



Maintenance Manual
for
VTC-160A/B, VTC-200B/C & VTC-300C
(Mazatrol Fusion 640M)
Publication # C557MA0014E

3/2000

CAUTION

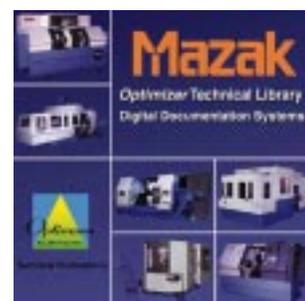
This Manual is published to assist experienced personnel on the operation, maintenance and/or programming of Mazak machine tools.

All Mazak machine tools are engineered with a number of safety devices to protect personnel and equipment from injury or damage. Operators should not, however, rely solely upon these safety devices, but should operate the machine only after fully understanding what special precautions to take by reading the following documentation thoroughly.

Do not attempt to operate or perform maintenance / repair on the machine without a thorough understanding of the actions about to be taken. If any question exists, contact the nearest Mazak service center for assistance.

Certain covers, doors or safety guards may be open or removed to more clearly show machine components. These items must be in place before operating the machine. Failure to comply with this instruction may result in serious personal injury or damage to the machine tool.

This manual was considered complete and accurate at the time of publication, however, due to our desire to constantly improve the quality and specification of all Mazak products, it is subject to change or modification.



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SAFETY PRECAUTIONS

The machine is provided with a number of safety devices to protect personnel and equipment from injury and damage. Operators should not, however, rely solely upon these safety devices, but should operate the machine only after fully understanding what special precautions to take by reading the following documentation thoroughly.

• BASIC OPERATING PRACTICES

DANGER:

- 1) Some control panels, transformers, motors, junction boxes and other parts have high voltage terminals. These should not be touched or a severe electric shock may be sustained.
- 2) Do not touch any switches with wet hands. This too, can produce an electric shock.

WARNING:

- 1) The emergency stop pushbutton switch location should be well known, so that it can be operated at any time without having to look for it.
- 2) Before replacing a fuse, turn off the main incoming power switch to the machine.
- 3) Provide sufficient working space to avoid hazardous falls.
- 4) Water or oil can make floors slippery and hazardous. All floors should be clean and dry to prevent accidents
- 5) Do not operated any switch without a thorough understanding of the actions about to be taken.
- 6) Avoid accidental operation of switches.
- 7) Work benches near the machine must be strong enough to hold materials placed on them to prevent accidents. Articles should be prevented from slipping off the bench surface.
- 8) If a job is to be done by two or more persons, coordinating signals should be given at each step of the operation. The next step should not be taken unless a signal is given and acknowledged.

CAUTION:

- 1) In the event of power failure, turn off the main circuit breaker immediately.
- 2) Use the recommended hydraulic oils, lubricants and grease or acceptable equivalents.
- 3) Replacement fuses should have the proper current ratings.
- 4) Protect the NC unit, operating panel, electric control panel, etc. from shocks, since this could cause a failure or malfunction.
- 5) Do not change parameters or electrical settings. If changes are unavoidable, record the values prior to the change so that they can be returned to their original settings, if necessary.

- 6) Do not deface, scratch or remove any caution plate. Should it become illegible or missing, order another caution plate from the supplier, specifying the part number shown at the lower right corner of the plate.

• BEFORE POWERING UP

DANGER:

Cables, cords or electric wires whose insulation is damaged can produce current leaks and electric shocks. Before using, check their condition.

WARNING:

- 1) Be sure the instruction manual and the programming manual are fully understood before operating the machine. Every function and operating procedure should be completely clear.
- 2) Use approved oil resistant safety shoes, safety goggles with side covers, safe clothes, and other safety protection required.
- 3) Close all NC unit, operating panel, electric control panel doors and covers.

CAUTION:

- 1) The power cable from the factory feeder switch to the machine main circuit breaker should have a sufficient sectional area to handle the electric power used.
- 2) Cables which must be laid on the floor must be protected from hot chips, by using rigid or other approved conduit, so that short-circuits will not occur.
- 3) Before first time operation of the machine after unpacking it or from being idle for a long period of time (several days or more), each sliding part must be sufficiently lubricated. To do so, push and release the pump button several times until the oil seeps out on the sliding parts. The pump button has a return spring, so do not force it to return.
- 4) Oil reservoirs should be filled to indicated levels. Check and add oil, if needed.
- 5) For lubrication points, oil specification and appropriate levels, see the various instruction plates.
- 6) Switches and levers should operate smoothly. Check that they do.
- 7) When powering the machine on, turn on the switches in the following order: first the factory feeder switch, then the machine main circuit breaker, and then the control power on switch located on the operating panel.
- 8) Check the coolant level, and add coolant, if needed.

• **AFTER CONTROL POWER IS TURNED ON**

CAUTION:

When the control power "ON" switch on the operating panel is on, the "READY" lamp on the operating panel should also be on (check to see that it is).

• **ROUTINE INSPECTIONS**

WARNING:

When checking belt tensions, do not get your fingers caught between the belt and pulley.

CAUTION:

- 1) Check pressure gages for proper readings.
- 2) Check motors, gear boxes and other parts for abnormal noises.
- 3) Check the motor lubrication, and sliding parts for evidence of proper lubrication.
- 4) Check safety covers and safety devices for proper operation.
- 5) Check belt tensions. Replace any set of belts that have become stretched with a fresh matching set.

• **WARM UP**

CAUTION:

- 1) Warm up the machine, especially the spindle and feed shaft, by running the machine for 10 to 20 minutes at about one-half or one-third the maximum speed in the automatic operation mode.
- 2) The automatic operation program should cause each machine component to operate. At the same time, check their operations.
- 3) Be particularly careful to warm up the spindle which can turn above 4000 rpm.

If the machine is used for actual machining immediately after being started up following a long idle period, the sliding parts may be worn due to the lack of oil. Also, thermal expansion of the machine components can jeopardize machining accuracy. To prevent this condition, always make sure that the machine is warmed up.

• **PREPARATIONS**

WARNING:

- 1) Tooling should conform to the machine specifications, dimensions and types.
- 2) Replace all seriously worn tools with new ones to prevent injuries.
- 3) The work area should be adequately lighted to facilitate safety checks.

- 4) Tools and other items around the machine or equipment should be stored to ensure good footing and clear aisles.
- 5) Do not place tools or any other items on the headstock, turret, covers and similar places (For T/M).

CAUTION:

- 1) Tool lengths should be within specified tolerances to prevent interference.
- 2) After installing a tool, make a trial run.

• **OPERATION**

WARNING:

- 1) Do not work with long hair that can be caught by the machine. Tie it back, out of the way.
- 2) Do not operate switches with gloves on. This could cause mis-operation.
- 3) Whenever a heavy workpiece must be moved, if there is any risk involved, two or more people should work together.
- 4) Only trained, qualified workers should operate forklift trucks, cranes or similar equipment and apply slings.
- 5) Whenever operating a forklift truck, crane or similar equipment, special care should be taken to prevent collisions and damage to the surroundings.
- 6) Wire ropes or slings should be strong enough to handle the loads to be lifted and should conform to the mandatory provisions.
- 7) Grip workpieces securely.
- 8) Stop the machine before adjusting the coolant nozzle at the tip.
- 9) Never touch a turning workpiece in the spindle with bare hands, or in any other way.
- 10) To remove a workpiece from the machine other than by a pallet changer, stop the tool and provide plenty of distance between the workpiece and the tool (for M/C).
- 11) While a workpiece or tool is turning, do not wipe it off or remove chips with a cloth or by hand. Always stop the machine first and then use a brush and a sweeper.
- 12) Do not operate the machine with the chuck and front safety covers removed (For T/M).
- 13) Use a brush to remove chips from the tool tip, do not use bare hands .
- 14) Stop the machine whenever installing or removing a tool.
- 15) Whenever machining magnesium alloy parts, wear a protective mask.

CAUTION:

- 1) During automatic operation, never open the machine door. Machines equipped with the door interlock will set the program to single step.
- 2) When performing heavy-duty machining, carefully prevent chips from being accumulated since hot chips from certain materials can cause a fire.

• **TO INTERRUPT MACHINING**

WARNING:

When leaving the machine temporarily after completing a job, turn off the power switch on the operation panel, and also the main circuit breaker.

• **COMPLETING A JOB**

CAUTION:

- 1) Always clean the machine or equipment. Remove and dispose of chips and clean cover windows, etc.
- 2) Make sure the machine has stopped running, before cleaning.
- 3) Return each machine component to its initial condition.
- 4) Check the wipers for breakage. Replace broken wipers.
- 5) Check the coolant, hydraulic oils and lubricants for contamination. Change them if they are seriously contaminated.
- 6) Check the coolant, hydraulic oil and lubricant levels. Add if necessary.
- 7) Clean the oil pan filter.
- 8) Before leaving the machine at the end of the shift, turn off the power switch on the operating panel, machine main circuit breaker and factory feeder switch in that order.

• **SAFETY DEVICES**

- 1) Front cover, rear cover and coolant cover.
- 2) Chuck barrier, tail barrier and tool barrier (NC software).
- 3) Stored stroke limit (NC software).
- 4) Emergency stop pushbutton switch.

• **MAINTENANCE OPERATION PREPARATIONS**

- 1) Do not proceed to do any maintenance operation unless instructed to do so by the foreman.
- 2) Replacement parts, consumables (packing, oil seals, O rings, bearing, oil and grease, etc.) Should be arranged in advance.
- 3) Prepare preventive maintenance and record maintenance programs.

CAUTION:

- 1) Thoroughly read and understand the safety precautions in the instruction manual.
- 2) Thoroughly read the whole maintenance manual and fully understand the principles, construction and precautions involved.

• **MAINTENANCE OPERATION**

DANGER:

- 1) Those not engaged in the maintenance work should not operate the main circuit breaker or the control power "ON" switch on the operating panel. For this purpose, "Do not Touch the Switch, Maintenance Operation in Progress!" or similar warning should be indicated on such switches and at any other appropriate locations. Such indication should be secured by a semi-permanent means in the reading direction.
- 2) With the machine turned on, any maintenance operation can be dangerous. In principle, the main circuit breaker should be turned off throughout the maintenance operation.

WARNING:

- 1) The electrical maintenance should be done by a qualified person or by others competent to do the job. Keep close contact with the responsible person. Do not proceed alone.
- 2) Overtravel limit and proximity switches and interlock mechanisms including functional parts should not be removed or modified.
- 3) When working at a height, use steps or ladders which are maintained and controlled daily for safety.
- 4) Fuses, cables, etc. made by qualified manufacturers should be employed.

• **BEFORE OPERATION & MAINTENANCE BEGINS**

WARNING:

- 1) Arrange things in order around the section to receive the maintenance, including working environments. Wipe water and oil off parts and provide safe working environments.
- 2) All parts and waste oils should be removed by the operator and placed far enough away from the machine to be safe.

CAUTION:

- 1) The maintenance person should check that the machine operates safely.
- 2) Maintenance and inspection data should be recorded and kept for reference.



WARNING

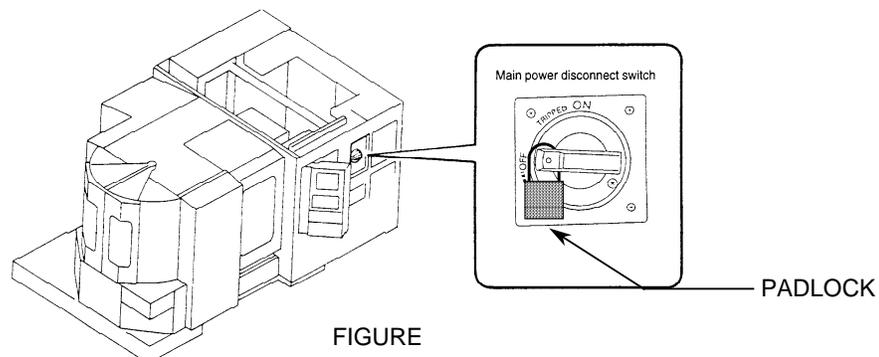
ALWAYS TURN THE MAIN CIRCUIT BREAKER TO THE “OFF” POSITION & USE AN APPROVED LOCKOUT DEVICE WHEN COMPLETING MAINTENANCE OR REPAIRS.

THE LOCKOUT PROCEDURE THAT FOLLOWS IS INTENDED TO SAFEGUARD PERSONNEL & EQUIPMENT DURING MAINTENANCE OPERATIONS, AND, REPRESENTS THE MINIMUM REQUIREMENTS. ANY ACTION SHOULD BE PRECEDED BY A “HAZARD ANALYSIS” TO DETERMINE ANY ADDITIONAL SAFETY PRECAUTIONS THAT MAY BE NECESSARY TO ENSURE THE SAFETY OF PERSONNEL AND EQUIPMENT.

NOTE: USE OF THE FOLLOWING LOCKOUT PROCEDURE IS MANDATORY WHEN COMPLETING MAINTENANCE OR REPAIRS.

LOCKOUT PROCEDURE

- 1) THE LOCKOUT PROCESS MUST BE PERFORMED BY AUTHORIZED PERSONNEL ONLY.
- 2) INFORM ALL EFFECTED PERSONNEL OF YOUR INTENT TO LOCKOUT AND SERVICE THE SPECIFIED MACHINE.
- 3) SHUT OFF MACHINE POWER USING NORMAL SHUT DOWN PROCEDURES.
- 4) TURN OFF THE MACHINE AND INDIVIDUAL BUILDING CIRCUIT BREAKERS. MAKE SURE ALL STORED ELECTRICAL ENERGY IS RELIEVED. (EG: SPINDLE & AXIS SERVO CONTROLLERS)
- 5) CONNECT THE LOCKOUT DEVICE AS SHOWN IN FIGURE 1, AND ATTACH THE APPROPRIATE TAG AT THE MACHINE CIRCUIT BREAKER. THE TAG MUST IDENTIFY THE PERSON RESPONSIBLE FOR THE LOCKOUT. THIS WILL ENSURE THAT POWER CANNOT BE RESTORED BY ANYONE ELSE.
- 6) TEST THE MACHINE TO VERIFY THAT MACHINE SYSTEMS DO NOT OPERATE IN ANY WAY. ONCE TESTING IS COMPLETE, MAKE SURE ALL SWITCHES ARE IN THE “OFF” POSITION. CONFIRM THAT THE LOCKOUT DEVICES REMAIN PROPERLY INSTALLED.
- 7) COMPLETE THE REQUIRED MAINTENANCE OPERATIONS.
- 8) MAKE SURE ALL PERSONNEL ARE CLEAR OF THE MACHINE.
- 9) REMOVE THE LOCKOUT DEVICE. MAKE SURE ALL PERSONNEL ARE AT A SAFE LOCATION BEFORE RESTORING MACHINE POWER.



FIGURE

INSTALLATION PRECAUTIONS

The following subjects outline the items that directly affect the machine installation and start-up. To ensure an efficient and timely installation, please follow these recommendations before calling to schedule a service engineer.

• ENVIRONMENTAL REQUIREMENTS

Avoid the following places for installing the machine:

- 1) Avoid exposure to direct sunlight and/or near a heat source, etc. Ambient temperature during operation: 0° thru 45°C (32°F to 113°F).
- 2) Avoid areas where the humidity fluctuates greatly and/or if high humidity is present; normally 75% and below in relative humidity. A higher humidity deteriorates insulation and might accelerate the deterioration of parts.
- 3) Avoid areas that are especially dusty and/or where acid fumes, corrosive gases and salt are present.
- 4) Avoid areas of high vibration.
- 5) Avoid soft or weak ground (**minimum load bearing capacity of 1025 lbs./ft²**)

• FOUNDATION REQUIREMENTS

For high machining accuracy, the foundation must be firm and rigid. This is typically accomplished by securely fastening the machine to the foundation with anchor bolts. In addition, the depth of concrete should be as deep as possible (minimum 6 - 8 inches). Note the following:

- 1) There can be no cracks in the foundation concrete or surrounding area.
- 2) Vibration proofing material (such as asphalt) should be put all around the concrete pad.
- 3) Form a "cone" in the foundation for J-bolt anchors, or use expansion anchors.
- 4) With the foundation anchor bolt holes open pour the primary **concrete at a minimum thickness of 6 - 8 inches**. Typically, the concrete must have a **minimum compression rating of 2500 lbs. @ 250 lbs. compression** and strengthened with reinforcing rods. When the concrete has cured, rough level the machine, and install the J-bolts, leveling blocks, etc., and pour grout into foundation bolt holes.
- 5) Mix an anti-shrinkage agent such as Denka CSA with concrete, or use Embecco grout to fill the foundation bolt holes.

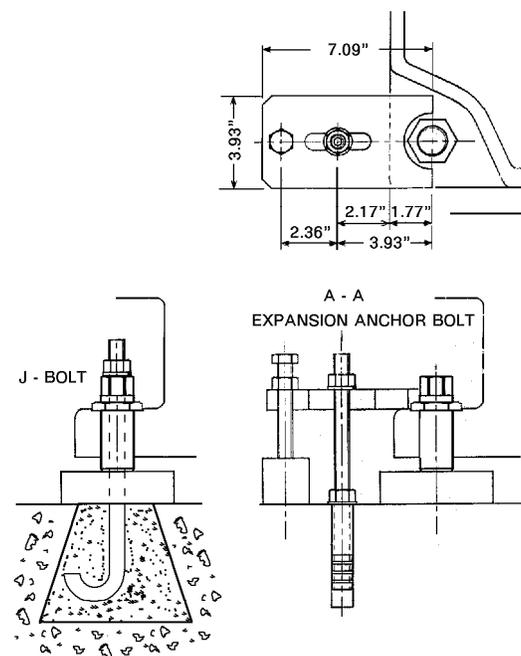
- 6) In pouring grout, fasten the leveling block base plates with the collar retaining screws to prevent the base plates from dropping. When the grout has completely hardened, level the machine properly, and tighten M24 nuts to secure the machine to the foundation.

Note:

The machine must be anchored to the foundation with J-bolts, expansion bolts or other suitable method.

The machine accuracy and alignment specifications quoted by Mazak can usually be obtained when the minimum foundation requirements are met. However, production of close tolerance parts requires the use of an appropriate certified foundation. Foundations that do not meet certified specifications may require more frequent machine re-leveling and re-alignment, which can not be provided under terms of warranty.

If any of these conditions cannot be met, contact the nearest Mazak service office immediately.

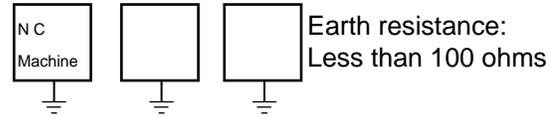


TYPICAL MACHINE HOLD DOWN OPTIONS

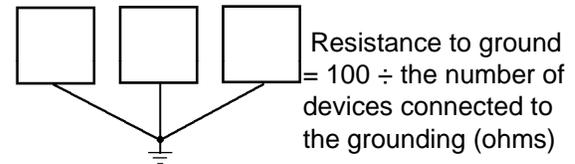
• WIRING

- 1) Use only electrical conductors with performance ratings equivalent or superior.
- 2) Do not connect any power cables for devices which can cause line noise to the power distribution panel, such as arc welders and high frequency machinery.
- 3) Arrange for a qualified electrician to connect the power lines.
- 4) Incoming supply voltage should not deviate more than $\pm 10\%$ of specified supply voltage.
- 5) Source frequency should be ± 2 Hz of nominal frequency.

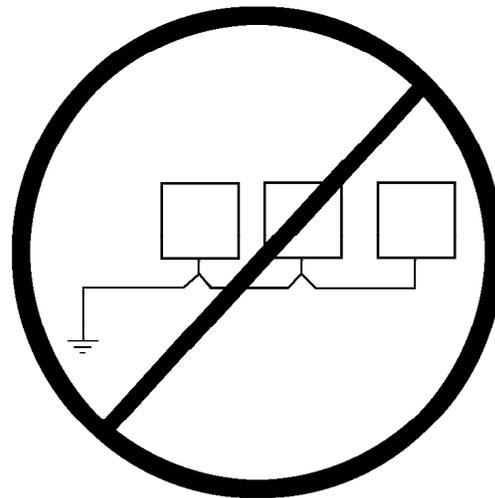
Desirable Independent Grounding:



Common Grounds:



Note: Never ground equipment as shown below:



[CAUTION]

VERIFY THE ACTUAL MACHINE ELECTRICAL POWER REQUIREMENT AND THE MAIN TRANSFORMER RATING (IF APPLICABLE), AS WELL AS THE LOCAL ELECTRICAL CODE BEFORE SIZING AND INSTALLING THE INCOMING POWER WIRING. PLEASE SEE THE ADDITIONAL CAUTIONS ON THE FOLLOWING PAGE.

• GROUNDING

- 1) An isolated earth ground with a resistance to ground of less than 100 ohms is required. Typically, a 5/8" copper rod, 8 feet long, and no more than 5 feet from the machine, is sufficient. Building grounds or multiple machines grounded to the same ground rod, are not acceptable.
- 2) The wire size should be greater than AWG (American Wire Gauge) No. 5 and SWG (British Legal Standard Wire Gauge) No. 6.

**CAUTION**

A step-down transformer is optional on some machine models. Be certain to verify the transformer Kva rating (where applicable), as well as local electrical code requirements before sizing and installing the incoming power wiring.

Machines not equipped with a main transformer are wired for 230 VAC, 3 phase. The end user must supply a step-down transformer where factory electrical power varies more than $\pm 10\%$ of the 230 VAC rating.

NOTE:

Step-down or voltage regulating transformers are external (peripheral) to the machine tool and are considered the primary input line (source) for the machine. Local electrical code or practice may require a circuit breaker or other switching device for the isolation of electrical power when this type of transformer is used. In such cases, the machine tool end user is required to supply the necessary circuit breaker or switching device.

FAILURE TO COMPLY CAN RESULT IN PERSONAL INJURY AND DAMAGE TO THE MACHINE. IF ANY QUESTION EXISTS, CONTACT THE NEAREST MAZAK SERVICE CENTER FOR ASSISTANCE.

**WARNING**

MAZATROL CNC CONTROLLERS PROVIDE PARAMETER SETTINGS TO LIMIT SPINDLE RPM. THESE SETTINGS ARE BASED ON THE MAXIMUM SPEED SPECIFIED BY THE CHUCK/ACTUATOR MANUFACTURER.

MAKE SURE TO SET THESE PARAMETERS ACCORDING TO CHUCK SPECIFICATION WHEN INSTALLING A CHUCKING PACKAGE. ALSO, STAMP THE MAXIMUM SPINDLE RPM ON THE CHUCK IDENTIFICATION PLATE LOCATED ON THE MACHINE TOOL COVERS.

REFERENCE THE CNC PARAMETER MANUAL SUPPLIED WITH THE SPECIFIC MACHINE TOOL TO IDENTIFY THE REQUIRED PARAMETERS TO CHANGE.

FAILURE TO COMPLY WITH THESE INSTRUCTIONS COULD RESULT IN DAMAGE TO THE MACHINE, SERIOUS INJURY OR DEATH.

IF ANY QUESTIONS EXIST, CONTACT THE NEAREST MAZAK SERVICE CENTER FOR ASSISTANCE.

**WARNING**

MAZAK MACHINES ARE ENGINEERED WITH A NUMBER OF SAFETY DEVICES TO PROTECT PERSONNEL AND EQUIPMENT FROM INJURY AND DAMAGE.

DO NOT REMOVE, DISCONNECT, BYPASS OR MODIFY ANY LIMIT SWITCH, INTERLOCK, COVER, OR OTHER SAFETY FEATURE IN ANY WAY, EITHER MECHANICALLY OR ELECTRICALLY.

FAILURE TO COMPLY WITH THESE INSTRUCTIONS COULD RESULT IN DAMAGE TO THE MACHINE, SERIOUS INJURY OR DEATH.

IF ANY QUESTIONS EXIST, CONTACT THE NEAREST MAZAK SERVICE CENTER FOR ASSISTANCE.

**WARNING**

MAZAK MACHINES ARE ENGINEERED WITH A NUMBER OF SAFETY DEVICES TO PROTECT PERSONNEL AND EQUIPMENT FROM INJURY AND DAMAGE.

MACHINE OPERATOR DOORS AND COVERS ARE DESIGNED TO WITHSTAND ACCIDENTAL IMPACT OF A BROKEN INSERT WHERE A MAXIMUM WEIGHT INSERT AT MAXIMUM TOOL DIAMETER IS RUNNING AT MAXIMUM SPINDLE RPM

NEVER USE A CUTTING TOOL OR TOOL INSERT THAT EXCEEDS MACHINE SPECIFICATIONS OR THAT OF A SPECIFIC TOOL HOLDER ITSELF, WHICHEVER IS LESS. THIS RESTRICTION APPLIES TO DIAMETER, WEIGHT, MAXIMUM SPINDLE RPM, MAXIMUM CUTTING TOOL ROTATION SPEED, ETC.

FOR COMPLETE SPECIFICATIONS, MAKE SURE TO REFERENCE OPERATION, MAINTENANCE AND DETAIL SPECIFICATION DOCUMENTATION SUPPLIED WITH THE MACHINE AND BY THE TOOLING MANUFACTURER.

NOTE: THE MAXIMUM INSERT WEIGHT FOR MAZAK MACHINES IS 20 gf. (0.04 lbs.).

FAILURE TO COMPLY WITH THESE INSTRUCTIONS COULD RESULT IN DAMAGE TO THE MACHINE, SERIOUS INJURY OR DEATH.

IF ANY QUESTIONS EXIST, CONTACT THE NEAREST MAZAK SERVICE CENTER FOR ASSISTANCE.

**WARNING**

BEFORE STARTING OPERATION, CHECK THAT THE WORKPIECE IS SECURELY MOUNTED IN A VISE OR A SUITABLE FIXTURE. BE CERTAIN THAT THE MOUNTING IS SUFFICIENT TO WITHSTAND CUTTING FORCES DURING WORKPIECE MACHINING.

FAILURE TO COMPLY WITH THESE INSTRUCTIONS COULD RESULT IN DAMAGE TO THE MACHINE, SERIOUS INJURY OR DEATH.

IF ANY QUESTIONS EXIST, CONTACT THE NEAREST MAZAK SERVICE CENTER FOR ASSISTANCE.

**WARNING**

CONFIRM PROPER WORKPIECE FIXTURING/CLAMPING, TOOL SETUP AND THAT THE MACHINE DOOR IS SECURELY CLOSED BEFORE THE START OF MACHINING.

VERIFY ALL SAFETY PRECAUTIONS OUTLINED IN THIS MANUAL BEFORE USING THE FOLLOWING CUTTING CONDITIONS:

- CUTTING CONDITIONS THAT ARE THE RESULT OF THE MAZATROL FUSION 640 AUTOMATIC CUTTING DETERMINATION FUNCTION
- CUTTING CONDITIONS SUGGESTED BY THE MACHINING NAVIGATION FUNCTION
- CUTTING CONDITIONS FOR TOOLS THAT ARE SUGGESTED TO BE USED BY THE MACHINING NAVIGATION FUNCTION

FAILURE TO COMPLY WITH THESE INSTRUCTIONS COULD RESULT IN DAMAGE TO THE MACHINE, SERIOUS INJURY OR DEATH.

IF ANY QUESTIONS EXIST, CONTACT THE NEAREST MAZAK SERVICE CENTER FOR ASSISTANCE.

DOOR INTERLOCK SAFETY SPEC.

Determined by YMW Eng. H.Q. '99/9/1
Revised by YMC Prod. Eng. '99.10.28

MACHINING CENTER

DOOR	MODE	SET UP SWITCH	
		O (OFF)	I (ON)
OPEN	MANUAL	Prohibit to move axis. Prohibit to start spindle running. Prohibit to operate manual ATC. Prohibit to operate manual Pallet Changer. Prohibit to run chip spiral conveyor.	Limit the rapid override. Max is 12%. Prohibit to run chip spiral conveyor. Can run spindle JOG. Can run spindle Orient. Can operate manual ATC.
	AUTO	Prohibit cycle start. Prohibit to run chip spiral conveyor.	Prohibit cycle start. Prohibit to run chip spiral conveyor.
CLOSE I V OPEN	MANUAL	Door is always locked. Door lock can be released by pushing "DOOR UNLOCK SW" on operator panel. But, it can not release in operating ATC/Pallet changer/Axis/Spindle.	
		Prohibit to move axis. Prohibit to start spindle running. Prohibit to operate manual ATC. Prohibit to operate manual Pallet Changer. Prohibit to run chip spiral conveyor.	Limit the rapid override. Max is 12%. Chip spiral conveyor would stop. Can run spindle JOG. Can run spindle Orient. Can operate manual ATC.
	AUTO	Door is always locked. Door lock can be released by pushing "DOOR UNLOCK SW" on operator panel. But, it can not release in auto operation running except single block stop or feed hold stop or M00 program stop or M01 optional stop and spindle stop . If not, Alarm displayed "Door open invalid".	
		If release the lock by note(*1), Alarm will occur then stop the all motion. Chip spiral conveyor would stop.	Prohibit cycle start. Chip spiral conveyor would stop.
CLOSE	MANUAL	No Limitation.	No Limitation.
	AUTO	No Limitation.	Can not run auto operation.

TURNING CENTER

DOOR	MODE	SET UP SWITCH	
		O (OFF)	I (ON)
OPEN	MANUAL	Can operate CHUCK, TAILSLEEVE , STEADY REST for Loading workpiece. Can NOT operate Spindle, Axis, Turret, Coolant, ToolEye, Partscatcher, Chip Conveyor.	Can operate CHUCK, TAILSLEEVE , STEADY REST for Loading workpiece. Can not operate Spindle running, but Can operate Spindle JOG and Spindle Orient. Limitation of speed for axis movement . (Override is 10% max.) 1 step index only for turret.
	AUTO	Can operate CHUCK, TAILSLEEVE , STEADY REST for Loading workpiece. Can not run Auto-operation.	Can operate CHUCK, TAILSLEEVE , STEADY REST for Loading workpiece. Can not run Auto-operation.
CLOSE -> OPEN	MANUAL & AUTO	Can not open the front door in Spindle running, Axis moving, Auto-running(Cycle start, Feed hold) due to Mechanical locking system. (Except Single Block Stop or M00 program stop or M01 optional stop) But, if release the lock by note(*1), Alarm will occur then stop the all motion.	
CLOSE	MANUAL	No Limitation.	No Limitation.
	AUTO	No Limitation.	Can not run Auto-operation.

*1 : Door lock mechanism can not be released in machine stop by NC power OFF.

If it is necessary to release the lock such as emergencies, the lock can be released by operating the supplementary lock release mechanism of the main body of the safety door lock switch.

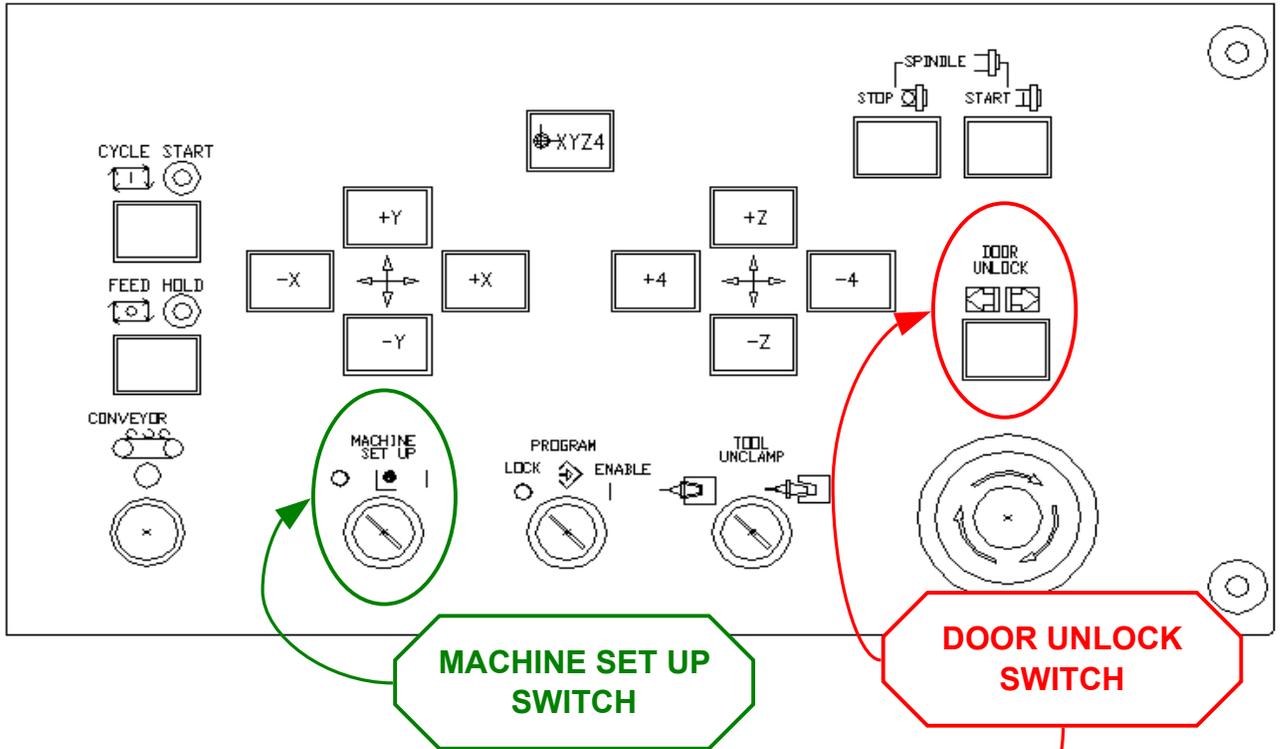
*2 : Override Limitation of Rapid speed of AXIS

Machining Center : 12%. Turning Center : 10%.

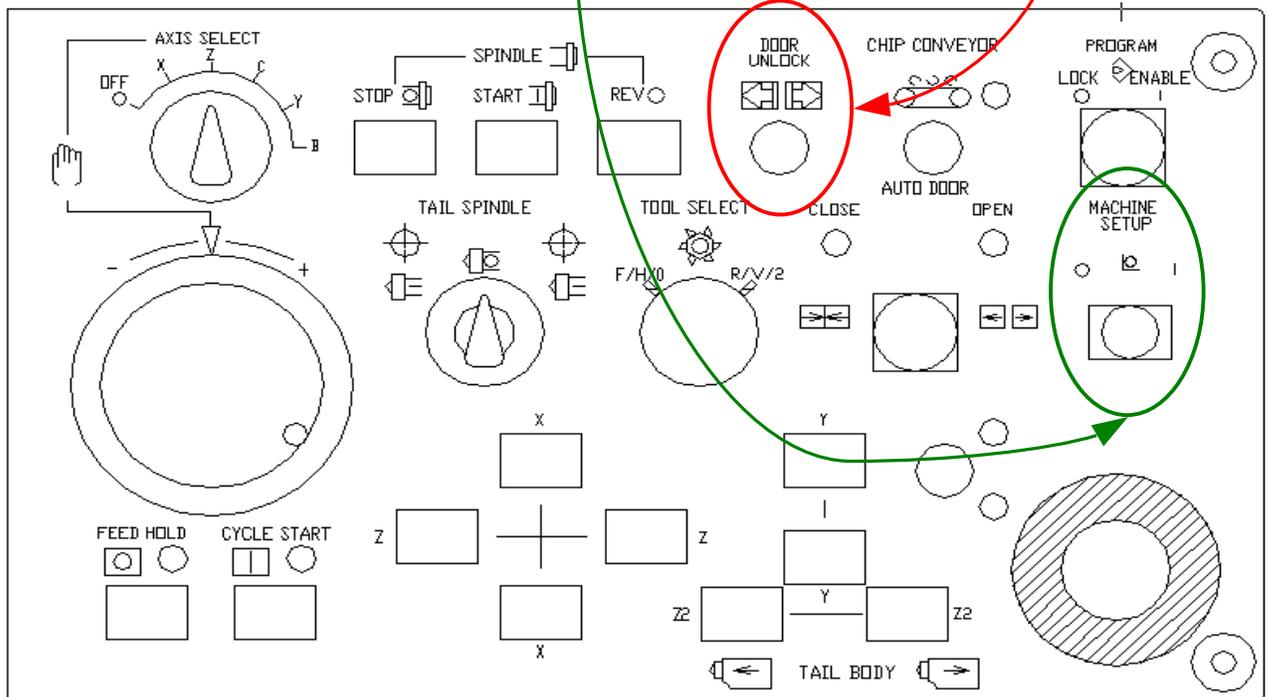
*3 : Chip Conveyor and Coolant should stop in the door open.

APPENDIX

SWITCH PANEL for M640M (Machining Center)



SWITCH PANEL for M640MT/T (Turning Center)



Notes:

1 INTRODUCTION

1-1 List of Related Manuals and Documents

For this model of machine, the following manuals and documents are relevant to this model of machine.

- Operating manual
Describes operation procedure and other general information on operating the machine.
- Maintenance manual
Describes the general information on maintenance including inspection and adjustment procedure.
- Programming manual
Describes the NC programming procedure and related information.
- Tooling manual
Gives the dimensional drawings of tool shank and retention bolt.
- Parameter list
Describes the details of parameters.
- Alarm list
Describes the details of alarms.
- Parts list
Describes the details of parts and the procedure for purchasing the necessary parts.
- Electric circuit diagrams
Shows the wiring diagrams.
- Instruction manuals for optional equipment
Describes operation procedure and other general information on the operation of the optional equipment.

1-2 Pagination

Page numbers are given as two numerals joined by a hyphen. The first number indicates chapter number and the second indicates the page number within that chapter.

Example 1:

Chapter number — 2 — 15 — Page number

If a change which necessitates altering the number of pages arises, additional pages will be inserted. The numbers of these pages will be made up by appending a hyphen and sequential numbers to the number of the page before the addition.

Example 2:

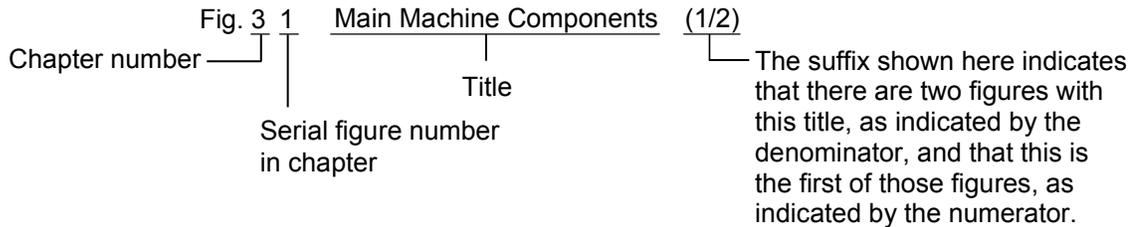
3-16-1 — Additional page

1-3 Numbering of Figures and Tables

1. Figure numbers

Figure numbers consist of the word “Fig.” followed by two numerals joined by a hyphen. The first number indicates the chapter number and the second indicate the serial number in that chapter. The figure number is followed by the title of the figure.

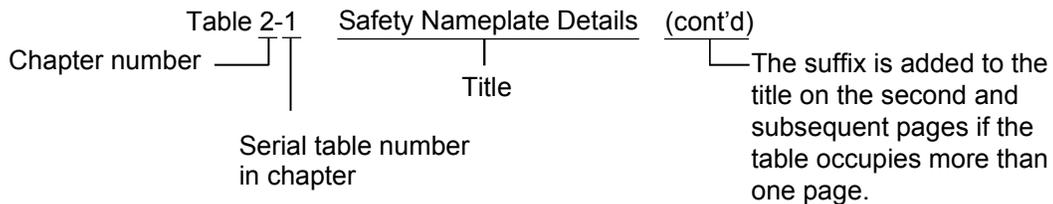
Example 1:



2. Table numbers

Table numbers consist of the word “Table” followed by two numerals joined by a hyphen. The first number indicates the chapter number and the second indicate the serial number in that chapter. The table number is followed by the title of the table.

Example 1:



Note: Some of the figures and tables in this manual are not numbered.

2 SAFETY PRECAUTIONS

The precautions to be observed to ensure safe operation of the machine are described here.

The machine must not be operated until these precautions have been thoroughly understood.

2-1 Rule

1. This section contains the precautions to be observed as to the working methods and states usually expected. Of course, however, unexpected operations and/or unexpected working states may take place at the user site.

During daily operation of the machine, therefore, the user must pay extra careful attention to its own working safety as well as to observe the precautions described below.

2. The meanings of our safety precautions to DANGER, WARNING, and CAUTION are as follows:



DANGER

: Failure to follow these instructions could result in loss of life.



WARNING

: Failure to observe these instructions could result in serious harm to a human life or body.



CAUTION

: Failure to observe these instructions could result in minor injuries or serious machine damage.

2-2 Basic Safety Items



DANGER

- There are high voltage terminals on the electrical control panel, transformer, motors, junction boxes, and other equipment (with a battery warning mark  attached).
- DO NOT touch any of them under any circumstances.
- Make sure that all doors and safety covers are fitted before switching on the power. If any door or safety cover must be removed, shut off and lock the main breaker first.



WARNING

- Memorize the position of the EMERGENCY STOP button so that you can press it immediately from any position.
- Take care not to touch any of the switches accidentally while the machine is in operation.
- Take care not to catch your fingers in the chuck. (For lathes)
- Never touch a rotating workpiece or the tool with your bare hands or any other object.
- To prevent incorrect operation of the machine, carefully check the position of the switches before operation.
- If in the slightest doubt about a procedure, ask the person in charge.
- Always switch off the main power switch on the operation panel and the main power breaker when you are taking a break from work and are going to leave the machine.
- If more than one operator is using the machine, do not proceed to the next step without indicating to the other operator(s) that you are about to do so.
- Do not modify the machine in any way that will affect its safety.
- Do not enter the machine. If you have to enter the machine, take measures such as pressing the EMERGENCY STOP button that disable machine operation.



CAUTION

- If there is a power failure, switch off the main power breaker immediately.
- Do not subject the NC unit, the operation panel, or the electrical control panel to strong shocks.
- Do not change the parameter values, volume values, or other electrical setting values without good reason. If you need to change a value, first check that it is safe to do so, then make a note of the original value so that it can be reset if necessary.
- Do not paint, soil, damage, modify, or remove any of the safety nameplates. If the details become illegible or the nameplate is lost, obtain a replacement by sending the part number stamped at the bottom right-hand corner of the nameplate to Mazak and mount the replacement in the original position. (If a nameplate has been lost, obtain the part number from the "Parts List" supplied separately.)
- Do not open any doors or safety covers while the machine is in automatic operation.
- Stop all machine operations before cleaning the machine or any of the peripheral equipment.
- After a job has been completed, set up each part of the machine so that it is ready for the next series of operations.

2-3 Clothing and Personal Safety



CAUTION

- Tie back long hair, which could become entangled in drive mechanisms.
- Wear safety equipment (helmet, goggles, safety shoes, etc.) whenever possible.
- Always wear a helmet if there are any overhead obstacles in the work area.
- Always wear a protective mask when machining magnesium alloys.
- Always use safety shoes with steel toecaps and oil-resistant soles.
- Never wear loose or baggy clothing.
- Always completely fasten buttons and hooks on the arms of clothing to avoid the danger of entanglement in drive mechanisms.
- Always use gloves when loading or unloading workpieces or tools and when removing chips from the work area to protect your hands from sharp edges and heat generated during machining.
- Do not operate the machine while under the influence of drugs with powerful effects, unprescribed drugs, or alcohol.
- Do not operate the machine if you suffer from dizziness or fainting spells.

2-4 Operational Safety



WARNING

- Close all doors and covers of the NC unit, operation panel, electrical control panel, and junction boxes to prevent damage from water, chips, and oil.
- Check all electrical cables for damage to prevent accidents due to current leakage or electric shock.
- Do not handle coolant with bare hands since it is liable to cause irritation. Operators with allergies should take special precautions.
- Do not operate the machine during violent thunderstorms.
- Check the safety covers regularly to make sure that they are properly filled and that they are not damaged. Repair or replace any damaged covers immediately.
- Always obtain assistance in handling loads beyond your capacity.
- Do not operate forklifts or cranes or carry out slinging work unless you have undergone officially approved training.
- When using forklifts or cranes, make sure that there are no obstructions in the vicinity of these machines.
- Always use wire rope or slings of a standard suitable for the load to be supported.
- Wait until the machine has come to a complete stop before adjusting the position of the coolant nozzle.
- Do not remove or otherwise interfere with safety equipment such as stop dogs, limit switches or interlocks in order to increase axis travel.
- Do not operate the machine with any of the safety covers removed.
- Always wear gloves and use a brush to clean chips off the tool tip; never use bare hands.
- Stop all machine operations before mounting or removing a tool.
- Check slings, chains, hoists, and other lifting gear for defects before use. Repair or replace defective gear immediately.



CAUTION

- Do not allow chips to accumulate during heavy-duty cutting since they will be hot and could start a fire.
- Warm up the spindle and all of the axis motion mechanisms before operation. (Operate the machine in the automatic mode for 10 to 20 minutes at maximum spindle speed or at 1/3 to 1/2 maximum axis motion speed.)
- Write the program for the warming-up operation so as to execute the functions of the full range of machine components. If operation is to be performed at spindle speeds in excess of 4000 min^{-1} , pay meticulous attention to the warming-up operation.
- Do not operate the operation panel switches while wearing gloves as this could lead to incorrect operation or other mistakes.
- When one series of operations is completed, switch off the power switch on the NC operation panel, the main power breaker, and then the factory power supply.

2-5 Safety Considerations Relating to Holding Workpieces and Tooling



WARNING

- Always use tools, which are suitable for the work to be carried out and conform to the machine specifications. Always observe the restrictions on weight of tool insert and tool diameter stipulated in the specifications. [Max. insert weight: 20 gf (0.04 lbs)]
- Replace tools promptly, since badly worn tools can cause accidents and injuries.
- Before starting operation, check that the workpiece is securely mounted and cannot become detached by the cutting forces applied to it during machining.
- Before mounting a cutting tool in the machine, make sure that the tool and its stud bolt are properly secured.
- Do not rotate a cutting tool or holder at speeds higher than the rated speed.
- Check the maximum safe operating speed with the manufacturer.
- Be very careful not to catch your fingers in workpiece holding devices.
- Always use the correct lifting gear for heavy fixtures and workpieces.



CAUTION

- Make sure that cutting tools will not interfere with the workpiece fixture, etc.
- Mount the tool holder in the correct orientation by aligning it with the drive key.
- Occasionally check for looseness after using a milling chuck.
- Make sure that the workpiece is correctly mounted on the pallet or table.
- Check that vices, fixtures, etc., have no overhang with respect to the table.
- Make sure that the tools are arranged in the tool magazine correctly in accordance with the tool data set in the TOOL LAYOUT display.
- Check that the lengths of all tools to be used have been measured.
- Move the tool nose to the initial point (X0, Y0) to check the basic coordinate system.
- Perform a test operation after mounting a cutting tool and workpiece.

2-6 Maintenance Safety



- Always switch off the main power breaker and lock it before carrying out any maintenance work. This will eliminate the possibility of the machinery being accidentally started by someone else.
- After the power has been switched off for a short while, check the voltage with a multimeter or similar instrument to make sure that there is no residual voltage. Also discharge the capacitors.



- Maintenance of electrical equipment must be carried out by qualified licensed electrical engineers only.
- Do not remove or modify limit switches, proximity switches, or other safety equipment.
- When carrying out maintenance in high places, always use a suitable ladder or a service platform, and always wear a helmet.
- Always switch off the main power breaker and lock it before replacing bulbs or other electrical equipment, and use products with the same specifications as the original.
- Do not start the machine until all of the covers removed for maintenance have been refitted.
- Wipe up any water or oil spills immediately, and keep the maintenance area and the workplace clean and tidy at all times.



- Maintenance work should be carried out by qualified personnel in accordance with the instructions of the person in charge.
- Keep a stock of replacement parts and consumable items.
- Make sure you fully understand how to maintain the machine.
- Do not use compressed air to clean the machine or to remove chips.
- Always use gloves when clearing away chips; never touch chips with bare hands.
- Use only the specified grades of hydraulic oil, lubricating oil, and grease or their equivalents
- When changing a fuse, check that the new fuse has the correct rating. (Using a fuse with too high a rating could result in damage to the equipment.)
- Follow the instructions on the instruction plate concerning the brands of oil to be used, lubrication points, amount to be used, and oil change intervals.
- Check the results of maintenance work in the presence of the person in charge.
- Stop all machine operation before cleaning the machine or the surrounding area.

2-7 Workplace Safety



WARNING

- Immediately remove all water and oil spills from the floor, and dry the floor to prevent accidents.
- Use strong service platforms only and make sure that nothing can slip off them.
- Keep combustible materials well away from the work area and any other place where there are hot chips.
- Always provide sufficient lighting in the work area.
- Always provide sufficient working space and clear access to the machine and peripheral equipment and store tools and other potential obstacles in a prescribed place away from the machine.
- Never place tools or other potentially dangerous objects on top of the headstock, turret tool-post or covers. (For lathes)
- Make sure that the nominal cross-sectional area of the power supply cable between the factory power supply switch and the machine main power breaker is such as to enable a stable supply for operation at the maximum output.
- Protect all cables which will run along the floor from being damaged by chips, since this could cause short-circuiting.

2-8 Safety Considerations Relating to Chip Conveyor



WARNING

- Before attempting any kind of work related to the chip conveyor, make sure that the chip conveyor is in a complete stop state with power supply shut off. Ignoring this will cause serious injury.
- While the chip conveyor is operating, never touch or extend your hands into any part of the chip conveyor. Ignoring this will cause your hands or fingers to be caught into the chip conveyor and injured seriously.

2-9 Safety Equipment

This machine is provided with various safety equipment to protect the operator and the machine.

The safety equipment includes interlock devices and emergency stop switches, as well as doors and covers.



- The machine is provided with various devices for the operator's safety. Never cancel any of the devices. Failure to observe this instruction could result in serious harm to a human life or body.

Arrangement of Safety Devices

No.	Name	Function
1	Operator's door interlock	<ol style="list-style-type: none">1. If the operator's door is opened during automatic operation, the machine enters the feed hold state with the spindle stopped.2. While the operator's door is open, spindle speed is restricted by the preset safety speed.
2	Magazine door interlock	<ol style="list-style-type: none">1. If the magazine door is opened while the magazine is operating, the magazine stops operating.2. While the magazine door is open, the magazine cannot be operated.3. While the magazine door is open, the magazine stops and the axes stop movements.
3	Emergency stop buttons (2 places)	<ol style="list-style-type: none">1. The emergency stop button is provided on each operation panel.2. When the emergency stop button is pressed, the machine stops in the emergency stop state independent of the selected operation mode (automatic, manual).
4	Safety plate	<ol style="list-style-type: none">1. A safety plate is fixed to the machine with screws to give operators and persons nearby warning information that standing near the movable area of equipment and devices is dangerous.

Safety device locations

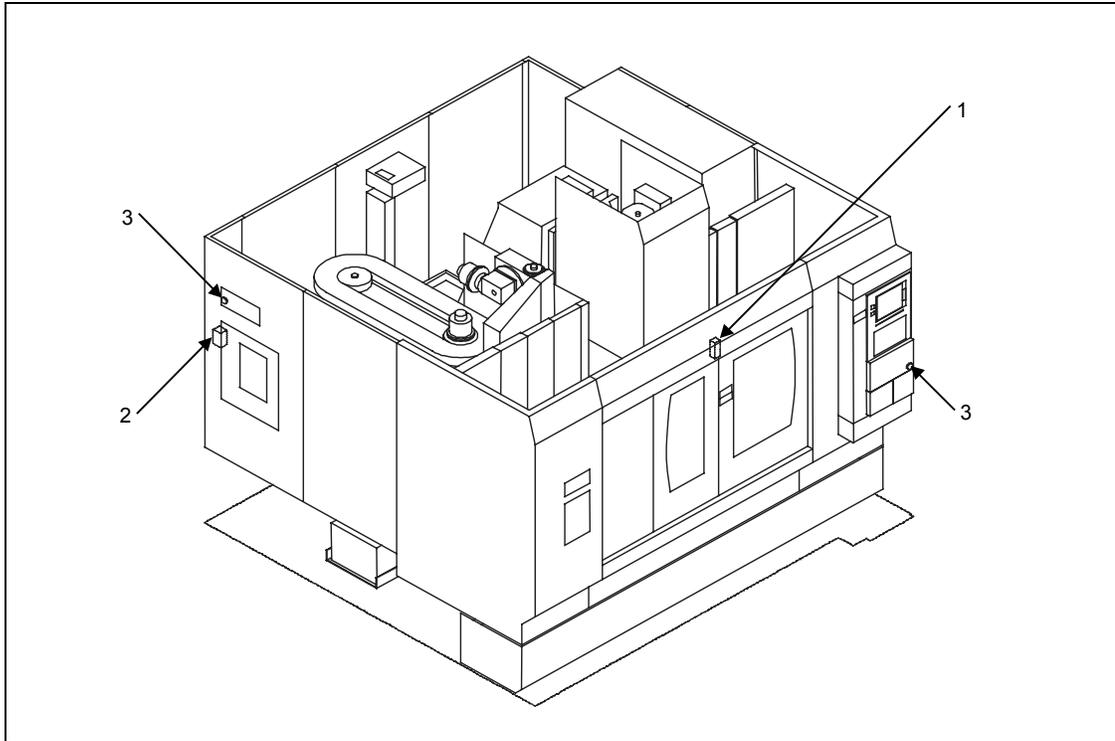


Fig. 2-1 Safety Devices

No.	Name
1	Operator's door interlock
2	Magazine door interlock
3	Pallet changer safety cover and door interlock (2 places)

2-10 Remarks on the Cutting Conditions Recommended by the NC



- Before using the following cutting conditions:
 - Cutting conditions that are the result of the Mazatrol Automatic Cutting Conditions Determination Function
 - Cutting conditions suggested by the Machining Navigation Function
 - Cutting conditions for tools that are suggested to be used by the Machining Navigation FunctionConfirm that every necessary precaution in regards to safe machine setup has been taken – especially for workpiece fixturing/clamping and tool setup.
- Confirm that the machine door is securely closed before starting machining. Failure to confirm safe machine setup may result in serious injury or death.

2-11 Safety Nameplates

Safety nameplates are mounted on the machine to protect the operators and the machine from danger.

3 OUTLINE OF THE MACHINE

3-1 Machine Construction

The machine consists of the following major units (see Fig. 3-1.).

1. Spindle

The spindle is driven by an AC inverter motor and its maximum speed is 10000 min^{-1} (rpm).

A cutting tool is clamped in the spindle by spring force and a hydraulic cylinder is used to force out the cutting tool from the spindle.

Cooling fluid is circulated around the spindle outer casing to minimize temperature rise of the spindle due to generation of heat from the bearings.

2. X-axis

The saddle travels right and left, driven by an AC servo motor and a ball screw.

An encoder used for position detection is built in the servo motor.

Linear guides are used as the guide for the saddle to move on the base.

3. Y-axis

The column travels back and forth, driven by an AC servo motor and a ball screw.

An encoder used for position detection is built in the servo motor.

Linear guides are used as the guide for the column to move on the saddle.

4. Z-axis

The spindle head travels up and down, driven by an AC servo motor and a ball screw.

An encoder used for position detection is built in the servo motor.

Linear guides are used as the guide for the spindle head to move on the column.

5. ATC

The roller-cam type ATC mounts/removes a tool to/from the spindle.

6. Magazine

The magazine stores tools. The magazine is driven by an AC inverter motor to index the specified tool to the tool change position.

7. Table

The top surface is finished with a high precision to be suitable to load workpieces. The table is fixed to the base not to move.

8. Hydraulic unit

A hydraulic pump generates hydraulic pressure by pumping working oil reserved in the tank to operate hydraulic actuators.

Refer to 5-4-3 "Hydraulic Circuit Diagram".

9. Air unit

An external air source is connected to the air unit to supply the pressure-regulated air to operate pneumatic actuators.

Refer to 5-5-3 "Pneumatic Circuit Diagram".

The air unit consists of a filter (with automatic drain system), regulator (reducing valve), shut-off valve, etc.

10. Centralized lubrication unit

Lubricating oil is supplied to the spindle bearings, the ball screws and the linear guides.

Refer to 5-6-3 "Lubrication Circuit Diagram".

By the intermittent operation (in intervals of 8 minutes) of the pump, lubricating oil is supplied to the each lubricating point automatically.

11. Spindle cooling unit

A trochoid pump is used to draw cooling fluid from the tank and feeds it to the outer casing of the spindle. Cooling fluid absorbs heat from the spindle and is cooled by the radiator and the fan; cooled oil is then circulated to the tank.

Refer to 5-7-3 "Spindle Cooling Circuit Diagram".

12. Coolant system

A coolant pump is used to feed coolant, pumped from the coolant tank, to coolant nozzles.

Coolant has two functions; to cool cutting tools and to wash away chips.

13. Control panel

Control units (spindle driver unit, servo control unit, NC unit, etc.) and control circuits are housed in the electrical control cabinet.

14. NC unit

Machine operation is controlled by the NC unit. It also has the function to diagnose the machine status.

Refer to 5-10 "NC Unit and Electrical Control Cabinet".

15. Covers

Covers are provide to prevent chips generated during machining from scattering outside the machine or entering the slideway surfaces as well as to protect operators from hazards.

Also, the machine has an ATC cover which automatically opens and closes for the execution of automatic tool change operation.

16. Machine light

One fluorescent tubes are used to light inside the machine.

17. Safety devices

Refer to 2-9 "Safety Equipment".

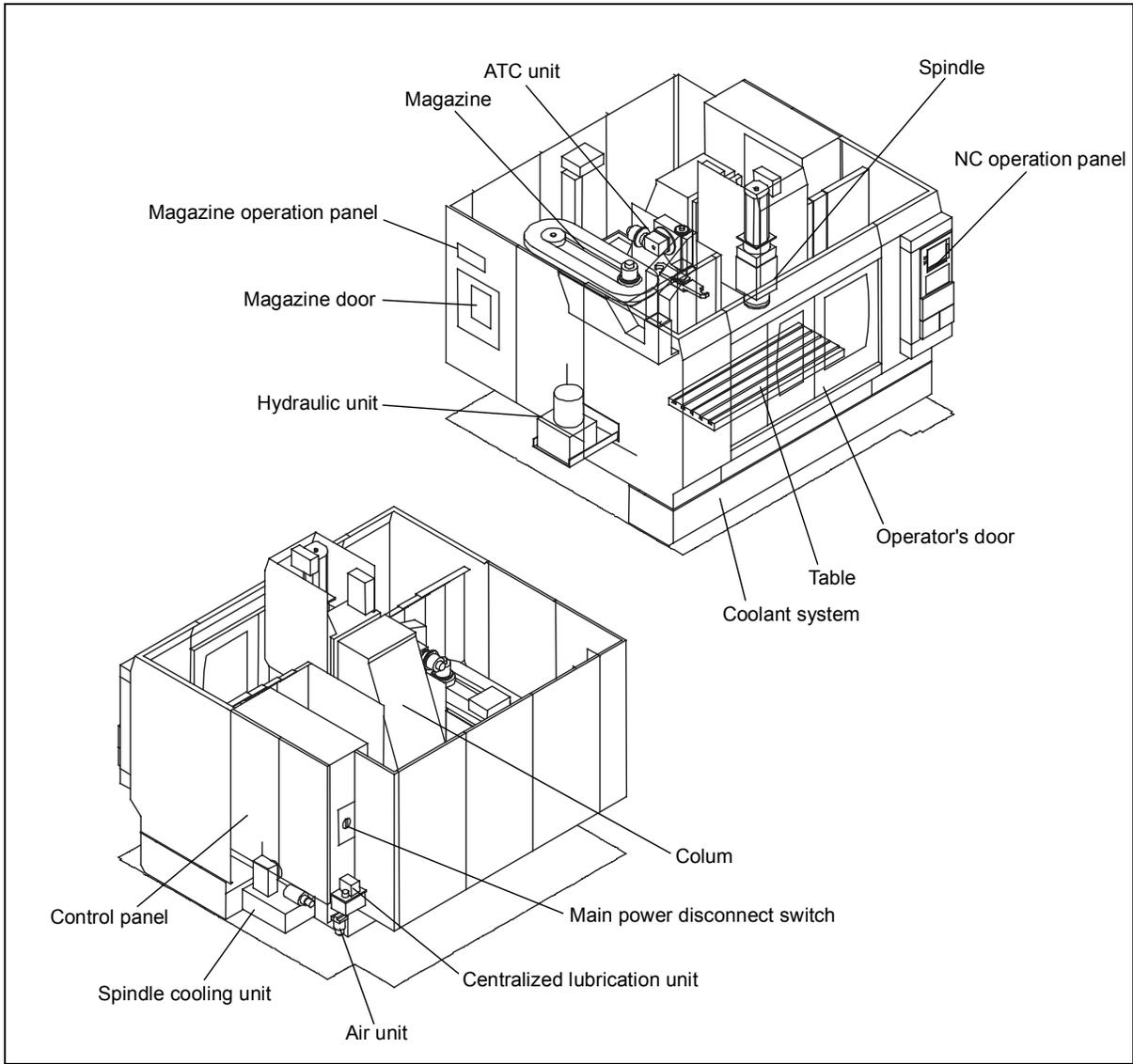


Fig. 3-1 Machine Construction - Major Units

3-2 Axis Definition

In the manuals supplied with the horizontal machining center, Model VTC-200B, the coordinate axes are defined as indicated below.

Note: The coordinate axes are defined assuming that an operator is standing in front of the machine.

X-axis	Saddle movements in the right-and-left direction Positive direction (+): Saddle movement to the right Negative direction (-): Saddle movement to the left
Y-axis	Column movements in the back-and-forth direction Positive direction (+): Column movement to the back Negative direction (-): Column movement to the front
Z-axis	Spindle head movements in the up-and-down direction Positive direction (+): Spindle head movement to the top Negative direction (-): Spindle head movement to the bottom

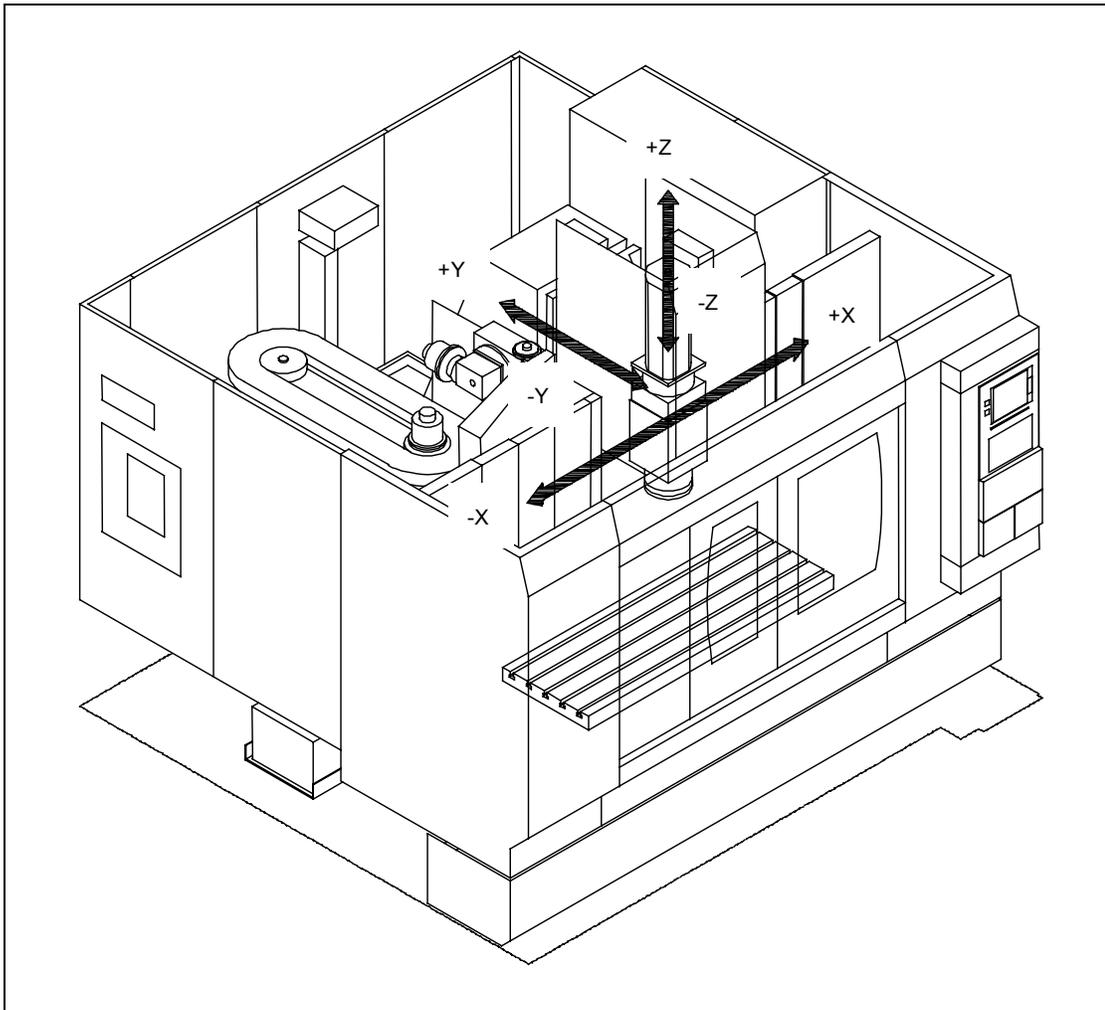


Fig. 3-2 Axis Definition

4 REGULAR INSPECTION

4-1 General

Regular inspection and maintenance is essential to maintain high accuracy for a long period. Therefore, regular inspection and maintenance must be given the top priority for operating the production facility.



- When carrying out inspection and maintenance, keep the doors of the electric control cabinet closed unless the intended inspection or maintenance requires the door to be open.
- Never use compressed air when cleaning inside the machine since it will cause sand grit, dust and other foreign matter to enter the bearings and slideways, causing the failure of the machine.



- Before carrying out maintenance or repair work on the machine, lock the main power disconnect in the “OFF” position with a padlock so that other workers cannot operate the machine.

* The user should prepare the padlock.

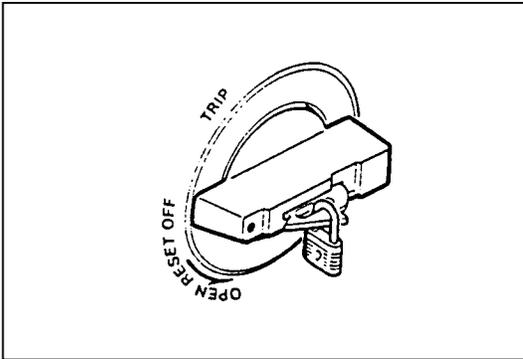


Fig. 4-1 Locking Main Power Disconnect in the “OFF” Position (Example)

Oiling:

The machine has many places that require lubrication. For appropriate lubrication, the most important point is “not to supply oil excessively”. When supplying oil, follow the instructions given in this manual.

Note: If lubricating oil is consumed faster than usual or if the machine generates abnormal noise, check the machine since such phenomena could be signs of machine failure.

4-2 Table of Inspection and Maintenance Items

Symbol “○” indicates the inspection interval.

Approximate Operating Hours Items	Inspection/Maintenance Intervals						Refer to
	Daily	Weekly 60 H	Monthly 250 H	Every 6 months 1500 H	Every year 3000 H	Every 2 years 6000 H	
Inside the Machine							
1. Removing accumulated chips (including chips within the magazine)	○						4-3-1
2. Cleaning the window in the operator's door	○						4-3-1
Outside the Machine							
1. Disposing of chips accumulated in the chip bucket	○						4-3-2
2. Cleaning the plate filters in the coolant tank	○						4-3-2
3. Cleaning the filter of the spindle cooling unit		○					4-4-1
Checking Oil Levels							
1. Checking the hydraulic oil level	○						4-3-3
2. Checking the spindle cooling fluid level	○						4-3-3
3. Checking the centralized lubricating oil level	○						4-3-3
4. Checking the coolant level	○						4-3-3
Checking Pressures (Hydraulic and Air)							
1. Checking the hydraulic unit oil pressure	○						4-3-4
2. Checking the air pressure	○						4-3-4
Changing or Replenishing Oils							
1. Replenishing coolant (As needed)	○						4-3-5
2. Replenishing the centralized lubricating oil level			○				4-5-1
3. Changing hydraulic oil and cleaning the filters				○			4-6-1
4. Changing hydraulic oil of ATC unit				○			4-6-1
5. Changing spindle cooling fluid and cleaning the filters						○	4-7-1

Approximate Operating Hours Items	Inspection/Maintenance Intervals						Refer to
	Daily	Weekly 60 H	Monthly 250 H	Every 6 months 1500 H	Every year 3000 H	Every 2 years 6000 H	
Around the Machine							
1. Cleaning the exterior of the machine	○						4-3-6
2. Checking the machine and hydraulic unit for oil leaks	○						4-3-6
3. Cleaning the spindle taper hole		○					4-4-1
4. Tightening the retention bolt		○					4-4-1
5. Cleaning the tool shank		○					4-4-1
6. Checking the emergency stop buttons for correct operation			○				4-5-2
7. Checking the indicator lamps on the operation panels		○					4-4-1
8. Checking the safety devices for correct operation				○			4-6-2
9. Checking the air unit drain function				○			4-6-2
10. Checking the wipers at the axis slideway cover for damage				○			4-6-2
11. Cleaning the coolant tank and changing coolant				○			4-6-2
12. Checking hoses on moving units for damage				○			4-6-2
13. Cleaning the centralized lubricating unit filters				○ (At the discharge port)	○ (At the suction port)		4-7-2 4-6-2

4-3 Daily Inspection and Maintenance

4-3-1 Inside the Machine



- Switch off the power before cleaning inside the machine.

Clear the inside of the machine, particularly those parts indicated below, of accumulated chips, dirt and dust.

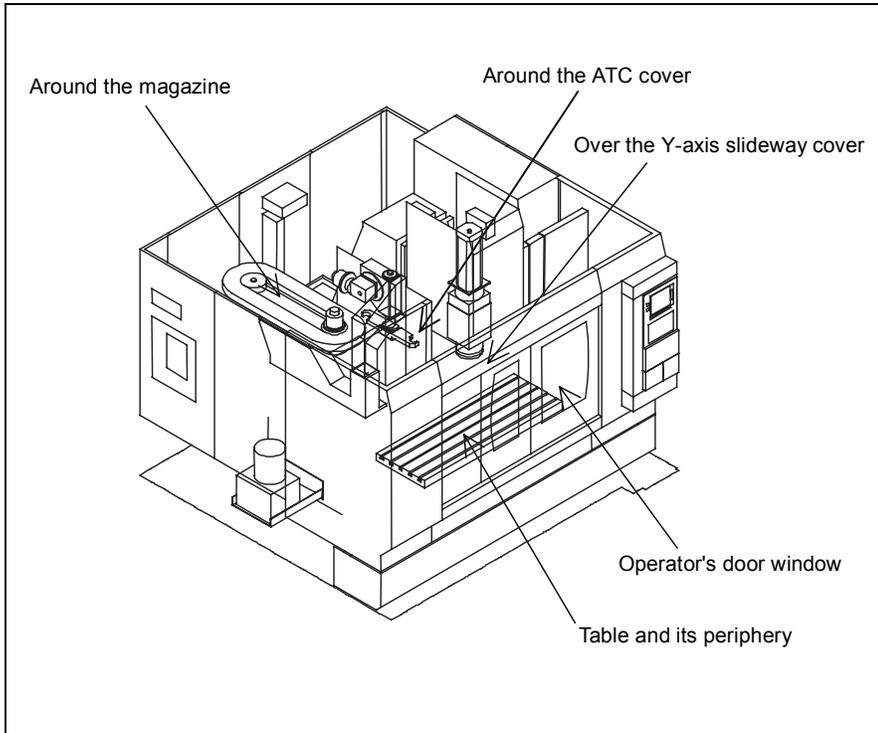


Fig. 4-2 Inspection and Maintenance Inside the Machine

4-3-2 Outside the Machine

1. Cleaning the chip bucket and filter



- If coolant, oil or other fluid gets spilled on the floor, wipe it off with a cloth and dry the floor immediately. If the floor remains wet with spilled fluid, personnel could slip over and be injured.



- Do not touch chips with bare hands, otherwise you could be injured.

Dispose of chips accumulated in the chip bucket several times a day according to the machine operating conditions.

2. Cleaning the filter (standard specification machine)

After removing chips from the chip bucket, clean the filter by using an air gun.

Note : Do not use the air gun around the machine, or it may cause trouble to the machine.

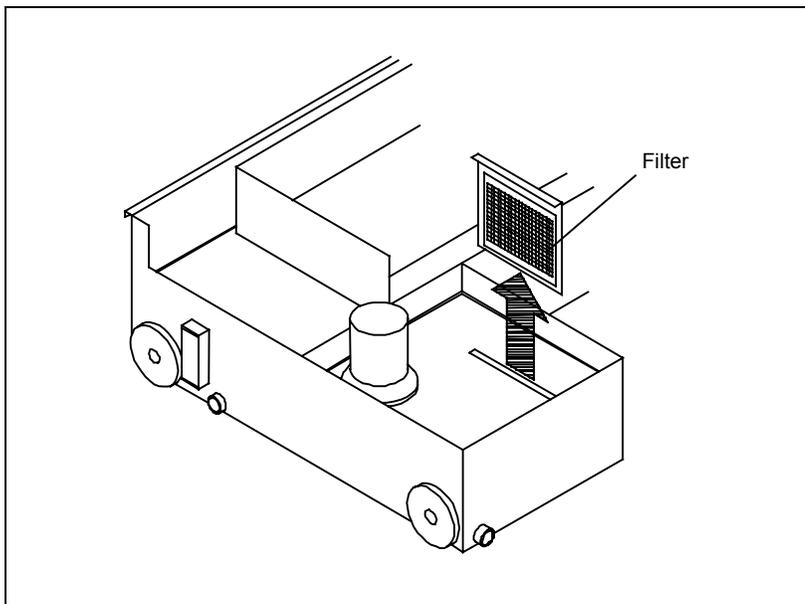


Fig. 4-3 Cleaning Chip Bucket Filter

4-3-3 Checking Oil Levels

Check the oil level at each of the tanks by the oil level gauge. If the oil level is lower than the allowable lower limit, replenish the specified oil.

1. Checking the hydraulic oil level
2. Checking the spindle cooling fluid level
3. Checking the spindle lubricating oil level
4. Checking the coolant level

4-3-4 Checking Pressures (Hydraulic and Air)

1. Checking the hydraulic unit oil pressure

0 kgf/cm² (0 PSI): With power OFF

70 kgf/cm² (996.1 PSI): With power ON

2. Checking the air pressure

5 kgf/cm² (71.15 PSI)

4-3-5 Changing or Replenishing Oils

1. Replenishing coolant (As needed)



- If coolant, oil or other fluid gets spilled on the floor, wipe it off with a cloth and dry the floor immediately. If the floor remains wet with spilled fluid, personnel could slip over and be injured.

< Procedure >

- (1) Check the coolant level at the oil level gauge.

Coolant tank capacity: 250 L (66.1 gal (US))



- Since some kinds of coolant are injurious to health, you must exercise due care when handling coolant. Do not handle coolant with bare hands.

- (2) If the coolant level is low, replenish with the stipulated coolant to the upper limit level of the oil level gauge. If the coolant goes over the upper limit level, coolant returned to the coolant tank could overflow the tank when the coolant pump is stopped.

Remark: For the selection of coolant, see PART 2, 4-3 “Preparing Coolant” in the Operating Manual.

4-3-6 Around the Machine

1. Cleaning the exterior of the machine

Wipe off oil, coolant, chips, and other foreign matter from the surface of the machine.

Use soft cloth soaked with neutral detergent to clean the screen and operation panels.

2. Checking the machine and hydraulic unit for oil leaks

Visually check the machine, hydraulic unit, hydraulic piping/hose, and blocks and cylinders for oil leaks.

If oil leak is found, appropriate measures must be taken.

4-4 Weekly Inspection and Maintenance

4-4-1 Around the Machine

Perform the following to maintain tool holding accuracy, etc.

1. Cleaning the spindle taper hole

Clean the taper hole of the spindle with clean cloth.

2. Tightening the retention bolt

Check the retention bolt for looseness and tighten it if loose.

3. Cleaning the tool shank

Clean the tool shank with clean cloth.

4. Cleaning the filter of the spindle cooling unit

Pull the filter upward to remove it, then clean the filter.

5. Confirming that each indicator lamp of each operation panel comes on.

Check each indicator lamp located on the NC operation panel and magazine operation panel for normal function. If there is any indicator lamp that is out of order, replace such lamp.

4-5 Monthly Inspection and Maintenance

4-5-1 Changing or Replenishing Oils

1. Replenishing centralized lubricating oil

< Procedure >

(1) When replenishing the spindle lubricating oil, pay attention so that the oil level does not exceed the upper limit line of the oil level gauge of the lubrication unit.

- Tank capacity: 3 L (0.79 gal (US))
- Lubricating oil consumption amount: 5.2 cc per hour

* Recommended oil: Refer to 7-1-2 "List of Oiling Points".

Note: When replenishing oil, use only the oil specified by Yamazaki Mazak. Otherwise, machine trouble and other problems will occur.

4-5-2 Around the Machine

1. Checking the emergency stop buttons for correct operation

Check that the emergency stop button arranged on the NC operation panel and pallet changer operation panel functions correctly.

If an emergency stop button fails to function correctly, the button must be changed.

4-6 Every Six-Month Inspection and Maintenance

4-6-1 Changing or Replenishing Oils



- Shut off the power before changing the hydraulic oil.
- When replenishing oil, use only the oil specified by Yamazaki Mazak. Otherwise, machine trouble and other problems will occur.

1. Changing hydraulic oil

Although intervals of hydraulic oil change vary depending on machine operating conditions, it should be changed in the first three months and every six months thereafter.

< Procedure >

- (1) Switch off the power by placing the main power disconnect to the "OFF" position.
- (2) Place the oil collecting can (min. capacity: 10 L (2.64 gal)) under the drain port.
- (3) Loosen the drain plug.
 - Hydraulic oil is discharged.
- (4) Wind a seal tape around the drain plug, and tighten the drain plug.
- (5) Remove the wire to the pump from the terminal box.
- (6) Remove the wire to the fan from the connector.
- (7) Remove all the hoses from the hydraulic unit.
- (8) Remove the tank.
 - Remove the M5×12L hexagon socket head cap screws (8 pcs), and the tank can be removed.
- (9) Clean the tank.
 - Carefully wipe stains and deposits off the inside and outside of the tank with a waste cloth.
- (10) Remove the suction strainer.
 - Fix the suction pipe with a pipe wrench, and turn the hexagonal part of the suction strainer in the loosening direction with a monkey wrench or the like, and the suction strainer can be removed.
- (11) Clean the suction strainer.
 - Wipe off stains with a waste cloth or the like, and air blow the mesh part.
- (12) Remove the oil supply port (air breather).
- (13) Clean the oil supply port (air breather).
 - Clear the inner casing of the strainer casing of dirt and dust, if any.
- (14) Install the tank, the suction strainer, the air port (air breather), the wires and the hoses in place.
- (15) Supply the hydraulic oil while observing the amount oil by the oil level gauge.
(Amount: 10 L (2.64 gal))

Note : Do not use the air gun around the machine, or it may cause trouble to the machine.
For the information of the oil specified by Yamazaki Mazak, refer to 7-1-2 "List of Oiling Points."

2. Changing the hydraulic oil of ATC unit

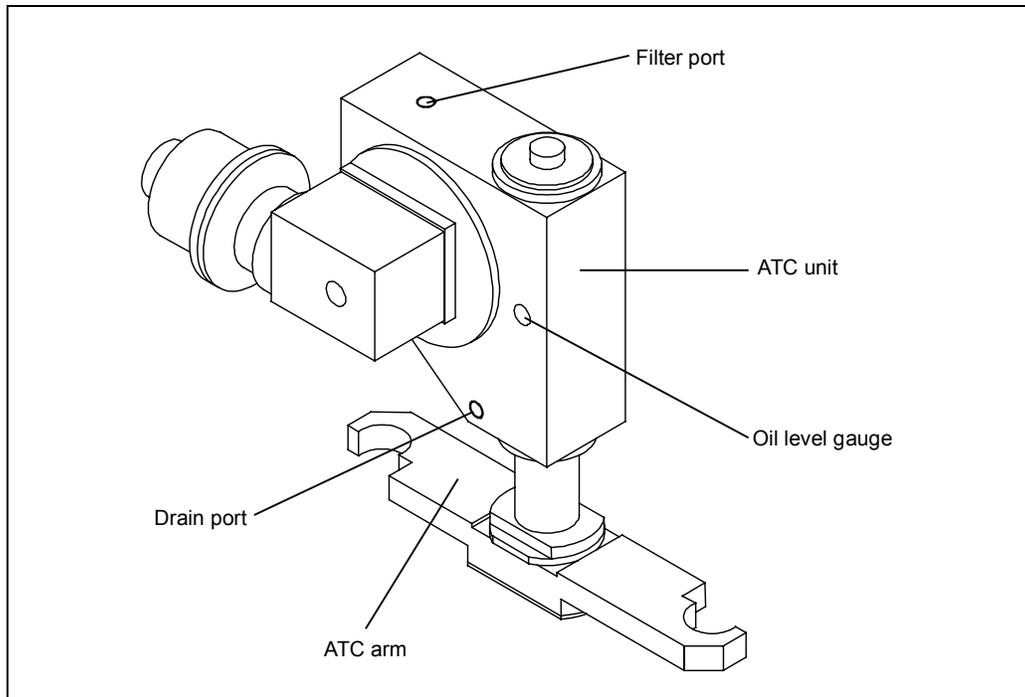


Fig. 4-4 Changing the Hydraulic Oil of ATC Unit

< Procedure >

- (1) Place the main power disconnect to the "OFF" position.
- (2) Loosen the drain plug to discharge the oil.
- (3) Tighten the drain plug.
- (4) Supply the fresh oil while observing the amount oil by the oil level gauge.
(Amount: 2 L (0.53 gal (US)))

For the specified oil, refer to 7-1-2 "List of Oiling Points".

4-6-2 Around the Machine

1. Checking the safety devices for correct operation



- Since the machine may move unexpectedly, leading to a hazardous situation if a safety device is faulty, do not rest your body, or leave any unnecessary objects, on the moving units or within the range of movement of the units when performing inspections.
- If an abnormality is found in the inspection, contact your local Mazak Technical Center or Mazak's distributor.

A. Operator's door interlock

Check that the operator's door interlock operates correctly by referring to PART 2, 2-7 "Operator's Door Interlock" in the Operating Manual.

2. Checking the air unit drain function

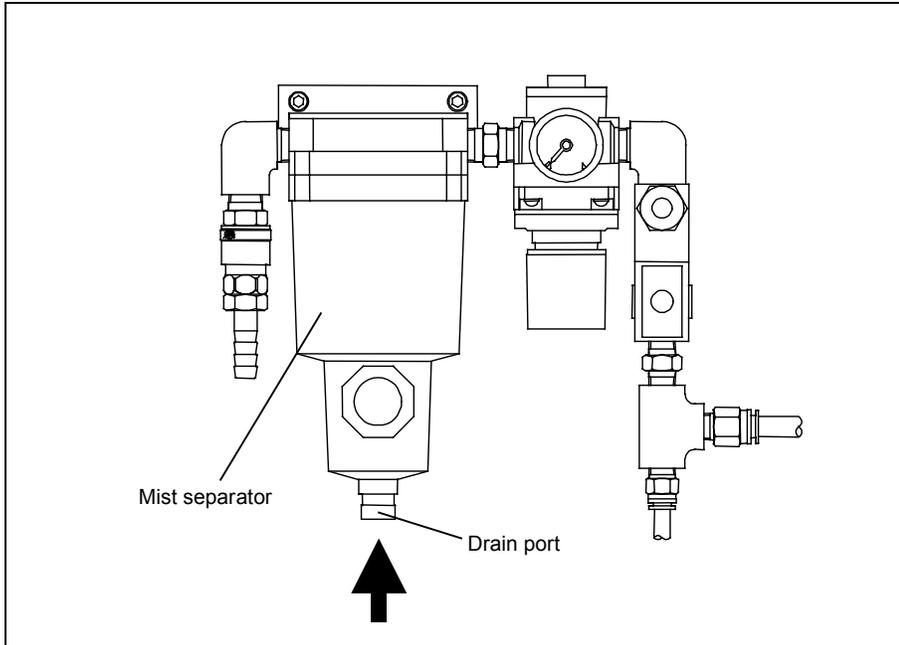


Fig. 4-5 Checking the Air Unit Drain Function

The automatic drain function of the mist separator is faulty in the following cases.

- A. Air is always leaking through the drain port.

Corrective action: Turn the drain port in the "→ S" direction for closing.

If the air still leaks, refer to 5-5 "Pneumatic System" for the corrective action to be taken.

- B. Large amount of water is discharged from the drain port when the drain port is turned in the "O ←" direction.

Corrective action: The mist separator must be changed.

3. Checking the wipers at the axis slidaway cover for damage



- Set the main power disconnect to the “OFF” position before entering the machine. Otherwise, you may sustain serious or fatal injury.

Visually check the wipers at the X-, Y- and Z-axis slidaway covers for damage. If damage is found in a wiper, change it with new one as soon as possible.

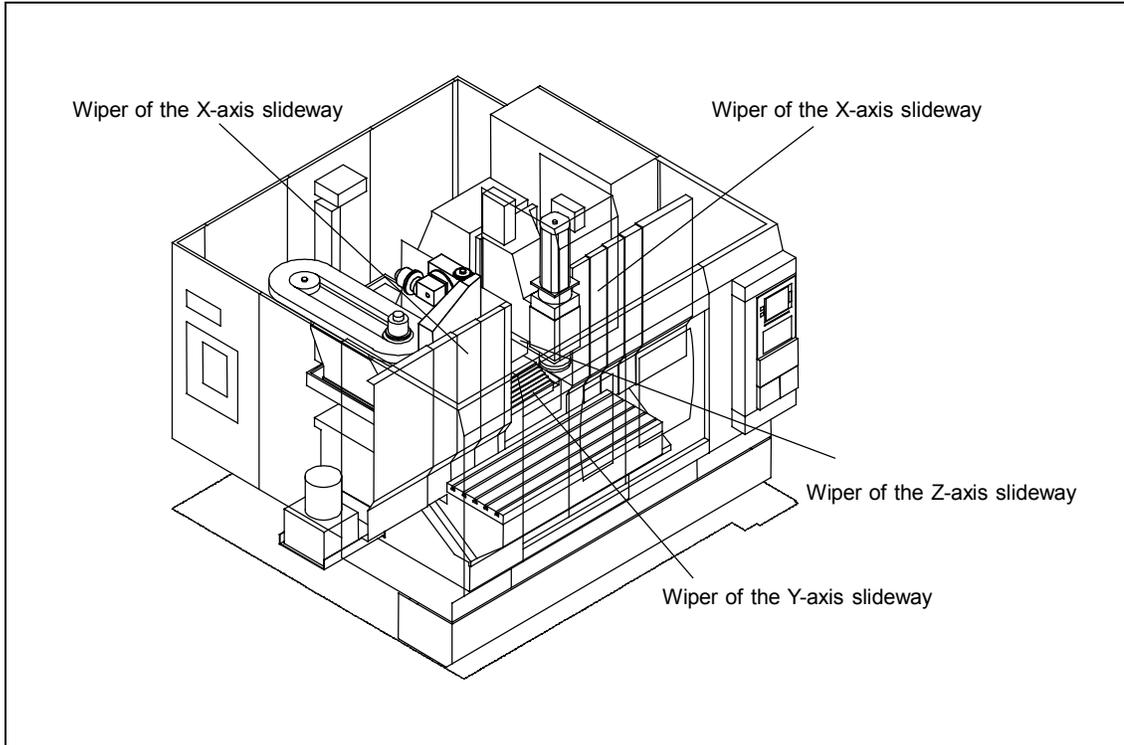


Fig. 4-6 Checking the Wiper at the X-axis Slidaway Cover

4. Cleaning the coolant tank and changing coolant



- If coolant, oil or other fluid gets spilled on the floor, wipe it off with a cloth and dry the floor immediately. If the floor remains wet with spilled fluid, personnel could slip over and be injured.

< Procedure >

- (1) Pull out the tank to the machine front side.
- (2) Remove the filters, bucket, coolant pump, and top cover from the coolant tank. If the machine is equipped with the chip conveyor, remove the chip conveyor too.
- (3) Pump the coolant from the coolant tank.
- (4) If coolant level becomes low and pumping becomes impossible, loosen the drain plug of the coolant tank to completely discharge coolant from the coolant tank.
- (5) When the coolant is completely discharged from the coolant tank, remove chips and sludge deposited at the bottom of the tank.
- (6) Clean the inside of the coolant tank with rag.
- (7) After cleaning the coolant tank, refit the drain plug and other parts removed.
- (8) Supply new coolant to the coolant tank.

5. Checking hoses on moving units for damage



- Switch off the power before checking hoses on moving units for damage. Otherwise, you may sustain serious or fatal injury.

< Procedure >

- (1) Place the main power disconnect to the "OFF" position.
- (2) Check the hoses at the rear of the machine for damage.

Check the hoses for damage such as cracks, abnormal bulge, and deterioration.

If any damage is found, contact your local Mazak Technical Center.

6. Cleaning the spindle lubricating unit filters

< Procedure >

- (1) Take out the filter from the oil filler port and clean it by supplying compressed air from the inside of the filter using the air gun.

Note: Do not use an air gun near the machine since this could cause machine trouble.

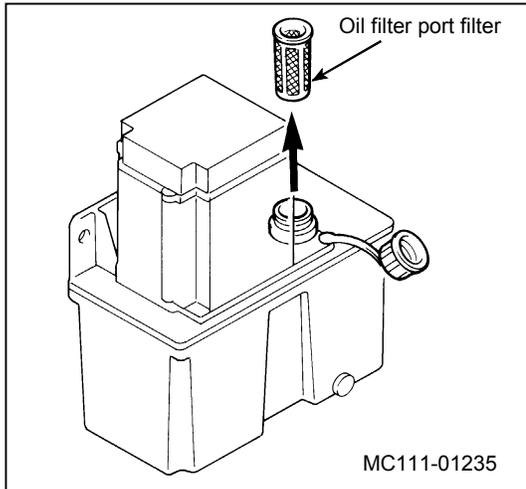


Fig. 4-7 Cleaning the Oil Filter Port Filter

4-7 Every One- and Two-year Inspection and Maintenance

4-7-1 Changing or Replenishing Oils

1. Changing spindle cooling fluid and cleaning the suction filters



- When replenishing spindle cooling fluid, use only the cooling fluid specified by Yamazaki Mazak. Otherwise, machine trouble and other problems will occur.

Change spindle cooling fluid every two years.

For the specified spindle cooling fluid, refer to 7-1-2 “List of Oiling Points”.

< Procedure >

- (1) Switch off the power.
- (2) Place the cooling fluid collecting pan under the drain port and loosen the drain plug.
→ Cooling fluid is discharged. (Max.: 20 L (5.28 gal (US)))
- (3) Loosen the bolts clamping the suction port cover and pull the cover up.

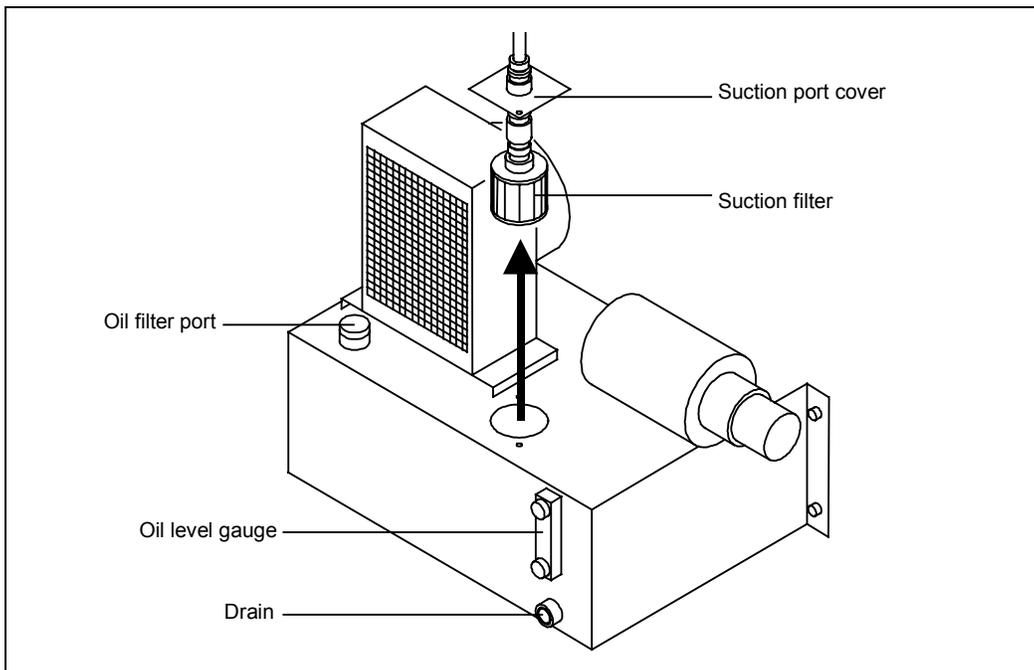


Fig. 4-8 Cleaning the Suction Filter

- (4) Remove the suction filter from the suction pipe and clean the suction filter by applying compressed air with the air gun.

Note: Do not use an air gun near the machine since this could cause machine trouble.

- (5) Install the suction filter to the suction pipe and return the suction pipe into the tank to the state as before step (3).
- (6) Remove the cap at the oil filler port.

(7) Supply spindle cooling fluid.

Observe the fluid level with the ball in the oil gauge; supply the spindle cooling fluid until the ball in the oil gauge comes to the center mark position.

(8) Fit the cap.

4-7-2 Around the Machine

1. Cleaning the spindle lubricating unit filters (suction port)

< Procedure >

(1) Switch off the power.

(2) Take out the lubrication unit.

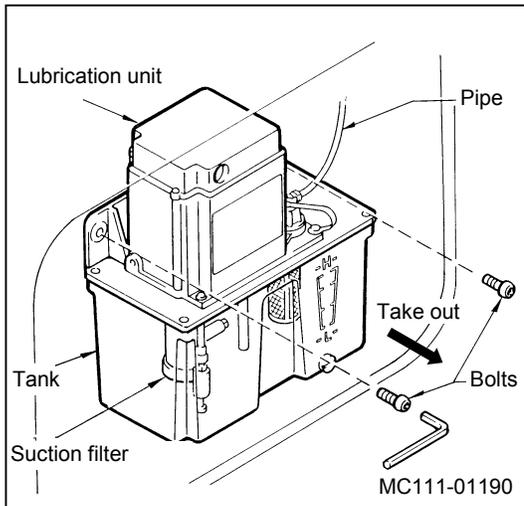


Fig. 4-9 Cleaning the Suction Filter (1/2)

Note: Do not disconnect the pipes. Otherwise, air will enter the pipe and cause spindle trouble.

(3) Remove the drain plug to discharge lubricating oil.

(4) Fit and tighten the drain plug after discharging the lubricating oil.

(5) Remove the screws clamping the pump unit to the tank and separate the pump unit from the tank.

(6) Remove the filter clamp and take out the suction filter.

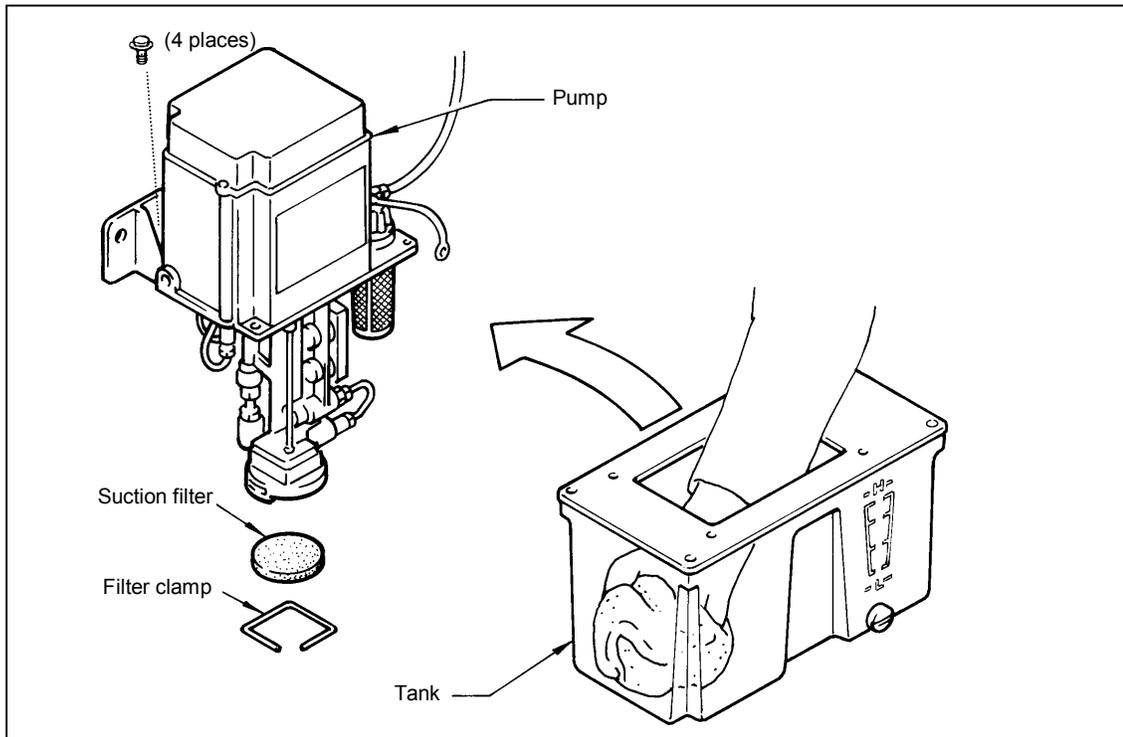


Fig. 4-10 Cleaning the Suction Filter (2/2)

- (7) Clean the suction filter.
Use washing oil (kerosene, etc.) to clean the suction filter.
At the same time, clean the inside of the tank with rag.

4-8 Inspection and Maintenance before Stopping the Machine for a Long Time

When stopping the machine for longer than two weeks, carry out the following inspection and maintenance.

- Applying rust preventive oil
- Discharging coolant
- Saving the NC data

1. Applying rust preventive oil



- Switch off the power before applying rust preventive oil.

If the machine is not operated for a long time, unpainted surface of the following parts will be rusted and the function of them will be deteriorated. Therefore, apply rust preventive oil to these parts if the machine will not be operated for a long time.

- Linear guide rails (X-, Y-, Z-axis)
- Ball screws (X-, Y-, Z-axis)
- Slideway covers (X-, Y-axis)
- Table
- ATC magazine
- Spindle

2. Discharging coolant

Completely discharge coolant from the coolant tank and clean both the inside and outside of the coolant tank.

For details, refer to 4-6-2 "Around the Machine".

3. Saving the NC data

Save all the NC data to the micro disk.

For details of operation procedure to save the NC data using the micro disk, refer to the instruction manual of the NC.

4-9 Inspection and Maintenance before Starting the Operation after Stopping the Machine for a Long Time

Before restarting the machine that has been stopped for longer than two weeks, carry out the following inspection and maintenance.

- Wiping off rust preventive oil
- Replenishing coolant
- Usual inspection before starting the operation
- Inspecting the machine for oil leaks
- Warm-up operation
- Inspecting the machine for noise, vibration, and abnormal temperature rise
- Uploading the NC data

1. Wiping off rust preventive oil



- Switch off the power before wiping off rust preventive oil.

Remove rust preventive oil, applied as explained in 4-8 “Inspection and Maintenance before Stopping the Machine for a Long Time”, using the rag soaked with washing oil.

2. Replenishing coolant

Replenish coolant to the coolant tank.

For details, refer to 4-6-2 “Around the Machine”.

3. Usual inspection before starting the operation

Perform the inspection which are required before starting daily operation.

For details, refer to 3-1 “Inspection before Starting Operation” in the Operating Manual.

4. Inspecting the machine for oil leaks

After switching on the power, visually check the machine, piping and hoses of the hydraulic unit, blocks, and cylinders for oil leaks.

5. Warm-up operation

Run the machine for approximately three hours using the warm-up program (PNO. 1000) which is stored in the NC memory.

Refer to the instruction manual of the NC.

6. Inspecting the machine for noise, vibration, and abnormal temperature rise

Check the machine for generation of abnormal noise and vibration, and also for abnormal temperature rise at the motors and bearings.

If any abnormality is found, take appropriate corrective action by referring to Chapter 5 “MAINTENANCE OF MAJOR UNITS”.

7. Uploading the NC data

Before starting the operation, upload the NC data having been saved to the micro disk before stopping the machine.

- MEMO -

5 MAINTENANCE OF MAJOR UNITS

If a machine trouble occurred, first check the following items and carry out inspection and maintenance according to the information described in this Chapter.

If you Contact Mazak Technical Center, the results of your check will very helpful to locate the cause of the trouble.

1. Call the DIAGNOSIS (ALARM) screen and confirm the past alarms in addition to the latest alarm. (For details of the DIAGNOSIS (ALARM) screen, refer to the Operating Manual of NC provided separately.)
2. Check the trouble and alarm if it recurs.
3. Check the ambient temperature if it is within the specified range.
4. Check if momentary power failure has occurred.
5. Check the source voltage for fluctuation.
6. Check if conditions differ depending on motion direction - forward and reverse rotation, retract and advance motion, etc.
7. Check if the trouble or alarm occurs only at specific operation or command.
8. Check the trouble or alarm occurrence frequency.
9. Check how long the machine has been operated.
10. Confirm if corrective action has been taken.

5-1 Spindle

5-1-1 Troubleshooting

Symptom	Check Points and Probable Causes	Corrective Action	Refer to
<ul style="list-style-type: none"> Spindle does not start. Spindle stops due to alarm. 	1. Insufficient capacity or a trouble of external power supply	Prepare the power supply which meets the requirements indicated in 6-2-2 "External Power Source Requirements".	6-2-2
	2. Ambient temperature of the spindle drive unit is higher than 40°C (104°F).	Lower the ambient temperature.	—
	3. Load is excessively large.	Reduce load applied to the spindle.	—
	4. Load is excessively large. The spindle drive unit is defective. The spindle drive motor is defective.	Contact Mazak Technical Center.	—
<ul style="list-style-type: none"> Spindle orientation does not complete. Spindle orientation status cannot be canceled. 	1. The spindle drive unit is defective. The spindle drive motor is defective. There is a trouble in the spindle.	Contact Mazak Technical Center.	—
<ul style="list-style-type: none"> There is abnormal noise or abnormal vibration during spindle rotation. 	1. The spindle is rotating at a high speed with an unbalanced tool mounted in it.	Change the tool with a balanced tool.	—
	2. The spindle drive unit is defective. The spindle drive motor is defective. Loose bolts	Contact Mazak Technical Center.	—
<ul style="list-style-type: none"> Tool clamp operation is not completed. Tool unclamp operation is not completed. 	1. The sensor is defective. (Although the clamp/unclamp cylinder operates correctly, the sensor is not turned on.)	Change the sensor.	5-10-3
	2. The sensor is not mounted securely. (Gap between the sensor and the dog is larger than 0.5 mm (0.020 in.).)	Mount the sensor correctly.	
	3. The hydraulic valve is defective or blocked. (The clamp/unclamp cylinder fails to operate).	Contact Mazak Technical Center.	—
	4. The clamp/unclamp cylinder is defective. (The clamp/unclamp cylinder does not operate although the hydraulic valve has no problems.)		
	5. The hydraulic unit is defective. (Hydraulic pressure is always lower than 70 kgf/cm ² (996.1 PSI).)		
	6. Loose bolts		

Symptom	Check Points and Probable Causes	Corrective Action	Refer to
<ul style="list-style-type: none"> Oil leak 	1. The seal in the clamp/unclamp cylinder has been worn.	Contact Mazak Technical Center.	—
<ul style="list-style-type: none"> ATC air blast is not supplied. ATC air blast does not stop. 	1. An external air source is not connected.	Connect the external air source.	6-4-3
	2. The solenoid valve is defective.	Contact Mazak Technical Center.	—

5-1-2 Construction of the Spindle head

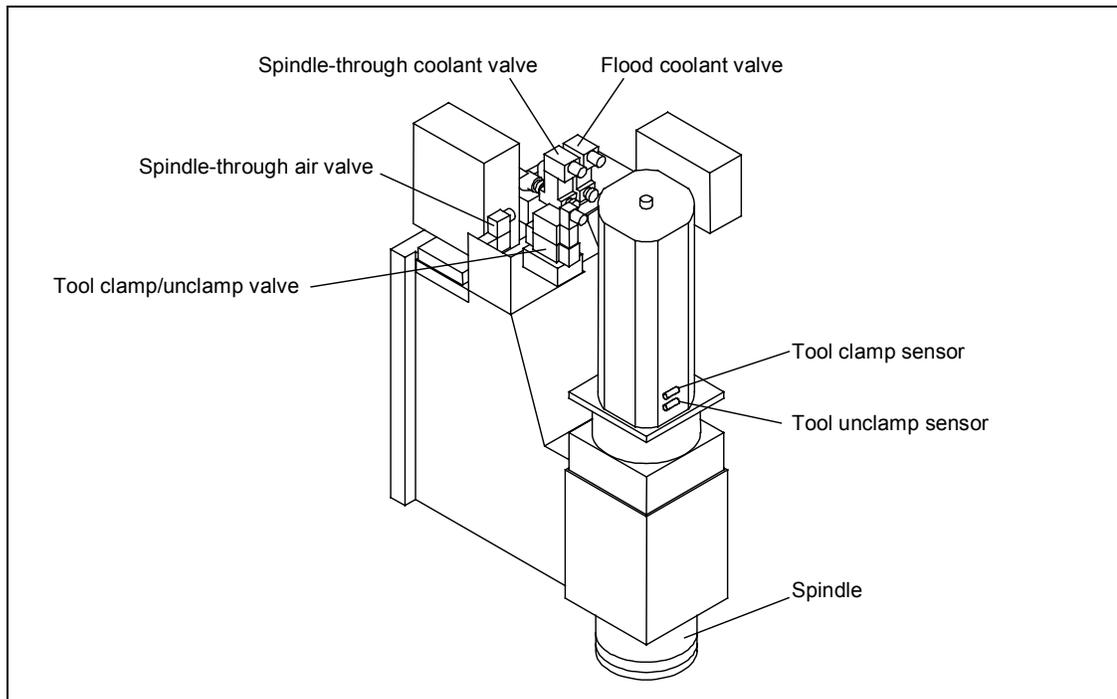


Fig. 5-1 Construction of the Spindle head

- A tool is clamped in the spindle by spring force.
Tool unclamp operation is performed by the hydraulic cylinder.
- The spindle bearings are lubricated by oil-air. The pressure switch is provided to prevent lubrication failure problem even if air pressure is lowered.

5-2 X-axis, Y-axis, Z-axis

5-2-1 Troubleshooting

Symptom	Check Points and Probable Causes	Corrective Action	Refer to
<ul style="list-style-type: none"> Positioning cannot be made accurately. 	1. Bolts of axis drive parts (ball screw, coupling, linear guide, etc.) are loose.	Contact Mazak Technical Center.	—
	2. The encoder in the servomotor is defective.		
<ul style="list-style-type: none"> Zero-point position is not fixed or the limit switch does not function correctly. 	1. The bolts fixing the zero-point return limit switch are loose.	Contact Mazak Technical Center.	—
	2. The bolts fixing the zero-point dog are loose.		
<ul style="list-style-type: none"> An axis stops due to alarm. 	1. Load is excessively large.	Reduce load applied to the spindle.	—
	2. Ambient temperature of the servo control unit is higher than 40°C (104°F).	Lower the ambient temperature.	6-2-1
	3. The servo control unit in the electrical control cabinet is defective.	Contact Mazak Technical Center.	—
	4. The servomotor is defective.		
<ul style="list-style-type: none"> Abnormal noise is generated during axis movement. 	1. The wiper at the slidaway cover is damaged.	Change the wiper.	4-6-2
	2. The slidaway cover is defective.	Contact Mazak Technical Center.	—
	3. A trouble in the axis drive system such as damaged ball screw support bearing.		

5-2-2 Construction of the Axis Drive Systems

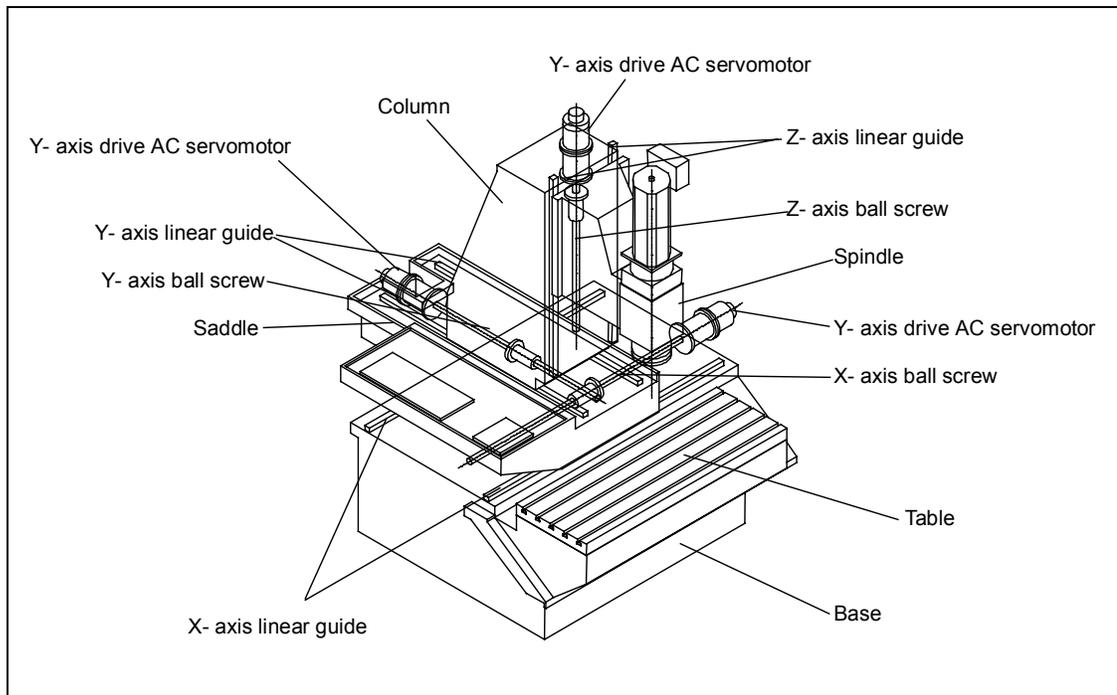


Fig. 5-2 Construction of the Axis Drive Systems

5-3 ATC Magazine

5-3-1 Troubleshooting

Symptom	Check Points and Probable Causes	Corrective Action	Refer to
<ul style="list-style-type: none"> ATC cover open/close operation does not complete. 	Refer to 5-9 "Covers".	Refer to 5-9 "Covers".	5-9
<ul style="list-style-type: none"> The magazine does not rotate. The magazine stop position is shifted from the correct index position. 	1. A tool exceeding the tool size specifications is stored in the magazine.	Store the tools in the magazine.	PART 2, 4-1 in the Operating Manual
	2. The magazine drive unit is defective.	Contact Mazak Technical Center.	—
	3. The magazine rotation motor is defective.		
<ul style="list-style-type: none"> The ATC does not operate. 	1. The drive motor is faulty.	Contact Mazak Technical Center.	—
	2. The ATC unit is defective.		

5-3-2 Construction of the ATC Magazine

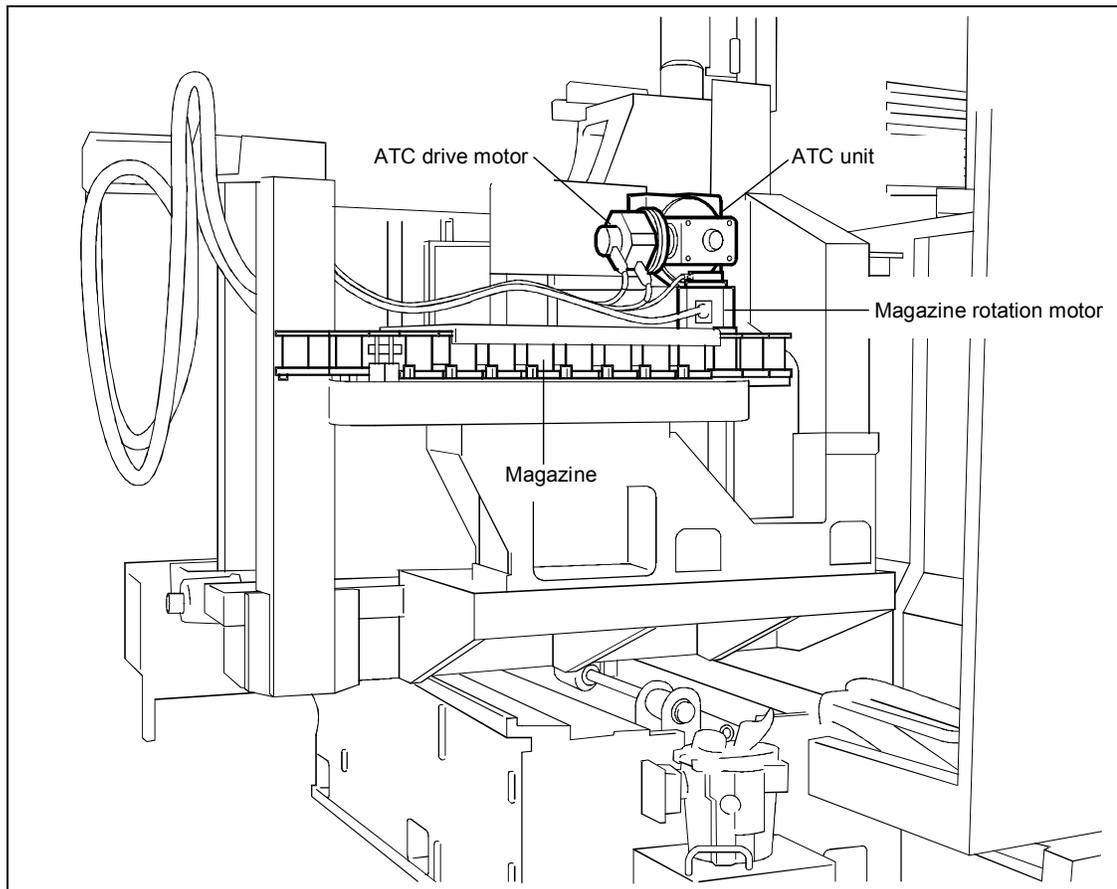


Fig. 5-3 Construction of the ATC Magazine

5-4 Hydraulic System

5-4-1 Troubleshooting

Symptom	Check Points and Probable Causes	Corrective Action	Refer to
<ul style="list-style-type: none"> • Pressure is always lower than 70 kgf/cm² (996.1 PSI). • Hydraulic oil is not discharged. • Heat generation from the pump or motor is excessive. 	1. Insufficient oil amount in the hydraulic unit tank.	Replenish the specified oil.	4-6-1
	2. The hydraulic unit filter is clogged.	Clean the filter.	4-6-1
	3. Oil viscosity is too high.	Change the oil to the specified oil.	7-1-2
	4. Hydraulic unit pump or motor is defective. (There are no problems with the wiring.)	Contact Mazak Technical Center.	—
	5. The relief valve of the hydraulic unit is defective.		
	6. Oil leak in the hydraulic circuit.		
<ul style="list-style-type: none"> • Noise level gets higher. • Abnormal noise is generated. 	1. The hydraulic unit filter is clogged.	Clean the filter.	4-6-1
	2. Insufficient oil amount in the hydraulic unit tank.	Replenish the specified oil.	4-6-1
	3. Bolts used in the hydraulic unit get loose.	Tighten the bolts.	—
	4. Hydraulic unit pump or motor is defective.	Contact Mazak Technical Center.	—
<ul style="list-style-type: none"> • Oil amount in the hydraulic unit tank reduces. 	1. There is oil leak in the hydraulic unit circuit.	Contact Mazak Technical Center.	—

5-4-2 Maintenance of the Hydraulic Unit

1. Changing the hydraulic pressure gauge



- Switch off the power before changing the hydraulic pressure gauge. Otherwise, you may sustain serious or fatal injury.

< Procedure >

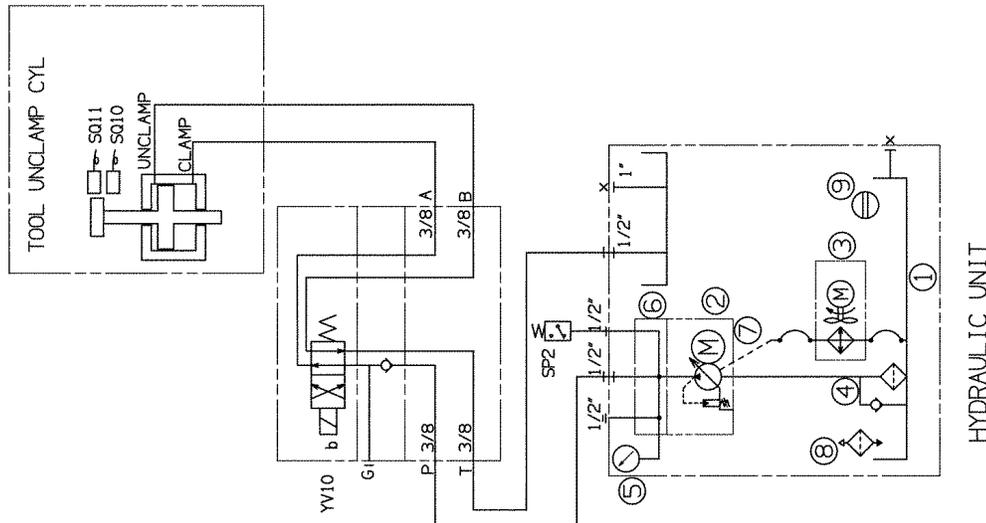
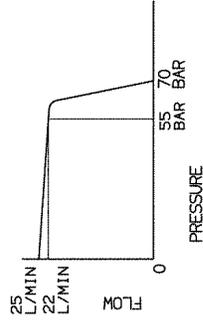
- (1) Loosen and detach the pressure gauge.
- (2) Mount the new pressure gauge after winding the threads with sealing tape.

5-4-3 Hydraulic Circuit Diagram

HYDRAULIC UNIT (G49MFH90280)

NO.	PART-NAME	REMARKS	QTY	NOTE
①	RESERVOIR	40-019	1	NACHI
②	PUMP	UVN-1A-1A4-1.5-A -4-018-6063A	1	NACHI
③	HEAT EXCHANGER	75-002	1	NACHI
④	SUCTION STRAINER	70-002	1	NACHI
⑤	PRESS GAGE	46-007	1	NACHI
⑥	MANIFOLD	31-031	1	NACHI
⑦	MOTOR MOUNT	44-002	4	NACHI
⑧	FILLER BREATHER CAP		1	NACHI
⑨	OIL LEVEL GAGE		1	NACHI

(PUMP CHARACTERISTIC CURVES)



ABBREVIATION-NO.	PART-NO.	PART-NAME	REMARKS (MAKER)	COMMENT
YV10	G16MPS2700	SOLENOID VALVE	(PARKER)	TOOL UNCLAMP
	G14MPS2490	CHECK VALVE	(PARKER)	
	G27MPS2710	SUBPLATE	(PARKER)	
SQ10	R25YB002590	PROXIMITY SENSOR	(HONEYWELL)	TOOL UNCLAMP
SQ11				TOOL CLAMP
SP2	G23MBK90020	PRESSURE SWITCH	(BARKSDALE)	HYD. OIL PRESS

5-5 Pneumatic System

5-5-1 Troubleshooting

Symptom	Check Points and Probable Causes	Corrective Action	Refer to
<ul style="list-style-type: none"> The pressure is lower than 5 kgf/cm² (71.15 PSI). 	1. Insufficient capacity of external air source	Prepare and connect the air source meeting the specifications given in 6-2-3 "Air Source Requirements".	6-2-3
	2. Reducing valve in the air unit is defective.	Change the reducing valve.	—
	3. Mist separator in the air unit is clogged.	Change the filter element.	5-5-2
	4. Leak in the pneumatic circuit.	Contact Mazak Technical Center.	—
	5. Air pressure switch, mounted in the spindle unit, is defective.		
<ul style="list-style-type: none"> Air is constantly leaking through the drain port of the air unit. 	1. Automatic drain of the mist separator is defective.	Change the mist separator.	4-6-2, 5-5-2

5-5-2 Maintenance of the Air Unit

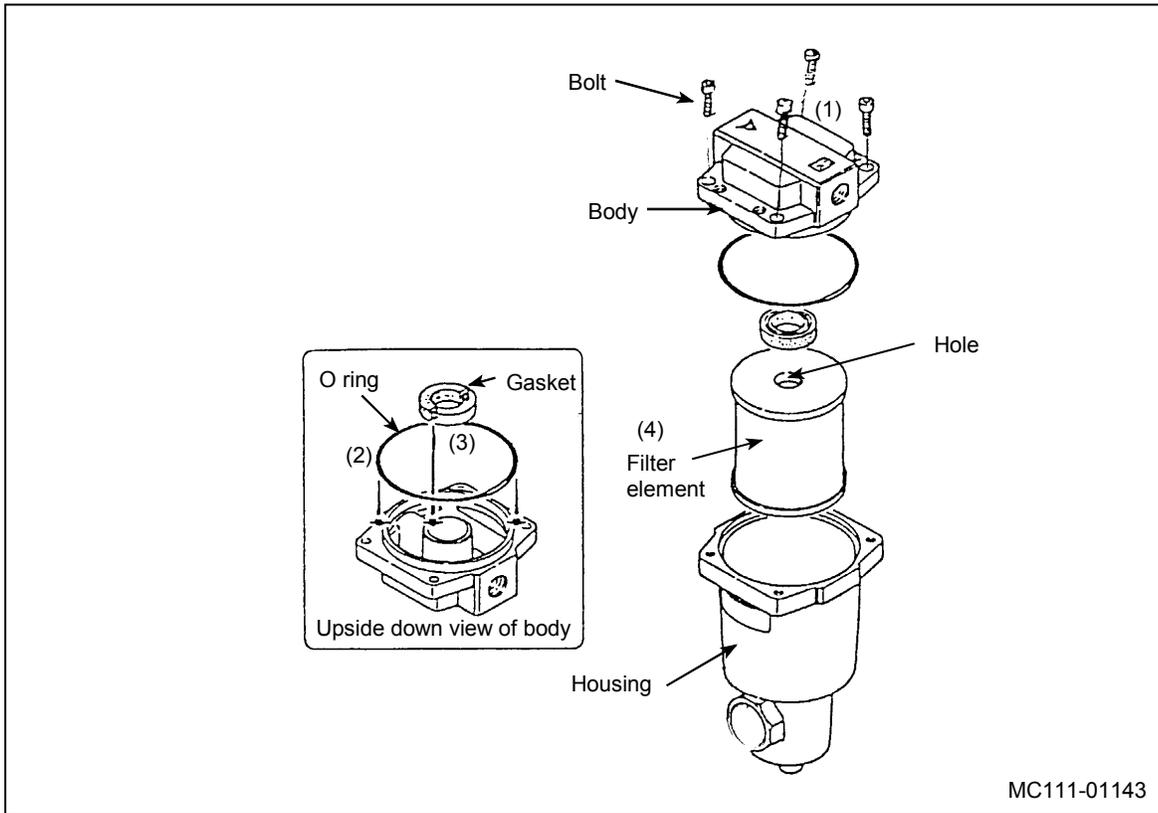
1. Changing the filter element of mist separator



- Shut off the power to the machine by turning the main power disconnect to the "OFF" position and disconnect the external air source before changing the filter element. Attempting to change the filter element without taking these precautions could cause machine damage or severe injuries.

The filter element is a consumable part and should be changed every two years.

In the list given in 7-2 "List of Wearable Parts", "element ass'y" indicates a set of filter element, O ring, and gasket. When changing the filter element, order the "element ass'y".



MC111-01143

Fig. 5-4 Changing the Filter Element

< Procedure >

- (1) Loosen the four bolts and detach the body from the housing.
- (2) Fit a new O ring to the body.
- (3) Fit a new gasket to the body.
- (4) Insert a new filter element into the housing with the hole in the filter element facing up.
- (5) Fix the body to the housing with the bolts.

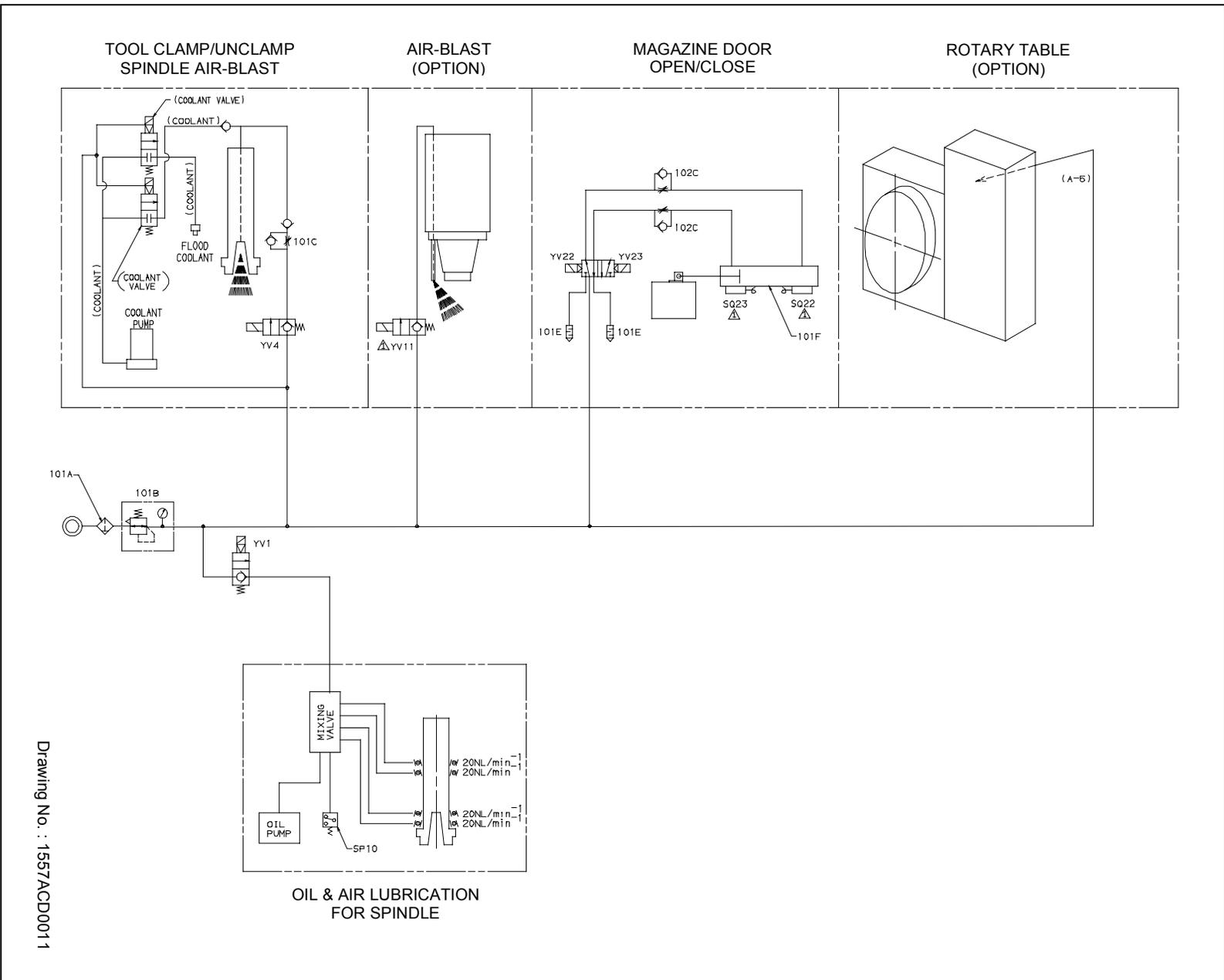


Fig. 5-5 Pneumatic Circuit Diagram

Drawing No. : 1557ACDD0011

No.	Part No.	Part name	Model	Application	Qty
101A	G48SV001290	Mist separator	AM350-03BD (SMC)		1
101B	G45SV000930	Regulator	AR3000-03G (SMC)		1
YV1	G50SV004890	Solenoid valve	VXD-2130-03-1D (SMC)	Air supply ON/OFF	1
SP10	G23SV000740	Pressure switch	IS1000-01 (SMC)	Air supply ON/OFF	1
YV4	G50SV005950	Solenoid valve	VX2130-02-1D-B (SMC)	Through air	1
101C	G54SV001480	Speed controller	AS3001F-08 (SMC)	Through air	1
YV22	G50SV006070	Solenoid valve	VFS2220-1D-02 (SMC)	Magazine cover (OPEN)	1
YV23	G50SV006070	Solenoid valve	VFS2220-1D-02 (SMC)	Magazine cover (CLOSE)	1
101F	G51SV000100	Silencer	AN200-02 (SMC)	Magazine cover	2
102C	G54SV001360	Speed controller	AS2201F-02-10 (SMC)	Magazine cover	2
101F	G20SV022490	Cylinder	MDBL40-620-A53 (SMC)	Magazine cover	1
YV11	G50SV005950	Solenoid valve	VX2130-02-1D (SMC)	Air blast	1
SQ22	-	Auto switch	D-A53 (SMC)	Magazine cover (OPEN)	1
SQ23	-	Auto switch	D-A53 (SMC)	Magazine cover (CLOSE)	1

5-6 Centralized Lubrication Unit

5-6-1 Troubleshooting

Symptom	Check Points and Probable Causes	Corrective Action	Refer to
<ul style="list-style-type: none"> Lubricating oil is not consumed. 	1. Piping is blocked.	Contact Mazak Technical Center.	—
	2. The centralized lubrication unit pump is defective.		
<ul style="list-style-type: none"> Lubricating oil is consumed abnormally quickly. 	1. Piping is loose.	Contact Mazak Technical Center.	—

5-6-2 Maintenance of the Centralized Lubrication Unit

For the information on centralized lubrication unit maintenance, refer to the following sections.

4-5 “Monthly Inspection and Maintenance”

4-7 “Every One- and Two-year Inspection and Maintenance”

5-6-3 Spindle, Linear Guide and Ball Screw Lubrication

Circuit diagram and lubricating oil discharge amount (per cycle)

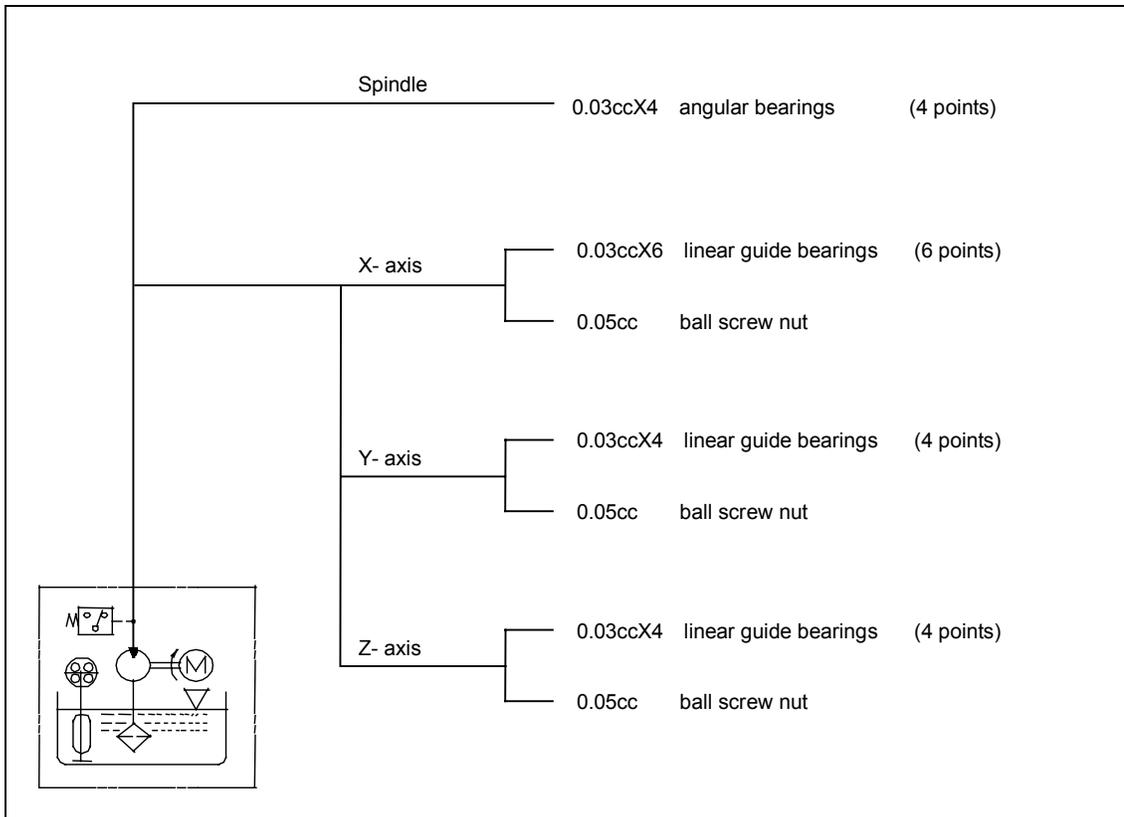


Fig. 5-6 Lubrication Circuit Diagram

5-7 Spindle Cooling Unit

5-7-1 Troubleshooting

Symptom	Check Points and Probable Causes {No. of Related Consumable Part}	Corrective Action	Refer to
<ul style="list-style-type: none"> Both the pump and the cooling unit are operating but oil is not cooled. 	1. Insufficient amount of spindle cooling fluid	Replenish the specified spindle cooling fluid.	4-7-1
	2. Oil viscosity is too high.	Change the oil to the specified oil.	7-1-2
	3. Air filter is blocked.	Wash the air filter.	
	4. There is an obstacle near the suction and/or the exhaust port.	Remove the obstacle.	
	5. Ambient temperature is high.	Use the chiller unit in the environment where temperature is within the specified operating temperature range. If the chiller unit is directly subject to hot air, take measures so that the chiller unit will not be subjected to the hot air.	
<ul style="list-style-type: none"> Spindle cooling fluid is consumed abnormally quickly. 	1. Leak in the spindle cooling circuit.	Contact Mazak Technical Center.	—
<ul style="list-style-type: none"> Noise level gets higher. Abnormal noise is generated. 	1. The filter is clogged.	Clean the filter.	4-7-1
	2. Insufficient amount of spindle cooling fluid	Replenish the specified spindle cooling fluid.	4-7-1
	3. Loose bolts	Tighten the bolts.	
	4. Hydraulic unit pump or motor is defective.	Contact Mazak Technical Center.	—

5-7-2 Construction of the Spindle Cooling Unit

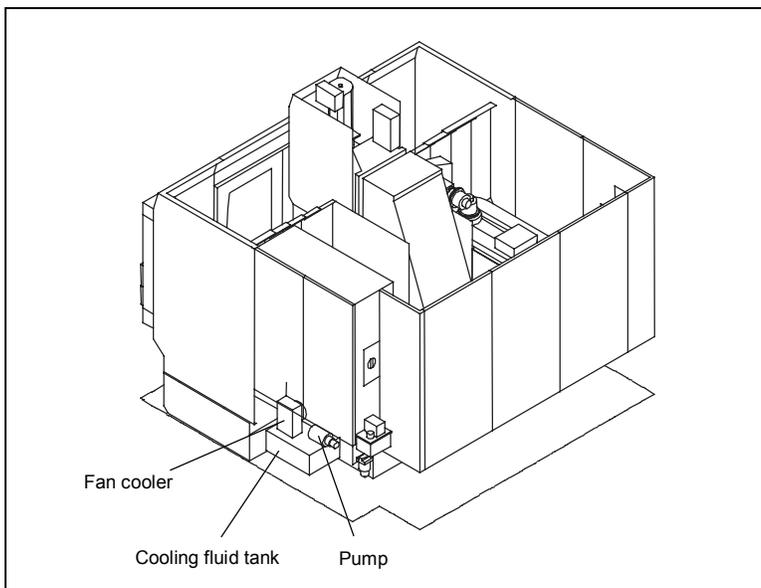


Fig. 5-7 Construction of the Spindle Cooling Unit

- The pump draws cooling fluid from the tank.
- The heat generated at the spindle warms the cooling fluid.
- The warmed cooling fluid is cooled by the fan cooler and returned to the tank.

5-7-3 Spindle Cooling Circuit Diagram

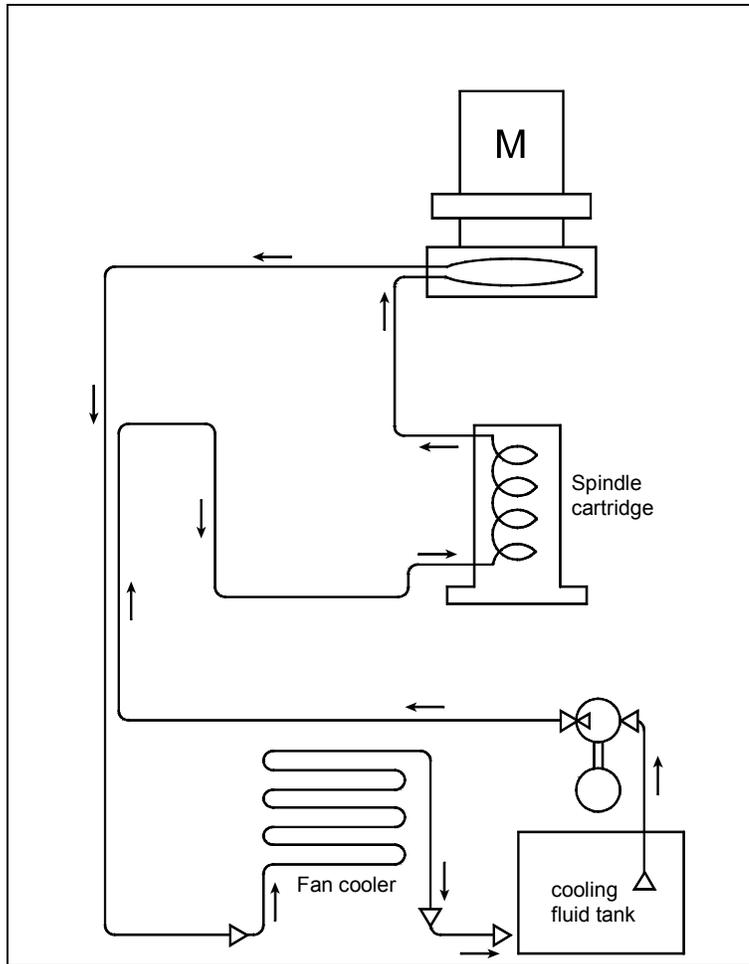


Fig. 5-8 Spindle Cooling Circuit Diagram

5-8 Coolant System

5-8-1 Troubleshooting

Symptom	Check Points and Probable Causes	Corrective Action	Refer to
<ul style="list-style-type: none"> Coolant is not discharged. Coolant discharge volume is reduced. 	1. The filter is clogged.	Clean the filter.	4-3-2
	2. Coolant amount is insufficient.	Replenish the specified coolant.	4-3-5
	3. Discharge nozzle is blocked.	Clean the nozzle.	—
<ul style="list-style-type: none"> Coolant is not discharged. 	1. Due to interlock <ul style="list-style-type: none"> ATC cover open Operator's door open Coolant stop menu-key ON Special tool selected 	Remove the cause of interlock.	—
	2. The coolant pump is defective. (There are no problems with the wiring.)	Contact Mazak Technical Center.	—
	3. The solenoid valve is defective.	Contact Mazak Technical Center.	—
<ul style="list-style-type: none"> Coolant discharge does not stop. 	1. The solenoid valve is defective.	Contact Mazak Technical Center.	—

5-8-2 Construction of the Coolant System

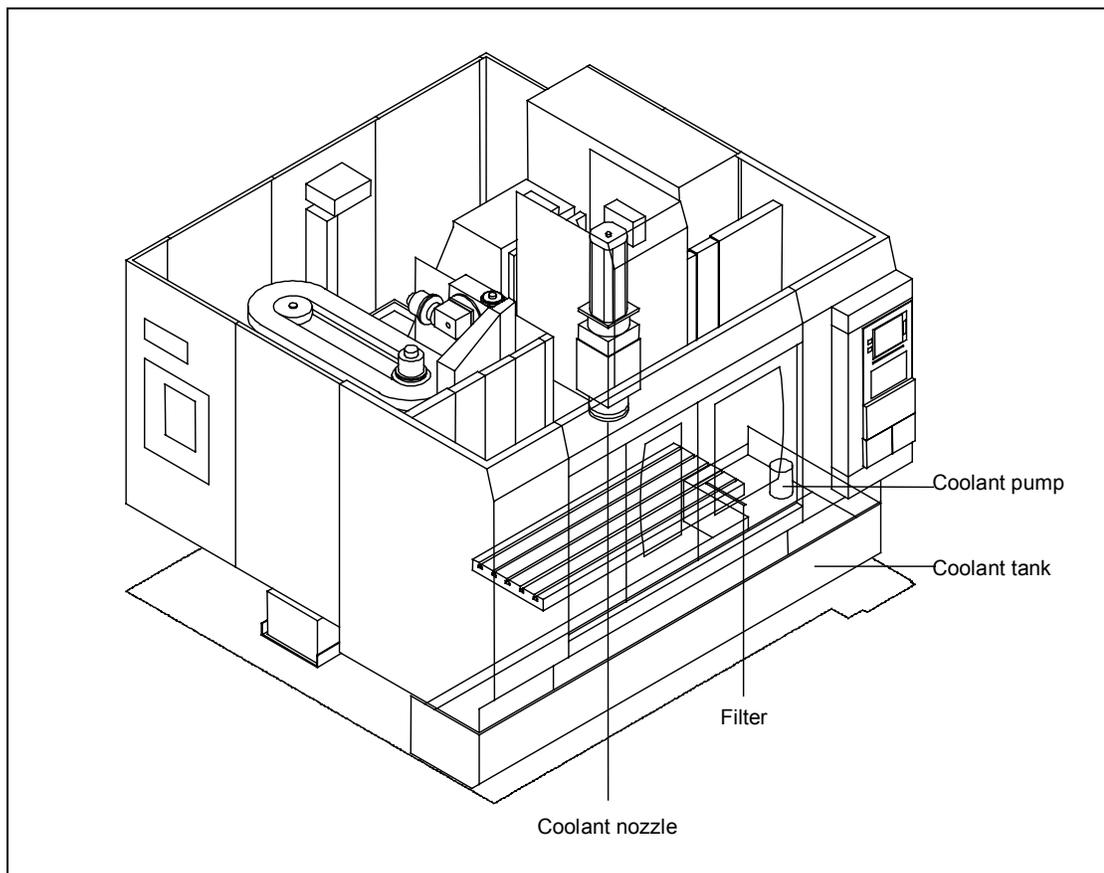


Fig. 5-9 Coolant System

5-9 Covers

5-9-1 Troubleshooting

Symptom	Check Points and Probable Causes	Corrective Action	Refer to	
<ul style="list-style-type: none"> Door interlock alarm occurred although the door is not open. 	Limit switch is defective.	Change the limit switch.	—	
<ul style="list-style-type: none"> When moving an axis, abnormal noise is generated from the slideway cover. 	1. The wiper of the slideway cover is damaged.	Change the wiper.	—	
	2. Slideway cover is defective.	Contact Mazak Technical Center.	—	
<ul style="list-style-type: none"> ATC cover open operation does not complete. ATC cover close operation does not complete. 	1. Insufficient capacity of external air source	Prepare and connect the air source meeting the specifications given in 6-2-3 "Air Source Requirements".	—	
	2. Reed switch is defective. (Although air cylinder has operated correctly, the reed switch is not turned ON.)	Change the reed switch.	—	
	3. The solenoid valve is defective.	Contact Mazak Technical Center.	—	
	4. Air cylinder is defective. (Solenoid valve is free of problems and the piping is free of disconnection.)			
	5. Loose bolts			

5-9-2 Machine Covers

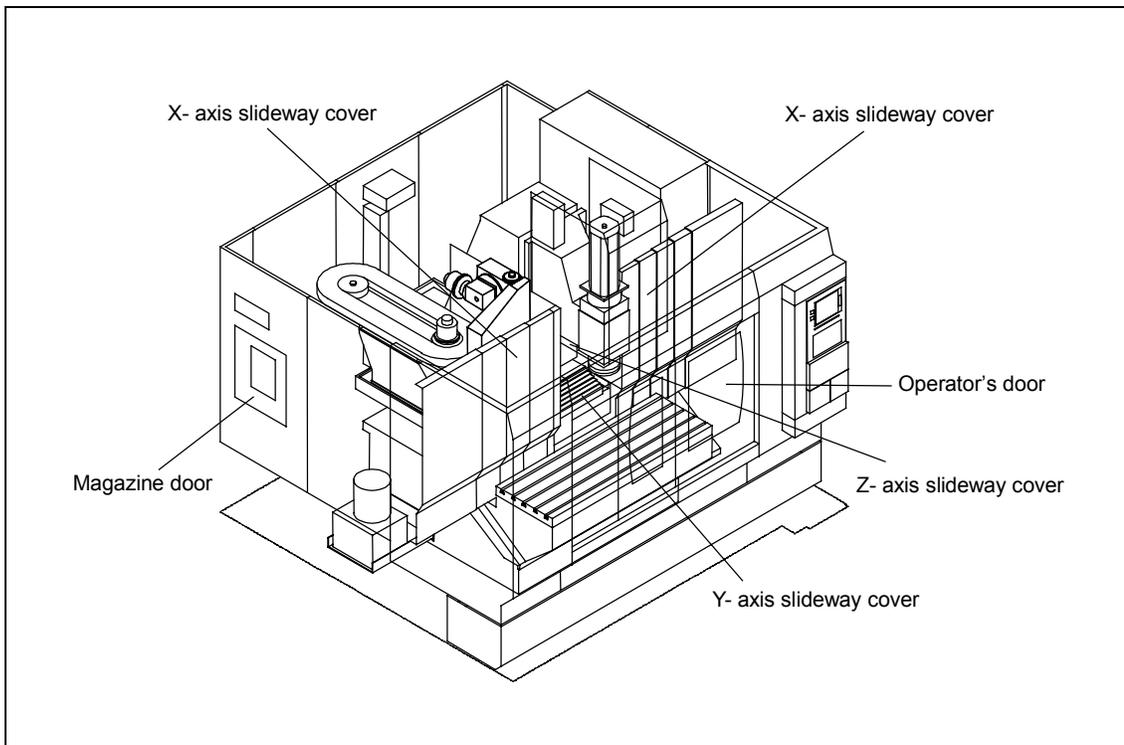


Fig. 5-10 Arrangement of Cover

5-9-3 Changing the Reed Switch

Reed switch specifications:

Part No.: R27SV000530

Type: D-A53L

Manufacturer: SMC



- Switch off the power before changing the reed switch. Otherwise, you may sustain serious or fatal injury.

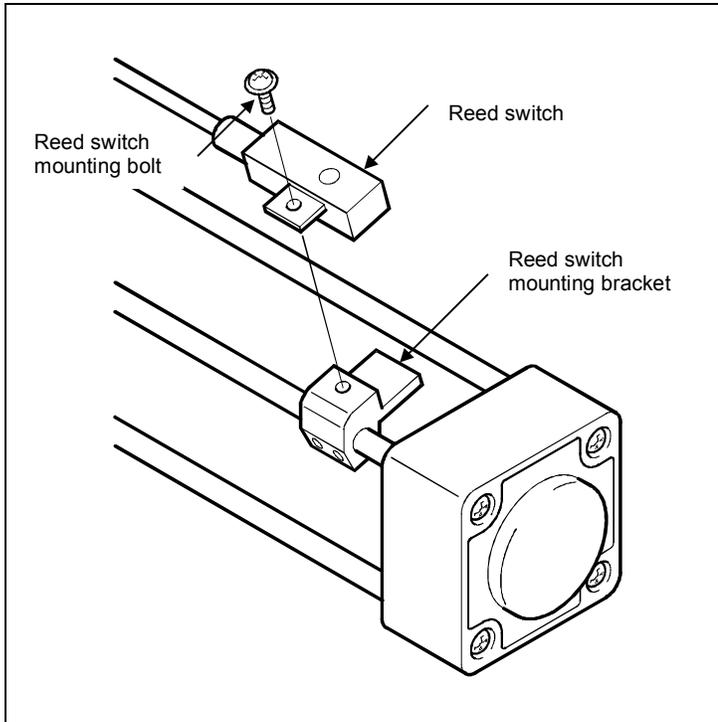


Fig. 5-11 Changing the Reed Switch

< Procedure >

- (1) Mark the position of the reed switch mounting bracket on the cylinder.
- (2) Unscrew the reed switch mounting bolt and pull out the reed switch.
- (3) Mount a new reed switch on the reed switch mounting bracket.
- (4) Align the reed switch mounting bracket with the mark and tighten the reed switch mounting bolt.

Torque: 10 kgf-cm (8.66 in-lbs)

5-10 NC Unit and Electric Control Cabinet

5-10-1 Troubleshooting

Symptom	Check Points and Probable Causes	Corrective Action	Refer to
<ul style="list-style-type: none"> The following alarm message is displayed on the screen: "052: BATTERY ALARM" 	Voltage of the battery used to retain the NC data is low. (Battery has been used to the life.)	Change the battery. The data will be lost if the battery is not changed.	Instruction manual of the NC
<ul style="list-style-type: none"> Error with the LCD screen 	Power supply to the display is faulty, or the display itself is faulty.	Contact Mazak Technical Center.	—
<ul style="list-style-type: none"> The following alarm message is displayed on the screen: "053: TEMPERATURE ERROR" 	Ambient temperature of the NC unit is higher than 45°C (113°F).	Lower the ambient temperature of the machine.	—
	Cooling fan of the NC unit is defective.	Change the NC unit cooling fan.	—
<ul style="list-style-type: none"> The following alarm message is displayed on the screen: "217: THERMAL TRIP" "219: MAIN TRANSFORMER OVERHEAT" 	Any of the motors is overloaded.	Eliminate the cause of overload and reset the thermal relay.	5-10-2
	The unit, which uses the motor for which the terminal relay has been tripped, is defective.	Follow the maintenance instructions for the individual units.	5-1 to 5-9
	(The same alarm occurs again soon even when the thermal relay is reset after cooling the motor.)	If the cause is unknown, contact your local Mazak Technical Center.	—

5-10-2 Resetting the thermal relay

If alarm message "AL 217 THERMAL TRIP" "AL 014 CONVEYOR THERMAL TRIP" is displayed, any of the following thermal relays is tripped. This could be caused by the overload of the related motor.

FR10 (thermal relay under magnetic contactor KM10) For hydraulic unit pump motor

FR11 (thermal relay under magnetic contactor KM11) For flood coolant pump motor

FR4 (thermal relay under magnetic contactor KM4) For spindle cooling pump motor

If a thermal relay is tripped, eliminate the cause and reset the thermal relay by pushing the corresponding reset button as shown below (Fig. 5-12).

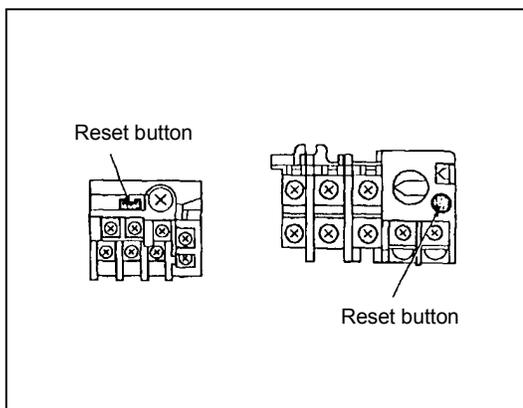


Fig. 5-12 Thermal Relay

5-10-3 Changing the Proximity Sensor

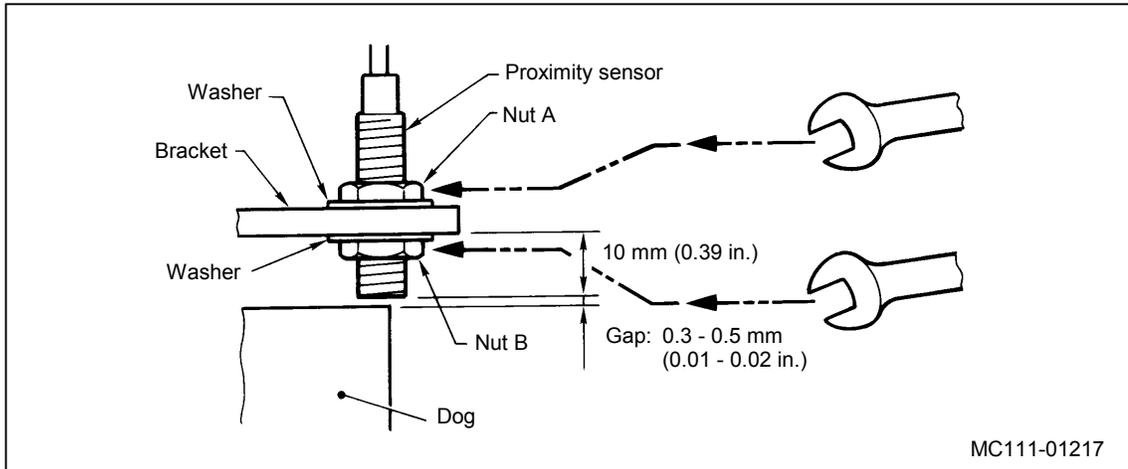


Fig. 5-13 Changing the Proximity Sensor

< Procedure >

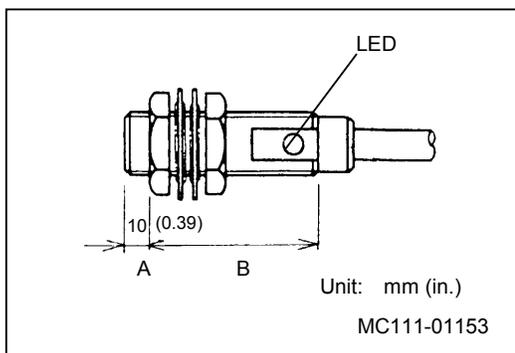
- (1) Remove nuts A and B by using the wrenches and then remove the sensor from the bracket.
- (2) Set a new sensor in the bracket.
- (3) Tighten nuts A and B temporarily.
- (4) Measure the gap between the sensor front edge and the dog using the thickness gauge.
- (5) Adjust the gap by turning the nuts.

Gap: 0.3 to 0.5 mm (0.01 to 0.02 in.)

Since the thread pitch of the sensor is 1 mm (0.039 in.), one turn of the nut moves the sensor 1 mm (0.039 in.)

- (6) Tighten nuts A and B at the same torque.
- (7) After adjusting the sensor, operate the related machine unit and make sure that the sensor operates ON/OFF correctly by observing the LED in the sensor.

Note: Tightening torque varies according to the distance from the front end of the head. Tighten the nuts within the allowable torque indicated for range A and range B.



Allowable tightening torque in range A:
120 kgf-cm (8.7 ft-lbs)

Allowable tightening torque in range B:
200 kgf-cm (14.5 ft-lbs)

Fig. 5-14 Proximity Sensor

-MEMO-

6 INSTALLATION

6-1 Precautions on Installing the Machine



- Before starting the installation work, read Chapter 2 “SAFETY PRECAUTIONS” and make sure you thoroughly understand the information in this Chapter.
- The floor must be completely dry and free of oil so that operators will not slip and fall during carrying and installation of the machine, electrical work, machine adjustments, or other work.
- Safety equipment (helmet, safety shoes, etc.) and clothing appropriate for the work to be undertaken must be worn.
- Use wire rope or slings whose specifications state that they can support the weight to be lifted, and inspect them for any abnormality before use.
- Lifting aids such as wire rope and slings must be secured at the specified locations, and the lifting angle must be correct.
- During piping and wiring work, check the matchmarks between the hose and fitting location when fitting hoses.
- Prepare an air source that meets the external air source requirements.
- Prepare a power source that meets the external power source requirements.
- When connecting the main power disconnect to the power source, carry out piping work such that the power disconnect box is protected to IP54 standards.
- When carrying out machine adjustments, refer to 2-9 “Safety Equipment” and make sure that all safety devices function correctly.

6-2 Preparing for Installation

6-2-1 Environmental Requirements

1. Machine

Avoid the following places for installing the machine.

- Places where the machine is exposed to direct sunlight, near a heat source, or temperature varies excessively.
- Places where humidity is considerably high.
- Dusty places
- Places near vibration generation equipment
- Places where the floor is not strong enough to support the machine.

Note 1: If the machine has to be installed near vibration-generating equipment, make foundation according to the specification of Mazak and take appropriate measures against vibration.

Note 2: If the soil is weak, reinforce it by driving piles to avoid settling and subsidence of the soil after the installation of a machine.

2. NC

A. Ambient temperature

Allowable temperature range during machine operation: +5 to +40°C (+41 to +104°F)
[the average temperature over periods longer than 24 hours must not exceed 35°C (95°F)]

B. Humidity

Allowable relative humidity: 30 to 95% (no condensation)

Note: As humidity increases, it impairs insulation and also accelerates deterioration of electric component parts. Although it is not necessary to take special dehumidifying measures, installation of a machine in humid places should be avoided.

C. Atmosphere

Although installation of the machine should be avoided in a dusty area or area where there is high concentration of organic or corrosive gas, if the machine must be operated under such environment, consult Mazak for appropriate measures.

D. Vibration

Allowable maximum vibration during operation: 5 m/S² (0.5 G or lower)

Allowable maximum vibration during transportation: 35 m/S² (3.5 G or lower)

3. Requirements for maintaining the guaranteed accuracy

A. Basic requirements

The machine should be installed at a site with tightly-packed soil, no vibration-generating equipment nearby and a certified foundation (See section 6-2-5 Foundation Work).

B. Environmental requirements (air conditioned)

Ambient temperature: 20 ± 2°C (154.4 ± 35.6°F)

Temperature variation: 1 °C (33.8°F) / 30 min or lower

Relative humidity: 75% or lower

Dust and other foreign matter: 0.3 mg/m³ or lower

6-2-2 External Power Source Requirements



WARNING

- To connect the power supply cable to the machine, grounding of class 3* or higher is required.
 - * Class 3 grounding: Grounding resistance is 100 Ω or lower.
- Use cable conductors that meet the following requirements (200 VAC power source)
 - Primary power cable: 38 mm² (0.6 in².) or larger
 - Grounding cable: 22 mm² (0.3 in².) or larger
- When an earth leakage breaker is used, it must have a trip current rating of 200 mA.
Since the machine has inverter driven equipment, an earth leakage breaker with a 30 mA trip current rating must not be used since it could malfunction.

1. Power source voltage

Voltage: 200/220 VAC, 3 phases

Permissible voltage fluctuation: $\pm 10\%$

2. Frequency

50/60 Hz $\pm 1\%$

3. Total power requirements

When installing the machine, the machine may malfunction if the power capacity is insufficient and the service life of the electric parts will be shortened.

In some cases, this may incur serious problems from the standpoint of safety. Therefore, always pay sufficient attention to the power facility so that sufficient power can be supplied to the machine.

Table 6-1 Power source

Frequency	50/60 Hz $\pm 1\%$
Voltage	3 phases (3 lines) 200/220 V
Permissible voltage fluctuation	$\pm 10\%$
Grand total of power requirement	See the separate table. * Install the transformer having the capacity (KVA) larger than the grand total of the continuous rating.
Power source connection cable	See the separate table. * Provide the earth (metallic conduit wiring) having grounding resistance of 100 Ω or less.

Table 6-2 List of Total Power Requirements

VTC200/300 10000 min⁻¹ (rpm) (standard specifications)

Item		Power requirement (kVA)	Output (kW)	Remarks
NC unit ····· 1		0.2	0.2	
Spindle motor and servo motor	Spindle motor	12	7.5	(Continuous) (30-min rating) (10-min. rating)
		17	11	
		23	15	
	X-axis servo motor HC153S-E51	- (Note 1)	1.5	
	Y-axis servo motor HC153S-E51	- (Note 1)	1.5	
Z-axis servo motor HC153BS-E51	- (Note 1)	1.5		
4th-axis servo motor HC52T-E51(option)	- (Note 1)	0.5		
Total power requirements ····· 2 (not including the 4th-axis servo motor (option))		16.12	12.0	(Continuous) (30-min rating) (10-min. rating)
		21.42	15.5	
		27.57	19.5	
Total power requirements ····· 2' (including the 4th-axis servo motor (option))		16.65	12.5	(Continuous) (30-min rating) (10-min. rating)
		21.95	16.0	
		28.00	20.0	
Other motors (standard specifications)	ATC drive motor	- (Note 2)	0.5	Servo motor
	Magazine rotation motor	0.65	0.5	Servo motor
	Hydraulic pump motor	2.88	2.2	
	Standard coolant pump	0.24	0.18	
	Spindle cooling fluid pump	0.26	0.2	
Total power requirements ····· 3		4.03	3.08 (Note 3)	
Other motors (option)	Through-spindle coolant pump	1.36	1.04	
	Chip conveyor	0.13	0.1	
Total power requirements ····· 4		1.49	1.14	
Control circuit, etc. ····· 5 (Note 4)		1.0	1.0	
Grand total power requirements (not including options) 1 + 2 + 3 + 5		21.35	16.28	(Continuous) (30-min rating) (10-min. rating)
		26.64	19.78	
		32.70	23.78	
Grand total power requirements (including all options) 1 + 2' + {3 - (standard coolant pump)} + 4 + 5		22.60	17.24	(Continuous) (30-min rating) (10-min. rating)
		27.90	20.74	
		33.95	24.74	

Note 1: The power requirement of this axis servo motor is added to the total power requirements 2 and 2' as this axis servo motor is controlled by integral amplifier.

Note 2: The power requirement of the ATC drive motor is not added to the total power requirements 3 as the ATC drive motor does not operate concurrently with the spindle.

Note 3: Only the outputs from one side of the ATC drive motor and magazine rotation motor are added to the total outputs of the other motors as the ATC drive motor and the magazine rotation motor do not operate concurrently with each other.

Note 4: Including the power supply to the slideway lubrication, fans, solenoid valves and control relays.

	Input voltage	200V	220V
Power source connection cables (Ambient temperature: 30°C (86°F) or lower)	Power cable	38 mm ² (0.6 in ²)	
	Grounding cable	22 mm ² (0.3 in ²)	

6-2-3 Air Source Requirements

Pressure	5.0 - 9.0 kgf/cm ² (71.2 - 128.1 PSI)
Minimum discharge Standard	140 L/min (4.942 ft ³ /min)
	With air blast option 722 L/min (25.487 ft ³ /min)
Dew point	-17°C (30.6°F) or lower (at atmospheric pressure)

Note: If the air has a high moisture content or if hot air is used, air actuators and equipment could be damaged. In such cases, use an air dryer or similar equipment.

6-2-4 Items to Be Confirmed when Carrying the Machine

1. Machine dimensions

In order to carry this standard machine into your plant, the entrance of your plant must be bigger than the dimensions indicated below:

Unit: mm (in.)

Status	Application	Dimensions	
		Type B	
Normal dimensions (Z-axis lowest position)		Overall width	:2996 (117.95 in)
		Overall height	:2553.5 (100.53 in)
		Crosswise	:2855 (112.40 in)
Dimensions when the machine is carried in/out by truck	Dimensions after the followings are dismantled: <ul style="list-style-type: none"> • Operation panel handle • Rear cover 	Overall width	:2939 (115.71 in)
		Overall height	:2553.5 (100.53 in)
		Crosswise	:2834.6 (111.60 in)

6-2-5 Foundation Work



CAUTION

- If the machine has to be installed near vibration-generating equipment, it is necessary to take appropriate measures such as providing a vibration insulation pit around the machine.
- If the soil is weak, reinforce it by driving piles to avoid settling and subsidence of the soil after the installation of a machine.

For machine installation, select a flat place; avoid places subject to direct sunlight, humid places, and places near vibration generation equipment. Although required foundation work will vary according to soil conditions, it is necessary to compact the ground well or pour concrete to avoid settlement or inclination of the soil after machine installation.

- Foundation parts

Part Name	Part No.	Quantity
		Type B (standard specifications)
Jack bolt	34710400020	8
Block	44856102010	5
Block	45576105340	3
Hex. nut M38	34710400030	8
Collar hex head cap screws M6 × 10	A15B06X100	5
Hex. nut M16	A40JJ00M160	5
Washer M16	A41JJ00M160	5
Anchor bolt	34946110050	5
Collar	44946110060	5
Plate	44966111010	2
Bolt	44966111020	2

6-3 Installation

6-3-1 Precautions on Installation



WARNING

- Two or more workers must handle heavy objects.
- Use wire rope or a sling that can bear the weight to be lifted.
- The machine must be lifted properly. Lift the machine slightly off the floor to check if it is well balanced.
- The angle made by the wire rope or sling must be less than 60°.



CAUTION

- Before lifting the machine, check that each machine unit is fixed in position and that there are no tools or anything else on the machine.

6-3-2 Lifting

Lift the machine in the manner as shown in Fig. 6-1.

- (1) Firmly fix the head to a lower position and the column and saddle to an almost center position with respective shipping brackets.
- (2) Use a dedicated lifting attachment as shown in Fig. 6-1.
- (3) Use sufficiently thick wire ropes with no slack or tears.
- (4) Place wood blocks or pads between the machine and wire ropes so that the machine will not be damaged by direct contact of the wire ropes.
- (5) When lifting the machine, pay attention so that the wire ropes will not touch the piping, hydraulic equipment, wiring, control equipment, and covers.
- (6) Make sure that the drain ports of hydraulic oil tank, coolant tank, and lubricating oil tank are all securely tightened so that oil will not leak.
- (7) When carrying the machine using rollers, pay attention so that impact will not be applied to the machine.

Machine body

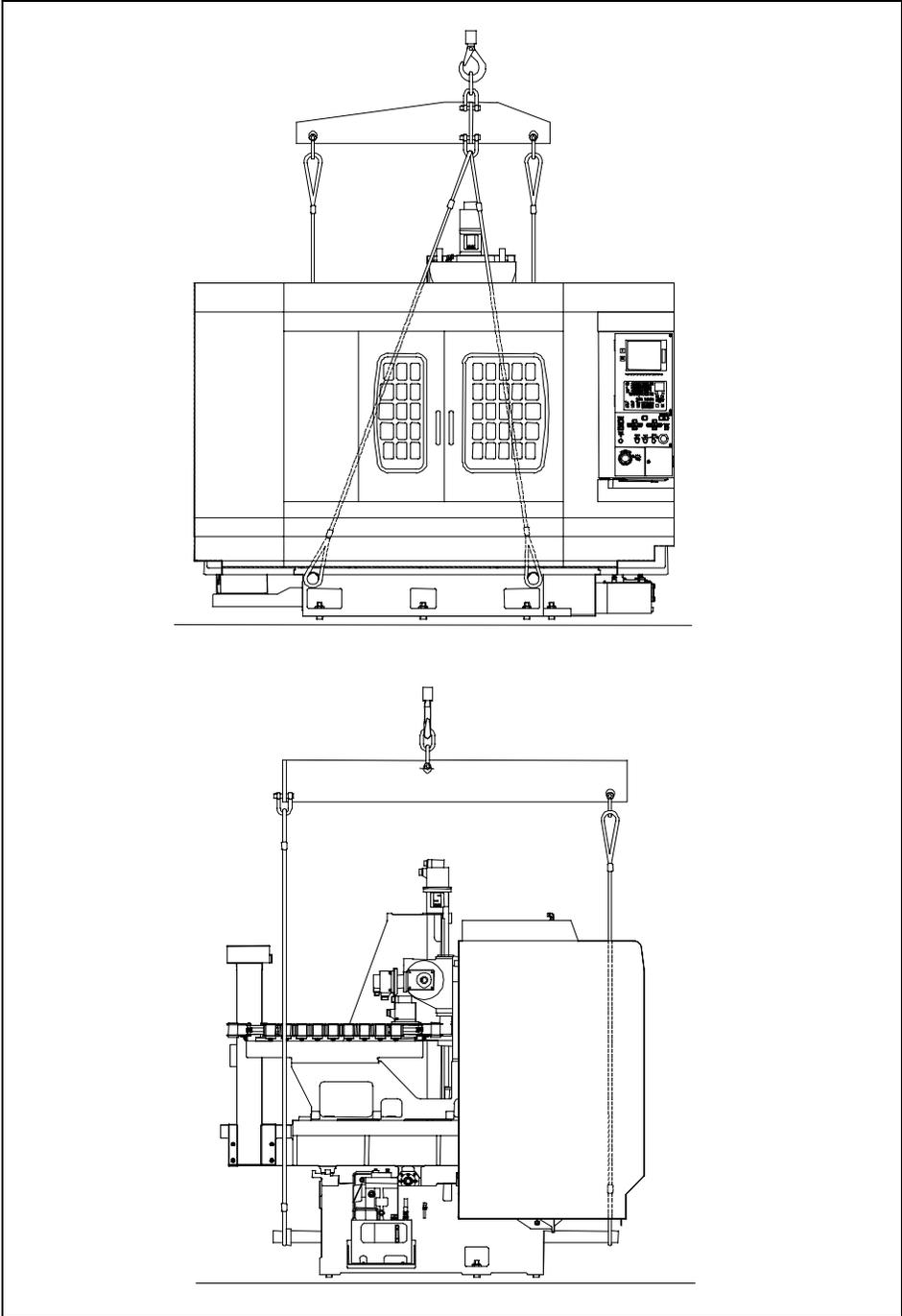


Fig. 6-1 Lifting the Machine

6-3-3 Weights of Machine Units

kg (lbs)

	VTC-200B	VTC-200C	VTC-300C
Machine body (standard specifications)	6100 (13725)		
Coolant tank	140 (315)		140 (315)
Chip conveyor (hinge type)	280 (630)		280 (630)
Chip conveyor (scraper type)	220 (485)		220 (485)

Note: The figures indicated in the machine plates shall be applied if ones in the manual may differ.

6-3-4 Unpacking, Inspection and Cleaning

1. Removing the shipping brackets

The machine is shipped with its units fixed in place with shipping brackets so that they will not move during transportation. After installing the machine, remove all of shipping brackets. Store the removed shipping brackets and bolts in a suitable place to allow for reuse during movement or transport of the machine in the future.

2. Installing the cover and other part

Install the cover and other part which are supplied in separate packages.

3. Cleaning

Slideways and other machine parts are coated with rust preventive oil to protect the metallic surfaces from rusting.

Since sand grits, dust and other foreign matter tend to stick to this rust preventive coating during the transportation of the machine, do not operate the machine before cleaning the machine.

Remove rust preventive oil with rag soaked with washing oil.

Note: Take care to avoid entry of cleaning oil into the slideway surfaces passing the wiper.

6-3-5 Location of the Shipping Brackets

Before starting the carriage of this machine, fix the machine at two locations with fittings and apply a wooden block to between the spindle and the table as shown in the following illustration.

Tool to be used: Allen wrench (10 mm (0.394 in))

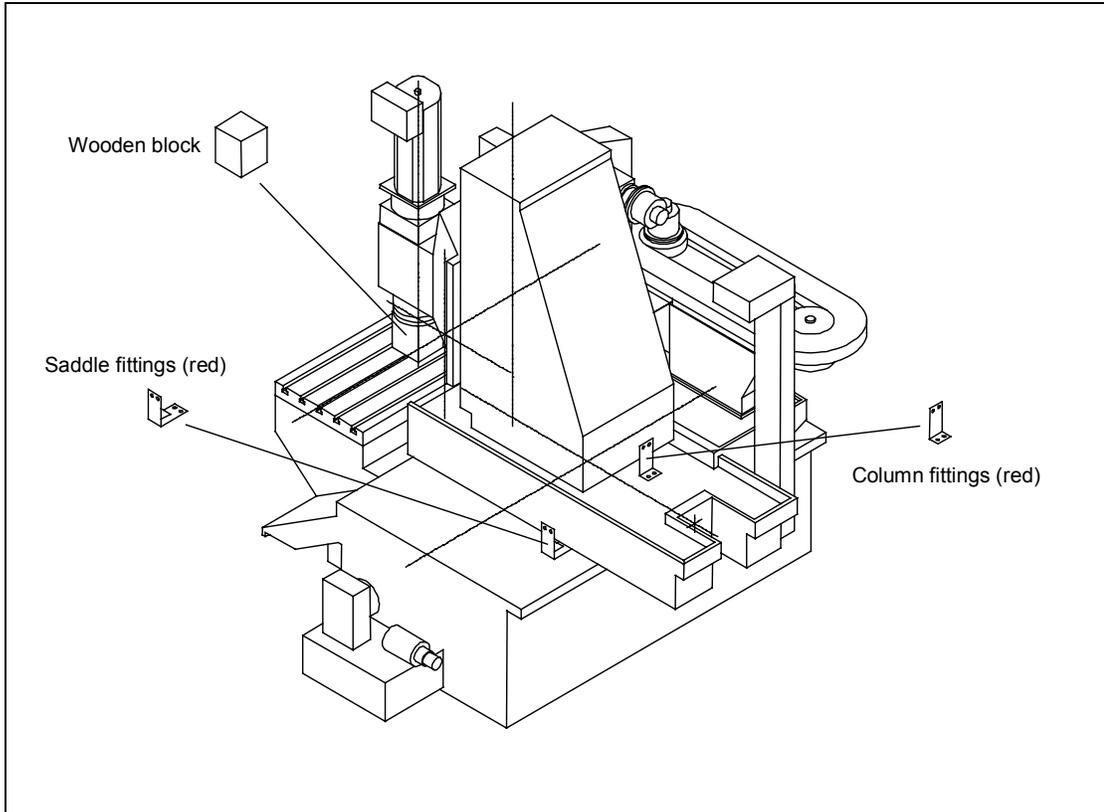


Fig. 6-1 Location of the Shipping Brackets

6-3-6 Installing the Machine

Machining accuracy is greatly influenced by installation conditions. No matter how precisely the slideway surfaces have been finished, machining accuracy will still be poor if the machine is not correctly installed.

Tools to be used: Allen wrench (3 mm (0.118 in))

Wrench (24 mm (0.94 in), 32 mm (1.26 in), 46 mm (1.81 in))

1. Temporary leveling adjustments

< Procedure >

- (1) Carry the machine to the installation site.
- (2) Distribute plates for use in temporary leveling to around each foundation hole according to the foundation drawing.
- (3) With the machine lifted, fit the leveling bolts, the foundation bolts, the collars, the foundation plates, etc. to the leveling bolt holes in the machine.
- (4) Set the set screws attached to the collars so that the foundation plates do not drop.
- (5) Lower the machine gently so that the foundation bolts are correctly inserted into the foundation holes prepared according to the foundation drawing.
- (6) Flow the concrete into the foundation bolt holes.

Note : Be sure to add an expanding agent to the concrete to prevent shrinkage during the solidification. At this time, the bottom surface of the foundation plate may be coated with grease to cut off the air flowing there.

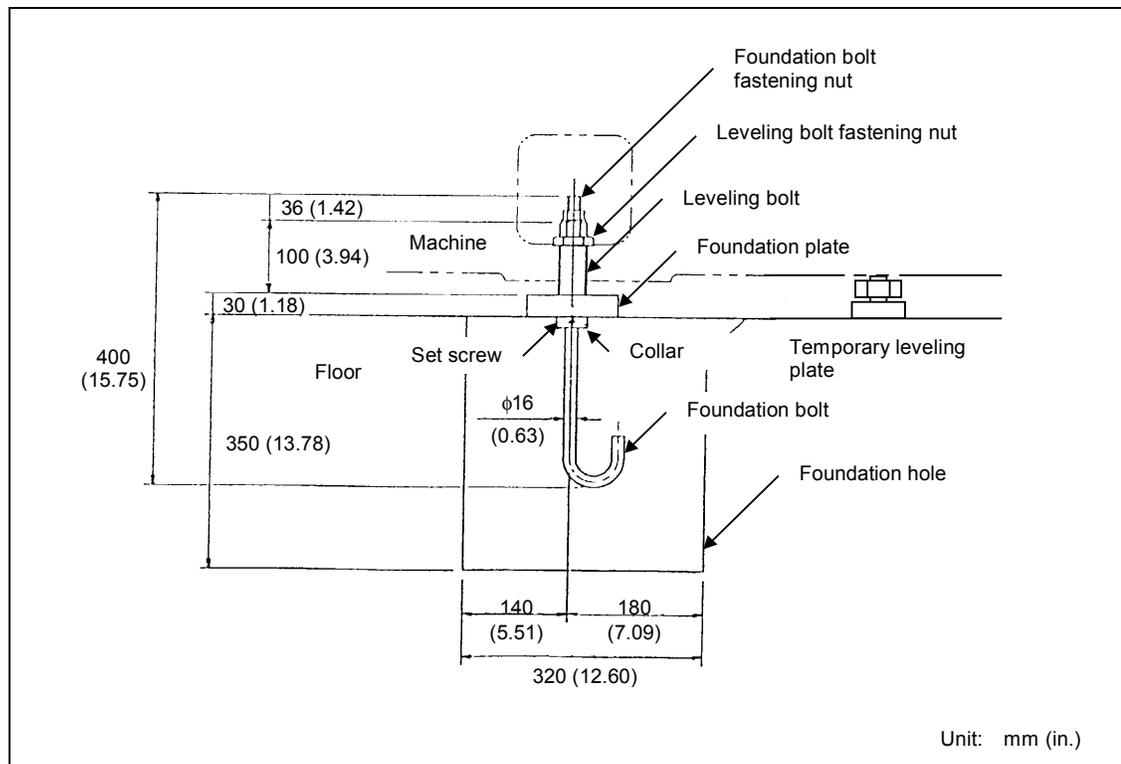


Fig. 6-1 Foundation

2. Adjustment of the clearance between the machine and the coolant tank

In order to prevent water leakage, adjust the leveling bolts so that the clearance between the machine and the coolant tank is approx. 15 mm.

Note : If this adjustment is neglected, water leakage may be caused.

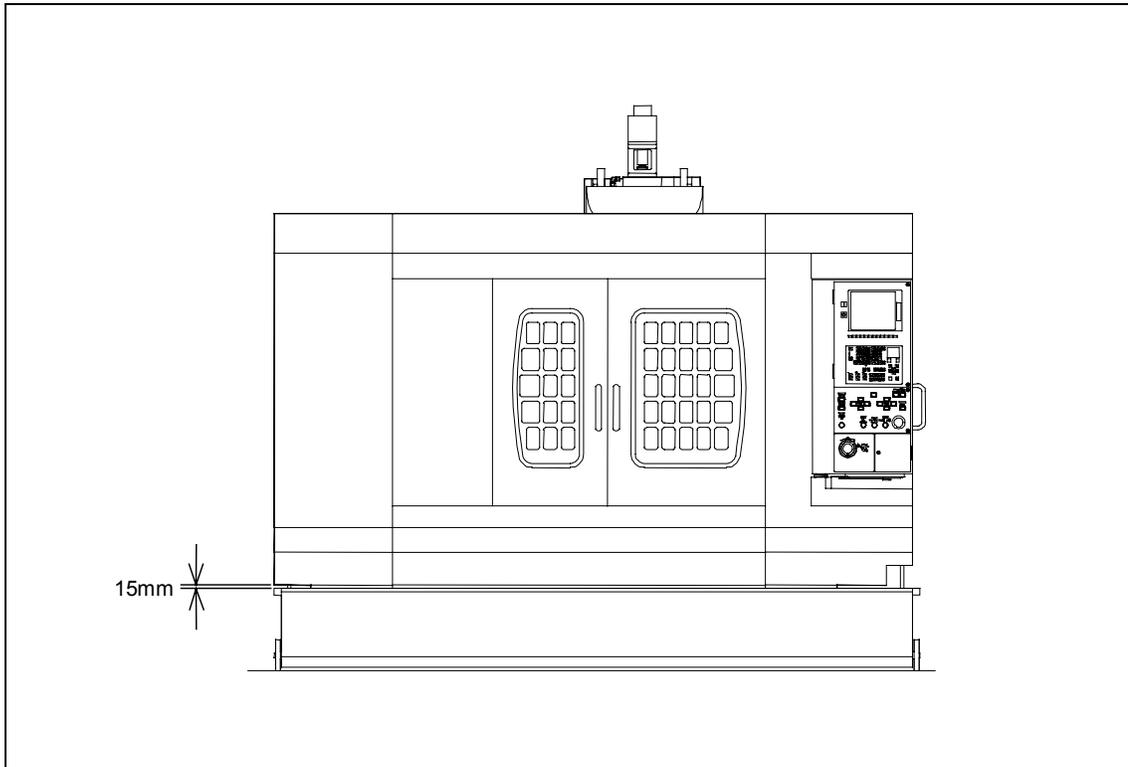


Fig. 6-1 Adjustment of the clearance between the machine and the coolant tank

3. Checking interconnections

After temporary leveling is finished, check and confirm the following items before switching the power on.

- Grounding (class 3 grounding work) Class D (formerly class 3) grounding requirements
- Screws at terminals (must be tight)
- Connection of cannon connectors and other connectors
- Relays (must be fitted and connected correctly)

4. Final level adjustment

After the second stage concrete has solidified, adjust the machine level using the leveling bolts. Place precision levels on the upper surface of the table.

Precision level accuracy: 0.02 mm (0.00079 in.)/division

For details of the procedure to adjust the machine level and allowable leveling error, refer to our CERTIFICATE OF THE MACHINE ACCURACY supplied with the machine.

After tightening the leveling nuts and foundation bolts, check the machine level again.

6-4 Connecting to the Power and Air Sources

6-4-1 Connecting to the Power Source



- Do not connect the power cable to the shop power distribution board until all installation work has been completed.

< Procedure >

- (1) Unscrew the bolts holding the main power disconnect box cover in place, turn the switch to the “OPEN RESET” position and remove the cover.

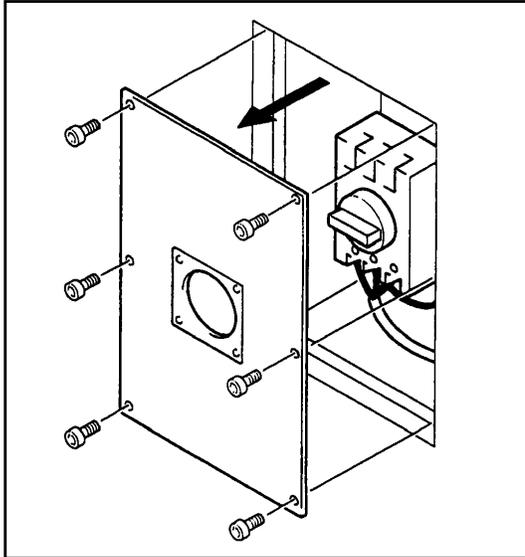


Fig. 6-1 Connecting the Power Supply Cable (1/2)

- (2) Pass the power supply cable into the main power disconnect box through the hole at the back of the electric control cabinet.

- (3) Connect the wires to the R, S, and T terminals and the ground terminal of the N.F.B. (no-fuse breaker).

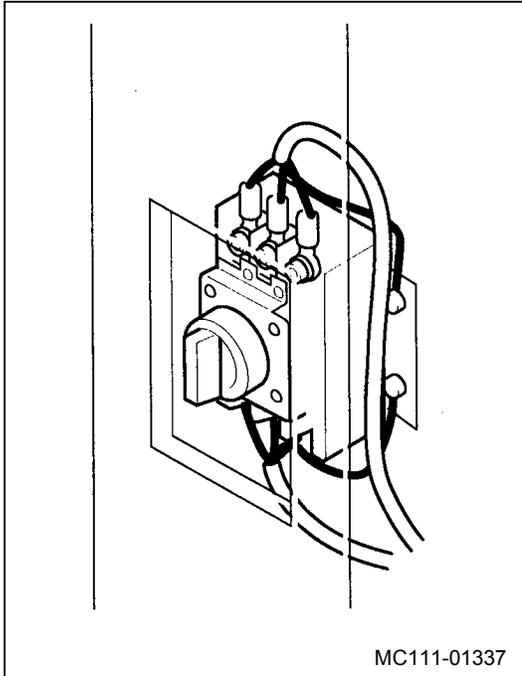


Fig. 6-1 Connecting the Power Supply Cable (2/2)

6-4-2 Grounding

1. All electrical devices must be grounded in order to protect personnel and machines from electrical hazards. Grounding must be carried out after the installation of the machine in accordance with the standards for electrical equipment.
2. Ideally, the grounding point should be as close as possible to the machine.

Class 3 grounding requirements Class D (formerly class 3) grounding requirements

Grounding resistance: 100 Ω max.

Power supply cable: Refer to the List of Total Power Requirements.

Measuring instrument: 500 V megger



- The grounding work must be entrusted to an officially authorized electrical engineer. Otherwise, serious injury, death, or accidents involving machine damage could result.
3. The machine must be grounded in one of the following ways.

A. Independent grounding

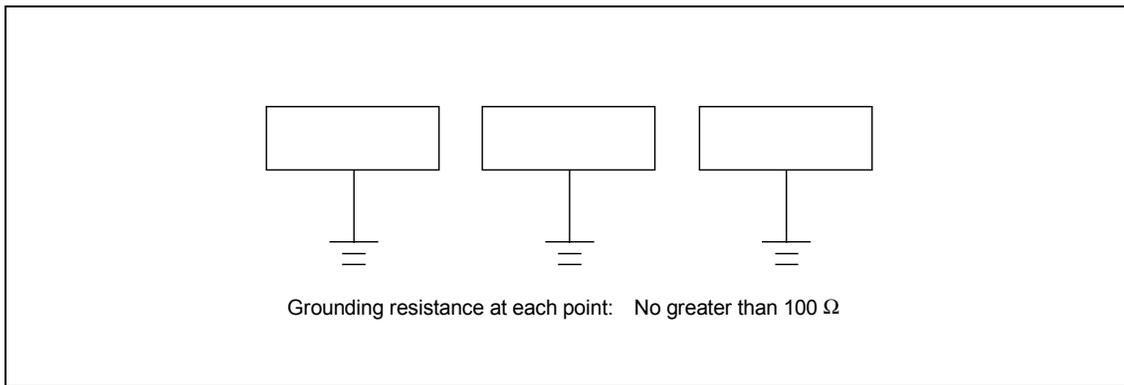


Fig. 6-1

B. Common grounding

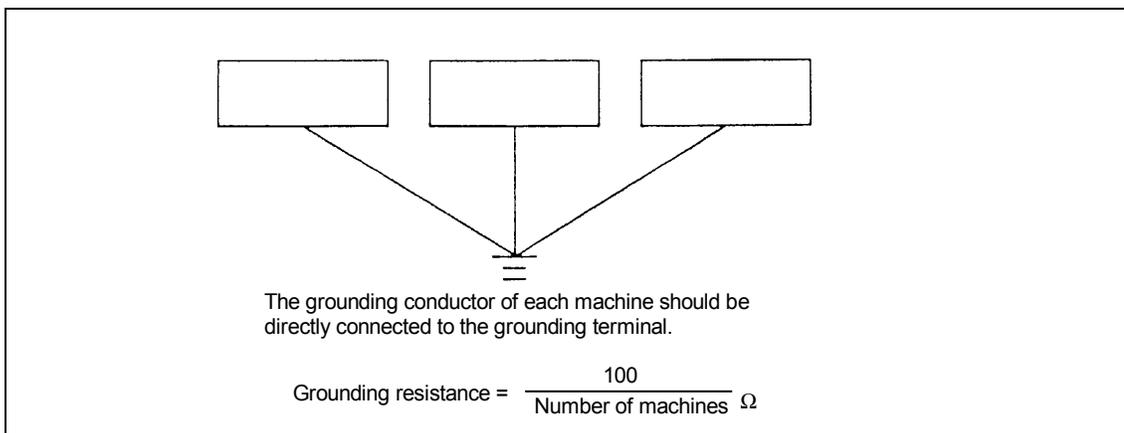


Fig. 6-2

4. Never ground the machine in the manner shown in the illustration below.

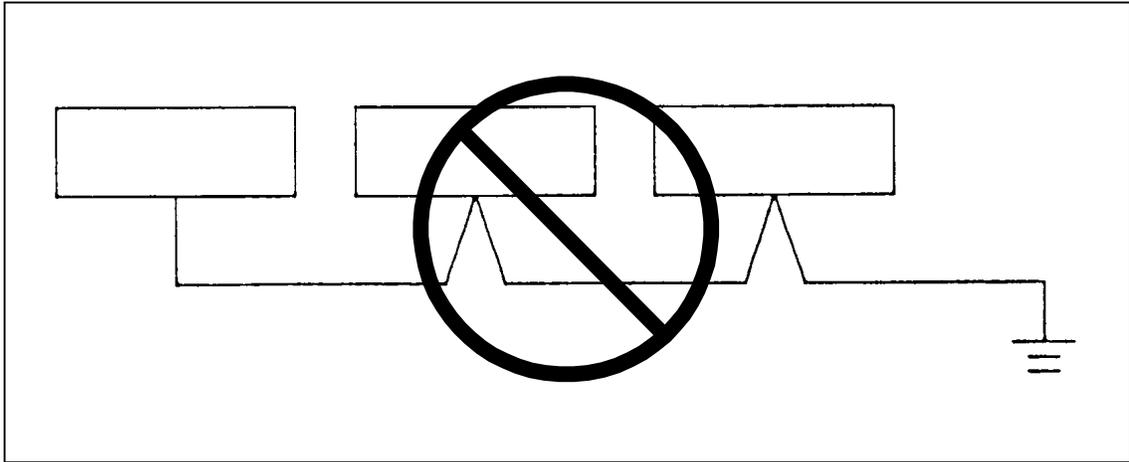


Fig. 6-3



- No more than one grounding conductor wire can be connected to a single terminal. If the grounding conductors are connected in the manner shown in the illustration above, a faulty connection at one of the terminals could cause grounding current to be fed back to the machine, resulting in serious accidents.

6-4-3 Connecting to the Air Source

Connect the air hose to the connection port of the FRL unit (air unit).

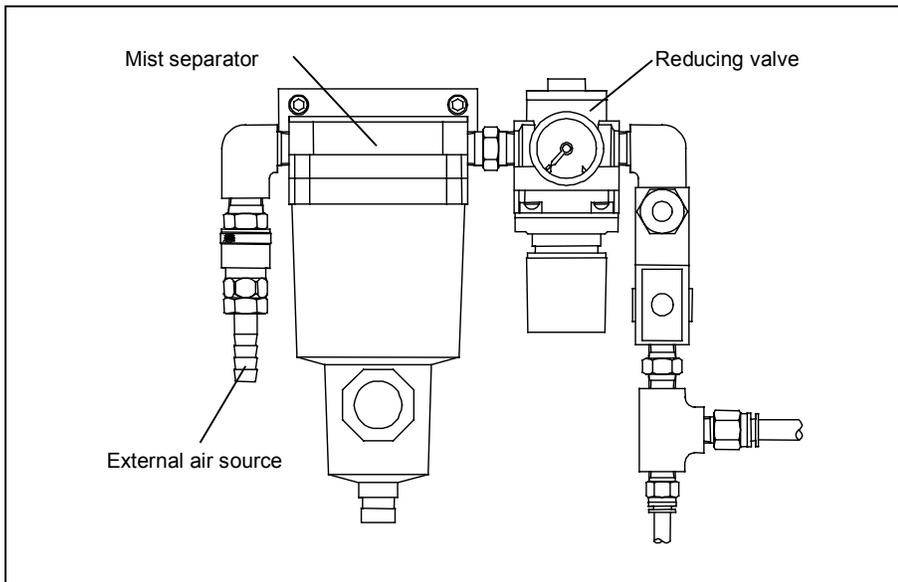


Fig. 6-1 FRL Unit

6-5 Test Run

6-5-1 Checking the Machine before Starting Test Run

1. Make sure that the lifting fixture and the shipping brackets are all removed.
If the machine is operated while they are still attached, the machine will be damaged.
2. Make sure that there are no missing parts or accessories.
3. Make sure that the centralized lubrication unit tank is filled with the specified lubricating oil to the specified level.
4. Make sure that the hydraulic unit tank is filled with the specified oil to the specified level.
5. Make sure that the spindle cooling fluid unit tank is filled with the specified oil to the specified level.
6. Make sure that the hoses and cables of the circuits for hydraulic, pneumatic, and coolant circuits are correctly connected.
7. Make sure that the coolant tank is correctly placed.
8. Make sure that the connection to the air source is correct.

6-5-2 Electric Inspection before Switching the Power ON

1. Check the phase sequence of power supply

If the NC power is switched on while the phase sequence of power supply is incorrect, trouble such as runaway of the machine and blowing of fuses will occur. Therefore, under no circumstances switch on the NC power until the phase sequence is confirmed to be correct.

A. Checking the phase sequence with the phase tester

Connect the phase tester to the transformer as shown in the illustration below (U ↔ R, V ↔ S, W ↔ T). The phase tester must show clockwise rotation.

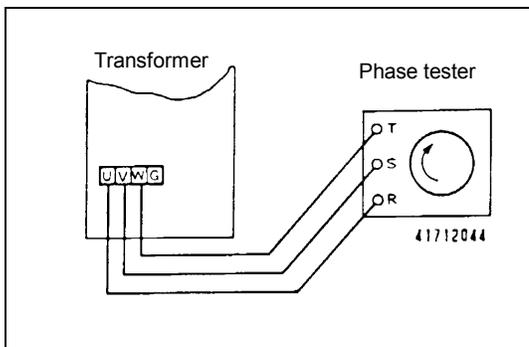


Fig. 6-1 Checking the Phase Sequence

2. Receiving power

If the phase sequence is correct, the main power disconnect may be turned on.

For the machine using the spindle drive motor:

Turn on the main power disconnect and check the indication of the LED lamps at the front panel of the spindle controller. Make sure that the LED lamps do not show an alarm indication.

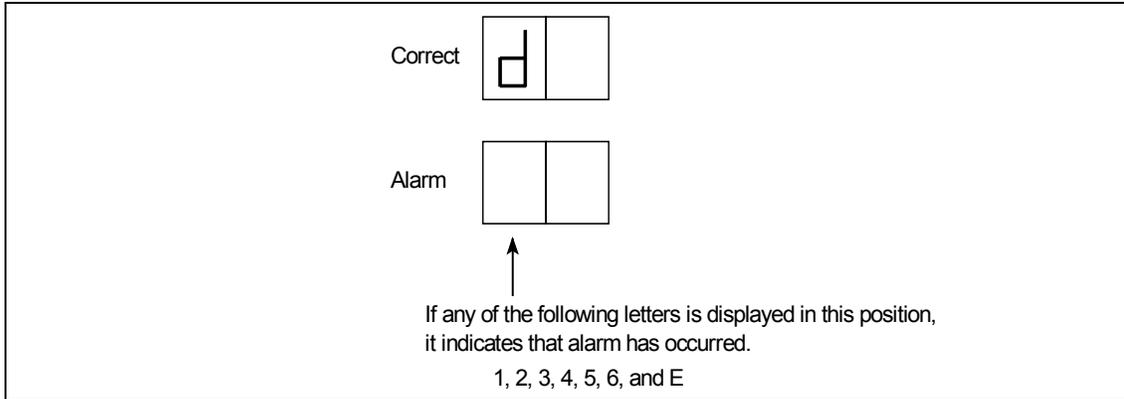


Fig. 6-1

6-5-3 Checking the Parameter Settings

Check the present parameter settings by referring to the parameter table in the electrical control cabinet.

6-5-4 Checking the Machine in Manual Operation

Operate the machine manually to make sure that the following operations are executed correctly.

- Spindle rotation
- Axis movement (X-, Y-, and Z-axis)
- ATC cycle
- Zero-point return

6-5-5 Breaking in Operation

When operating the machine for the first time after the installation, pay special attention so that the machine can operate without abnormalities.

Breaking in operation should be carried out for approximately 8 hours. During breaking in, do not apply a large load to the machine.

The machine is shipped with the program for breaking in operation (Pno. 1000) already input; use this program for breaking in operation.

7 APPENDIX

7-1 List of Sensors, Limit Switches, and Oiling Points

7-1-1 List of Sensors and Limit Switches

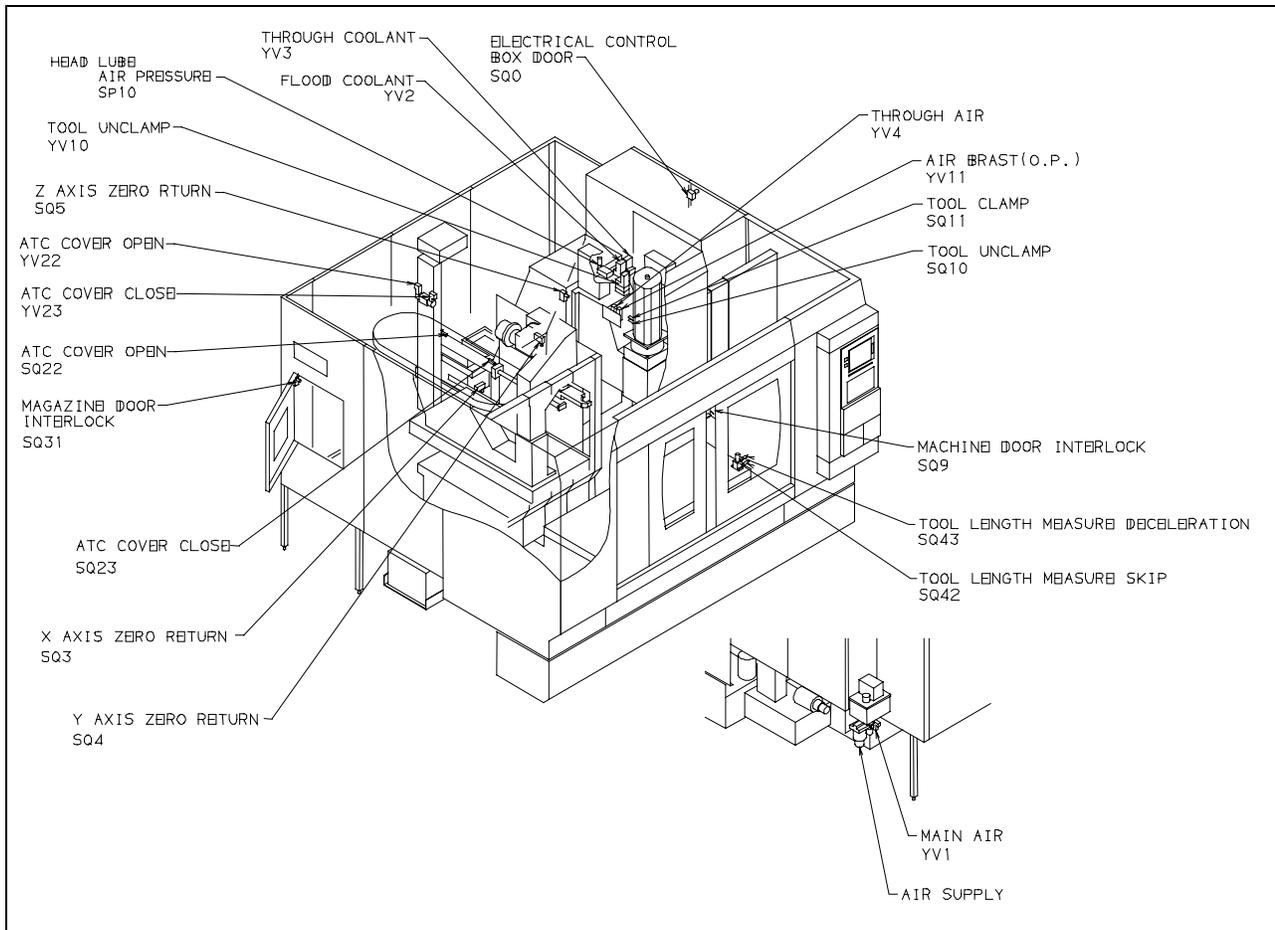


Fig. 7-1

7-1-2 List of Oiling Points

The lubrication period is decided on the basis of eight hours operation a day.

No.	Lubricating Point	Q'ty	Recommended Oil	Remarks
1	Spindle lubrication Slide way Ball screw	3 L (0.76 gal)	TERRESSO 68 (ESSO) TELLUS OIL 68 (SHELL) DTE 26 (MOBIL)	Auto lubrication replenish oil whenever necessary. Clean the filter every year.
2	Hydraulic power unit	10 L (2.64 gal)	UNI POWER 32 (ESSO) TELLUS OIL 32 (SHELL) DTE 24 (MOBIL)	Change oil every 6 months. When changing oil, clean the filter at the same time.
3	Spindle cooling unit	20 L (5.28 gal)	VELCITE OIL No.3 (MOBIL)	Change oil every 2 years. Never fail to clean the filter every month.
4	ATC arm cam box	2 L (0.53 gal)	FEBIS K68 (ESSO) VACTRA No. 2 (MOBIL) TONNA OIL T68 (SHELL)	Change oil every 6 months.

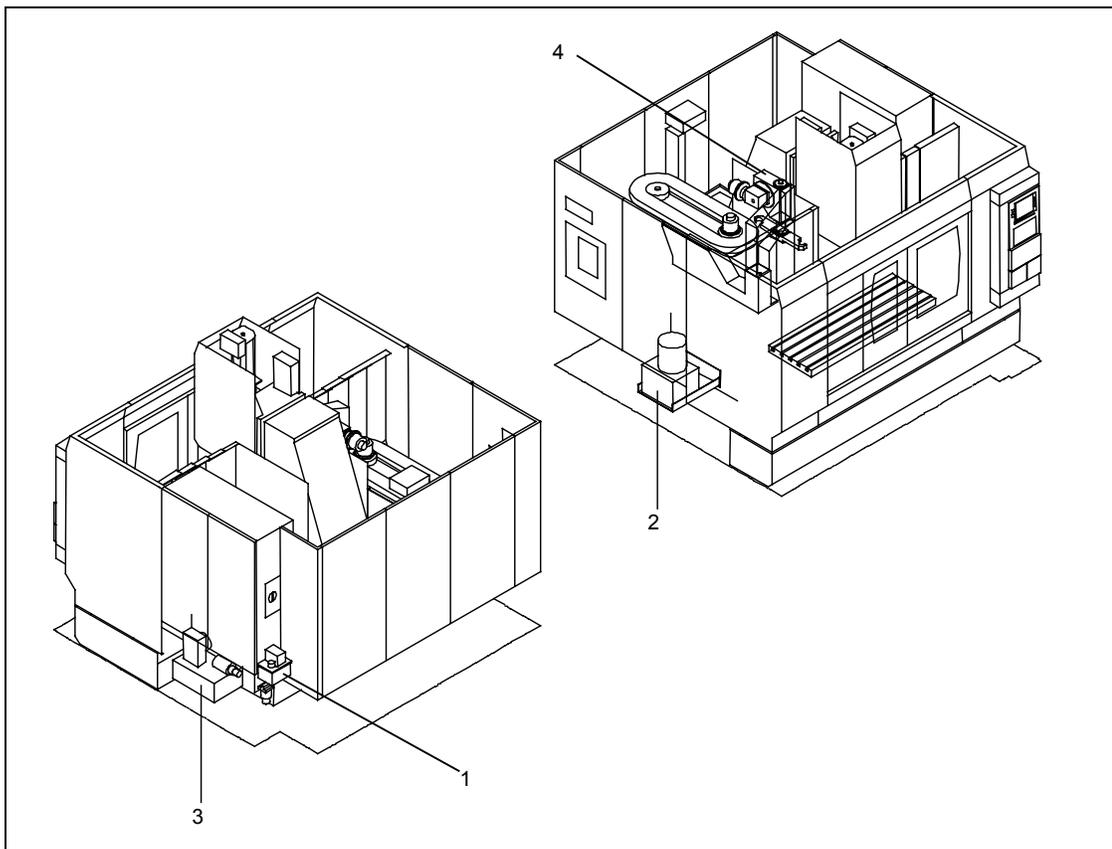


Fig. 7-1 Oiling points

7-2 List of wearable Parts

Service life of wearable parts below will vary according to the conditions under which they are used.

Location	Name	Part No.	Type	Manufacturer	To be changed in	Refer to
Hydraulic unit	Pressure gauge	G23MBK90020	96201-BB2-T2	Barksdale	5 years	-
	Suction strainer	-	70-002	Nachi	3 years	-
Air unit	Element ass'y	G48SV00130A	AM-EL350	SMC	2 years	-
Spindle cooling fluid tank	Suction filter	G30TP002170	SFG-04-100W	Taisei	3 years	-
Centralized lubrication unit	Filter set	G06LAP00140	489011	Lube	3 years	-
Slideway cover	X-axis slideway cover, right	Z33MBB90091	VTC-200B		If necessary	-
		Z33MBB90040	VTC-300C			
	X-axis slideway cover, left	Z33MBB90081	VTC-200B		If necessary	-
		Z33MBB90050	VTC-300C			
	Y-axis slideway cover	Z33ZZ002720	VTC-200B		If necessary	-
		Z33MBB90061	VTC-300C			
Column side wiper, right	25575003342	VTC-200B VTC-300C		If necessary	-	
Column side wiper, left	25575003352	VTC-200B VTC-300C		If necessary	-	
Z-axis slideway cover	Z33MMP90020	VTC-200B		If necessary	-	
	Z33MMP90040	VTC-300C				

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