil ISO VG32, 46, 56 or equivalent

Oil temperature 0~60°C

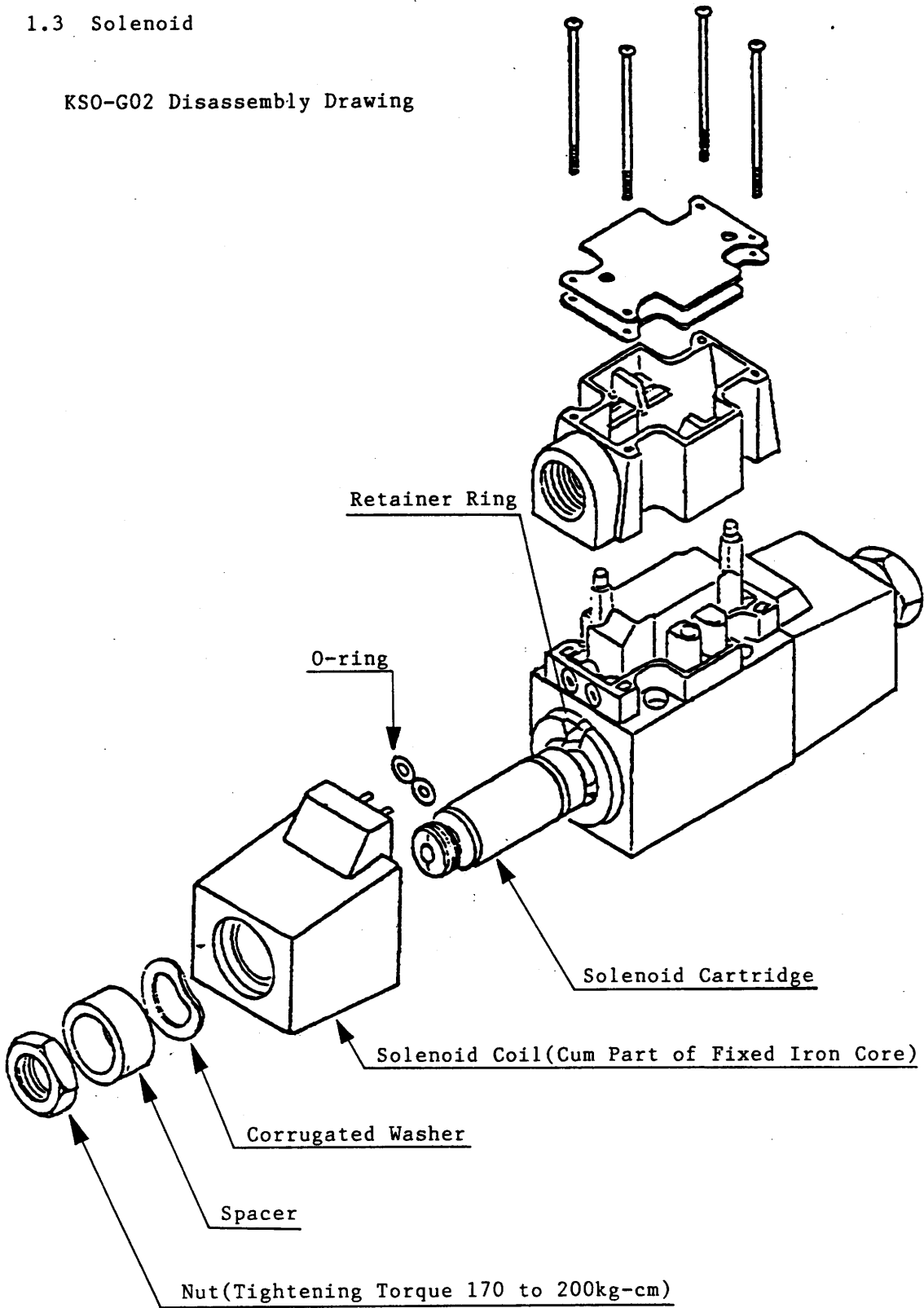
Weight kg

Case internal pressure Normal 0.35kgf/cm² or less

Maximum 0.7kgf/cm² or less

1.3 Solenoid

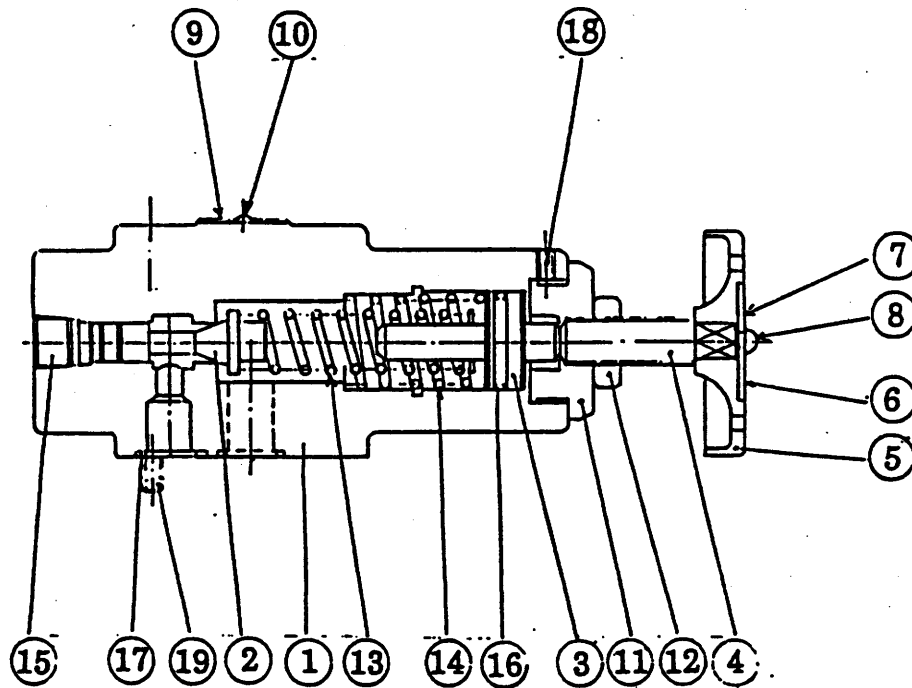
KSO-G02 Disassembly Drawing



1.3.1 Models List

Model No.	JIS Symbol	Power Source	Pressure vs. Flow Rate Characteristic (Refer to Graph)			Pressure Drop (Refer to Graph)		
						P-A P-B	A-T B-T	P-T
K50-G02-2C		AC	A	b	b	4	2	-
		DC	A	a	a			
-3C		AC	D	D	D	4	1	5
		DC	D	D	D			
-4C		AC	B	d	d	5	2	-
		DC	C	e	c			
-44C		AC	G	d	d	5	2	-
		DC	H	e	c			
-5C		AC	E	f	f	6	8	7
		DC	F	f	f			
-66C		AC	E	f	f	6	8	7
		DC	F	f	f			
-7C		AC	A	e	e	4	3	-
		DC	A	e	e			
-8C		AC	B	d	d	5	2	-
		DC	C	c	c			
-9C		AC	K	e	b	4	2	-
		DC	K	e	a			
-51C *		AC	E	f	f	6	8	7
		DC	F	f	f			
-81C *		AC	B	d	d	5	2	-
		DC	C	c	c			
-91C *		AC	A	b	e	4	3	-
		DC	A	a	e			
-2A *		AC	L	h	e	4	6	-
		DC	K	g	e			
-2B		AC	L	e	h	4	6	-
		DC	K	e	g			
-3A *		AC	N	m	L	4	2	-
		DC	D	L	L			
-3B		AC	N	L	m	4	2	-
		DC	D	L	L			
-2N		AC	A	l	l	3	4	-
		DC	J	k	k			
-20N		AC	-	l	l	3	-	-
		DC	-	k	k			
-2D		AC	M	j	j	3	4	-
		DC	I	i	i			
-20D		AC	-	j	j	3	-	-
		DC	-	i	i			
-20A *		AC	-	h	e	4	-	-
		DC	-	g	e			
-20B		AC	-	e	h	4	-	-
		DC	-	e	g			
-2A-H2 *		AC	A	b	-	4	2	-
		DC	A	a	-			
-2B-2T *		AC	A	-	b	4	2	-
		DC	A	-	a			
-3A-H3 *		AC	D	D	-	4	1	5
		DC	D	D	-			
-3B-3T *		AC	D	-	D	4	1	5
		DC	D	-	D			
-81A-H4 *		AC	B	d	-	5	2	-
		DC	C	c	-			
-8B-4T *		AC	B	-	d	5	2	-
		DC	C	-	c			
-81A-H44 *		AC	G	d	-	5	2	-
		DC	H	e	-			
-8B-44T *		AC	G	-	d	5	2	-
		DC	H	-	c			

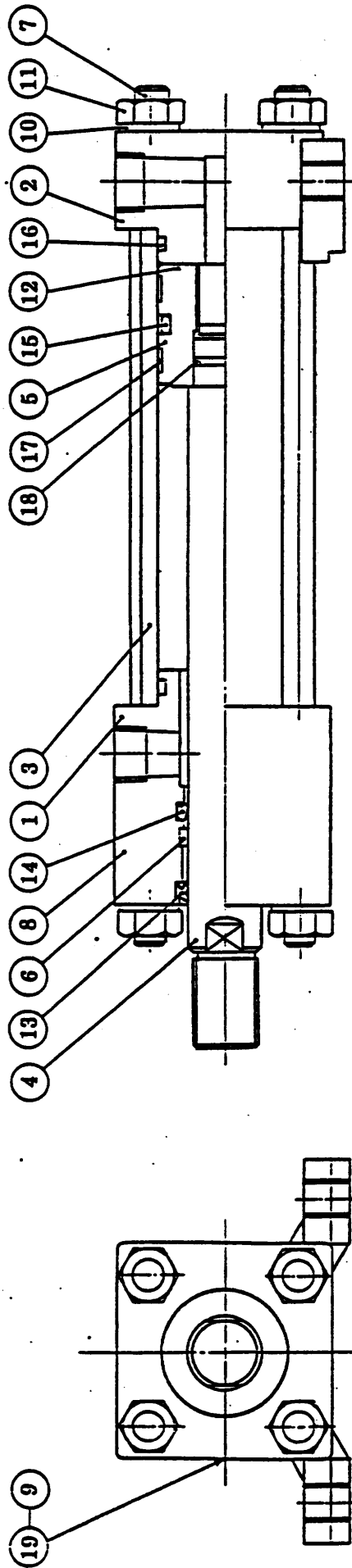
1.4 Relief Valve(SR G03-1-11)



DPF NO.	PARTS NAME	MODEL		DRWG No & SPECIFICATION			REMARKS
		QTY		SRG3			
1	Body						
2	Piston						
3	Plunger						
4	Adjusting screw						
5	Knob						
6	Notice plate						
7	Plain washer						
8	Machine screw						
9	Drive screw						
10	Name plate						
11	Retainer						
12	Hexagon nut						
13	Spring	SWP-B	1843142				
14	Spring	SWP-B	1843143				
15	Taper plug	SCM-3	1/4T				
16	"O" ring	NBR	1A P22				JISB2401
17	"O" ring	NBR	1A P15				JISB2401
18	Set screw						
19	Socket head bolt	SCM3	M6× 65				JISB1176

1.5 Balance Cylinder(For Spindle Head)

1. Structural drawing



2. Specifications

- Type : LA40B35N710
- Cylinder bore : ϕ 40mm
- Stroke : 710mm
- Rod diameter : ϕ 22.4mm
- Rated pressure : 35 kgf/cm²
- Test pressure : 70 kgf/cm²
- Cushion : None

Remarks 1. Hard chrome plating 2/100 used for the A-marked part
 2. Lock nut M16 x 1.5, Class-3, 2 pieces

3. Parts List

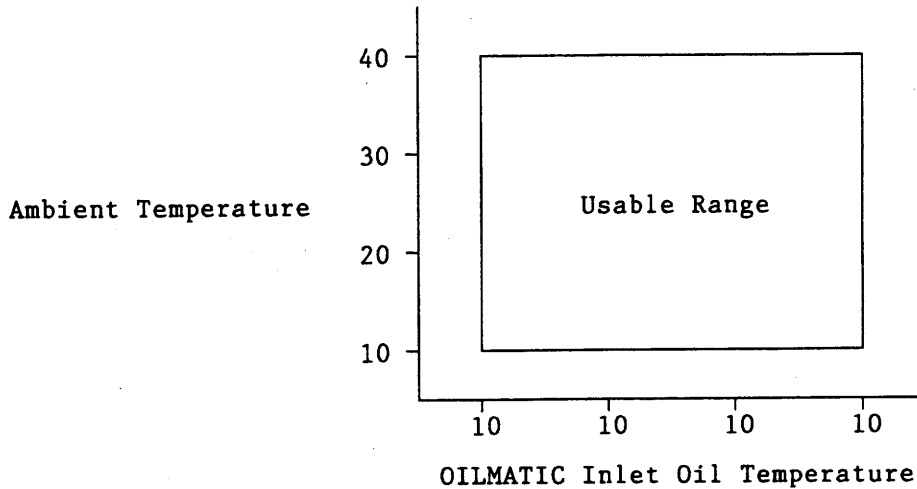
19	Cap gasket	NBR	2	P.8
18	Piston gasket	NBR	1	P.14
17	Piston wear ring	Phenol resin	2	SWA-40
16	Tube gasket	Phenol resin	2	G.35
15	Piston packing	Teflon NBR	1	(ST-40)
14	Rod packing	NBR	1	SKY-22.4
13	Dust wiper	NBR	1	SDR-22.4
12	Hexagon socket head setscrew	SCM435	1	M4
11	Hexagonal nut	S25C	8	M10 Class-1
10	Spring washer	SWRH57	8	10 No.2
9	Cap	S25C	2	
8	Flange	SS41	1	
7	Tie rod	S45C	4	
6	Sleeve	Polyamide resin	1	WRB-22.4
5	Piston	FC25	1	
4	Piston rod	S45C	1	
3	Cylinder tube	STKM13C	1	
2	Head cover	SS41	1	
1	Rod cover	SS41	1	
No.	Name	Material	Q'ty	Remarks

2. SPINDLE COOLING UNIT

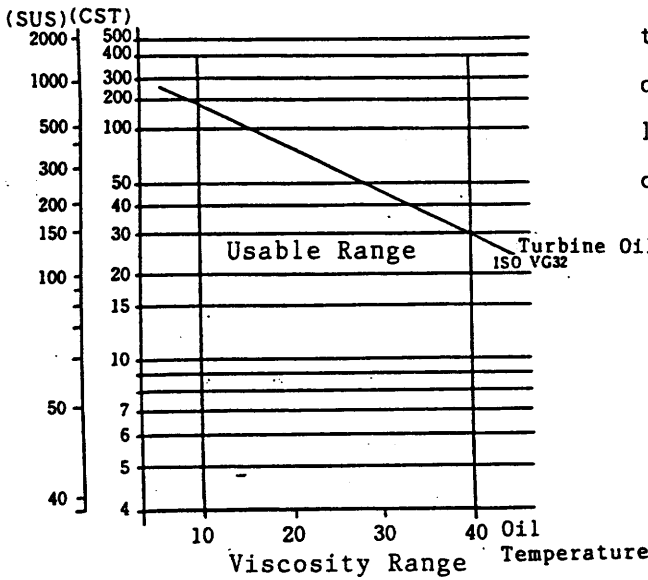
2.1 General Precautions

(1) Usable range

OILMATIC incorporates a refrigerator to cool. The usable range of an ambient temperature and oil temperature is limited. Use it within the range shown in the figure below.



(2) Oil used



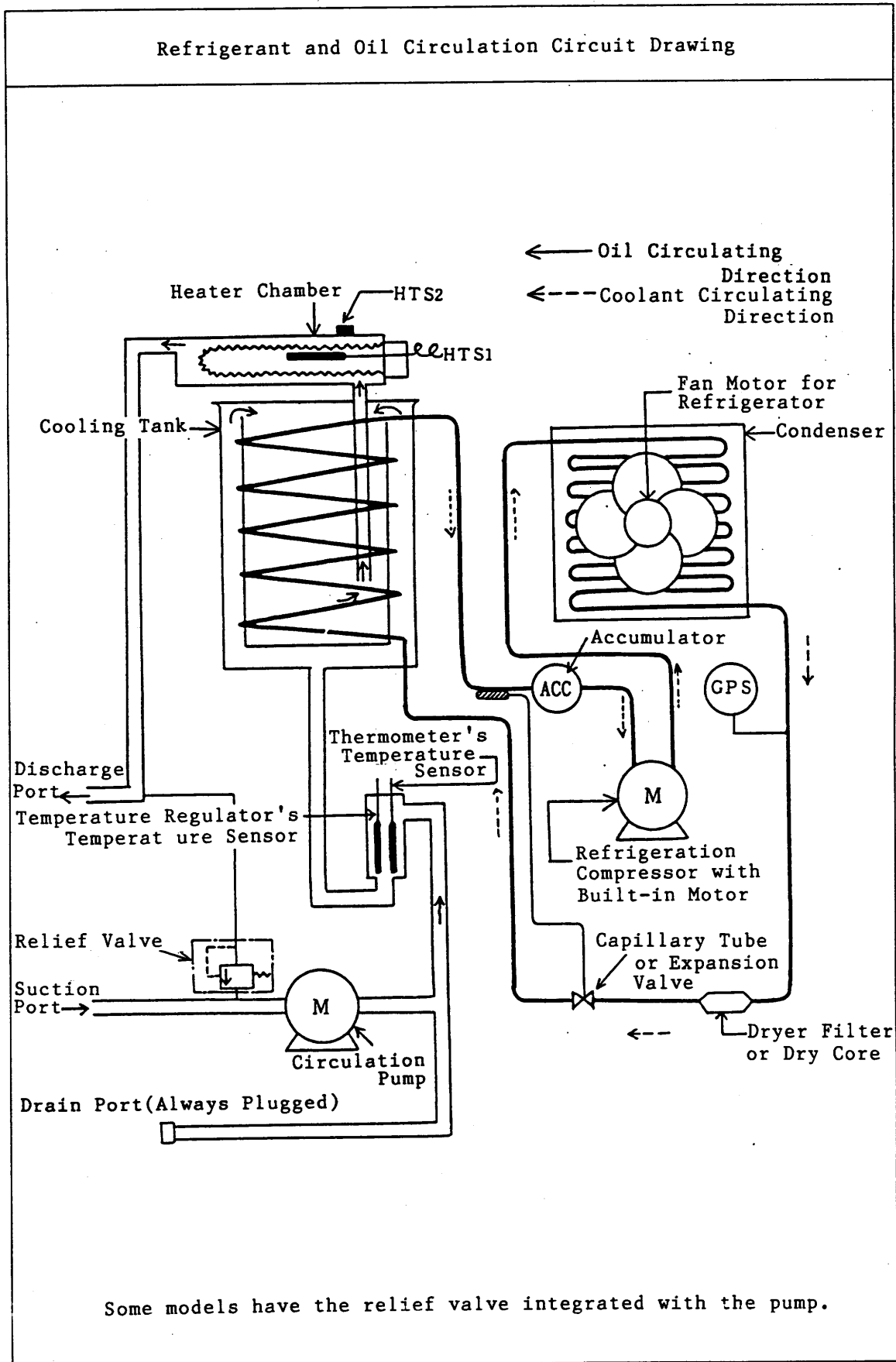
The KTC type OILMATIC is an oil temperature controller for mineral oil system working oil and lubricating oil. The following oils(liquids) are not available:

- ① Coolant(liquid) and grinding oil(liquid)
- ② Water and water soluble liquids
- ③ Chemicals and food liquids
- ④ Highly volatile liquids with low lubrication capability such as gasoline, thinner, etc.
- ⑤ Flame resisting hydraulic working oils Phosphoric ester system, Water + guaiacol system, O/W emulsion system, Chlorinated hydrocarbon system

(3) Safety work upon inspection/repair

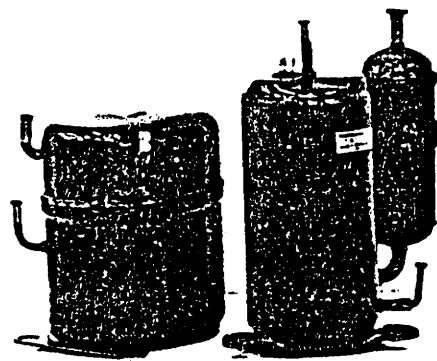
When inspection or repair is required by any chance, turn off the start switch to stop OILMATIC and be sure to turn off the power switch.

2.2 Component Parts and their Functions



- Refrigeration compressor with built-in motor

This is to compress a refrigerant gas to increase a pressure in order to facilitate liquefaction at a normal temperature. In order to prevent a leakage of the refrigerant gas, the compression mechanism and drive motor are enclosed in a steel plate case. When the refrigeration compressor stops, if the refrigerant gas is cooled down and liquefied, liquid compression may occur and damage the valve of the cylinder head at start time. To prevent this, a crank case heater has been installed for the compressors with larger capacity than the Model KTC-22(nominal capacity 2.2kW).



Refrigeration Compressor with Built-in Motor

- Fan motor and fan for the refrigerator

They are to supply cooling air to the condenser. A suction type propeller fan is used.(Some models use a blow-off type.) (For the Model KTC-5A, a fan drive motor doubles as a pump motor.)

- Condenser

This is a heat exchanger to cool down and liquefy the refrigerant gas turn to a high temperature and high pressure by the refrigeration compressor. A standard type uses the forced air cooling method by means of a fan. Some models uses a water cooled condenser as an option.

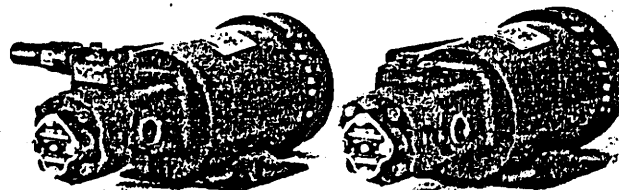
- Cooling tank(heat exchanger)

Heat exchanger to deprive the oil of its heat through evaporation of the refrigerant. It has an enclosed structure and incorporates an evaporator(made of copper pipe).

- Circulation pump and relief valve

The circulation pump circulates the oil into the cooling tank at a constant flow rate. OILMATIC uses a trochoid gear pump directly connected to a motor.

The relief valve is activated when the pressure in the oil circuit exceeds a specified pressure to protect the component parts of the oil circuit.



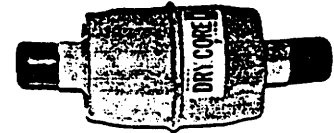
Relief Valve Integrated Type

Relief Valve Separate Type

Circulation Pump and Motor

- Dryer filter and dry core

Moisture or foreign substances in the refrigerant gas will have a bad effect on each part of the refrigerator. To avoid this, these devices are used to adsorb moisture and collect the foreign substances.



Dry Core

- Capillary tube and temperature type automatic expansion valve

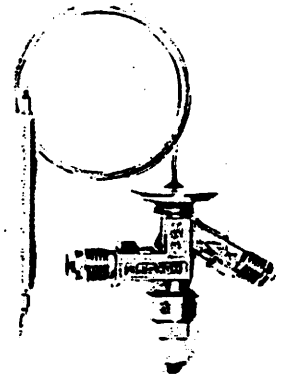
These are to have the high-pressure liquid refrigerant heat-insulated and expanded to a low temperature and low pressure by throttling.

- Capillary tube

Used for smaller-capacity models than KTC-11.
Throttled with a small I.D. steel pipe.

- Temperature type automatic expansion valve

Used for larger-capacity models than KTC-15.



Temperature Type Automatic Expansion Valve

In order to obtain a stable cooling capability against fluctuations of a thermal load in the cooling tank, this valve automatically adjusts the opening of the throttle valve, following up a temperature change at the evaporator outlet, to control a flow rate of the refrigerant liquid.

- Heater chamber

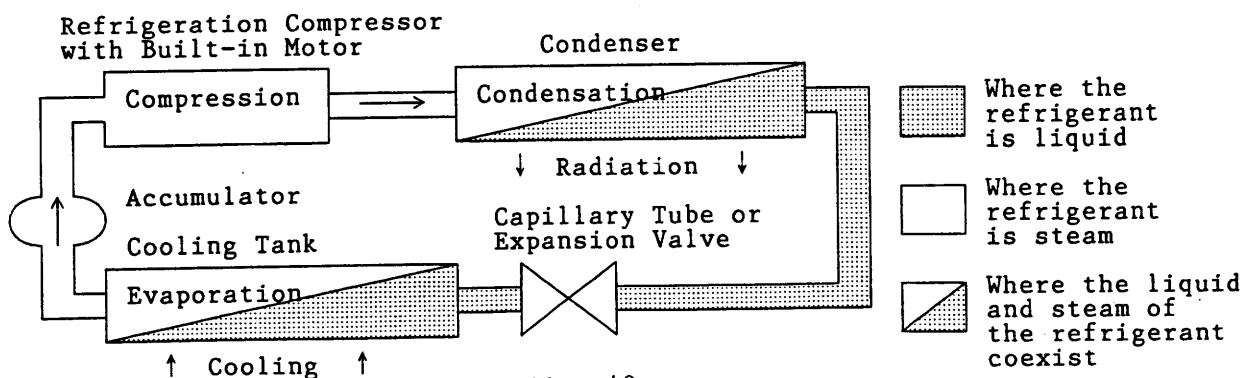
It incorporates a sheath heater and heats the oil, circulating the oil by the the circulation pump.

In order to prevent quality change and deterioration of the oil, power density of the heater surface has been designed low.

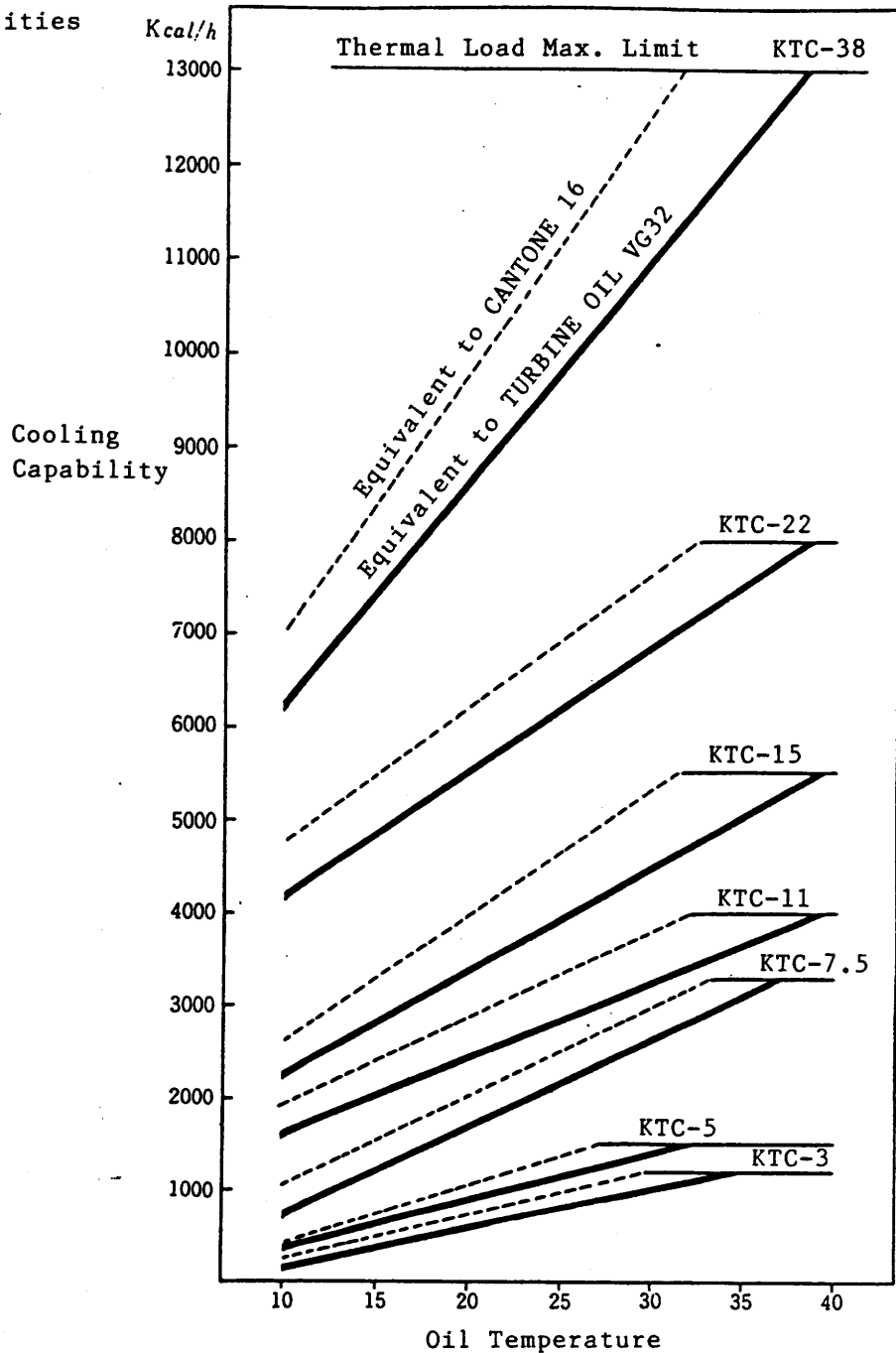
- Accumulator

The accumulator is a vessel to be attached to the piping between the cooling tank and compressor, and when the refrigerant liquid is mixed with the sucked gas, it separates the liquid and has the compressor suck only the steam to prevent liquid compression and protect the compressor.

Refrigeration Cycle and Condition Change of Refrigerant



2.3 Cooling Capabilities



- Notes) 1. The above chart shows the capabilities when an ambient temperature is 35°C and the power source is of 65Hz.
2. The characteristic curves in the above chart are envelopes of multiple characteristic curves with different refrigerant charging amounts. The characteristic curve for a single unit assumes a convex curve outside the design temperature range.
3. The above chart shows the OILMATIC's capabilities and a range of set temperature. The cooling capabilities greatly change depending on whether an oil temperature is high or low, even if the output of the compressor is the same. Even at the same temperature, they change depending on dynamic viscosity of the oil.
4. With the standard model, a liquid temperature should be 10 to 40°C (oil equivalent to turbine oil VG32 in terms of viscosity).

2.4 Installation

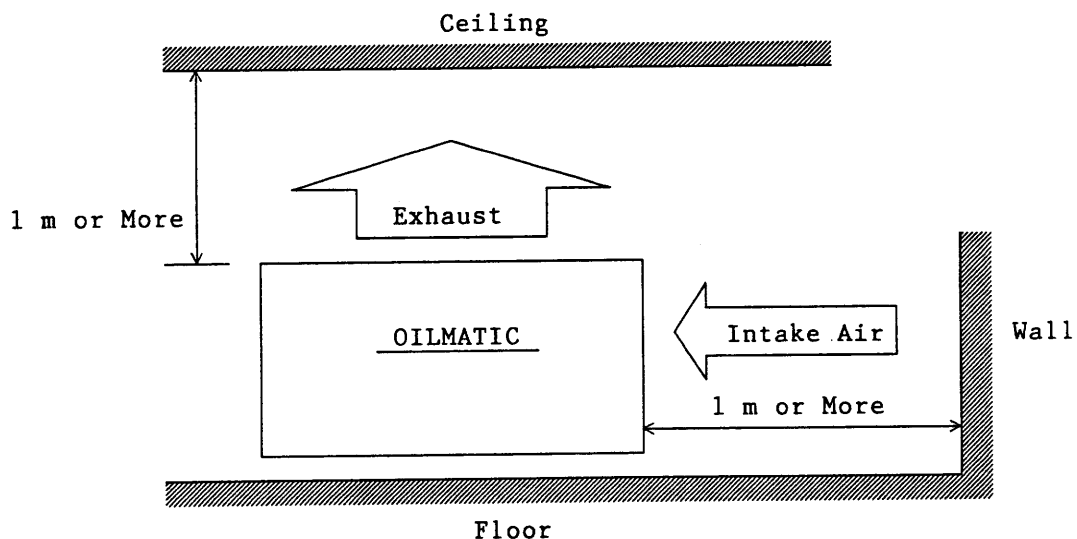
A. Transportation

When transporting the OILMATIC, do not incline it back/forth or left/right over an angle of 40° . Inclination over the limit causes the compressor to go out of order. Also, do not give a strong shock or vibrations. The gas(refrigerant) may leak.

Note that any of the above cases cannot be repaired on the spot.

B. Installation Place

- (1) Install the unit horizontally in a place free from direct sunshine and vibrations.
- (2) The OILMATIC takes in the air through the condenser(refer to the appearance drawing). See to it that it can let in as low-temperature and clean air as possible through this suction port. When there is a heat generating unit nearby, think of using a screen, etc. Secure a distance between the suction port and an obstacle as shown in the below figure, taking maintenance and inspection into account.
- (3) Hot air is discharged from the exhaust port(refer to the appearance drawing) of the OILMATIC. Keep a good air flow in the exhaust direction so that heat will not hang over around it. Spaces in the exhaust direction should be secured as much as shown in the below figure, taking maintenance and inspection into account.



- (4) For the standard OILMATIC, an ambient temperature should be 40°C or less. When using at 40°C or more, it will be of optional specifications.

Note 1) If any one of the above conditions is not met, not only refrigeration capabilities go down, but also the refrigeration compressor will be overloaded and a protective device will be activated to stop it.

C. Piping Connection

The pump built in the OILMATIC is a constant flow rate type pump (trochoid gear pump) in order to obtain stable heat exchange capabilities.

Due to relations between the OILMATIC internal structure and pump motor's output, the OILMATIC should be used within a discharge pressure of 3.5kg/cm² (5kg/cm² when the discharge port is fully closed and all is relieved) and suction pressure limit of -0.3kg/cm² (-230mmHg). When the discharge pressure comes to 3.5 kg/cm² or more, the relief valve(refer to the circulation system diagram) is activated to decrease an oil feed rate and lower cooling capabilities, and the pump produces more noise. When the suction pressure exceeds -0.3kg/cm², the pump noise becomes loud, a flow rate decreases, and cooling capabilities go down. Also, it causes violent vibrations and incurs a trouble.

Even under the same piping conditions, a pressure loss due to piping resistance increases as oil viscosity goes up, or a temperature becomes lower even with the same oil(generally, oil viscosity goes up as a temperature becomes lower).

Therefore, piping should be installed taking into account the low-temperature condition in winter. From the above, the piping for the OILMATIC must have its piping resistance minimized.

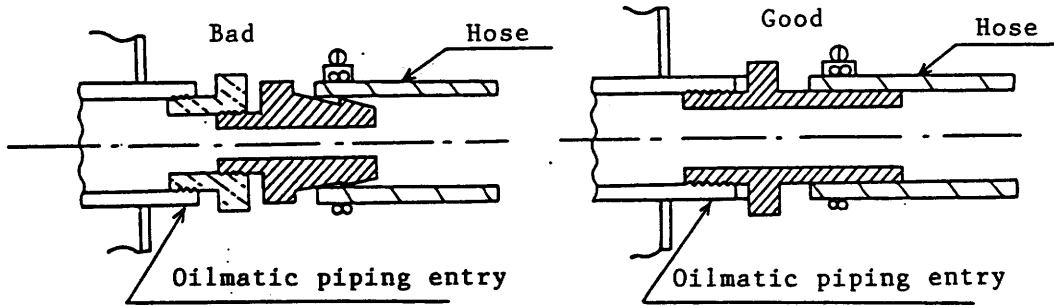
(1) Thickness of the piping

The piping from the OILMATIC to a load should use a gas pipe of the size listed in the table or a hose with an equivalent or larger inner diameter. When using a hose, since the suction side has a negative pressure, use the one which is not crushed(for example, wire blade hose).

Model	Piping Diameter(Gas Pipe Size)	
	Suction Side	Discharge Side
KTC-38 KTC-22	1-1/4 B	1 B
KTC-15	3/4 B	3/4 B
KTC-11	3/4 B	3/4 B
KTC-7.5	3/4 B	3/4 B
KTC-5	3/4 B	1/2 B
KTC-3	1/2 B	1/2 B

(2) Piping joint

Minimize the number of piping joints used. Some piping joints have an extremely narrow inner diameter. Do not use those joints. Note that when using the hoses, the inner diameter of a joint tends to be particularly narrow.



(3) Use of the valves

When using the valves halfway the piping, be sure to use sluice valves (gate valves). Do not use stop valves (globe valves) because they have a high resistance.

(4) Length of the suction piping

Minimize the length of the suction piping, referring to the below table.

Model	Piping Diameter (For SGP)	Maximum Length of Suction Piping	
		Turbine Oil ISO VG32, at 10° C (180cSt)	Turbine Oil ISO VG68, at 10° C (550cSt)
KTC-38	1-1/4 B(I.D. 35.7)	3.0	1.2
KTC-22	1-1/4 B(I.D. 35.7)	4.0	1.6
KTC-15	3/4 B(I.D. 21.6)	1.0	0.4
KTC-11	3/4 B(I.D. 21.6)	1.0	0.4
KTC-7.5	3/4 B(I.D. 21.6)	1.5	0.6
KTC-5	3/4 B(I.D. 21.6)	2.0	0.8
KTC-3	1/2 B(I.D. 16.1)	1.0	0.4

(5) Piping work

The piping on the suction side may suck the air. A piping connection should be done elaborately.

(6) Use of the filter

When using a suction filter or line filter for the suction-side or discharge-side piping of the OILMATIC, attach it in such a way that you can easily inspect/clean it periodically to avoid an increase of resistance due to clogging.

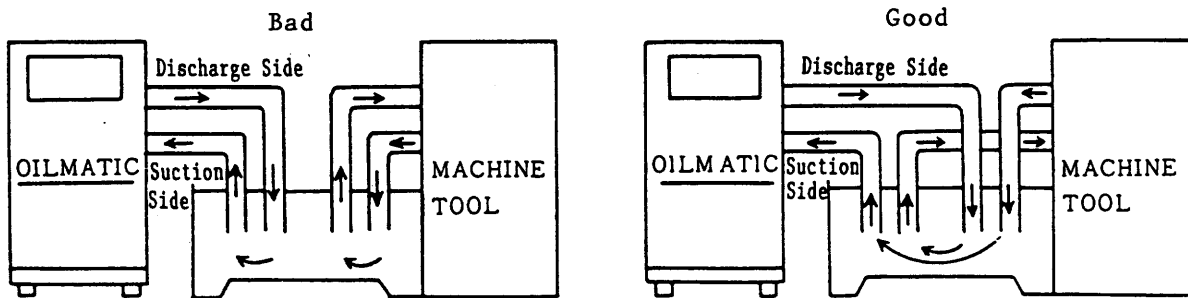
Note 2) The above-mentioned is necessary to reduce a resistance halfway the piping and minimize a pressure loss. If the pressure loss is high, a heat value caused by it cannot be ignored.

Note 3) When operating the OILMATIC, be sure to firmly plug the drain port(DRAIN) so that the oil will not leak from it.

Note 4) As mentioned above, the trochoid gear pump is used as an oil pump. If a solid foreign substance is sucked, it will get caught by the trochoid gear and disable rotation. If this is the case, you cannot restart the pump unless you disassemble the pump and eliminate the foreign substance.

(7) Layout of the piping(when piping to the oil tank)

In order to feed the oil with little temperature change to the machine, the suction and discharge pipings should be installed as shown in the right figure.



D. Power Connection

(1) Power capacity

Determine a power capacity, referring to the specifications list and wiring diagram.

(2) Rotating direction

The power source must be connected so that the oil pump and fan motor in the OILMATIC will rotate in the forward direction.

The input terminals of the power switch of the OILMATIC are for the phases R, S, and T respectively, from the left. Connect the phases R, S, and T of the 3-phase power source respectively to rotate in the forward direction.

When the phases R, S, and T of the power source are not known, it is necessary to make a temporary connection to check for the rotating direction. Check for the rotating direction as follows.

Model	Rotating Direction Checking Method	
	When Checking with Oil Pump	When Checking with Exhaust Direction of Fan
KTC-38A type KTC-3B type KTC-5A type	<ul style="list-style-type: none"> • Check with suction/discharge of the oil • Check for the motor rotating direction through the rotating direction inspection window. 	<ul style="list-style-type: none"> • Sucks from the rear of the OILMATIC and exhausts upward. (The fan does not rotate unless the refrigerator is running.)
KTC-5C type KTC-7.5A type KTC-7.5 type KTC-7.5D KTC-11A type KTC-15B type KTC-22A type	<p>Since a negative-phase protective relay has been installed, they do not start at negative phase time.</p>	

Note 5) If the oil pump is idled(rotated without oil) or rotated reversely for a long time, the oil seal of the pump will be damaged. In order to check for the rotating direction, do not keep on idling or rotating reversely for a long time. (Complete within several seconds)

Note 6) Even when the phases R, S, and T of the power source are unknown, only the phase S(grounding-side wire) can be easily identified with an electric pen(detector). Connect only the phase S to the central terminal S among the power source grounding terminals. If the phase S of the power source has been connected to the terminal S, the circuit can be protected and its malfunctioning can be avoided, even if the control circuit has a grounding trouble.

E. Cooling Water Piping of OILMATIC with Water Cooled Condenser(Option)

When using the OILMATIC with water cooled condenser, the cooling water piping is also required for the condenser. The following table lists the cooling water piping diameters and cooling water required flow rates. Refer to the appearance drawing in the Specifications separately provided and install the cooling water piping.

When installing the piping, attach sluice valves to the cooling water inlet and outlet of the OILMATIC in order to facilitate maintenance such as cleaning of the water cooled condenser, and so on.

Model	Cooling Water Piping Diameter		Cooling Water Inlet Temperature	Cooling Water Required Flow Rate
	Inlet	Outlet		
KTC-38 type	1 B	1 B	At 25° C	30
			At 34° C	60
KTC-22 type	3/4 B	3/4 B	At 25° C	19
			At 34° C	42
KTC-15 type	3/4 B	3/4 B	At 25° C	13
KTC-11 type			At 34° C	30
KTC-7.5 type	1/2 B	1/2 B	At 25° C	7.5
KTC-5 type			At 34° C	18

2.5. Operation

A. Start

Before turning on the power switch, check the piping for any abnormality. When there is a valve halfway the piping, be sure to fully open it.

Note 7) If the suction-side(IN) piping of the OILMATIC is closed by a valve or the oil pump is rotated reversely under a high piping resistance, the oil seal of the pump will be turned up by a counter pressure and the oil will leak. Therefore, after installing as mentioned above, you must check the piping, and then, start the OILMATIC at the time of initial starting operation.

After completing the above-mentioned preparations, turn on the power switch, and then, turn on the start switch.

Start switch ON Start lamp ON Oil pump started

When the oil pump starts rotating, the oil on the load side is sucked into the cooling tank of the OILMATIC through its suction port(IN) and circulated to the load side through the discharge port(OUT).

※ When you have the OILMATIC with water cooled condenser, be sure to confirm a through passage of the cooling water.

Note 8) The heat exchanger inside the OILMATIC and piping require the following amount of oil. Note that the oil level of the oil tank will decrease by that amount.

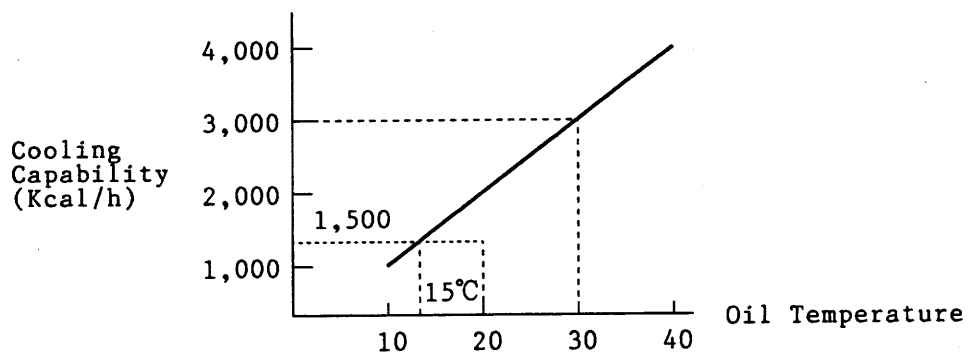
KTC-3 type	: Approx. 4 ℓ	KTC-5 type	: Approx. 8 ℓ
KTC-7.5 type	: Approx. 12 ℓ	KTC-11 type	: Approx. 15 ℓ
KTC-15 type	: Approx. 25 ℓ	KTC-22 type	: Approx. 30 ℓ
KTC-38 type	: Approx. 55 ℓ		

B. Oil Temperature Adjustment

Upon starting the OILMATIC, an oil temperature is higher than the set temperature of the temperature regulator, the cooler is activated to start cooling. When the oil temperature is lowered to the set value, the cooler stops automatically. Functioning of the cooler can be confirmed by lighting of the cooler lamp. When the oil temperature at start time is lower than the set value, the cooler does not function. When the OILMATIC is provided with a heater, however, the heater will be activated(heater lamp turned on) to increase the oil temperature, and when it reaches the set temperature, the heater will stop automatically.

When heat generation is started by operating the machine and the oil temperature is about to change, the temperature regulator will adjust the oil temperature to your desired temperature by automatically turning on/off the cooler/heater.

Note 9) The cooling capability of the OILMATIC change depending on the oil temperature. Suppose you set to 20°C the temperature setting of the temperature regulator of the OILMATIC which has the cooling capability as shown in the right figure. When a thermal load is 3,000 kcal/h, the oil temperature will become 30°C without going down to 20°C. When the thermal load is 1,500 kcal/h, the oil temperature can be lowered to 15°C, but it is adjusted to 20°C through on/off control of the temperature regulator.



(1) Constant electronic temperature regulator (A)

The graduations of the liquid temperature setting dial indicate a temperature as they are. Set the dial to your desired temperature graduation.

(2) Reference temperature follow-up electronic temperature regulator (B, C)

When a room temperature is assumed to be a reference temperature, setting the graduation of the liquid temperature setting dial to 0, this temperature regulator causes the liquid temperature to follow up the room temperature. If set to -5(or 3), the temperature regulator works to adjust the liquid temperature to the room temperature -5°C(or + 3°C). a target temperature should be kept in a range of 10 to 40°C.(Standard)

When using the temperature regulator over the above range, we will discuss it upon your ordering.

C. Using the Timer(When the Timer Has Been Attached)

(1) When setting the current time, be sure to turn the center knob of the clock unit in the arrow direction(right).

- The timer will go out of order if you forces the knob in the opposite direction or turn the dial to set the time.

- (2) When setting the operation time, shift a desired time's setter to inside the dial. Then, the equipment will be turned on at that time. (A red color appears on the periphery of the dial) If the setter is kept shifted to inside the dial, the ON state continues for the number of setters x 15 minutes.
- The setter should be shifted sufficiently until it clicks.
 - If the setting is shifted to outside the dial, the equipment will be turned off at that time. (The red color on the periphery of the dial disappears)
- (3) If the manual switch is set to AUTO, the output will be turned on/off according to the setting of the operation time with the setter.
- When turned to ON, the ON state takes effect regardless of the setting of the operation time.
- (4) For AC frequency setting, operate the frequency selector switch located on the upper right of the front with a regular screwdriver, etc.

2.6 Protective Devices

A. Oil Circulation Circuit

OL₁ (thermal relay for the pump motor)

This is activated when the circulation pump has a fault and the pump motor is overloaded. To reset it, eliminate a cause and press the reset button of the thermal relay proper in the control box.

B. Refrigerant Circuit

When the refrigerant circuit has a fault, the following protective devices are activated.

- OL₁ (thermal relay for the fan motor) KTC-11 or above
- OL₂ (thermal relay for the refrigeration compressor)
It is activated when a current flowing to each motor increases.
To reset it, eliminate a cause and press the reset button of the thermal relay proper.
- GPS Refrigeration circuit pressure switch (KTC-15 or above)
To reset it, eliminate a cause and press the reset button on the upper part of the pressure switch.
- ※ All models with water cooled condenser have high and low pressure switches. They are activated respectively when a gas pressure increases or decreases excessively.
- ITS (internal thermostat) KTV-15, KTC-38
It is embedded in the motor windings inside the refrigeration compressor and activated by a temperature increase.
Activated at $105 \pm 5^{\circ}\text{C}$ or more
Reset at $81 \pm 11^{\circ}\text{C}$ or less
- Although it is an automatic reset type, it may take some time to be reset after it is activated. (Up to about 40 minutes)
- THP (thermal protector) KTC-5, KTC-7.5, KTC-11, KTC-22
It is activated by an excessive temperature rise of the refrigeration compressor's dome.
Although it is an automatic reset type, it may take scores of minutes to be reset.

C. Danger Prevention of Heater(When the Heater Has Been Attached)

If the heater is turned on with the oil not circulating(flowing) in the OILMATIC or with no oil supplied in the OILMATIC, an oil temperature around the heater will become high locally or the heater will be turned on with no load applied, thus leading to a danger as well as trouble. We recommend you to install one of the following protective devices.

- HTS₁: (No-load heater operation preventive thermostat)

It is attached to the heater surface. It is activated when a heater's surface temperature increases abnormally with no oil contained in the heater chamber.

- HTS₂: (No-load heater operation preventive bimetal switch)

It is attached to the heater surface. It is activated when a heater's surface temperature comes to 50° C or more.

Note 11) Both HTS₁ and HTS₂ are reset automatically. Eliminate a fault cause, wait for automatic reset, and then, restart operation.

D. Buzzer

When the OILMATIC has a fault, an alarm buzzer keeps on sounding.

- When the pump motor has a fault and OL₁ is activated, all functions of the OILMATIC stop and the buzzer keeps on sounding.
- When the refrigeration circuit has a fault and the above-mentioned protective device is activated, the circulation pump keeps on operating, the refrigerator stops, and the buzzer keeps on sounding.

In either case, turning off the start switch(SS1) stops the buzzer. Eliminate a fault cause and reset the manual resetting block. For the automatic resetting block, wait for automatic reset and restart operation. For the fault causes, refer to 2.8 Troubles and Their Causes.

2.7 Maintenance and Inspection

Be sure to carry out the following maintenance and inspection so that you can use the OILMATIC efficiently and without troubles.

● Cleaning the Condenser and Air Filter

If much dust adhered to the condenser, a heat exchange capability will go down. If it is operated as it is, the refrigeration compressor will be overloaded, protective circuits(OL2, GPS, ITS, MP, etc.) will be, activated, and the cooler will stop. When the conditions are bad, the refrigeration compressor will go out of order and make it difficult to repair it on the spot.

Therefore, inspect and clean the condenser and air filter periodically in accordance with an amount of dust in the air. The condenser uses the suction type forced air cooling method. Since dust adheres to the outer surface of the air filter and condenser, inspection and cleaning can be easily done.

[Cleaning Method]

Remove the air filter from the outer surface of the condenser and eliminate dust with an air gun or vacuum cleaner. When dust is sticky due to oil, etc., wash away with neutral detergent plus water or lukewarm water.

When the air filter is detached, eliminate dust from the surface of the internal condenser fins, using the air gun, wire brush, etc.

Note 12) When cleaning the condenser fins, be careful not to bend or break them. Also, avoid using a hard wire brush or pointed metal, because they may damage the copper pipe inside the condenser. If the copper pipe is damaged and the gas leaks, it is impossible to repair on the spot.

● Cleaning the water cooled condenser(option)

If fur or scale adheres to the internal cooling water circuit of the water cooled condenser, a heat exchange capability will go down. If it is operated as it is, the refrigeration compressor will be overloaded, as with the above-mentioned standard air cooled condenser. An amount of fur or scale and their natures differ depending on the quality of the cooling water, examine the water quality and clean periodically(at least once a year) using a cleaning agent suitable for the water quality.

If you have any questions about the cleaning agent and cleaning method, contact our office for the information.

2.8 Troubles and Their Causes

We believe that you will be always satisfied with the OILMATIC as far as it is given the normal power and operated under an adequate load. If there is a fault by any chance, inspect and eliminate a trouble cause, referring to the following table. If you have any questions, contact the service headquarters at our plant (phone: 0272-51-5585).

When you request for a repair, look at the name plate attached to the upper right side of the OILMATIC body and let us know the following information:

1. Manufacture number
2. Model number
3. Trouble(in details)
4. Site of operation(address, phone number)

Trouble	Faulty Device	Direct Cause	Check Point and Remedy
A. Even if the start switch is turned on, the start lamp does not go on.	F	<ul style="list-style-type: none"> a. The normal power is not supplied. b. The fuse for the control circuit is gone. c. Faulty contact or snapping at the connection of the wiring d. Faulty lamp 	<ul style="list-style-type: none"> • With a voltmeter, check a voltage between each of the terminals R, S, and T in the control box. • Check the fuse in the control box. If it is gone, replace it by a new one. When it goes again, the circuit may be short-circuited. Check each part of the wiring. • Check the connection of each wiring for faulty contact or snapping.
B. Although the start lamp is turned on, the circulation pump does not start.	OLL	<ul style="list-style-type: none"> a. Since the oil pump motor M1 is overloaded, the thermal relay OLL for the electromagnetic switch MS1 is being activated. 	<ul style="list-style-type: none"> • Remove a lamp lens cap from the front of the operation panel and replace it by a good one. ① Check if the piping for the oil circuit is not too fine or long, or if a flow path is not closed by a valve, etc. ② Check if oil viscosity is not too high. If high-viscosity oil is circulated at low temperature, the pump motor will be overloaded. Start it after an oil temperature increased, or use low-viscosity oil. ③ Check if a solid foreign substance is not caught inside the pump, by manually rotating in one of the following methods: (a) For the models which uses one motor to drive the pump and fan, rotate the fan manually. (Models KTC-5A and KTC-7.5A) (b) For the other models, remove the end cover of the motor and rotate the motor fan manually. In the above methods, when you felt fan rotation abnormally heavy or cannot rotate the fan, disassemble the pump and eliminate the internal foreign substances. ④ Check if the motor or pump bearing is not broken. As with ③, rotate manually, and when the bearing is faulty, replace the bearing by a good one.
C. The pump is noisy.		<ul style="list-style-type: none"> a. Piping resistance of the oil circuit b. Suction of the air c. Trouble of the pump 	<ul style="list-style-type: none"> ① The piping resistance on the suction side(circuit through which the oil enters the OILMATIC) or discharge side is too high. } (Refer to 2.4-C Piping Connection) ② Oil viscosity is too high or an oil temperature is too low. ③ Clogging of the relief valve with dust or trouble If it is clogged with dust, disassemble and clean. • The air is sucked through the piping joint, etc. on the suction side. • Breakage of the pump or motor bearing, or breakage of the coupling between the pump and motor. Replace by a good one.

		Check Point and Remedy	
Trouble	Faulty Device	Direct Cause	
D. Although the oil temperature increases, the cooler does not work. (The cooler lamp is not turned on.)	ITS THP CPS OL21 OL2	An excessive increase of the dome temperature of the refrigeration compressor and motor coil temperature due to an insufficient amount of the circulating refrigerant Abnormal refrigerant pressure due to insufficient condensation capability and overloaded refrigeration circuit Overloaded fan motor due to eccentricity of the fan, etc. Overloaded refrigeration compressor	<p>① Check if the air flow conditions for the air intake and exhaust ports are adequate, and if an air intake temperature for the condenser is not too high; the standard working limit of the air intake temperature is 40°C. Where the heat hangs over, improve ventilation, using an industrial fan, etc. (Refer to 2.4-B Installation Place.)</p> <p>② Check the condenser for adhesion of dust and an air flow effect. (Refer to 2.7 Maintenance and Inspection)</p> <p>③ Check if the fan is rotating in the forward direction.</p> <p>④ Check if the OILMATIC was not started at a high oil temperature, or if the oil temperature is high because of too high a thermal load.</p> <p>⑤ The refrigeration compressor is out of order. } In these cases, it is necessary to replace Seizure of the cylinder due to oil shortage } the refrigeration compressor. Breakage of the discharge pipe or crank shaft } They cannot be repaired on the spot. Burnout, snapping, etc. of the motor coil } Contact our office.</p> <p>⑥ Insufficient refrigerant. Exhaust from the exhaust port is not warm and close to or equal to a room temperature. The refrigerant may be short due to a leak from a crack caused when a shock was given. Consult our office because it may not be repaired on the spot.</p> <p>⑦ <input checked="" type="checkbox"/> OILMATIC with water cooled condenser <input type="checkbox"/> The cooling water is not passing through, or a condensation capability is insufficient because a flow rate is low. <input type="checkbox"/> The condensation capability is insufficient because of adhesion of fur, etc. to the internal cooling water circuit of the water cooled condenser. (Refer to 2..7 Maintenance and Inspection)</p>
E. Even if the oil temperature increases, the cooler does not work. (The cooler lamp is not turned on.)	CTC or ATA	The temperature regulator is out of order.	Short-circuit the temperature regulator's circuit, and if the refrigeration compressor is activated, The temperature regulator is out of order. Replace by a good one. For the electronic temperature regulator, refer to 2.9 Troubleshooting of Electronic Temperature Regulator on the next page.
F. The cooler is working (cooler lamp ON), but the cooling capability is insufficient.		a. A thermal load is too high.	<p>If hot air is coming out of the exhaust port, it is likely that the cooler is working normally, but a thermal load is too high. Calculate the cooling capability(Q) of the OILMATIC, using the following formula.</p> $Q = V \cdot \gamma \cdot Cp \cdot \Delta t$ <p>Q: Cooling capability(kcal/h) Δt: Temperature difference between incoming and outgoing oils from the OILMATIC. V: Oil feed rate(m³/h) γ: Specific gravity of the oil(kg/m³) γ: Specific gravity of the oil(kcal/kg°C) Cp: Specific heat of the oil(kcal/m³°C) } approx. 400 kcal/m³°C.</p> <p>When the cooling capability is normal and the oil temperature still increases, use the OILMATIC with higher cooling capability.</p>

Trouble	Faulty Device	Direct Cause	Check Point and Remedy
F. The cooler is working (cooler lamp ON), but the cooling capability is insufficient.		b. An oil circulation rate is low or the oil is not circulating.	If the refrigeration circuit is normal, but an oil circulation rate goes down, a heat exchange rate will decrease and the cooling capability may become insufficient. ① Since the lift of the oil circuit is too big or a piping resistance is excessive, the relief valve is actuated and a circulation rate has decreased. (Refer to 2.4-C Piping Connection) ② The motor-pump coupling is broken and the motor is idling. (Replace the coupling or pump motor) ③ The trochoid gear of the pump has been worn out and a discharge rate has decreased. (Replace the pump) ④ The pump is running in the reverse direction. (Refer to 2.4-D Power Connection) ⑤ Clogging of the relief valve with dust or trouble of the relief valve itself. (When it is clogged with dust, disassemble and clean. When it is out of order, replace by a good one)
C. The oil temperature does not increase when heated. (When the heater has been attached) Lamp is not turned on, or it is turned on, but goes off soon)	HIS1 HIS2	a. The overheat preventive thermostat(HIS1) has been turned off. The overheat preventive bimetal switch(HIS2) has been turned off.	Due to shortage of the refrigerant, each protective device would not be activated, but the cooling capability may run short. Find a refrigerant leakage, repair it, and replenish the refrigerant gas. Consult our office because the fault may not be repaired on the spot. ① A temperature of the heater chamber increased too much due to F-b. ② There is no oil. ③ The device proper is out of order.
	CIC or ATA	b. The temperature regulator is out of order.	Make sure that the refrigeration circuit is turned off. Short-circuit the heater side of the temperature regulator. Then, if the heater can be turned on, the temperature regulator is out of order. (Replace by a good one) For the electronic temperature regulator, refer to 2.9 Trouble shooting of Electronic Temperature Regulator on the next page.
H. Others	OH	c. The heater is snapped.	Check with a tester. If there is no normal continuity between each phase, the heater is snapped. (Replace by a good one) When functioning of the OILMATIC is electrically faulty, check if each component part of the electric circuit is defectless, wirings are clamped tight, or they are not snapped, depending on the troubles.

Symbol	Activating Condition	Reset
HIS2	Off at the heater chamber surface temperature of 50° C or more	Auto
HIS1	Off by an excessive temperature increase of the heater proper	Auto
THP	Turned off by excessive temperature increase of the refrigeration compressor's dome	Auto

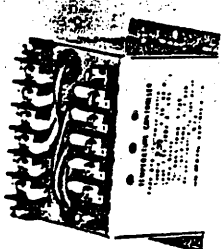

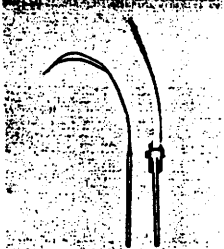
Symbol	Activating Condition	Reset
MP	Turned off by excessive temperature increase of the refrigeration compressor's dome + overcurrent	Auto
ITS	Turned off by excessive temperature increase at the motor windings of the refrigeration compressor (Off at 105±5° C or more)	Auto
GPS	Off by excessive increase of the refrigerant pressure(Off at the set pressure of 26kg/cm ² or more)	Manual
OL	Off by a current over the set value	Manual

Note 1. The protective devices for each model have the resetting mechanisms as shown in the right table. When there is a fault, they stop automatically and issue an error signal. Turn off the start and power switches and eliminate a cause. Manually reset the devices, if they are manually resettable. For those automatically reset, wait for them to be reset automatically, and then, restart.

Note 2. When the circulation pump has a fault, although this applies to every model, all functions of the OILMATIC will stop.

2.9 Troubleshooting of Electronic Temperature Regulator

When you referred to "Troubles and Their Causes" and has figured out that the temperature regulator was out of order, refer to the following table and check each part of the temperature regulator.

Device Checked	Diagnostic Procedure	Remedy				
<p>A. Controller</p> 	<p>a) When the refrigerator does not start, short-circuit ATA or CTC, load contact for the refrigerator, in the control circuit, and check if the refrigerator can start. (Short-circuit the contact in the control circuit diagram, shown as left.) When the refrigerator still does not start even after short-circuiting, other part than the temperature regulator is defective.</p> <p>b) With the terminal block of the controller body, Short-circuiting A_1 and A_2 starts the refrigerator. Short-circuiting A_3 and A_4 does not start the refrigerator. When the OILMATIC has a heater attached to it, the heater is turned on. If the above functionings are met, the controller is defectless.</p>	<p>① When the controller body is defective, replace it. ② Refer to the label pasted onto the controller body and let us know the model number of the controller as well.</p>				
<p>B. Potentiometer, Oil(liquid) temperature setting dial</p> 	<p>Disconnect the lead wire terminals A_1, A_2, and A_3 of the potentiometer from the terminal block of the controller body. Turning the oil(liquid) temperature setting dial in the $K\Omega$ range, measure a resistance value between each terminal. The resistance value between A_1 and A_2 changes to 0 to approx. $2K\Omega$ (changes to 0 to approx. $1K\Omega$.) The resistance value between A_2 and A_3 is constant at approx. $2K\Omega$ ($1K\Omega$). If normal, the measured values will be as shown above. The resistance values in parentheses are effective when the set range is 5 to $-5^\circ C$.</p>	<p>① When the resistance value has an error or there is a faulty contact, replace the potentiometer.</p>				
<p>C. Thermistor</p> 	<p>Disconnect the lead wire A_1, A_2, and A_3 of the oil(liquid) temperature detection thermistor and room temperature(reference temperature) detection thermistor from the terminal block of the controller body.</p> <p>a) In the $K\Omega$ range of the tester, measure a resistance value between the terminals A_1 and A_2, and A_2 and A_3. A normal resistance value of the thermistor is about $5K\Omega$ when a temperature at the thermistor is $20^\circ C$. (The resistance decreases as the temperature increases.) When the resistance value is 0 or ∞, the thermistor is either shortcircuited or snapped. It is also likely that the wiring from the terminal block to the thermistor is short-circuited or snapped. Check the wiring as far as the connection of the thermistor. (The connection may have a faulty contact.) b) Disconnect the thermistor's wiring from the terminal block of the controller body, and measure an insulation resistance value between the thermistor's wiring and OILMATIC body earthing conductor(E-terminal), using an insulation resistance tester. It is normal if the value is $2 M\Omega$ or more at $500V$.</p>	<p>When the thermistor body is improperly insulated or snapped or shortcircuited, replace it. Operating conditions of the refrigeration circuit when the thermistor is snapped or short-circuited</p> <table border="1"> <tr> <td>Oil(liquid) temperature detection thermistor is short-circuited or room temperature detection thermistor is snapped</td> <td>Continuous operation</td> </tr> <tr> <td>Oil(liquid) temperature detection thermistor is snapped or roomtemperature detection thermistor is short-circuited</td> <td>Stop</td> </tr> </table>	Oil(liquid) temperature detection thermistor is short-circuited or room temperature detection thermistor is snapped	Continuous operation	Oil(liquid) temperature detection thermistor is snapped or roomtemperature detection thermistor is short-circuited	Stop
Oil(liquid) temperature detection thermistor is short-circuited or room temperature detection thermistor is snapped	Continuous operation					
Oil(liquid) temperature detection thermistor is snapped or roomtemperature detection thermistor is short-circuited	Stop					
<p>D. Others</p>	<p>a) When the refrigerator does not start, the protective device may be functioning. Check each protective device as well. b) For the OILMATIC with low-temperature protective thermostat(optional), when an oil temperature is too low($10^\circ C$ or less), the protective thermostat is activated and the refrigerator may not start. c) When the set oil temperature differs from the indication of the OILMATIC's thermostat, the following causes are possible. ① The thermometer is out of order(the indication error of the thermostat is normally within $\pm 2^\circ C$). ② A room temperature(reference temperature) detection thermistor is exposed to hot air and detects a temperature higher than an ambient temperature. ③ A setscrew for the oil temperature setting dial has been loosened and the dial does not indicate a specified temperature.</p>	<p>Refer to the electric control circuit. c)-② Think of using a cover, screen, etc. to protect against the hot air. c)-① It is necessary to readjust the zero point.</p>				

Equipment Replacement Standards

(1) Equipment with an insulation resistance of not more than 0.2 megohm should be replaced.

(2) Instruments(Pressure gages, thermometers, etc.):

When an instrument shows an indication error of one scale point or more, it should be replaced.

(3) Main Equipment(refrigeration compressors, expansion valves, pumps, heaters, motors, etc.):

Equipment operating for 5 years or 10,000 hours or less should be replaced or overhauled.

Frequent ON-OFF relays and refrigeration compressor relays should be replaced.

* Users are requested to judge the timing of replacement according to the conditions of maintenance and use.

* We recommend replacement of OILMATIC which has been operating for eight years or less.

Electric Circuit Component Parts

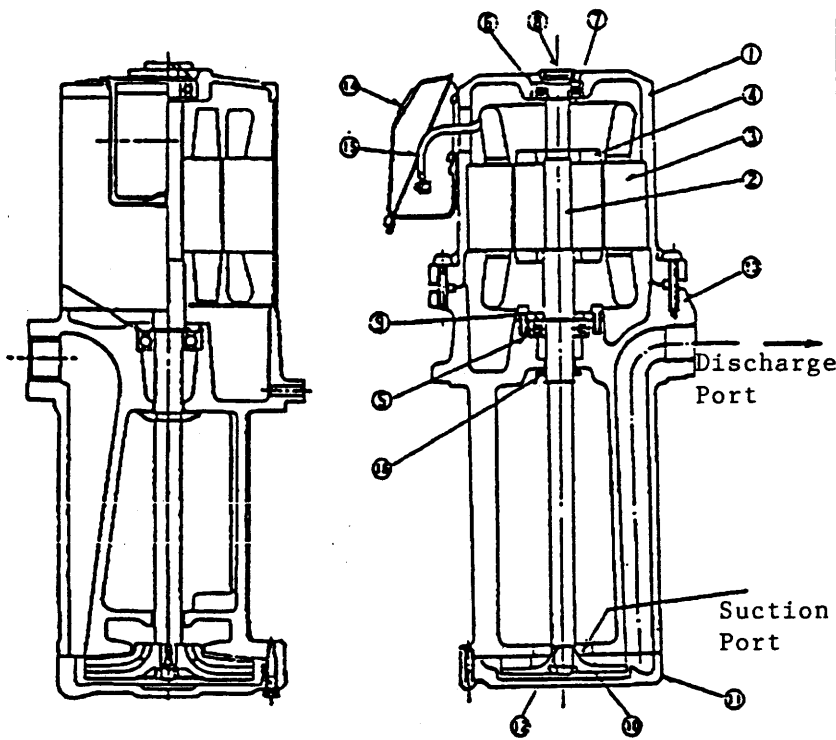
Symbol	Name	Specification	Q'ty	Type	Maker	Remarks
ATA1	Temperature regulator	Ref. temperature follow-up type, Ref. temperature $\pm 5^{\circ}\text{C}$	1	KT2-F05-200	KANTO SEIKI	
CB	Circuit breaker	3P AC220V 10A	1	E30C-3P 10A	TOSHIBA	
CR1	Auxiliary relay	2ab contact 200/220V 50/60Hz	1	MY2 200V FYF08A	OMRON	
F1	Fuse	Cartridge fuse 1A	1	F-7111(holder)	SATO PARTS	
F2	Fuse	Cartridge fuse 1A	1	F-7111(holder)	SATO PARTS	
M1	Pump motor	200Q4P 200V 50/60Hz 220V 60Hz3 ϕ	1	TOP-2MY200	NOP	
M2	Compressor	Nominal capacity 500W 2P 200V 50/60Hz	1	C-R53H3W	SANYO ELECTRIC	
M21	Fan motor	12W4P 200V 50/60Hz 220V 60Hz1 ϕ	1	BP-12S-255B	SHIBURA SS	
MS1	Thermal relay	Auxiliary contact 1a.200V 50/60Hz 220V60Hz	1	ML1A-W 200V	TOSHIBA	
OL1	Thermal relay	Set value 1.6 A, 3-pole 2-element, manual reset type	1	Integrated with MS1		
MS2	Electromagnetic switch	Auxiliary contact 1a.200V 50/60Hz 220V60Hz	1	ML1A-W 200V	TOSHIBA	
OL2	Thermal relay	Set value 3.0 A, 3-pole 2-element, manual reset type	1	Integrated with MS2		
PL1	Operation indicator lamp	200-220V AC, white neon globe	1	LMU-6H 220V W	SAKAZUME SS	
PL2	Operation indicator lamp	200-220V AC, white neon globe	1	LMU-6H 220V W	SAKAZUME SS	
RP	Negative-phase protective relay	3ph 200V 50/60Hz "OFF" at negative phase	1	RDR-S-1	SANYO ELECTRIC	
SK	Spark killer	Rated voltage 350VAC(0.1 μ F+120 Ω)	3	953M500310411	MATSUO DENKI	
SK3	Spark killer	Rated voltage 250VAC(0.47 μ F \times 3)	2	RFM2E145KPD	MARUKON DENSHI	
SS1	Start switch	Selector switch, 2-notch(1a contact)	1	ASS210N	IZUMI DENKI	
TH1	Liquid temperature detection thermistor	PT screw mounting type PT1/8" 5K Ω	1	TCA25P5KPT	KANTO SEIKI	
TH2	Ref. temperature detection thermistor	Mold type(temperature regulator accessory)	1	502AT-1NW		
THP	M2 thermal protector	Off by excessive increase of the dome temperature, automatic reset	1	Attached to M2		
VR	Temperature setting VR	(Temperature regulator accessory)	1	BIK Ω		

Oil Circuit Component Parts

Symbol	Name	Specification	Q'ty	Type	Maker
000	Compressor(ass'y)	Nominal capacity 500W 2P 200V 50/60Hz	1	806 503 83	SANYO ELECTRIC
011	Condenser	4-row 13-stage, Type 5	1	01108	KANTO SEIKI
020	Cooler(enclosed type)	Type 5C	1	02002	KANTO SEIKI
051	Trochoid gear pump motor	200W set pressure 5kg/cm ²	1	2MY200-208HAEMWK	NOP
081	Fan motor	12W4P 200V 50/60Hz 220V 60Hz 1φ	1	BP-12S-255B	SHIBAJURA SS
203	Dryer	For 500W, 140mm(for capillary)	1	KC-6476-00	KAWAMURA SEIKAN
204	Service valve	Pressure resistance 30kgf/cm ² G	1	ZVH-W	NICHIDEN
380	Capillary tube	Type 5	1	38007	KANTO SEIKI
431	Sensor	Thermistor φ 5X50 PTL/8	1	TCAT25P5KPT-01M	KANTO SEIKI

3. COOLANT PUMP

3.1 Flood Coolant Pump(Standard Attachment) LSW 15A 0.18 and Gun Coolant Pump(Optional Attachment) VKP-071A



LSW15A0.18

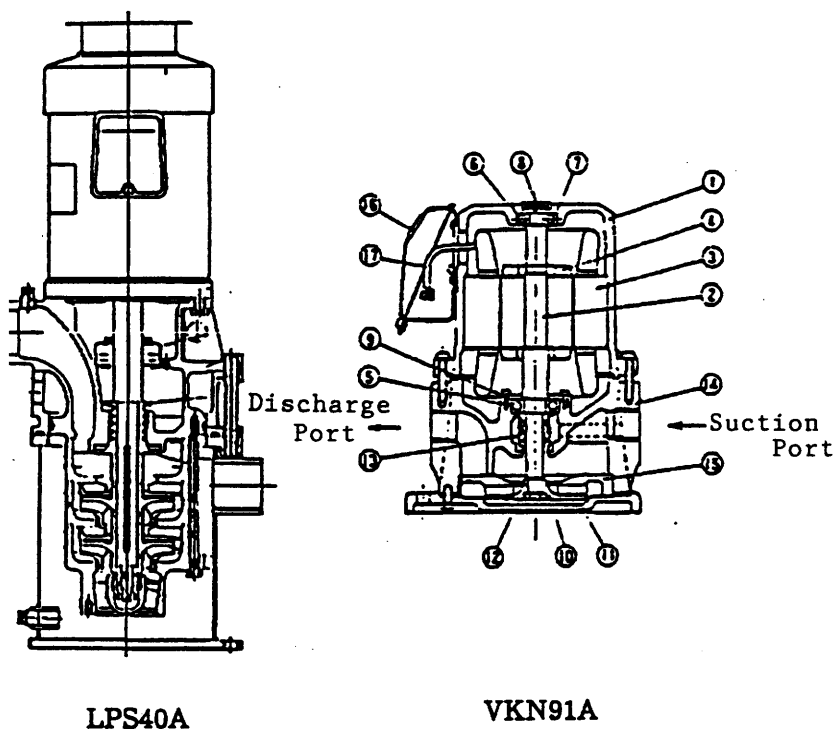
VKP-071A

Parts List

1	Frame
2	Shaft
3	Stator
4	Rotor
5	Operationside bearing
6	Non-operation-side bearing
7	Corrugated washer
8	Rotating direction inspection window
9	End cover
10	Runner
11	Spiral box
12	Adjusting washer
13	Pump leg
14	Terminal box
15	Terminal cable
16	Oil thrower

Specification	Type	LSW15A0.18		VKP071A	
Application		For flood coolant		For gun coolant	
Output	[W]	180		180	
Rated voltage	[V]	200	200, 220	200	200, 220
Frequency	[Hz]	50	60	50	60
Rated current	[A]	1.1	1.2	0.85	1, 1
Discharge rate	[ℓ /min]	10~60		75	100
Total lift	[m]	9~5	13~8	3	
Working viscosity limit [Redwood second]		150(CST)	75(CST)	1200	600
Standard piping diameter		1/2		1/2	
Painting color	[PS]	Munsell 7.5B 5/7.5		Dark green FM	
Pump standard				JEM1242	
Rough weight	[Kg]	13	14	10.2	
Remarks					

3.2 Jet Coolant Pump (Optional Attachment) VKN 91A, LPS 40A

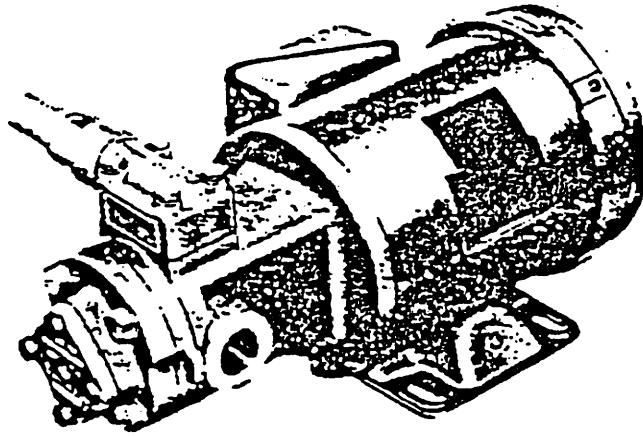


1	Frame
2	Shaft
3	Stator
4	Rotor
5	Operation-side bearing
6	Non-operation-side bearing
7	Corrugated washer
8	Rotating direction inspection window
9	End cover
10	Runner
11	Bottom plate
12	Adjusting washer
13	Mechanical seal
14	Casing
15	Spiral box
16	Terminal box
17	Terminal cable

Specification	Type	VKN91A		LPS40A	
Application		For flood coolant		For gun coolant	
Output	[W]	400		750	
Rated voltage	[V]	200	200, 220	200	200, 220
Frequency	[Hz]	50	60	50	60
Rated current	[A]	2.4	2.5, 2.4	3.2	3.3, 3.0
Discharge rate	[ℓ /min]	140	200	75	100~ 300
Total lift	[m]	5		10~ 5	15~ 8
Max. suction pipe length	[m]	0.7		0.7	
Working viscosity limit [Redwood second]		800	300	32(CST)	
Standard piping diameter	[PS]	1		1-1/2	
Painting color		Dark green FM			
Pump standard		-			
Rough weight	[Kg]	12.6		41	
Remarks					

3.3 Oil Hole Coolant Motor and Pump (Optional Attachments)

TOP-2MY-400-206-HWM-VB5

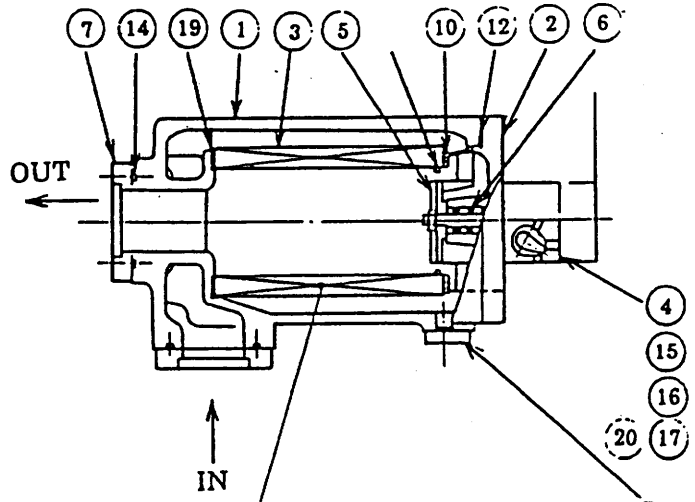
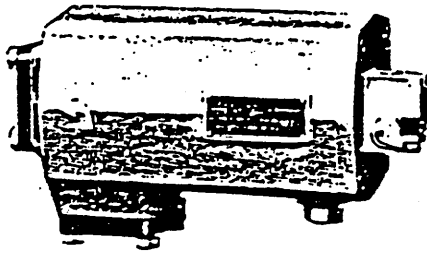


Motor Used YASUKAWA ELECTRIC MFG.

Output (W)	Type	Frame No.	Poles (P)	Rating	Voltage	Frequency	Rotation Freq.	Current	Weight
→ 400	FEL-8	71HTB	4	Contin- uous	200	50	1430	2.2	10.0
					200	60	1710	2.1	
					220	70	1730	2.1	

Pump type	50Hz 4p(1500rpm)					60Hz 4p(1800rpm)				
	Discharge rate ℓ /min	Max. output to motor output				Discharge rate ℓ /min	Max. output to motor output			
		200W	400W	750W	1500W		200W	400W	750W	1500W
→ TOP-206HWM	9.0	3.0	10.5	25.0		10.8	2.0	7.0	23.5	25.0

Filter Unit ISH-04-100W



Spare Element P-ISH-100W

Parts List for ISH-04-100W

20	Backup ring	Teflon	1	11.25x φ 8.4/φ 5
19	Packing	NBR	1	
18	O-ring	NBR	1	"
17	O-ring	NBR	1	"
16	O-ring	NBR	1	"
15	O-ring	NBR	1	"
14	O-ring	NBR	2	"
13	O-ring	NBR	1	"
12	O-ring	NBR	1	JISB2401.1A
11	Drain plug	SCM3	1	
10	Flat spring	SK5	1	
9	Hexagon socket head bolt	SCM3	4	
8	Bolt	SS41	8	
7	Phase flange	SS	2	
6	Spring	SWPA	1	
5	Relief valve	BSC	1	
4	Indicator		1 set	
3	Element	SUS304 SPCC	1 set	P-ISH-04-100W
2	Lid	AC2B	1	
1	Main body	AC2B	1	
No.	Name	Material	Q'ty	Remarks

1. This cased filter is very light and solid. It consists of a aluminum alloy housing, stainless element, indicator, and relief valve.
2. Since it is a horizontal type filter, the element can be pulled out in the horizontal direction even if there is no space above.
3. The element uses stainless wire nets of 60, 100, 150, and 200 meshes as standard specifications.
4. Clogging of the filter element can be confirmed with the indicator.
5. The built-in relief valve prevents a danger caused by clogging.

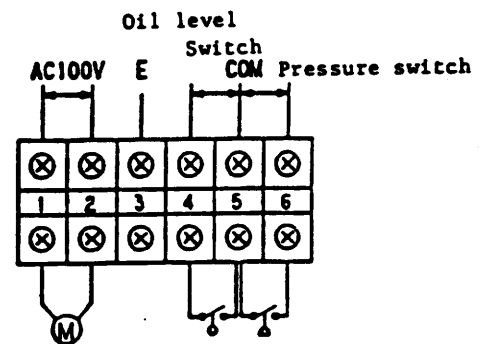
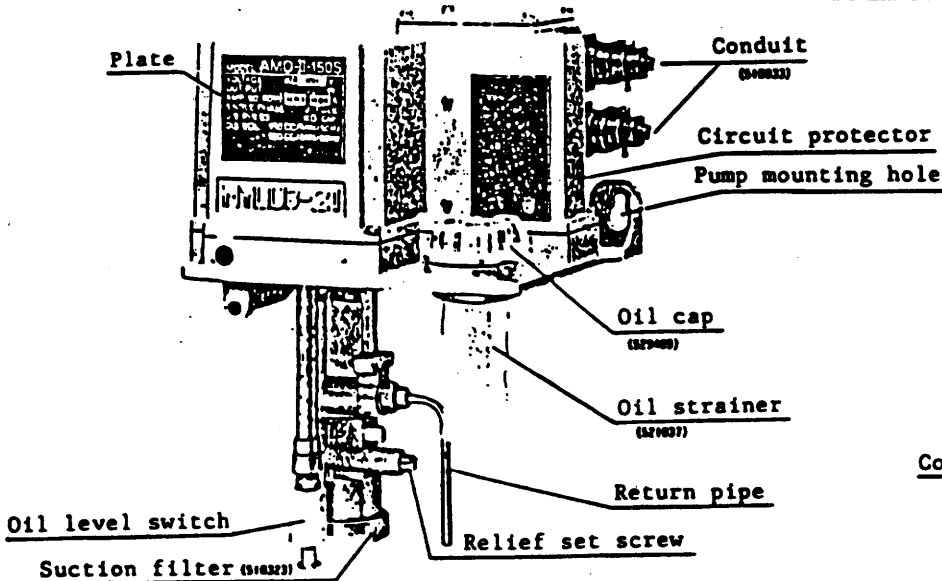
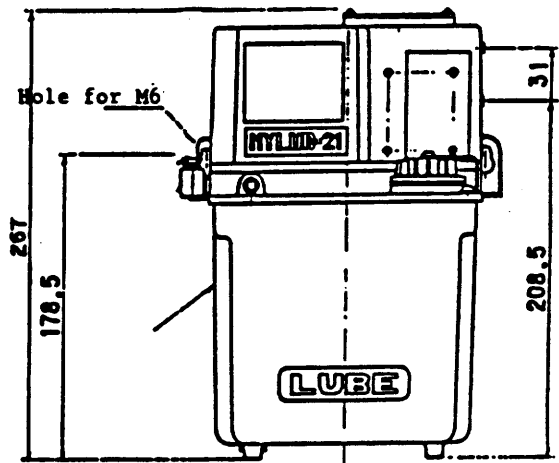
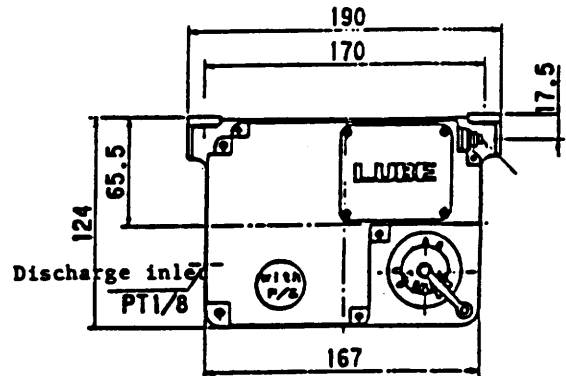
O-rings and Packings List

No. Type	12	13	14	15	16	17	18	19
ISH-03	G65	G35	G30	P15	P14	P5	P11	12x φ 65/φ 40
ISH-04								12x φ 85/φ 55
ISH-06								12x φ 100/φ 70
ISH-08	G90	G45	G45	P15	P14	P5	P14	12x φ 120/φ 85
ISH-10								12x φ 140/φ 105
ISH-12	G100	G65	G55					
ISH-16	G125	G80	G70					
ISH-20	G145	G100	G95					
ISH-24								

4. Lubrication Pump

AMO-II-150S Model pump

Model	AMO-150SA-18LP-P
Code No.	202562
Motor	AC100V 20W 50/60Hz 0.83/0.64 A (50/60Hz)
Discharge volume	150cc/min 50Hz 180cc/min 60Hz
Discharge pressure	12Kgf/cm ² (Relief setting pressure)
Range of applicable viscosity	68 - 1800cSt
Range of applicable temperature	-5°C ~ +40°C
Oil level switch	Applicable Max. voltage : AC, DC200V Contactor type : A (ON at lower limit) Contactor capacity : 30W or 0.5A (Resistance load) Whichever smaller one.
Pressure switch	Capacity : AC120/240V-125VA AC, DC28V-2A Model : A Operating pressure : 11Kgf/cm ² ON Resumed pressure : 6Kgf/cm ² OFF
Tank	Full capacity : 1.8 ℓ Effective capacity : 1.5ℓ (H-O/L)



Connecting diagram of terminal

- Note
1. Lubricant should be used recommended clean one.
 2. A suction filter should be replace or clean once a year or more.
 3. Avoid a use of this pump in the atmosphere with high produce of corrosive gas, dust, lmmidity (Within 35 ~ 85%HR).

5. Pneumatic Devices

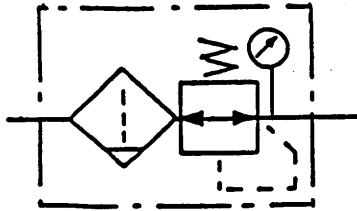
Air filter/regulator unit

Outline and features

SELEX FR unit (W3000) is a unit type combined with a filter F3000 which has high eliminating effect of drip and dust and a regulator R3000 which has accurate and steady pressure setting capability.

It is the most suitable at narrow space.

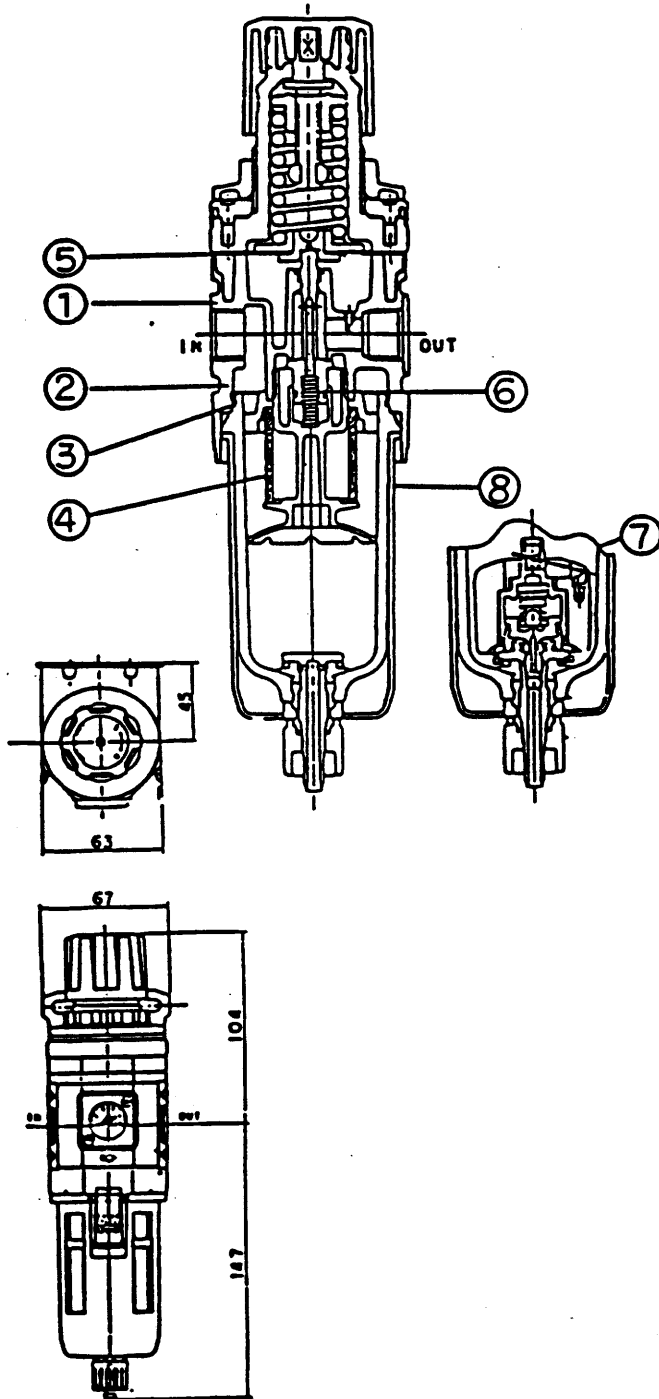
JIS symbol



No.	Part name	Material	Part No.
1	Plate cover	ABS	
2	Body	ADC	
3	O-ring	SP. NBR	F4-550349
4	Element	PP	F4-550350
5	Diaphragm assembly	ZDC.NBR	F4-550464
6	Valve assembly	C3604.NBR	F4-550477
7	Bowl assembly	PC.POM.PUR	F4-550478
8	Bowl guard	PA	F3-550425

Precaution of use

- .Keep away from direct sunlight.
- .Avoid use of chemicals and in the atmosphere such as thinner, carbon tetrachloride, alcohol, chloroform, ethylene trichloride, ester acetate, sulfuric acid or lye, because material of bowl is poly carbonate.
- .To clean a bowl element, use a neutral detergent for household then rinse it by fresh water.
- .Use a pipe with 6mm or more for inside diameter and less than 5m of length and avoid rise up piping.
- .Do not handle with adjusting knob to transfer the commodity or swing around.



Principle of the movements of the automatic drain with manual discharger
(W3000-8-F)

When no pressure acts upon the inside of the bowl, the valve ⑫ is forced up by the spring ⑩ to be in the state detached from the stem packing ⑤.

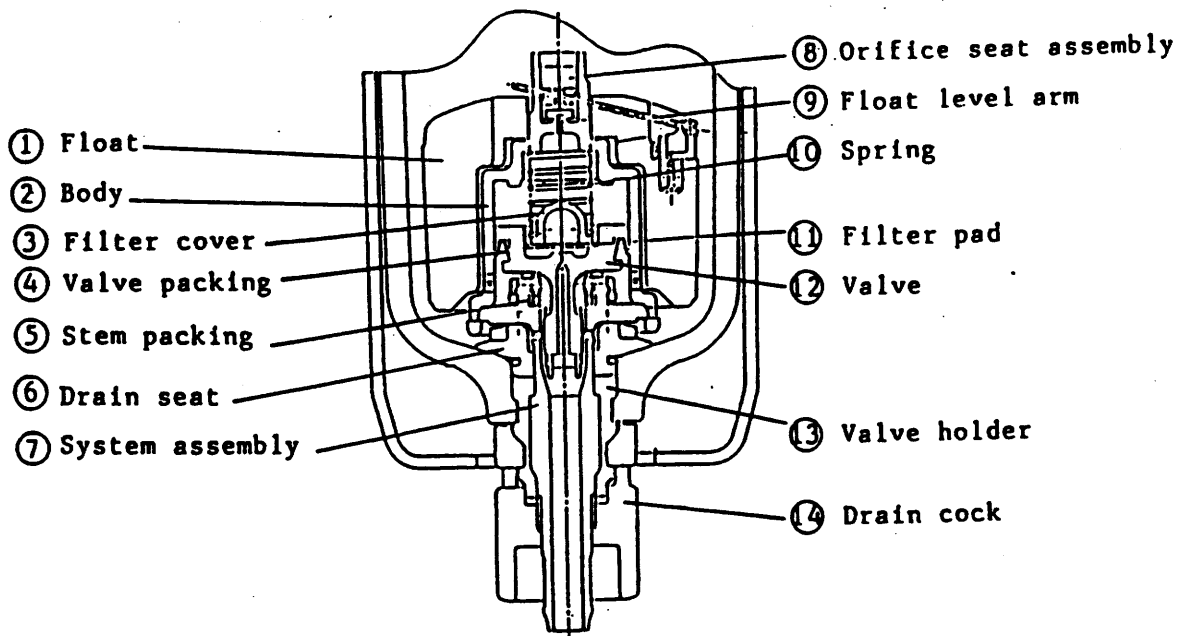
If more than 1 Kgf/cm² of pressure acts upon the inside of the bowl, the receiving pressure of the valve ⑫ becomes larger than the force of the spring ⑩, and the valve ⑫ is forced up and sealed with the stem packing ⑤. Next, when drain is accumulated in the bowl, the float ① is elevated and the Orifice seat assembly ⑧ is opened by the float level arm ⑨. Then, pressed air is guided into the upper chamber of the valve ⑫, and the valve becomes pressurized state. And the valve ⑫ is forced down, and when it parts from the stem packing ⑤, drain is discharged into the atmosphere through following the arrow mark.

When drain is discharged, the float ① is lowered and the Orifice seat assembly ⑧ is closed by the float level arm ⑨.

Then, pressurized air is discharged into the atmosphere through the Orifice of the valve ⑫.

Whereupon, the receiving pressure of the valve ⑫ from the lower part exceeds the force of the spring ⑩ and the valve ⑫ is lifted up and sealed with the stem packing ⑤. As a manual discharging device is built in this model of machine, it can be used as a manual drain.

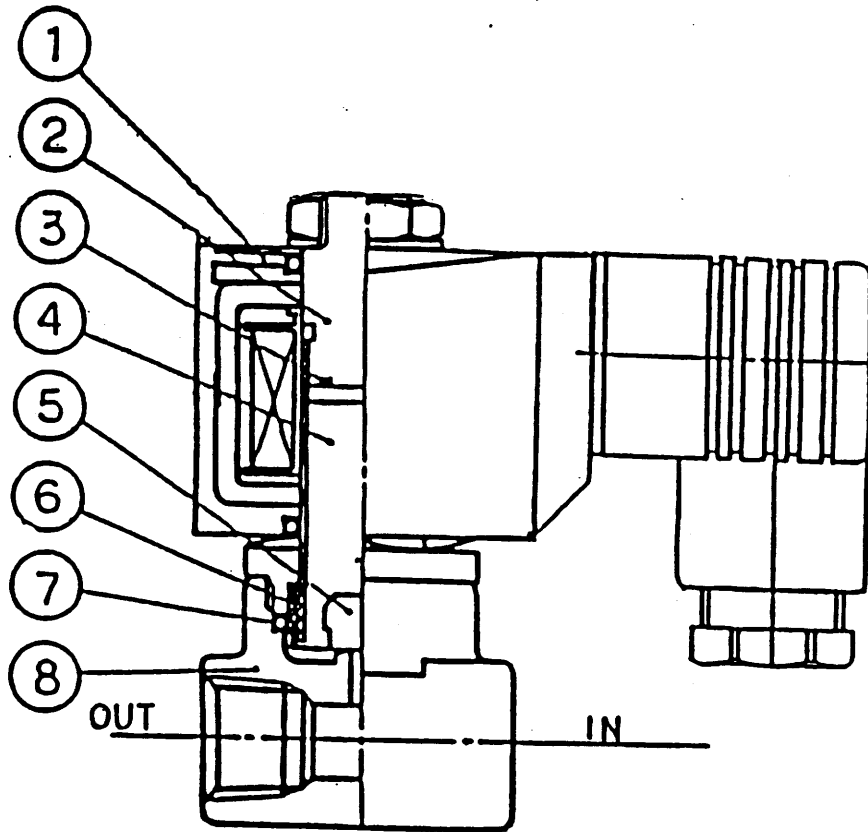
The tube connected to the drain line shall be of ID ϕ 6mm and within 5mm long.



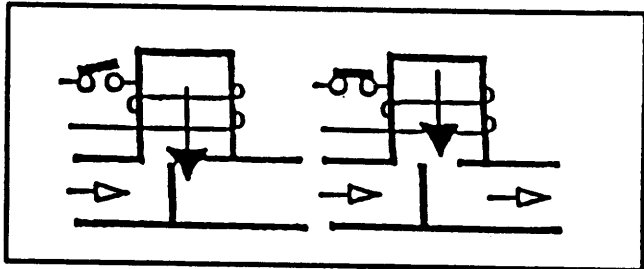
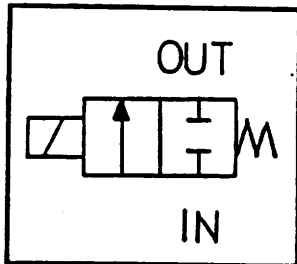
When the phenomena such as the below occur, replace it with a new parts (Bowl assemble F4-550178).

- a. Drain is not discharged automatically.
- b. Air is leaking ceaselessly from the drain port.

AB41-02-5-02G-AC100V



JIS symbol



No.	Part name	Material
①	Coil	Resin
②	Core assembly	SUS405, 316L. 403
③	Shudding coil	Cu
④	Plunger	SUS405
⑤	Seal	NBR
⑥	Spring	SUS304
⑦	O-ring	NBR
⑧	Body	C3771

Chapter 12 EXPENDABLE PARTS LIST

VG45 Expendable parts list of standard machine

No.	Code No.	Description	Model	Q'ty
Column related				
1	2741-10-430-00	Wiper	(SS-3)	8
2	2772-01-432-00	Wiper	(SH-8)	1
3	2772-01-440-00	Wiper	(SS-3, SS-6)	1
4	2772-01-441-00	Wiper	(SS-3, SS-6)	1
5	2772-01-442-00	Wiper	(SS-3)	1
6	2772-01-443-00	Wiper	(SS-3)	1
7	2772-01-431-00	Plate spring	(SUS304, Plate spring)	1
8	03999007843	Angular ball bearing	40TAC9OBSU C10 PN7B	6
9	04999010291	Packing	CPI D=90 FC 0157C0	1
10	05905500520	Poly urethane foam	10 x 12	0.6m
Bed related				
1	06315100900	O-ring	15L93	4
2	2741-10-434-00	Wiper	(SS-3)	4
3	2772-01-435-00	Wiper	(SS-3, SS-6)	2
4	2772-01-463-00	Wiper	(SS-3, SS-6)	2
5	2752-01-453-00	Coil spring		2
6	02341300300	Limit switch	LDV-5412	1
7	03999007812	Angular ball bearing	BST30*62-1BP4	6
8	05905500520	Poly urethane foam	10*12	0.7m
9	2722-00-525-10	Slide cover	For Y axis	1
Table related				
1	2764-10-431-00	Piece	(Brush No.3)	2
2	02341201450	Limit switch	SL1-A	3
3	03999007812	Angular ball bearing	BST30*62-1BP4	6
Head related				
1	06315100900	O-ring	15L9	1
2	2741-05-444-10	Wiper	(SS-6)	10
3	2741-05-445-00	Wiper	(SS-3)	2
4	2772-05-440-00	Wiper	(SS-3)	1
5	2772-05-441-00	Wiper	(SS-3)	1
6	2000-91-193-00	Coil spring		16
7	2772-05-333-00	Packing	(NBR)	1
8	2772-49-430-00	Hose assembly		1

No.	Code No.	Description	Model	Q'ty
9	02341300300	Limit switch	LVD-5412	1
10	04133108210	Electro-magnetic valve	AB41-02-5-02G-AC100V	1
11	04999003420	Electro-magnetic valve	VXD2130-02-1DS-B	1
12	2772-00-304-00	Angular ball bearing	HSB020T2DB/G05P4	1
Tool lock related				
1	06315108500	O-ring	15L85	1
2	06315101200	O-ring	15L12	1
3	06326045000	Dust seal	26L45	
4	02341201470	Limit switch	SL1-H	2
5	04824430160	SKY packing	SKY-45	1
6	04824440150	SKY packing	SKY-85	
7	04999025435	Electro-magnetic valve	KSO-G02-2BA-10-N	1
Draw bar related				
1	06315104500	O-ring	15L45	2
2	06315104800	O-ring	15L48	1
3	03999004039	Wear ring	S55906-540-47A	1
4	04824420170	SKY packing	SKY-25	1
5	04824430030	SKY packing	SKY-40	1
6	2741-00-574-00	Coil spring	TB50*300 Special	1
Power source related				
1	04133108210	Electro-magnetic valve	AB41-02-5-02G-AC100V	1
F. Coolant pump				
1	2772-47-345-00	Seat	(NBR)	1
2	04133108210	Electro-magnetic valve	AB41-02-5-02G-AC100V	1
3	2741-00-212-00	Coolant pump	LSW25A0.4-280	1
ATC related				
1	06315100900	O-ring	15L9	8
2	06315101200	O-ring	15L12	1
3	06315102000	O-ring	15L20	1
4	06315102400	O-ring	15L24	1
5	2711-70-506-00	Spring/C coil		2
6	2732-49-191-00	Spring/C coil		2
7	2732-70-175-12	Plate	(Spring steel t 0.3)	1
8	2732-70-177-10	Spring/C coil		1
9	2732-70-413-00	Roller		2

No.	Code No.	Description	Model	Q'ty
10	2741-70-500-01	Spring/C coil		2
11	2772-49-431-10	Hose saaembly		1
12	2772-70-431-00	Plate spring	(SUS)	1
13	2772-70-445-00	Spring/C coil		2
14	02999052462	Proximity switch	FL7M-3J6HD-L5	8
15	02999052479	Proximity switch	FL7M-7J6HD-L5	1
16	02999055650	Proximity switch	FL7M-3J6HD-L10	4
17	03660144000	Deep groove ball bearong	6014ZZ	2
18	03660202000	Deep groove ball bearing	6020Z	2
19	03662094000	Deep groove ball bearing	6209ZZ	3
20	03668187000	Deep groove ball bearing	6818VV	1
21	03669090000	Deep groove ball bearing	6909	2
22	03821115010	Reller follower	NA2202LL	1
23	03865119040	Cam follower	CF8UUR	2
24	03913112150	Bushing	70B-1215	1
25	03913220150	Washer	70W-2-15	4
26	03990000400	Spherical bearing	GE 20EC	2
27	04824420460	SKY packing	SKY-14	2
28	04824820090	SER scraper	SER-	2
29	04824420080	SKY packing	SKY-	2
30	04824520140	SDR scraper	SDR-18	1
31	04824820120	SER scraper	SER-18	1
32	04824430160	SKY packing	SKY-45	2
33	04829020330	Wear ring	S55904-300-47A	3
34	04999008906	O-ring	S85	2
35	04999025774	Electro-magnetic	KSO-G02-2CA-10-A	5
Splash guard related				
1	02999021329	Fluorescent lamp	JF21220/FZ20111800 Task light 1 set	1
2	03660005000	Deep groove ball bearing	6000LLU	4
3	05902200010	Bearing	NBM-6 6*24*12	4
4	05999037516	Roller chain	RS35*173 link - JL. with JL	2
Spiral C/V related				
1	04999033760	O-ring	JIS B2401-1	1

VK45II Main Body Standard Consumable Parts List

No	Code No.	Part Name	Type	Q'ty	Remarks
Column					
1	2736-01-434-01	Cover		1	
2	03999007812	Angular ball	BST30×62-1BP4	3	NTN
3	02341300760	Limit switch	LDV-5312	1	YAMATAKE
Bed					
1	03999007812	Angular ball	BST30×62-1BP4	3	NTN
2	2736-00-505-00	Slide cover	For Y-axis	2	ISOBE
Table					
1	02341201450	Limit switch	SL1-A	3	YAMATAKE
2	03999007812	Angular ball	BST30×62-1BP4	3	NTN
3	2736-00-503-00	Slide cover	For X-axis right	1	ISOBE
4	2736-00-504-00	Slide cover	For X-axis left	1	ISOBE
NT40 Head					
1	02341300760	Limit switch	LDV-5312	1	YAMATAKE
2	2764-00-310-00	Angular ball	ACH015CA-1DBB2	1	KOYO
3	2764-00-307-00	Deep-groove ball	6011C2	1	KOYO
4	2000-91-193-00	Spring/coil		8	
5	04133108210	Solenoid valve	AB41025-02G-AC100V	1	CKD
6	04999003420	Solenoid valve	VXD2130-02-1DS-B	1	SMC
NT50 Head					
1	02341300760	Limit switch	LDV-5312	1	YAMATAKE
2	2732-00-316-00	Angular ball	7018CEX10BT/G4P4	1	NTN
3	03600900120	Deep-groove ball	6215CG10P5	1	NSN
4	2764-06-434-00	Spring/coil		12	
5	04133108210	Solenoid valve	AB41025-02G-AC100V	1	CKD
6	04999003420	Solenoid valve	VXD2130-02-1DS-B	1	SMC
NT40 Tool Lock					
1	06315109000	O-ring	15L90	1	
2	04824440100	packing	SKY-80	1	SAKAGAMI
3	04824430010	Packing	SKY-30	1	SAKAGAMI
4	02341201470	Limit switch	SL1-H	2	YAMATAKE
5	04999025435	Solenoid valve	KSO-G02-2BA-10-N	1	DAIKIN
NT50 Tool Lock					
1	06315108500	O-ring	15L85	1	
2	06315101200	O-ring	15L12	1	
3	06326045000	Dust seal	26L45	1	
4	02341201470	Limit switch	SL1-H	2	YAMATAKE
5	04824430160	Packing	SKY-45	1	SAKAGAMI

No	Code No.	Part Name	Type	Q'ty	Remarks
NT50 Tool Lock					
6	04824440150	Packing	SKY-85	1	SAKAGAMI
7	04999025435	Solenoid valve	KSO-G02-2BA-10-N	1	DAIKIN
NT40 Drawbar					
1	04824420310	Packing	SKY-17255	1	SAKAGAMI
2	04824430010	Packing	SKY-30	1	SAKAGAMI
3	2752-05-490-00	Spring/Coil		1	
4	04829030390	Wear ring	S55906-400-47A	1	CAPTAIN
5	2752-00-507-11	Spring/C-coil	THS909-1	1	TOKYO HATSUJO
NT50 Drawbar					
1	06315104500	O-ring	15L45	2	
2	06315104800	O-ring	15L48	1	
3	03999004039	Wear ring	S55906-540-47A	1	CAPTAIN
4	04824420170	Packing	SKY-25	1	SAKAGAMI
5	04824430030	Packing	SKY-40	1	SAKAGAMI
6	2741-00-574-00	Coil spring	TB50*300 special	1	TOKYO HATSUJO
Flood Coolant					
1	2761-00-222-00	Coolant pump	LSW15A0.18MR	1	KYOKUTO
2	2732-47-239-00	Cover	NBR	1	
ATC					
1	06315100900	O-ring	15L9	8	
2	06315101200	O-ring	15L12	1	
3	06315102000	O-ring	15L20	1	
4	06315102400	O-ring	15L24	1	
5	2711-70-506-00	Spring/C-coil		2	
6	2732-49-191-00	Spring/C-coil		2	
7	2732-70-175-12	Plate	(Spring steel 0.3 thick)	1	
8	2732-70-177-10	Spring/C-coil		1	
9	2732-70-413-00	Roller		2	
10	2741-70-500-01	Spring/C-coil		2	
11	2772-49-431-10	Hose ass'y		1	SHOUNAN
12	2772-70-431-00	Spring/plate	(SUS)	1	
13	2736-71-433-00	Spring/C-coil	(Arm for NT40)	2	
14	02999052462	Proximity switch	FL7M-3J6HD-L5	8	YAMATAKE
15	02999052479	Proximity switch	FL7M-7J6HD-L5	1	YAMATAKE
16	02999055650	Proximity switch	FL7M-3J6HD-L10	4	YAMATAKE
17	03660144000	Deep-groove ball	6014ZZ	2	
18	03660202000	Deep-groove ball	6020Z	2	
19	03662094000	Deep-groove ball	6209ZZ	3	

No	Code No.	Part Name	Type	Q'ty	Remarks
ATC					
20	03668187000	Deep-groove ball	6818VV	1	NSK
21	03669090000	Deep-groove ball	6909	2	
22	03821115010	Roller follower	NA2202LL	1	NTN
23	03865119040	Cam follower	CF8UUR	2	IKO
24	03913112150	Bush	70B-1215	1	Oiless
25	03913220150	Washer	70W-2015	4	Oiless
26	03990000400	Spherical bearing	GE 20EC	2	IKO
27	04824420460	Packing	SKY-14	2	SAKAGAMI
28	04824820090	SER scraper	SER-14	2	SAKAGAMI
29	04824420080	Packing	SKY-18	2	SAKAGAMI
30	04824520140	SDR scraper	SDR-18	1	SAKAGAMI
31	04824820120	SER scraper	SER-18	1	SAKAGAMI
32	04824430160	Packing	SKY-45	2	SAKAGAMI
33	04829020330	Wear ring	S55904-300-47A	3	CAPTAIN
34	04999008906	O-ring	S85	2	NOK
35	04999025774	Solenoid valve	KSO-G02-2CA-10-A	5	DAIKIN
36	2772-70-445-00	Spring/C-coil	(Arm for NT50)	2	
Splash Guard					
1	02999021329	Fluorescent lamp	JF21220/FZ20111800 Task light	1	MATSUSHITA
2	03660005000	Deep-groove ball	6000LLU	4	NTN
3	05902200010	Bearing	NBM-6 6*24*12	4	OCHIAI

