

SANCO®

DOUBLE COLUMN **MACHINING CENTER**

MODEL : SDL-SERIES

INSTRUCTION MANUAL



WARNING

Read all instructions carefully before operation.

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SDL Series INSTRUCTION MANUAL

Apply to model:SDL Series

M1V113C2A 2016/9/7

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IMPORTANT NOTICE

At first, we appreciate it very much for your purchase of SANCO CNC MACHINES. All related personnel should always remember instructions for machine installation, operation and maintenance. SANCO offers one year warranty for free repair, effected from the date when machine installation and adjustment is finished.

In general, our engineer or your local agent will inform customer various cautions and safety rules when operating the machine. When installing a new machine, the operator must remember all details to avoid accident. Basic safety rules are given as below:

1. The operator's body or hands must not enter into the auto door.
2. Abnormally opening the door may result in failure of safety detecting sensor.
3. Make sure all locking devices are tightened securely.
4. Abnormally turning power off may cause tool damage.

WARRANTY INSTRUCTION

SANCO offers a 12-months warranty for its machines. After warranty period is finished, if a maintenance service is required, maintenance cost should be charged according to our company's regulations of service charge. During the warranty period, if any unstable or abnormal operation occurs, please contact with your local agent or SANCO for correction.

If the warranty period is over, SANCO does not accept any requirement for machine modification. When modification is required, the modification should be dependent on the SANCO'S design concepts. Also, the modification cost is responsible by the customer.

INTRODUCTION OF MACHINE

■ FEATURES:

1. All major structural parts are box type construction combined with comprehensive rib layout, assuring ultra-high rigidity without deformation.
2. The X-axis (table) is fully supported by the bed in its entire travel, that resists heavy load and ensures high accuracy at any position.
3. The beam is a fixed bridge type construction with stepped slideway design to achieve excellent rigidity and high accuracy.
4. X, Y, Z-axis are mounted with the advanced high-precision linear ways. This results in long-term accuracy, minimum displacement and higher accuracy.
5. Z-axis travel provides 900, 1200 and 1400 mm to choose from. Also, available to equip with a 90° side milling head for side milling or a universal head for various angular machining.
6. Three-axes ball screws are fitted with double nuts. Preloaded ball screws combined with pretensioned axis transmission system permit accuracy to be maintained at all times and extend service life.
7. The tool loading capacity of the automatic tool changer provides over 24 tools to choose from with maximum stability.
8. Foot switches provided at the operator side and the magazine side make tool loading / unloading conveniently and safely.
9. The chip guards and X-axis are manufactured from high tensile strength, wear-resistant steel plates without deformation year after year. The chip guards are slant design, allowing coolant and chips to self-flow to chip removing channel.
10. There are two chip augers provided at both sides of table. They deliver chips to the chain type chip conveyor, then delivering to a chip bucket.
11. Multi-window transparent splash guard makes it easy to check machining condition and provides safety protection for the operator.
12. Choice of various compatible controls-FANUC, MELDAS, SIEMENS and HEIDENHAIN, etc.

I. SAFETY RULES

A. VARIOUS SAFETY RULES AND NOTICES

When the machine is running, the running parts, such as cutting tool, transmission belts, pulleys or voltage, air pressure and hydraulic pressure etc, and noise may cause danger. Before operating the machine, the operator must thoroughly understand all parts of the machine and absolutely observe the safety rules. This will reduce the possibility of personnel injury or damage to the machine.

B. SAFETY RULES

Each machine is shipped with various safety devices, labels and operation manuals. To prevent serious accident or damage to the products caused by incorrect operation, the operator must carefully read the supplied various operation manuals. The operator is also requested to understand all safety devices before operating the machine.

SANCO provides two kinds of operation manuals together with the machine, including:

- Maintenance and installation manual : provided by SANCO
- Control operation and maintenance manual: provided by the control manufacturer.

Following items are the basic safety rules:

1. Read the operation manual before starting the machine.
2. Do not use the machine over its rated specifications.
3. Do not clean off chips during machining.
4. Make sure the workpiece is clamped securely before performing machining.
5. Before starting the machine, check the distances between the tool and the workpiece and the fixture.
6. Do not use incorrect cutter and tool, such as dulled cutter and not secured tool.
7. During the machine is running, it is prohibited to use any object to clean or adjust the spindle tool.
8. Do not use your hands or any other object to force the machine to stop or slow down.
9. Before operating the machine, make sure all safety guards and doors are closed.
10. Never leave the machine running unattended.
11. When the machine is running, never try to adjust coolant and air flow rates.
12. Measuring the workpiece only when the machine is in stop condition.
13. Do not use compressed air to clean the machine.
14. Keep machine area clean, and remove unnecessary obstacles or chips etc.
15. If oil leaking, treat it immediately. Otherwise it may cause floor wet and danger.
16. During the machine is running, it is prohibited to perform maintenance or lubrication.
17. When performing maintenance, lubrication or repair, place a proper marking on the control panel or lock it. It is also suggested to ask another one for watching.
18. Do not replace with unqualified or not confirmed parts.
19. Do not use wet hand to touch the controller or any switches.
20. During performing automatic tool changing, do not try to remove or fit any tool from the tool magazine.
21. In case the electric control system is damaged, only a qualified engineer is allowed to perform maintenance.
22. In case an abnormal sound or loosening occurs, do not operate until the problem is corrected.

C. NOTICES BEFORE STARTING MACHINE

To ensure the safety of operator and machine, be sure to perform following checking items. This also may ensure the machine accuracy and its service life.

1. Check to see if there is any liquid existed around the machine or liquid leak from the hose. If there is , treat it immediately to avoid accidents.
2. Understand all emergency stop switches, indication lamps and operational switches, positions.
3. Always observe all warning labels and indication labels attached on the machine.
4. Do not destroy any warning labels and indication labels attached on the machine.
5. Check whether any power wire breaking or not. Electric leakage may cause an accident of electric shock.
6. Check whether oil amount in hydraulic oil tank, lubrication oil tank or coolant tank are sufficient or not. Also, check whether air and hydraulic pressures are correct or not.
7. Make sure all safety guards are closed, that may prevent chips or coolant from splashing, resulting in an accident.
8. Make sure the cutting tool is clamped securely to avoid danger due to tool loosening.
9. Make sure the workpiece is clamped securely to avoid danger due to workpiece loosening.
10. Make sure there is no obstacle existed in the vicinity of the machine and the controller.
11. Check whether the control system door is closed.
12. Make sure all control switches are in normal condition.
13. Check whether there is any person stay in the dangerous area of the machine.
14. Check whether there is any obstacles existed in the travel range of the machine.

D. NOTICES DURING MACHINE IS RUNNING

1. When the machine is running, it is prohibited to open any safety guard to avoid danger.
2. When the machine is running, it is prohibited to enter into the machine for removing chips.
3. When the machine is running, it is prohibited to enter into the machine for measuring the workpiece size.
4. When the machine is running, it is prohibited to enter into the machine for loading or unloading workpiece.
5. When the machine is running, keep long hair and easy-to-entangle object away from the machine to avoid entangling by the machine.
6. When the machine is running, keep non-related person away from the machine to avoid danger.
7. When the machine is running, in case power failure occurs, turn main power switch off immediately.
8. When the machine is running, in case any trouble or malfunction occurs, turn all power sources immediately and repair it.
9. When g the machine is running, do not perform any adjustment.
10. When the machine is running, do not adjust speed to a maximum value.
11. When the machine is running, do not use your hand or any tool to touch the workpiece being cut or any mechanism.
12. When the machine is running, do not allow its running speed over the allowable maximum value.
13. When the machine is performing automatic operation, do not touch any buttons.
14. Illumination in the working environment should keep at 500 Lux.
15. After a long time operation, the lighting device may get hot, any touch will cause a burning injury.
16. When performing cutting, if noise value exceeds 80dB (A), it is requested to wear ear protection device.

17. When performing wet cutting, coolant can be applied to reduce the high temperature during cutting to avoid burning injury.
18. When workpiece or cutting tool weight over 10kg, they should be moved by using a proper lifting device or equipment for moving.
19. When cleaning off chips or changing tool, be sure to wear gloves.
20. Once job finished, turn power off. Turning power on again for the next operation.

E. NOTICES AFTER STOP RUNNING

1. Before opening guard, make sure the moving parts (such as spindle) have come to a complete stop.
2. After dry cutting being finished, then handling the workpiece, be sure to wear safety gloves to avoid burning injury.

F. NOTICES FOR MALFUNCTION TREATMENT

1. In case malfunction occurs, press the emergency stop switch immediately.
2. Make sure main power source has been shut off before entering into the machine.
3. If anyone is closed in the machine, heavily knock on the sheet metal and ask for help loudly.

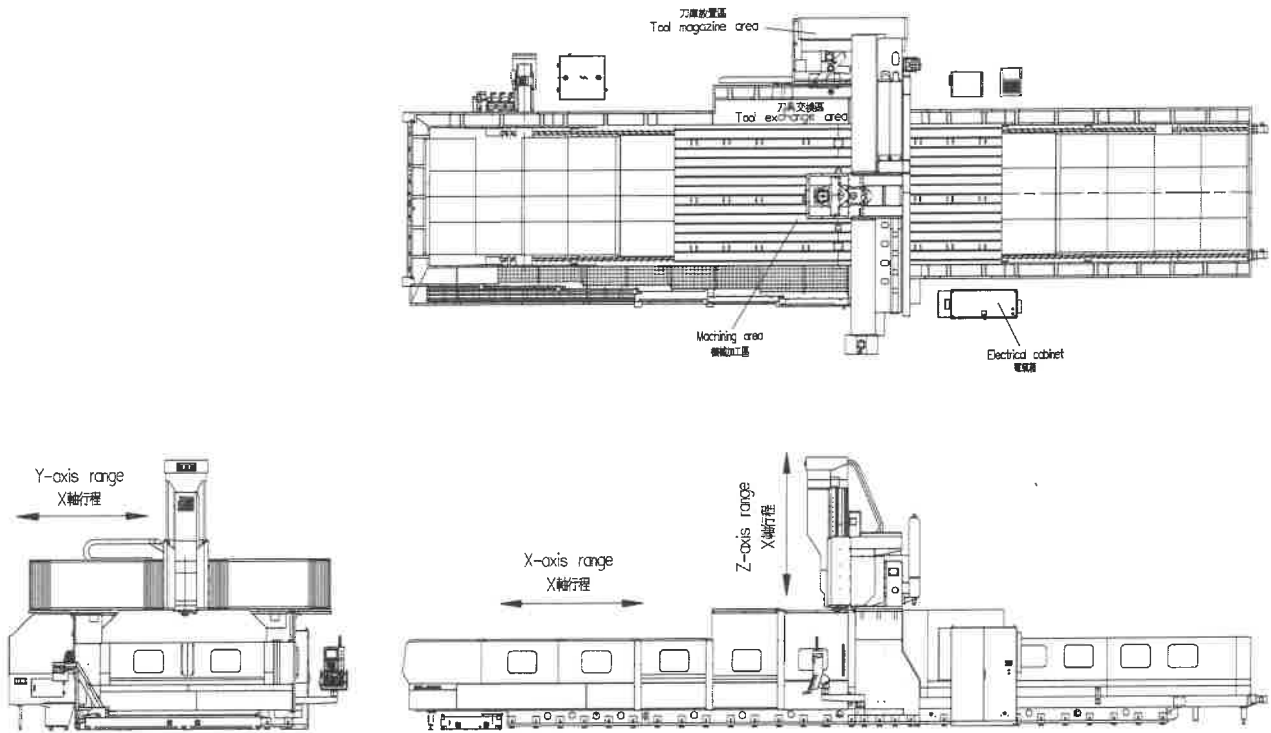
G. NOTICES FOR MAINTENANCE

1. Before performing maintenance job, turn main power source off. This may avoid an accidental starting that results in injury.
2. When performing maintenance job, any mechanisms or parts, removed from the machine, must be installed back to their places after maintenance job being finished.
3. After job finished, do not leave any serving tools or parts in the machine or on the control panel.
4. Periodically washing the coolant tank to prevent bacteria growth. When washing , wear proper gloves to avoid allergic response or cutting injury.
5. Always keeping see-thru windows clean. Poor transparency of window may interfere sight. When this occurs, replace it with a new one.
6. Before adjusting or replacing belt, be sure to turn power off.

H. DANGEROUS AREAS

The dangerous areas included are all areas separated by the sheet metal and guards, traveling areas of moving parts and the areas where the electrical devices located. Once the machine is started, the operator and the maintenance personnel must leave these dangerous areas to avoid personnel injury or machine damage.

DANGEROUS AREA DIAGRAMS ON SDM SERIES



I. MEANING OF VARIOUS SYMBOLS

1. DEFINITION OF VARIOUS SYMBOLS

DANGER

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

DANGER

It indicates a potentially hazardous situation, if not avoided, will result in death or serious injury.

CAUTION

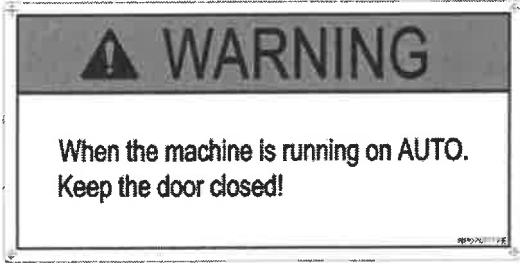
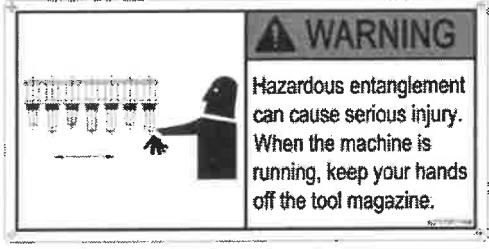
It indicates a potentially hazardous situation which, if not avoided, could result in damage to the machine.

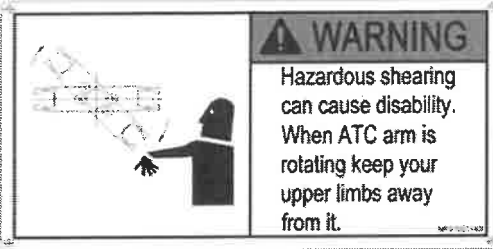
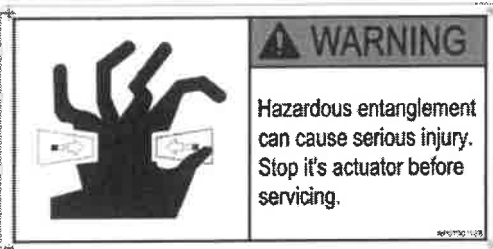
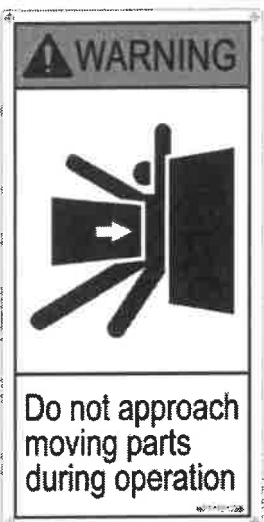
NOTE

It indicates the items to be inspected and suggestions.

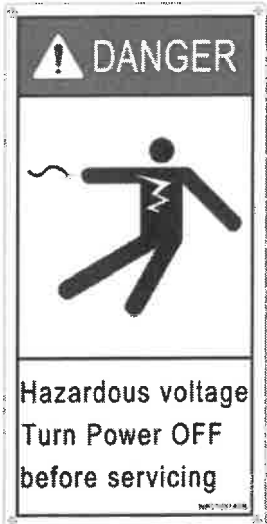
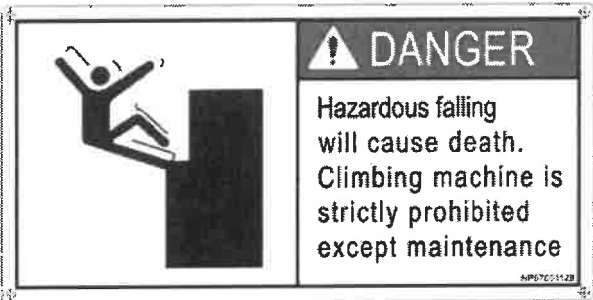
2. DESCRIPTION OF LABELS

(1) DESCRIPTION OF LABELS (WARNING LABELS)

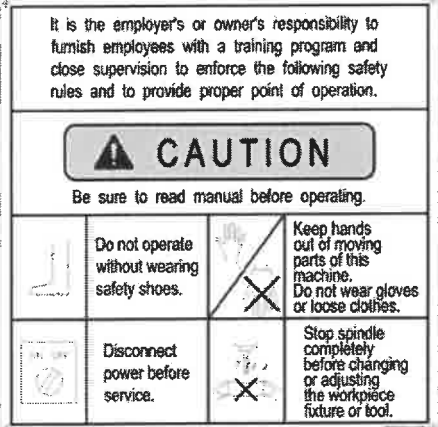
LABEL FIGURE	DESCRIPTION
 A rectangular warning label with a black header containing a white exclamation mark in a triangle and the word "WARNING" in white. The main body is white with black text: "When the machine is running on AUTO. Keep the door closed!".	When the machine is running in auto mode, do not open the door.
 A rectangular warning label with a black header containing a white exclamation mark in a triangle and the word "WARNING" in white. The main body is white with black text: "Slide can move quickly".	Moving parts can move fast!
 A rectangular warning label with a black header containing a white exclamation mark in a triangle and the word "WARNING" in white. The main body is white with black text: "Hazardous entanglement can cause serious injury. When the machine is running, keep your hands off the tool magazine." To the left of the text is a black silhouette of a person's head and shoulders, with a hand reaching towards a series of vertical bars representing a tool magazine.	When the tool magazine is running do not allow your hands to touch the magazine. Failure to comply may cause serious injury.

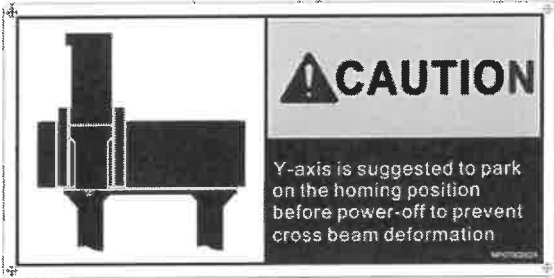
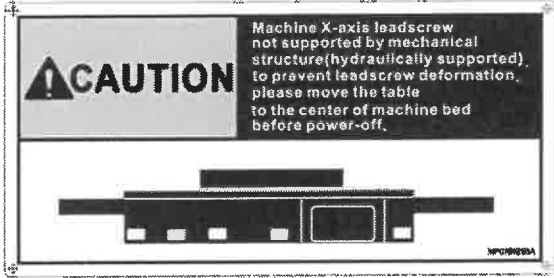
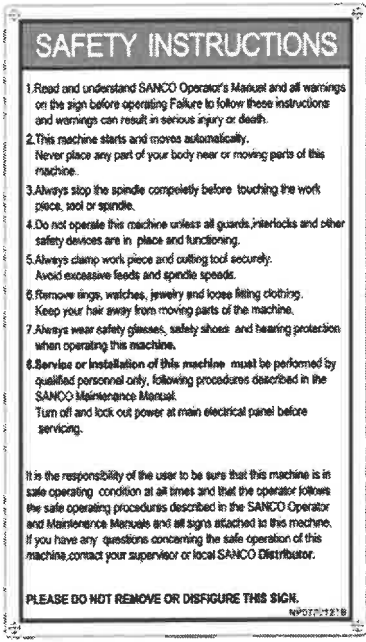
LABEL FIGURE	DESCRIPTION
	When the ATC arm is rotating, keep your upper limbs away from it. Failure to comply may cause disability.
	Exposed screw and moving parts can cause severe injury. Be sure to turn power off before removing cover or servicing.
	Turn all switches off before servicing to avoid danger.
	Do not approach the moving parts of the machine during running. Failure to comply may cause danger.

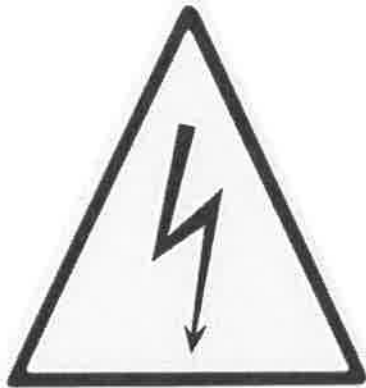
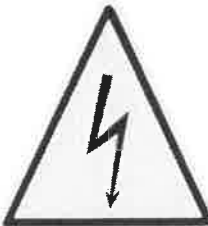
(2) INSTRUCTION OF LABELS (DANGER LABELS)

LABEL FIGURE	DESCRIPTION
	A danger of electric shock.
	When the screw is running, keep your body away from it to avoid danger.
	Except for maintenance, entering into the machine is strictly prohibited to avoid danger.

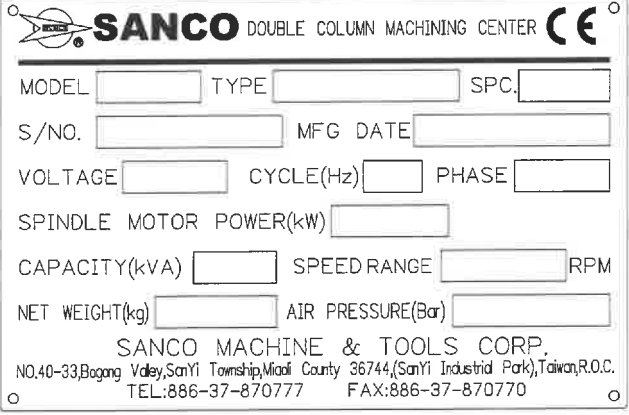
(3) INSTRUCTION OF LABELS (DESCRIPTION LABELS)

LABEL FIGURE	DESCRIPTION
	Description for automatic tool change, adjustment and setting.
	Description for electrical cabinet.
	Description for opening or closing the electrical cabinet door.
	Description for safety rules and operational safety.

LABEL FIGURE	DESCRIPTION
 CAUTION Y-axis is suggested to park on the homing position before power-off to prevent cross beam deformation.	Description for Y-axis stop at home position before turning power off.
 CAUTION Machine X-axis leadscrew not supported by mechanical structure(hydraulically supported), to prevent leadscrew deformation, please move the table to the center of machine bed before power-off.	Description for moving the table to the center of machine base before turning power off. ※ Suitable for some models only.
 CAUTION Do not operate before shutting door.	Do not operate before opening or shutting the safety door to avoid danger.
 SAFETY INSTRUCTIONS 1. Read and understand SANCO Operator's Manual and all warnings on the sign before operating. Failure to follow these instructions and warnings can result in serious injury or death. 2. This machine starts and moves automatically. Never place any part of your body near or moving parts of this machine. 3. Always stop the spindle completely before touching the work piece, tool or spindle. 4. Do not operate this machine unless all guards, interlocks and other safety devices are in place and functioning. 5. Always clamp work piece and cutting tool securely. Avoid excessive feeds and spindle speeds. 6. Remove rings, watches, jewelry and loose fitting clothing. Keep your hair away from moving parts of the machine. 7. Always wear safety glasses, safety shoes and hearing protection when operating this machine. 8. Service or installation of this machine must be performed by qualified personnel only, following procedures described in the SANCO Maintenance Manual. Turn off and lock out power at main electrical panel before servicing. It is the responsibility of the user to be sure that this machine is in safe operating condition at all times and that the operator follows the safe operating procedures described in the SANCO Operator and Maintenance Manuals and all signs attached to this machine. If you have any questions concerning the safe operation of this machine, contact your supervisor or local SANCO Distributor. PLEASE DO NOT REMOVE OR DISFIGURE THIS SIGN.	Safety description

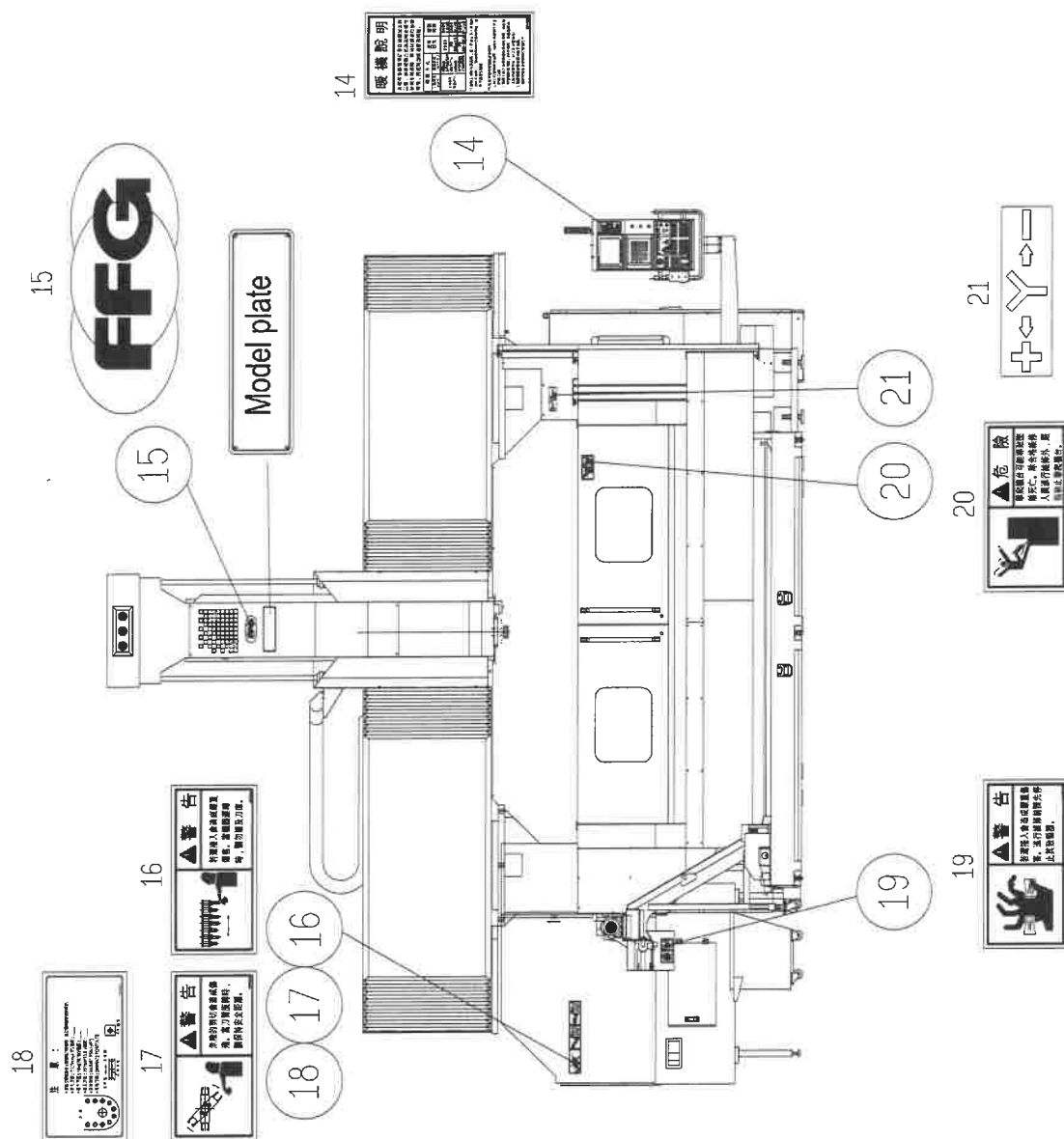
LABEL FIGURE	DESCRIPTION
	An indication for power source position (Big)
	An indication for power source position (Small)
	An indication of axis direction
	An indication of axis direction
	An indication of axis direction

(4) INSTRUCTION OF LABELS (LOGO AND SPECIFICATION LABELS)

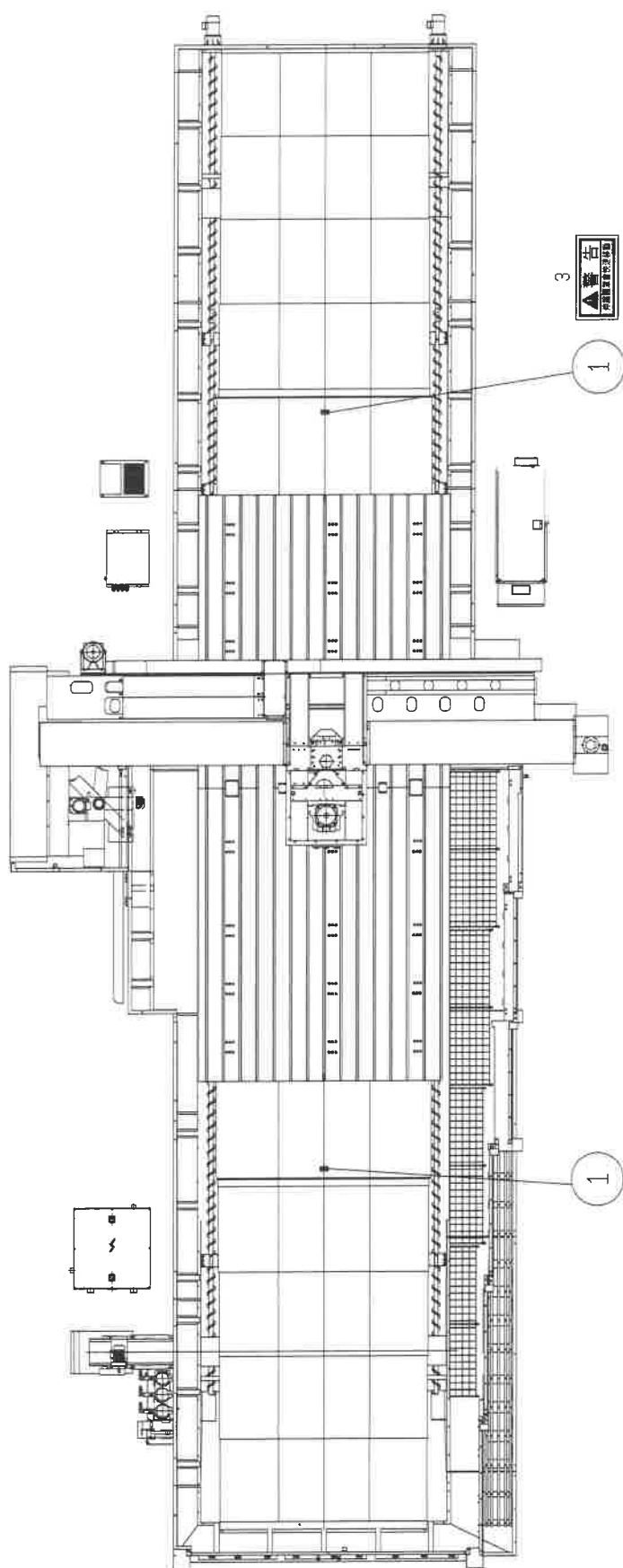
LABEL FIGURE	DESCRIPTION
	Logo plate
	Model plate
	CE plate
	Power source, manufacturer and CE plate

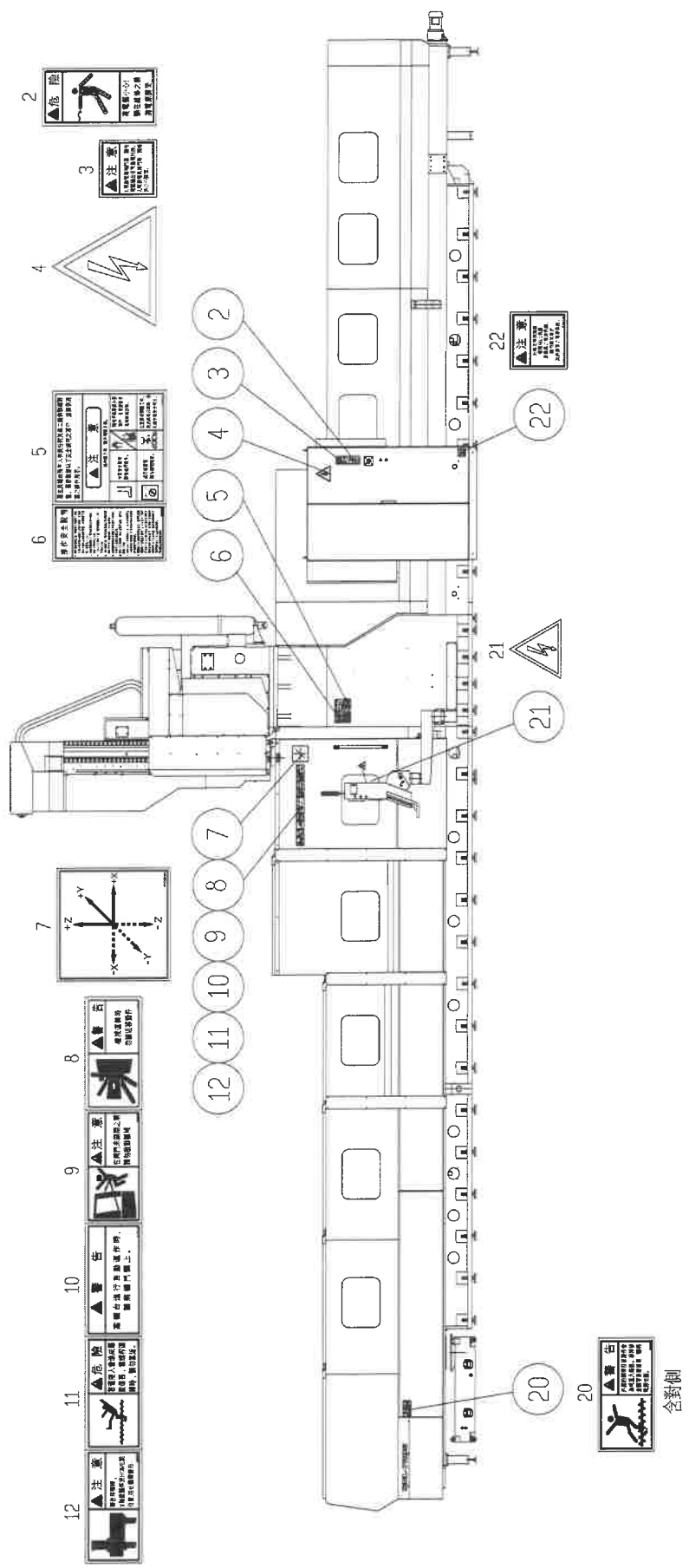
****NOTE: CE specifications are optional for some models.**

3. LABEL LOCATIONS DRAWING



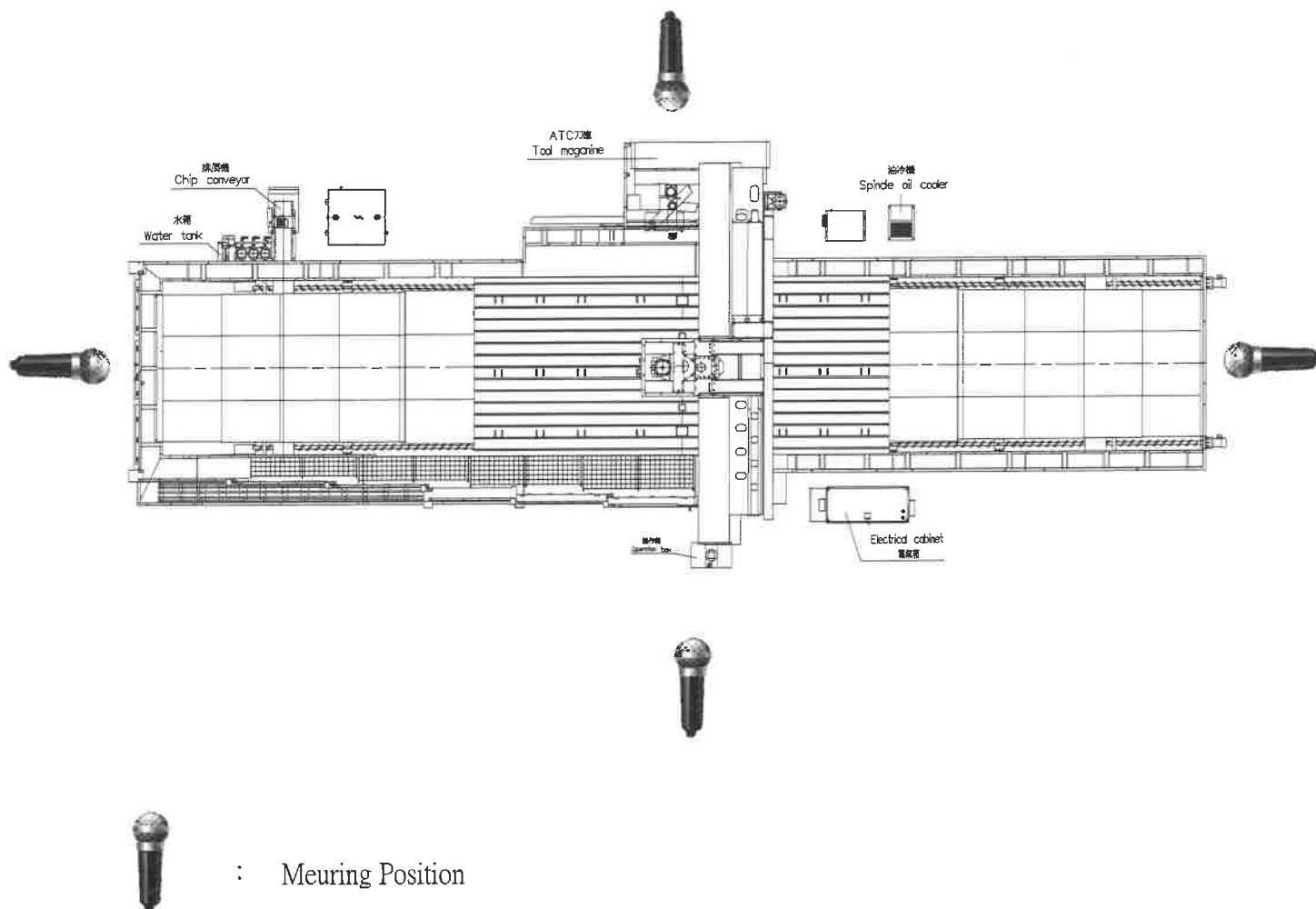
N0	繁體中文	簡體中文	英文
1	NP0700277B	NP0700610A	NP0700139C
2	NP0700259B	NP0700242B	NP0700180C
3	NP0700286B	NP0700612A	NP0700140C
4	NP0700137B	NP0700137B	NP0700137B
5	NP0700276A	NP0700605A	NP0700120B
6	NP0700253B	NP0700243B	NP0700121C
7	NP0700107A	NP0700107A	NP0700107A
8	NP0700105A	NP0700105A	NP0700105A
9	NP0700614A	NP0700617A	NP0700115B
10	NP0700257B	NP0700241B	NP0700181C
11	NP0700275B	NP0700608A	NP0700119C
12	NP0700283B	NP0700611A	NP0700113C
13	NP0700234B	NP0700607A	NP0700282B
14	NP0700206B	NP0700237B	NP0700272B
15	NP0700623B	NP0700623B	NP0700623B
16	NP0700281B	NP0700343B	NP0700116C
17	NP0700282B	NP0700342B	NP0700114C
18	NP0700285B	NP0700613A	NP0700123B
19	NP0700279B	NP0700602A	NP0700118C
20	NP0700284B	NP0700603A	NP0700112C
21	NP0700106A	NP0700106A	NP0700106A
22	NP0700280B	NP0700604A	NP0700117C
23	NP0700138B	NP0700138B	NP0700138B
24	NP0700278B	NP0700606A	NP0700122C





J. NOISE

According to ISO / DIS 230-5 standards, the machine noise level should be less than 80dBA when it is under a stop condition or in an operating condition. If noise level exceeds this standard, contact the machine manufacturer for improving. The noise level measuring positions are shown as the figure below:



MEASURING STANDARD : According to the regulation of Machinery Directive 98/38/CE Annex I clause 1.7.4 (f).

SPINDLE SPEED : 80% of the allowable maximum speed.

MEASURING DISTANCE : 1m from the machine enclosure.

MEASURING HEIGHT : 1.6m from the floor.

■ **NOISE EMISSION VALUE PUBLICIZED BY ISO 7960**

	IDLE RUNNING	NORMAL RUNNING
Publicized A weighted curved sound power class Lward ∙ dB re 1 pW	89	91
Publicized A weighted curved emitted sound pressure class at operator's position lpAd ∙ dB re 20 μPa	76	78

Above test results are made according to ISO3746 standard

Above data is the noise emission class instead of the working safety class. The noise emission class is related with sound exposure, however this can not be used for deciding if a further protection device is required or not. The factors that affecting the actual sound exposure class include continuous noise length (i.e. the nearby machine quantity).

In addition, the permissible sound exposure class may vary with different countries. The information shown here provides the machine operator better estimation of risk.

II. INTRODUCTION OF MACHINE

A. MACHINE SPECIFICATIONS

For specifications, please refer to appendix or catalogue.

B. APPLICATIONS OF THE MACHINE

1. PRIMARY APPLICATIONS

This is a CNC controlled milling machine, which is designed for precision machining of machine parts and molds. With the CNC control, the operator may select manual or automatic operation to perform precision machining jobs, such as milling, drilling, tapping and boring, etc.

2. APPLICABLE CUTTING MATERIALS

- (1) **METALLIC MATERIALS:** Such as cast iron, steel, bronze, aluminum and stainless steel etc.
- (2) When machining non-metallic material is required, consult your local agent or the machine manufacturer. This may avoid machine damage or personnel injury caused by improper machining of material.

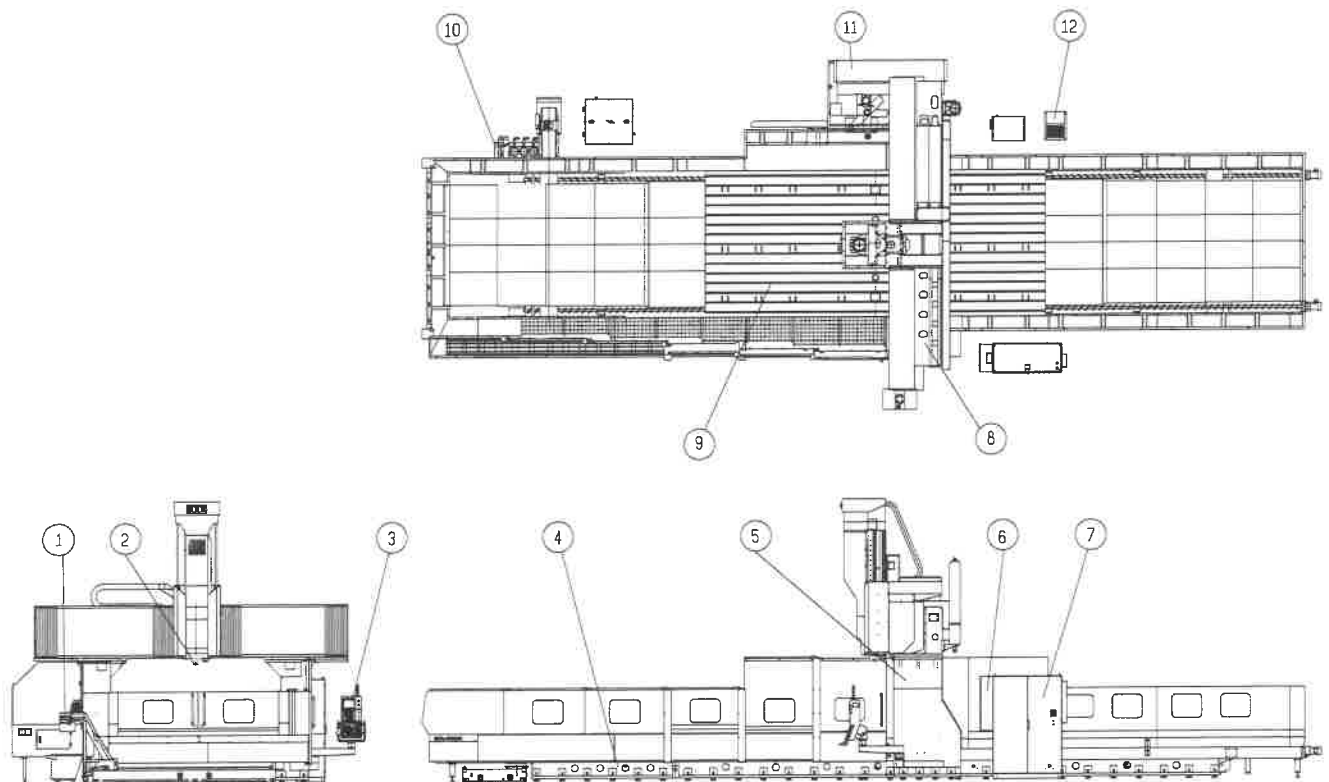
****CAUTION :** Do not try to machine low-rigidity material which cannot be clamped securely or low burning point material, such as magnesium alloy, etc.

C. MACHINE PARTS AND DIMENSIONS

1. MAJOR MACHINE PARTS

The SDM series double column machining center from SANCO is designed for precision machining for machine parts and molds. Its major parts include base, table, column, beam, spindle, tool magazine, electric box, pneumatic box, operation box, oil cooler, chip conveyor and coolant tank.

NO.	DESCRIPTION	NO.	DESCRIPTION
1	Chip conveyer	7	Electric box
2	Spindle	8	Beam
3	Operation box	9	Table
4	Base	10	Coolant tank
5	Column	11	Tool magazine
6	Pneumatic box	12	Oil cooler



2. MACHINE DIMENSIONS

For specifications, please refer to appendix or catalogue

**** NOTE: For machine equipped with special optional equipment or special dimensional drawing, contact the machine manufacturer. We will provide the proper information.**

D. WORKING TRAVELS

For specifications, please refer to appendix or catalogue

E. SUITABLE ENVIRONMENTAL CONDITIONS

1. Environmental temperature : Within $0^{\circ} \sim 35^{\circ} \text{ c}$.
2. Environmental humidity : Under 75% RH
3. Install the machine on a plain enough location.
4. A location without massive dusts, acid gas, corrosive gas salt.
5. No direct sunshine or serious variation of environmental temperature, such as near to a heat source.
6. A location without affection caused by abnormal vibration.
7. A location without possibility of potential explosion.

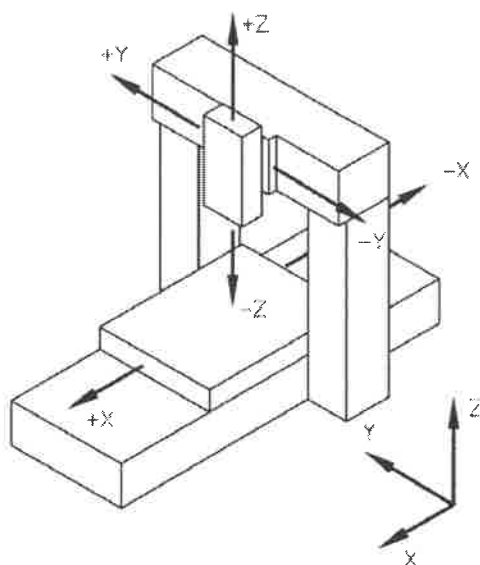
F. MACHINE COORDINATE SYSTEM

Axes are defined as below :

X AXIS : The X-axis is defined as table movement in right and left directions. The table moves to left is positive (+) direction. The table moves to right is negative (−) direction.

Y AXIS : The Y-axis is defined as spindle head movement in forward and backward directions. The spindle head moves backward is positive (+) direction. The spindle head moves forward is negative (−) direction.

Z AXIS : The Z-axis is defined as spindle head movement in up and down directions. The spindle head moves upward is positive (+) direction. The spindle head moves downward is negative (−) direction.



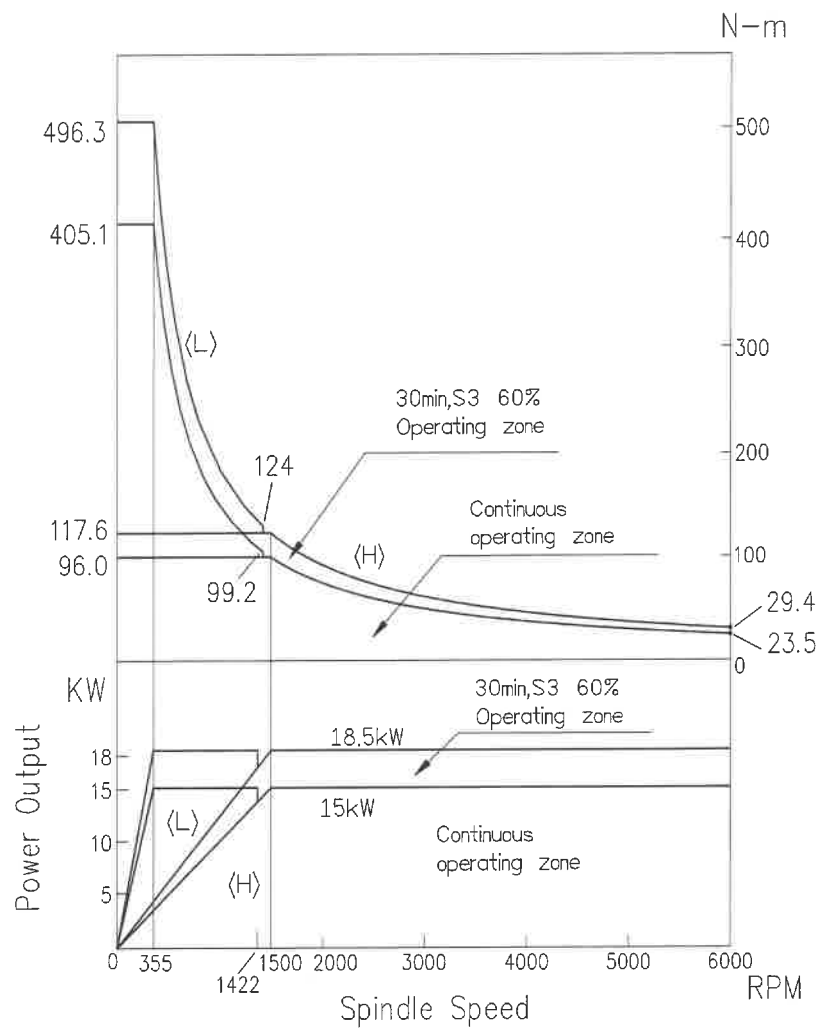
H. SPINDLE POWER OUTPUT / TORQUE DIAGRAM

1. FANUC SPINDLE POWER OUTPUT / TORQUE CORRESPONDING TABLE

MOTOR MODEL	SPEED(rpm)	REF TO CAD NO.
FANUC α 15	6000	NP0700333A
FANUC α 22	6000	NP0700336A

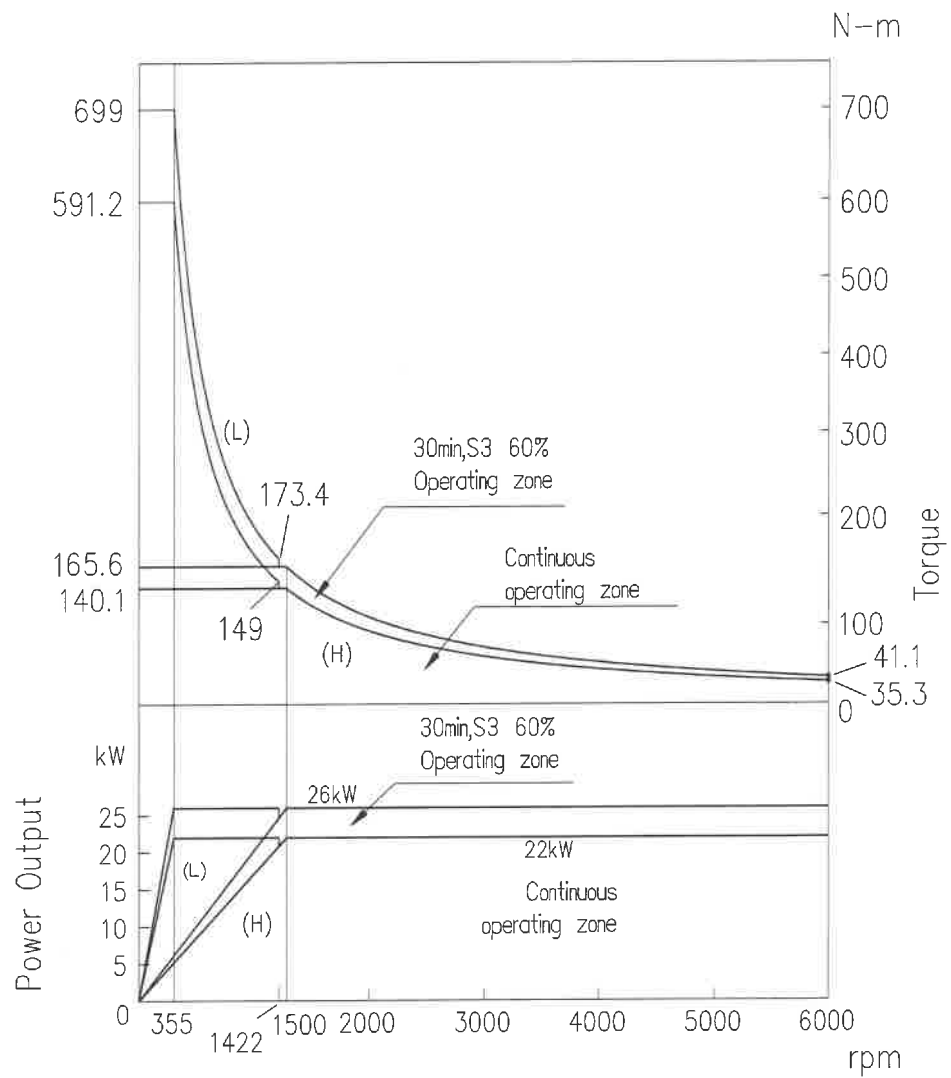
FANUC TORQUE DIAGRAM

CNC DOUBLE COLUMN MACHINING CENTER
SPINDLE 6000RPM



18.5/15kw spindle motor with gear box
(FANUC α 15/BELT TYPE) rate 1:4.22 force
characteristics

CAD NO : NP0700333A



26/22kW spindle motor with gear box
(FANUC α 22/Belt type) rate 1:4.22 force
characteristics

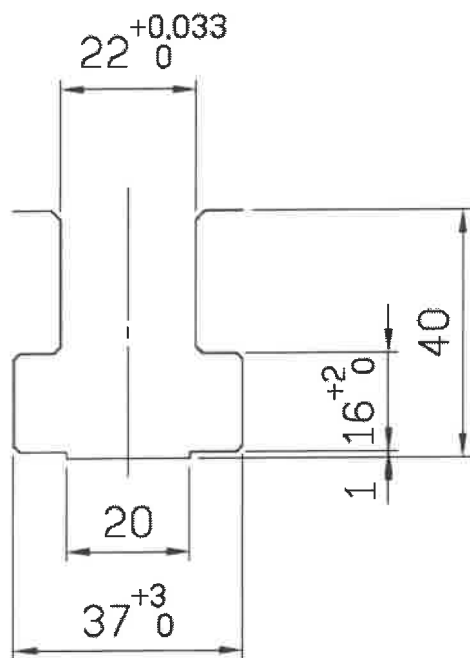
CAD NO :NP0700336A

I. TABLE & T-SLOT SIZES

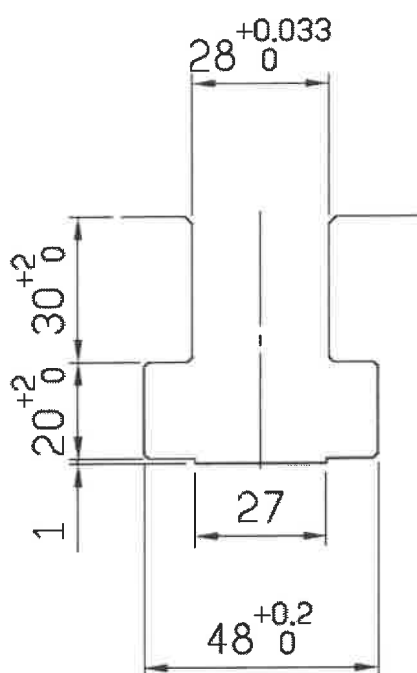
1. TABLE SIZES

2. T-SLOT SIZES

(1) T-slot / 22 mm (standard)



(2) T-slot / 28 mm (standard)



III. MACHINE INSTALLATION PROCEDURES

A. PREPARATION BEFORE INSTALLATION

1. POWER SOURCE

- (1) Power source SPECIFICATIONS (For details refer to specification table and your local voltage).

Power Source	Volt	Frequency	Phase	Capacity
specif	200~575V	50 / 60 HZ	3	40 / 45 / 50 KVA

- (2) Only an authorized qualified electrical engineer is allowed to conduct wiring job.
- (3) Keep electronic interference sources away from the machine, such as electric welder and electric discharge machine, etc.
- (4) Voltage instability due to insufficient power may lead to a failure of controller.
- (5) Power wires must be independent and directly connected to the electric circuit board.
- (6) The grounding wire is as short as possible, which diameter should be same as that of input power wires.
- (7) Various allowable values :
- Voltage : + 10% of voltage (Depends on local voltage).
 - Frequency : 50 / 60 HZ (± 1 Hz)
 - Instant Power Failure : Less than 0.01 sec.
 - Voltage Pulsation : The peak value should not be higher than 200% or lower than the effective value (rms value) during 0.0015 second of stable pulse.
 - Wave Shape Error : 7% or less.
 - Uneven Voltage Stability : 5% or less.
 - Ground : Class 3 ground.
 - Ground Resistance : 100Ω or less.

2. AIR SOURCE :

- (1) Air is applied for cleaning spindle, cutting cooling, auto door and tool magazine, etc.
- (2) Air pressure required is over 5-7 kg / cm². Air supply is at least 100 L / min.

3. OIL

Before using the machine, it is requested to fill oil to various oil tanks shown as below :

application	Description	Viscosity (40°C)	Capacity	Remarks
Hydraulic oil tank	Hydraulic oil	28.8~35.2	180 L	ISO VG32 R-32 , H-32
Lubrication	Slideway oil	61.2~74.8	8 L	ISO VG68 R-68 , K-68
Spindle cooling / lubrication	Circulation oil	28.8~35.2	20 L	ISO VG32 HD-32 , T-32
Cutting fluid	coolant	Depend on use	NOTE 1	

※ NOTE 1 : Capacity may vary with machine models. For details refer to specifications shown in chapter II-A.

4. Tools required for measuring machine accuracy :

- (1) Precision level gauge 0.02mm/M, at least 2 pcs are required.
- (2) Standard test bar, taper ISO No.50#x300 mm(L)
- (3) Dial gauge with magnetic stand, 1/100 , 2/1000 mm, each over 1 set.
- (4) Granite square 600x400x100 mm x 1 pc

B. MACHINE INSTALLATION LOCATION

Before installing the machine, prepare various powers and tools required by the instructions given in this chapter.

1. ENVIRONMENTAL CONDITIONS FOR MACHINE STORING AND INSTALLATION

- (1)** ENVIRONMENTAL TEMPERATURE : 0~35°C
- (2)** ENVIRONMENTAL HUMIDITY : Under 75%RH
- (3)** Install the machine on a plain enough location.
- (4)** A location without massive dusts, acid gas, corrosive gas and salt.
- (5)** No direct sunshine or serious variation of environmental temperature such as near to a heat source.
- (6)** A location without possibility of potential explosion.
- (7)** If there is welder or electric discharge machine that is placed on the frame of the factory building, do not connect the grounding wire of this machine to the frame of the factory building.
- (8)** Do not place any unnecessary objects on the floor around the machine. If coolant or lubrication oil drop on the floor, clean it immediately.
- (9)** Always preventing the machine and the controller from direct sunshine.
- (10)** Do not allow coolant, lubrication oil and chips to contaminate the machine and the controller.
- (11)** The machine and the controller should not be affected by serious vibration.
- (12)** Make sure the floor is rigid enough to support the machine weight.
- (13)** The floor should not be muddy or foundation work is not implemented according to the instructions.

2. When planning the machine installation space, be sure to leave enough space for convenience of machine operation and maintenance. Before planning the installation space, refer to “ MACHINE DIMENSION DRAWINGS” shown on the chapter II. Conduct space planning according to dimensions of the machine.

- (1)** Keep a proper distance between this machine and other machines. Do not get close.
- (2)** Keep enough space for machine maintenance. When installing the machine, make sure the machine doors and the controller can be opened and swiveled freely.
- (3)** Keep proper space to enable the chip conveyor and the coolant tank to be moved conveniently.
- (4)** Leave enough space to fit with the tool magazine.

C. DESCRIPTION OF FOUNDATION

Excellent geometric accuracy such as leveling, squareness and circularity provides a solid foundation for precision machining. The double column machining center has big machine dimensions and is applicable for big sizes of workpiece, therefore it needs solid, stable and anti-vibration foundation to ensure machining accuracy. The typical foundation is constructed of over 300 psi strength of cement, proper pebbles and over 600mm thickness of concrete after pressed. The foundation should be made according to the related sizes of foundation bolts. The entire foundation should have anti-vibration channel to isolate from other floor area, that may reduce interference of vibration.

1. DESCRIPTION OF FOUNDATION TYPE

- (1) The "J" type bolt (standard) requires two layers of concrete construction, therefore it takes a longer construction time.
- (2) The "H" type steel (optional. Only one layer of concrete construction is required). Its composition and construction procedures are shown as below.
For detailed construction sizes, refer to the Foundation plan.

2. FOUNDATION CONFIRMATION

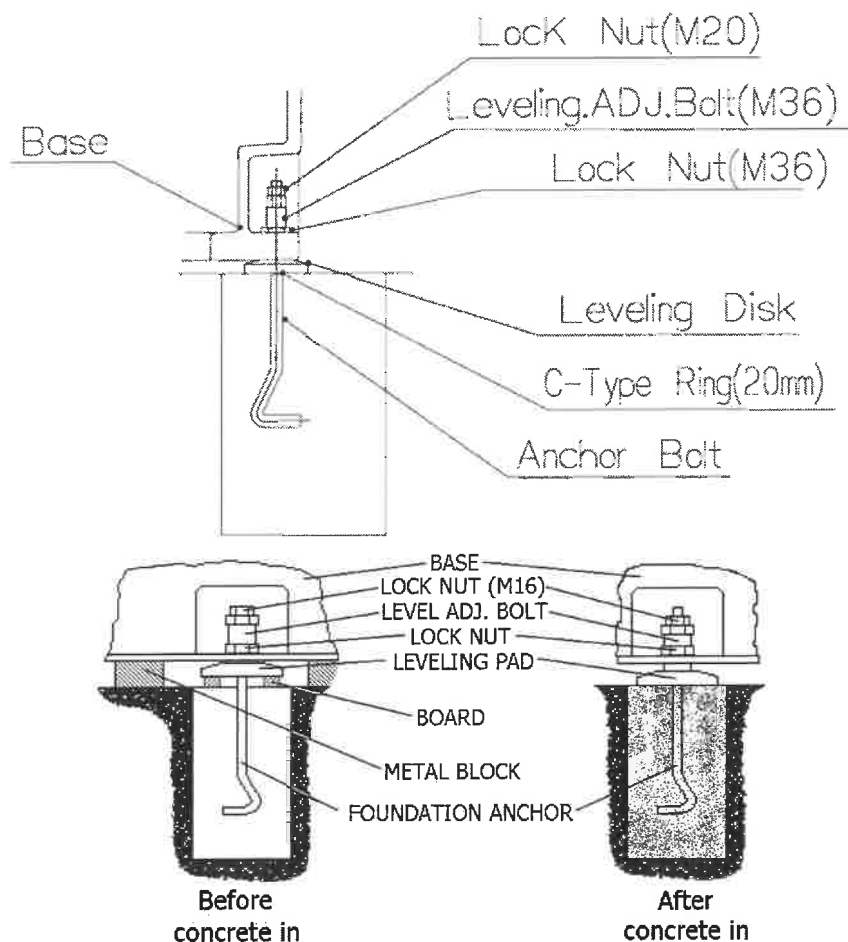
A solid, stable and anti-vibration foundation will ensure excellent accuracy of the machine and extend tool service life. Before constructing foundation, contact with your local agent or the machine manufacturer who will provide proper foundation drawings.

For soil quality problem, consult your local qualified civil expert. Constructing foundation must follow the foundation drawings. If you have any question regarding the sizes, contact with your local agent or the machine manufacturer for assistance. Once foundation construction is finished, confirm all sizes again. In this case, if you have any questions, contact with your local agent or the machine manufacturer for assistance.

**** NOTE : Soil quality may vary with different countries, before constructing a foundation, you need to consult your local qualified expert in soil quality. Then perform foundation construction according to your local soil quality.**

3. CONSTRUCTION PROCEDURES FOR "J" TYPE STEEL

FOUNDATION CONSTRUCTION PRODURES FOR "J" TYPE STEEL		
STEP	PROCEDURE DESCRIPTION	REMARKS
1	Perform foundation digging according to foundation plan.	Refer to foundation plan
2	Perform the first layer of foundation work.	Refer to foundation plan Days required for complete solidification of foundation : 7-10 days (summer / fine days)
3	Move the machine to the foundation location.	Refer to foundation plan
4	Apply forklift, crane or other lifting equipment to lift the machine, then install the anchor bolts, metal blocks and leveling pads.	
5	Place the precision level gauges at the center of the table. Raise the machine by using forklift, crane or lifting jack. Perform initial leveling adjustment.	Accuracy required for initial leveling adjustment : Within 0.08mm in X-axis direction. Within 0.08mm in Y-axis direction.
6	Use fast-dry cement to perform second layer of concrete filling work.	Days required for complete solidification of foundation : 7-10 days (Summer / fine days)
7	Perform the second time of installation job.	



CONSTRUCTION EXAMPLE

D. INSTALLING THE MACHINE

Refer to chapter IV

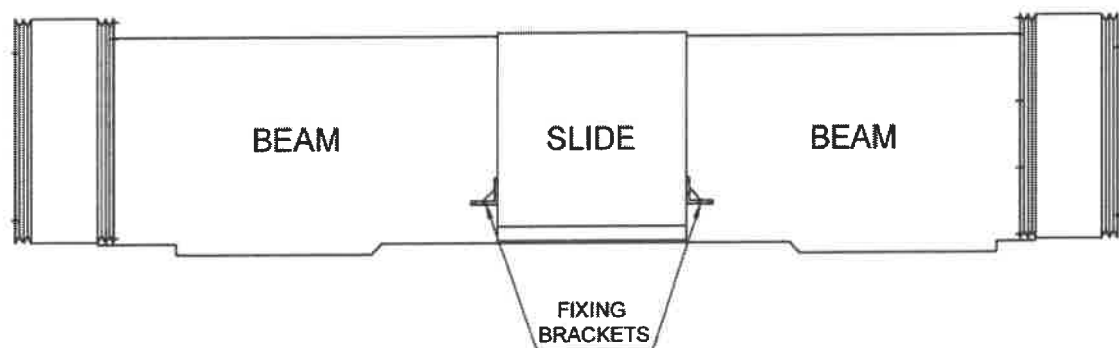
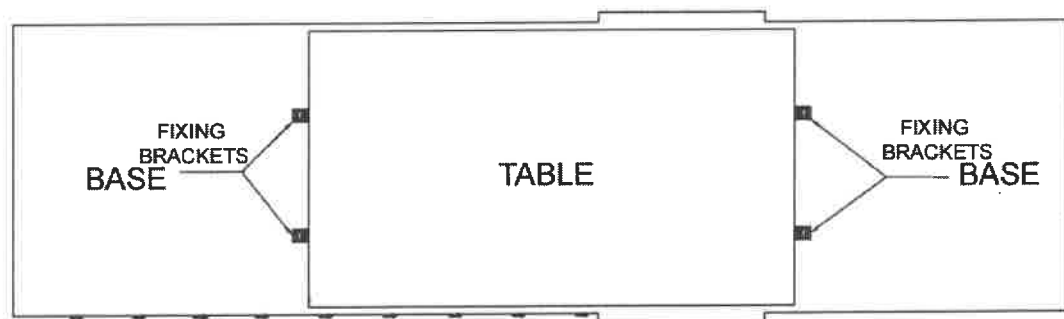
E. INSTALLING MACHINE, POSITIONING PROCEDURES AND ADJUSTMENT

NO.	STEP	DESCRIPTION
1	Machine structure positioning and leveling adjustment	Refer to description of foundation
2	Positioning hydraulic power unit	Install the hydraulic power unit to the place as shown on the machine installation layout. Connect hoses according to the marking on each hose. Connect and tighten the electrical connectors according to the marking. Fill sufficient hydraulic oil.
3	Install the spindle oil cooler (In case oil cooler was purchased)	Connect and tighten the inlet and outlet ports on the spindle head. Plug-in and tighten the electrical connectors. Fill sufficient coolant.
4	Compressed air source	Connect the flexible hose of air source to the air inlet port.
5	Fill slideway lubrication oil	Fill sufficient slideway lubrication oil.
6	Remove fixing blocks.	Remove the fixing blocks on X,Y-axis (Fixing blocks painted with yellow color). Do not remove the spindle head supporting block at this moment.
7	Install A.T.C.	Fix the A.T.C. base. Install the A.T.C. guard, then adjust and fix it.
8	Connect wires and hoses	Connect the removed wires and hoses according to the marked numbers.
9	Electric control	Inspect the electric control circuit, then connect wires.
10	Turn power on for test.	• Check if power phase is correct or not. • Check if motor running direction is correct or not. • Check if hydraulic and air pressures are correct or not. • Check if all hoses are tightened securely or not. If hoses are connected correctly. If mechanism positions are correct or not (mechanisms must be located at correct positions). Raise the spindle head and remove the supporting block.
11	Confirm slideway lubrication	Check if the lubrication system discharges oil or not. If the oil distribution to three axes are proper or not.
12	Cleaning	Clean off rust-prevention oil on the table and dusts on the machine. Clean them thoroughly.

13	Running test	• Manually return three axes to their home positions at a low speed. • Use 100% high speed to turn three axes to their home positions, and check if home positions are same or not. • Check if each axis travel complies with the setting value or not. Also, if over-travel safety function works normally or not. • Check if the parameter list attached with the machine complies with that displayed on the controller or not. • Check if spindle CW and CCW running and running speed are normal or not.
14	Inspect and adjust machine leveling	• Place the precision level gauges on the table, shown as Fig. 1-2-7. • Move X-axis to a full travel range, the level gauge should keep within 0.04mm/M. If the accuracy is out of this range, turn the adjustment screw until leveling accuracy reaches to the standard condition. • Inspect various machine accuracy according to the accuracy inspection list. Make adjustment for items that exceed the specified tolerance.
15	Adjust tool change position of A.T.C. and spindle head position	• Place jig on the spindle and the tool gripping arm. • Move the spindle head and adjust the tool gripping angle position, so that the jig is easily aligned. • Register the Y,Z tool change position of the spindle head into the parameters of the controller. Then tighten all screws on the A.T.C. • Try to perform tool change test, and check if auto door and tool change motions are smooth or not.
16	Warm-up running	When performing running test, refer to accuracy inspection list.
17	Install the splash guard, coolant tank and chip conveyor. Perform various functions test.	In general, the splash guard is installed after machine leveling and running test have been finished. This will prevent interference against the installation and adjustment. Once the machine installation is finished, install the coolant tank and the chip conveyor under the machine. Connect hoses then fill sufficient coolant into the coolant tank. Perform cutting discharge function, and check anti-leak function of the splash guard, coolant flow rate and coolant pressure, etc. In addition, if the coolant through spindle device, coolant through tool holder device and manually remote control for coolant nozzle angle are equipped, these devices should also be tested.

F. INSTALLING THE MACHINE

1. Before lifting the machine by using a forklift, check with the following items.
 - (1) The machine lifting job is conducted only by a qualified technician.
 - (2) The steel wire, chain and hook to be used must comply with the sizes specified in the operation manual. Make sure they are durable enough to resist the machine weight.
 - (3) Before lifting the machine, make sure three axes have been tightened.
 - (4) Before lifting the machine, make sure there is no unnecessary object exists in the vicinity of the machine.
 - (5) When placing the machine on the floor, make sure the vertical faces and the horizontal faces are properly balanced.
 - (6) If two or more pieces of objects are being lifted or placed, pay attention to the lifting and placing condition for each object.
2. If rust-prevention oil exists on the slideway, clean it off thoroughly. Otherwise, a servo alarm will occur when starting the machine.
3. Before shipment, the three axes slideways are fixed by the fixing brackets (devices). Be sure to completely remove these fixing brackets before starting the machine.



4. Once machine installation job is finished, it is requested to perform leveling adjustment. The machine accuracy needs to be adjusted according to the attached accuracy test report.
5. Keep the door lock switch at " ON " position. Then remove the key and place it at a safe location.

G. AFTER INSTALLATION, BEFORE AND AFTER POWER ON

1. VARIOUS NOTICES FOR AFTER INSTALLATION AND BEFORE POWER ON

- (1) Make sure all screws are tightened securely.
- (2) Make sure all electronic connectors are fastened properly.
- (3) Make sure all hydraulic ports and water hoses are connected properly.
- (4) If the machine is equipped with optional equipment, make sure each cable and hydraulic and air hose are connected properly.
- (5) Check if voltage and " R.S.T" power wires are connected correctly.

2. AFTER INSTALLATION AND BEFORE POWER ON

- (1) Once turning power on, do not perform 3 axes feeds immediately. You need to manually start the hydraulic system motor to deliver lubrication oil to slideways. This means it is requested to perform warm-up running once turning power on.
- (2) Check if there is oil leak. Make sure all gauges indicate correctly.
- (3) Make sure all fixing brackets (devices), during transportation, have been completely removed.

Once above items are checked correctly, then you are allowed to adjust the machine.

H. START AND STOP MACHINE

1. START MACHINE

- (1) Before operating the machine, make sure there is no personnel or obstacle existed in the vicinity of the machine for safety. .
- (2) If the machine stop is caused by power failure, turn off the main power switch immediately.
- (3) Do not operate the machine under an unstable power environment. The temporary power off caused by power failure or lightning may result in an accident. If unstable current occurs due to various factors, such as lightning, be sure to turn off power source immediately.
- (4) Before operating the machine, check if all pressure gauges (hydraulic, lubrication oil and air pressure) indicate correctly.
- (5) After turning power on, make sure the hydraulic system motor and the spindle fan are running normally.
- (6) Before operating the machine, it is suggested to perform at least 15 minutes of running test for warm-up running.

2. STOP MACHINE

- (1) Remove tool from the spindle, so that the spindle is under no-tool condition.
- (2) Move each axis to a proper position.
- (3) Press EMG button on the control panel.
- (4) Turn off the main power switch.

3. NOTICES FOR SETTING UP WORKPIECE

- (1) Basically only one operator is allowed to operate the machine. For special requirement an well-trained operator is also allowed for help of operation. If there are two more operators are operating the machine, they should communicate each other and take care of safety at any time.
- (2) SETTING FUNCTIONAL BUTTONS ON CONTROL PANEL BEFORE POWER ON :
 - a. Mode selector manual
 - b. Spindle speed override selector manual
 - c. Jog or rapid traverse selector manual position
 - d. Machine lock switch ON
- (3) During machining, do not enter into the machine (such as in front of the spindle, tool change area and cutting area). Before entering into the machine, be sure to stop machine running and make sure the safety door is opened.
- (4) When loading or unloading tool, keep proper footing.
- (5) The working light is very hot after a long time of working, do not approach it or try to touch it with your hand.
- (6) Before starting or stopping the spindle running manually, set the spindle speed at the lowest speed.

4. NOTICES WHEN OPERATING MACHINE

- (1) No matter what of any conditions, when the machine is operating, do not try

- to touch or stand near to a running or moving part.
- (2) Do not touch any switches with a wet hand.
 - (3) When the machine is operating, close the front chips guard door. The front door is a dangerous area, it is easy to cause a danger during cutting.
 - (4) When the spindle is running, do not try to open the safety door for removing chips or inspecting the workpiece and the cutter.
 - (5) When the spindle is running, do not stand before the spindle under any conditions. This will avoid injury due to flying chips.
 - (6) If not absolutely necessary, do not remove the telescopic guard.
 - (7) Do not operate the machine without guard in place.
 - (8) Long hair and loose clothing may result in an injury. Care should be taken for it. Wear safety boots when operating the machine.
 - (9) When the machine is operating , do not lean against the machine. Lean on any guard is also very dangerous.
 - (10) Once job finished, do not unload the workpiece until the cycle start indication lamp extinguished and the program stop indication lamp (yellow) lights on.
 - (11) The operator must confirm workpiece is clamped securely.
 - (12) Clamping workpiece and tool securely are important safety factors. Cutting conditions should start from low to high.
 - (13) Before pressing the " CYCLE START " key, make sure the " DRY RUN " is under invalid condition. The spindle speed adjustment, 3 axes jogs movement and rapid traverse are started only at proper addresses.
 - (14) Before executing new programs, it is necessary to confirm the program numbers. When a new program is used in automatic mode, execute them by using single block.
 - (15) When executing program in automatic mode, do not touch any key to avoid incorrect motion.
 - (16) Before starting or stopping the spindle running manually, turn the spindle speed override selector to the lowest value position.
 - (17) In case over-travel occurs, the machine will be locked. Press the " RELEASE " key for releasing it. Once the machine lock is released, make sure the axis moving direction is correct. Do not move the axis to the hardware limit direction.
 - (18) Do not place any cutter or tool on the control panel or the machine part.
 - (19) Avoid incorrect pressing on the functional key. The operator must understand the functional keys before operation.
 - (20) When operating special function, always observe the instructions given in the operation manual.

I. NOTICES FOR MAINTENANCE AND INSPECTION

Machine maintenance and inspection are dangerous jobs. Before performing such jobs, be sure to turn power off.

1. DAILY MAINTENANCE

- (1) Always keep the machine clean for easy to find any malfunction.
- (2) Each pressure gauge should be properly adjusted to indicate correctly, such as hydraulic pressure, air pressure and lubrication oil pressure, etc.
- (3) Make sure lubrication oil has reached to each slideway.
- (4) Release water accumulated in the pressure regulation valve.

2. NOTICES BEFORE PERFORMING MAINTENANCE AND INSPECTION

- (1) Only a qualified electrical technician is allowed to conduct high-voltage wiring.
- (2) Do not alter any machine parameter without authorized by the machine manufacture.
- (3) Do not climb up the machine if not necessary.
- (4) If the machine is not in OFF condition, do not try to use your hands or feet to touch the chip conveyor.
- (5) The spindle head guard is used to ensure the service life of the spindle unit. Do not remove the guard, otherwise coolant may enter into the spindle. The parts that may affect the spindle should always be kept at a clean condition.
- (6) All solenoid valves may get hot after a long time of operation. Once the machine is just turned off, do not try to touch them using your hands.
- (7) Always keep proper amount of oil in the hydraulic system and on the slideways according to instructions given in the operation manual.
- (8) Use only the clean slideway oil according to the instructions given in the operation manual. Also, check filter screen and oil flow rate.
- (9) Keep the dust-guard screen clean, that protects the heat-dissipation fan in the electrical cabinet.
- (10) If any dust enters into the electrical cabinet or the operation box, it may lead to instability of the machine. Therefore, if not necessary, do not open the electrical cabinet door or the operation box door.
- (11) Replace battery only when the machine is in power on condition. If replacing battery at power off condition, some programs, parameters and settings may disappear.
- (12) The working light will become very hot after a long time of use, therefore do not approach it or touch it with your hands.
- (13) Perform daily and monthly inspection for the machine according to the instructions given in the operation manual.

IV. MOVING AND STORING THE MACHINE

A. MOVING THE MACHINE

This machine is heavy. The forklift to be applied for moving the machine should have enough tonnage (The loading capacity of the forklift should be over 15 tons). Insufficient tonnage of the forklift may cause danger. If an electric hoist is applied for lifting the machine, it is requested to prepare lifting pipes and steel wire ropes, etc. (For detail refer to instruction given in this chapter).

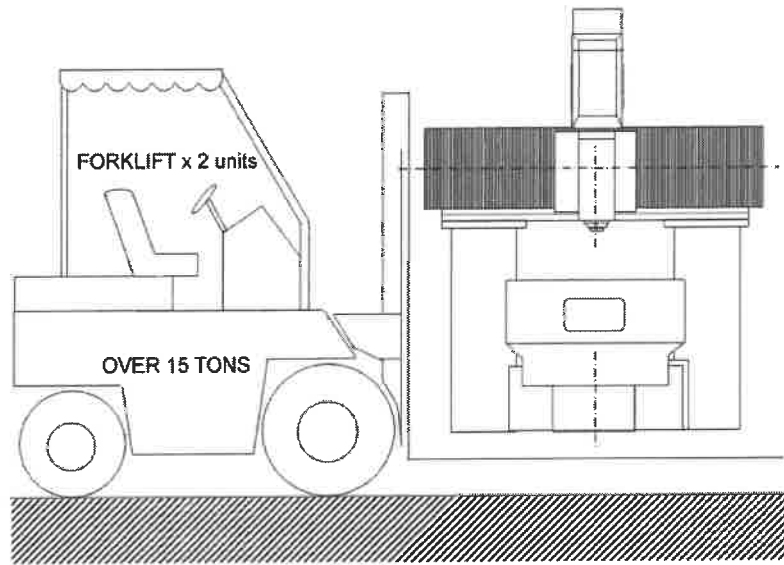


FIGURE OF MACHINE LIFTING

B. STORING THE MACHINE

1. ENVIRONMENTAL TEMPERATURE : 0~35℃
2. ENVIRONMENTAL HUMIDITY : Under 75%RH
3. Install the machine on a plain enough location.
4. A location without massive dusts, acid gas, corrosive gas and salt.
5. No direct sunshine or serious variation of environmental temperature such as near to a heat source.
6. A location without possibility of potential explosion.

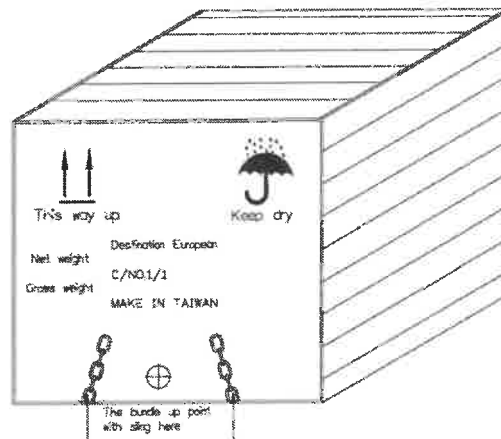
C. PACKING DIMENSIONS / WEIGHT

Due to variation of the machine dimensions and weight, the packing space may vary with different models, and packing method is also different. Therefore, before shipment you may consult with your local agent or SANCO to confirm the actual packing cases and weight, etc. to decide proper loading capacity of the lifting equipment.

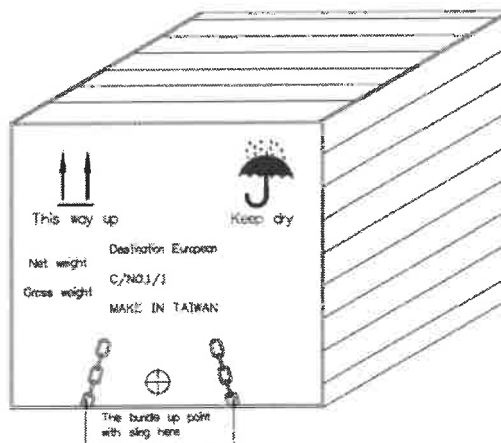
****For specifications, please refer to appendix or catalogue**

D. DESCRIPTION OF PACKING

A packing crate is marked with “ Keep dry “, “ This way up “ and “ Net weight / Gross weight “ etc, that provides related notices and important information during transportation and handling. When transporting or lifting the machine, always follow the direction, lifting positions and weight marked on the crate. In addition, it is important to use a proper loading capacity of moving / lifting equipment. Note that an improper transportation / lifting may lead to personnel injury or machine damage. Below figures show various marking on a crate. Marking positions may vary with different packing.



"A" CRATE PACKAGE



"B" CRATE PACKAGE

E. UNPACKING THE MACHINE

1. CHECK AFTER UNPACKING

- (1) Check to see if there is any mechanism of the machine damaged or not.
- (2) Check all accessories, such as auxiliary tools, documents and operation manuals, etc.
- (3) After unpacking, remove all packing materials to avoid accident.
- (4) Check all machines' mechanisms to see if there is any corrosion or paint peeling off.
- (5) Make sure the machine is placed stably.
- (6) Check if connectors of the hoses and electrical circuits loosened or not.
- (7) Check if the lock screws on the splash guard loosened or not.
- (8) Check if the machine specifications are correct or not.
- (9) Do not remove the fixing blocks between the spindle head and the table at this moment.
- (10) After checking, if you find any specification is incorrect, parts missed or machine damage, immediately contact your local agent or SANCO.

F. LIFTING THE MACHINE

1. NOTICES OF LIFTING BEFORE UNPACKING

- (1) Understand the lifting positions marked on the wooden crate.
- (2) Use proper lifting devices according to the weight of the package.
- (3) Prepare some rags and wood blocks to protect the machine, and prevent the machine damage when lifting.

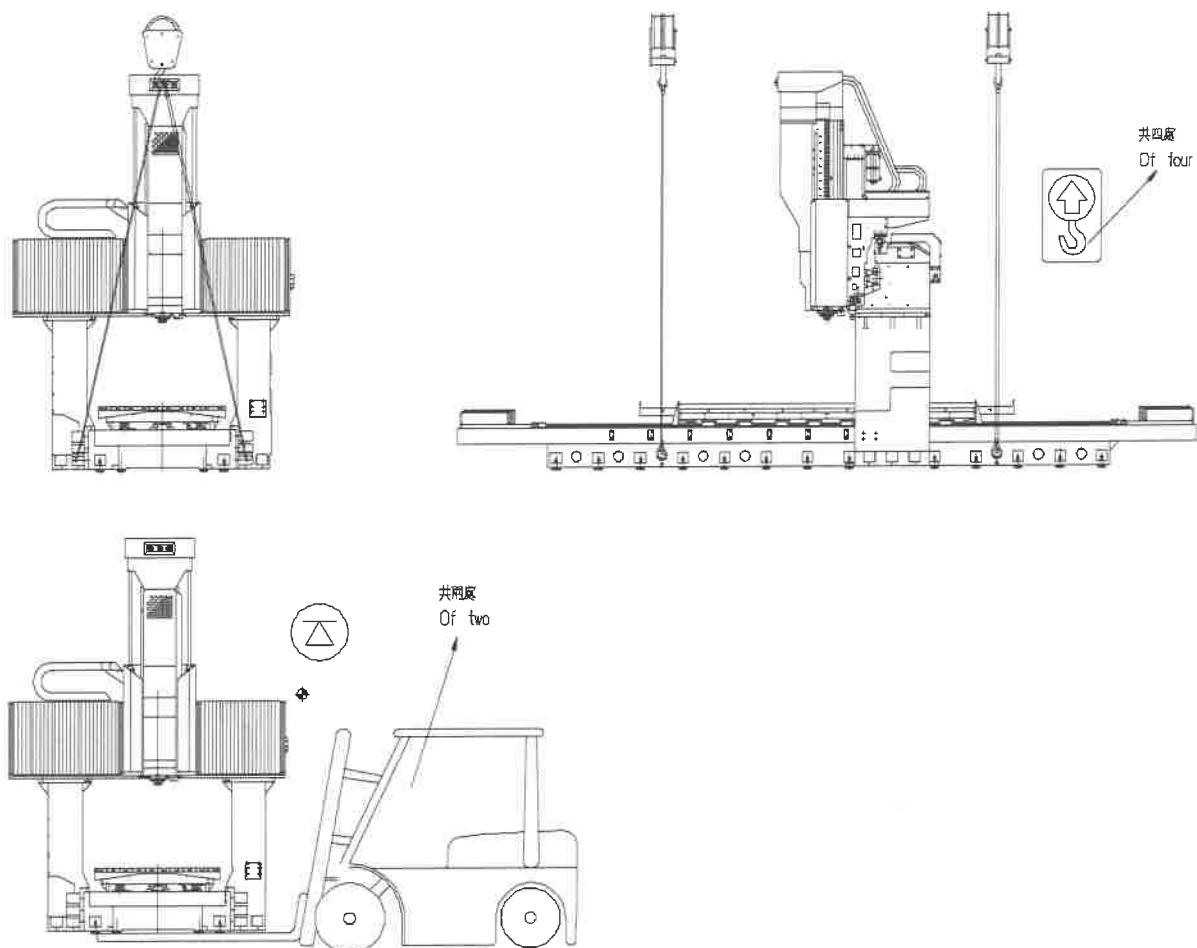
2. NOTICES OF LIFTING AFTER UNPACKING

- (1) Do not allow the lifting equipment to overloaded.
- (2) Make sure the machine is properly balanced when lifting.
- (3) Only a qualified lifting technician is allowed to conduct the machine lifting job.
- (4) To avoid machine damage, always use shims for protection and prevent the lifting devices from directly contacting the machine.
- (5) Have sufficient persons to watch each direction of the machine and communicate each other at any time.
- (6) Any person related with lifting job must not stand under the machine.
- (7) When the machine is not stable, do not move, raise or lower it.
- (8) Before lifting the machine, remove all tools, workpiece and equipment near the machine.
- (9) Before lifting the machine, check if all axes of the machine and related accessories are fixed or not.

The lifting method may vary with different machine models. Select a proper lifting method according to the actual unpacked condition.

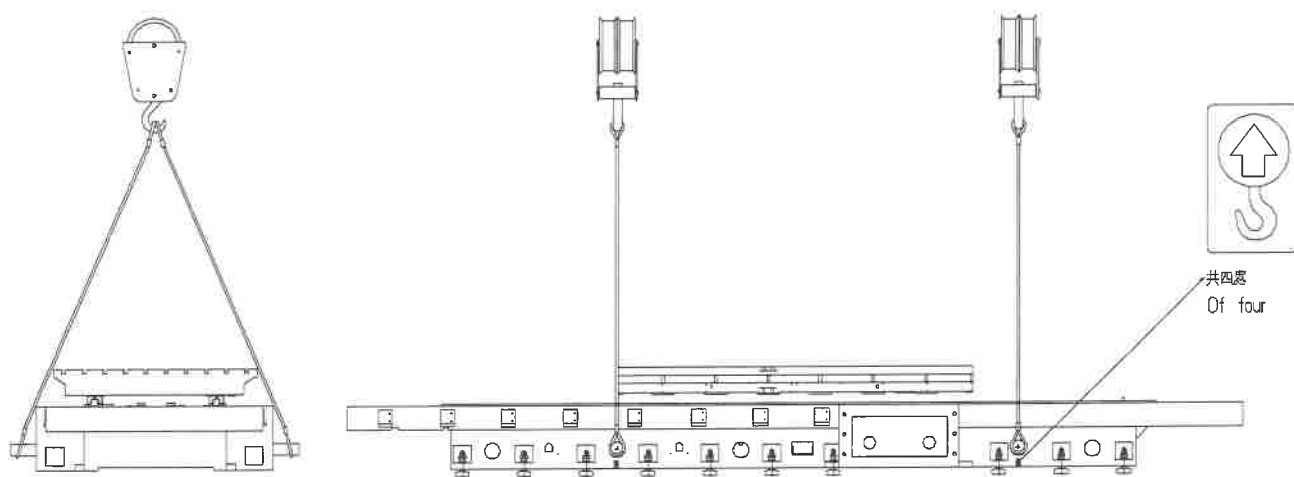
CAUTION : Be sure to remove the lifting rings before starting the machine. Otherwise, it may cause machine damage due to colliding.

3. FIGURES OF MACHINE LIFTING

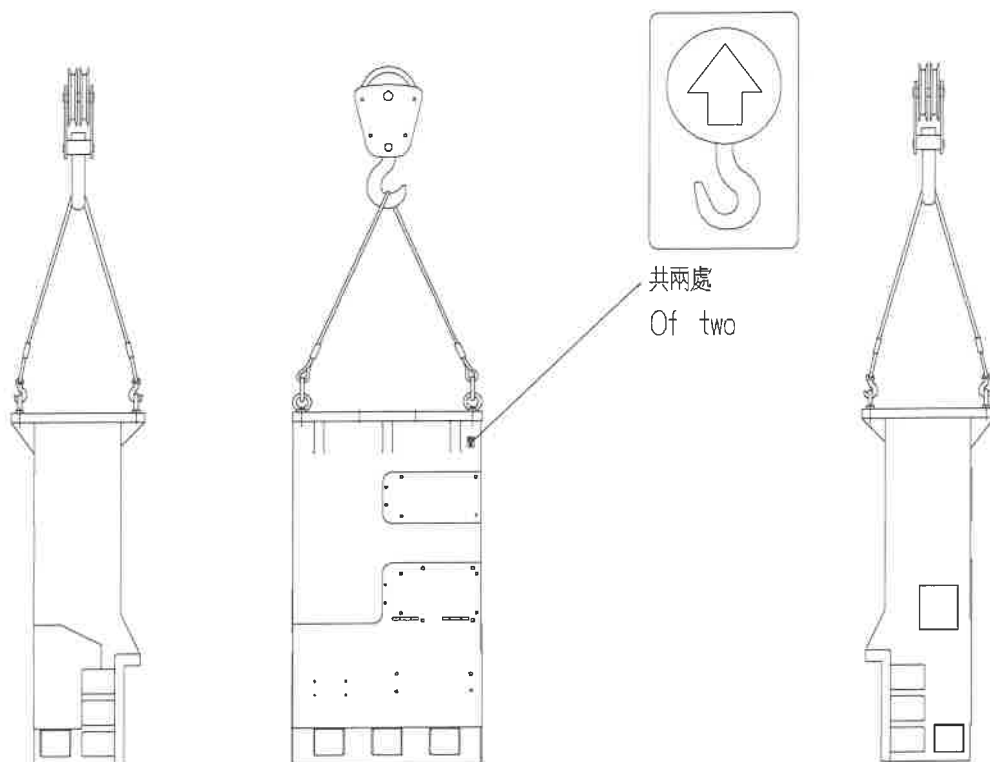


4. FIGURES OF MECHANISMS LIFTING

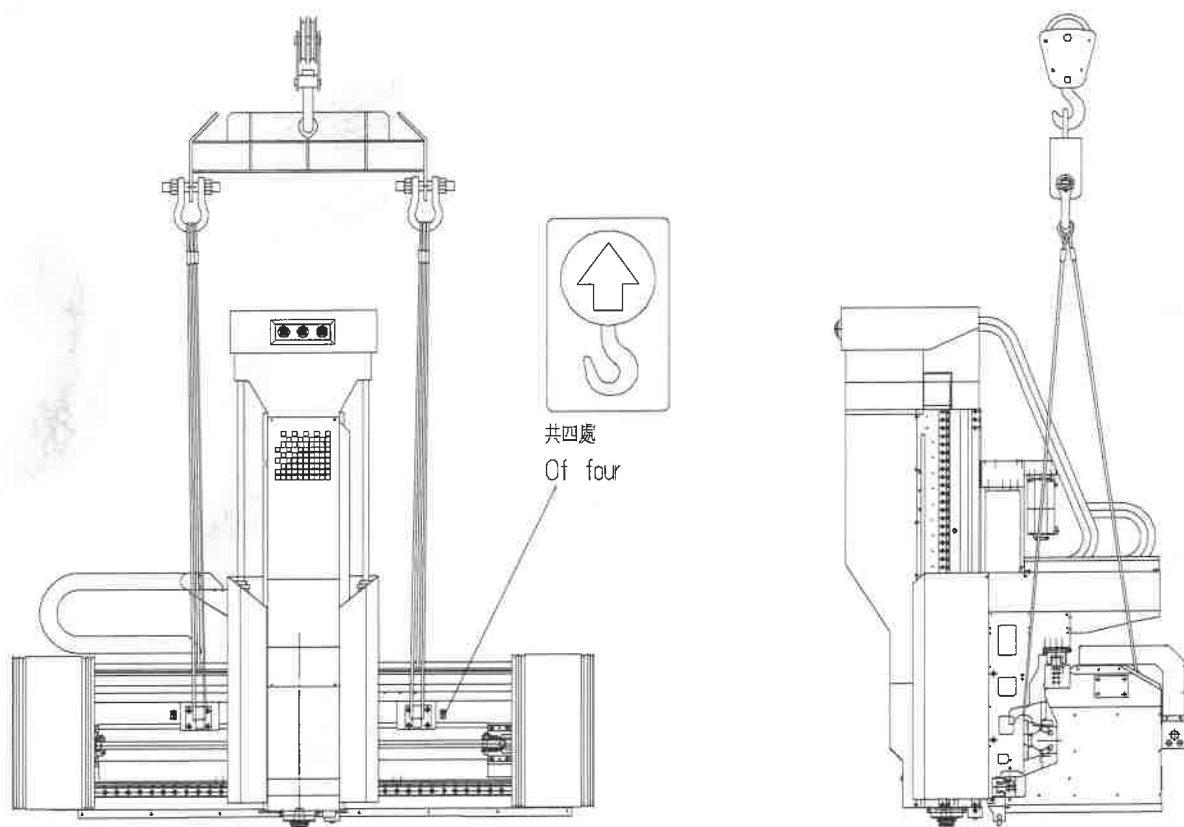
(1) BASE & TABLE



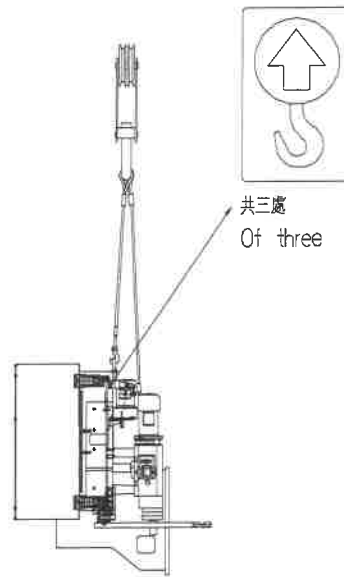
(2) COLUMNS



(3) BEAM & SADDLE

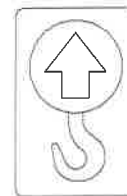
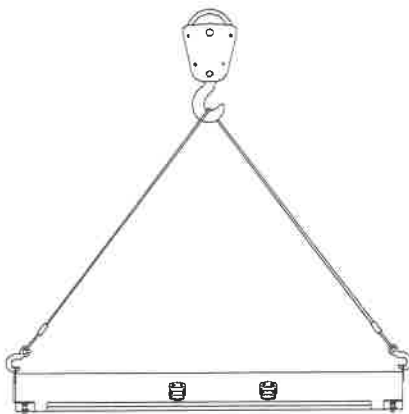


(4) TOOL MAGAZINE



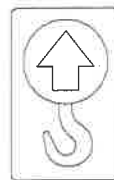
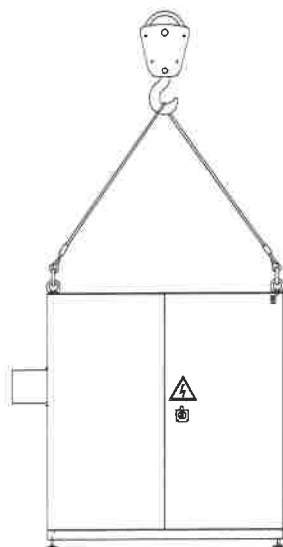
共三處
Of three

(5) COOLANT TANK



共四處
Of four

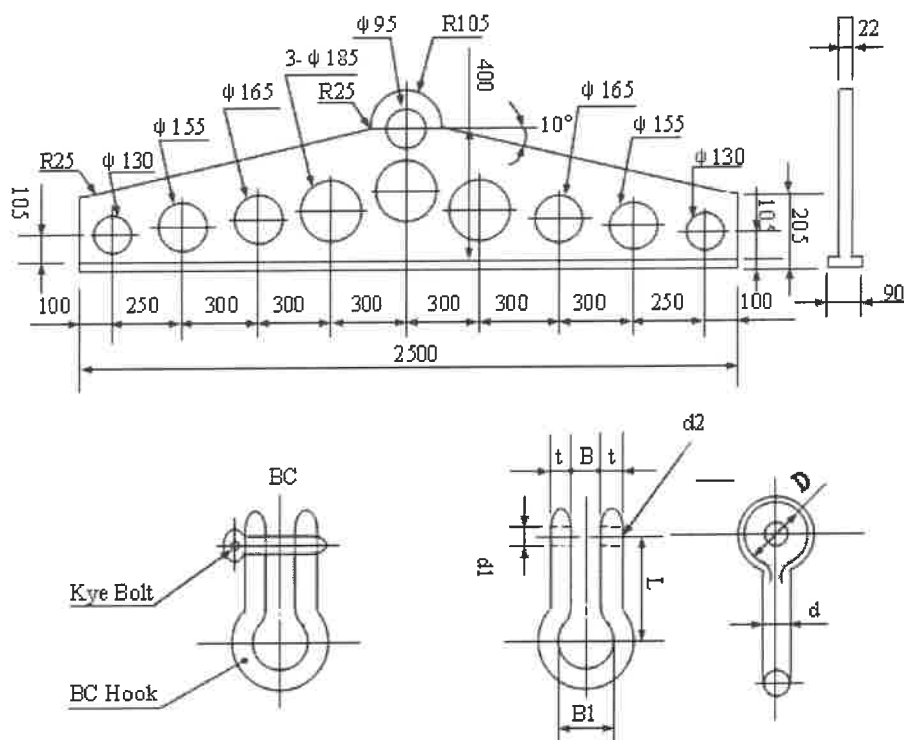
(6) Electrical cabine



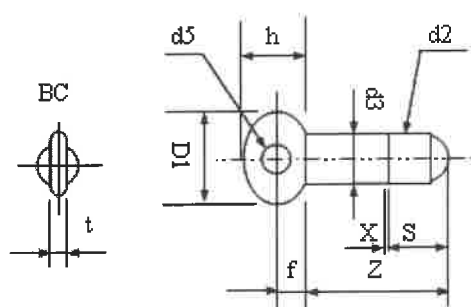
共兩處
Of two



(7) LIFTING BRACKET & LIFTING HOOK (FOR REFERENCE ONLY)

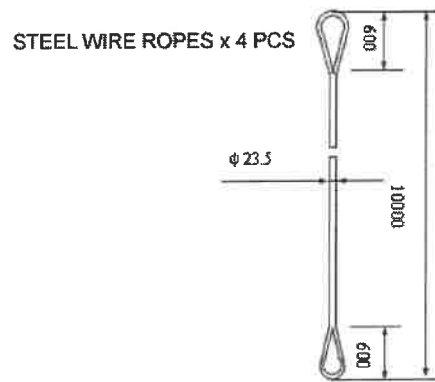


LIFTING HOOK SIZES	t	d	B	B1	D	d1	d2	L	Rdf Weight (Kg)		
									BA	BB	BC
34	34	39	50	98	85	41	M39	176	8.38	10.0	9.05

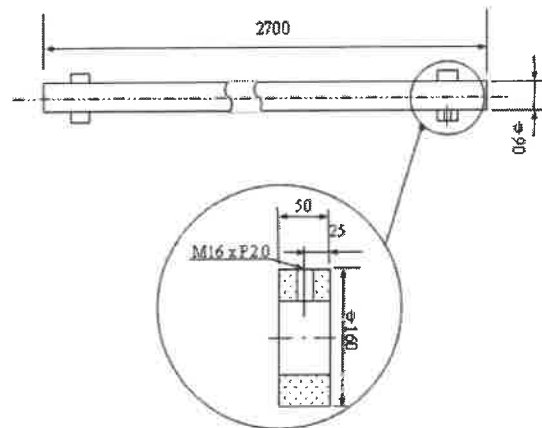


FIXING BOLT SIZES	d3	d2	Z	S	D1	f	h	d5	r	t
34	39	M39	126	45	60	19	40	20	30	14

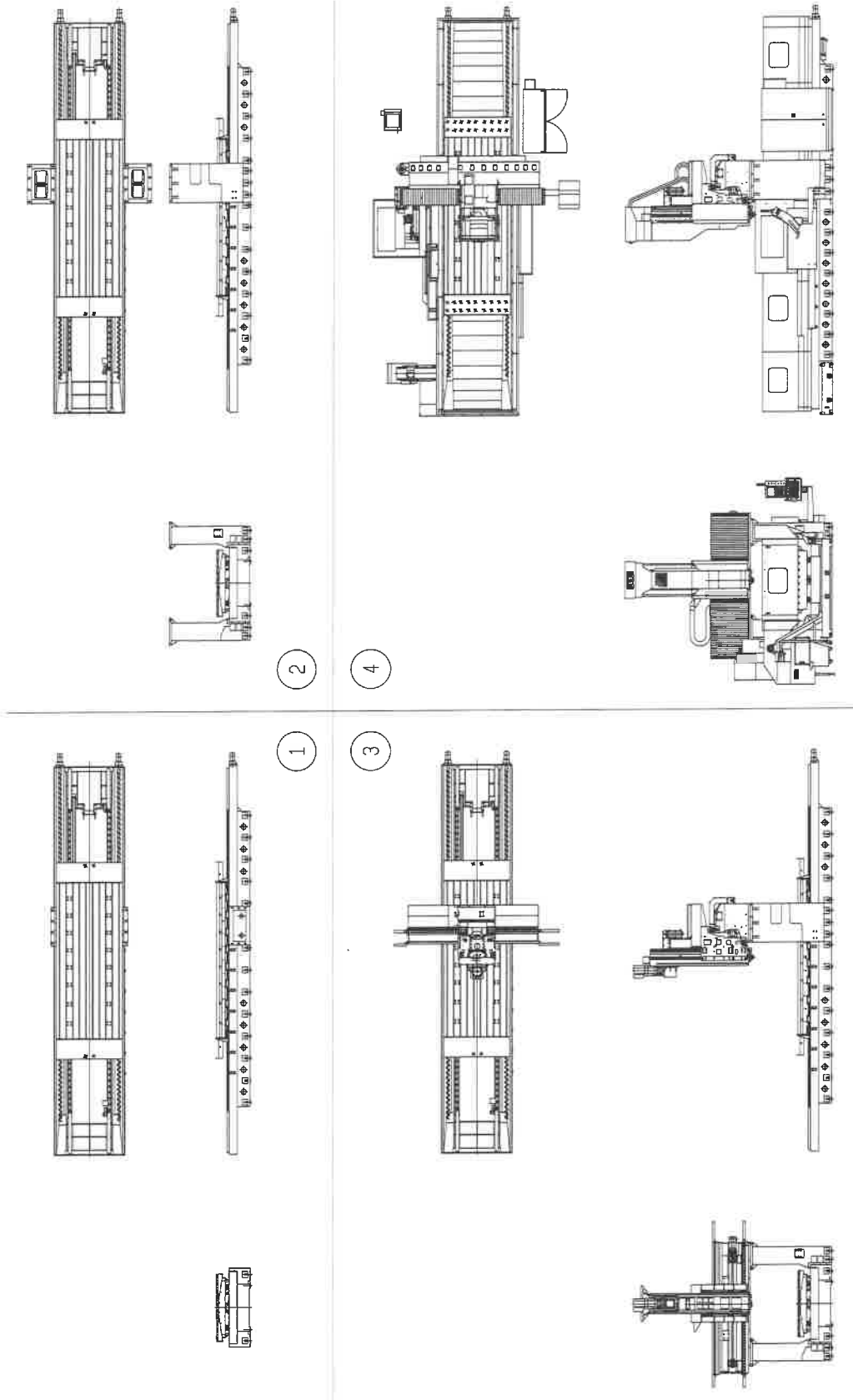
(8) STEEL WIRE ROPE & LIFTING BRACKET

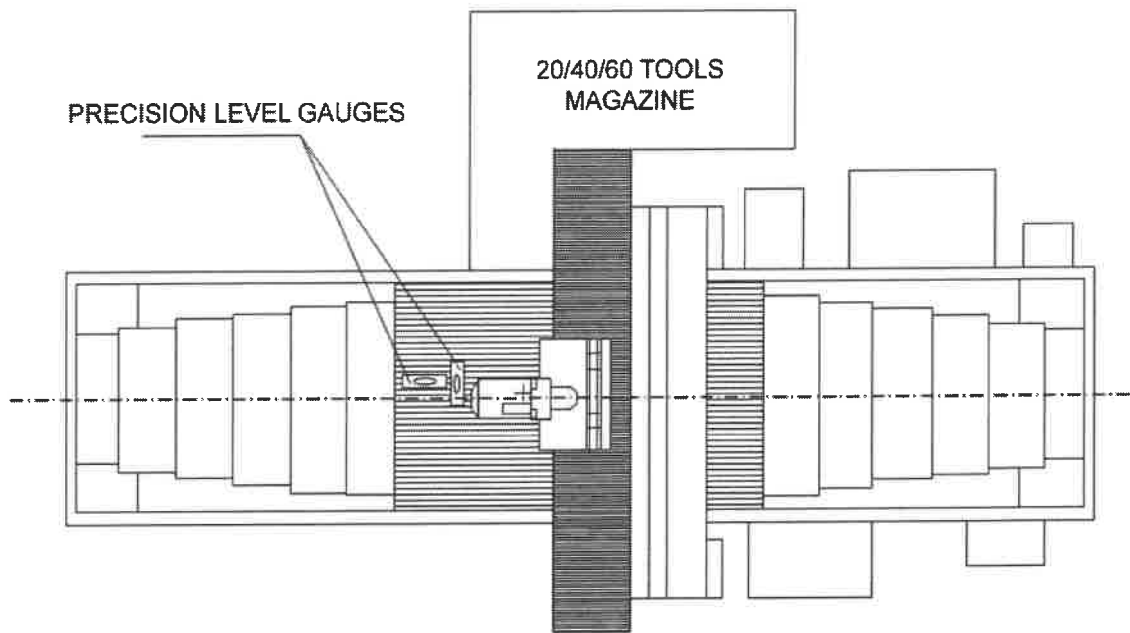


LIFTING ROD x 2 PCS



G. FIGURES OF ASSEMBLING PROCEDURES





PRECISION LEVEL GAUGES PLACING POSITIONS

V. MAINTENANCE & ADJUSTMENT

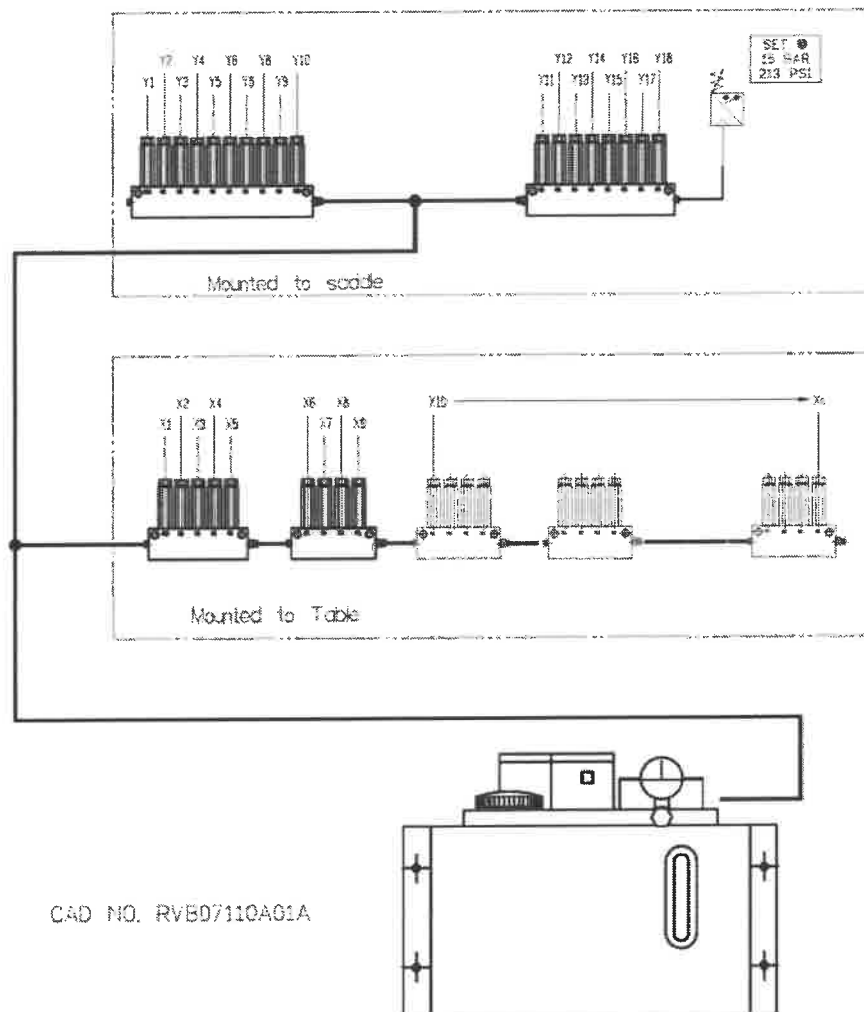
A. LUBRICATION SYSTEM :

1. THREE AXES LUBRICATION SYSTEM

The automatic lubrication system provides lubrication to 3 axes slideways and ball screws etc.

Below items are maintenance notices for the lubrication system:

- (1) Before starting the machine, check to see if lubrication oil is sufficient or not. Fill oil if necessary.
- (2) Use only correct lubrication oil, otherwise it may shorten the machine life and trouble.
- (3) The lubrication oil flow rate has been properly adjusted. In case there is no jamming or damage, do not adjust oil flow rate by yourself.
- (4) Refer to chapter IV-A for recommended oil brand and code.
- (5) Below figures show lubrication circuit.



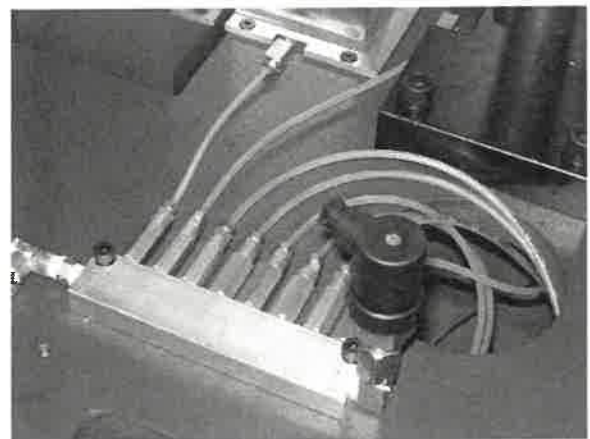
The three-axes lubrication system consists of a lubricator and several sets of oil distributors. A set of pressure sensor is provided at the far end to detect the circuit end pressure. In case the far end pressure is insufficient, it will result in malfunction (breakage or oil lack). At this time, the system will indicate an alarm. When this problem occurs, stop the machine immediately. Have a qualified technician to inspect to prevent parts damage.

(6) TROUBLE SHOOTING FOR LUBRICATION SYSTEM

ITEMS	PROBLEM	PROBABLE CAUSES	CORRECTION
1	Oil outlet failed	1. Hose is jammed. 2. Lubrication oil viscosity is too high. 3. Filter screen is jammed. 4. Insufficient oil. 5. Floating switch is damaged. 6. Check valves at inlet and outlet ports are jammed. 7. Part in the pump is damaged. 8. Hose is broken.	1. Clean or replace hose. 2. Replace with qualified oil. 3. Remove jammed object 4. Fill oil 5. Replace 6. Remove jammed object 7. Repair 8. Replace hose.
2	Alarm occurs	1. Short circuit of pressure switch. 2. Hose is broken. 3. Pump discharge pressure is insufficient.	1. Replace pressure switch or wire. 2. Replace hose 3. Repair pump 4. Replace pump
3	Oil problem	1. Too much parts wear 2. Oil seal is not tight	1. Replace model 2. Replace



Lubricator



Oil distributor & end pressure sensor

**2. LUBRICATION AND MAINTENANCE FOR MAGAZINE AND ATTACHMENTS
(ADDITIONAL MILLING HEAD)**

The magazine and attachment lubrication and maintenance should be dependent on the actual condition as indicated.

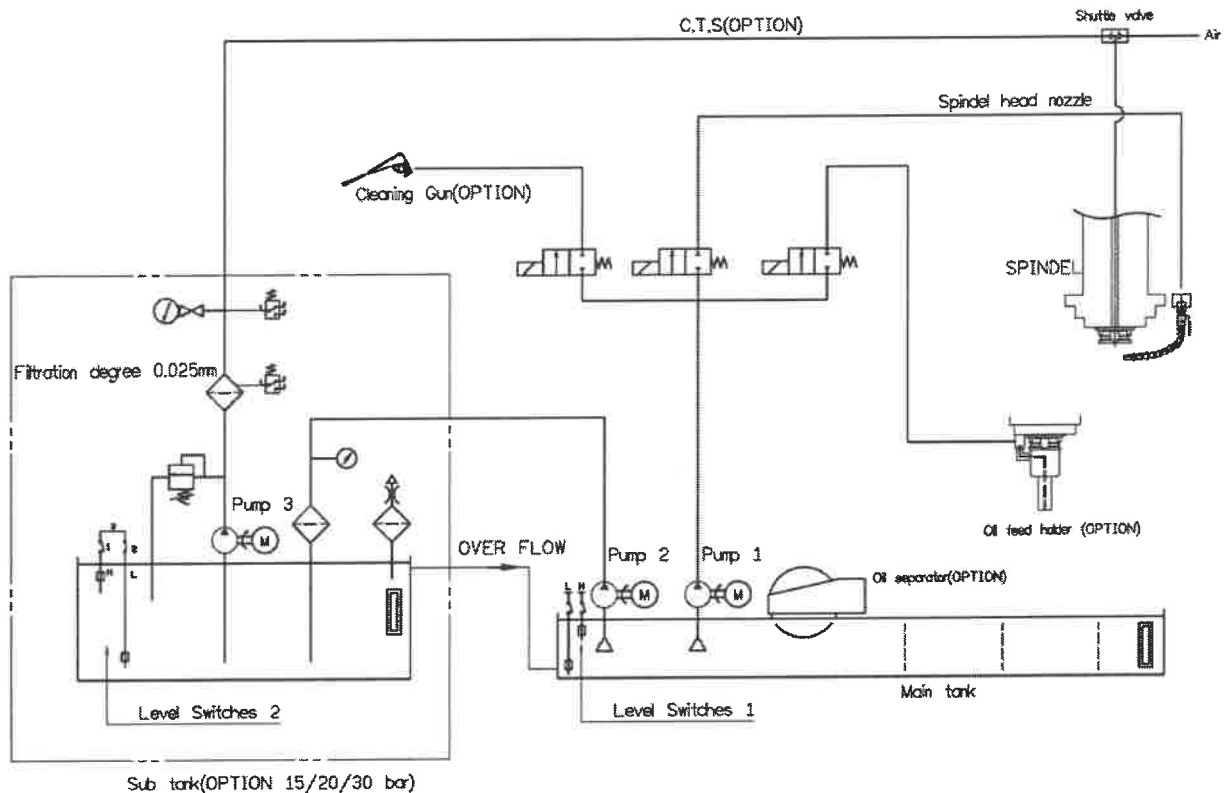
	
ATC lubrication points	Additional milling head lubrication points (example)

****NOTE : Refer to the magazine operation manual for magazine maintenance.**

B. COOLANT TANK AND CHIP CONVEYOR SYSTEM:

1. DESCRIPTION OF COOLANT CIRCUIT

During cutting process, high temperature may generate combined with chips deposit that leading to the poor surface of machining. The high temperature will also affect machining accuracy due to thermal deformation of workpiece, therefore coolant is applied for reducing thermal rising and thermal deformation, while achieving better machining surface. The coolant is also used for increasing the tool service life. The coolant circuit primarily consists of a coolant pump, which delivers coolant to workpiece and cutting tool position. Then coolant will return-flow to the coolant tank, located under the machine bed.

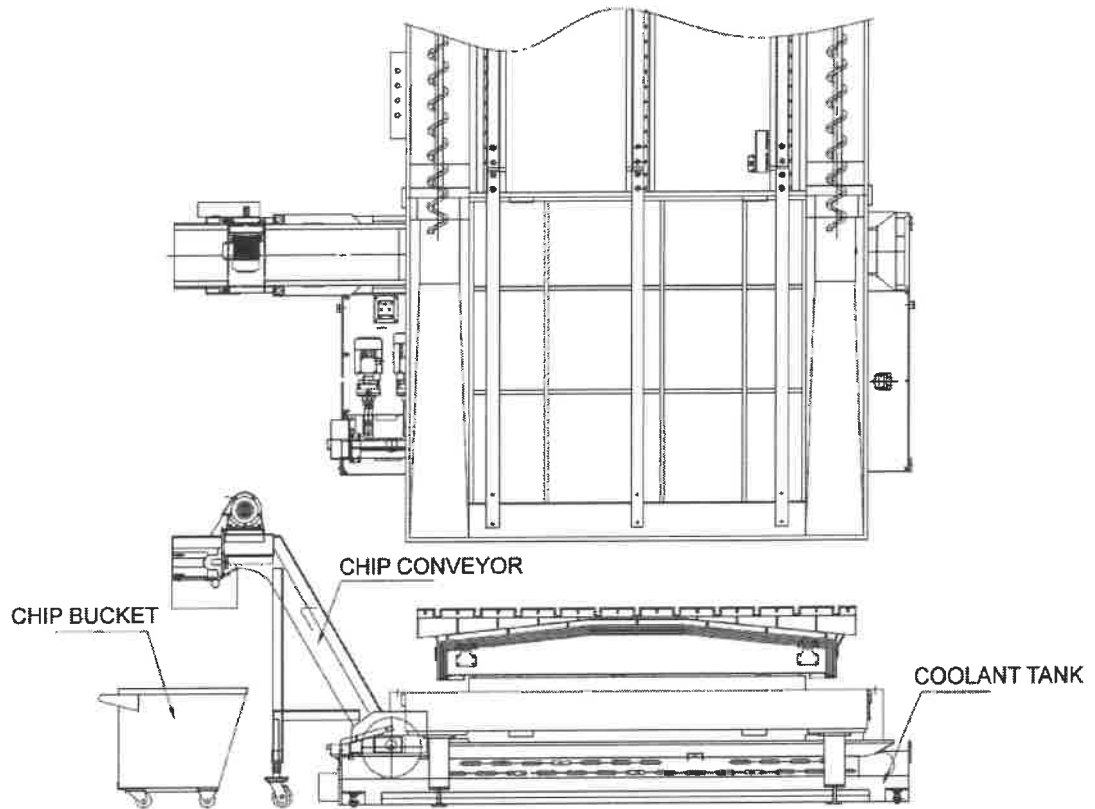


2. DESCRIPTION OF COOLANT TANK

To enhance operational automation and reducing chips removing time for operational convenience, there are two chip augers mounted on both sides of the base. They deliver chips to the chain type chip conveyor, located at the front of the machine, then chips fall down into a bucket.

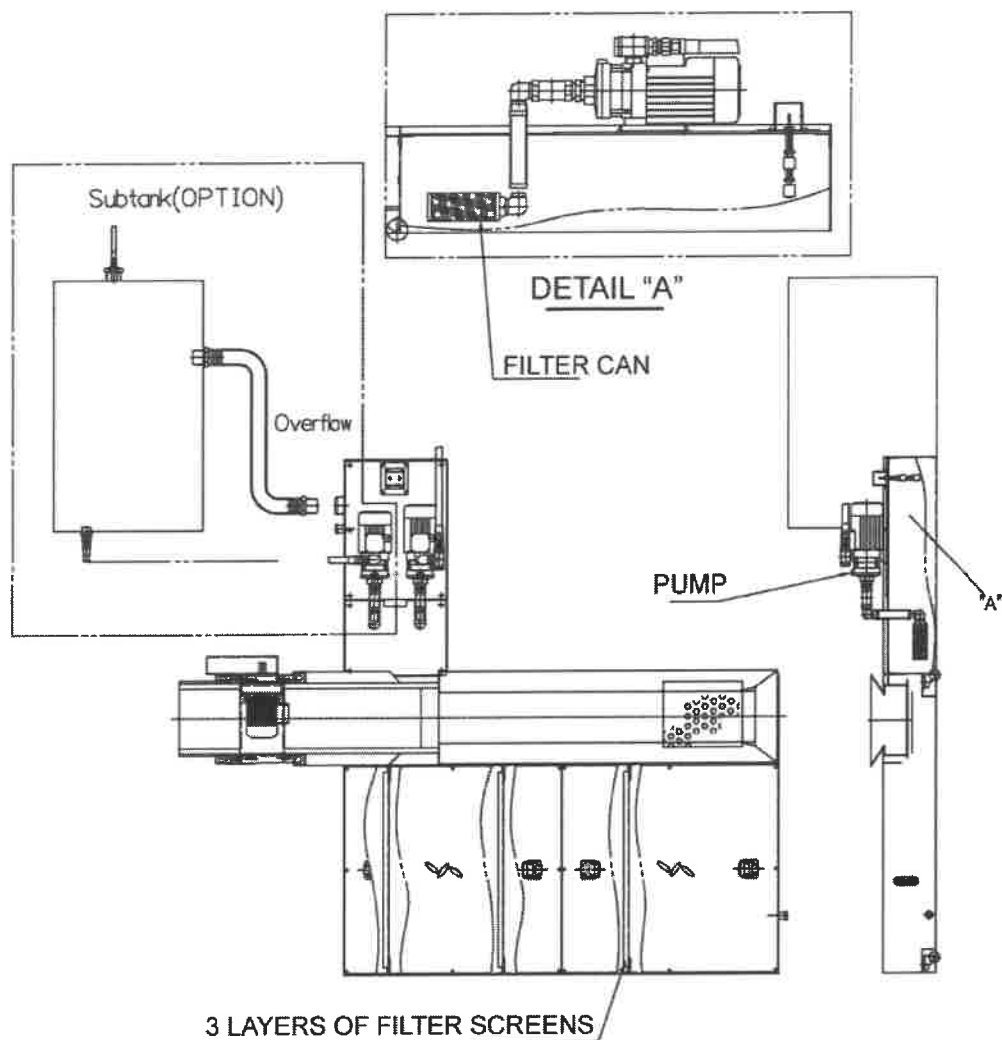
- (1) Do not allow mass chips to deposit, because this will increase the load of the driving unit. This is not only to shorten the service life of the delivery system, but also even cause damage.
- (2) Various chip conveyors can be selected to suit different workpiece materials (such as cast iron, aluminum and bronze). Select a correct chip conveyor according to your workpiece material.
- (3) The chip conveyor layout is shown as below.

****CAUTION :** When the chip conveyor is running, care should be taken for personnel safety to avoid danger. In case any object is jammed, stop the machine immediately. Failure to comply may result in damage to chip conveyor.



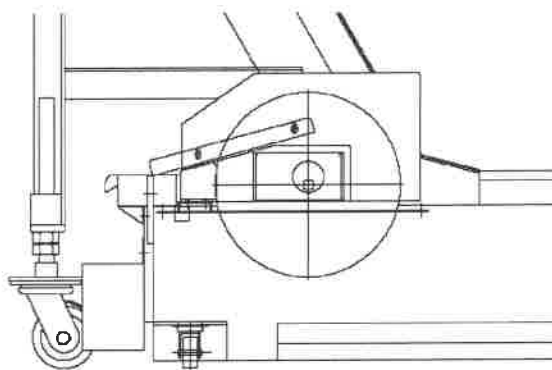
3. DESCRIPTION OF MAINTENANCE AND APPLICATION

- (1) Different workpiece material requires different coolant. If you have any questions regarding the correct use of coolant, consult coolant supplier for correct use.
- (2) Coolant should meet the following conditions.
 - a. Coolant should not be harmful to the human body.
 - b. Do not use coolant stored for a long time.
 - c. Make sure coolant is not corrosive.
 - d. Coolant should not contain any dusts.
 - e. Coolant should not cause chemical reaction with rubber or plastic parts.
 - f. Coolant should not deteriorate easily.
- (3) Before operation, check the coolant level. Fill enough coolant if necessary.
- (4) If coolant has been used for a long time, replace it.
- (5) Periodically cleaning the iron chips existed in the coolant tank.
- (6) For the capacity of the coolant tank, refer to the specification table given in Chapter II-A.



The coolant tank is equipped with 3 layers of filter screens, and a cylindrical filter can be provided at the inlet port of each pump. It is requested to clean these filter elements according to the actual conditions, that will ensure the best filtration effect and the service life of the pump.

Upon request, the coolant tank can be fitted with an oil separator. Its function is to separate oil from coolant for extending coolant life.



Oil separator

C. CTS FILTER SYSTEM (OPTIONAL)

The coolant through spindle filter system is an optional equipment. With this filter system, the coolant will flow through the spindle to the front side of cutter. It provides high pressure chip flushing for high speed machining.

1. DESCRIPTION OF CIRCUIT :

The CTS filter system applies an additional sub-tank in addition to the original coolant system, which is used for the high pressure pump. The pump "2" on the main coolant tank discharges coolant to the sub-tank. After filtration, the high pressure pump "3" sucks coolant. If coolant level in the sub-tank is too high, coolant may flow through the return-flow hose to the main tank to keep normal coolant levels in both tanks.

2. DESCRIPTION OF MOTIONS :

- (1) Either under manual or automatic operation mode, the high pressure pump starts running only when the CTS switch is turned ON. The coolant will be delivered to the rotating connector of the CTS, then flowing through the spindle to the outlet port of cutter for flushing chips.
- (2) In case coolant amount is insufficient, the level switch will control pump to stop. At this moment, the screen displays a Coolant Alarm.
- (3) Available coolant pressure, flow rate and filtration degree are shown as below table.

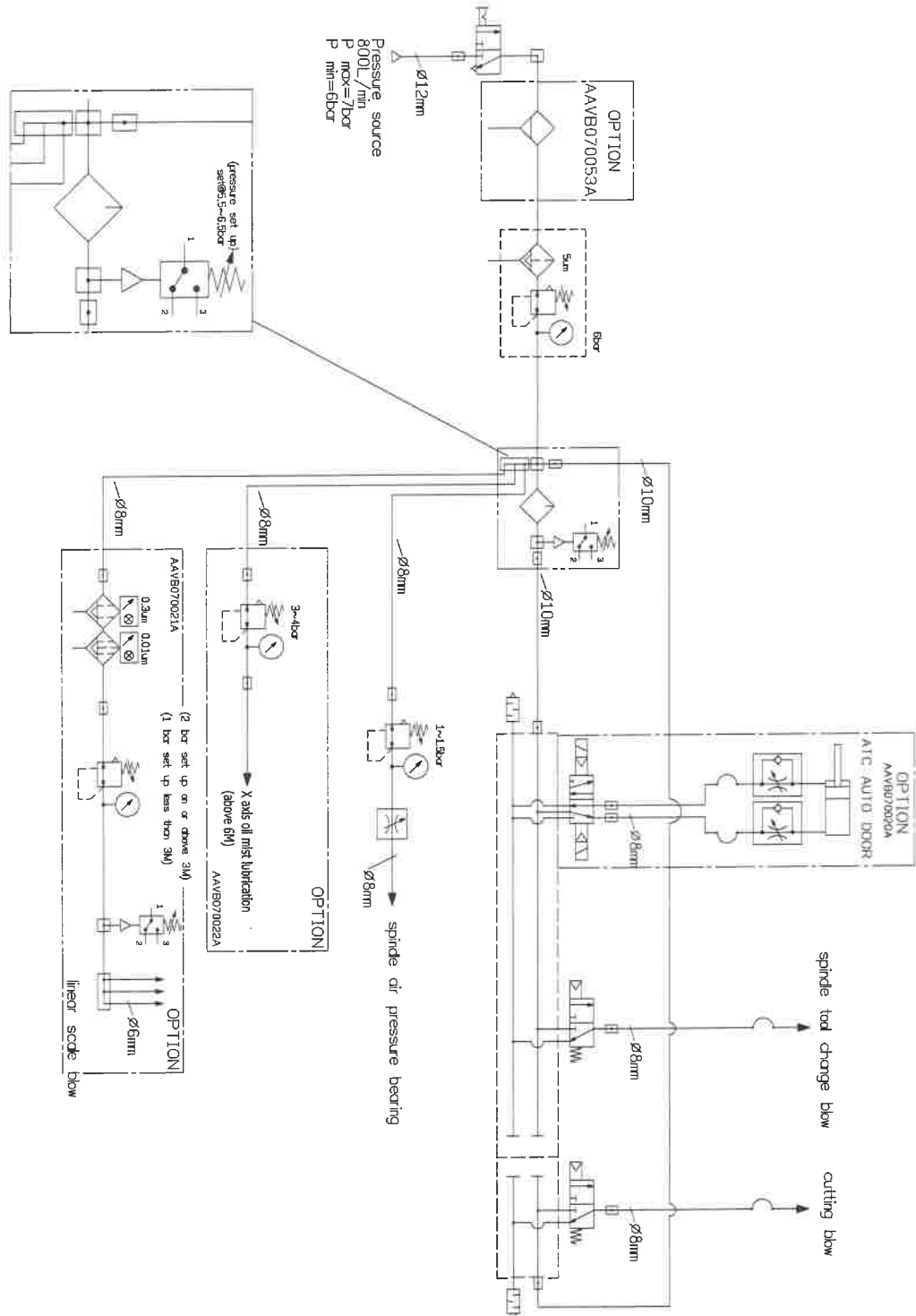
	Pressure/Bar	Flow rate L/min	Filtration degree/mm
1	15	28~30	<0.025
2	20	28~30	<0.025
3	30	28~30	<0.025

*The pressures shown on above table are the outlet port of the pump

- (4) For details, refer to the coolant circuit diagram.

D. PNEUMATIC SYSTEM

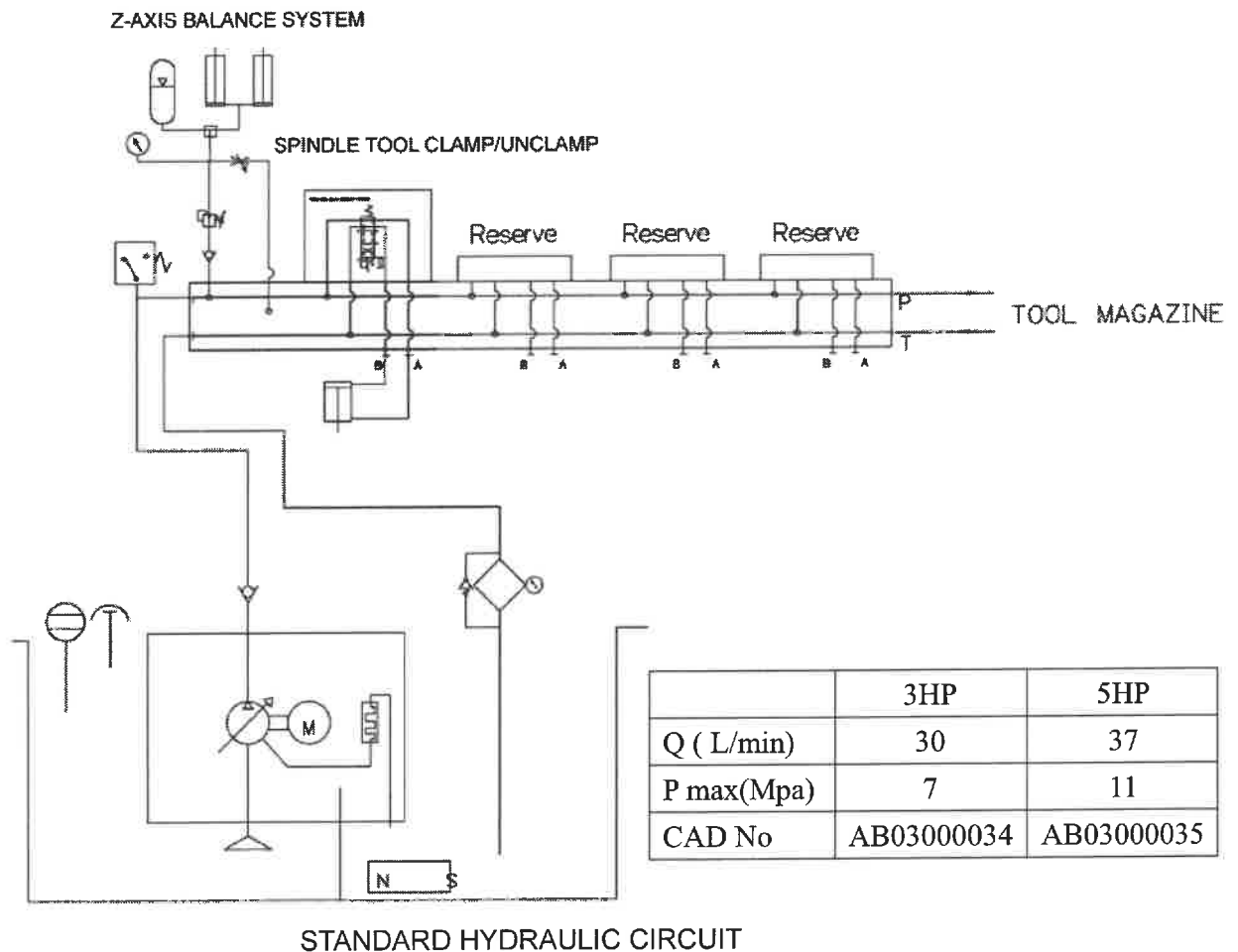
The pneumatic system is used for cleaning the spindle taper, auto door as well as cleaning and blowing off chips when machining cast iron. In addition to full speed air blowing to the spindle, the other parts are equipped with throttle valves for adjusting air flow rate. Air pressure is adjusted through the pressure regulation valve on the filter / regulator / lubricator combination unit. A pressure switch is provided, which will send a signal to the controller in case of insufficient pressure for proper correction.



CAD NO. RVB07090A01C

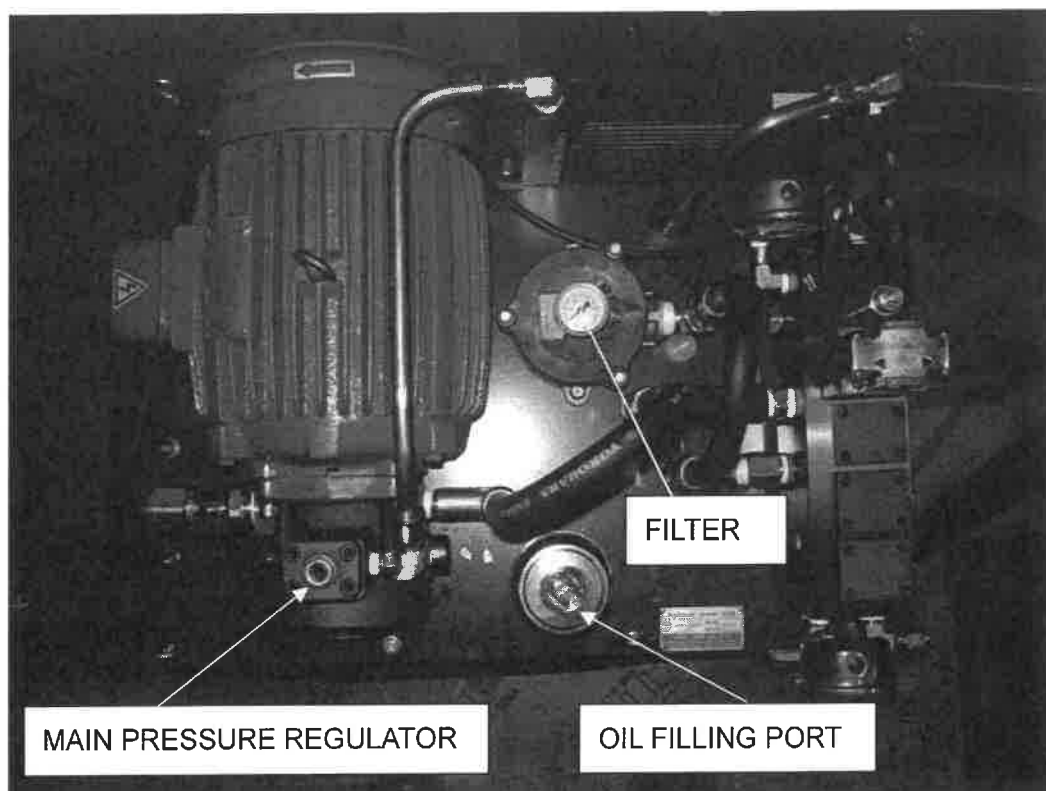
E. HYDRAULIC SYSTEM:

The hydraulic system is used for Z-axis hydraulic counter-balance system and spindle tool clamp / unclamp. A hydraulic pump discharges oil for the hydraulic system. Oil flows through check valve, high pressure filter screen and pressure gauge (Normal pressure 60kg/cm^2). Then oil flows through single-direction solenoid valve to tool clamping / unclamping hydraulic cylinder and pressure balancing valve. Oil then flows to a pressure switch to check if pressure ($52\sim 55\text{kg/cm}^2$) is normal or not, then it flows through a single direction solenoid valve to a hydraulic cylinder. During flowing process, if any abnormal condition occurs, the hydraulic system will fail. When this occurs, the machine cannot be started. Be sure to correct the problem before starting the hydraulic system.

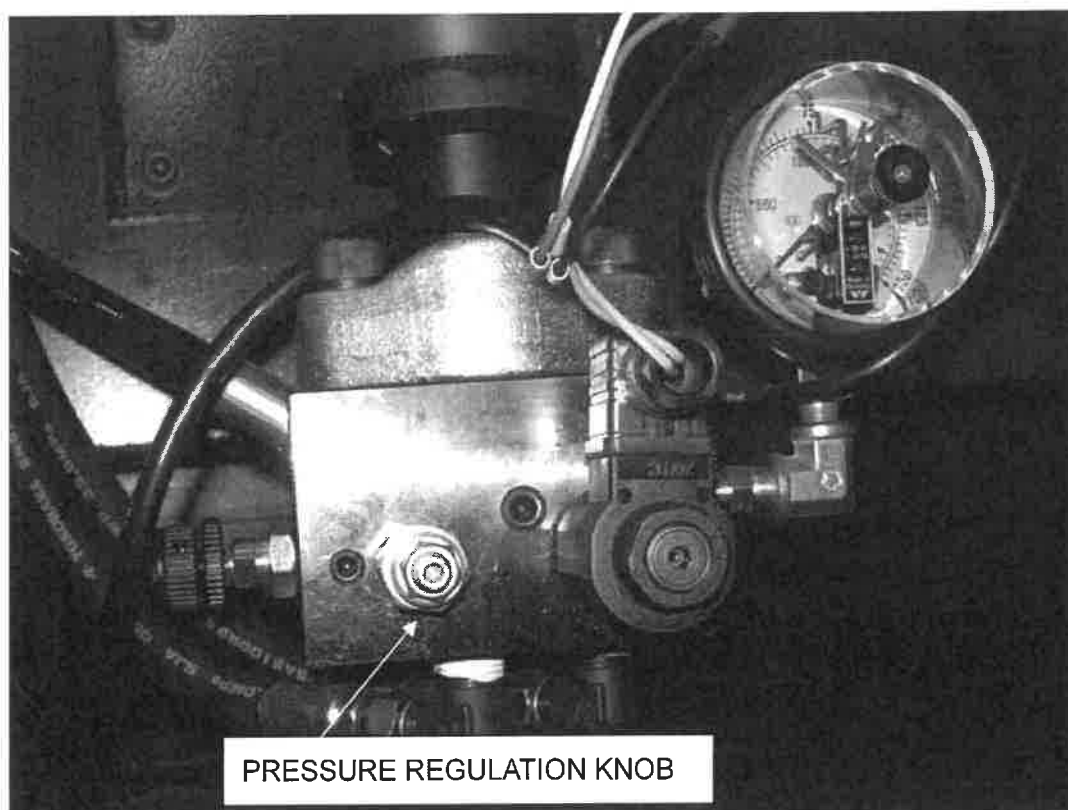


1. ADJUSTING PROCEDURES

- (1) Once the hydraulic system is well installed, use jog mode to start motor running 3 times before using continuous running.
- (2) Turn the flow regulation screw to extremely loosening condition and fix it.
- (3) Check to see if the motor running direction is correct or not, according to the arrowhead instruction.
- (4) Rotate the pressure regulation screw clockwise until the system pressure reaches 60kg/cm^2 , and then fixes it.
- (5) Properly set pressure for Z-axis balancing valve at $52\sim 55\text{kg/cm}^2$ (For standard machines only).



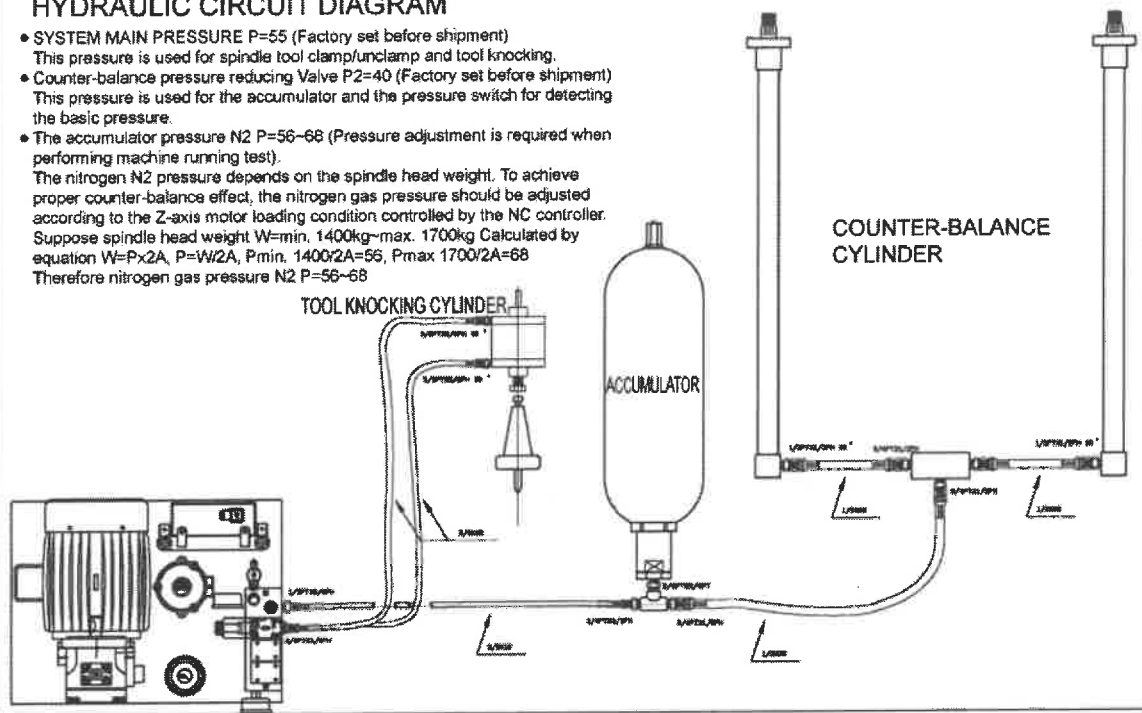
HYDRAULIC OIL TANK



For Z-axis balancing cylinder regulation, properly adjust it according to actual load on Z-axis.

HYDRAULIC CIRCUIT DIAGRAM

- **SYSTEM MAIN PRESSURE P=55** (Factory set before shipment)
This pressure is used for spindle tool clamp/unclamp and tool knocking.
- **Counter-balance pressure reducing Valve P2=40** (Factory set before shipment)
This pressure is used for the accumulator and the pressure switch for detecting the basic pressure.
- The accumulator pressure N2 P=56~68 (Pressure adjustment is required when performing machine running test).
The nitrogen N2 pressure depends on the spindle head weight. To achieve proper counter-balance effect, the nitrogen gas pressure should be adjusted according to the Z-axis motor loading condition controlled by the NC controller. Suppose spindle head weight $W = \text{min. } 1400\text{kg} \sim \text{max. } 1700\text{kg}$ Calculated by equation $W = P \times 2A$, $P = W/2A$, $P_{\text{min. } 1400/2A = 56}$, $P_{\text{max } 1700/2A = 68}$ Therefore nitrogen gas pressure N2 P=56~68

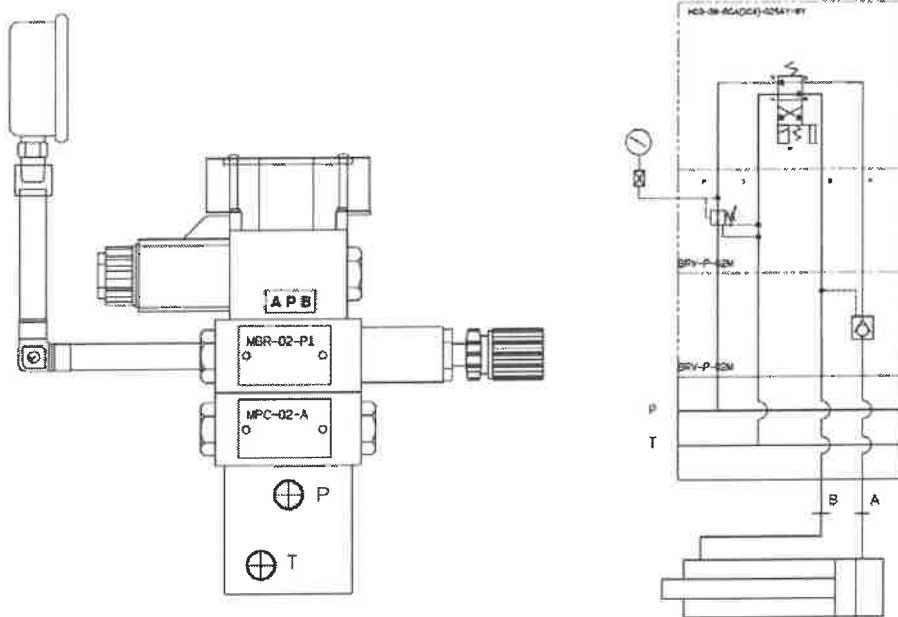


2. NOTICES

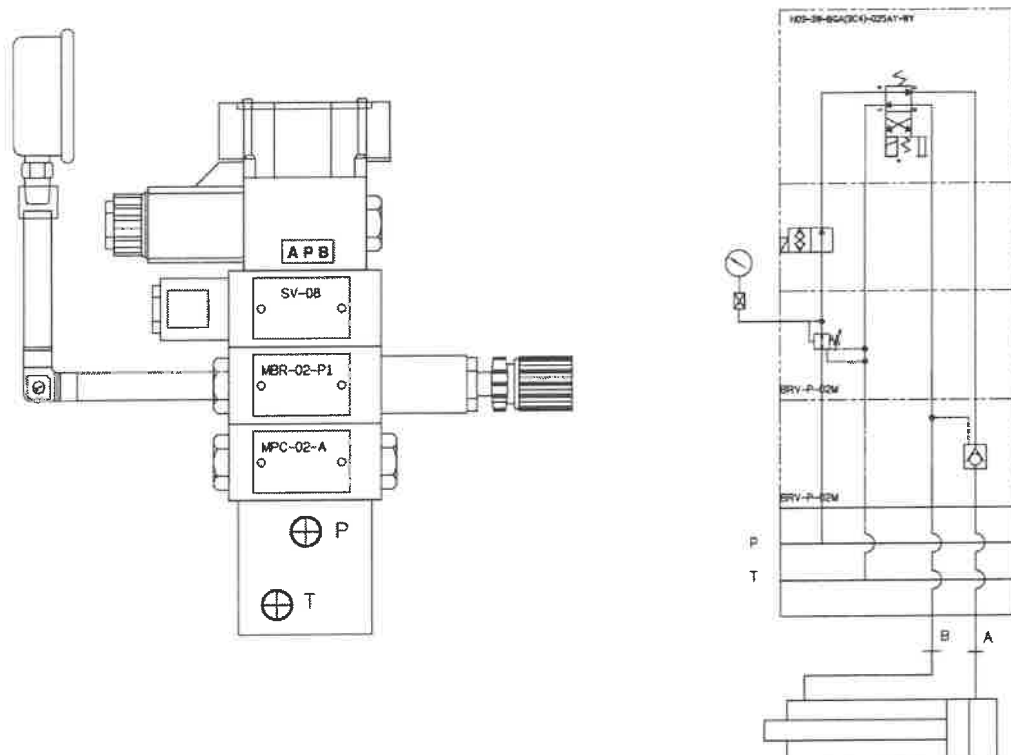
- (1) Before starting the machine, check to see if oil amount in the tank is sufficient or not. Fill enough oil if necessary.
- (2) The oil tank should be located at a position shown on the machine layout diagram. Always keep oil tank clean.
- (3) Periodically check if hydraulic pressure switch works normally or not.
- (4) When filling oil, do not remove the filter screen at the oil filling port.
- (5) To ensure oil being normal quality, replace oil at least once a year. Refer to Chapter VI-A for recommended oil.
- (6) Wash filter screen at least once half a year.
- (7) Refer to Chapter IV-C for system trouble shooting instruction.

3. REFERENCE CIRCUIT (OPTIONAL)

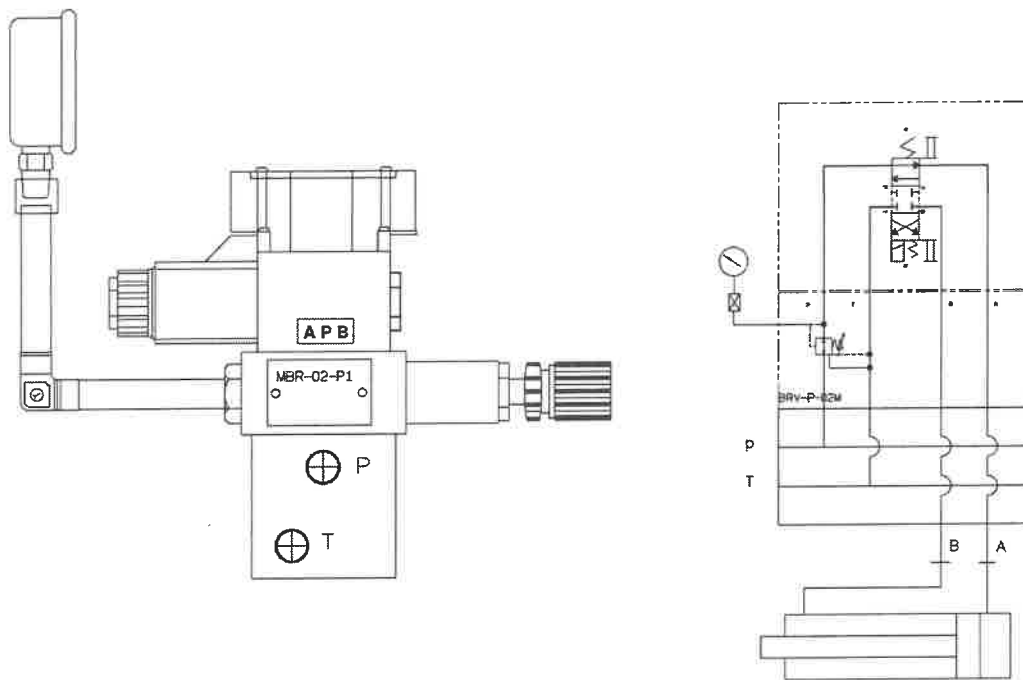
- (1) MANUAL INDEXING INTERFACE FOR 90° MILLING HEAD
(MH01000001)



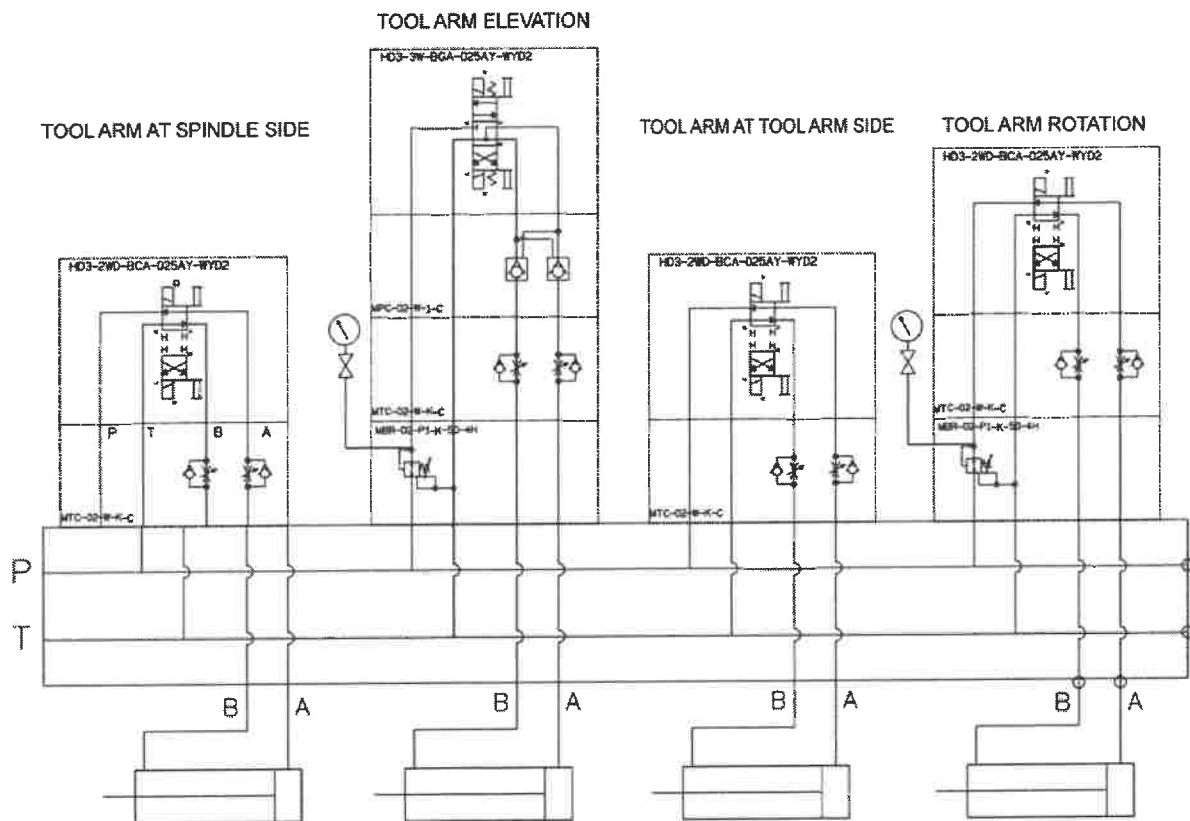
- (2) AUTOMATIC INDEXING INTERFACE FOR 90° MILLING HEAD
(MH01000024)



(3) FOR 4TH -AXIS (MH1000003)



(4) HYDRAULIC CIRCUIT FOR SANCO MAGAZINE



F. GEARBOX & SPINDLE COOLING SYSTEM

1. DESCRIPTION OF CIRCUIT :

The system circuit is to apply the spindle oil cooler to cool oil. The hot oil flow from the gearbox. Then it is delivered to a heat exchanger for cooling. After that, the oil returns to the gearbox for circulated cooling and lubrication. The cooling effect primarily comes from the spindle oil cooler. The purpose of cooling is to reduce oil temperature of the gearbox running at high speed for a long time, that will extend the service life of the parts in gearbox.

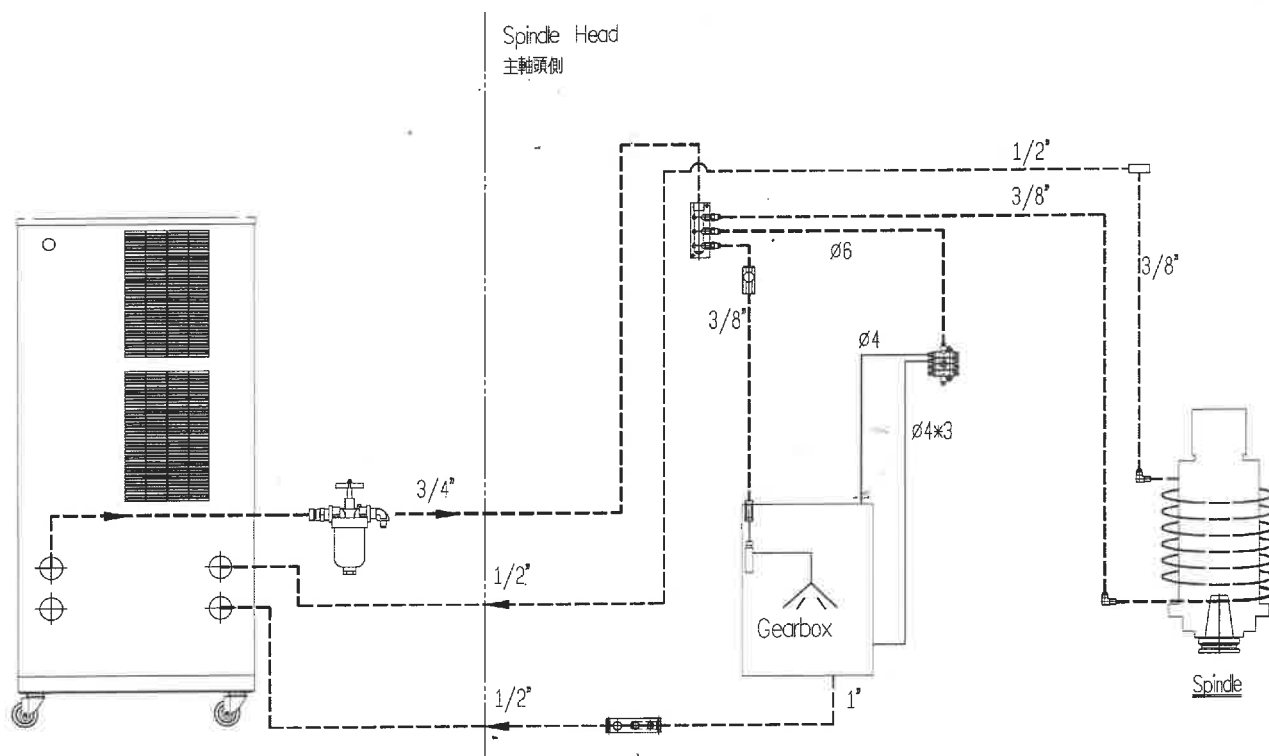
2. SYSTEM CONTROL :

As soon as the machine is started, the pump starts together, which will continuously run until the machine stops. During running, a set of pressure switch will detect if the pump runs normally or not and if oil amount is sufficient or not. This ensures normal performance of such function. In addition, it also provides an alert to the operator for filling oil if it is insufficient.

3. MAINTENANCE :

The system is covered by a sheet metal. As the gearbox always runs at a high speed for a long time, the oil quality may deteriorate. Therefore it is suggested to replace oil at least once half a year.

4. COOLING CIRCUIT :



5. MAINTENANCE FOR OIL COOLER

1. Always follow the safety rules before performing any maintenance job. To ensure the cooling efficiency of the oil cooler and extend its service life, it is important to perform periodic maintenance for the oil cooler. The normal running performance of an oil cooler requires an well-ventilated location and jamming-free environment.
2. Do not clean and maintain the oil cooler when it is running. When the oil cooler is running, dismantling any parts may lead to personnel injury or machine damage. The parts needed to be periodically washed include : housing , condenser, air filter screen, oil tank and oil filter screen.

(1) HOUSING CLEANING

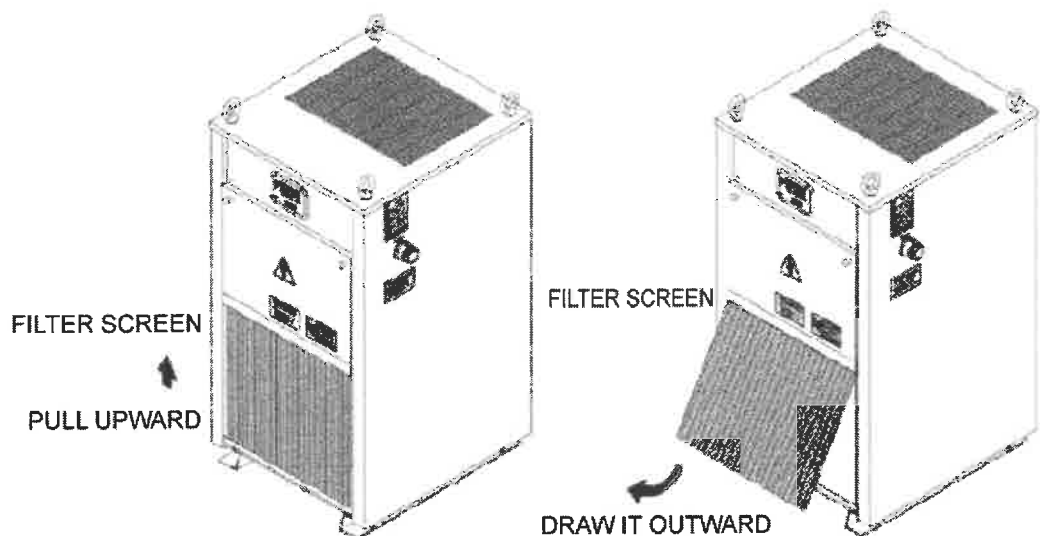
- a. Use mild detergent or high quality soap to remove stains on the cooler surface. Do not use stone, acid agent, abrasive powder, steel brush or hot water for washing, as it may damage the coating surface.
- b. WASHING COOLER BODY : During washing, do not allow water splashing on the electronic parts.
- c. Clean the electronic parts by using a dried rag.

(2) CONDENSER

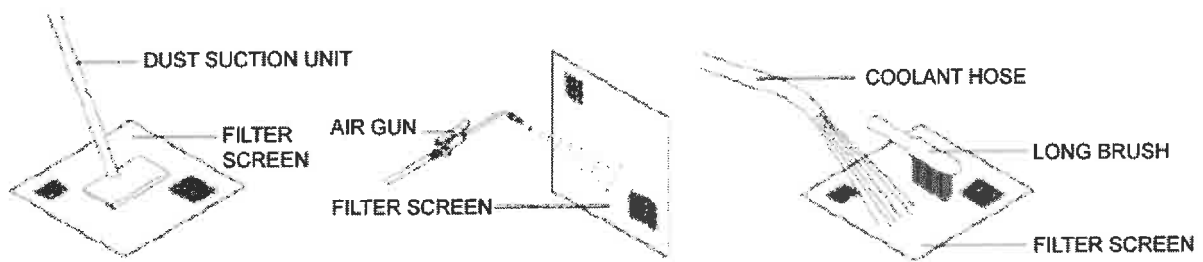
- a. Check if the condenser is jammed by any dusts. Periodically use compressed air or brush to wipe off dusts on the condenser.

(3) AIR FILTER SCREEN

- a. To remove the air filter screen, pull it up and draw it outward.



- b. Use dust suction device, air gun, water hose and long brush to wash the dusts on the filter screen, then mount it back to its position. Wash the filter screen once a week. If dusts are serious, frequently wash it by using mild detergent.



(4) COOLANT TANK

- a. If the coolant tank is mounted at a location of too much moisture, water may condense at the bottom of the coolant tank. It is requested to exhaust water out from the bottom of the coolant tank once a month.

(5) FILTER SCREEN

- a. Once the oil hose is just connected, at the initial stage, it is necessary to clean the filter screen every day. Afterward, during normal running condition, clean the filter once every 2-4 days.

6. STORING

In case the oil cooler has not been used for a long time, pay attention to protect the inside of the oil cooler and the condenser and prevent dusts or water adhering.

- (1) Store the oil cooler at a location away from dusts.
- (2) Clean the power wires.
- (3) Use protection cover to guard the oil cooler to prevent dusts or water adhering.
- (4) Store the oil cooler at a plain floor with a dry and cool location.
- (5) If the oil cooler is equipped with castors, fix the castors to prevent slipping that will result in personnel damage.

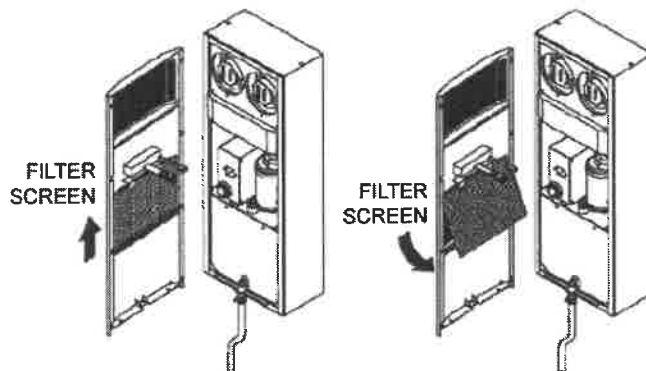
G. COOLER FOR ELECTRICAL CABINET

1. COOLER MAINTENANCE :

Periodically check to see if water hose exhausts water normally or not. Poor water exhaust may cause water leak in the electrical cabinet. Also, it is necessary to periodically clean the air filter and the condenser.

2. CLEANING :

- (1) Remove the filter screen according to below figure. Apply air gun or clean water for cleaning, then dry the filter screen.
- (2) Use air gun to remove dusts existed on the heat dissipation fins of the condenser, then mount it back to its position.
- (3) Periodically clean the cooler depending on air cleanliness in the environment. This may prevent poor cooling effect or damage to the cooler.
- (4) As oil mist may damage the control system, make sure the electrical cabinet door is closed at all times.
- (5) Use only mild detergent to clean the cooler body. Do not use hot water, gasoline or organic solvent for washing.
- (6) Do not use water to flush the cooler to prevent electric shock.



3. NOT RUNNING FOR A LONG TIME :

- (1) If cooler is not in use for a long time, protect the cooler from dusts.
- (2) Be sure to turn power off to avoid accident.

4. MAINTENANCE FOR HEAT EXCHANGER

The heat exchanger is driven only by a fan. This reduces maintenance to job a minimum, however it still needs to be periodically maintained according to following table :

FREQUENCY	PARTS	CHECK ITEMS	CORRECTION
Every day (Initial use)	Internal & external fan	Check if fan rotation is normal or not. If any noise or vibration occurs or not.	If it is abnormal, try to find cause. If damaged, replace it.
Weekly or monthly	Filter screen	Oil deposit or dust contamination	1. For slight contamination, slightly knock on the filter screen or the dust suction unit then mount it. 2. If dust contamination is serious, use mild detergent or clean water for washing. Remove water from the filter screen, after drying then mount it.
Every 6 months or 1 year (Stop cooler)	External fan	Oil deposit, dust contamination	

VI. ATTACHMENT

A. RECOMMENDED OIL FOR VARIOUS MECHANISMS

RECOMMENDED OIL LIST							
OIL	VISCOSITY	MOBLE	SHELL	ESSO	CASTROL	BP	C.P.C
Slideways and screws	ISO VG68	Vactra Oil No.2	TONNA OILS T68 or S68	FEBIS K68	MAGNA BD68	Maccurat D68	C.P.C. oil 68
Air filter	ISO VG10~12	Velocite Oil No.6	TELLUS 10	SPINASSO 10	HYSPIN VG10	Bartran 15	C.P.C special ingot oil R12
Spindle oil cooler	ISO VG32	DTE 24	TELLUS OIL 32	NUTOH 32	HYSPIN AWS-32	Bartran 32	C.P.C. oil HD32
Hyd. Oil tank	ISO VG32	DTE 24	TELLUS OIL 32	NUTO HP32	RANDO VG10~15	Bartran 32	C.P.C. hyd. AW32
Cam box	ISO VG150	MOBILE GEAR 629	Omala oil R150	SPARTAN EP150	ALPHA ZN150 MAX 150	GR-XP 150	C.P.C. oil HD150
ZF earbox	ISO VG46	DTE 25	Tellus 46	Vnvis N46	HYSPIN AWS-46	GR-XP 46	C.P.C. oil HD46
Grease	ISO EP 2	GREASE NIGI 2	GREASE R2	Beacon EP-2	GREASE EPC-2	Energreas e EP-2	Multi-function #2

LUBRICATION OIL CHANGE FREQUENCY

LUB. POS.	HYD. UNIT		PNEU UNIT		SLIDEWAYS				MAGAZINE	GEARBOX LUB
NO.	1	2	3		4	5	6	7	8	9
CONT HOURS ITEMS	Check oil level	Check pres. gauge	Check oil level	Check pres. gauge	Check oil level	Check oil flow			Coat grease	Check oil level
check	8	8	8	8	8	100	100	100	200	100
Fill			200						2000	
Wash					2000					
Replace	One year									Half year
Capacity	180 liters				8 liters					6 liters

B. MAINTENANCE FREQUENCY LIST

A good machine needs the operator to perform regular maintenance and inspection to ensure it develop the best operational performance. If a small problem is not improved, it may cause an error, that may result in serious trouble. Therefore it is very important to conduct prevention and maintenance according to the instructions. Below table gives correct maintenance frequency and adjustment method for each mechanism. If there is any item that is not listed in this table or cannot be solved, contact with our maintenance service department.

FREQ.	INSPECTING ITEMS
DAILY MAINTENANCE	1. Check if air blast for cleaning spindle taper is normal or not. 2. Use a clean rag without burrs or filament to clean spindle taper. 3. Check coolant level. Fill enough coolant if necessary. 4. Check hydraulic oil level. Fill enough oil if necessary. 5. Check lubrication oil level. Fill enough oil if necessary. 6. Check if return oil tank is full or not. If it is full, pour oil to an oil container. 7. Clean the control panel and the exposed limit switches. 8. If the machine is equipped with a tool magazine, clean the tool shank and the tool pocket on the magazine.
WEEKLY MAINTENANCE	1. Clean the entire machine, working area and the area around the machine. 2. Check if the hydraulic system works normally or not. If hydraulic pressure is normal or not. 3. Check if the hydraulic oil leaks or lubrication oil leaks or not. 4. Clean the filter screen of heat exchanger for the electrical cabinet. 5. Check if the lubrication oil cup on the F.R.L combination unit has proper oil amount or not.
MONTHLY	1. Check if lubrication to the three axes ball screws and slideways are normal or not. 2. Check if hydraulic oil in the oil tank is clean or not. If oil viscosity is too low or not. 3. Check the chain on the hydraulic counter-balance system. 4. If an A.T.C. is equipped, make lubrication properly (Incl. magazine transmission gears, tool pocket transmission gears and rail of tool change mechanism). 5. Check if lubrication oil in the ZF gearbox is sufficient or not. If there is any noises or not.
SEASONLY MAINTENANCE	1. Check reference point on each axis. 2. If an A.T.C. is equipped, calibrate the tool change reference point. 3. Check if the spindle belt and X,Z-axis transmission belts tension are loosened or not. Check belt teeth shape. Also, check if Y-axis coupler is loosened or not. 4. Check the hydraulic cylinder of counter-balance system. 5. Clean or replace the filter in the coolant tank.
SEMI-YEARLY MAINTENANCE	1. Check the filter screen of the filter in the hydraulic oil tank and high pressure cleaner on the counter-balance system. 2. Replace oil in the gear reducer of the screw type chip conveyor and oil in the Z.F. gearbox. 3. Wash the coolant tank.
YEARLY MAINTENANCE	1. Inspect the entire machine accuracy. Adjust accuracy if necessary. 2. Check if there is any noises on each motor. 3. Replace oil in hydraulic power unit and the 4th axis.

C. SIMPLE TROUBLE SHOOTING ON HYDRAULIC SYSTEM

The hydraulic system has been carefully designed, however a hydraulic system trouble still may occur during assembling or running or may be caused by environmental factor or parts fatigue. Below table shows various troubles and probable causes for hydraulic system commonly occurring. This information is helpful for operator and maintenance personnel.

PROBLEM	PROBABLE CAUSES	CORRECTION
1. Hydraulic pump discharge failed or discharge amount is small	(1) Incorrect running direction	Stop running immediately and change running direction.
	(2) Oil level is too low or hydraulic pump mounting position is too high.	1. Fill hydraulic oil to raise oil level. 2. Change the hydraulic pump mounting position to lower oil suction height. In particular, the oil suction capability of a piston pump is poor, therefore it is better to mount it as close to the oil tank as possible. If possible, its mounting position should be lower than the oil tank to facilitate oil flow in.
	(3) Oil suction or oil hose filter is jammed.	1. Clean the oil suction hose and the oil hose filter. If jamming is serious, clean the entire circuit and replace with new oil.
	(4) Air enters into the oil suction hose.	1. Check oil level in the oil tank. 2. Repair the packing in the pipe jointing position and tighten it securely.
	(5) Air enters through oil seal into the hydraulic pump.	If oil seal is damaged, replace it. If it needs to be used urgently, coat with little grease for temporary use.
	(6) Too low running speed	The input running speed of the hydraulic pump should be over the specified lowest speed according to the instruction manual or the catalog.
	(7) Too low oil temperature or too high oil viscosity.	1. Select the proper hydraulic oil recommended by the supplier according to actual requirement and temperature. 2. If oil temperature is too low, warm-up running is requested.
	(8) Hydraulic pump is seriously worn out without oil suction capability.	Repair the wearing part or replace part. If necessary, replace with a new one.
2. Hydraulic system pressure can't be raised	(1) Pressure gauge is damaged.	1. Calibrate pressure gauge. 2. Replace pressure gauge.
	(2) Poor motion of relief valve 1. Needle valve is polluted.	1. Wash the needle valve. 2. In case needle valve is worn out or damaged, repair or replace it.
	2. Piston motion is poor or can't move.	1. Wash piston 2. Adjust assembly between the body and the cover.
	3. Spring fatigue or too weak.	Replace spring

	(3) Internal leak in the circuit is serious. 1. internal leak in actuator	1. Repair actuator 2. Replace actuator
	2. Poor motion of direction control valve or check valve.	1. Inspect circuit in order. 2. Repair damaged part or replace.
	3. Packing is damaged	1. Inspect circuit in order. 2. Replace the damaged packing.
	(4) Hydraulic pump is damaged.	The major parts of a hydraulic pump includes: In gear pump: bearings and gear rotor. In vane pump: bearings, blades and side bushing. In piston pump: piston rod, valve plate and spring may be damaged after a long time of use. Replace it if necessary.
	(5) Pin holes existed in the body or oil distribution valve	1. Inspect circuit in order. 2. Repair the pin holes or through holes or replace with a new one.
3. Hydraulic system pressure is unstable. 1. Hydraulic pump has abnormal noise. Or oil become white.	(1) Water mixed with oil that causes oil emulsified, deteriorated resulting in abnormal noise.	1. Inspect oil tank and circuit. Repair the part that is easy to leak. 2. Reduce temperature difference in hydraulic system to prevent water condensation.
	(2) Cooler is damaged or used incorrectly.	1. Inspect cooler 2. Install and use the cooler correctly according to manufacturer's instruction.
	(3) Oil level in the tank lowers to cause air intake.	Fill hydraulic oil.
	(4) Improper mounting of oil return hose.	1. The oil return hose end should be immersed under the oil level. 2. Keep the oil return hose end away from the oil suction hose.
	(5) Actuator suck air due to instant vacuum, caused by load.	When using an actuator, pay attention to the instant load to avoid vacuum.
	(6) Improper oil suction hose diameter or length.	Use a bigger diameter of oil suction hose, and keep flow rate under 1m/sec.
	(7) When a pressure booster pump is used, it is damaged.	Repair or replace pressure booster pump.
	(8) Running speed exceeds rated valve.	Check hydraulic pump running speed. If necessary, use a speed reducer.
	(9) Coupler eccentricity is too much.	Correct alignment.
	(10) Coupler is connected too loose.	1. Pay attention to the matched parts. 2. Prevent loosening on the fixing pin.
2. Pulsation on the pressure gauge of the system.	The pressure pulsation of the hydraulic pump may cause a resonance.	1. If necessary, use an accumulator to eliminate pulsation problem. 2. Fix hoses.

3. Relief valve vibrates	(1) Relief valve is contaminated.	1. Wash the relief valve. 2. Inspect the contamination condition. Replace it if necessary.
	(2) The drain oil from relief valve does not independently flow back to the oil tank.	Connect the drain oil circuit to the return oil tank.
	(3) Air bubbles exist in hydraulic oil.	The air bubbles contained in oil may cause poor motion of the relief valve. Inspect oil tank and check the source of the air bubbles. If necessary, replace oil.
4. Vibration is caused by flow control valve and direction control valve.	Oil flow through valve exceeds the rated amount.	Change port diameter of valve.
4. Abnormal heat growth 1. Too high temperature on the hydraulic valve or actuator.	(1) Internal leak in the hydraulic pump or the actuator caused by too low volumetric efficiency.	Inspect the internal parts fitting clearance and wearing condition in the hydraulic pump or the actuator. If necessary, repair or replace it.
	(2) Hydraulic pump or actuator is damaged, causing abnormal friction.	Inspect the inside of the hydraulic pump or the actuator. If damaged, repair or replace it.
	(3) Dusts or chips existed in hydraulic oil that causes a damage on the hydraulic pump or the actuator.	1. Inspect the contamination degree of hydraulic oil. If necessary, replace it. 2. Inspect the filter. If necessary, wash or replace it.
	(4) Hydraulic oil is deteriorated, causing poor lubrication effect and damage to the hydraulic pump and the actuator.	Inspect hydraulic oil composition. If necessary, replace it.
3. Oil temperature of hydraulic system is too high	(1). Internal leak in the circuit is too much. 1. internal leak in the control valve or the actuator is too much.	1. Inspect each part in the circuit to see the internal leak condition. 2. Repair or replace the damage part.
	2. Oil seal or packing in the circuit is damaged causing abnormal internal leak.	1. Inspect each oil seal and packing in order in the circuit. 2. Replace the damaged oil seal or packing.
	(2) Improper hose diameter	Too small hose diameter and too high flow speed may cause flow friction. Select a proper hose diameter, so that flow speed in the hose can be kept under 3-4 M/sec.
	(3) Oil tank capacity is too small causing insufficient heat dissipation capability.	1. Increase heat dissipation area of the oil tank. 2. Fit with an additional cooler.
	(4) Serious cavitation existed in the hydraulic system.	Try to find the cause of cavitation, and correct it.
	(5) Hydraulic system is designed with too many flow restriction ports.	Check the design of flow restriction ports.

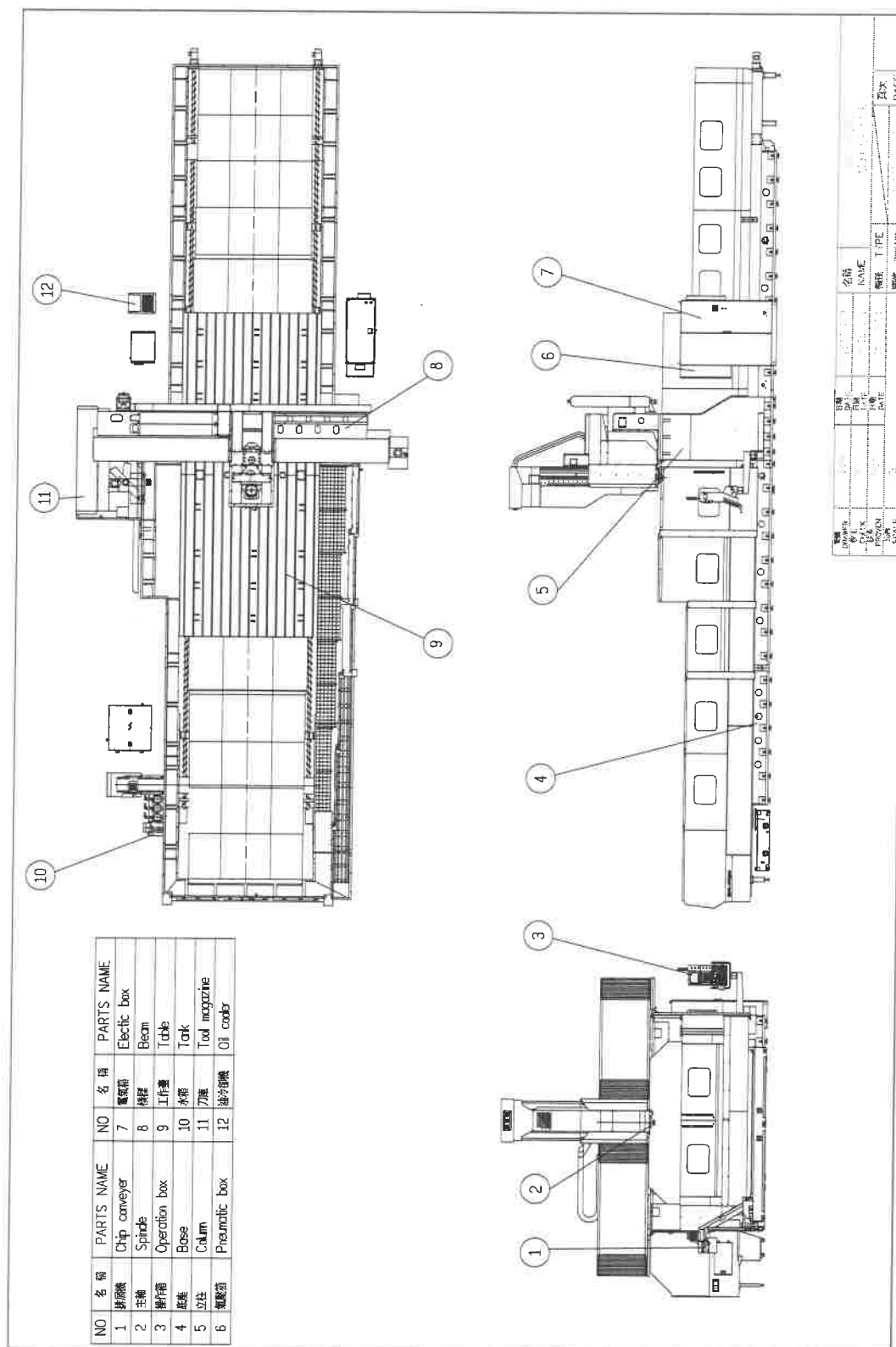
	(6) Improper relief pressure setting causes frequent relief.	Check the setting pressure for the relief valve. Adjust pressure correctly.
3. Bearing temperature growth in hydraulic pump or actuator	(1) When installing, incorrect alignment causes eccentric load.	Inspect alignment of installation and correct it.
	(2) Too much radial load on bearing.	Install another bearing for reducing radial load.
5. External leak of hydraulic oil	(1) Oil seal or packing is damaged.	Check the oil seal and the packing at leaked position, and replace it.
	(2) Improper design of " O " ring slot.	Check " O " ring slot design.
	(3) Pipe thread is damaged or poor connector.	1. Modify pipe thread or use anti-leak tape. 2. Replace poor connector.
	(4) Poor welding at pipe jointing position.	Modify welding.

D. RECOMMENDED FREQUENCY FOR GENERAL CONSUMMABLE PARTS

NO	ITEM	RECOMMENDED REPLACING FREQUENCY	REMARKS
1	Spindle transmission belt	Periodically inspect and replace in 3 years.	Normal service life 70000 hours.
2	3 axes transmission belts.	Periodically inspect and replace in 5 years.	Normal service life 70000 hours.
3	Wiper of slideway	Periodically inspect and replace in 5 years.	Normal service life 10 years.
4	Roll cover	Inspect and replace according to actual damaged condition.	

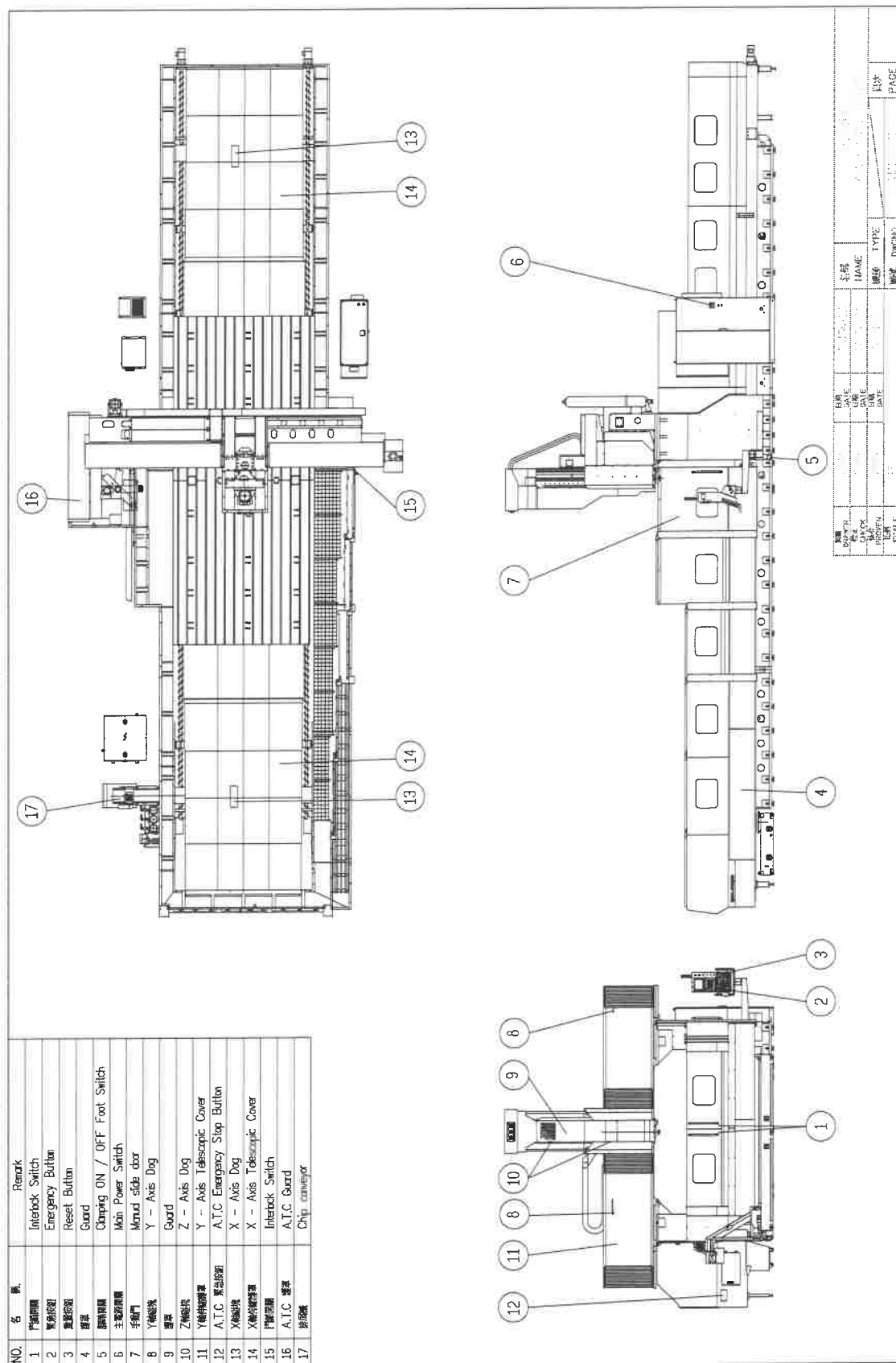
E. RELATED DRAWING

1. MAJOR PARTS DRAWING



Architectural drawings of a building facade and interior. The top drawing is a cross-section of a building facade showing structural elements, windows, and a staircase. Dimensions of 1000 and 2000 are indicated. The bottom drawing is a plan view of a building interior showing a staircase, a person standing, and dimensions of 1000 and 225.

3. SAFETY PARTS DIAGRAM



4. WARNING LABEL POSITIONS

NO	舊學校	新學校	校名
1	NP0700277B	NP07000610A	NP07000139C
2	NP0700295B	NP0700242B	NP0700100C
3	NP0700286B	NP07000612B	NP0700140C
4	NP0700137B	NP0700137B	NP0700121B
5	NP0700275A	NP07000856A	NP0700012B
6	NP0700253B	NP07000243B	NP07000121C
7	NP0700107A	NP0700107A	NP0700107A
8	NP0700105A	NP0700105A	NP0700105A
9	NP0700614A	NP07000617A	NP0700115B
10	NP0700257B	NP0700241B	NP0700181C
11	NP0700275B	NP0700020A	NP0700119C
12	NP0700283B	NP07000811A	NP0700113C
13	NP0700234B	NP07000607A	NP0700126B
14	NP0700205B	NP07000237B	NP0700027B
15	NP0700623B	NP07000623B	NP0700623B
16	NP0700281B	NP07000343B	NP0700116C
17	NP0700282B	NP0700142B	NP0700114C
18	NP0700284B	NP07000813A	NP07001014C
19	NP0700279B	NP07000602A	NP0700112B
20	NP0700284B	NP07000612A	NP0700118C
21	NP0700105A	NP0700105A	NP07001012C
22	NP0700280B	NP07000604A	NP0700106A
23	NP0700138B	NP0700030A	NP0700177C
24	NP0700207B	NP0700138B	NP0700136B
		NP07000606A	NP07000122C

