

Instruction Manual

HM 1000

2025-11-01 01:34:55/ELLTECHCA/24.17.247.208

MH0013INE258





2025-11-01 01:34:55/ELLTECHCA/24.17.247.208

INTRODUCTION

Thank you for choosing our machine tool. We are pleased to have you as our customer.

This manual briefly describes the setup and operation of the machine. In order for the machine to maintain its best operating condition for a long period of time, the machine itself must be installed properly, and the operation and maintenance procedures must be clearly understood and carefully followed.

Our company has tried to be exact in all information contained in this manual. The description, however, may differ from the time the machine was delivered to you due to improvement in the quality and performance implemented at the time of shipping. Should you have any question or need any further information, please contact a nearby Technical/Service Center of our company.



BASIC INFORMATION

1. LIST OF MANUALS

The following manuals are provided to our customers basically.

No.	Part name	Description	Remarks
1	Safety Guidance	Safety Information and Precautions	
2	Instruction Manual	Machine Installation, Operation and Maintenance	
3	Parts Book	Parts List	
4	Operation Manual	Machine Operation and Troubleshooting	
5	NC Manual	Operation, Maintenance, and Parameters Manual	Provided by NC Maker
6	Electrical Circuit Diagram	Electrical Circuit Diagram Required for Machine Installation and Maintenance	

2. NUMBERING

Type	Description
Part 1	Chapter
1.	First Category
1.1	Second Category
(1)	Third Category
1)	

3. MANUFACTURER'S INFORMATION

Type	Description
Manufacturer	DN Solutions Co.,Ltd.
Address	40, jeongdong-ro 162beon-gil, Seongsan-gu, Changwon-si, Gyeongnam, Korea,51537
Telephone No.	82 55 280 4114
Website	https://www.dn-solutions.com

※ Please refer to the website for more information about service center and products.

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Part 1 SAFETY PRECAUTIONS

1. CLASSIFICATION OF SAFETY INFORMATION

Safety information is classified into danger, warning, caution(relating to safety) and notice (relating to property losses) in this manual as follows:



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



Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.



Indicates information considered important, but not hazard-related.
(e.g. messages relating to property losses)

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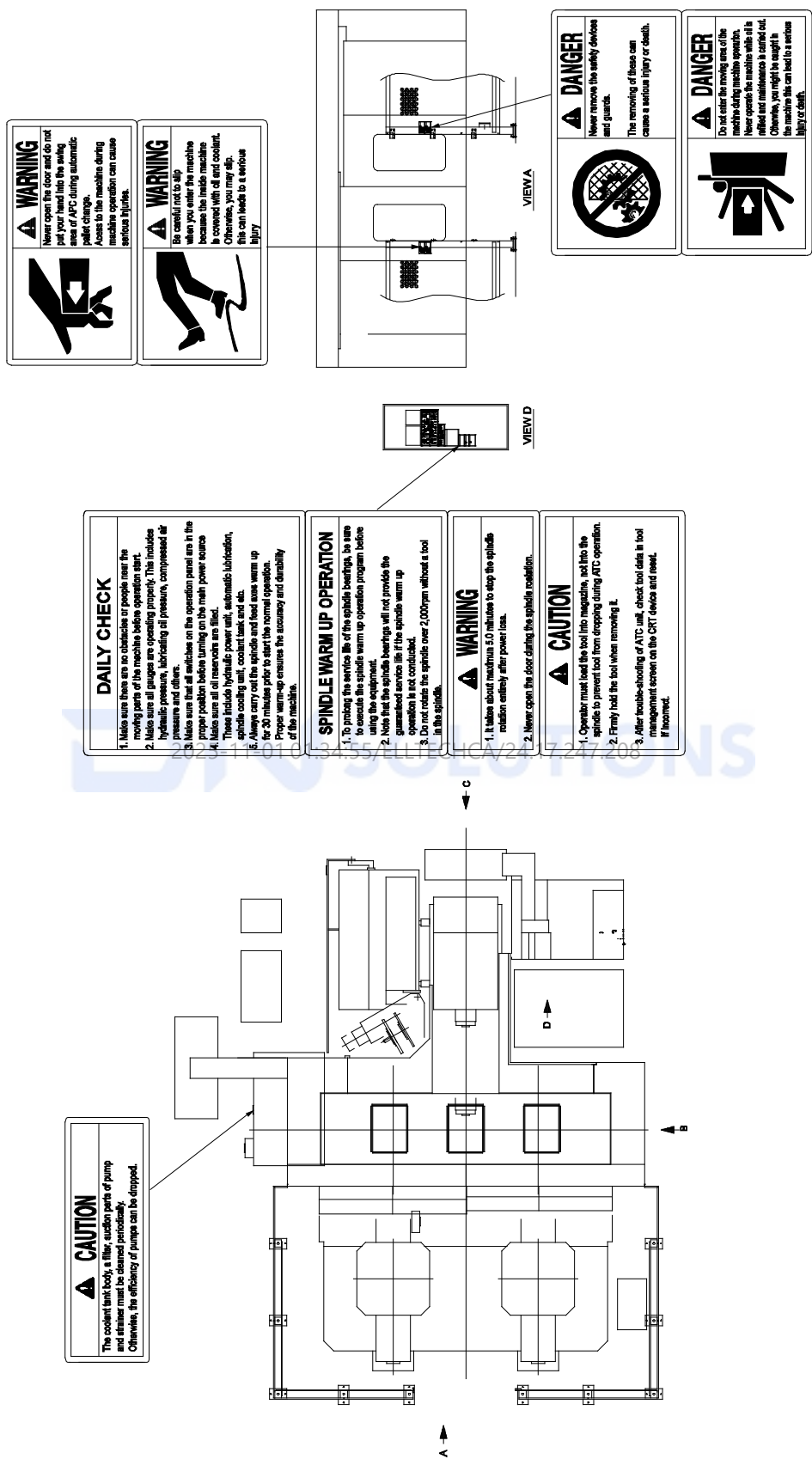
2. WARNING PLATES



- ✓ Warning plates are installed in the machine to protect the operator and machine from danger. Do not remove warning plates. If warning plates are damaged thus unreadable or lost, please contact us to purchase them to install them.
For warning plate types and installation positions, refer to the handling manual.

2.1 Warning sign placement

Warning signs are attached to the machine to require all machine operators to observe them.



⚠ DANGER

Never touch cutting tools while it is rotating.
Also do not operate the machine unless doors are closed and interlocks are working. Otherwise, cutting tools can cause serious injury or death.

⚠ DANGER

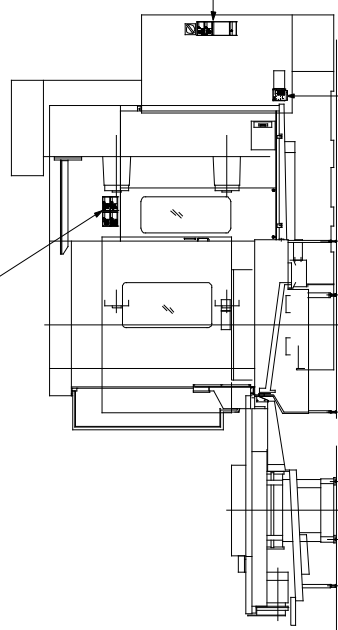
Never operate the machine unless safety doors are closed or interlocks are working. Otherwise, you can meet an accident including serious injury or death.

⚠ DANGER

Do not enter the working area of the machine during machine operation. Never operate the machine with oil is refilled and maintenance is carried out. Otherwise, you might be caught in the machine. This can lead to a serious injury or death.

⚠ WARNING

Be careful not to slip when you enter the machine because the inside machine is covered with oil and coolant. Otherwise, you may slip. This can lead to a serious injury.



VIEW B

DN SOLUTIONS		MACHINING CENTER	
MODEL	_____	DATE	_____
SERIAL NO.	_____	DATE	_____
POWER SOURCE	_____	DATE	_____
MAX. CAPACITY	_____	DATE	_____
MAX. TORQUE	_____	DATE	_____
MAX. CURRENT	_____	DATE	_____
SHORT CIRCUIT CAPACITY	_____	DATE	_____
ELECTRIC DRAWING EDITION	_____	DATE	_____
NET WEIGHT	_____	DATE	_____
DATE OF MANUFACTURE	_____	DATE	_____

DN SOLUTIONS

⚠ DANGER

Switching by qualified personnel for the electric shock can be resolved in the enclosure.
The electric shock can cause a serious injury or death.

⚠ DANGER

Because a high voltage is applied to the motor, cut off the power supply and then open the door. Otherwise, you may receive an electric shock. This can lead to a serious injury or death.

SAFETY PRECAUTION

- Operator must read all a manual (operation, instruction, safety) carefully and understand the contents of them.
- Do not remove the safety cover, safety switch and other safety devices.
- Stop of the main power switch before entering the moving mechanism.
- Electric equipment must be handled by a trained personnel. Never touch the components of a trained personnel. Never touch the components of them with the main power switch is on.
- Never touch a switch, button, key with wet hands.
- Never attempt to change the setting of CNC parameters. Keep safety without consulting with POSAM infocenter.
- Keep the area near the machine clean. Wipe up spill oil or coolant immediately to avoid slippery hazards.
- Never touch the cutting edge of any tools or any of waste chips with your hands.
- Always select the proper cutting conditions.
- Never operate the machine over the rated capacity for table load, work piece size, tool dimension, spindle motor power, axes motor power.

⚠ DANGER

This machine weight is 27,000kg.
You must refer to the instruction manual when the machine is lifted or transferred for safety. Otherwise, you can meet an accident including serious injury or death.
(Note) Machine total weight can be changed when special specifications or options are included.

⚠ CAUTION

Be careful not to slip when you enter the machine because the inside machine is covered with oil and coolant. Otherwise, you may slip. This can lead to a serious injury.

⚠ WARNING

Never access to the machine without any approval. Access to the machine by unauthorized personnel can cause serious injuries.

⚠ DANGER

Do not enter the working area of the machine during machine operation. Never operate the machine with oil is refilled and maintenance is carried out. Otherwise, you might be caught in the machine. This can lead to a serious injury or death.

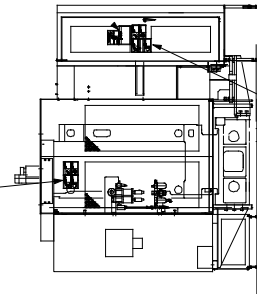
⚠ DANGER

Never remove the safety devices and guards. The removing of these can cause a serious injury or death.

TOOL LOADING

⚠ CAUTION

- Operator must load the tool into magazine, not into the spindle to prevent tool from dropping during ATC operation.
- Firmly hold the tool when removing it.
- After finish-loading of ATC unit, check tool data in tool management screen on the CRT device and reset. If incorrect.



VIEW C

⚠ CAUTION

Be careful not to slip when you enter the machine because the inside machine is covered with oil and coolant. Otherwise, you may slip. This can lead to a serious injury.

⚠ WARNING

Never access to the machine without any approval. Access to the machine by unauthorized personnel can cause serious injuries.

⚠ DANGER

Never open this door while the magazine is rotating. Access to the magazine during rotation can cause serious injuries.

⚠ DANGER

Never remove the safety devices and guards. The removing of these can cause a serious injury or death.

⚠ DANGER

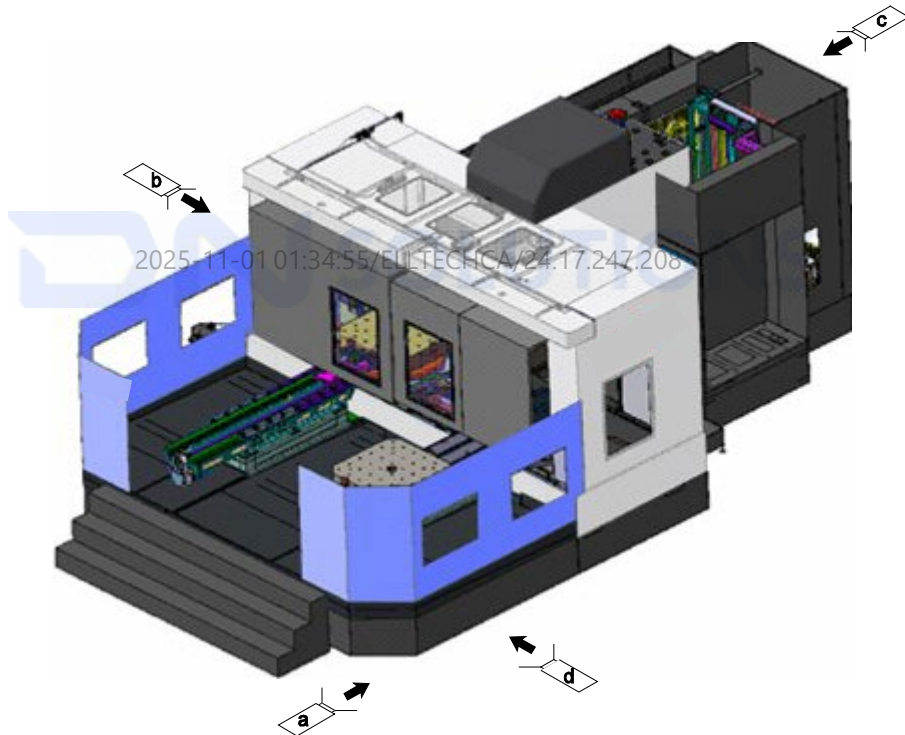
Do not enter the working area of the machine during machine operation. Never operate the machine with oil is refilled and maintenance is carried out. Otherwise, you might be caught in the machine. This can lead to a serious injury or death.

3. MACHINE NOISE EMISSION

- (1) The machine was checked for noise level based on actual norms.
- (2) Noise level during normal work condition is not over 80 dB.
- (3) Particular care must be taken when air gun is used, the air gun can generate high noise level peak so ear protectors and safety glasses must be used.
- (4) In case of not normal machine noise, it is highly recommended to call immediately the authorized technical service company.
- (5) Values of areal noise produced by the machine, according to section 1.7.4.2 (u) ANNEX 1 of 2006/42/EC DIRECTIVE.

Measuring method: ISO 11202

- The measuring positions is four, as shown on drawing and is taken at 1.55 m from the floor and at 1 m from the machine.
- The machine is completely close with covers.
- Spindle rotation at maximum speed(not cutting).



Machine Noise Data

Measurement point		a	b	c	d
The A-weighted emission sound pressure level at workstations, where this exceeds 70 dB(A); where this level does not exceed 70 dB(A). (LPA)	dB(A)	65	71	76	70
The peak C-weighted instantaneous sound pressure value at workstations, where this exceeds 63 Pa (130 dB in relation to 20 µPa). (LPC, PEAK)	dB(C)	<130	<130	<130	<130
The A-weighted sound power level emitted by the machinery, where the A-weighted emission sound pressure level at workstations exceeds 80 dB(A). (LWA)Number of () indicates uncertainty level.	dB(A)				



NOTICE

- ✓ The noise values indicated are emission levels and they don't represent absolute safe level
- ✓ The relation that exists between exposition and emission level can't be reliably used to prove that a specific protection must be used.
- ✓ The operator exposition level must consider the time of exposition, the acoustic behavior of the room and finally the presence of other noise source.
(ex. Other machines near the operator)
- ✓ The exposition level can be different for different country.
- ✓ This information is useful primary for a proper evaluation of risk and danger to which the operator is exposed.

Part 2 MACHINE GENERAL SPECIFICATION

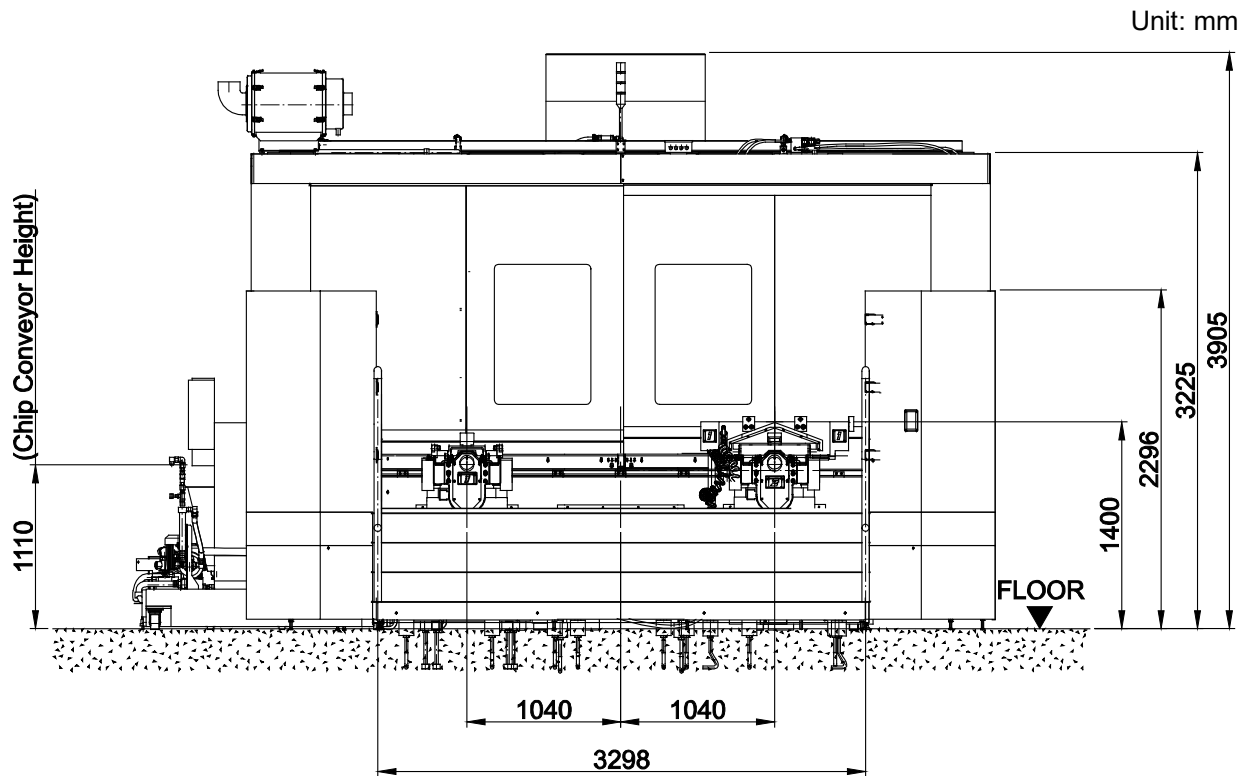
In this section, the brief data for understanding machine totally is provided with illustrations.



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1. LAYOUT DRAWINGS

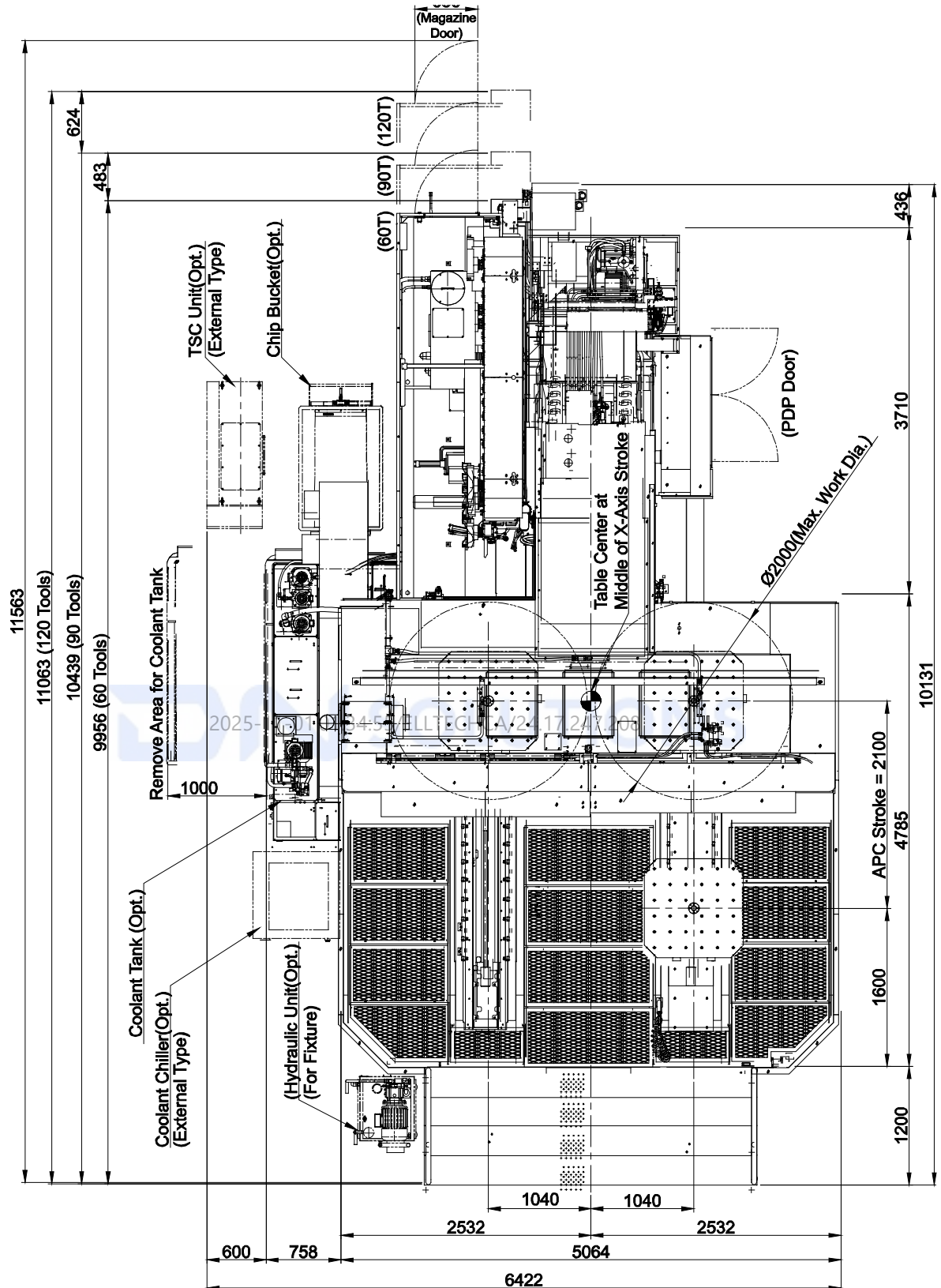
1.1 Front view



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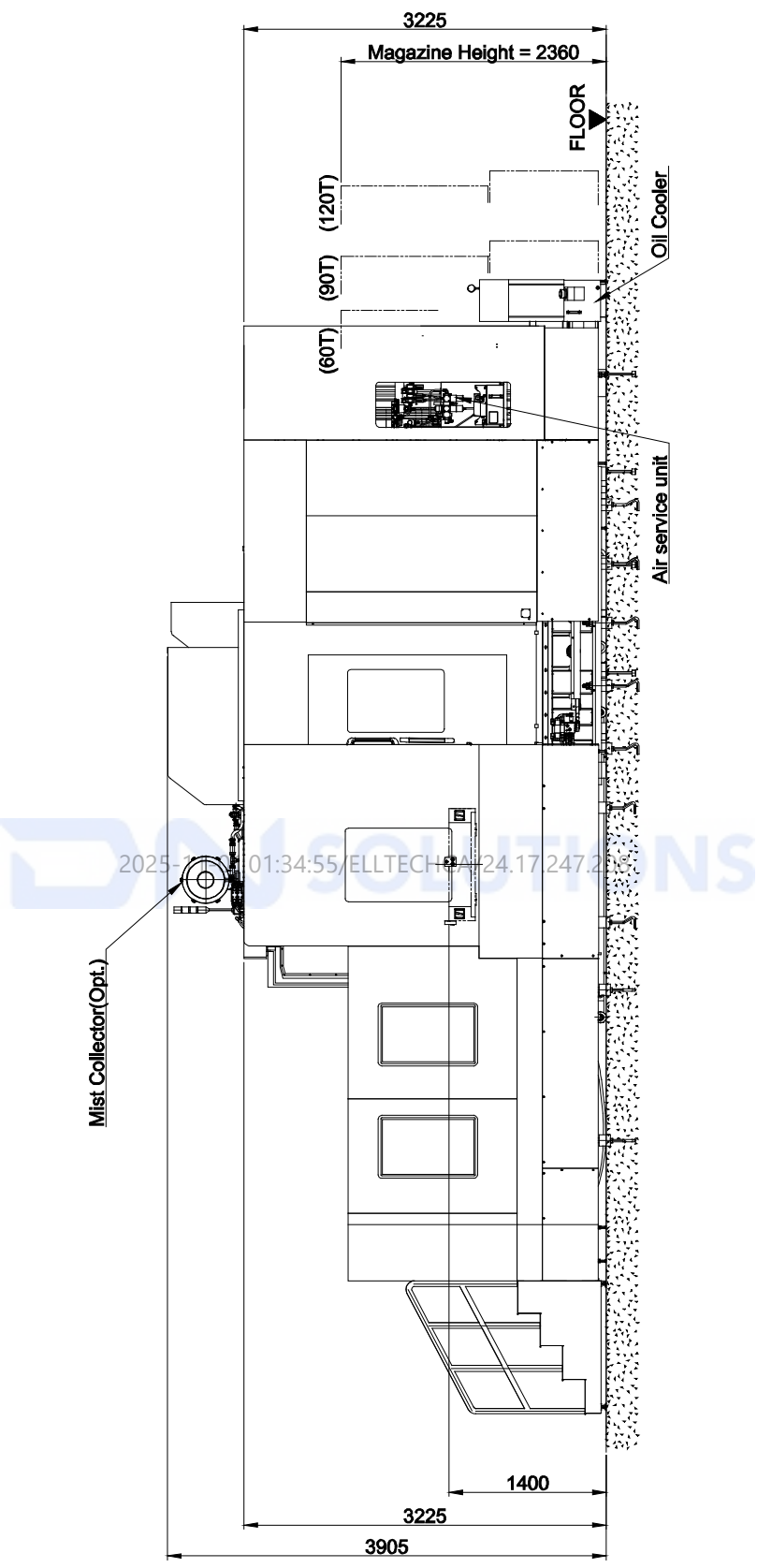
1.2 Top view

Unit: mm



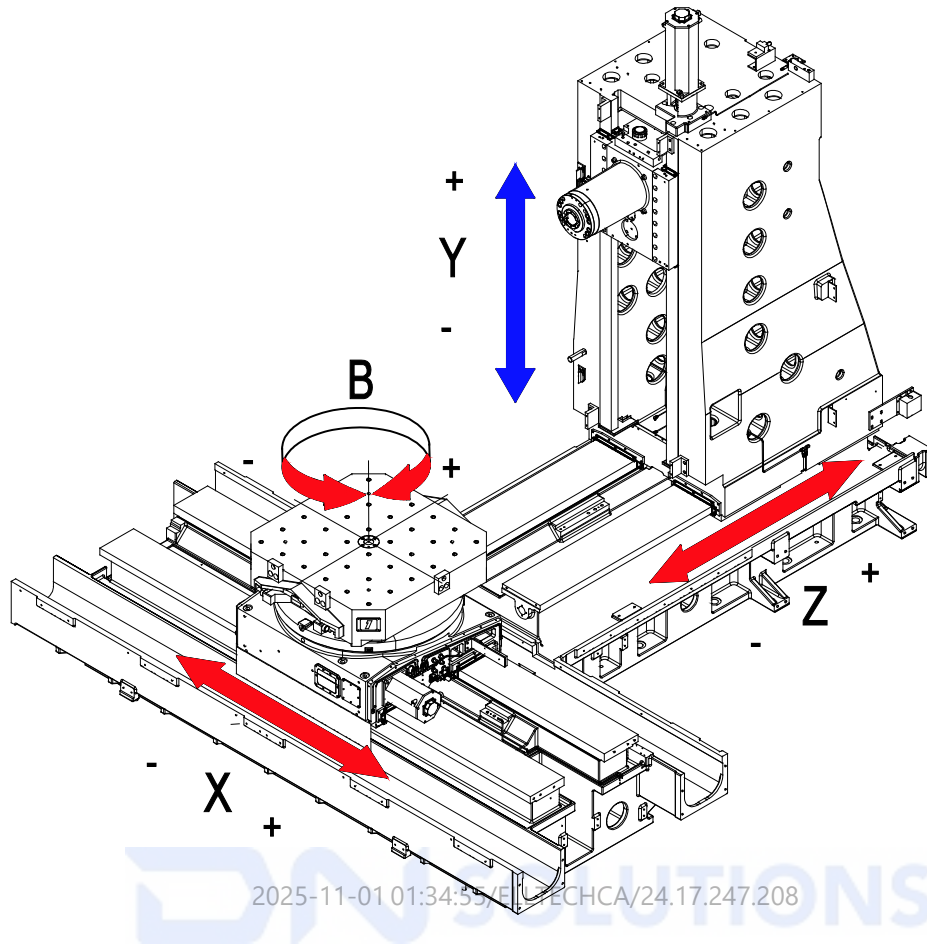
1.3 Side view

Unit: mm



2. COORDINATE SYSTEM & MACHINE REFERENCE POINT

2.1 Coordinate system



X-axis: Table cross

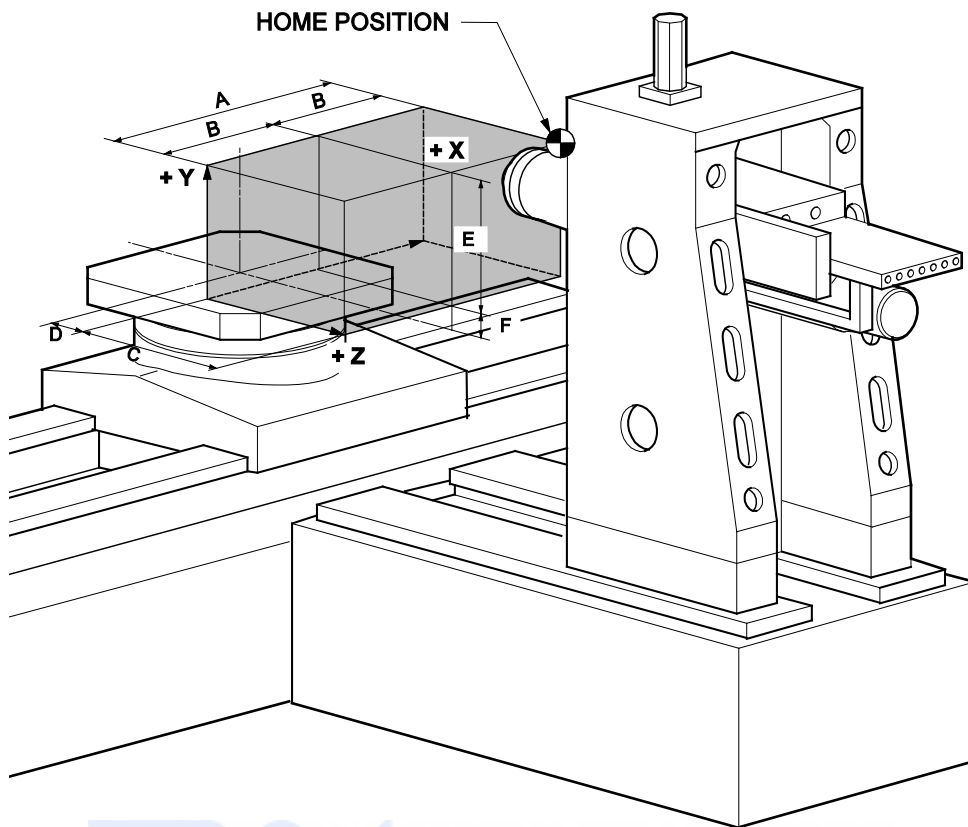
Y-axis: Spindle head vertical

Z-axis: Column longitudinal

B-axis: Table rotation

2.2 Machine reference point

Unit: mm (inch)



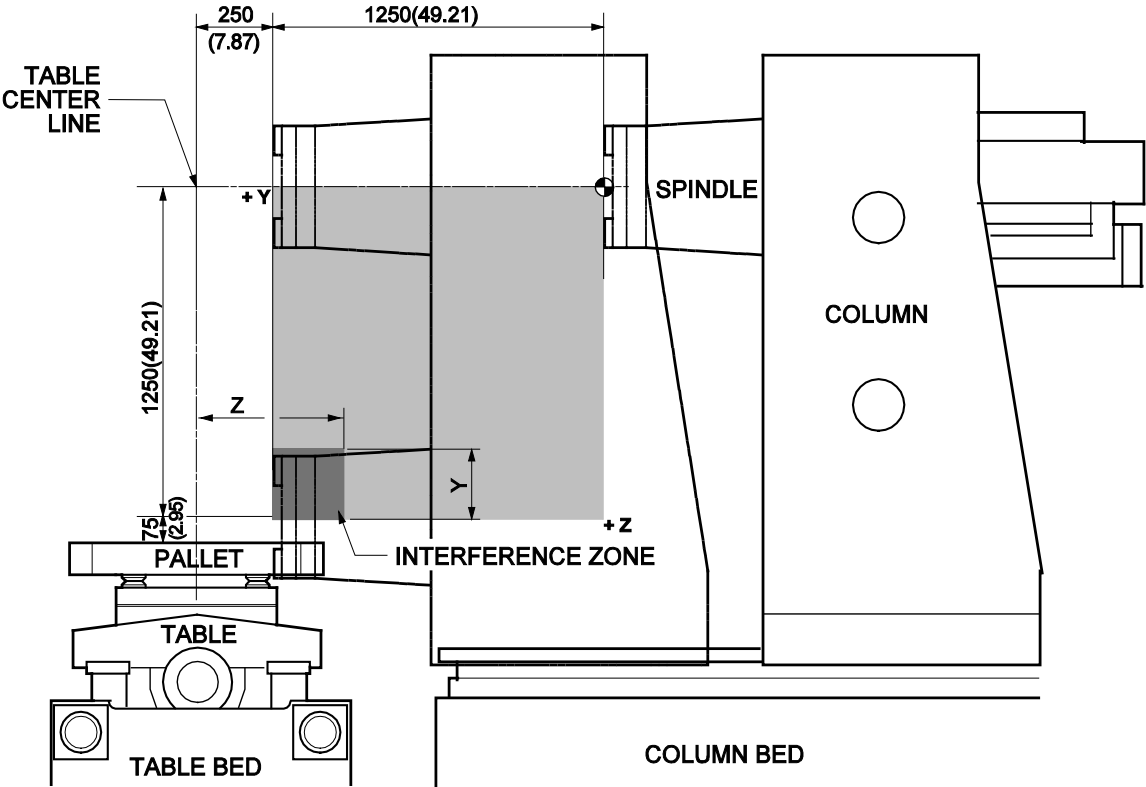
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Axis	HM 1000
A	2100(82.68)
B	1050(41.34)
C	1250(49.21)
D	250(9.84)
E	1250(49.21)
F	75(2.95)

※ When the HM1250 pallet Size are <1250x1000>, <1000x1000>, E = 1500 and F = 75

2.3 Interference zone

Unit: mm (inch)



Available Pallet Size	1000 x 1000	1250 x 1000
Y	100(3.94)	100(3.94)
Z	380(14.96)	410(16.14)



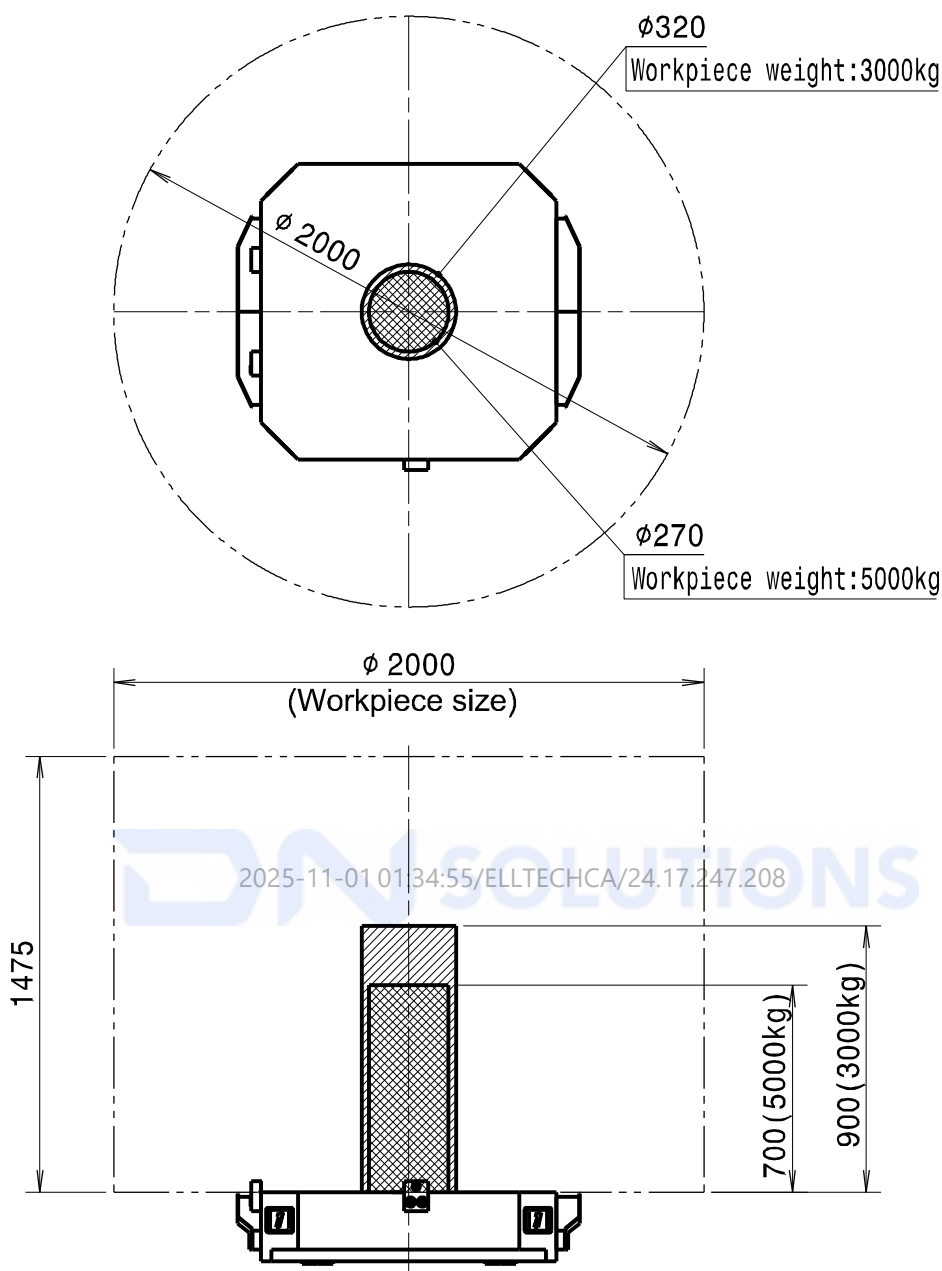
- ✓ The previous interference zone is determined by soft-limit in order to make the spindle head not to get into the area and is effective only in the following preconditions.
 - 1) Precondition
 - This area is interference area between table and spindle head
 - When the index angle of table is 0°, 90°, 180° and 270°
 - When the spindle has no forward travel
 - 2) The soft limit values is set in NC parameter N1322, N1323.
- ✓ Please execute the operation of table rotation after ensuring the following cases.
 - 1) Isn't the rotating body interfered with column?
 - 2) Isn't the rotating body interfered with spindle head?
 - 3) Isn't the rotating body interfered with spindle?
 - 4) Isn't the rotating body interfered with the loaded tool?
- ✓ When a workpiece or fixtures are loaded on the table, it is impossible to eliminate all the possibilities in soft methods on account of complexity of interference zone.
Therefore, it is an operator or programmer that can avoid a collision.
- ✓ When the work must be done in the interference veritably, please check the interfering possibility sufficiently.



2.4 The allowable load of the table

The center of gravity of the workpiece must be in the hatched area as shown in the figure.

Unit: mm



3. MACHINE WEIGHT

Model	Unit	Machine weight
HM 1000	kg	29 000



NOTICE

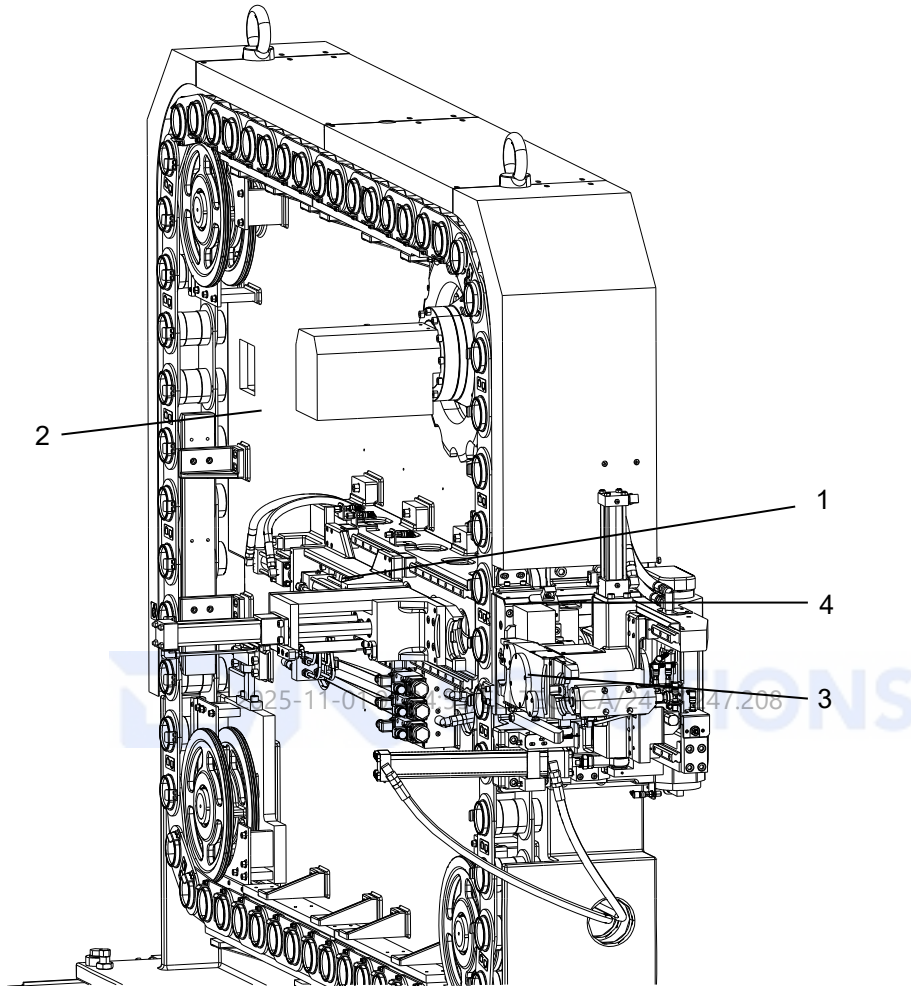
- ✓ Specified weight is based on the machine with standard specification.

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Part 3 EACH UNIT SPECIFICATION

1. ATC(AUTOMATIC TOOL CHANGER)

ATC exchanges both tools in magazine and spindle head. ATC changer is attached to the right side of tool magazine and tool magazine is attached to the left side of machine. Sol. valves for a tool magazine control are attached to the left side of magazine frame.



Symbol	Description	Function
1	Changer	- Execution of tool exchange
2	Tool Magazine	- Tool storing lot - Automatic selection for tool exchange
3	MAG. Sub Changer	- To move the tool from magazine to waiting pot
4	Waiting Pot Moving Device	- Moving the tool to the change position

1.1 Main specifications

Item	Unit	Specification								
Tool Shank		MAS403 BT50			CAT50			DIN69871-A50		
Pull Stud		MAS 403 P50T-1(45°)			MODIFIED CAT			DIN 69872#50		
		ISO 12164-1HSK-A100								
Tool Storage Capacity	EA	60	90	120	60	90	120	60	90	120
		196	256	316	196	256	316	196	256	316
Tool Select Type		Fixed address random								
Max. Tool Diameter	mm (inch)	130(5.1) ^{*1} / 300(11.8) ^{*2}								
Max. Tool Length	mm (inch)	650								
Max. Tool Weight	kg(lb)	30								
Max. Tool Moment	N·m (lbf·inch)	34.3								
T-T-T Time*3	s	10 ^{*4}								
C-T-C Time*5	s	15								
Tool Change Position		· X, B-axis: arbitrary position · Y, Z-axis: return to the 1st reference point								



CAUTION

- ✓ Possible to set when adjacent pots empty.
- ✓ Possible to set when adjacent pots are empty

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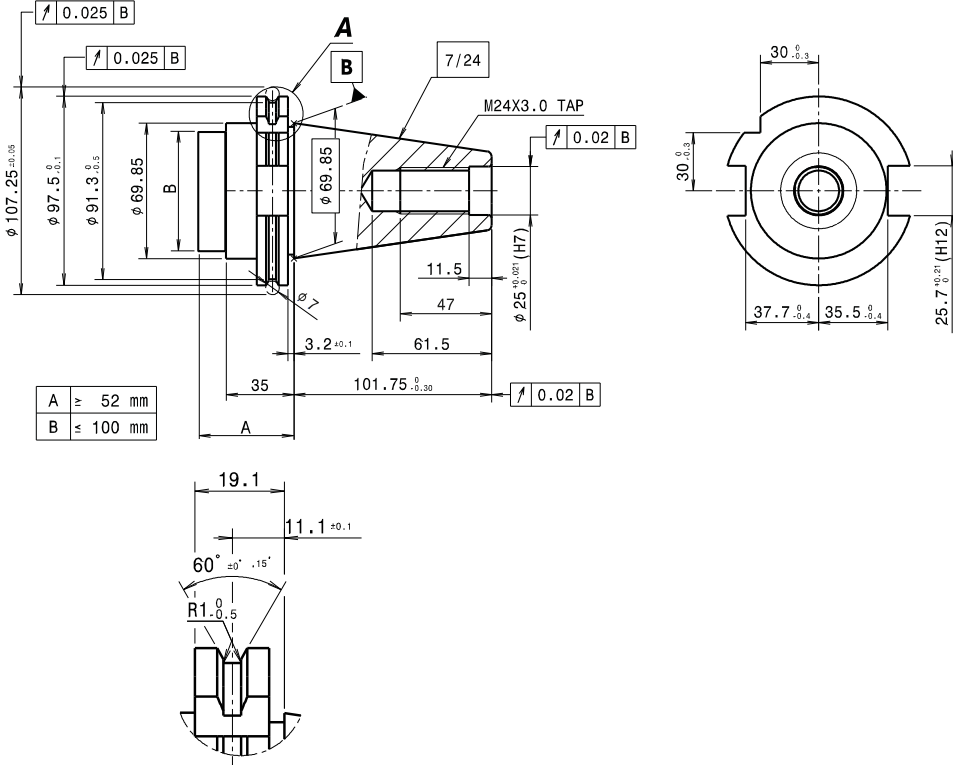
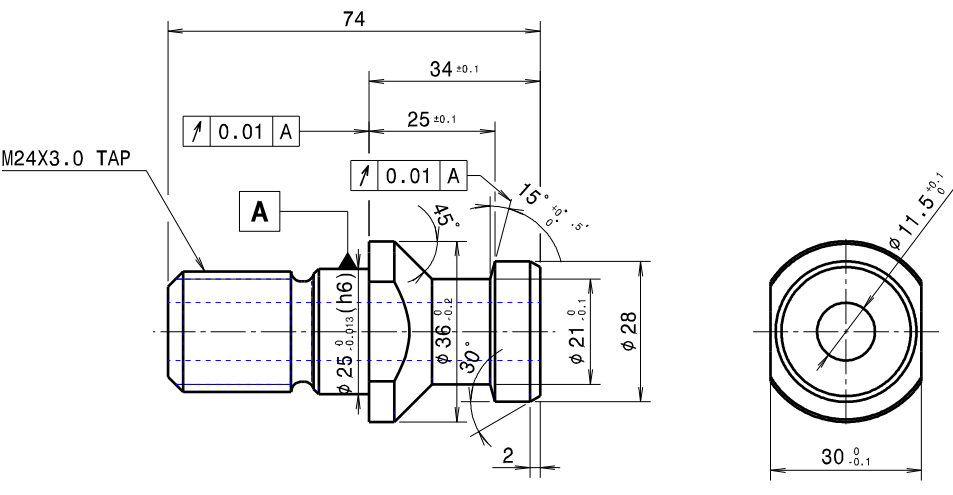
NOTICE

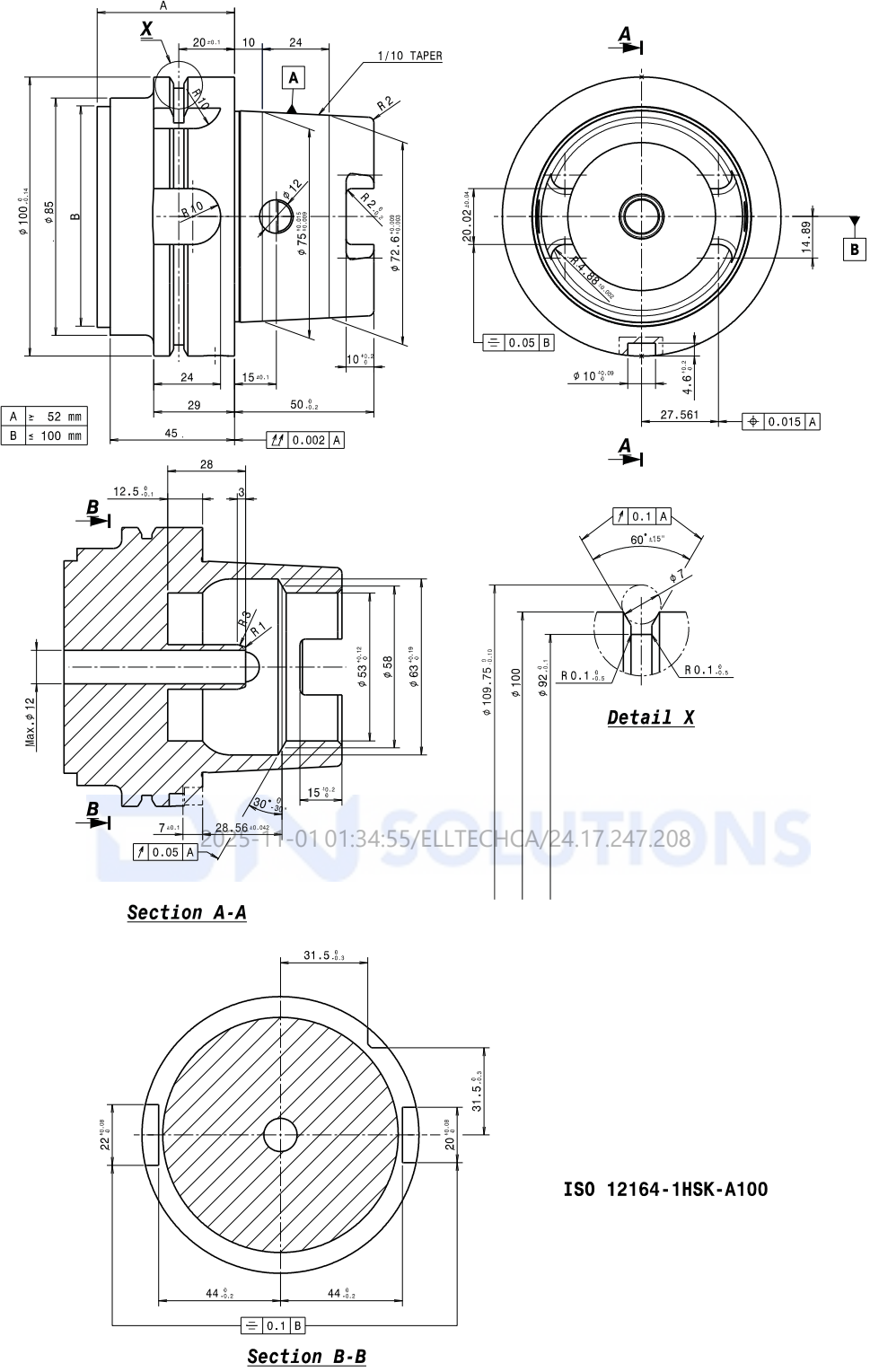
- ✓ 1 cycle time of tool changer
- ✓ It is a measured operating time of each step and each time on the specification has 10% allowance.
- ✓ Time referring to factory standard

1.2 Tool specification

Unit: mm

Type	Tool Specification	Remark
BT	MAS403 BT50	BT STD.
	Tool shank	
	MAS403P50T-I(45°)	
	Pull stud	

Type	Tool Specification	Remark
DIN	 Detail A DIN69871-A50 2025-11-01 01:34:55/ELLTECHCA/24.17.247.208	DIN STD.
	Tool shank  DIN69872#50 Pull stud	

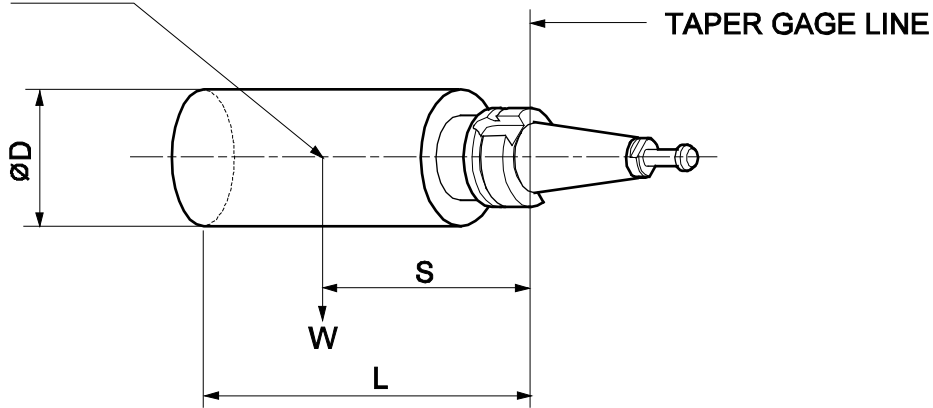
Type	Tool Specification	Remark
HSK	 Section A-A Section B-B Detail X ISO 12164-1 HSK-A100 Tool shank	HSK STD.



- ✓ You should use only tool shanks and pull studs that comply with the specified standard.
[Preventing machine damage]
- ✓ The dimensions given in the table are for reference only. Do not manufacture tool shanks and pull studs according to the table. Our company is not liable for any losses and problems arising from the use of tool shanks and pull studs manufactured in this way.

1.3 Available tool

WEIGHT
CENTER

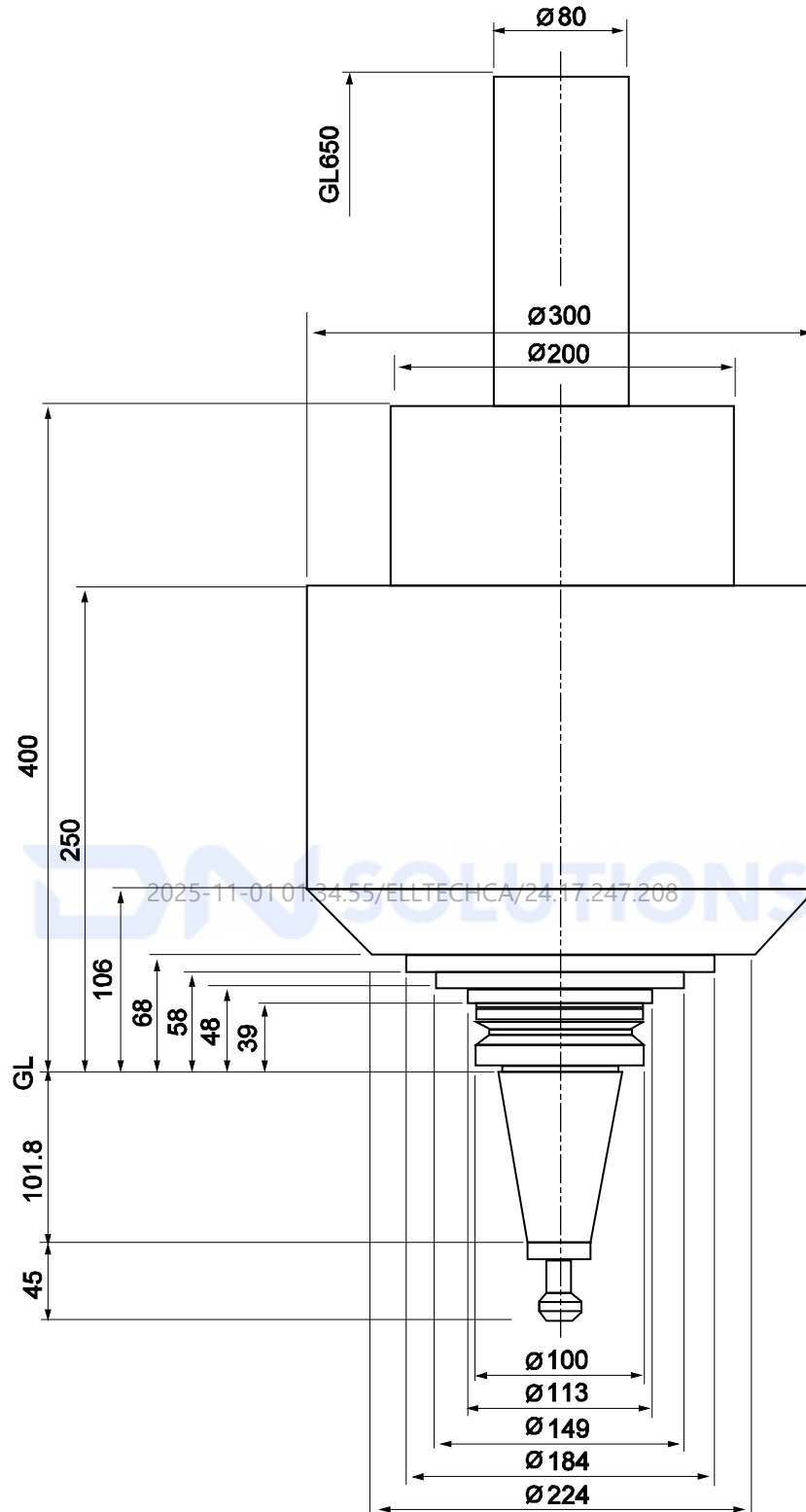


Item	Symbol	Unit	Max.	Remark
Tool length	L	mm	650	
Tool diameter	D	mm	130	Possible to set continuously
			300	Possible to set when adjacent pots empty
Tool weight	W	kg	30	
Moment of tool	$W \cdot S$	N m	34.3	

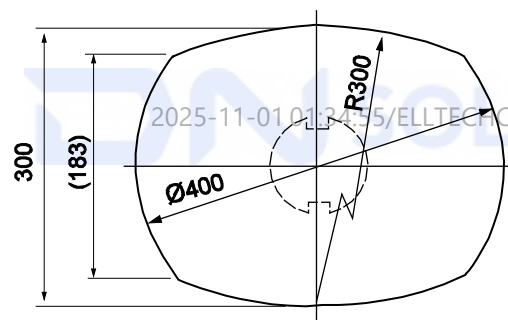
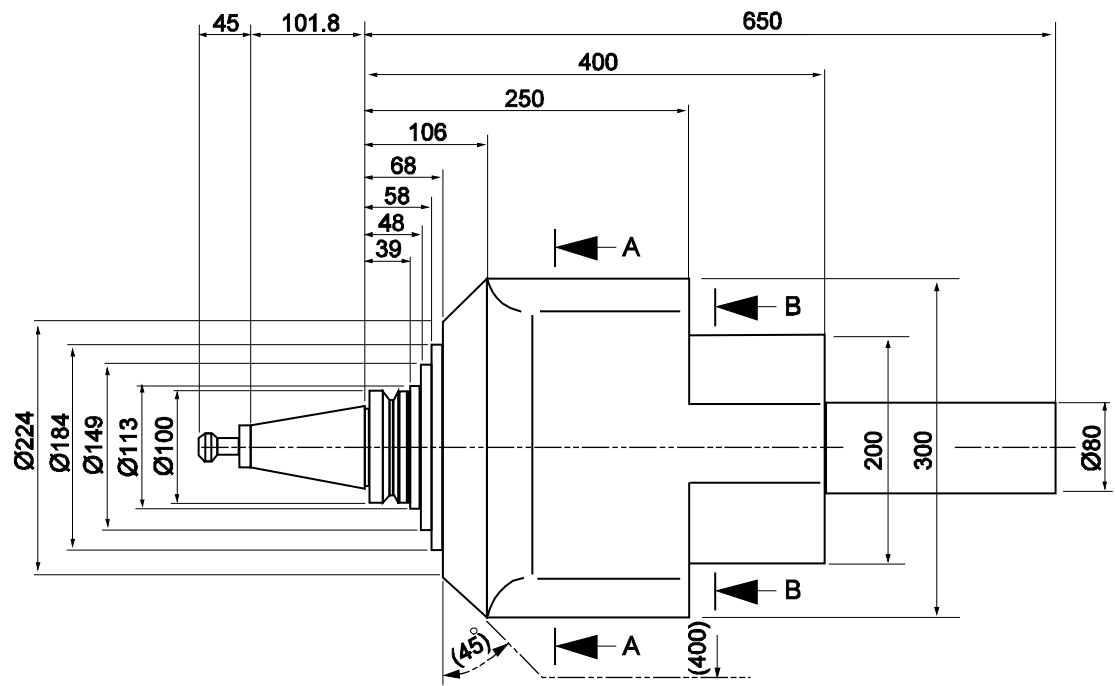


- ✓ Non-circular tool larger than 300mm in diameter may be used depending on the tool shapes. Therefore, the usage of non-circular tool must be confirmed by DHI R&D or service center.

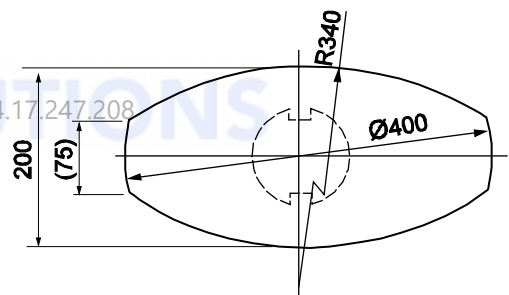
(1) MAXIMUM TOOL



(2) MAXIMUM TOOL



SECTION A-A



SECTION B-B

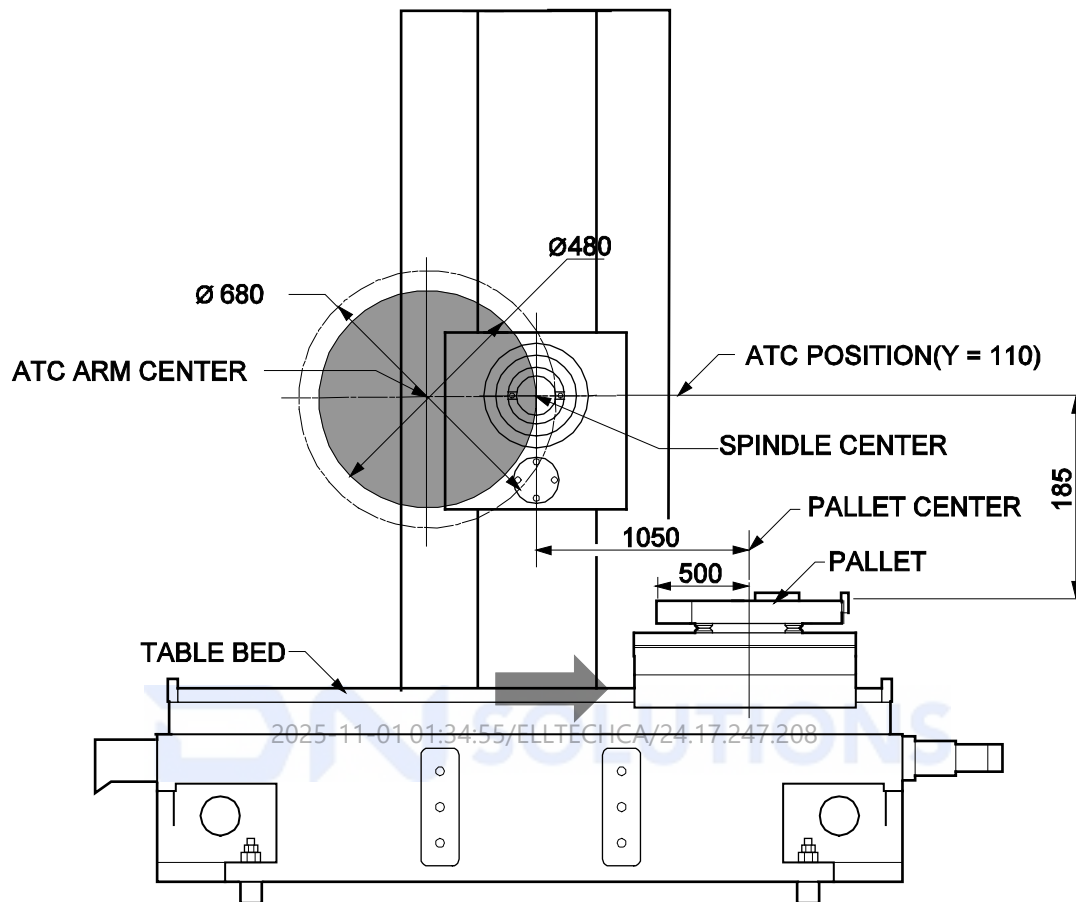
1.4 Changer arm swing area

Any large workpiece may collide with tools in ATC operation.

So check the interference between workpiece and tool before tool change.

The following figure shows the swing of a tool of 200mm diameter at X=2100.0(travel limit) position.

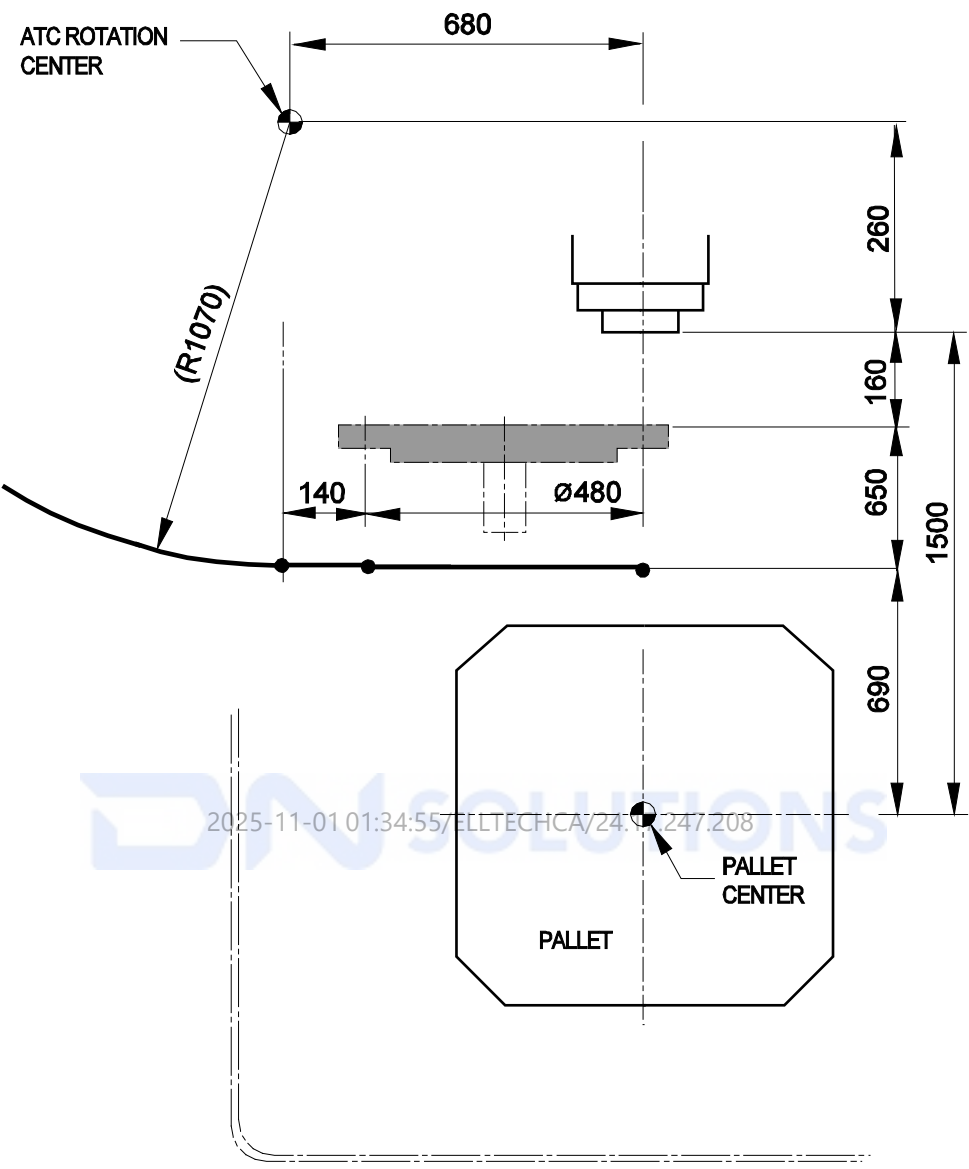
Unit: mm



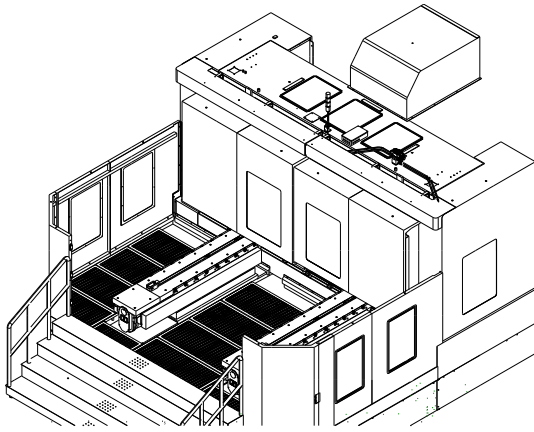
1.5 Interference in ATC operation

The following figure shows the path of 650mm length tool in ATC operation.

Unit: mm



2. APC(AUTOMATIC PALLET CHANGER)



APC is attached to the front of machine, and make it possible to load/unload workpiece and to change pallet fast. Solenoid valves for APC operation control are attached the right side of APC base.

Symbol	Description	Function
1	Change	- Execution of pallet change - Changer up/down and rotation by hyd. actuators
2	APC Base	- Changer support
3	Stopper	- Confirm the pallet change position
4	APC Door	- Safety door - Protect from chip/coolant
5	Cover	- Chip and coolant disposal

2.1 Main specifications

Item	Unit	Specification
Number Of Pallet	EA	2
Type		Parallel
Pallet Change Time*1	s	75(82)
Max. Workpiece Weight	kg	3000(5000)
Max. Workpiece Size	mm	Ø2000 X 1475h
APC Pallet Change Position*2		X axis : Return to 2nd reference point B axis : Return to 1st reference point

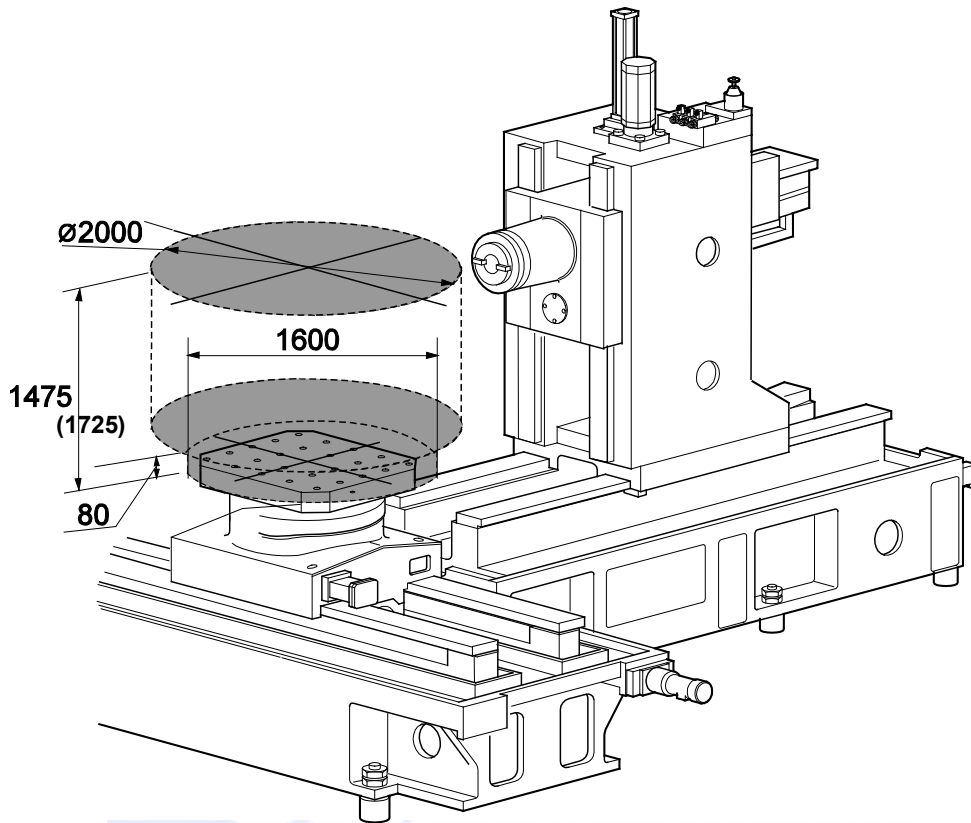


NOTICE

- ✓ APC time on the specification have 10% allowance.
- ✓ Before pallet change operation, Y and Z coordinates should be moved to tool change position

2.2 Max. workpiece

The size of workpiece is restricted by splash guard and APC operation. The following figure shows the maximum size of workpiece in APC.



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Max. height of workpiece: 1475mm from pallet top.(HM1000)



NOTICE

- ✓ When the automatic tool length measurement system is installed, the maximum size of workpiece is restricted.

3. AXIS SYSTEM

Axis system consists of bodies for axis and ball-screw/servo motor to move then. And in X, Y and Z axis, box type guide ways are adopted for high accuracy and maximum rigidity.

3.1 Main specifications

(1) Specifications

Item	Axis	Unit	Specification (HM1000)		
Stroke	X Axis	mm	2100		
	Y Axis	mm	1250		
	Z Axis	mm	1250		
Rapid Traverse	X Axis	m/min	24		
	Y Axis	m/min	24		
	Z Axis	m/min	24		
Acceleration / Deceleration time	X Axis	mesc	200		
	Y Axis	mesc	200		
	Z Axis	mesc	200		
Rated thrust force at stall	Z Axis	kN	19.9		
Cutting Feedrate		mm/min	1 ~ 12,000		
Ball screw		mm	Ø50 x P12		
Positioning accuracy / Repeatability		mm	±0.021 / ±0.01		
		mm	±0.016 / ±0.009		
		mm	±0.016 / ±0.009		
Feedback System*2		mm	X, Y, Z, B Axis: Absolute		
Spd. Nose To Table Center		mm(inch)	250 ~ 1500 (9.84~59.06)	285~1750(11.22~68.9)	
Spd. Center To Pallet Top		mm(inch)	75 ~ 1325 (2.95~52.17)	50~1550(2~61.02): Std.<1250x1250>	75~1535(3~60.43): Opt.<1250x1000> <1000x1000>



NOTICE

- ✓ This value is based on FANUC servo motor refer to 25. Servo motor
- ✓ In case of FANUC 16MC and export to the United States of America, absolute pulse coder is standard (all axis).

3.2 Servo motor specifications.

Item		Unit	Specification
NC System			FANUC
X Axis		kW/N m	6.0/38 (9.0/53)
Y Axis		kW/N m	6.0/38 (6.0/70)
Z Axis		kW/N m	6.0/38 (9.0/53)
B Axis	Index	kW/N m	4.0/22 (6.0/38)
	Rotary	kW/N m	6.0/38 (6.0/38)



3.3 Equipments

The following equipments are referred to machine series production, special production can have different characteristics.

(1) Standard Equipments

The machine is provided with:

- Instruction Manual
- CE declaration of conformity
- Coolant supply equipment
- Full enclosure chip and coolant shield
- Hydraulic power unit
- Leveling bolts & plates
- Lubrication equipment
- Signal tower
- Tool box

and, for safety, also provided with:

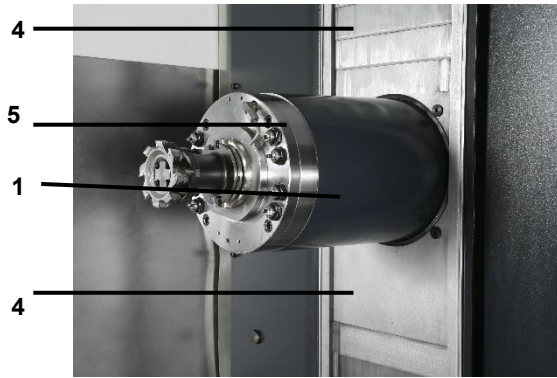
- Door interlock switch
- Electrical torque limiter clutches
- Splash guard with transparent panel
- Symbolic operation panel
- Various safety precautions name plates

(2) Optional Equipments

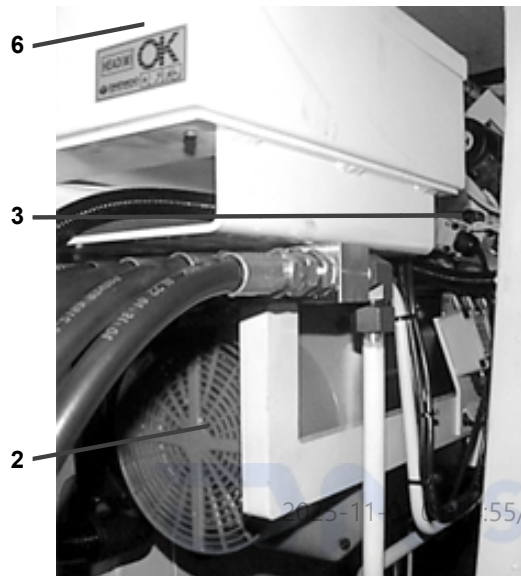
The machine is optionally provided with:

- Coolant gun
- Air gun
- Automatic measuring system (OMP60)
- Auto tool length measurement (TS27R)
- Automatic power off
- Chip conveyor & chip bucket
- Linear scale (X, Z-axis)
- Oil skimmer
- Oil mist collector
- Test bar
- Pallet clamping conformation
- Air blowing nozzle

4. SPINDLE HEAD



As the device to generate cutting force with gripping tool, the spindle is supported with 5-row bearings, and various maximum speeds and powers are available as optional specifications, and solenoid valves for spindle operation are attached to the rear side of spindle.



Symbol	Description	Function
1	Spindle	- Tool gripping and rotation
2	Driving unit	- Generation of power for rotation - Various optional specification
3	Tool unclamp	- To execute unclamp for tool change
4	Device	- Protection of inner devices - To form outline
5	Y-axis Slide cover	- Blow out flood coolant
6	Nozzle for flood coolant	- To connect electric wire

4.1 Main specifications

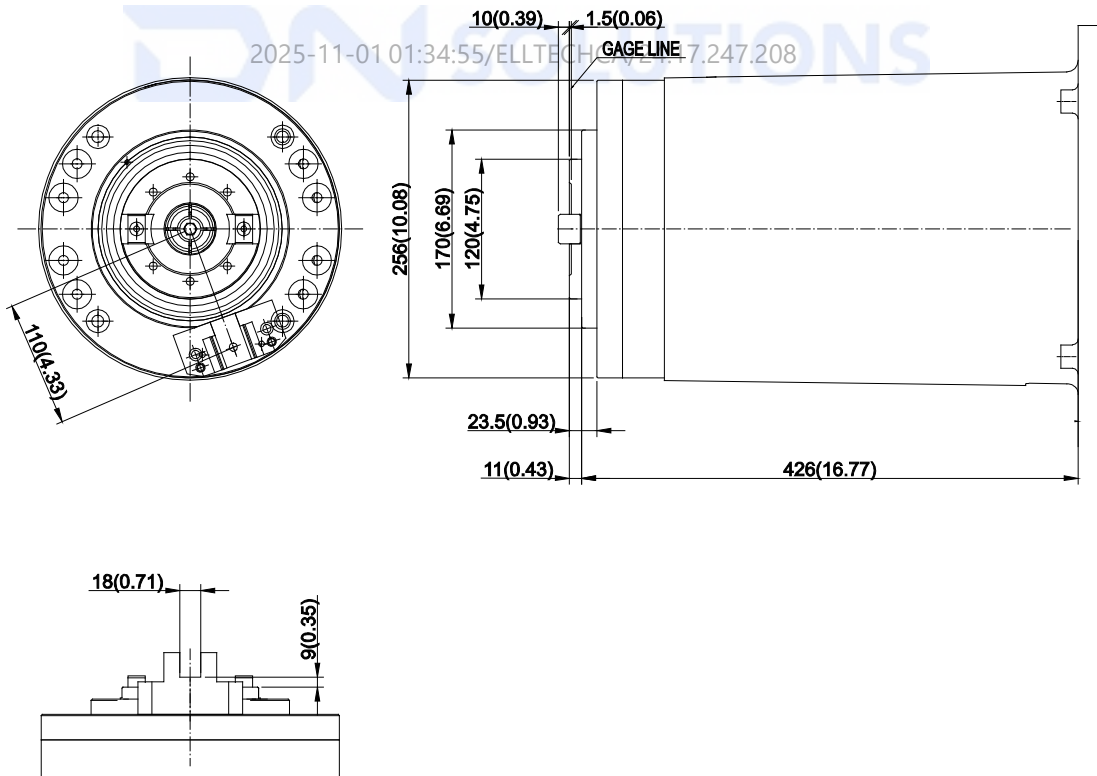
Item	Unit	Specification			
NC System		FANUC			
Motor Power* ¹	kW	22/26		30/37	37/45
Max. Torque* ²	N·m	1989.4(30min)		3687(30min)	3439(30min)
		1410(30min)			
Base Spindle Speed	r/min	125	176	96	108
Max. Spindle Speed	r/min	6,000	8,000	6,000	
Orientation		Position coder			
Taper Type		ISO#50, 7/24 Taper			
Power Transmission		Gear Train (3 STEP)			

(1) Tool clamping force

Model	Spec.	r/min	Clamping force
HM 1000	BT/CT/DIN	6,000	Criteria 26.5 kN (Permissible range 23.9 kN ~ 30.4 kN)
		8,000	
	HSK100A	6,000	Criteria 44.3 kN (Permissible range 40.0 kN ~ 51.0 kN)

4.2 Spindle nose shape

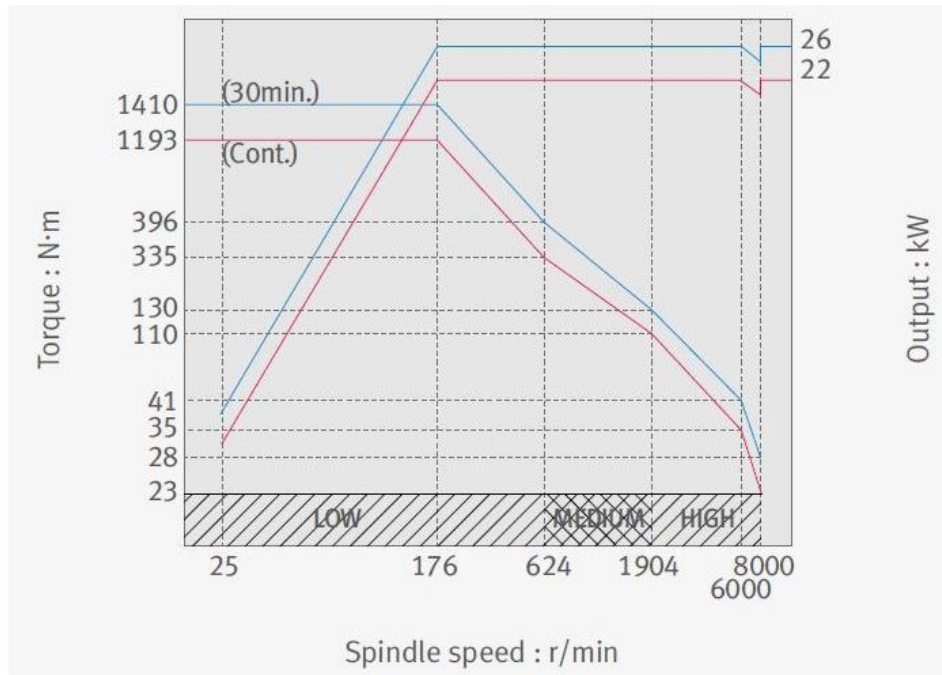
Unit: mm(inch)



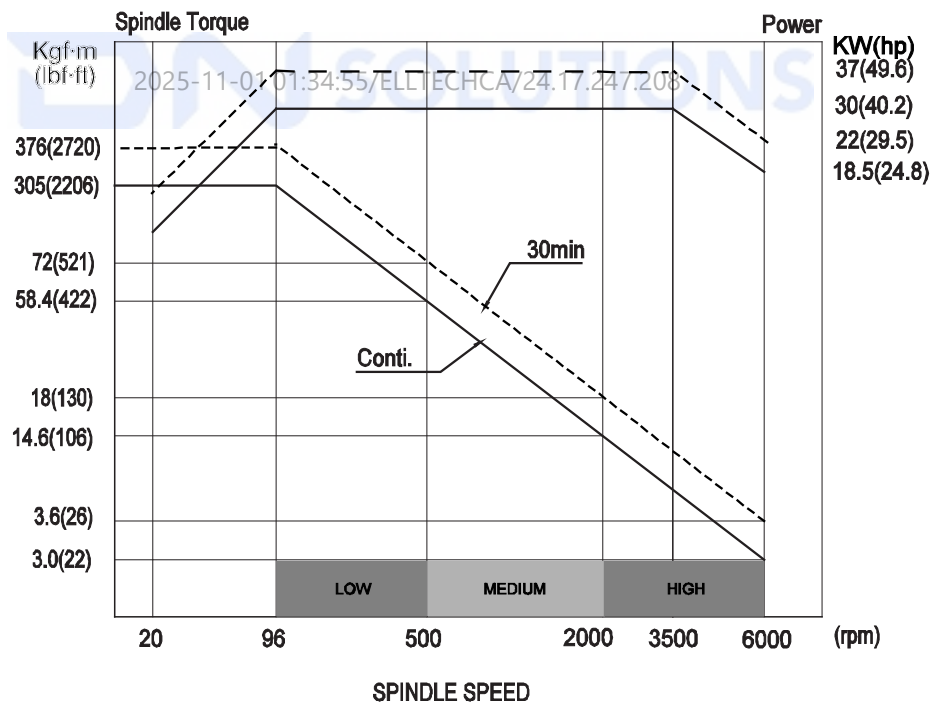
4.3 Spindle r/min(s) & output diagram

The figures below show the relations between spindle r/min(s), output and torque.

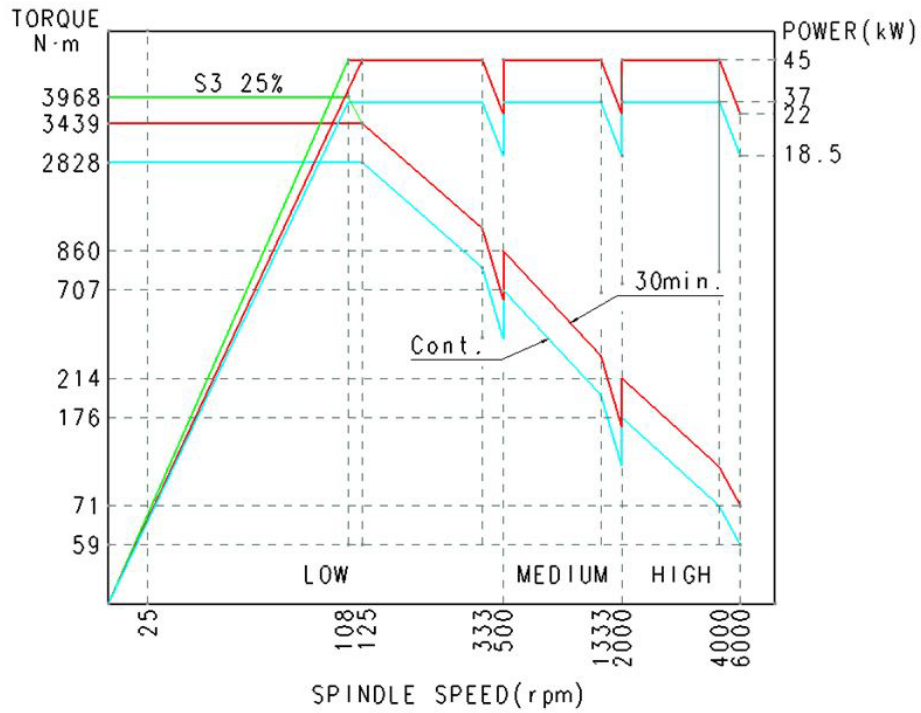
(1) FANUC α22



(2) FANUC α30



(3) FANUC α40



CAUTION

- ✓ There are 3 steps, low, medium and high in spindle speeds. If any speed in other range is commanded, the spindle stops first, changes gear and rotates again in the designated speed. Therefore, S code must not be commanded during cutting process.

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NOTICE

- ✓ Spindle speed does not vary until other S code is commanded, and stops by power off.

5. TABLE

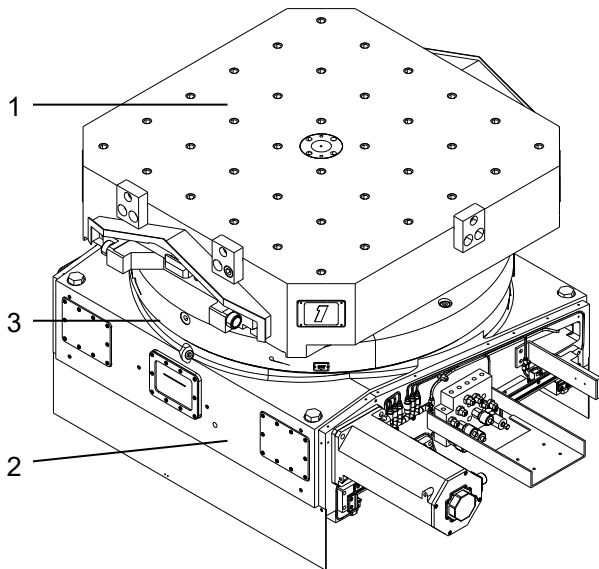


Table is attached to the inside of machine, carries out moving pallet for machining. And solenoid valves for table operation control are attached to the front side of table bed.

Symbol	Description	Function
1	Pallet	- Space to load workpiece
2	Driving Unit	- Table indexing - Driven by servo motor
3	Location & Clamp Device	- Adjusting the step position of pallet change - Pallet clamp/unclamp

5.1 Main specifications

(1) Table specifications

Item		Specification	
Index Degree		1° Index	0.001° Rotary Table
Positioning Accuracy(Sec)		±7"	±9"
Repeatability Accuracy(Sec)		±4"	±5"
Max. Rotating Speed	r/min	5(3)	5(3)
Table Indexing Time(Sec)	90°	4.2	*1
	180°	7.2	*1
	360°	13.2	*1
Clamping Force Or Torque		151.4 kN	20580 N m



NOTICE

✓ Please inquire Our machine tools R&D CENTER if necessary.

(2) Pallet specification

Item	Unit	Specification	
Pallet Size	mm(inch)	1000 x 1000(39.37 x 39.37)	
Pallet Surface	mm	Tap Pallet (M20XP2.5)	T-Slot Pallet (22H8)
Remark			Standard for America

5.2 Pallet shape (1000 x 1000)

Unit: mm(inch)

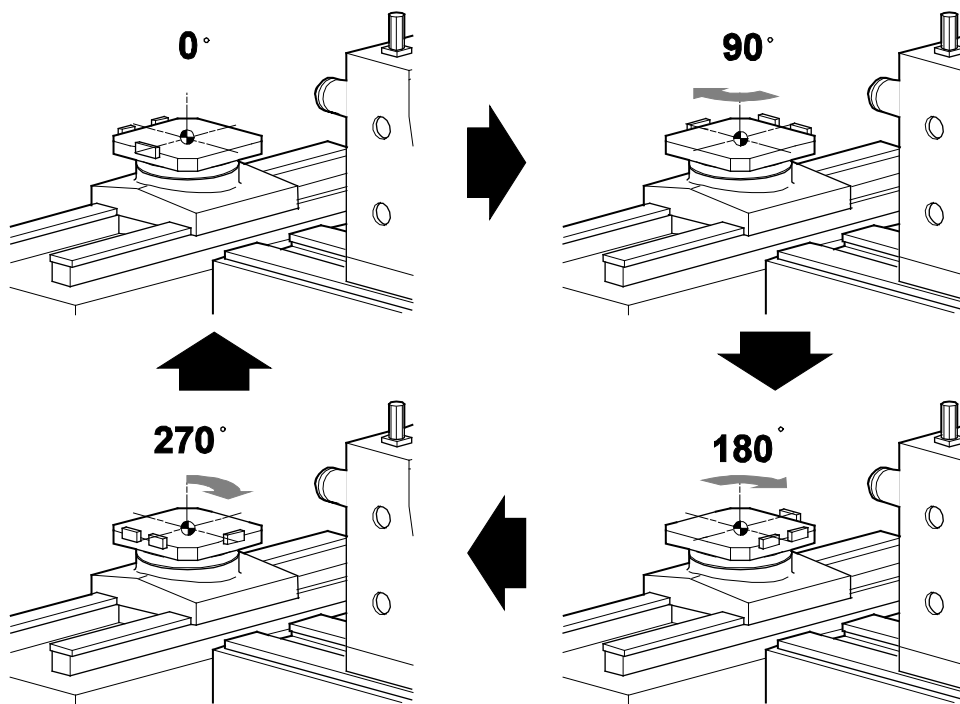
Type	Shape
Tap Pallet (Std.)	
T-Slot Pallet (Opt.)	

5.3 Pallet shape (1250 x 1000)

Unit: mm(inch)

Type	Shape
Tap Pallet (Std.)	
T-Slot Pallet (Opt.)	

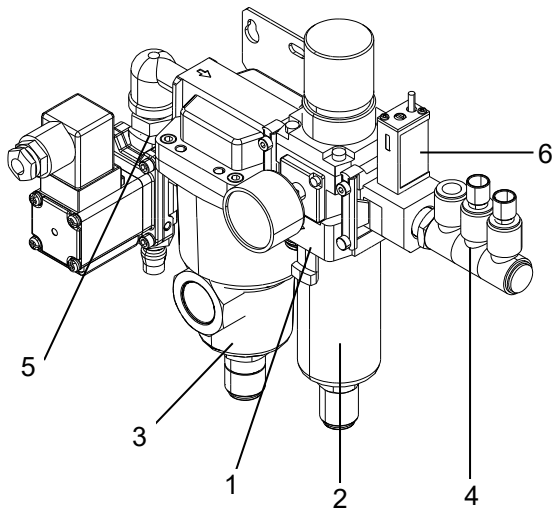
5.4 Table Indexing



NOTICE

- ✓ Pallets can be exchanged in 0° position.
- ✓ Before B command, it should be checked first if there is any interference among the tool, workpiece and machine at the position.
- ✓ A decimal fraction can not be used for B command in 1 degree index table.
- ✓ Tool change command (M06) and table rotation may be executed simultaneously to shorten processing time.
(Be careful of interference between tool and workpiece)
ex) M06 BXXX ;

6. AIR SERVICE UNIT



This device regulates and purifies the compressed air used as power source or cleaning medium of machine.

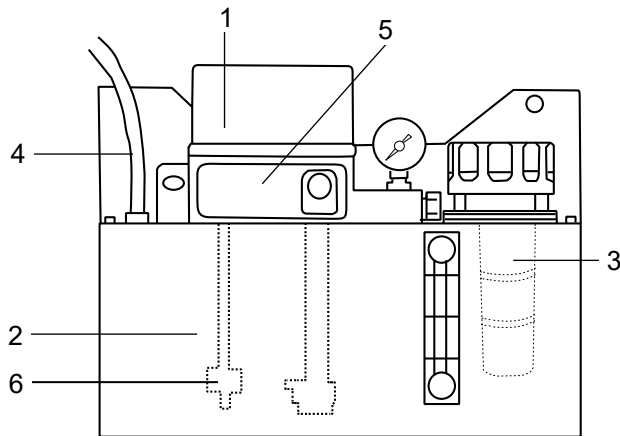
Symbol	Description	Function
1	Regulator	- To regulate and maintain specified pressure - To indicate pressure
2	Oilier	- To lubricate air - To protect devices/pipings from corrosion
3	Filter Unit	- To remove foreign matter in air - To extract moisture from air
4	Piping	- To supply air to operating devices
5	Sol. Valve	- Air source ON/OFF
6	Pressure Switch	- To detect air pressure down

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6.1 Main specifications

Item	Unit	Specification
Output Pressure	MPa	0.54
Consuming Volume	NI/min	450

7. LUBRICATION UNIT



<Lubrication unit>

Lubrication unit supplies lub. oil to guideways and ball-screw bearings, and pressure switch and float switch are installed in it for safety.

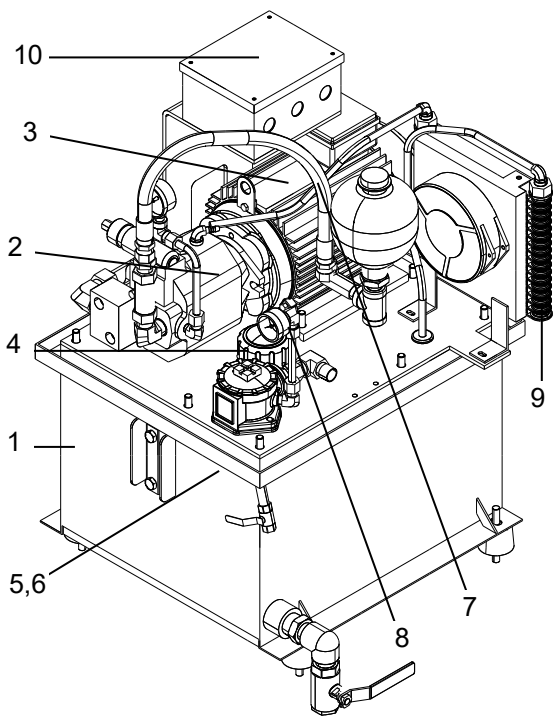
Symbol	Description	Function
1	Pump	- To make pressured oil
2	Tank	- To store oil
3	Inlet filter	- To filter oil poured in
4	Piping	- To supply oil to each device
5	Pressure switch	- To detect oil pressure
6	Float switch	- To detect oil level

7.1 Main specifications

Item	Unit	Specification
Tank Capacity	ℓ	7.2
Pump Motor Power	kW	0.057
Pressure	MPa	1.67
Flowrate	ℓ/min	0.15
Distributor Type		Metering

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8. HYDRAULIC UNIT



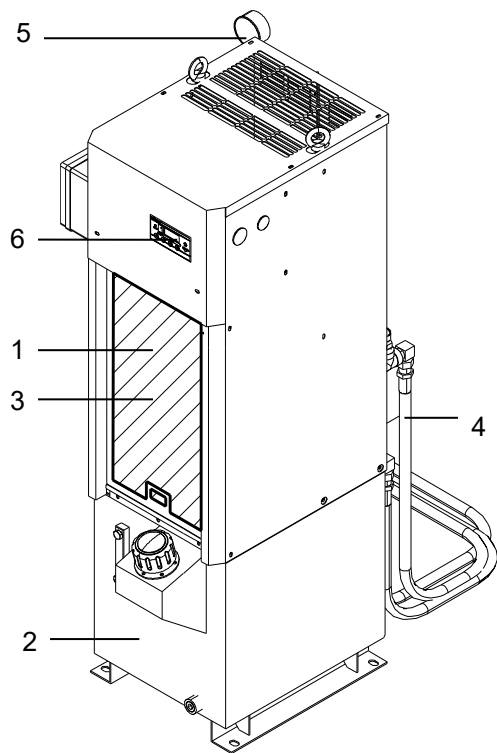
This device generates hydraulic power used to actuate hyd. Cylinder & hyd. Devices.
It is attached with pressure switch and oil fan for Europe CE regulation.

Symbol	Description	Function
1	Tank	- To store oil
2	Pump	- To make pressured oil
3	Motor	- To run pump
4	Inlet Filter	- To filter oil supplied
5	Suction Filter	- To filter suction oil of pump
6	Return Filter	- To filter return oil
7	Piping	- To supply oil chilled
8	Pressure Switch	- To detect oil pressure
9	Cooling Fan	- To cool oil
10	Terminal Box	- To connect electric wire

8.1 Main specifications

Item	Unit	Specification
Pump Motor Power	kW	2.2
Tank Capacity	ℓ	43
Pressure	MPa	5.39
Max. Flowrate	ℓ /min	25

9. OIL COOLER



As a spindle cooling unit, it chills oil returned from spindle circulation, and recalculates.

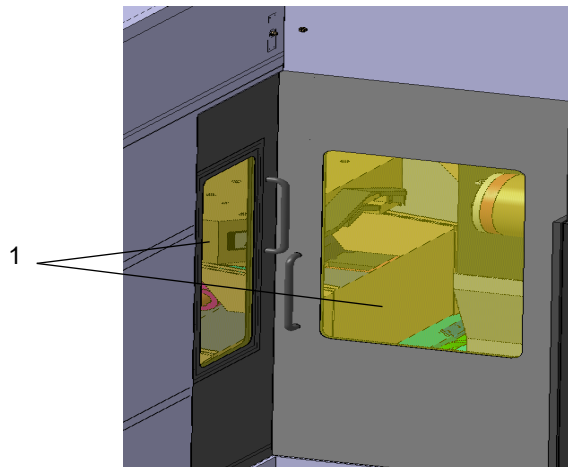
Symbol	Description	Function
1	Pump	- To extract oil
2	Tank	- To store oil
3	Filter	- To filter air for condenser
4	Piping	- To supply oil chilled
5	Pressure Gauge	- To indicate oil pressure supplied
6	Operation Panel	- To set temperature - Alarm indication

9.1 Main specifications

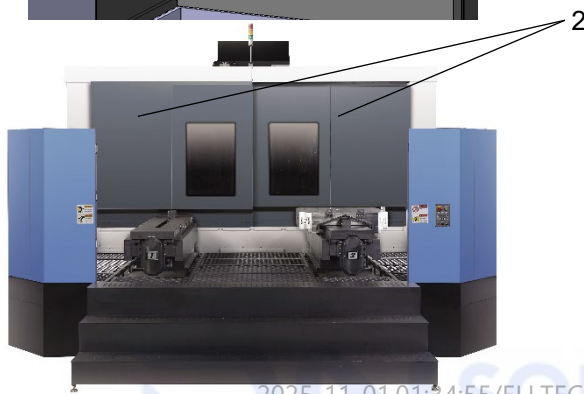
Item	Unit	Specification
Circulation Pump Motor Power	kW (hp)	0.4(0.54)
Tank Capacity	ℓ (gal)	40(10.6)
Cooling Position		Spindle Head
Compressor Power	kW (hp)	0.7(0.94)
Cooling Capacity	Kcal/h	3,480
Oil Pump Discharge Rate	ℓ /min(gal/min)	28(7.4)

10. SPLASH GUARD

They show machine name, safety precautions and hyd. pneumatic diagram, so are carefully observed and fully understood before operating machine.



Symbol	Description	Function
1	Operator's Door	- To check cutting state/inspect/clean
2	APC Door	- To protect operator during workpiece loading/unloading
3	ATC Door & Safety cover	- To load/unload the tool into/from magazine - To protect operator in magazine rotation



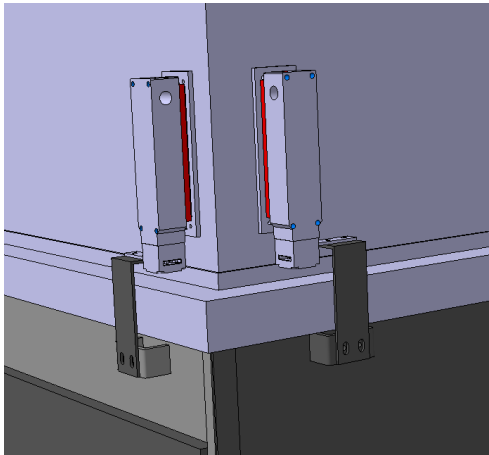
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10.1 Main specifications

Item	Unit	Specification
Machine Color		Our machine tools NEW 4TONE COLOR APC Door/Op Door : MT MIDDLE GRAY (MM 1.4RP 4.8/0.1) Others: MT LIGHT GRAY (ML 7.3B7.8/0.4) MT DARK GRAY (MD 5.3B3.0/0.4) APC Frame: MT BLUE (MB 6.1PB5.9/7.6)
Covering Type		Round Shaped, Full Enclosed Splash Guard

10.2 Safety switches for doors



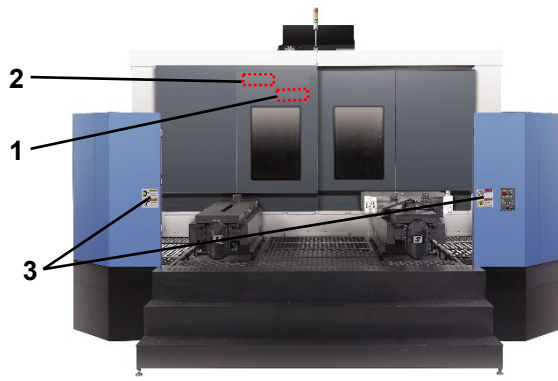
This devices generate alarm and operation prohibition signals for safety according to door open/close states, and are fitted according to the "CE regulation" in Europe.

<Safety switches installation example>

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Item	Functions	Remark
Switches for operator's door	Door locking in auto. operation When door is open during manual operation 1. Impossible ATC, APC, spindle operation 2. Impossible rapid traverse	Alarm state
Switches for ATC door	When door is open 1. Impossible tool change 2. Impossible magazine rotation	
Beam sensor for APC GUARD	Impossible pallet change when beam sensor is operated.	

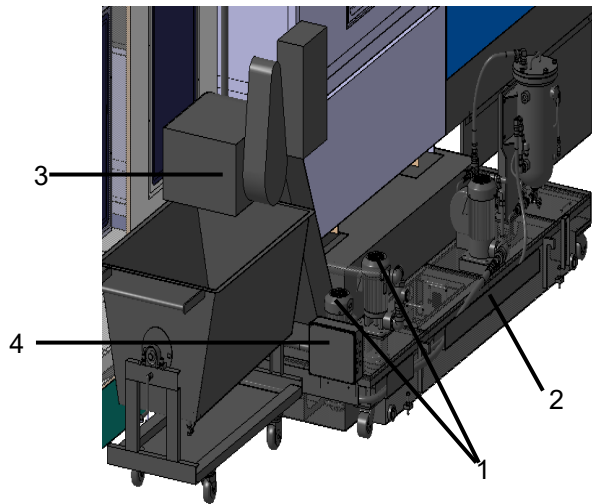
11. NAME PLATES



They show machine name, safety precautions and hyd. pneumatic diagram, therefore they are carefully observed and fully understood before operating machine.

Symbol	Description	Function
1	Model Name	- To indicate machine name
2	Our machine tools Logo	- Our machine tools symbol mark
3	Safety Precautions	- To inform safety precautions
4	Machine Layout	- To show position of motor, pressure switch, safety switch
5	Circuit Diagram	- To show circuit diagram
6	Lub. Instruction	- To show lub. instruction

12. COOLANT & CHIP DEVICES



They consist of the device to supply coolant into cutting space for smooth cutting condition and the device to manage chips, and have various selections like T-S-C, shower, etc. as optional specifications

Symbol	Description	Function
1	Pump	- To extract coolant
2	Tank	- To store coolant
3	Chip Conveyor	- To separate and remove chips from coolant
4	Terminal box	- To connect electric wire
5	Screw Conveyor	- To disposal chip from inner machine
6	Screw Conveyor Motor	- To drive screw conveyor



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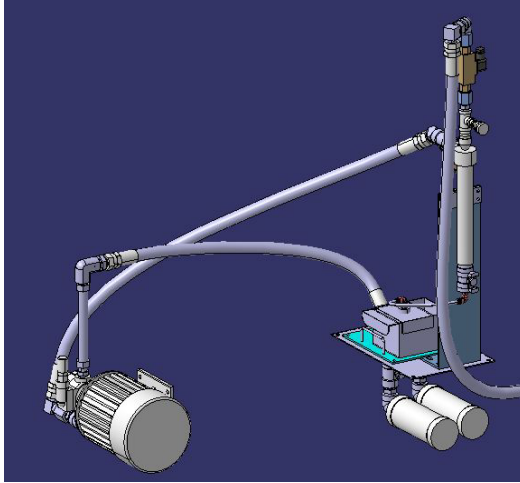


12.1 Main specifications

Item		Unit	Specification		
Flood Coolant	Type		Std. Type		
	Pump Type		Immersion type		
	Capacity	ℓ (gal)	1000(266)		
	Filtration	mesh	10(screen filter)		
	Output	kW	1.1		
	Max. Pressure	MPa	0.7(0.47)		
	Max. Flowrate	ℓ /min	30(30)		
Flushing Coolant	Type		Std. Type		
	Pump Type		Immersion type		
	Capacity		Std. Coolant Tank		
	Filtration	mesh	10(screen filter)		
	Output	kW	1.8		
	Max. Pressure	MPa	0.2(0.1)		
	Max. Flowrate	ℓ /min	260(260)		
T-S-C Coolant System	Type		Middle pressure		High Pressure
	Pump Type		T-Rotor		Piston
	Capacity	ℓ (gal)	Standard coolant tank		400(106)
	Filtration	μm	25(Cyclon Type)		25(Cyclon Type)
	Output	kW	1.5	3.7	7.5
	Max. Pressure	MPa	2.0(1.9)	3.0(29)	7.0
	Max. Flowrate	ℓ /min	23(18)	23(21)	27(18)
Oil Type			User defined		

12.2 20Bar pressure T-S-C(Through spindle coolant)

Generally recommended specification is as below.



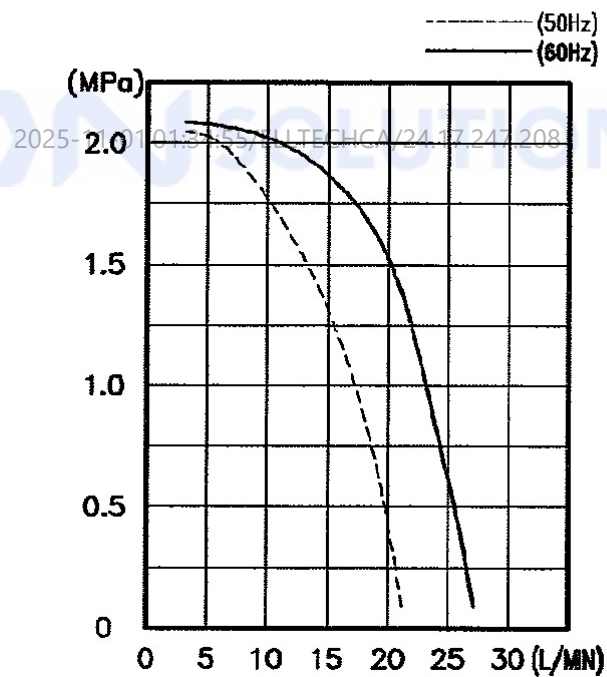
Item	Unit	Specification
Pump Motor Power	kW	1.5
FILTRATION		Cyclone
Suction Filter Type	μm	25micron
Recovery Pump		Trochoid Pump

<20BAR pressure T-S-C installation example>

PERFORMANCE CURVES(EMULSION COOLANT)

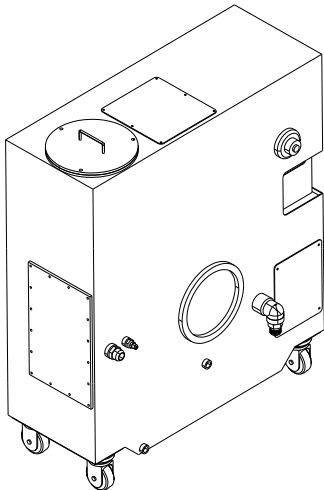
TEST CONDITION

- OIL TEMPERATURE : 20°C
- VISCOSITY : 2cst



12.3 30Bar pressure T-S-C(Through spindle coolant)

Generally recommended specification is as below.

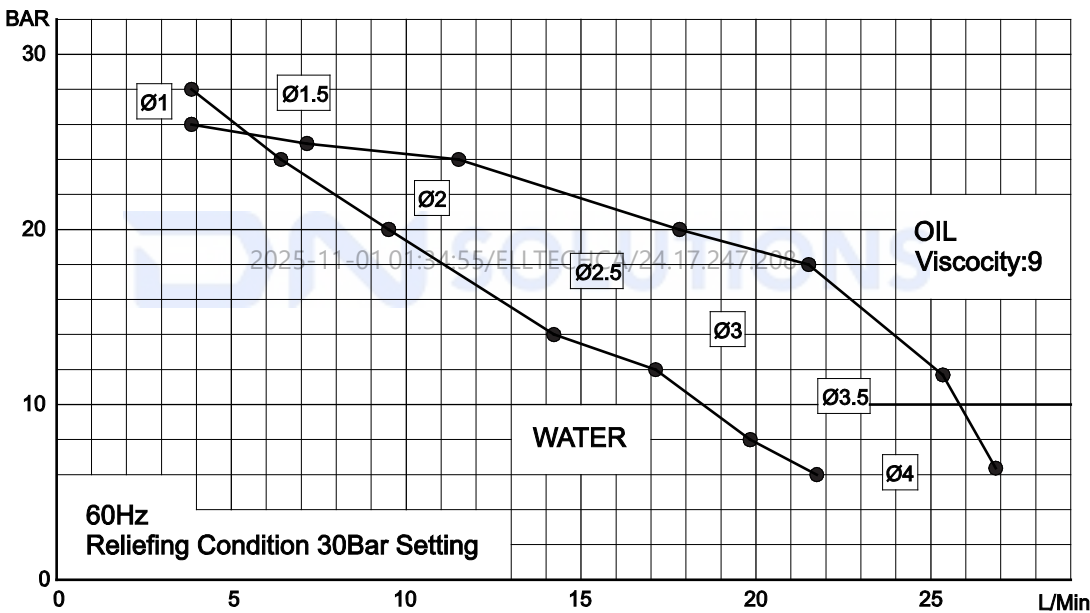


Item	Unit	Specification
Tank Capacity	ℓ (U.S gal)	259 (OPT. TANK)
Pump Motor Power	kW	3.7
FILTRATION		Cyclone
Suction Filter Type	μm	emulsion coolant: 20~30 synthetic coolant: 40~50
Recovery Pump*		Immersion

*For more information, refer to the attached manual.

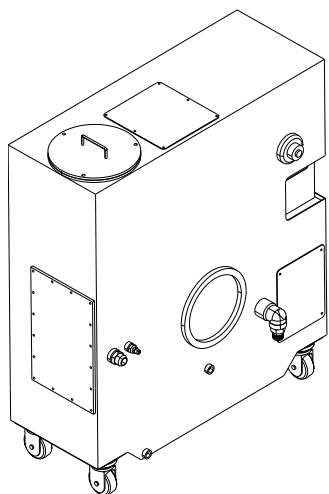
<30BAR pressure T-S-C installation example>

High-Pressure Pump Performance Curve



12.4 70Bar pressure T-S-C(Through spindle coolant)

It consists of extra tank and filter unit, and the followings are the general specifications



Item	Unit	Specification
Tank Capacity	ℓ(U.S gal)	259 (OPT. TANK)
Pump Motor Power	kW	7.5
FILTRATION		Cyclone
Suction Filter Type	μm	Emulsion coolant: 20~30 Synthetic coolant: 40~50
Recovery Pump*		Screw type

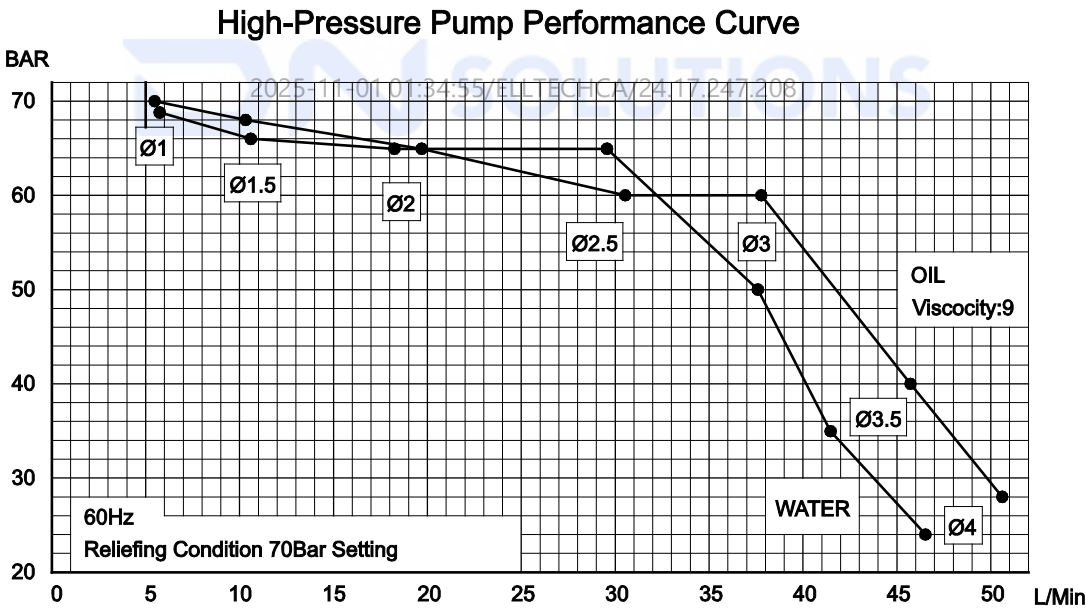
*For more information, refer to the attached manual.

<T-S-C installation example>

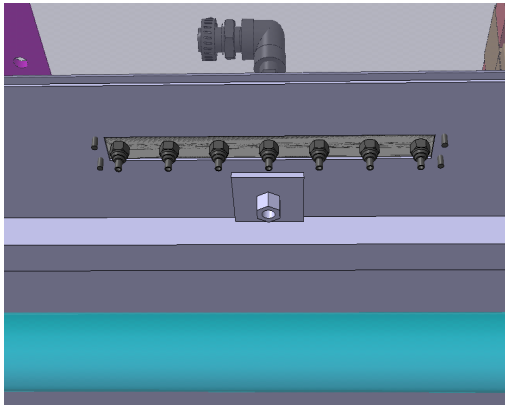


NOTICE

- ✓ The recovery pump is installed on standard coolant tank.



12.5 Shower coolant device(optional specifications)



As the device for cleaning the finished workpiece with large volume coolant, the following is the specifications recommended.

Item	Unit	Specification
Tank Capacity		STD. Coolant tank
Pump Motor Power	kW	1.8
Filtration	mesh	15 (Screen filter)
Max. Pressure	MPa	0.2(0.1)
Max. Flowrate	ℓ /min	260(260)
Pump Type		Immersion type

12.6 Chip screw conveyor

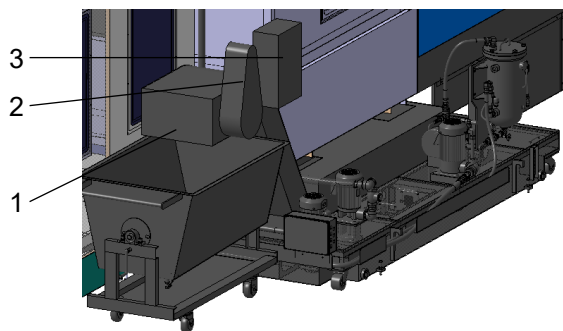


Chip screw conveyor remove chips to outside from machine inner.

Symbol	Description	Function
1	Motor(0.4kw)	- To drive screw bar
2	Coil Screw	- To discharge chip From machine inner



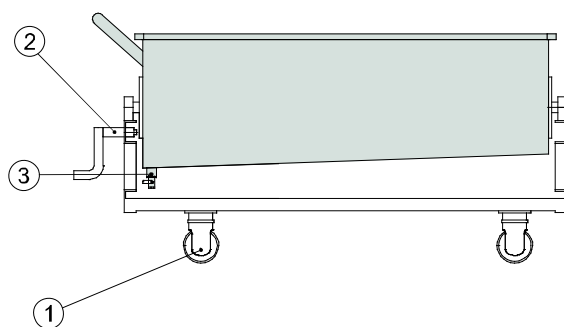
12.7 Chip conveyor(optional specifications)



Chip conveyor as optional specification which discharges chips out of machine, provides more convenient management of chip cleaning.

Symbol	Description	Function
1	Outlet	- Outlet of chip
2	Motor	- To run chip conveyor
3	Operation Box	- Operation device

12.8 Chip bucket(optional specifications)



It stores chips discharged from chip conveyor temporarily and to remove them easily, casters, rotating device and drain plug are installed

Symbol	Description	Function
1	Caster	- To move bucket
2	Locking Device	- To lock rotation
3	Drain Plug	- To drain oil on the bottom

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12.9 Coolant gun(optional specifications)

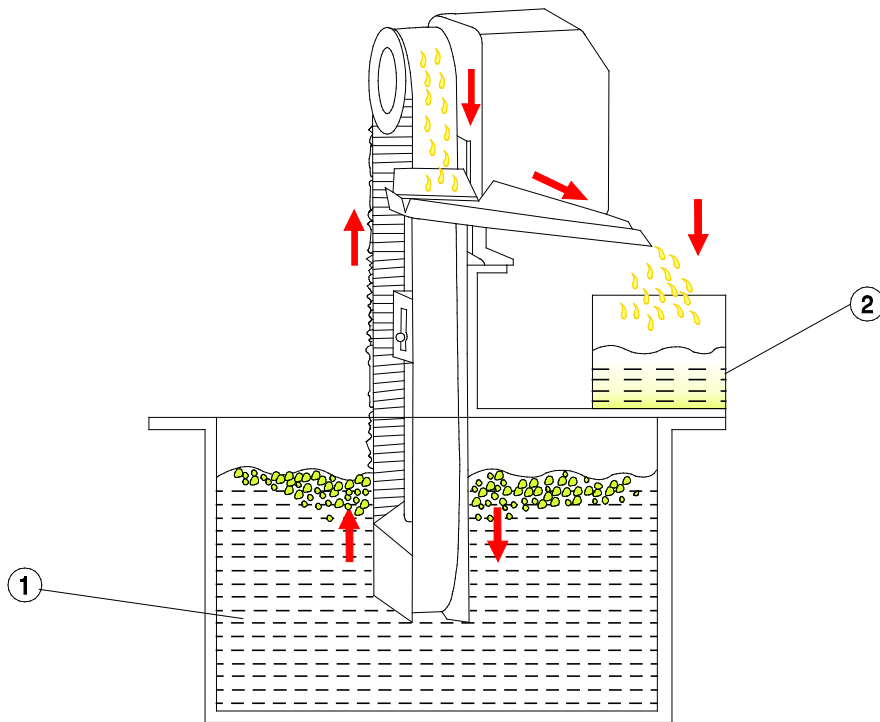


As the device for removing chips around the finished workpiece and fixture manually with additional pump.

Symbol	Description	Function
1	Coolant Gun	- To control the extract of coolant
2	Hose	- To supply the coolant

12.10 Oil skimmer

The oil skimmer installed on top of the coolant tank removes oil from the coolant tank where oil is mixed with coolant.

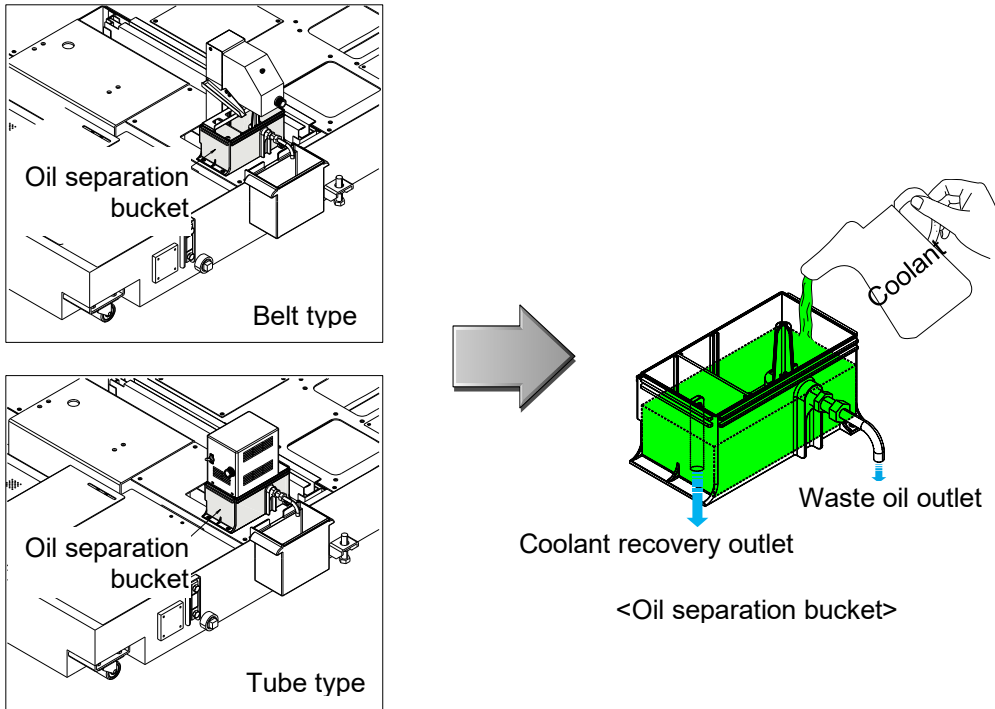


Symbols	Name	Function
1	Water-soluble coolant	- Remove the heat generated in cutting operation.
2	Waste oil tank	- Keeps separated waste oil



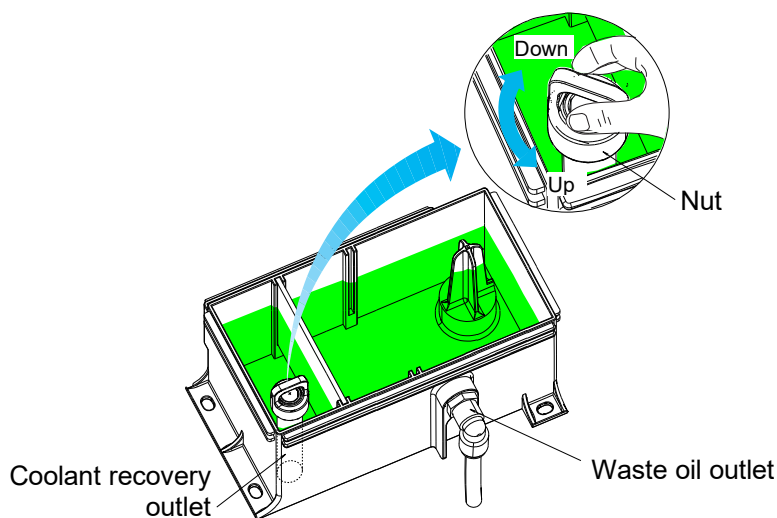
NOTICE

- ✓ Fill the oil separation bucket with enough clean coolant at the beginning of the installation of the machine.
If the initial coolant is not filled, you won't be able to separate the oil and coolant.



NOTICE

- ✓ Adjust the height of the coolant recovery outlet relative to the waste oil outlet to the appropriate level using the nut on the coolant recovery outlet. Be careful not to discharge the coolant through the waste oil outlet or allow any waste oil to flow into the coolant tank.
(NOTE: Certain models may not have a nut for adjusting the height of the coolant recovery outlet.)



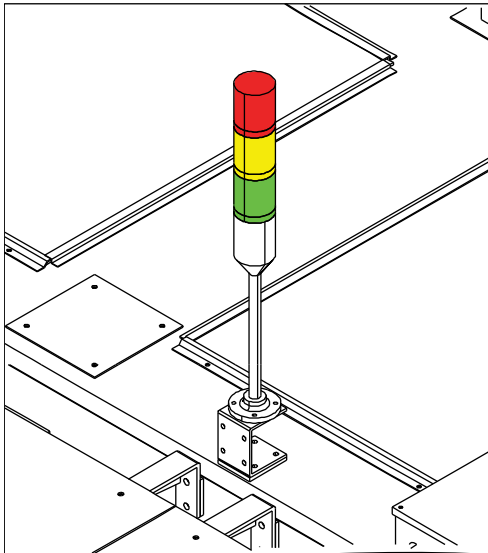
13. ELECTRIC DEVICES

As the device to supply main power and to operate machine, please refer to operation manual to know how to operate.



Symbol	Description	Function
1	Electrical Cabinet	- Various electric devices are built in - Main power connection/supply device
2	Operation unit	- Machine operation, NC operation, and programming - NC power ON/OFF and mode selection. Equipped with buttons and switches for operation
3	ATC OP. Panel	- Manual operation for ATC. - To maintain/adjust of ATC
4	APC OP. Panel	- Manual operation for ATC
5	Work light	- Lights up the machining area inside the machine
6	Signal tower	- Displays machine state information

13.1 Signal tower



<Example of Signal tower Installation >

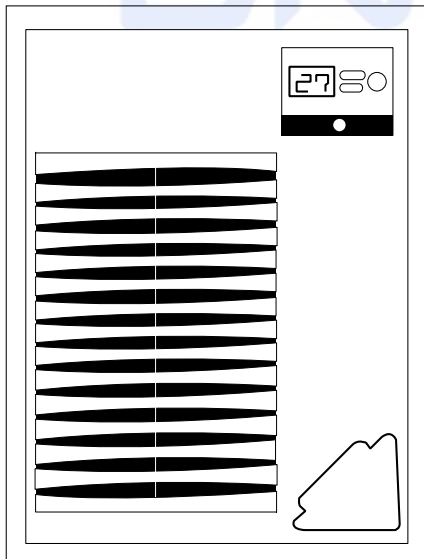
As standard specification, green.yellow.red lamp indicates accurate machine state more easily.

Color	Condition
Red	Alarm state
Yellow	Program stop
Green	Automatic operation

13.2 Extra transformer(optional specifications)

It is available as optional specification according to user's power source.

13.3 Air conditioner for electrical cabinet(optional specifications)



<Air conditioner for electrical cabinet installation example>

When the machine is used in warm environment, this device regulates the temperature inside of electrical cabinet in order to prevent the devices from malfunction because of temperature fluctuation, as optional specification.

Part 4 TRANSPORT.INSTALLATION & PREPARATION FOR OPERATION

In this chapter, works needed in each process from selection of machine location to final leveling are explained.

The following contents are steps of each process, and only maintenance staff (or each mechanic and electrician) performs each works.



- ✓ Please fully understand mechanical and electrical specification before installation.
- ✓ Please contact our service with points which are not clear.

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1. MACHINE LOCATION

1.1 Storage of the machine

After the machine arrives, if you store it for a certain period of time without installing it right away,

- (1) Please store it at a place with the temperature of between -20 and 60℃ and with humidity not exceeding 75 % (no condensation allowed). Otherwise, problems may occur with the electric systems of the NC unit and peripheral devices.
- (2) Store the machine in a place that is not exposed to dust or fine dust. Dust and fine dust will cause rust and corrosion to the machine.

1.2 Installation environment

- (1) Temperature/humidity condition at the installation location of the machine

Under the cold weather machine performance can be affected by deteriorated lubrication.

Under hot weather the oil cooler's cooling performance can be impaired. In addition, temperature change at the location of installation may cause thermal displacement in respective parts of the machine, resulting in bad effect on the precision of the machine. In order to prevent temperature fluctuates at the installation location of the machine, observe the following guidelines:

- 1) Keep away from direct sunlight. If it enters, it would be difficult to maintain a constant indoor temperature.
- 2) Do not install the machine at the entrance of the factory. If it is unavoidable, make sure that outside air is properly blocked by a certain measure.
- 3) The temperature may rise depending on the location of radiation heat from the wall or direction of air from the air conditioning unit fan, etc. Take necessary precautions in order to ensure that the temperature rises and is uniformly maintained.
- 4) If the ceiling is too low or too many machines are installed and running in a small space, the ceiling lights may cause temperature difference in temperature between the upper and lower part of the room, which may lead to an machine's heat deflection. In this case, take necessary measures to ensure that the air is forced to move up and down.
- 5) Temperature/humidity condition
 - ① Allowable temperature range for the machine operation: 5 ~ 40 °C
 - ② Relative humidity: 30 ~ 75 % (No condensation)



- ✓ The allowable temperature range above(5 ~ 40 °C) is a general range of proper temperature for machine operation. It is not designed for maintenance of machine precision.
 - ✕ Temperature range to maintain machine precision
 - Temperature range: ± 2 °C within 24 hours(1 °C or less within 30 minutes)
 - Difference in temperature between the floor and 5 meters above the floor should be 1 °C or less. (Ideal temperature range: 20 °C ± 1 °C)
- ✓ When it is extremely cold (-5 °C or below): As viscosity of various fluids increase, significant loss of pressure and reduced service life may result. In addition, efficiency may also be reduced due to the increased mechanical friction of the pump, valve, cylinder, etc. Therefore, it is necessary to initially raise oil temperature through sufficient warming up of the machine. Especially, if the spindle rotates at a high speed all of a sudden, it may cause damage to the spindle bearing. Be sure to warm up the machine before starting operation.
- ✓ When it is extremely hot (40 °C or above): When the temperature of lubricant is high, viscosity decreases and oil film is reduced, leading to an increased wear and tear of parts due to mechanical friction and deterioration of the sealing function. Therefore, in order to maintain normal quality of the machine, be sure to maintain the temperature within the allowable temperature range.

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(2) Compressed air supply conditions

- 1) For the provision of the device for supplying compressed air necessary for the basic operation of the machine, it is important to supply enough air amount and pressure to be consumed by the machine.

It is important to be able to install Line Filter or Air Dryer to supply clean air so that there is no malfunction or damage to the machine due to foreign matter (moisture, dust, oil) in the air.

- 2) High-speed spindle requires considerable amount of air for spindle bearing's lubrication/cooling and chip air blow. Please be sure to check this beforehand and make proper preparations.

(For models with high-speed spindle)

(3) Environment check for vibration

- 1) The location of installation of the machine needs to be as far away as possible from vibration sources such as road, stamping/press machine or planer, etc.
- 2) If you install the machine near a vibration source, install a damping pit around the foundation to reduce vibration.
- 3) In normal work space, vibration limit is 0.8 mm/sec.

(4) Floor for Installation

- 1) Ensure a sufficient strength of the machine installation floor, and that the machine is not deformed and its accuracy is not affected due to the unevenness of the floor. If the ground where the machine is installed is weak or feared to sink, we recommend proper foundation work.
- 2) Since the foundation drawing is prepared on the assumption that the ground condition is good, the foundation depth shall be changed according to the ground conditions where the machine actually is installed.
- 3) When doing foundation works based on the foundation drawing, be sure to leave spaces for door opening, chip conveyor length, and maintenance, etc.
- 4) If the ground is too weak and soft, drive concrete piles into the ground to reinforce it. If necessary, contact a company specializing in piling work.

(5) Other cautions

- 1) If a device that generates high frequency, electrical discharge machine, or electrical welder is placed near or if the power for the machine is shared with other devices using a switchboard, the NC may malfunction. Please earth the machine separately. (For further information on wiring, please contact the engineers from Our company to assist the machine installation.)
- 2) In order to calibrate the machine's static precision, the machine has to be installed at a location not affected by airflow within the factory. Depending on the airflow, measurement of machine precision may not be possible.
- 3) Install the machine at a location not exposed to dust or fine dust. Dust and fine dust will cause rust and corrosion to the machine.
- 4) Do not install the machine around corrosive gas.
- 5) Install and use the machine at or below 1,000m above sea level. If the height at the location of installation exceeds 1,000m, pressure change may affect machine operation.



NOTICE

- ✓ The user is required to prepare the power wiring to the machine and the pneumatic hose.

(6) Coolant

- 1) Our company recommends an emulsion type of coolant appropriate for the workpiece material and cutting method.
- 2) Do not use synthetic coolant.
 - ① Due to its high alkalinity, the sliding bearings may peel off.
(For models with sliding bearing adopted)
 - ② Due to the sticky nature and rapid curing, it easily becomes bonded or mastic, which may cause machine malfunction.

- ③ The paint may peel off and rust transpires.
 - ④ It may cause swelling and hardening of chemical products including rubber, plastic, and resin. The property of matter is transformed which may lead to machine malfunction.
- 3) Please pay particular attention when selecting a semi-synthetic coolant. The same problem with synthetic coolant may occur depending on the component and synthetic ratio.
- 4) Consideration when selecting coolant
- ① Coolant should not contain harmful substances such as odor, pollutant, and hazards to the human body.
 - ② Coolant should not deteriorate during storage.
 - ③ Coolant should be rustproof.
 - ④ Coolant should not peel paint.
 - ⑤ Coolant should not change the property of matter. That is, the swelling and hardening of chemical products including rubber, plastic, and resin must not occur.
 - ⑥ When machining copper materials, chips may react with certain components of the coolant, resulting in deposits and surface deposition that can damage the machine. Before machining copper materials, please contact a coolant supplier in advance to select the most appropriate coolant for copper materials.
 - ⑦ Coolant should not contain ingredients that reduce precision of the machine.
 - ⑧ Select a coolant bearing in mind lubrication, rust prevention, infiltration prevention, foam generation prevention, and oil separability.



- ✓ Our company never recommends a specific coolant. Consult with the coolant maker to select the appropriate type of coolant.
- ✓ Our company does not provide warranty for damage caused by the coolant.
- ✓ There are the flammable components in the water-insoluble coolant, and may cause fire or machine damage if ignited. If you need to use water-insoluble coolant for any reason, contact our sales representative.
(Familiarize yourself with/observe the fire prevention of the safety guidance)
- ✓ When using the water-insoluble coolant of a high viscosity, the viscosity may rise in a low temperature environment, causing pump problems. Use the coolant of a low viscosity.
- ✓ The heat of the coolant circulates around the machine, and causes thermal deformation by transferring the temperature to the machine body and workpiece/fixture, which adversely affects precision. We recommend using a coolant chiller to prevent this temperature rise and minimize thermal deformation.
In particular, if you use a water-insoluble coolant or a coolant system of a high pressure, it will increase the temperature of the coolant more and more, so make sure to select a coolant chiller.

5) Coolant Management

- ① Keep coolant clean at all times to prevent decomposition.
 - Chips cause coolant decomposition. Remove any chips from the coolant tank, hose, manifold, nozzle, and filter.
 - If a different type of oil is mixed, the coolant may deteriorate. Remove the different oil (such as lubricant) using an oil skimmer as soon as possible. Over time, it becomes more difficult to separate other oils from the coolant.
 - The coolant dilution method and diluted oils vary according to the type of coolant. Follow the coolant maker's instruction. Low viscosity causes coolant degeneration and rust.
- ② At the beginning and the end of work, remove the chips and wipe off the coolant attached to the turret of the tool post, cross slide, etc., and apply a thin coat of lubricant.
- ③ Clean the guide surface of each axis, limit switch, feed motor, etc. once every 6 months.
- ④ Water-soluble coolant is made to be rustproof, but rust may form when it dries. Special precautions must be taken at all times.
- ⑤ Since the coolant has a high level of alkalinity, it has a strong de-greasing ability. The coolant may cause dermatitis, etc., so take careful hygienic precaution at all times.
- ⑥ Water-soluble coolant is affected by water (tap water, underground water). To select an appropriate coolant that is suitable for the specific type of water, please consult with the coolant maker.

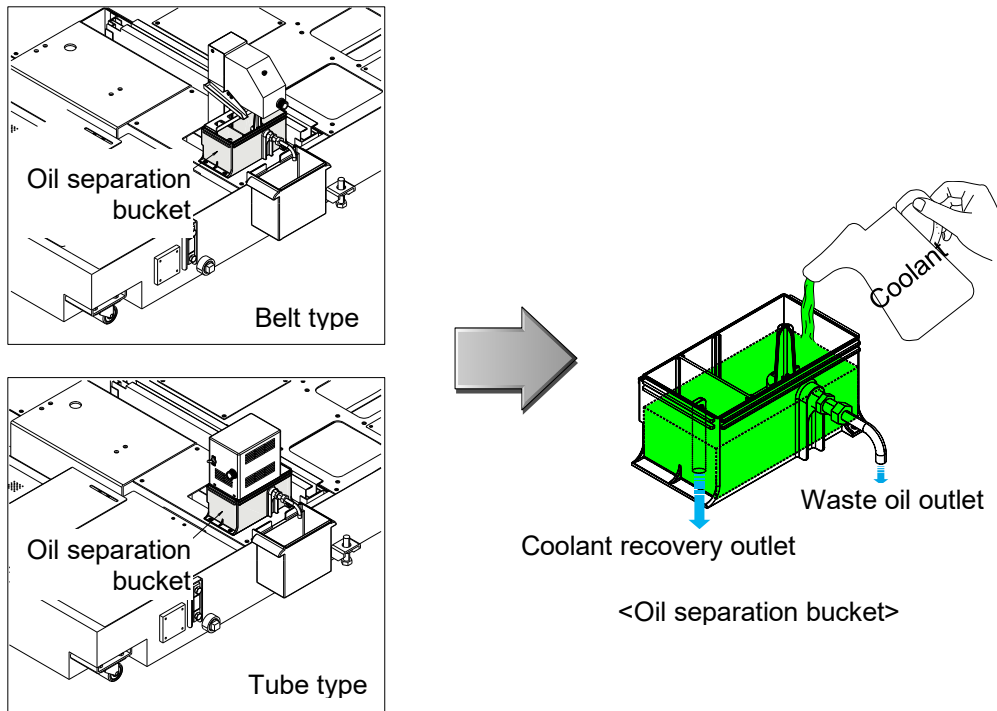


- ✓ Even when the machine is not being operated, if necessary, use the oil skimmer. You can separate other oils effectively using the oil skimmer.
- ✓ If the coolant shows any sign of deterioration, replace it immediately.



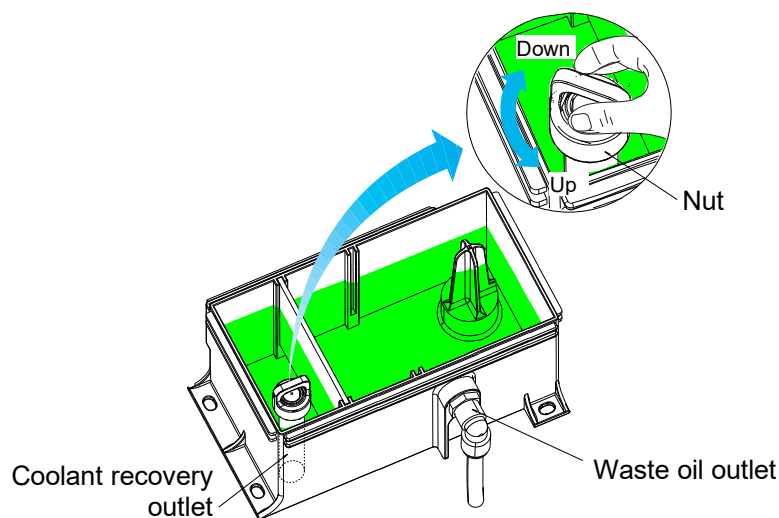
NOTICE

- ✓ Fill the oil separation bucket with enough clean coolant at the beginning of the installation of the machine.
If the initial coolant is not filled, you won't be able to separate the oil and coolant.



NOTICE

- ✓ Adjust the height of the coolant recovery outlet relative to the waste oil outlet to the appropriate level using the nut on the coolant recovery outlet. Be careful not to discharge the coolant through the waste oil outlet or allow any waste oil to flow into the coolant tank.
(NOTE: Certain models may not have a nut for adjusting the height of the coolant recovery outlet.)



(7) Way of Waterproofing

1) Waterproofing when installing a Jig & Fixture.

- ① Remove any foreign substances such as coolant, chips, dust, and oil completely from the installation surface.
- ② **Apply a waterproofing oil to the installation surface by using a brush or a spray gun.** When using a spray gun, the waterproofing oil is sprayed in mist form into the air, so be sure to wear protective equipment while working.
- ③ Regularly check the installation surface of the jig and fixture for corrosion. If a problem is found, take immediate action. Follow the waterproofing oil maker's instructions for the inspection cycle.
- ④ Consult with the waterproofing oil maker to choose the type of waterproofing oil considering the type of jig and fixture, installation period, and the internal and external environment of the machine (temperature, humidity).

2) Coolant contains oil and waterproofing additives, which have an anti-corrosion effect. However, if soluble coolant deteriorates or if non-soluble coolant is penetrated by moisture, the waterproofing effect will decrease. Follow the coolant maker's instructions for coolant management.

3) Waterproofing after machine installation is the customer's scope. If short-term or long-term waterproofing is required for the machine, consult with the waterproofing oil maker.



2. FOUNDATION PLAN



- ✓ The foundation is ideal only if it is completed two months before the machine is installed, and after completion of the foundation, the detailed dimensions of the foundation should be checked according to the foundation drawing.

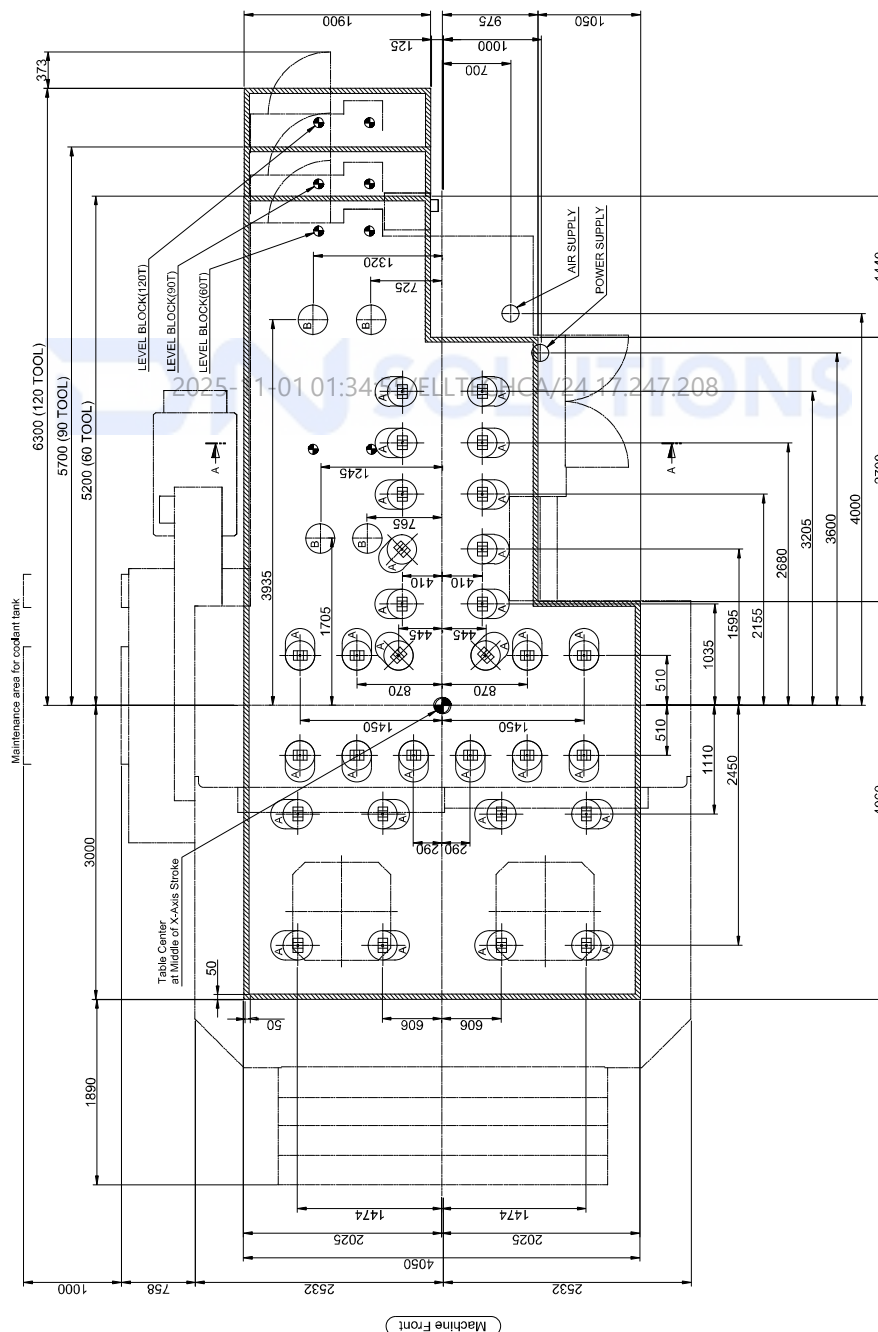


- ✓ When doing foundation works based on the foundation drawing, be sure to leave spaces for door opening, chip conveyor length, coolant tank removal and maintenance, etc.

2.1 HM 1000 Foundation plan for 60 tool / 90tool / 120tool magazine

(1) Lay-out

Unit: mm

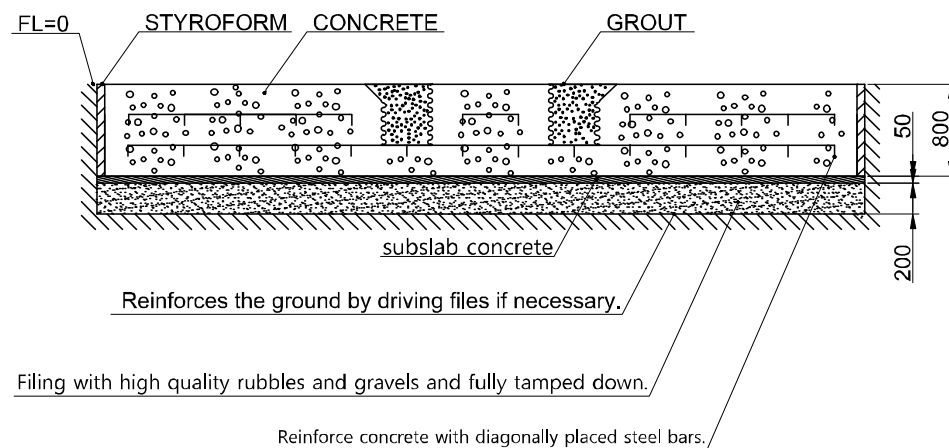


REMARKS

1. WIRING FROM POWER SOURCE TO THE MACHINE MUST BE PERFORMED BY CUSTOMER
2. CURING PERIOD OF CONCRETE SHOULD BE MORE THAN ONE MONTH
3. USE Ø300 CORRUGATED TYBE, AND REMOVE TUBE AFTER CONCRETE.
4. POUR GROUT AFTER POSITIONING AND PRELIMINARY LEVELING WORK.
5. REMOVE P88120020 PART AFTER CURING OF GROUT.
6. THE FOUNDATION VALUES SHOWN IN THIS DRAWING ARE REFERENCE/
RECOMMENDED VALUES. IF THE SOIL CONDITION IS POOR, VERIFICATION IS NEEDED
THROUGH THE STRUCTURAL DESIGNER

(2) Detail

Unit: mm

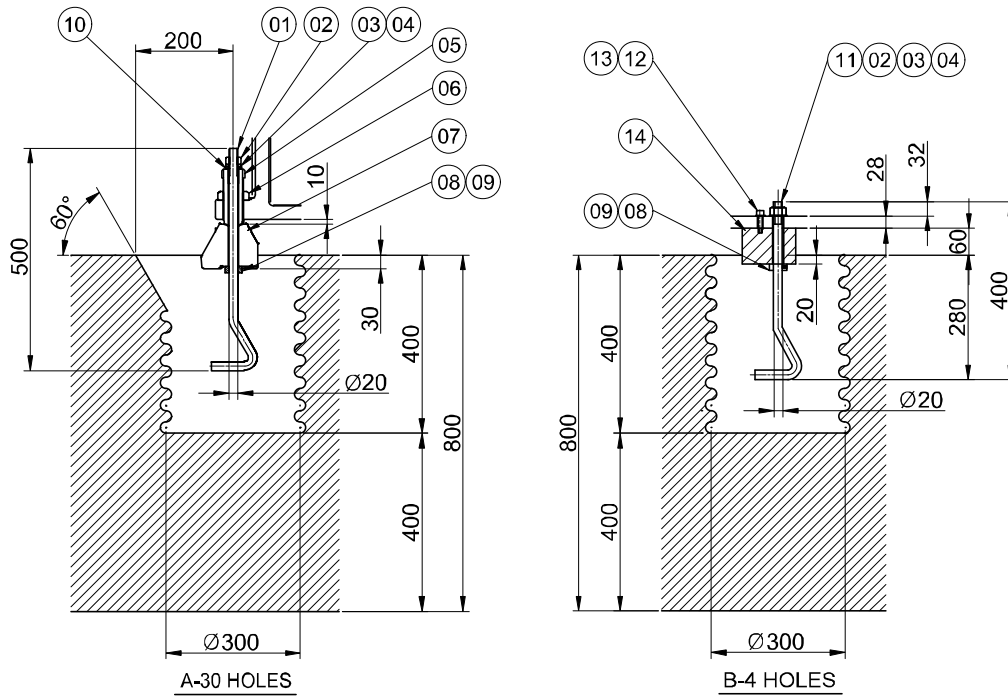


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MAIN VALUES		
MACHINE WEIGHT	60 TOOL	29 000 kg
	90 TOOL	29 700 kg
	120 TOOL	30 700 kg
MAX. WORKPIECE WEIGHT	5 000 kg (Each pallet)	
BEARING OF SOIL	7 kPa	

TOLERANCE		
PLATNESS		±5mm
PITCH OF HOLES	SINGLE	±10mm
	ACCUMULATED	±20mm
DIMENSIONS OF HOLES		±10mm

FOUNDATION MATERIAL		
CONCRETE	STRENGTH	24 MPa
	QUANTITY	20.9 m ³ (50 070 kg)
		21.6 m ³ (51 890 kg)
		22.5 m ³ (54 080 kg)
GROUT	STRENGTH	40 MPa



NO.	ITEM NO.	DESCRIPTION	Q'TY	MAT./SPEC	REMARK
1	120104-00017	BOLT FOUNDATION	30		
2	S4001132	NUT, HEX	34	NA20	
3	S5001101	WASHER, PLAIN	34	ZP20	
4	S5101101	WASHER, SPRING	34	ZS20	
5	P88074512	BOLT, LEVELING	30	BLVC45125	
6	P88100045	NUT	30	NLV 45	
7	P88020100	BLOCK	30	LBB 100	
8	P88110020	COLLAR	34	FC 20	
9	S3526386	SCREW, SET; HEX. S/HEAD	34	BQK6X10	
10	P88120020	BUSHING	30	FB 20	
11	P31200400	BOLT; FOUNDATION	4	BFLA20X400	
12	S2212462	BOLT, HEX SOCKET HEAD	4	BB10X40	
13	S5000601	WASHER, PLAIN	4	ZP10	
14	250205-03242	PLATE; FOUNDATION	4		

3. PREPARATION BEFORE MACHINE ARRIVAL

3.1 Preparation of Grout

The followings are quantity of grout necessary for foundation.

(It is ideal quantity, so it is proper to prepare 20% more)

Grout(Non-Shrink)	0.96 m ³ (2 305 kg)
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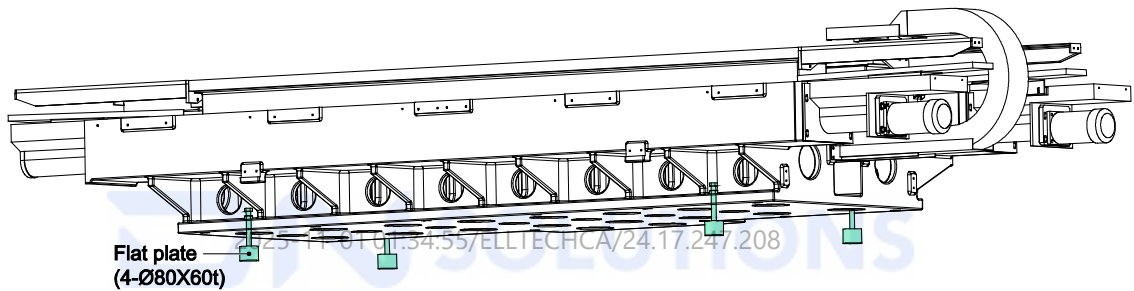
NOTICE

- ✓ Anti-shrinkage can be selected among Non-shrink(grout type), Embeco and Tascon.
- ✓ When grouting, observe the construction method of the grout maker.

3.2 Preparation of parts for preliminary leveling

When the machine is installed on the foundation, it is necessary to level temporarily with using shim plates and flat plates.

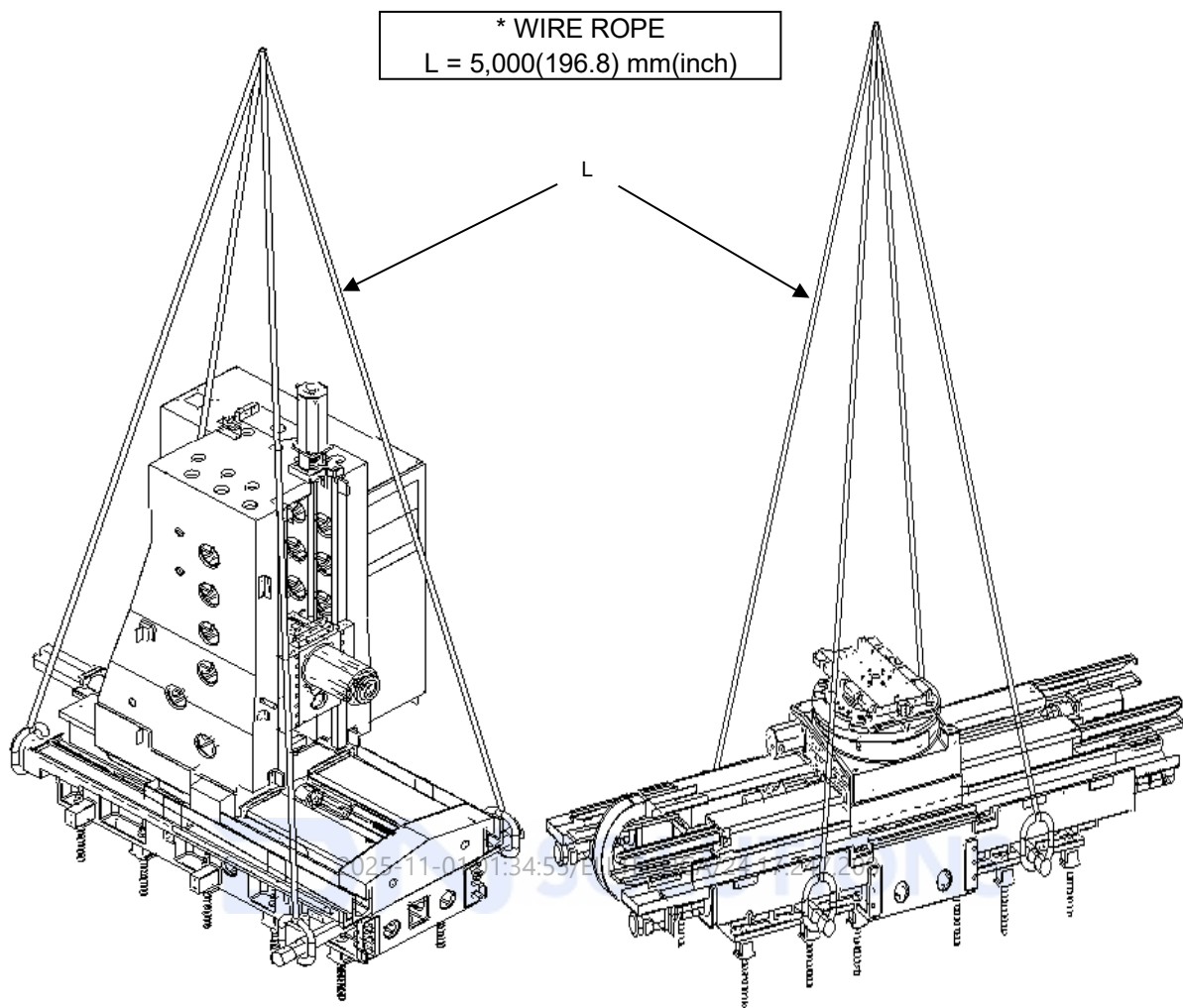
When the machine is installed on the foundation, we will supply bolts and plates (Ø80x60t)



3.3 Preparation of air and power source

Please prepare the air and power source up to the machine.

4. TRANSPORTATION



Model	Unit	Machine weight
HM 1000	kg	29 000



- ✓ A crane or forklift truck capable of safely moving the machine of which weight is equal to or heavier than the lifting weight must be used.
- ✓ When using a crane, the crane must have a lifting height enough to move the machine. (height 3 meters or more)



- ✓ The lifting weight is based on the standard specification. The lifting weight may not include the weight of some of the units removed.

5. INSTALLATION

5.1 Preliminary leveling

- (1) Lay down the machine on the floor with foundation bolts assembled.



NOTICE

- ✓ Please refer to C.3.2 for foundation bolts assembly.



CAUTION

- ✓ At this time, allow the distance from floor to bed bottom more than 60mm in order to prevent chip pan and chip conveyor from interfering with bed.

- (2) Level temporarily the machine with the parts described in C.3.2. The absolute level should be less than 0.05mm/m when the level gauge is laid on pallet.

5.2 Filling mortar in anchor bolt holes

- (1) Face roughly the surfaces of anchor bolt holes, and moisten them more than 12 hours, and finally extract water out just before filling mortar.



CAUTION

- ✓ Moisten more than 24 hours if concrete has been set more than one month.



NOTICE

- ✓ This work makes bonding and flowing characteristics of mortar better, and prevents it from being dry too fast.

- (2) Fill the mortar into anchor bolt holes - The weight proportion of (cement: anti-shrinkage additive: sand) is 1: 1: 2.7

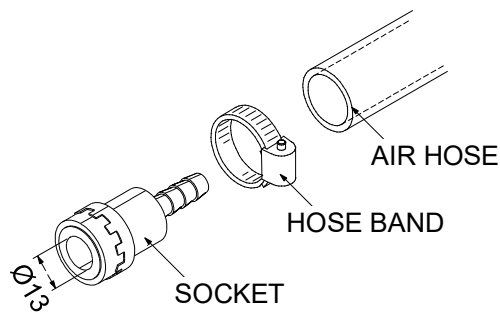


CAUTION

- ✓ Because anti-shrinkage additive expands approximate 3 hours later, this work should be completed within 30 minutes ~ 1 hours.
- ✓ Sand should be dry and nice, and should not contain mud, dust and salt.
- ✓ Composite sand, anti-shrinkage and cement properly, and apply water. At this time, be careful to absorb water into composition.
- ✓ The proportion of water: cement is 1:2.
- ✓ 10~21° C is the proper working temperature.

- (3) After filling mortar, stir it up with stick or pipe.
Using pipe is more recommended to extract air absorbed in mortar.
- (4) Prevent air from permeation by filling from one direction.
- (5) Be sure to turn off the near machines to avoid the influence of vibration during working.
- (6) Reinforce the naked surface of mortar for 2~3 days with water.
More term makes more strength.

6. AIR SOURCE CONNECTION



Perform the piping from air source to air service unit in the rear of machine.



- ✓ Use of Inner diameter $\varnothing 13$ socket with hose and a hose band.
- ✓ Be sure that the pressure of air source is 5.5~7.5kgf/cm².

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- ✓ Please use clean and dry air free of moisture and foreign matter. If necessary, install additional air dryers.
- ✓ The connection line (between factory pneumatic source and machine) of compressed air should be as short as possible.

(1) Compressed air

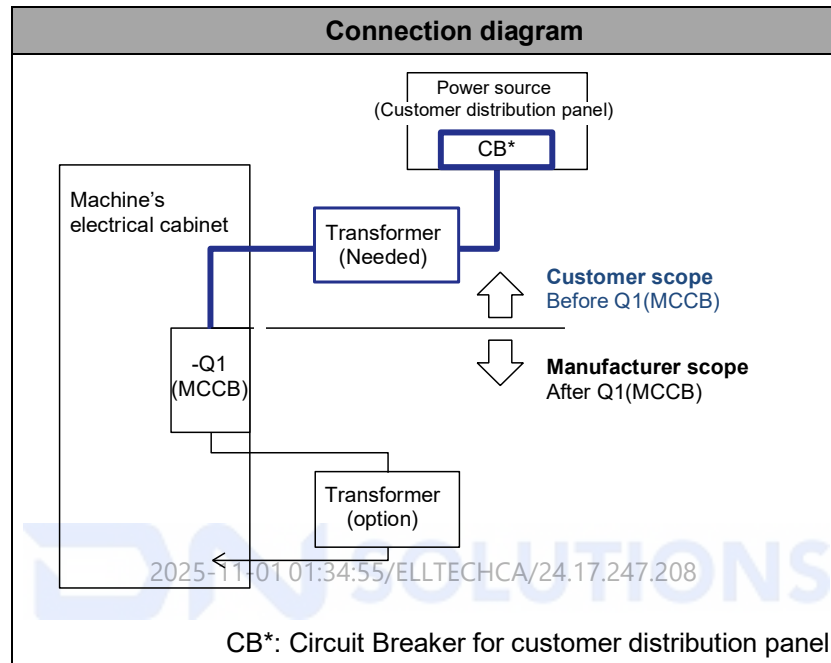
Item		Unit	Specification	
Compressed Air	Pressure	MPa	0.54	Default
	Consumption	NL/min	330	

* This Value is based on the standard spec.

7. CONNECTING POWER

7.1 Connection diagram

The following illustration shows the wiring route from the facility's input power distribution panel CB* to Q1 (MCCB, Molded Case Circuit Breaker) in the machine's electrical cabinet. The sections marked with " " indicate the cables that should be prepared by the customer on-site. When preparing a transformer, consider the power requirements and the on-site power capacity. The Transformer(option) provided by our company is configured after passing through Q1 (MCCB). The transformer configuration between the Q1 (MCCB) and facility's power source will be provided by the customer as needed.



7.2 Input power requirements

Items	Condition
Power source (*)	3Ph-AC200~480V 50/60Hz
Allowed voltage regulation ratio	Nominal voltage $\pm 10\%$
Voltage drop	Less than 15% within 0.5 sec
Frequency variation	Nominal frequency ± 1 Hz
Momentary power failure	Less than 3 msec
Voltage impulse	Less than 200% of Line-to-Line Voltage's Root Mean Square (RMS) whose peak value pulse duration is 1.5 msec
AC voltage waveform distortion	Less than 7%
Unbalance of line-to-line voltage	Less than 5%



✓ (*): Depending on the voltage specifications, a Step-up Transformer (optional) or a Step-down Transformer (optional) must be prepared.



- ✓ A voltage stabilizer is required if the voltage fluctuation exceeds the above limit. If the factory's low power capacity causes voltage drop or an unbalance in the line voltage, the machine's rated output may not be reached and it may lead to a dangerous situation. It also can be one of the reasons that causes unexpected problem or decreases the machine's life expectancy.

7.3 Power consumption and cable thickness

(1) Power capacity and cable thickness

Model	Controller	Main spindle motor	Rated power capacity Pa [kVA]	Power cable thickness S [mm ²]	
				Factory power AC 200~220V	Factory power AC 360~480V
HM 1000	FANUC	α22/7000i	68.46	50	35
		α30/6000i	80.00	70	50
		α40/6000i	89.46	70	50
		α22/10000i	68.46	50	35

*Power capacity and cable thickness can be changed depending on options.

Please contact us when you need options.

(2) Earth cable thickness

Power cable thickness S [mm ²]	Minimum cross-sectional area of earth cable [mm ²]
$S \leq 16$	$S/8$
$16 < S \leq 35$	16
$35 < S$	$S / 2$

(EN 60204-1:2018 standard.)

7.4 Calculation of input current

To choose overcurrent device (such as fuse) or on-site power circuit breaker, the maximum allowable current (A) should be checked first. Generally the input current can be confirmed by referring to the maximum allowable current (A) printed in the machine's nameplate. The input current can also be calculated by using the rated power capacity (kVA) for the cable thickness.

$$\text{Input current calculation [A]} = \frac{\text{Rated power capacity (kVA)} \times 1000}{\sqrt{3} \times \text{Factory power (V)}} \times (1.2)^{*1}$$

*1: "1.2" is tolerance, 20%. It can be reflected selectively.

Example) If the rated power capacity is 48.54kVA, factory power is AC 380V, and tolerance 20% is applied, the result of input current calculation is 88.50(A).

$$\text{Input current} = \frac{48.54 \times 1000}{\sqrt{3} \times 380} \times 1.2 = 88.50 \text{ [A]}$$

7.5 Earth

The machine should be grounded alone. If electrical welder and electrical discharge machine are earthed to the factory's steel frames, do not connect the machine's earth cable to the factory's steel frame. If earth has not been completely done, the short circuit and noise may occur.

Connect the earth cable to the external protective earth terminal (PE) placed next to the main breaker.

This machine conforms the Test 1 of **EN 60204-1:2018 – part 18.2.2.**

As described in the regulation **EN 60204:2018**, earthing must be done to protect the machine.

7.6 Connecting power cable

(1) The machine power connection must consider the following.

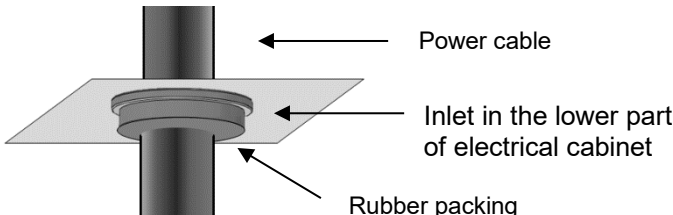
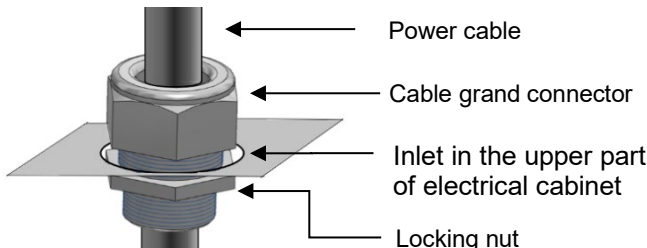
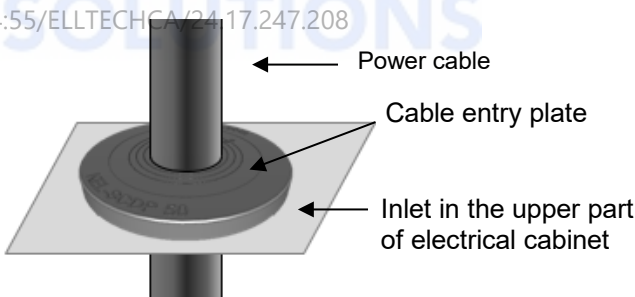
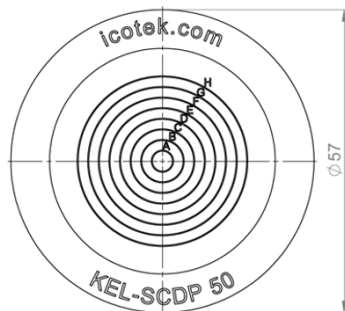
- Current laws and technologies regarding the power installation place.
- All values specified on the name plate

(2) Shut all factory power before connecting the power.

(3) Insert the factory power cable into the electrical cabinet inlet. Ensure that dust particles and liquid do not enter the machine through the inlet. Please use the parts to maintain air tightness. When inserting the cable to the upper part, please use the cable entry plate provided by us or the cable gland connector prepared by yourself.

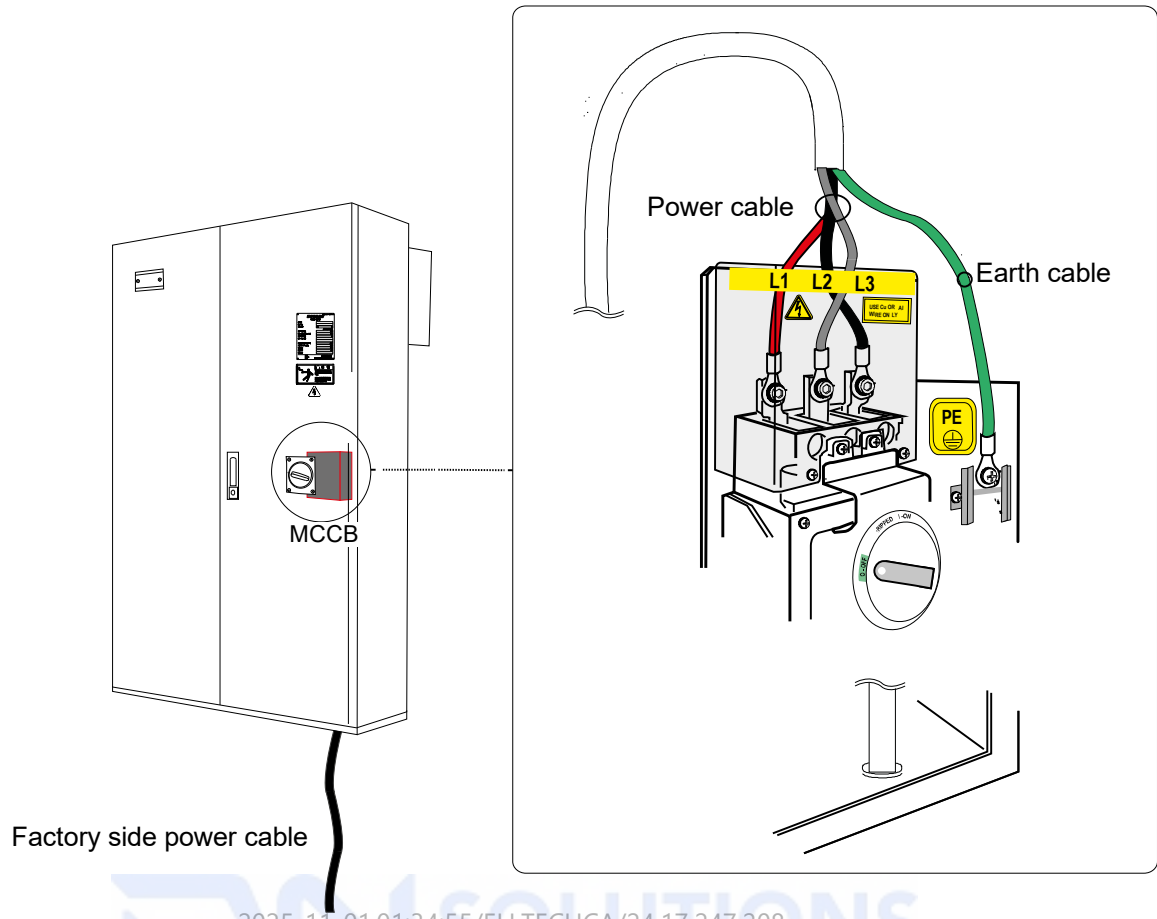
When inserting the cable to the lower part, please use rubber packing.



Location of inlet	Parts for maintaining air tightness	To Do																	
Lower part of electrical cabinet	Rubber Packing (Provided by us)	Cut packing considering cable's thickness 																	
Upper part of electrical cabinet	Cable grand connector	Grand connector work for inlet 																	
	Cable entry plate (Provided by us) Spec.: KEL-SCDP50 Maker: ICOTEK	Check the table below and cut the membrane ring of the cable entry plate to use. 2025-11-01 01:34:55/ELLTECHCA/24.17.247.208  <table><thead><tr><th>Membrane ring</th><th>Cable - Ømm</th></tr></thead><tbody><tr><td>A</td><td>8 – 12</td></tr><tr><td>B</td><td>10 - 18</td></tr><tr><td>C</td><td>16 – 23</td></tr><tr><td>D</td><td>21 – 26</td></tr><tr><td>E</td><td>24 – 28</td></tr><tr><td>F</td><td>26 – 31</td></tr><tr><td>G</td><td>29 – 34</td></tr><tr><td>H</td><td>33 - 36</td></tr></tbody></table> 	Membrane ring	Cable - Ømm	A	8 – 12	B	10 - 18	C	16 – 23	D	21 – 26	E	24 – 28	F	26 – 31	G	29 – 34	H
Membrane ring	Cable - Ømm																		
A	8 – 12																		
B	10 - 18																		
C	16 – 23																		
D	21 – 26																		
E	24 – 28																		
F	26 – 31																		
G	29 – 34																		
H	33 - 36																		

Reference: <https://youtu.be/GUfwEWmg0tA>

- (4) Connect the power cable to the L1, L2, L3 and earth terminal (PE) of Molded Case Circuit Breaker (MCCB).



- (5) With electrical cabinet's MCCB turned off, check short circuit and earth.
Use a tester to see if there's an electrical continuity among the secondary electrical power's each phase (1L1, 1L2, 1L3), PE lines, and 3 phases.
- (6) Before turning on the main power circuit breaker, use a phase detector to check whether the sequence of the three phases "R(L1)-S(L2)-T(L3)" is normal.
- (7) Turn the factory power on and check the input power voltage.
- (8) Ensure that the rotating direction of hydraulic pump motor is CW.
If it does not rotate clockwise, check the order of the three phases again.



- ✓ Incorrect wiring can cause serious damage to the NC device and various motors.

7.7 Cautions when connecting power



- ✓ To prevent electric shock, the power cable connection and earth works should be done by an authorized engineer.



- ✓ Do not serially connect the power cable and earth. Doing so may lead to bad influence to other device or cause malfunction.
- ✓ Do not let the power cables laid on floor. Being laid on the floor, the cable becomes vulnerable to damages by chips and other causes.
- ✓ Always use power cables with specified quality. When cables or accessing cables are damaged, immediately stop the machine operation. Risk of electric shock or fire exists. When a cable is damaged, stop using it and replace it with a new one.

7.8 Residual Current Device, RCD

To prevent electric shock and fire caused by leakage current, if installing a Residual Current Device (RCD) instead of a Circuit Breaker (CB) in the distribution panel of the customer's factory, please select a product that satisfies the following conditions.

Selection criteria for Residual Current Devices (RCDs)

- RCD B-type
- Rated residual current 300 mA



- ✓ Electric shock or fire when using unsuitable residual current protective devices.
- ✓ In the case of a fault, converters can generate irregular DC fault currents, which render normal residual current devices (RCDs) unusable.
 - Protect the converter by using the recommended B-type RCD.
 - Even when using higher-level Residual Current Devices (RCDs), B-type RCDs must be used.

8. DISASSEMBLING OF FIXTURES & CLEANING OF MACHINE



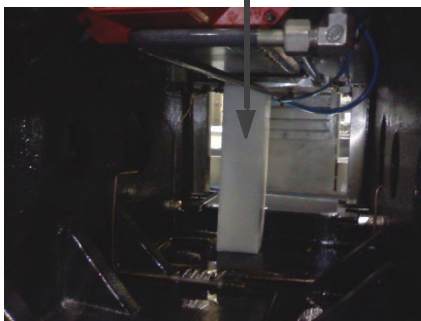
- ✓ Each axis is clamped with fixtures for safety in delivery. Therefore, be sure not to operate the machine without disassembling these fixtures.
- ✓ After disassembling fixtures, clean out the anti-corrosion oil on the machine with wash oil or gasoline if not designated by factory, and lubricate the cleaned parts.
- ✓ At this time, be careful not to use improper oil which can affect paint on the machine and be careful to avoid fire.
- ✓ The figure below shows the position of each fixture(red color painted parts).

Z axis fixture
(Red color painted)



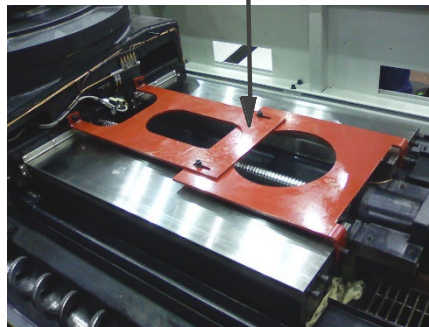
<Fixture between column and column bed>

Y axis fixture



<Support spindle head>

X axis fixture
(Red color painted)



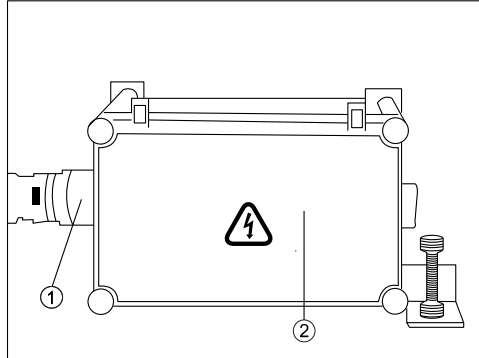
<Fixture between table and table bed>

9. REASSEMBLING OF REST DEVICES

After finishing disassembling fixtures, reassemble the separated devices for transportation.

(1) Connectors

The electrical connectors are located at the lower part of electrical cabinet and in the rear of the machine, and they are showed in left figure.



Symbol	Description
1	Connection for chip conveyor and coolant devices.
2	Terminal box

(2) Reassembling of Signal tower

Check the tap position for lamp, and assemble.

(3) Reassembling of optional devices

Check their position and state, if any devices are attached.

(4) Coolant tank & chip conveyor

1) Push-in the coolant tank with chip conveyor on, taking care of the coolant outlet position in the bottom of splash guard.

Bad positioning results in coolant leakage.

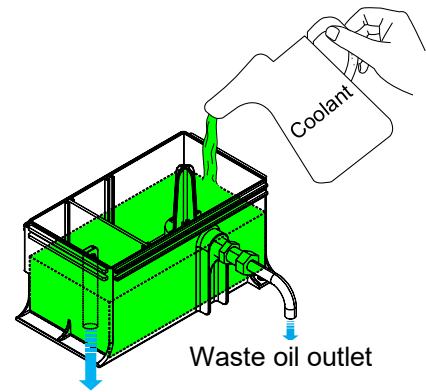
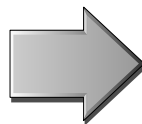
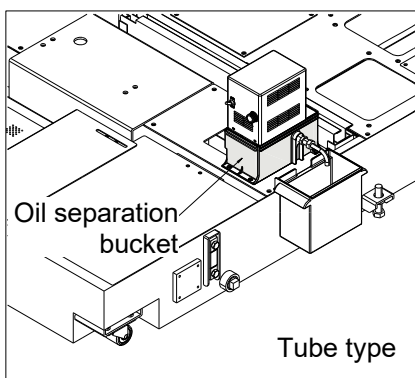
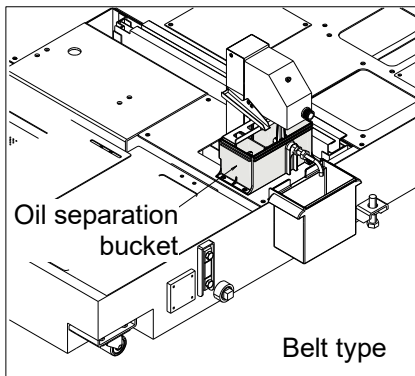
2) Connect the piping connector for coolant pump.

Also connect the piping connector for T-S-C recovery pump, shower pump if attached.



NOTICE

- ✓ Fill the oil separation bucket with enough clean coolant at the beginning of the installation of the machine. If the initial coolant is not filled, you won't be able to separate the oil and coolant.



Coolant recovery outlet

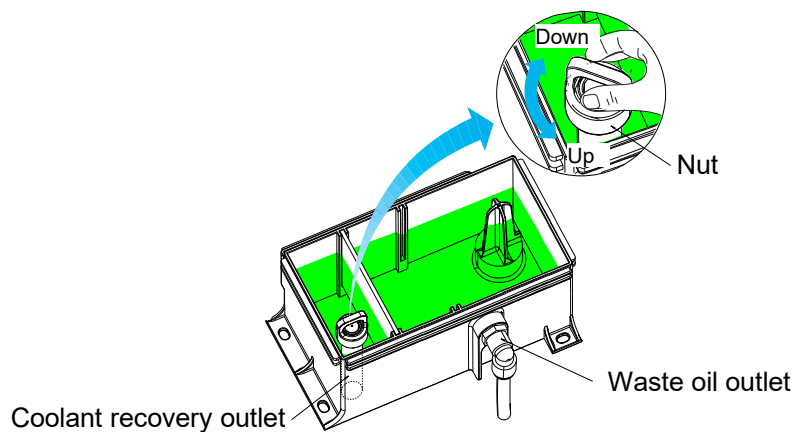
< Oil separation bucket >

2025-11-01 01:34:55/ELLTECHCA/24.17.247.208



NOTICE

- ✓ Adjust the height of the coolant recovery outlet relative to the waste oil outlet to the appropriate level using the nut on the coolant recovery outlet. Be careful not to discharge the coolant through the waste oil outlet or allow any waste oil to flow into the coolant tank. (NOTE: Certain models may not have a nut for adjusting the height of the coolant recovery outlet.)



10. SUPPLYING OIL

Before the operation, fill the tank with proper oil up to the 'H' mark on the oil level gauge attached to the each tank.

11. FINAL LEVELING AND INSPECTION

After machine installation, please check finally the state of each part, refering to Factory control file and Section E.

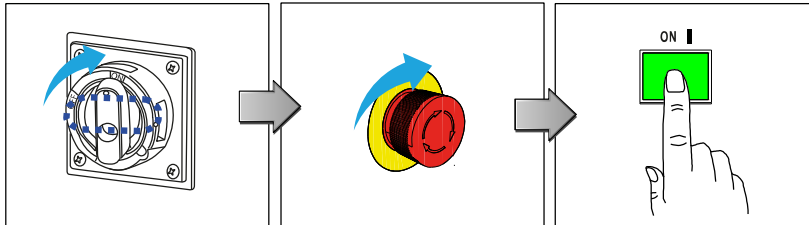
At this time, because it needs machine operation, please fully understand those in Machine operation manual before final inspection.



12. MACHINE POWER ON/OFF

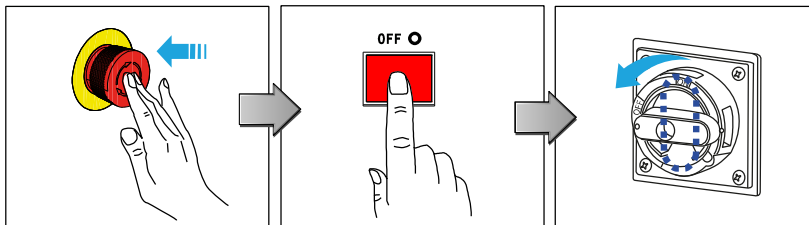
12.1 Machine power ON

- (1) Turn the electrical cabinet's main power ON.
- (2) Release the emergency stop pushbutton switch state.
- (3) Press the NC power “ON” button on the operation panel.
- (4) Check if any alarm has been triggered, perform zero point return if necessary, and then start an operation.



12.2 Machine power OFF

- (1) When the machine power is off (program finished, axis stopped, spindle stopped), press the emergency stop pushbutton switch on the operation panel.
- (2) Press the NC power “OFF” button on the operation panel.
- (3) Turn off the electrical cabinet's main power. Be sure to check if the machine has completely stopped.
- (4) Clean the machine and work space.



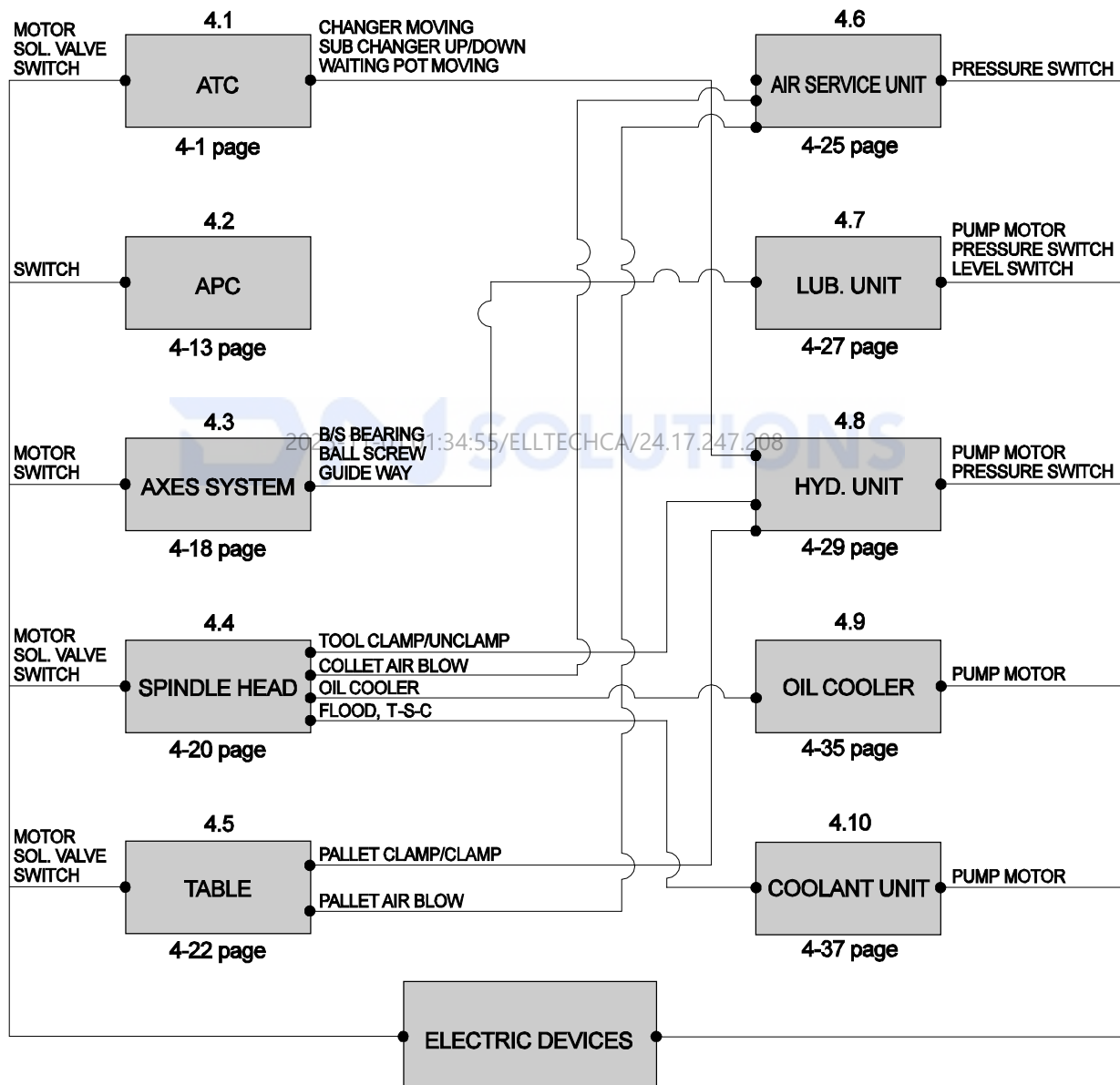
Part 5 CIRCUIT DIAGRAMS AND FUNCTIONS

In this Section, circuit diagrams and functions of machine are illustrated for understanding machine action totally. Please refer to PARTS LIST and ELECTRIC CIRCUIT DIAGRAM, if necessary.

The figure below is total circuit diagram.



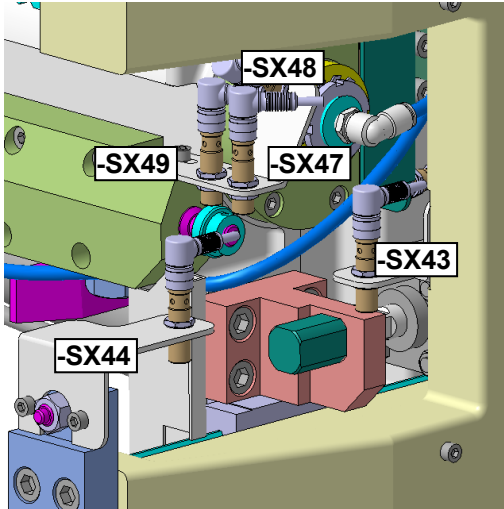
✓ Be sure to adjust each device referring to Section 8.



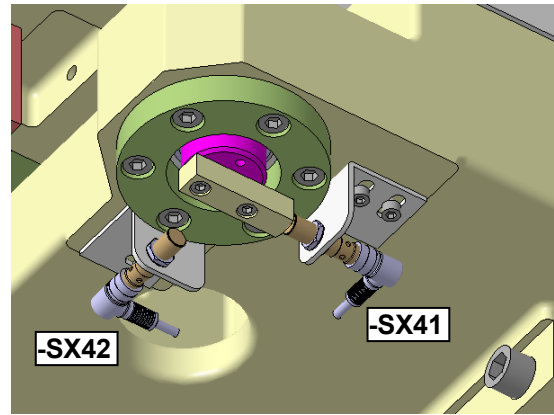
Refer to Electric diagram and Machine operation manual

1. ATC(AUTOMATIC TOOL CHANGER)

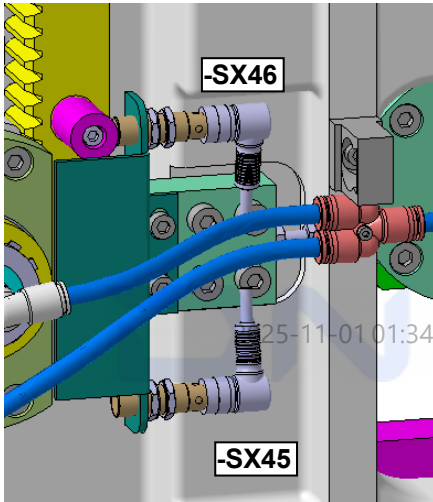
(1) Circuit diagram



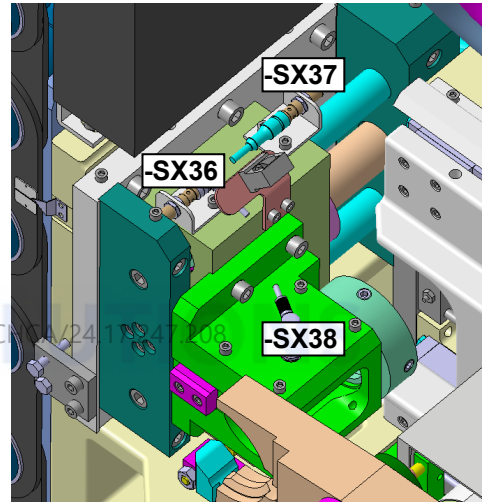
<Change Left/Right>



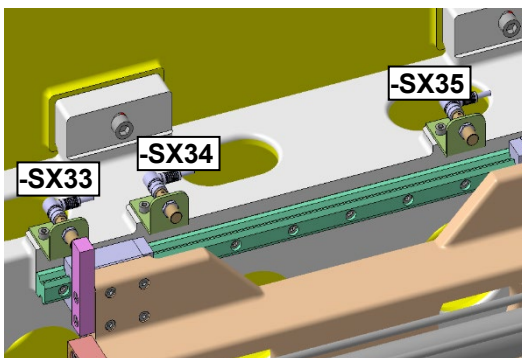
<Change Position>



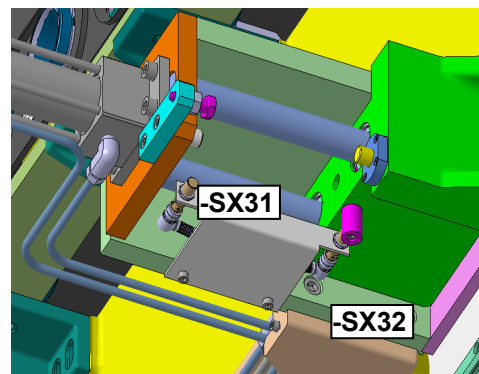
<Change Arm Rotation>



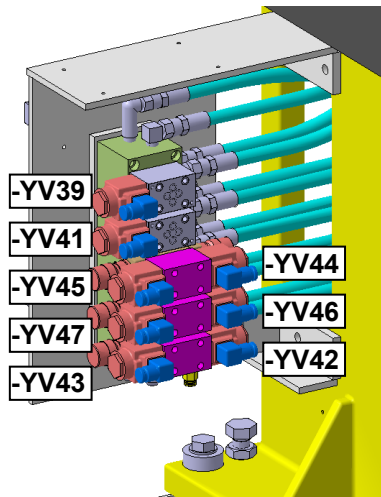
<Waiting Pot>



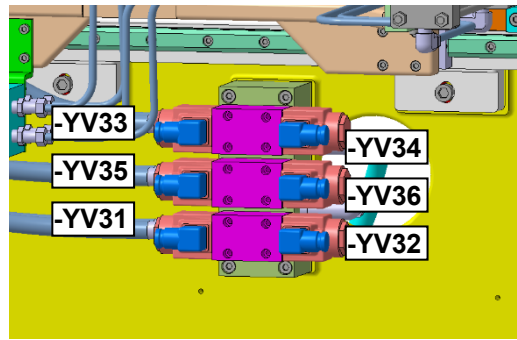
<Sub changer>



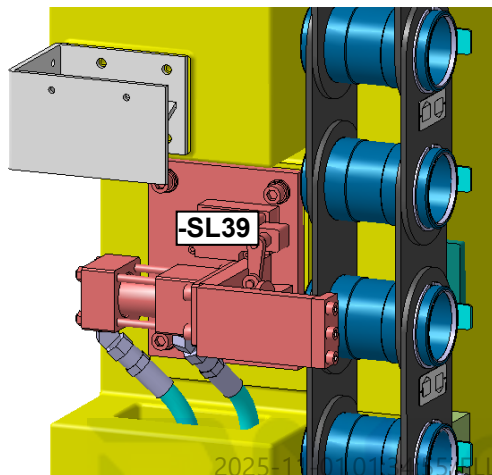
<Arm In/Out>



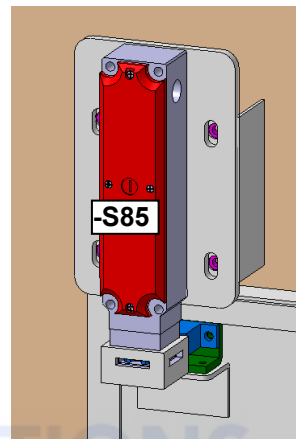
<Magazine Manifold>



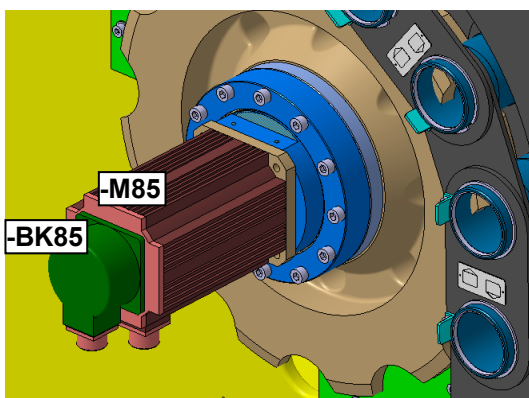
<Sub changer Manifold>



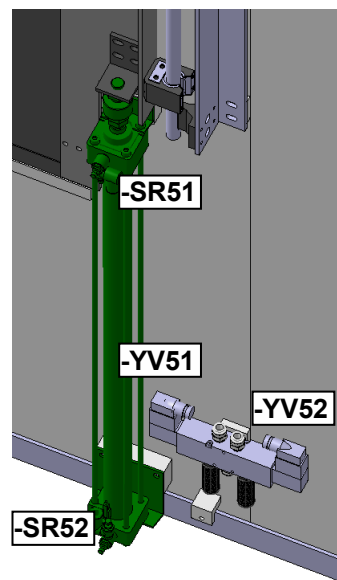
<Tool Pull-out>



<Magazine Door Lock>

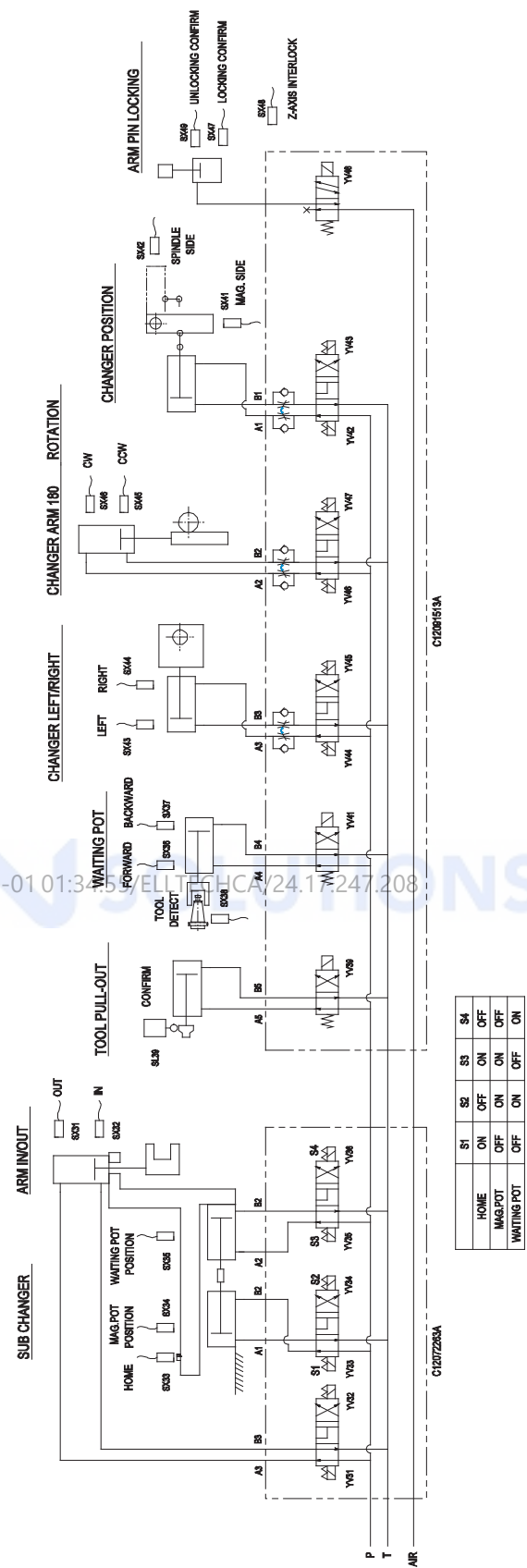


<Magazine Servo Motor>



<ATC Door & Manifold>

<CIRCUIT DIAGRAM>



(2) Functions

Type	Symbol	Description	Function	Normal
Motor	- M85	Magazine servo motor	- To drive magazine motor	OFF
Brake	- BK85	Magazine servo motor brake	- To release magazine motor brake	OFF
Valve	- YV31	Sub changer ARM IN	- To move ARM to IN position	ON
	- YV32	Sub changer ARM OUT	- To move ARM to OUT position	OFF
	- YV33	Sub changer position 1	- To move changer to home position	ON
	- YV34	Sub changer position 2	- To move changer to MAG. or waiting pot position	OFF
	- YV35	Sub changer position 3	- To move changer to home or MAG. pot position	ON
	- YV36	Sub changer position 4	- To move changer to waiting pot position	OFF
	- YV39	Tool pull-out confirm	- To pull out tool manually	OFF
	- YV41	Waiting pot forward	- To move waiting pot forward	OFF
	- YV42	Main changer magazine side	- To move changer to MAG. side	ON
	- YV43	Main changer spindle side	- To move changer to spindle side	OFF
	- YV44	Main changer left side	- To move changer to left side	ON
	- YV45	Main changer right side	- To move changer to right side	OFF
	- YV46	Main changer ARM 180 ° CCW	- To rotate arm in CCW	-
	- YV47	Main changer ARM 180 ° CW	- To rotate arm in CW	-
	- YV48	Main changer ARM pin locking	- To lock arm pin	OFF
	- YV51	ATC door open	- To open ATC door	OFF
	- YV52	ATC door close	- To close ATC door	ON
Switch	- SL39	Tool pull-out confirm	- To check pull-out CYL. Operation	ON
	- SX31	Sub changer ARM IN	- To detect arm in state	ON
	- SX32	Sub changer ARM OUT	- To detect arm out state	OFF
	- SX33	Sub changer Home position	- To check changer position in home	ON
	- SX34	Sub changer Magazine position	- To check changer position in mag.	OFF
	- SX35	Sub changer Waiting pot pos	- To check changer position in pot	OFF
	- SX36	Waiting pot forward	- To detect waiting pot forward	OFF
	- SX37	Waiting pot backward	- To detect waiting pot backward	ON
	- SX38	Waiting pot tool detect	- To check a tool in waiting pot	OFF
	- SX41	Main changer magazine side	- To check changer position in mag. side	ON
	- SX42	Main changer spindle side	- To check changer position in spindle side	OFF

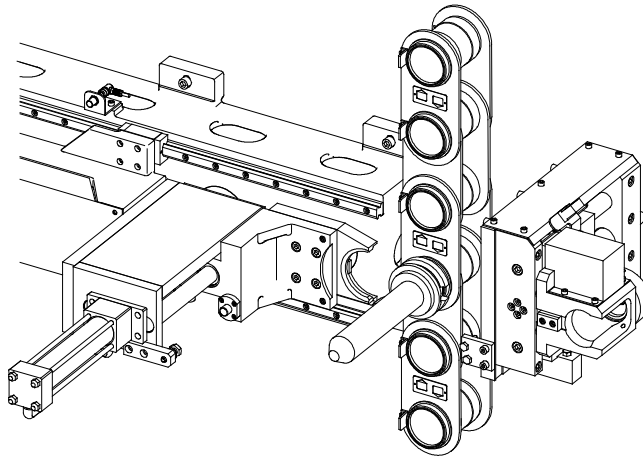
Type	Symbol	Description	Function	Normal
Switch	- SX43	Main changer left side	- To check changer position in left side	ON
	- SX44	Main changer right side	- To check changer positioning right side	OFF
	- SX45	Main changer ARM 180 ° CCW	- To detect arm 180 ° CCW State	-
	- SX46	Main changer ARM 180 ° CW	- To detect arm 180 ° CW state	-
	- SX47	ARM pin locking	- To detect pin locking state	OFF
	- SX48	ATC Z-axis interlock	- To detect Z-axis interlock state	OFF
	- SX49	ARM pin unlocking	- To detect pin unlocking state	ON
	- SR51	ATC door open	- To detect ATC door open	OFF
	- SR52	ATC door close	- To detect ATC door close	ON
	- SF31	Magazine tool pot pull out	- To pull out tool in mag.	OFF
	- S85	Magazine door lock	- To check MAG. door lock	ON



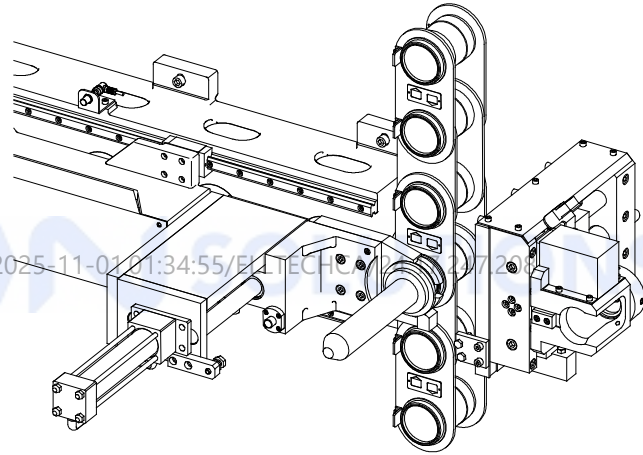
(3) Tool change sequence

1) Tool search sequence at tool magazine side

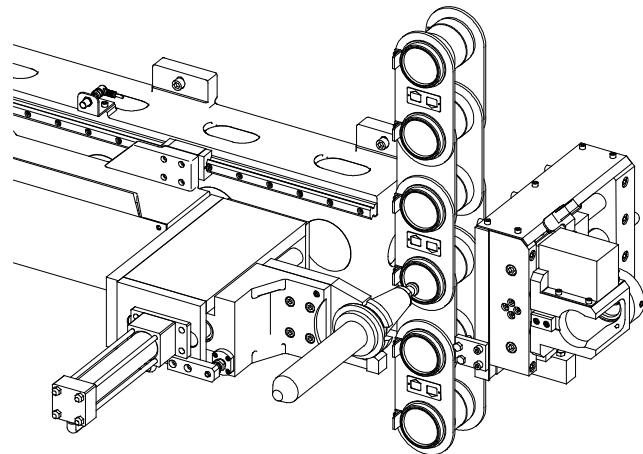
- ① Waiting for next tool search command at initial state.



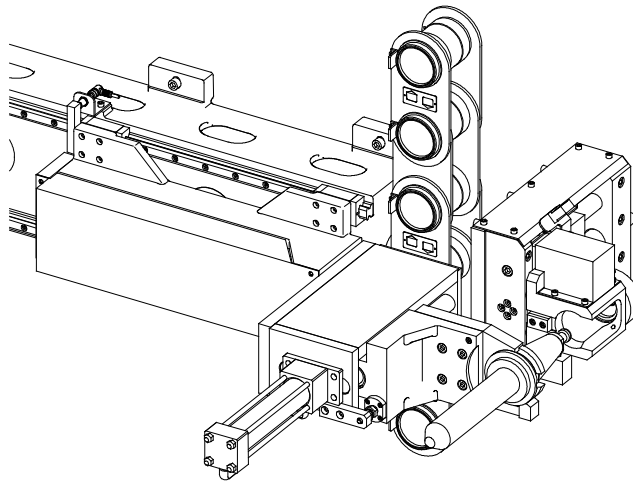
- ② After the tool is located at the tool change position, the sub-changer moves to magazine pot position



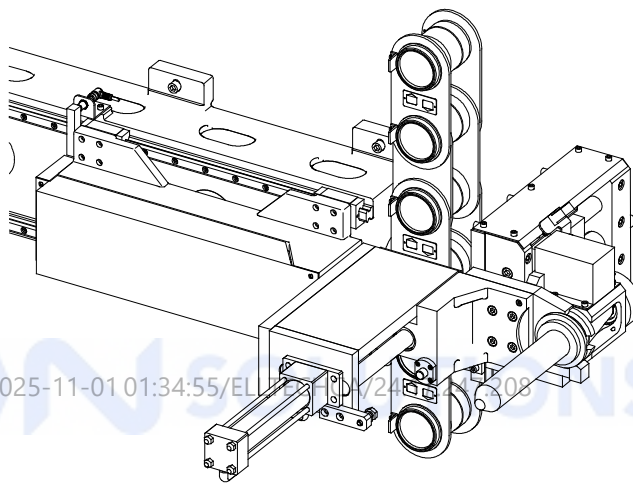
- ③ Arm out



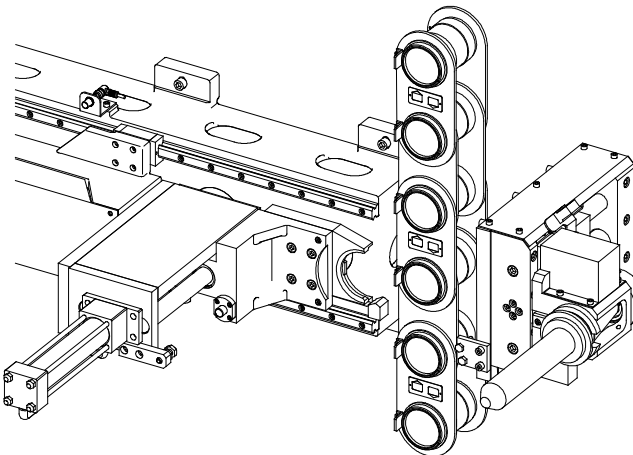
④ Sub-changer moves to waiting pot position



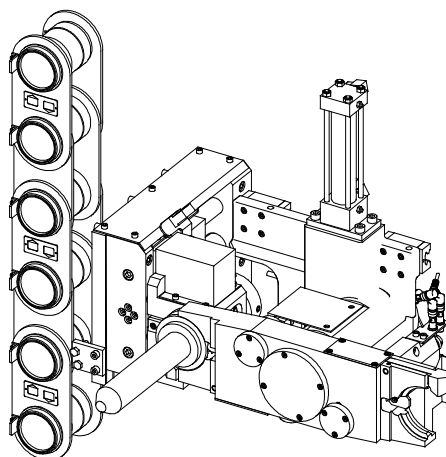
⑤ Arm in



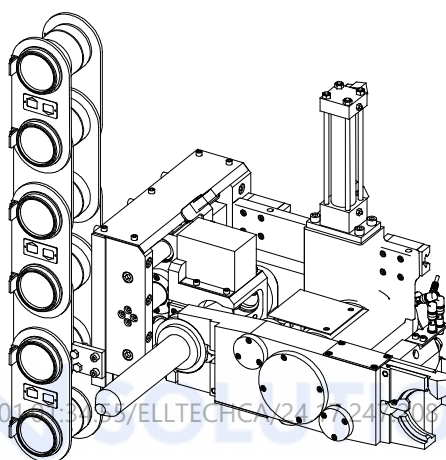
⑥ Sub-changer moves to initial position



⑦ Changer arm moves left



⑧ Waiting pot moves backward

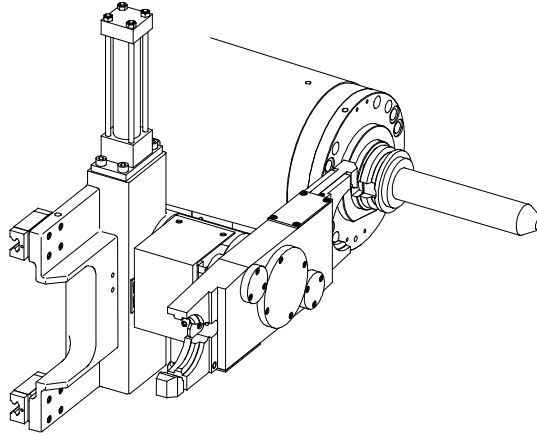


NOTICE

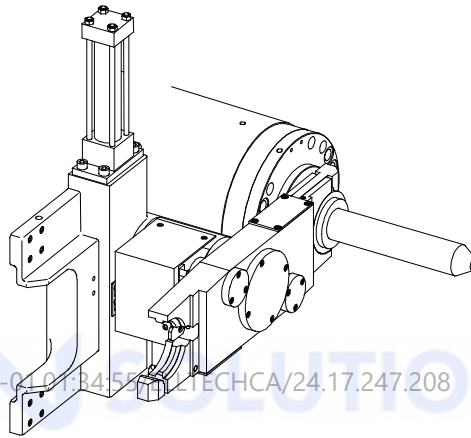
- ✓ The tools are selected by pot-address random selection method that follows the shorter path. All tools are returned to the pots from which they were taken.
- ✓ Tool selection can be executed regardless of machine movement.
- ✓ Repeated T command without tool change command (M06) makes the machine to replace the tool of waiting pot with the newly commanded tool. If the T commands are the same, the latter will be ignored.
- ✓ T155(T555) command makes the waiting pot empty. So, there will be no tool in the spindle after the execution of the following commands.
ex) T155(T555) ;
M06 ;
- ✓ If same a T command of spindle tool no, and tool change command will be ignored.
- ✓ If same a T command of spindle tool no. and tool change command (M06) is inputted, T and M06 command will be ignored.
- ✓ To shorten tool change time, T command may be executed previously before tool change command (M06).
- ✓ If T0 command is inputted, the command will be ignored.

2) Tool change sequence at main changer side

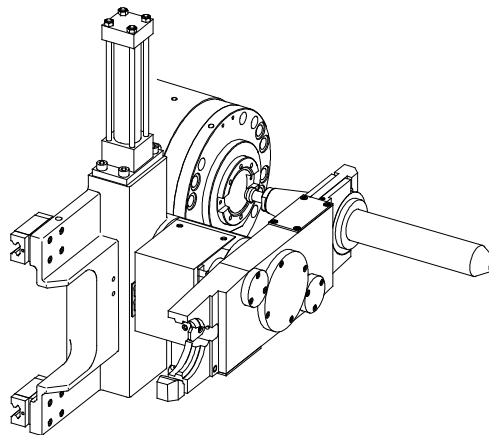
- ① Door open by M06. ATC unit rotation spindle side



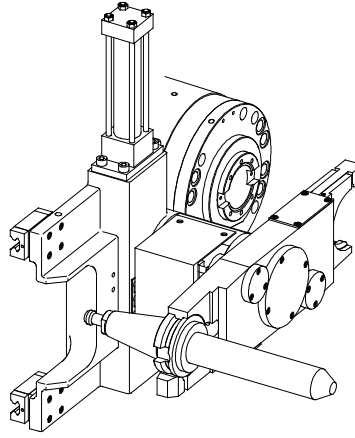
- ② Changer arm moves right. Tool unclamp



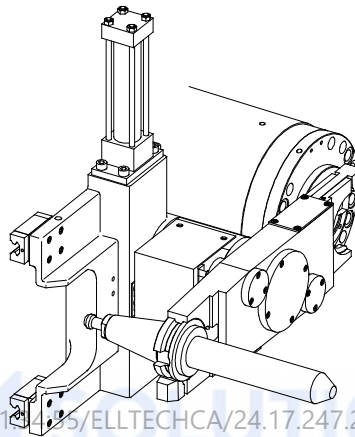
- ③ Spindle head moves backward



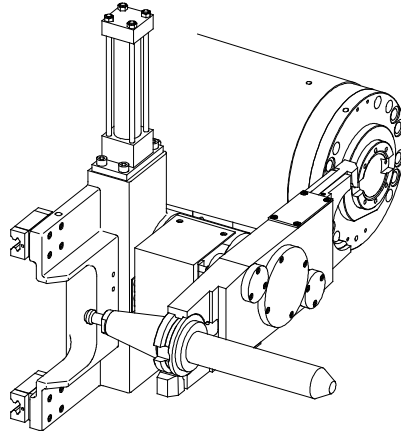
- ④ Changer arm rotation 180 ° CW/CCW



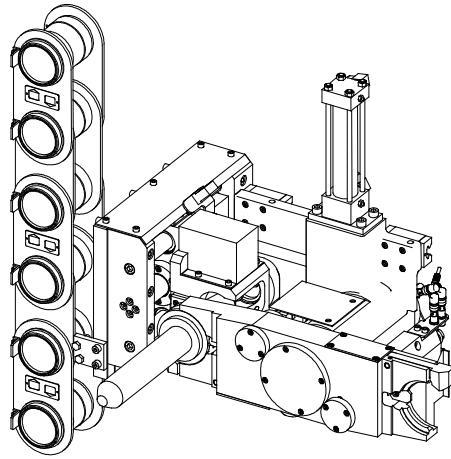
- ⑤ Spindle head moves forward. Tool clamp



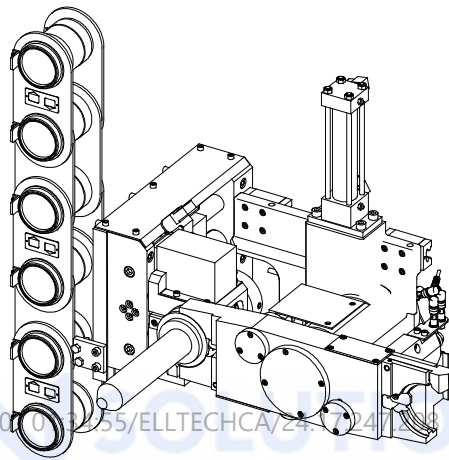
- ⑥ Changer arm moves left



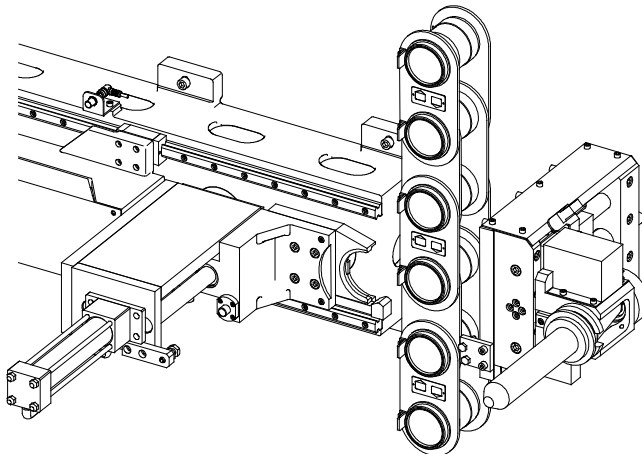
⑦ ATC unit rotation magazine side. Door close.



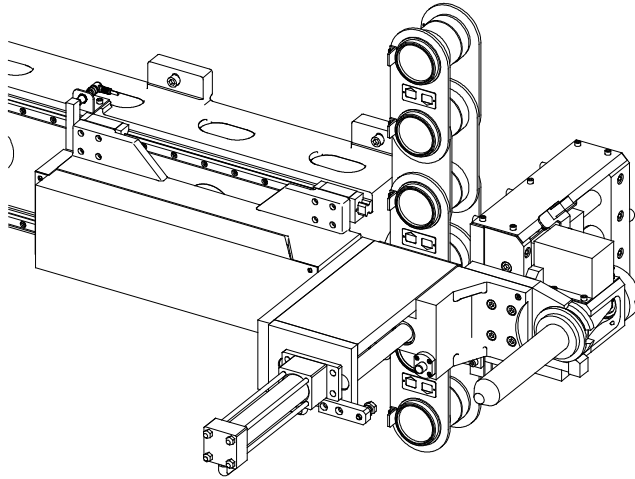
⑧ Waiting pot moves forward



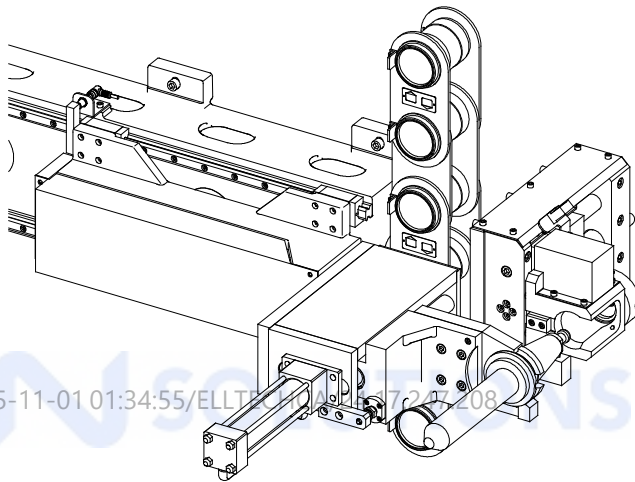
⑨ Changer arm moves right



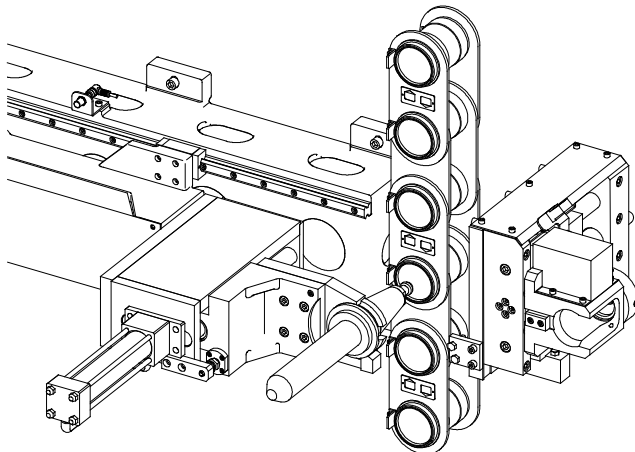
⑩ Sub-changer moves to waiting pot position



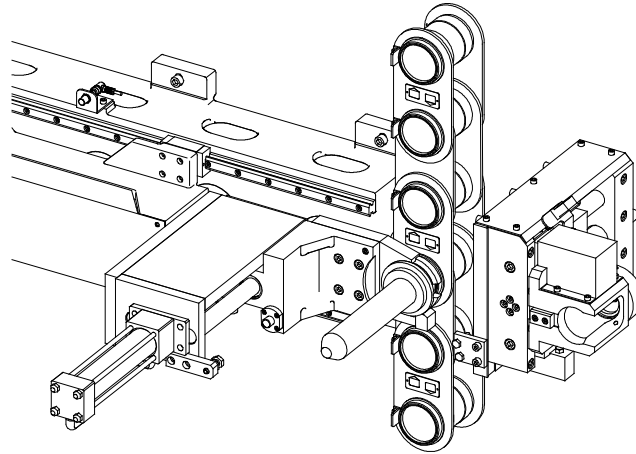
⑪ Arm out



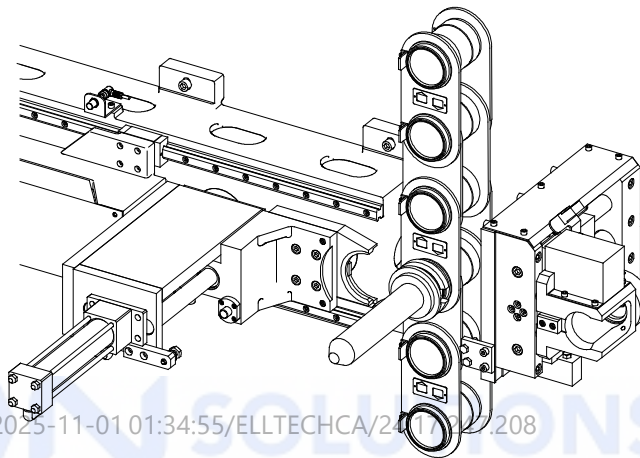
⑫ Sub-changer moves to magazine pot position



⑬ Arm in



⑭ Sub-changer moves to initial position

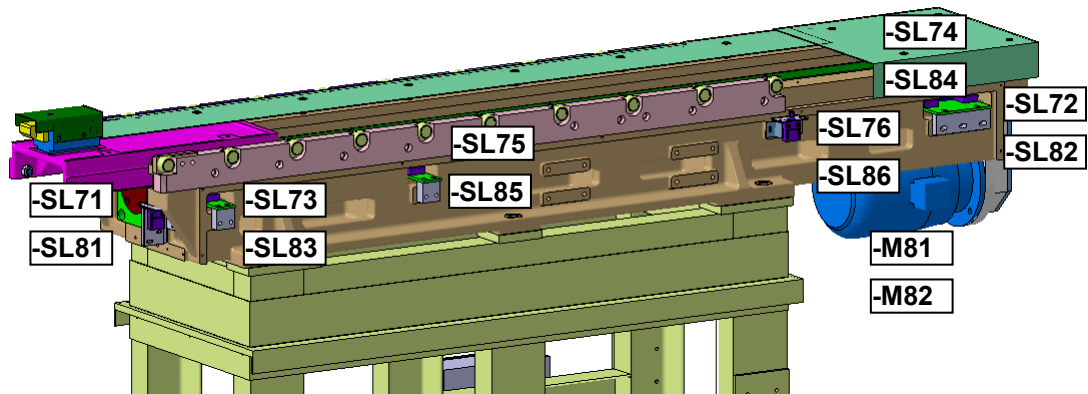


NOTICE

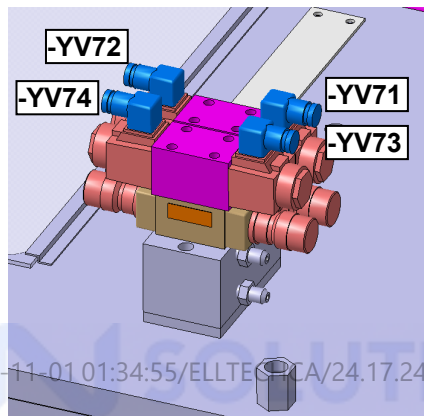
- ✓ ATC door open, movements of Y, Z axis to ATC position, spindle orientation are executed simultaneously, when M06 is commanded. But, be care of the interference between tool and workpiece during reference point return, because Y, Z axis move simultaneously.
- ✓ It is helpful to execute next tool search command directly after M06 to save tool change time.

2. APC(AUTOMATIC PALLET CHANGER)

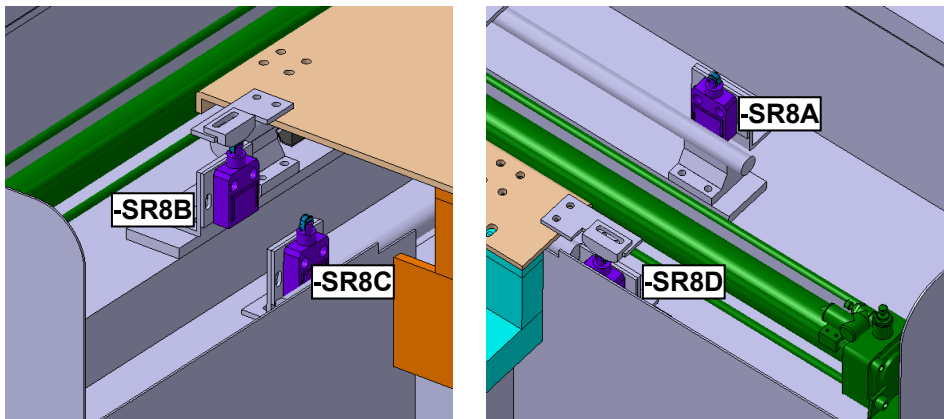
(1) Circuit diagram



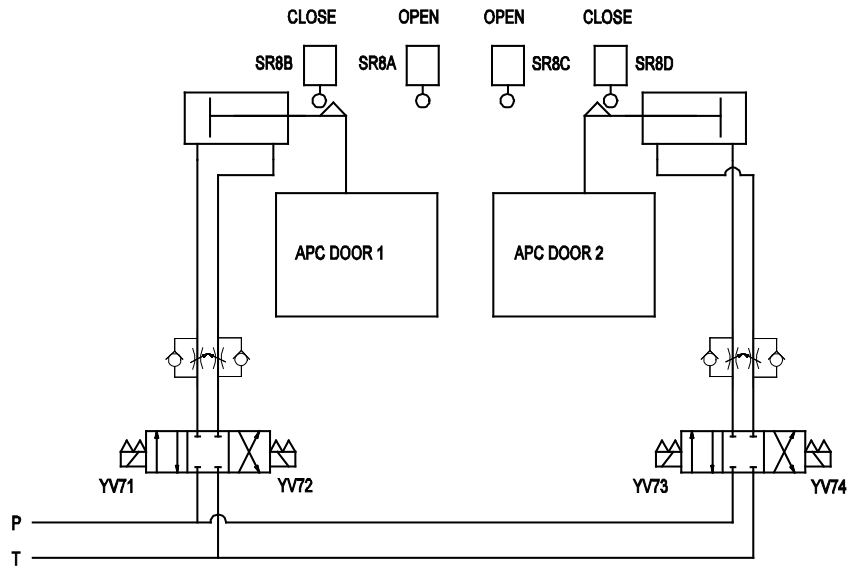
<Switch for APC>



<APC door manifold>



<Switch for APC door>



(2) Functions

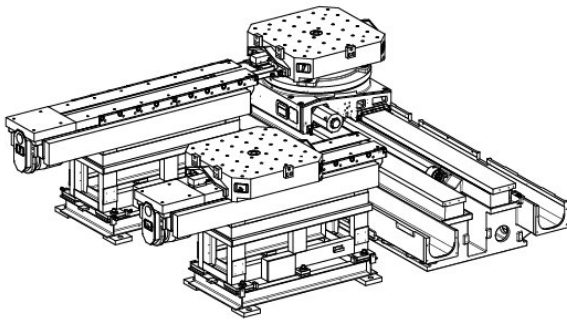
Type	Symbol	Description	Function	Normal
Motor	- M81	APC1 Motor	- To drive APC1 Motor	OFF
	- M82	APC2 Motor	- To drive APC2 Motor	OFF
Valve	- YV71	Door 1 open	- To open APC door 1	OFF
	- YV72	Door 1 close	- To close APC door 1	ON
	- YV73	Door 2 open	- To open APC door 2	OFF
	- YV74	Door 2 close	- To close APC door 2	ON
Switch	- SL71	APC arm 1 advance	- To detect APC arm1 advance state	OFF
	- SL72	APC arm 1 return	- To detect APC arm1 return state	ON
	- SL73	APC arm 1 advance slow down	- To detect APC arm1 advance slow down state	OFF
	- SL74	APC arm 1 return slow down	- To detect APC arm1 return slow down state	OFF
	- SL75	APC arm 1 waiting position	- To check APC arm1 in waiting position	OFF
	- SL76	Pallet 1 stay on APC	- To check pallet1 on APC	-
	- SL81	APC arm 2 advance	- To detect APC arm2 advance state	OFF
	- SL82	APC arm 2 return	- To detect APC arm2 return state	ON
	- SL83	APC arm 2 advance slow down	- To detect APC arm2 advance slow down state	OFF
	- SL84	APC arm 2 return slow down	- To detect APC arm2 return slow down state	OFF
	- SL85	APC arm 2 waiting position	- To check APC arm2 in waiting position	OFF
	- SL86	Pallet 2 stay on APC	- To check pallet2 on APC	-
	- SR8A	APC door 1 open	- To detect APC door 1 open	OFF
	- SR8B	- APC door 1 close	- To detect APC door 1 close	ON
	- SR8C	- APC door 2 open	- To detect APC door 2 open	OFF
	- SR8D	- APC door 2 close	- To detect APC door 2 close	ON

(3) Pallet change sequence

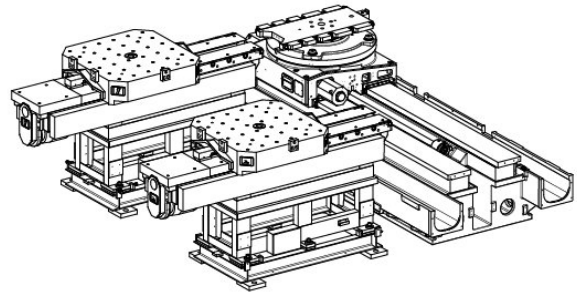
1) Door open

Pallet unclamp

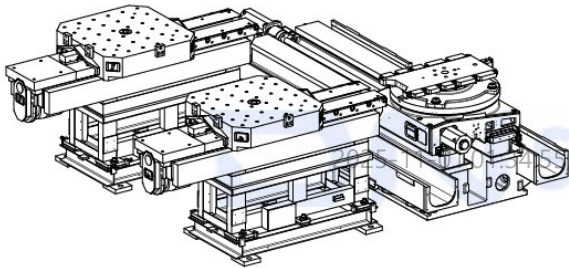
① Arm advance



② Arm retract



③ X axis move to load position

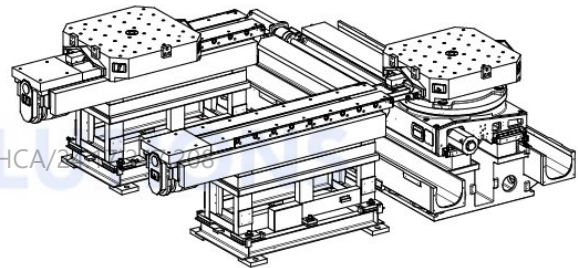


④ Arm advance

Pallet clamp

Arm retract

Door close



CAUTION

- ✓ There is a little safety function in manual operation by APC OP. box, so execute each operation with care.



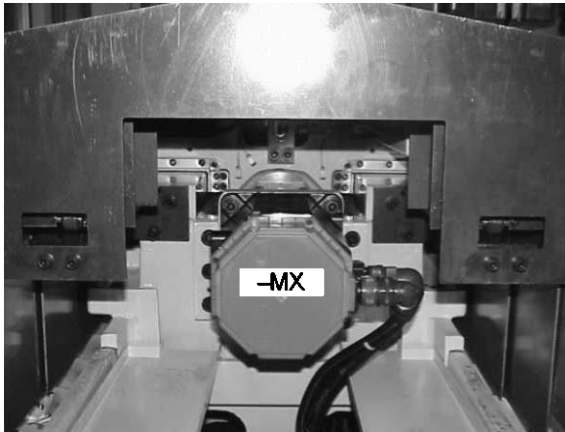
NOTICE

- ✓ Coolant stop (M09) and spindle stop(M05/M19) must be commanded out before pallet change(M06).

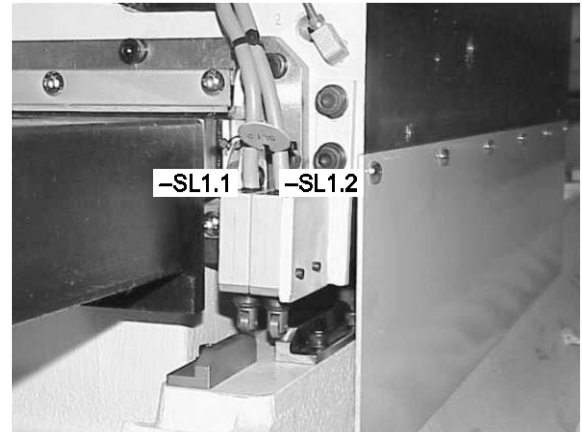
3. AXIS SYSTEM

(1) Circuit diagram

1) X axis

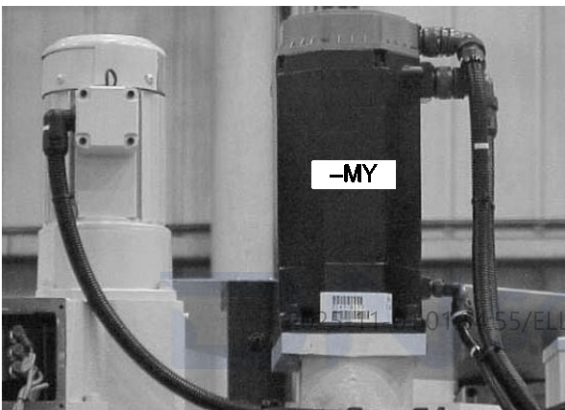


<Servo motor>

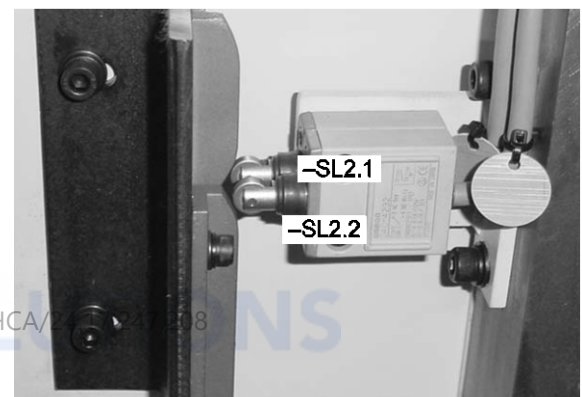


<Switch for emergency stop and reference point return>

2) Y axis

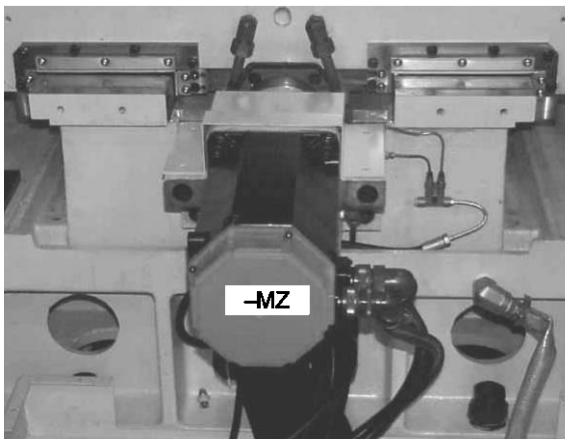


<Servo motor>

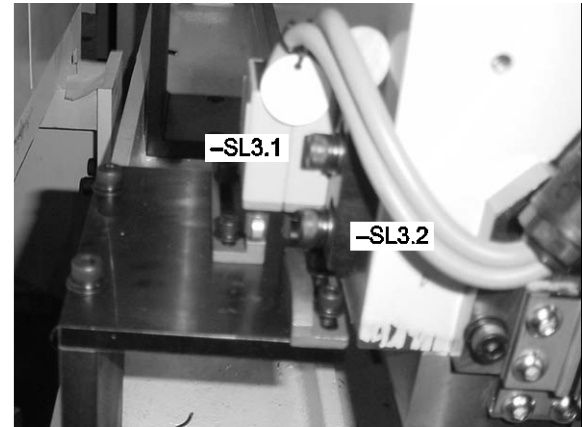


<Switch for emergency stop and reference point return>

3) Z axis



<Servo motor>



<Switch for emergency stop and reference point return>

(2) Functions

Type	Symbol	Description	Function	Normal	Location
Motor	- MX	X-Axis servo motor	- To drive X-axis	OFF	Table bed
	- MY	Y-Axis servo motor	- To drive Y-axis	OFF	Column
	- MZ	Z-Axis servo motor	- To drive Z-axis	OFF	Column bed
Switch	- SL1.1	X-Axis emergency stop	- To detect X-axis emergency stop	ON	Table bed
	- SL1.2	X-Axis reference point	- To position X-axis reference point	*	
	- SL2.1	Y-Axis emergency stop	- To detect Y-axis emergency stop	ON	Column
	- SL2.2	Y-Axis reference point	- To position Y-axis reference point	*	
	- SL3.1	Z-Axis emergency stop	- To detect Z-axis emergency stop	ON	Column bed
	- SL3.2	Z-Axis reference point	- To position Z-axis reference point	*	

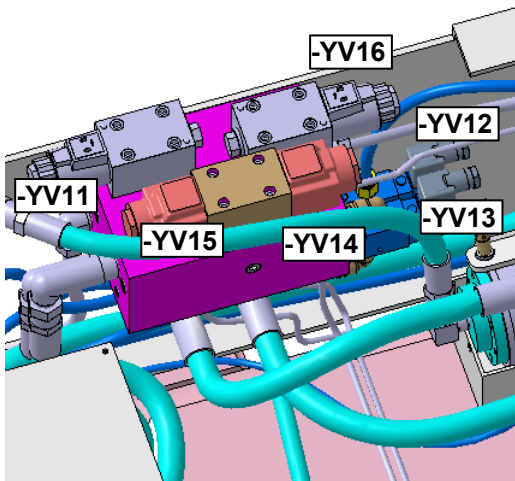


NOTICE

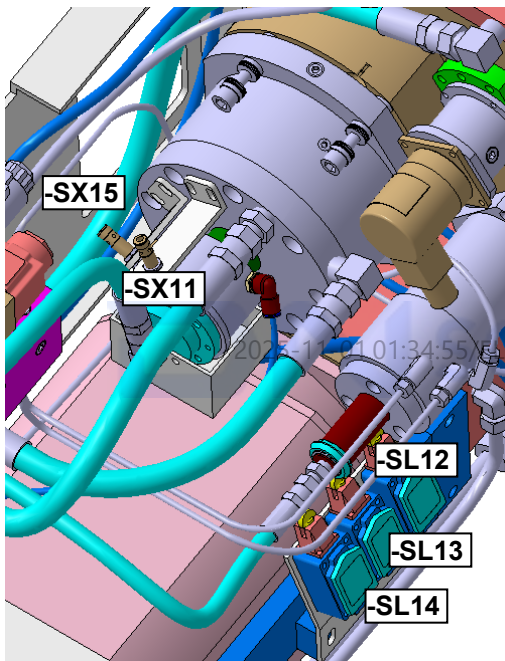
- ✓ Switch for reference point return
On the reference point return of each axis, the machine is decelerated when this switch is "OFF" at about forward 73mm from the reference point, and stops at exact position due to stop signal after this switch "ON". The shift of grid signal makes the machine stop at reference point exactly, and its adjustment is in Section G.
- ✓ Switch for emergency stop pushbutton switch
The emergency stop position is set at 6mm outside from both ends of the stroke range. When the machine goes over stroke range and this switch is actuated, emergency stop state occurs.
- ✓ As double safety device, over travel(OT) function is adapted. The OT position is set at 1mm outside from the both ends of the stroke range, and the federate stops immediately and alarm message is displayed when the machine goes over this range.

4. SPINDLE HEAD

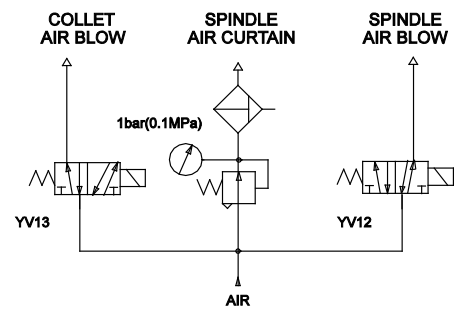
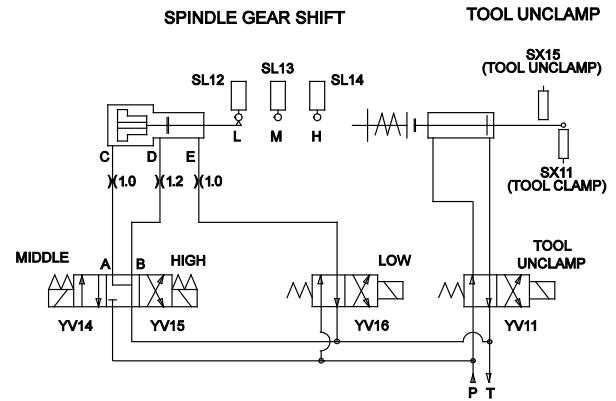
(1) Circuit diagram



<Sol. valve for spindle action>



<Switch for spindle action confirm>



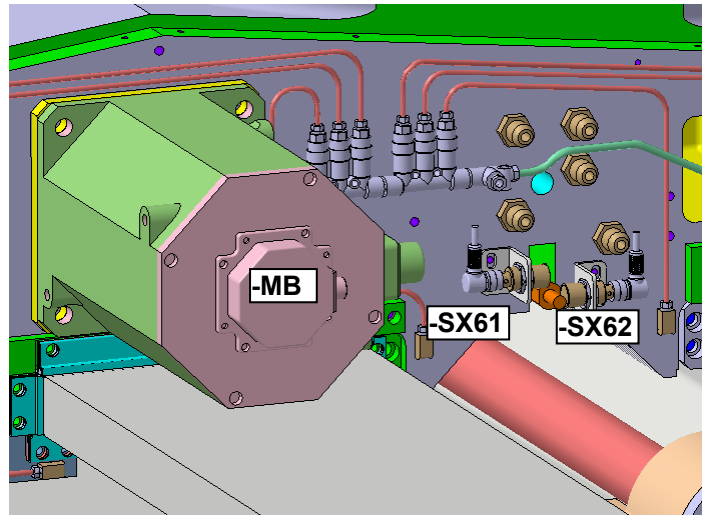
(2) Functions

Type	Symbol	Description	Function	Normal
Motor	- M1	Spindle motor	- To drive spindle	OFF
Valve	- YV11	Spindle tool unclamp	- To actuate tool unclamp	OFF
	- YV12	Spindle air blow	- To actuate spindle air blow	OFF
	- YV13	Collet air blow	- To actuate collet air blow	OFF
	- YV14	Spindle gear shift(middle)	- To shift spindle gear to middle	OFF
	- YV15	Spindle gear shift(high)	- To shift spindle gear to high	OFF
	- YV16	Spindle gear shift(Low)	- To shift spindle gear to low	ON
Switch	- SX11	Spindle tool clamp	- To detect spindle tool clamp	ON
	- SX15	Spindle tool unclamp	- To detect spindle tool unclamp	OFF
	- SL12	Spindle gear shift(low)	- To detect spindle gear shift low	ON
	- SL13	Spindle gear shift(middle)	- To detect spindle gear shift middle	OFF
	- SL14	Spindle gear shift(high)	- To detect spindle gear shift high	OFF
	- SV11	Spindle head oil overflow	- To detect spindle oil overflow	OFF

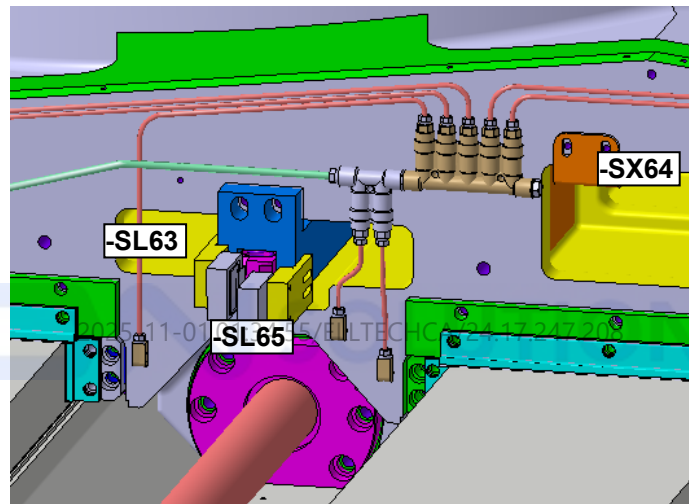


5. TABLE

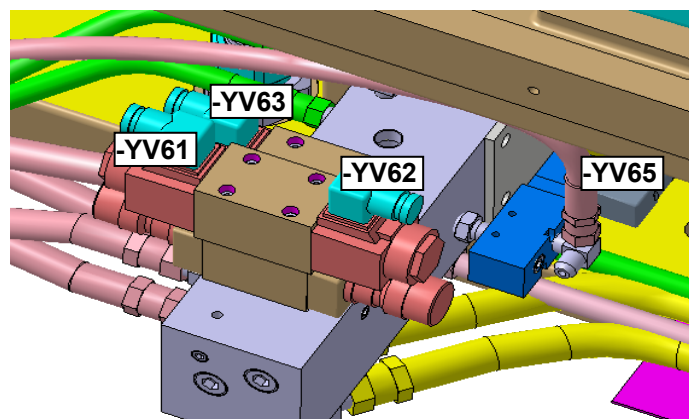
(1) Circuit diagram



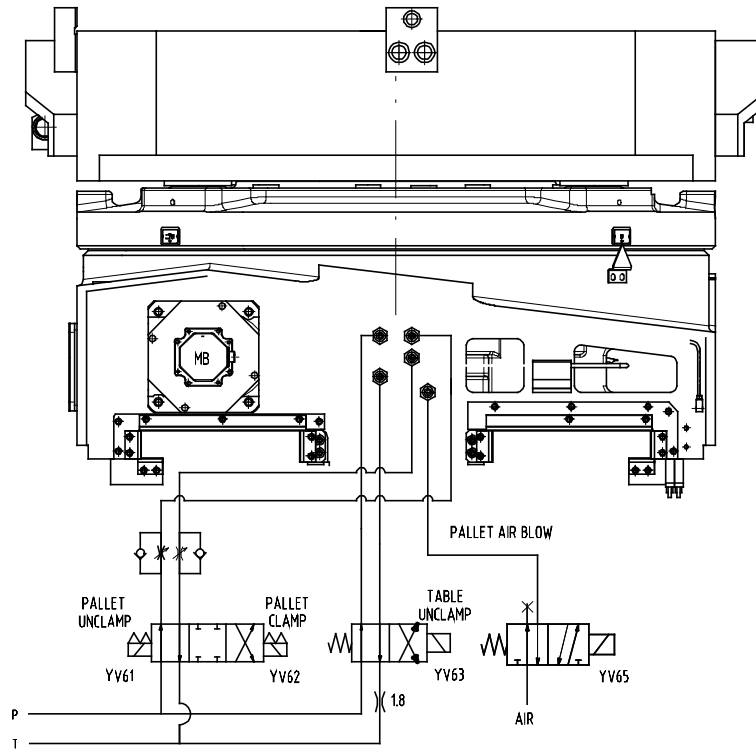
<Axis servo motor and switches>



<Switch for table action confirm>



<Table manifold>



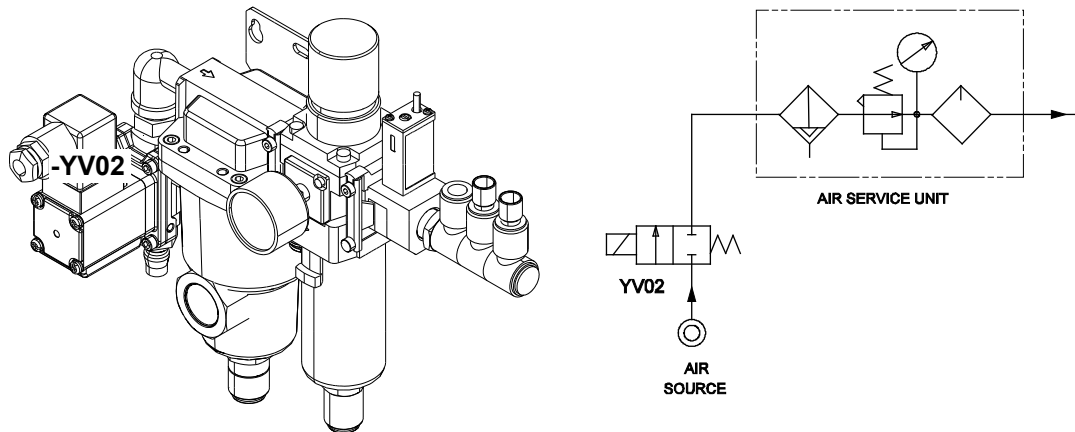
<Circuit diagram>

(2) Function

Type	Symbol	Name	Function	Normal
MOTOR	- MB	B-Axis servo motor	- B-Axis servo motor	OFF
VALVE	- YV61	Pallet unclamp	- Pallet unclamp on table	OFF
	- YV62	Pallet clamp	- Pallet clamp on table	ON
	- YV63	Table unclamp	- Table unclamped	OFF
	- YV65	Pallet cleaning air	- APC air blow	OFF
SWITCH	- SP61	Pallet clamp	- Pallet clamp check	ON
	- SL62	Table clamp	- Table clamp confirm	ON
	- SL63	Pallet changing position	- APC position of table checked	OFF
	- SX64	Pallet stay on table	- Detected pallet on the table	OFF
	- SL65	Table unclamp	- Detected table unclamp	OFF

6. AIR SERVICE UNIT

(1) Circuit diagram



<Air service unit>

(2) Functions

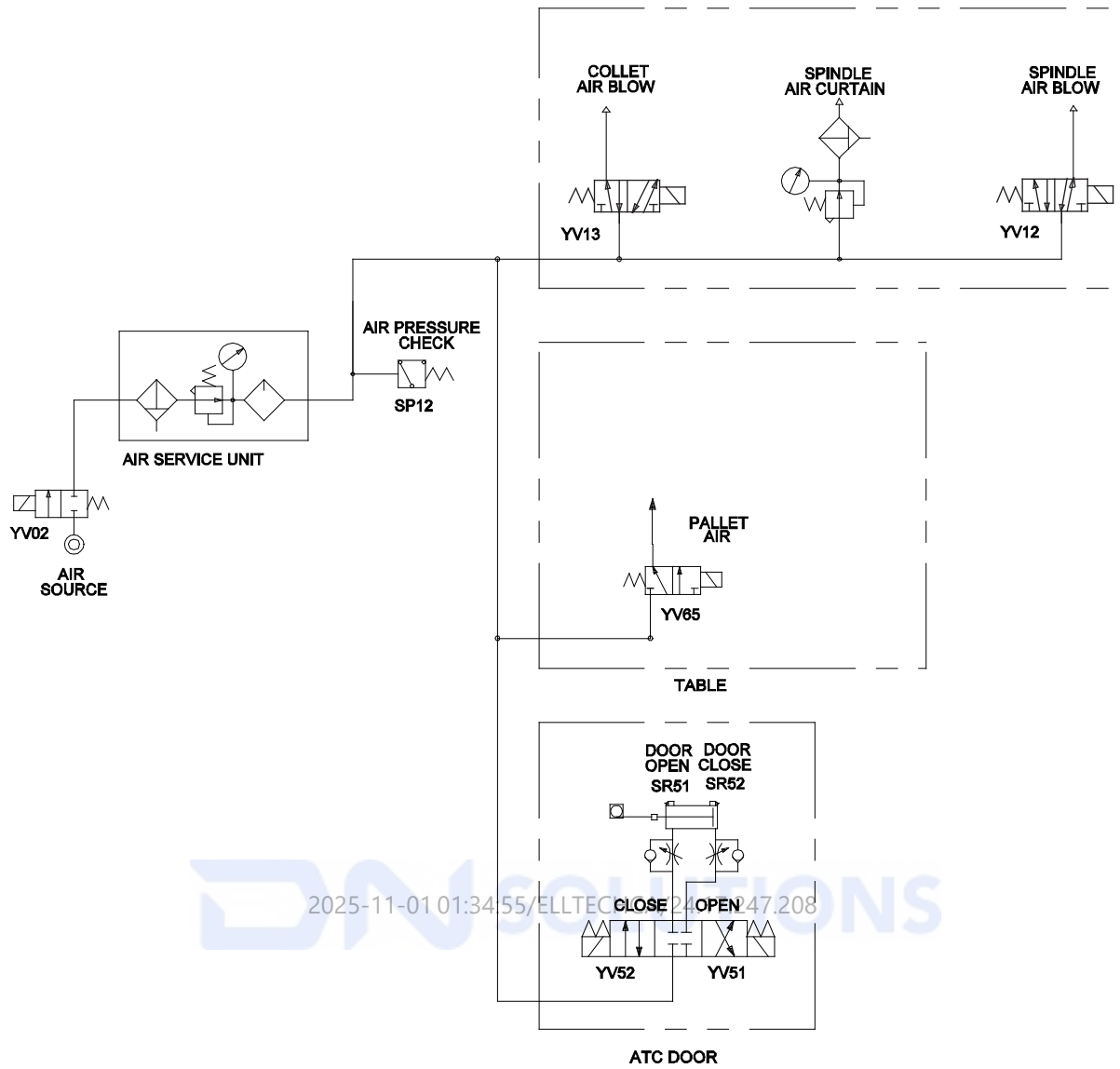
Type	Symbol	Description	Function	Normal
Valve	- YV02	Main air source	- To disconnect air line when main power is OFF	ON
Switch	- SP61	Air pressure check	- To detect air pressure down	ON



NOTICE

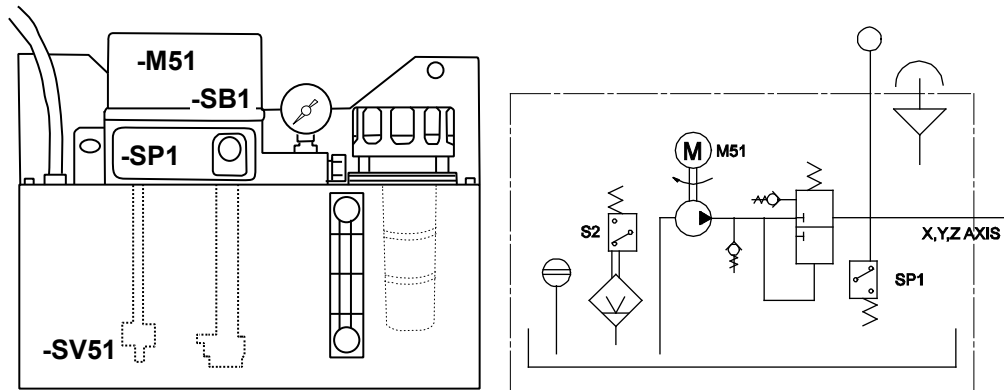
- ✓ To prevent spindle damage caused by coolant and dust particles inside the spindle, the machine is designed to create an air curtain at the spindle even after the spindle rotation is stopped but with the power ON. Continuous creation of air curtain is not a malfunction. When the machine power if off, the air curtain stops too.

(3) Air diagram of std. machine



7. LUBRICATION UNIT

(1) Circuit diagram



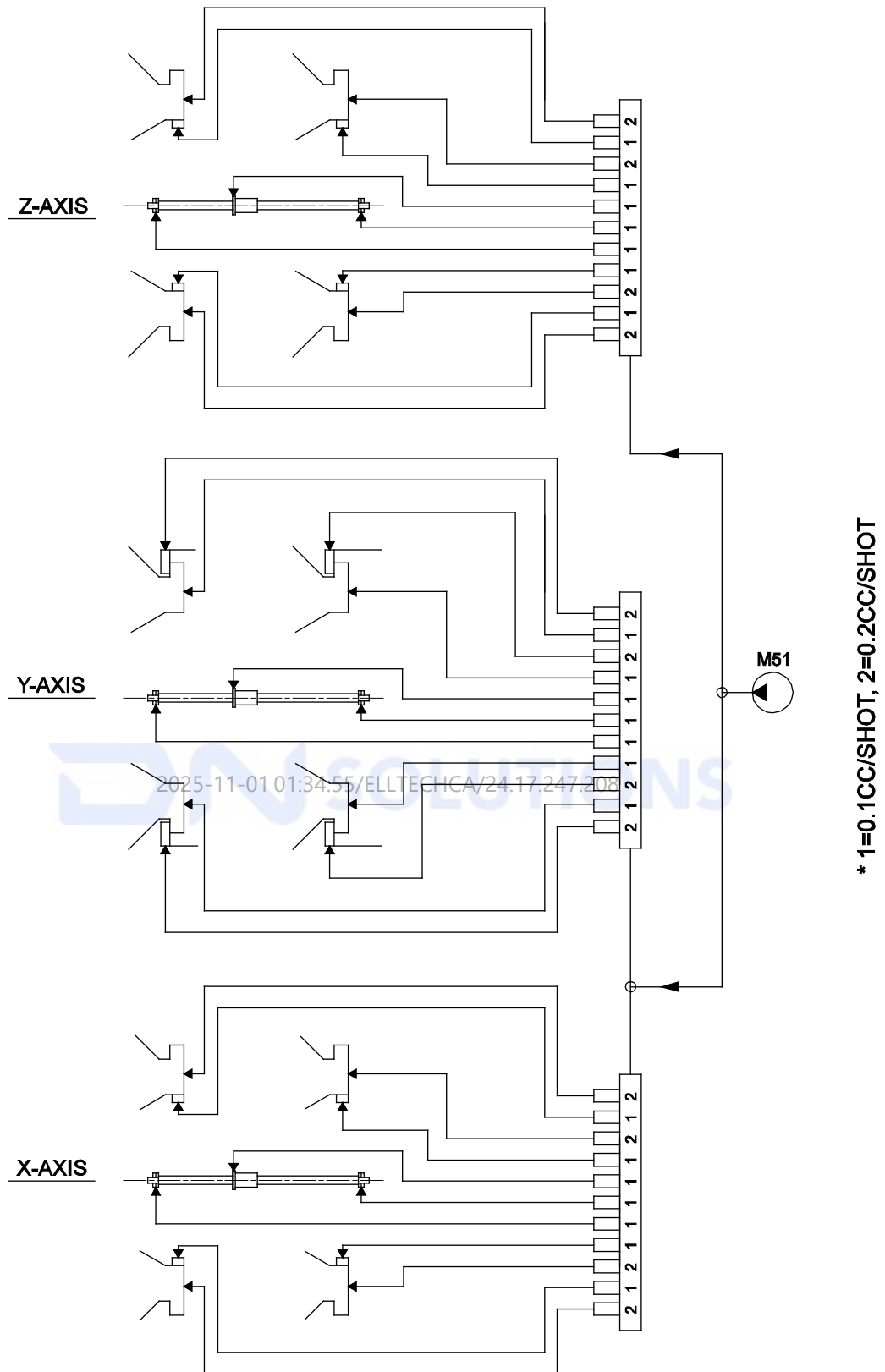
NOTICE

- ✓ The pump is actuated periodically by NC signal. The period is set by NC parameter. The normal consuming rate(1 cycle/4 minutes) is about 60cc/hour.
- ✓ When lubricant is reduced to the lower limit of level gauge, the float switch signal will stop the machine under BLOCK END STOP mode.
If lubricant is replenished, the alarm is released.

(2) Functions

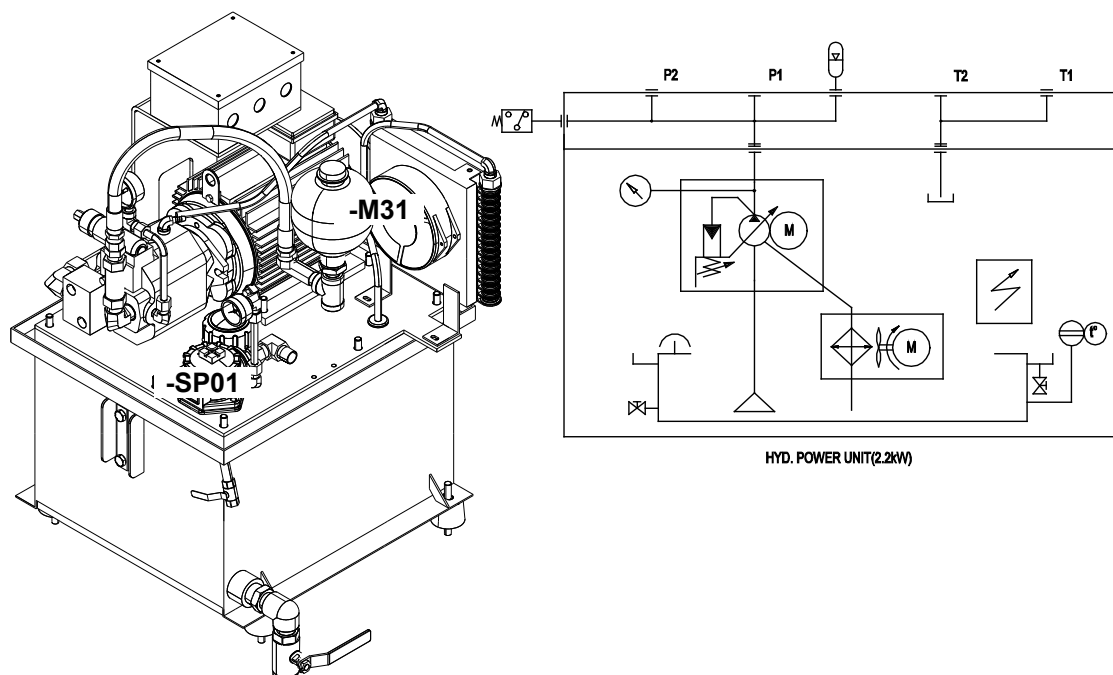
Type	Symbol	Description	Function	Normal
Valve	- M51	Lubrication pump motor	- To extract lub. oil	OFF
Switch	- SP1	LUB. pressure	- To detect oil pressure down	ON
	- S2	LUB. level	- To detect oil level down	OFF
	- SB1	LUB. manual start	- Oil supply manually	OFF

(3) Lub. diagram of std. machine



8. HYDRAULIC UNIT

(1) Circuit diagram

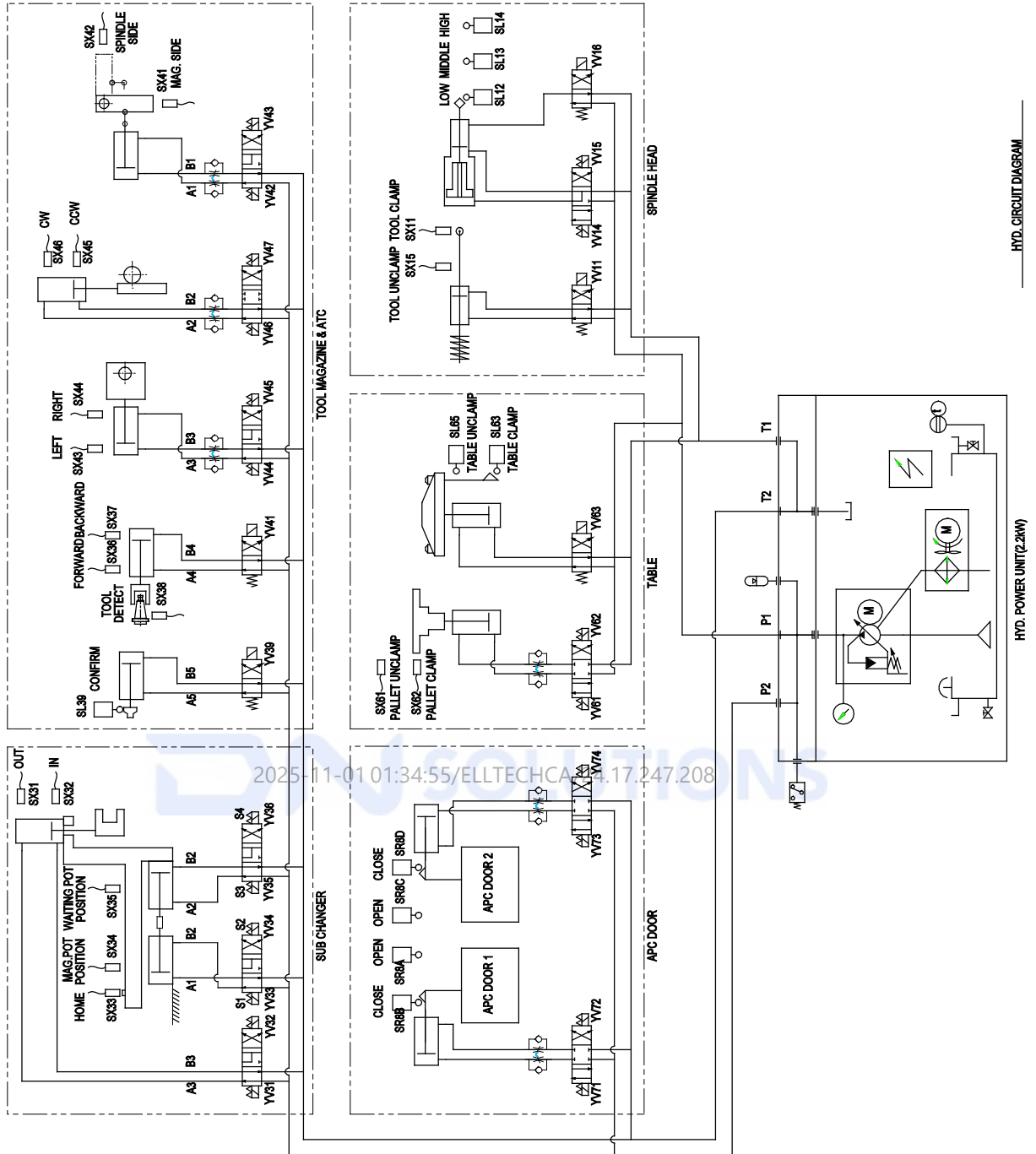


(2) Functions

Type	Symbol	Description	Function	Normal
Motor	- M31	Hydraulic pump motor	- To run HYD. pump	ON
Switch	- SP01	Hydraulic pressure check	- To detect oil pressure down	ON

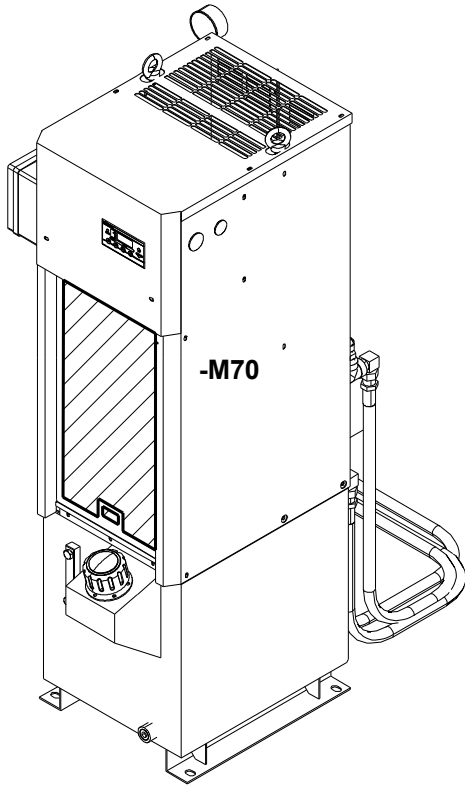
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(3) HYD. circuit diagram

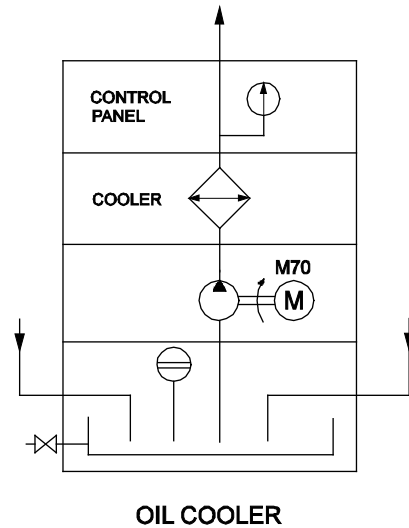


9. OIL COOLER

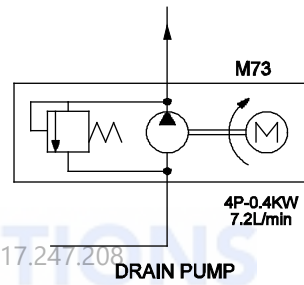
(1) Circuit diagram



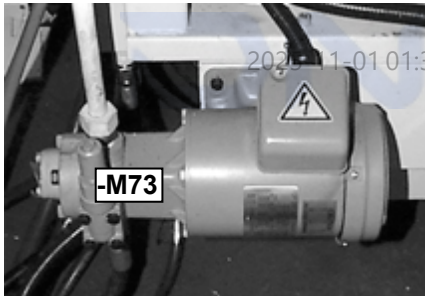
<Oil cooler>



OIL COOLER



DRAIN PUMP

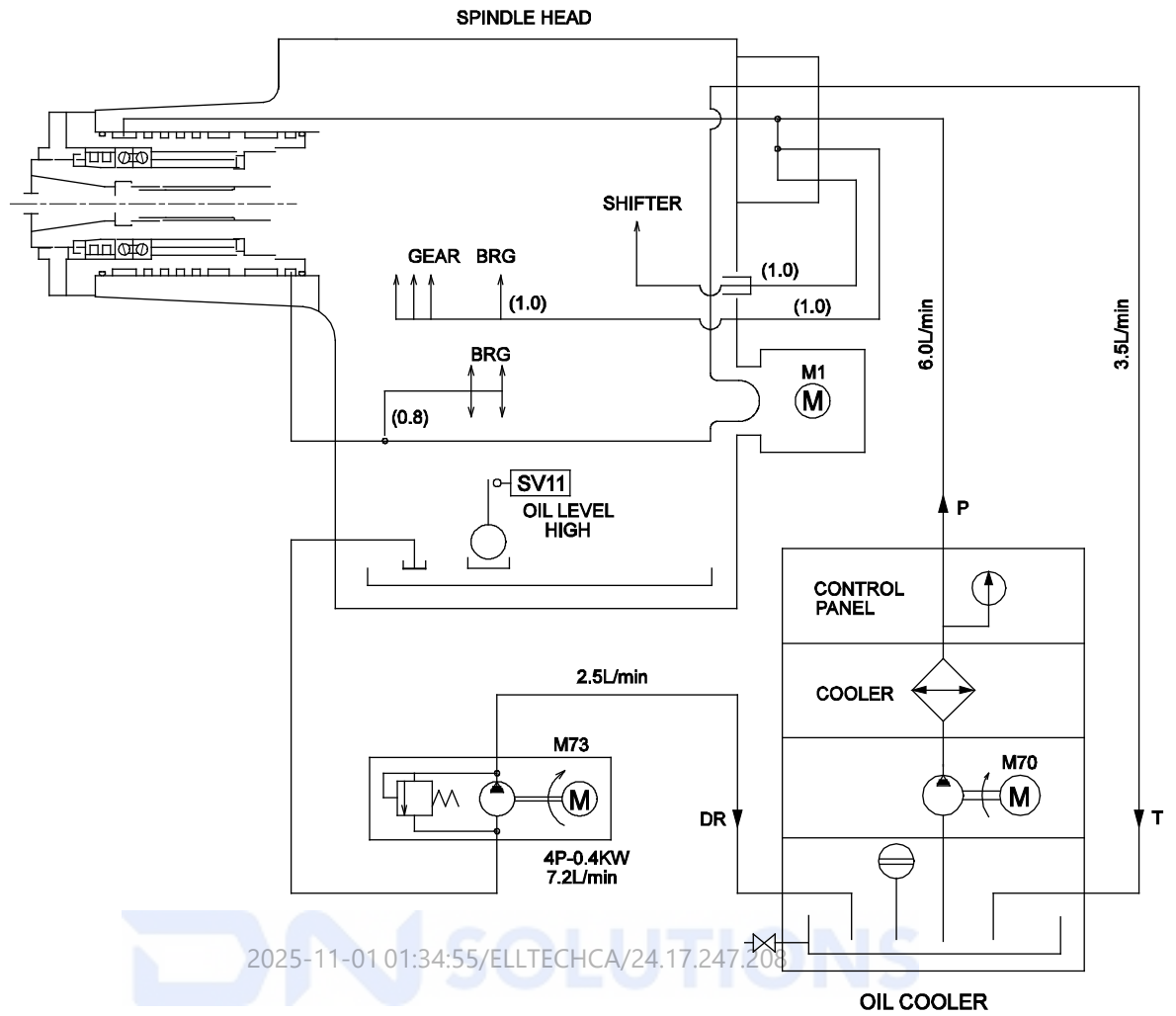


<Drain pump>

(2) Functions

Type	Symbol	Description	Function	Normal
Motor	- M70	Oil cooler motor	- To run cooling pump	ON
	- M73	Oil cooler drain motor	- To drain oil to oil cooler	ON

(3) Oil cooling diagram of std. machine



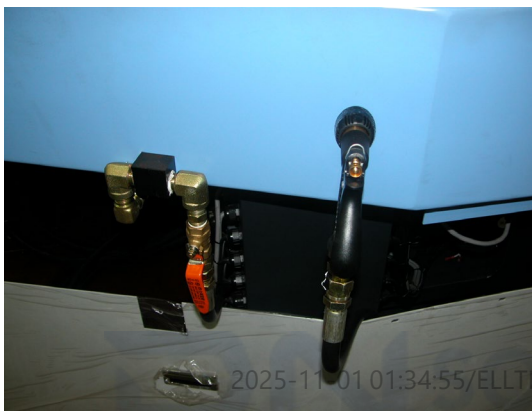
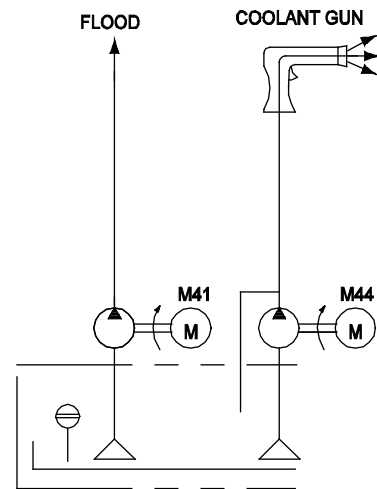
10. COOLANT & CHIP DEVICES

(1) Circuit diagram

1) Flood coolant, flushing coolant & coolant gun device.



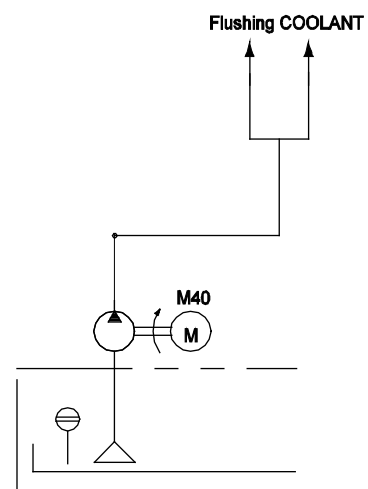
<Flood coolant device>



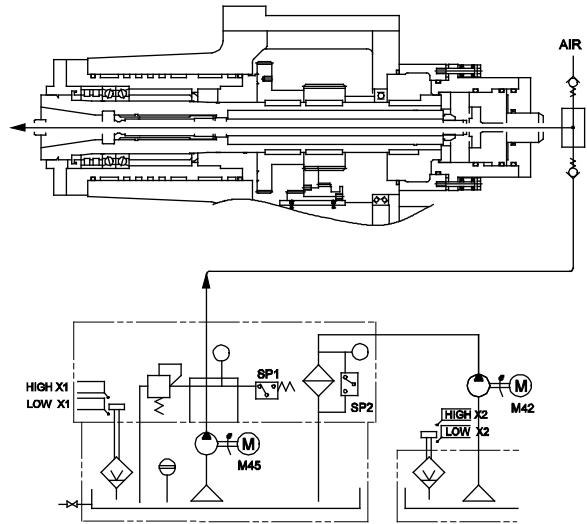
<Coolant gun>



<Flushing coolant>



2) High pressure T-S-C device(optional specifications)

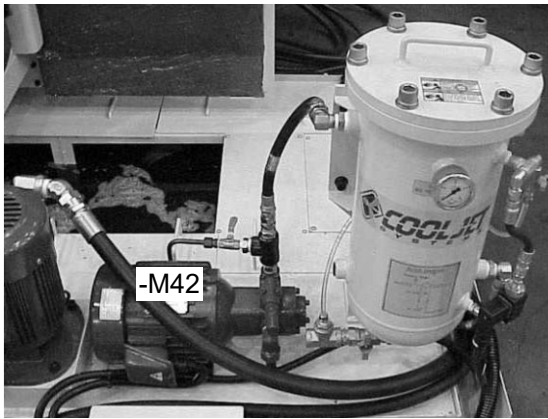


<Tank for high T-S-C>

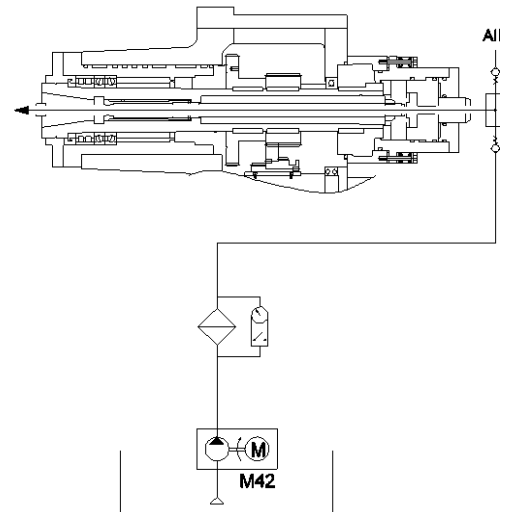


<Recovery pump>

3) Middle pressure T-S-C device(optional specifications)



<Pump installation>

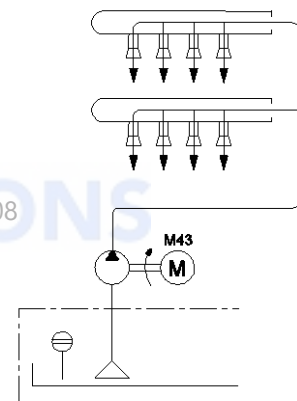


MIDDLE PRESSURE TSC

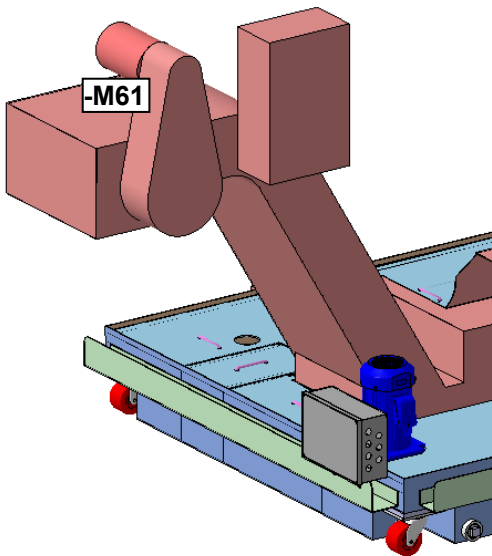
4) Shower coolant device(optional specifications)



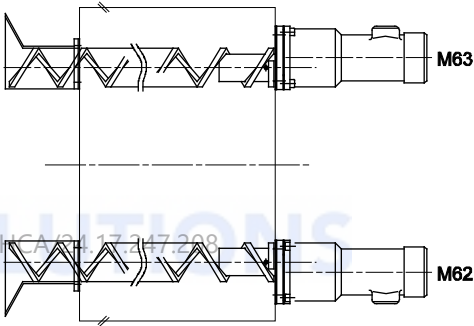
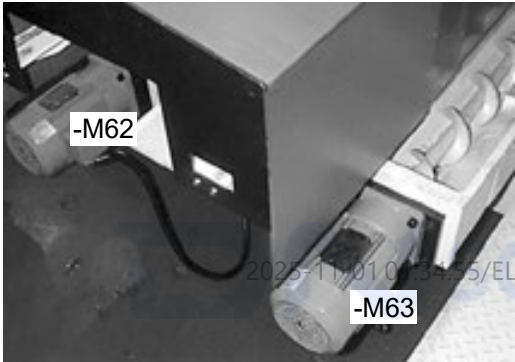
<Pump installation>



5) Chip conveyor(optional specifications)



6) Screw conveyor device



(2) Functions

Type	Symbol	Description	Function	Normal
Motor	- M40	Flushing coolant motor	- To supply coolant for setup	OFF
	- M41	Flood pump motor	- To supply flood coolant	OFF
	- M42	Coolant recovery pump motor	- To supply coolant to T-S-C tank	OFF
	- M43	Shower pump motor	- To supply shower coolant	OFF
	- M44	Coolant Gun Motor	- To supply coolant for coolant gun	OFF
Unit	- M45	Through spindle coolant unit	- To supply high pressure T-S-C	OFF
	- M61	Chip conveyor	- To extract chips automatically	OFF
Valve	- YV03	Head flushing	- To supply coolant for head nose	OFF

Part 6 PERIODIC INSPECTION

In this section, brief and compact information just after installation is provided.

In addition to the inspection items given here, there can be some other items which should be checked according to the actual condition of the machine. Please make extra check sheet and schedule, if necessary.

Re-adjustment and maintenance must be followed carefully by maintenance staff or our service man, if anything is observed by inspection.

Be sure not to change setting and adjusting value without intention in any case.



1. ATC(AUTOMATIC TOOL CHANGER)

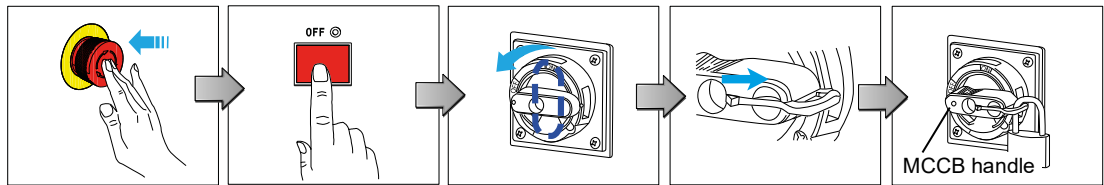
Item	Check point	Remark	After inst.	Daily	Semi-annual	Annual
State	ATC centering	Check with jig	●		●	
	Tool magazine	Check position	●		●	
	Tool pot stopping position		●		●	
	Waiting pot stopping position		●		●	
	Gripper	Check abnormal Wearing			●	
	Taper in pot				●	
	Key of pot				●	
	Input voltage for motors	± 10%			●	
	Bolts and connectors	Check connecting state	●			●
	Checking the Magazine chain tension	Checking the chain state	●		●	
Function	Tool change action	Manual operation	●	●		
	Tool magazine action		●	●		
	Sub changer action		●	●		
	Waiting pot moving action		●	●		
	Sol. valves action	Check DGN			●	
	Switches action				●	
Oil supply	Nipple for grease	Apply grease			●	
	Cam-follower for magazine				●	
	Tool pot chain				●	
	HYD. motor gear box				●	
Cleaning	Changer arm gripper	Remove Foreign substance	●			
	Inside of pot		●			
	Waiting pot moving guide		●			
	Tools		●			
	Inside of cover					●



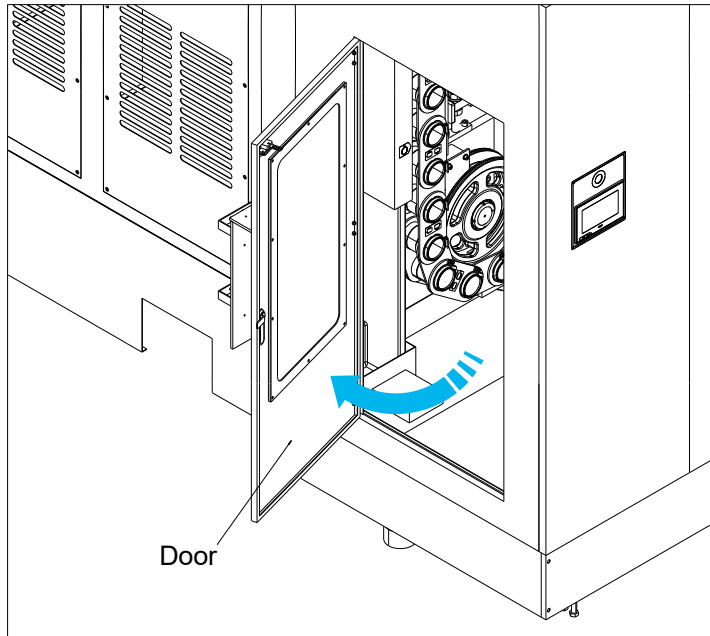
NOTICE

- ✓ ATC moves up and down in vertical direction. It has a sealed construction to protect the drive unit using coolant and oil mist. Long term use and severe service condition cause seal wear and burn damage leading to drive unit damage due to oil mist infiltrated inside the box. Regular checkup and replacement of oil (grease) are recommended.
- ✓ Inspection Cycle: Weekly(50 hours)

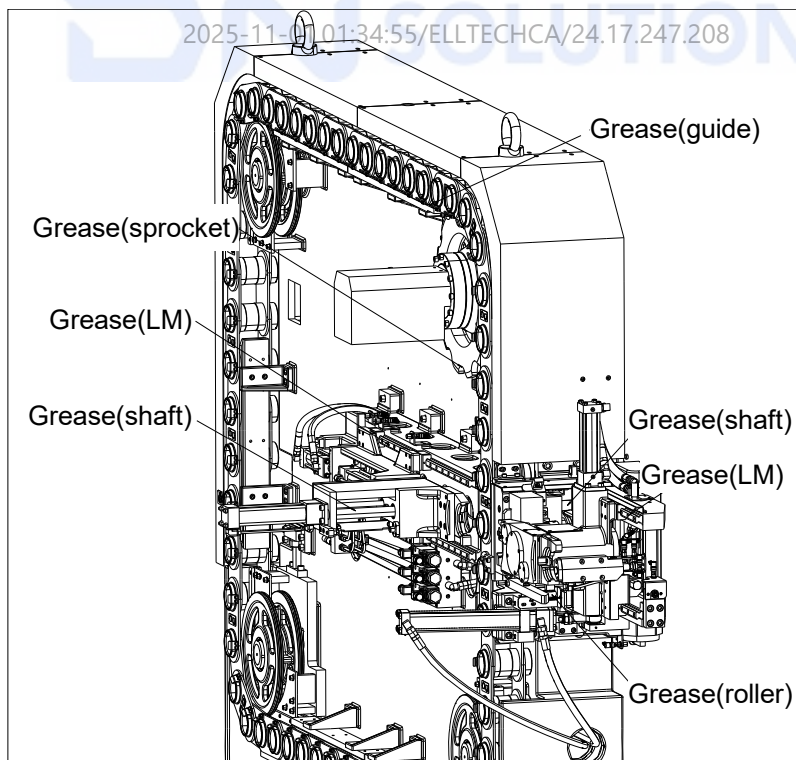
(1) Apply grease to ATC & magazine

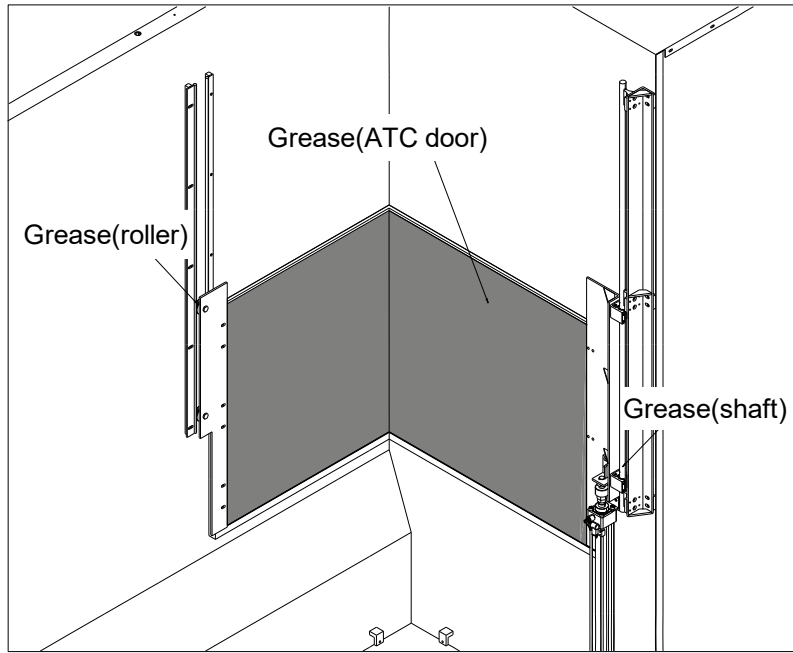


1) Turn the power off and lock the MCCB handle.



2) Open the door.





3) Apply grease.



NOTICE

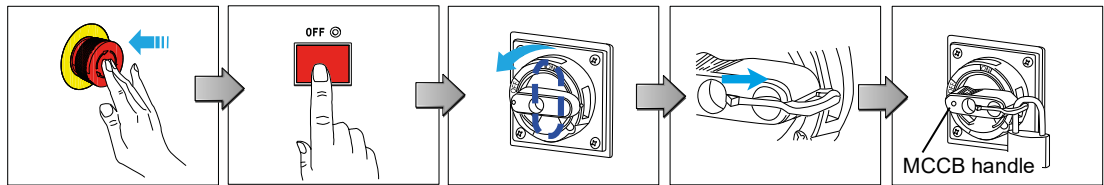
✓ Cycle: Semi annual (1000 hours)

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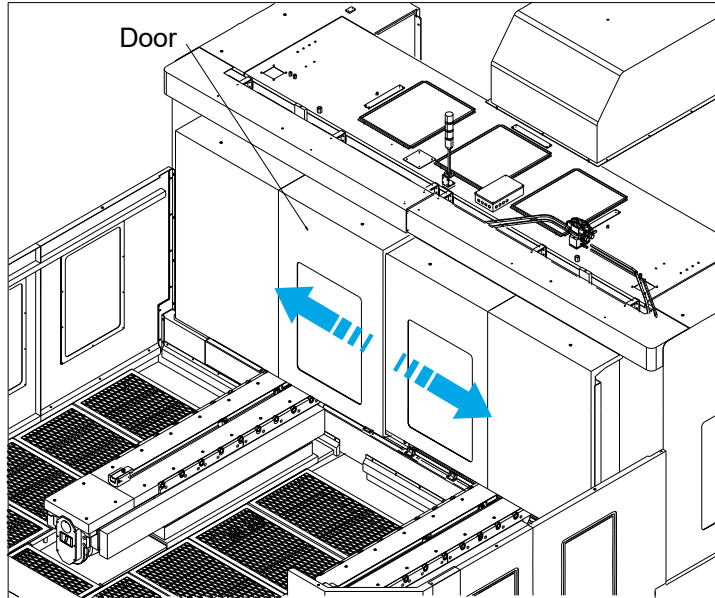
2. APC(AUTOMATIC PALLET CHANGER)

Item	Check point	Remark	After inst.	Daily	Semi-annual	Annual
State	APC Centering	Check with jig	●		●	
	Changer arm pin	Check abnormal wearing			●	
	Bolts and connectors	Check connect- ing state	●		●	
Function	Change action	Manual operation	●	●		
	Sol. valves action	Check DGN			●	
	Switches action				●	
Oil supply	Gear Box for HYD. Motor	Apply grease			●	
	Nipple for grease				●	
Cleaning	Surface of changer	Remove foreign		●		
	Inside of cover	substance				●

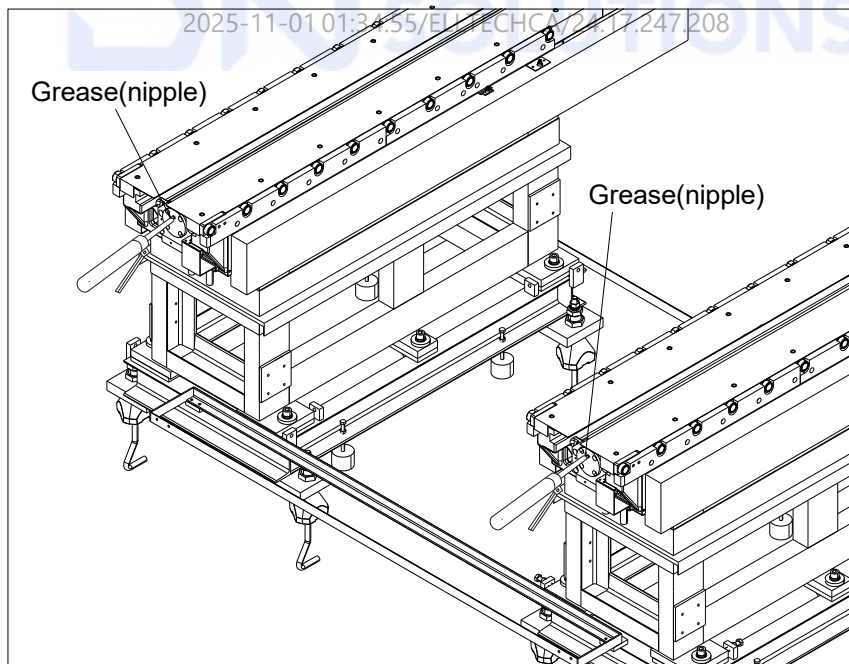
(1) Inject APC grease



1) Turn the power off and lock the MCCB handle.



2) Open the door.



3) Inject grease.



NOTICE

✓ Cycle: Semi annual (1000 hours)

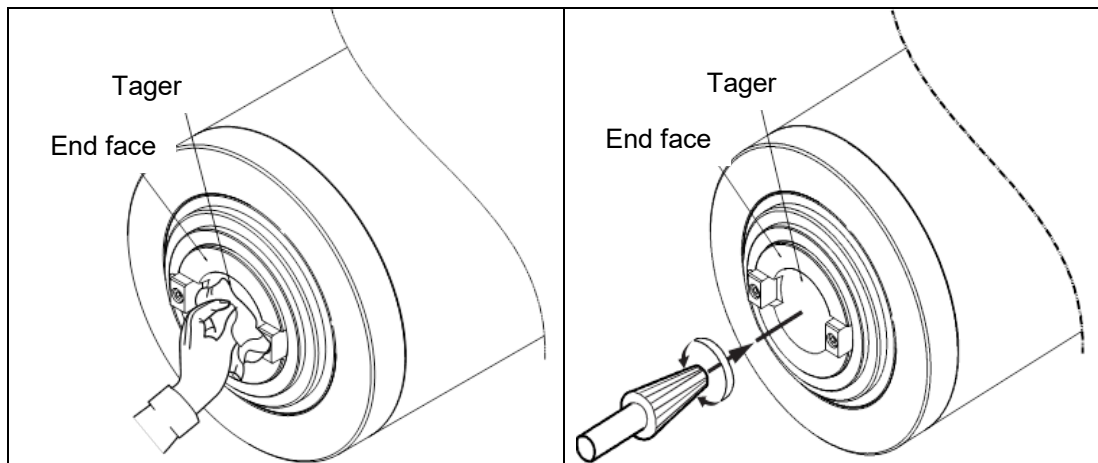
3. AXIS SYSTEM

Item	Check point	Remark	After inst.	Daily	Semi-annual	Annual
State	Check reference point	Check and adjust				●
	Static accuracy					●
	Position accuracy					●
	Feedrate accuracy					●
	Slide cover wear				●	
	Input voltage of servo-motors	± 10%			●	
	Bolts and connectors	Check connecting state	●			●
Function	Switch action for ref.point	Check DGN	●		●	
	Switch action for emergency		●		●	
	Reference point return	Manual operation	●	●		
	Axis motion		●	●		
Oil supply	Moving parts	Apply grease			●	
Cleaning	Moving parts	Remove foreign substance		●		
	Inside of cover				●	

4. SPINDLE HEAD

Item	Check point	Remark	After inst.	Daily	Semi-annual	Annual
State	Tool unclamp device	Check and adjust			●	
	Spindle orientation	Adjust stop position	●		●	
	Spindle drive key	Check abnormal wearing			●	
	Spindle taper				●	
	Spindle RPM	Check and adjust				●
	Input voltage of motor	± 10%			●	
	Bolts and connectors	Check connecting state				●
Function	Spindle rotation	Manual operation	●	●		
	Spindle orientation	MDI operation	●	●		
	Clamp/unclamp	Manual operation	●	●		
	Position detector	Compare RPM				●
	Sol. valves action	Check DGN				●
	Switches action					●
Oil supply	Moving parts					●
Cleaning	Spindle taper	Remove foreign substance		●		
	Inside of cover					●

(1) Clean chips on spindle taper/tip

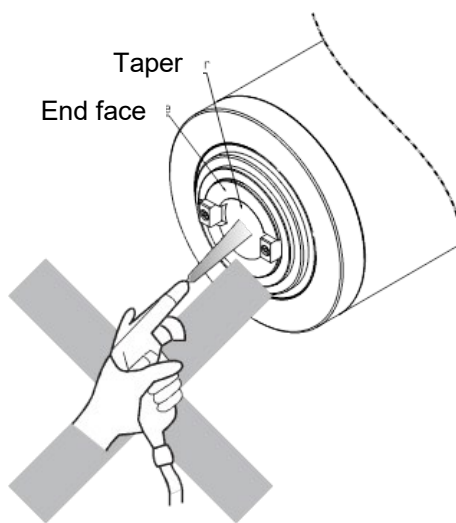


- 1) Ensure that the spindle rotation is completely stopped.
- 2) Disassemble the tool from the main spindle.
- 3) Press the emergency stop pushbutton switch.
- 4) Remove dust and chips from the spindle taper surface and the tip.
- 5) It is highly recommended that you clean spindle taper surface using a spindle cleaning solution. If these parts are not cleaned properly, spindle taper may rust causing tool stuck. If chips on spindle are not removed, it can cause tool vibration leading to deteriorated machining accuracy.
- 6) After removing chips, release the emergency stop pushbutton switch.



NOTICE

- ✓ When removing chips, never use compressed air.
Do not use air gun or compressed air to clean the taper and end tip.
Compressed air may push coolant or dust particles inside the spindle unit and may cause spindle bearing burn and damage.
- ✓ Cleaning cycle: Daily (8 hours)



5. TABLE

Item	Check point	Remark	After inst.	Daily	Semi-annual	Annual
State	Check reference point	Check and adjust				●
	Position accuracy					●
	Pallet clamp				●	
	Input voltage of servo motor	$\pm 10\%$			●	
	Bolts and connectors	Check connecting state	●			●
Function	Pallet clamp action	Check DGN	●		●	
	Sol. valve action		●		●	
	Switch action for emergency		●		●	
	Reference point return	Manual operation	●	●		
	B-Axis moving		●	●		
Oil supply	Moving parts		●			●
Cleaning	Inside of cover	Remove foreign substance				●

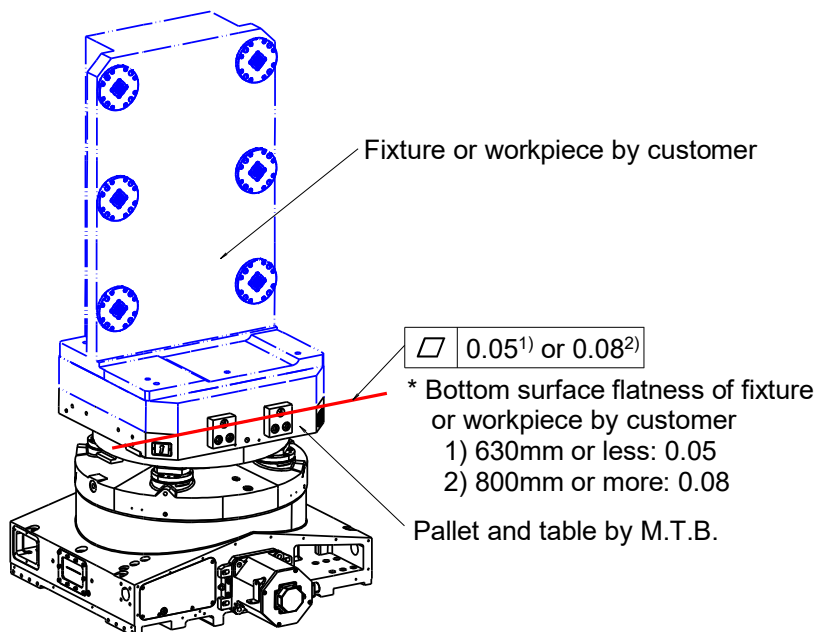


NOTICE

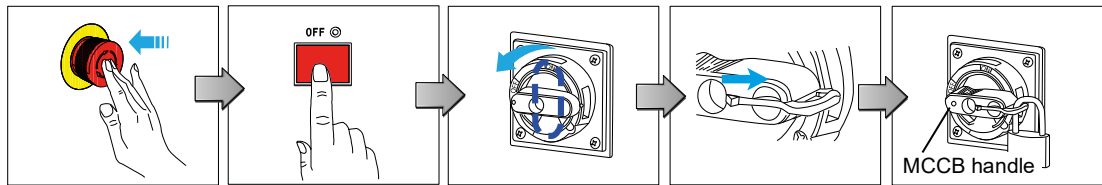
- ✓ In the case of parts (such as fixtures, workpieces, etc.) that are fastened/assembled on the pallet of the table provided by our company, observe the tolerance of surface flatness.

- 1) Pallet size 630 mm or less: 0.05 mm
- 2) Pallet size 800 mm or more: 0.08 mm

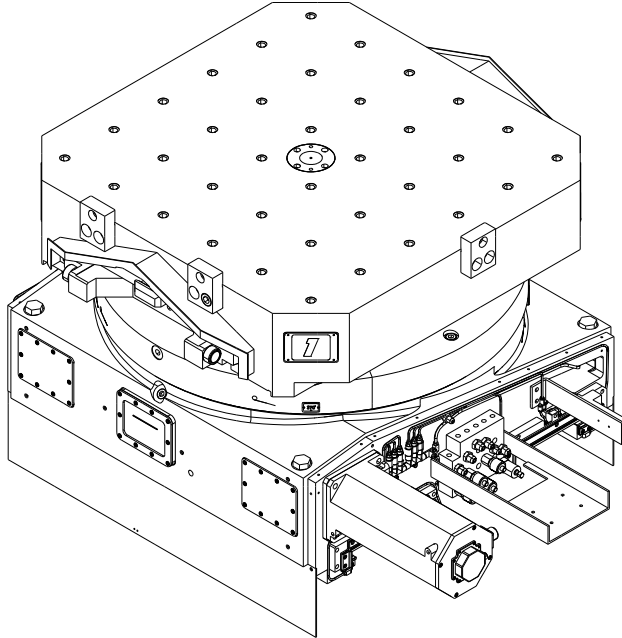
Clamping parts exceeding the above surface flatness could cause deformation and damage to the table.



(1) Table oil replacement

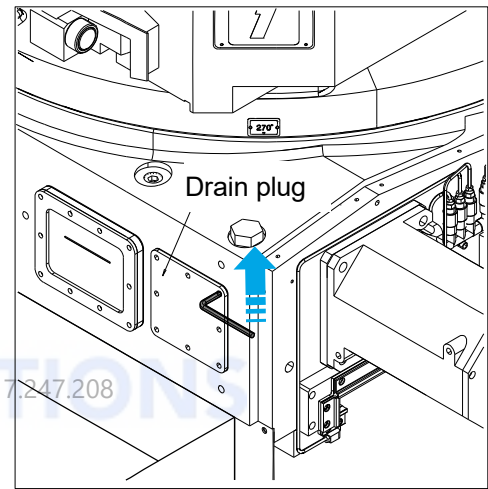
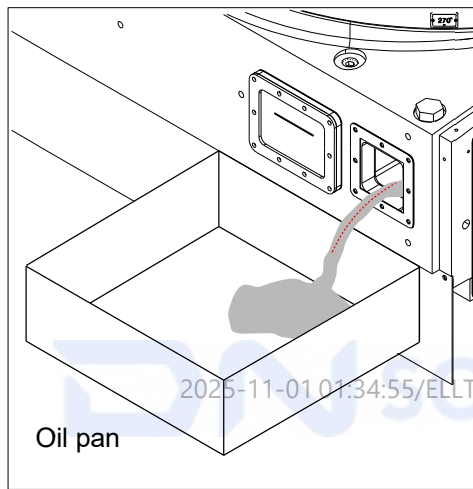
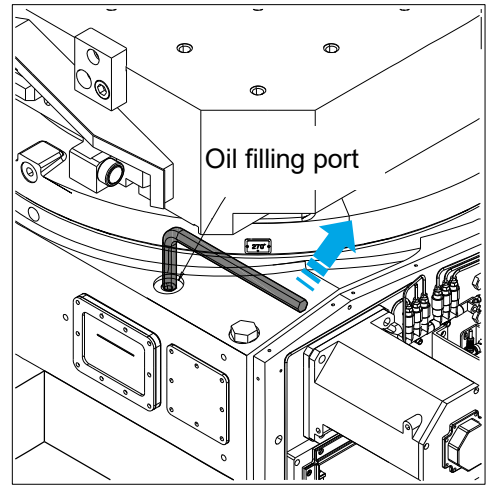
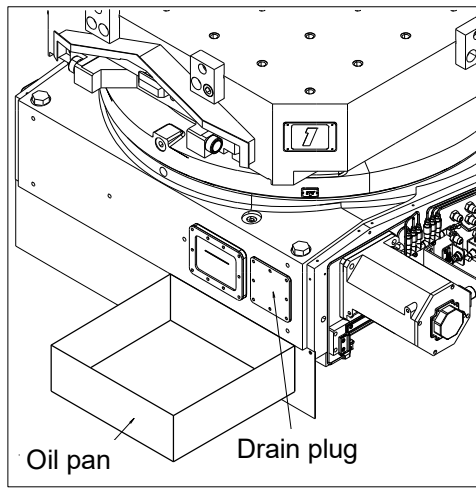


1) Turn the power off and lock the MCCB handle.

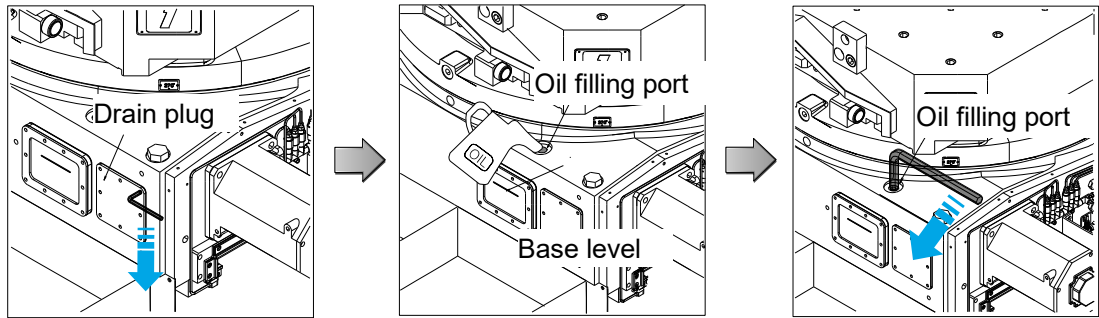


2) Move the rotary table. (for securing the workspace)

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- 3) Place oil pan under the drain cover.
- 4) Unfasten the plug of the oil filling port.
- 5) Disassemble the drain cover and wait until the oil is completely drained.



- 6) Assemble the drain cover, and supply oil with oil can of recommended oil through the oil inlet.
- 7) Use an oil level gauge to check whether the oil level is above the base level, and fasten the cap of the oil port tightly.
- 8) Dump leaked oil in the designated place.
- 9) Check the operational status and finish the work if there is no abnormality.



NOTICE

- ✓ Oil, coolant, chips, refrigerant and other industrial waste should be treated strictly in compliance with the safety and environmental protection laws prescribed by the competent national and regional agencies.
- ✓ Replacement cycle: Semi-annual (1000 hours)

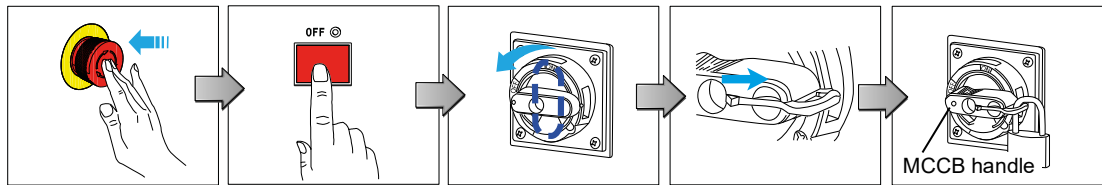
6.

AIR SERVICE UNIT

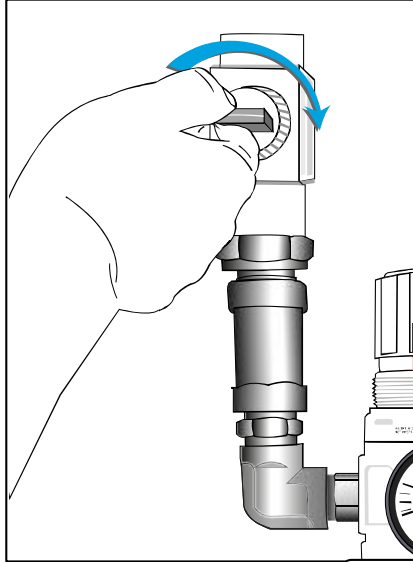
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Item	Check point	Remark	After inst.	Daily	Semi-annual	Annual
State	Pressure gauge	0.5MPa (71psi)	●	●		
	Oiler flowrate	5drops/min.	●	●		
	Pressure switch	0.4MPa(57psi)	●	●		
	Pipings	Air leakage	●	●		
	Bolts and connectors	Check state	●			●
Function	Air blow for cleaning	ATC & APC	●	●		
	Air regulator	Check function			●	
	Oiler				●	
	Pressure switch				●	
Oil supply	Oiler	Level gauge	●	●		
Cleaning	Tank for filter device	Extract water	●	●		
	Filter for filter device	Check cleaning			●	

(1) Air filter replacement of the air service unit (Main air)



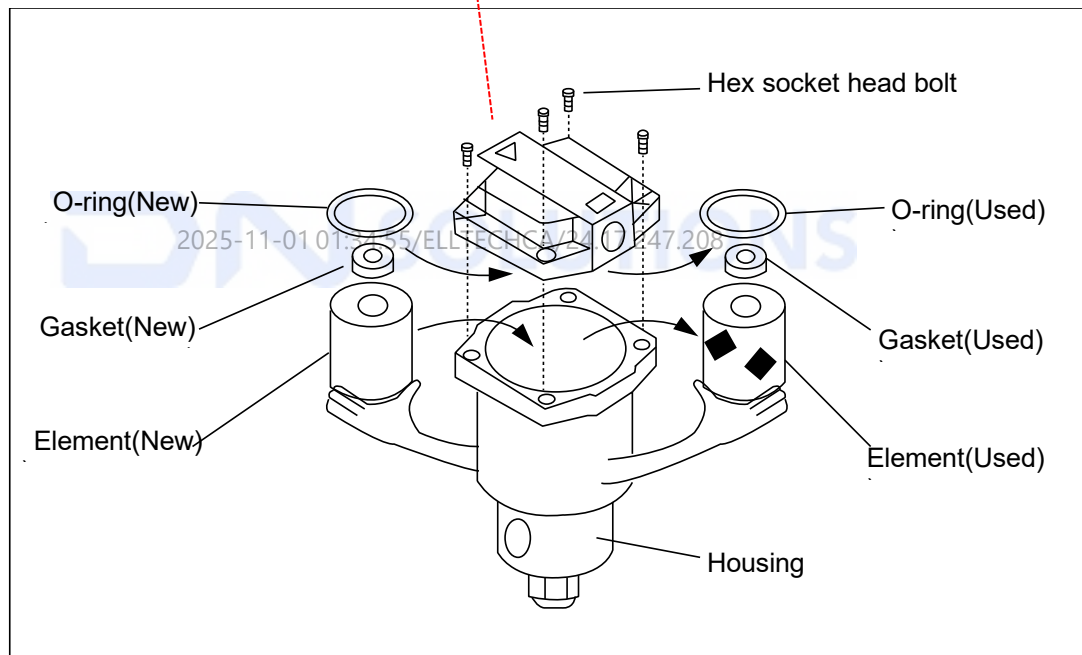
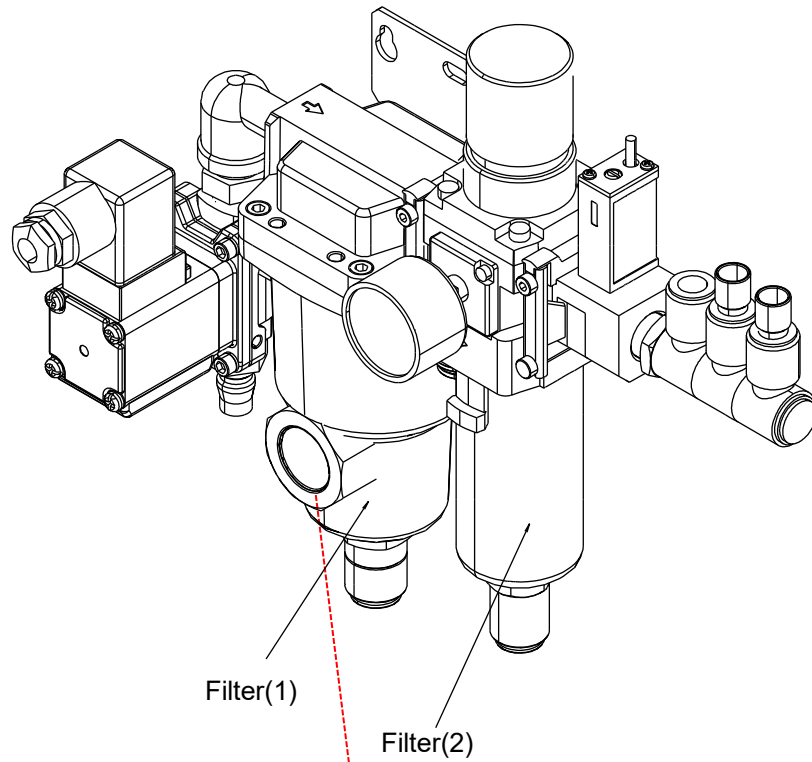
1) Turn the power off and lock the MCCB handle.



2) If shutoff valve is available, shutoff compressed air with the shutoff valve.

(Compressed air may not be automatically shutoff when the power is shutoff. Be sure to check if the pressure is "0" with a pressure gauge before continuing the work.)

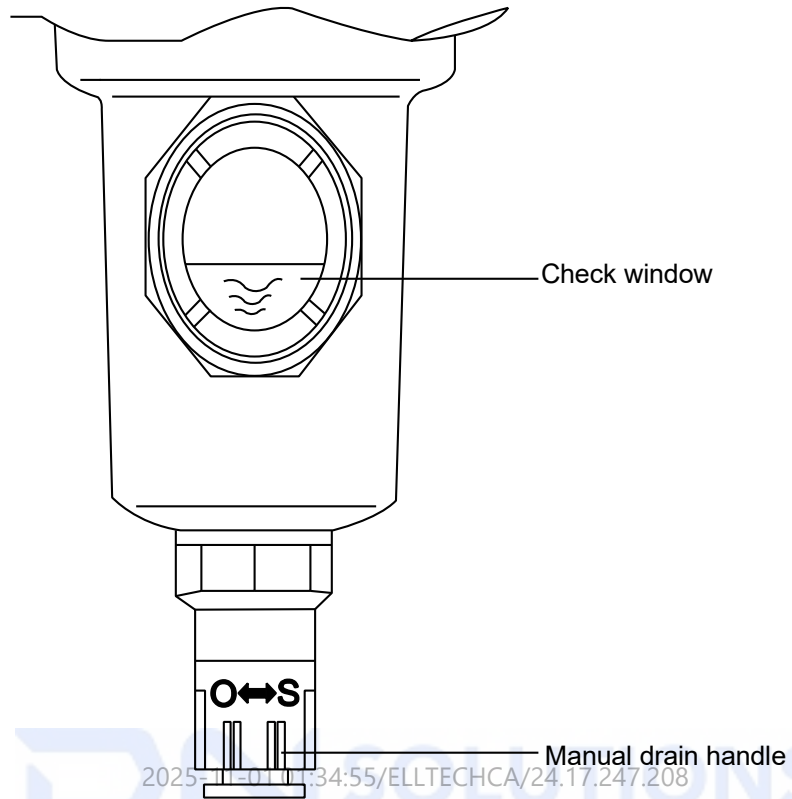
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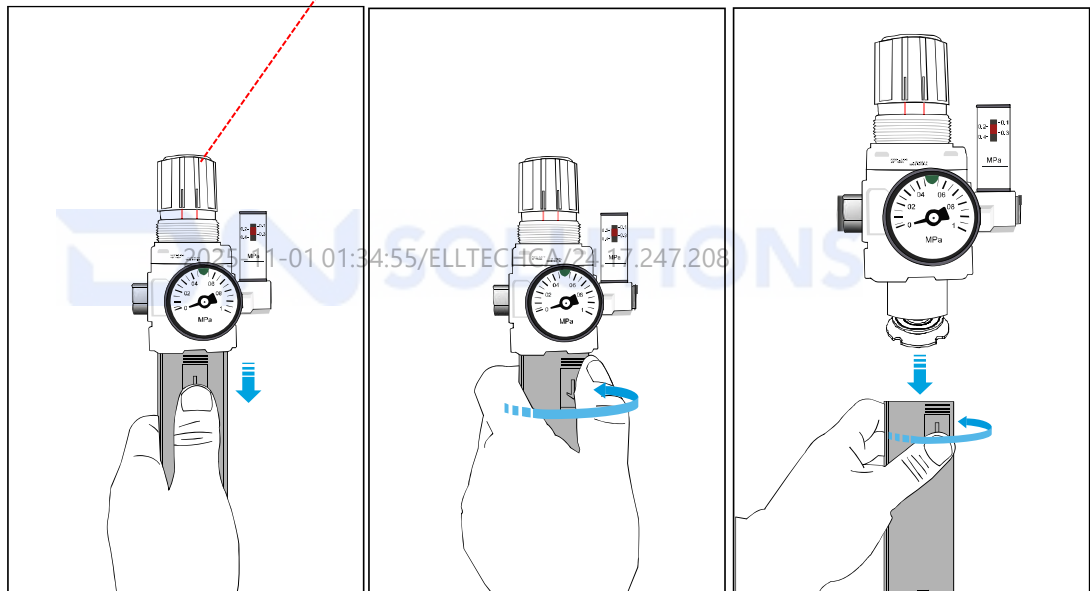
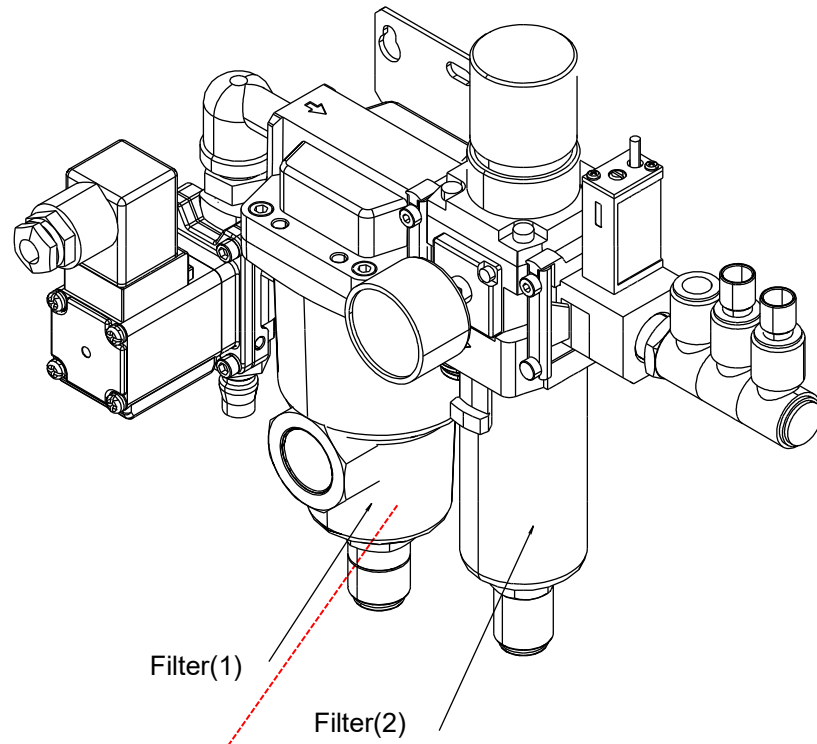


- 3) Unfasten the bolt on the top of the filter and take out the filter body.
- 4) Replace the element, gasket, and O-ring.
- 5) Fix the filter body with the bolt again.

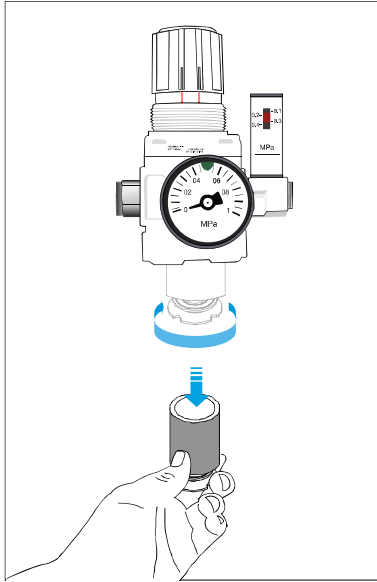
[Note] **Manual drain (Main air)**

- Moisture or dusts inside the separator can be automatically discharged.
- If drainage is not possible due to a failure of the auto drain valve (the drain can be checked through the check window), rotate the handle on the bottom left ("O") to start discharging.
- In this case, as air pressure may remain inside, open slowly.

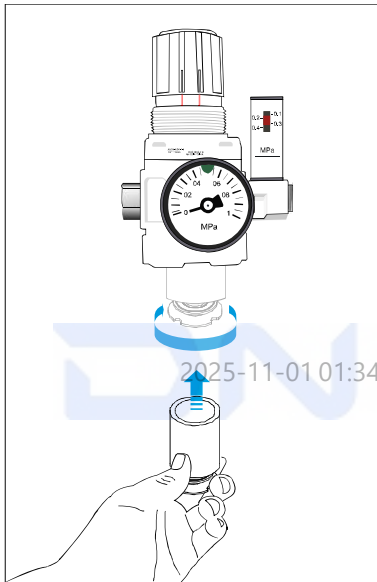




- 6) Remove the filter (2) cap downwards.
(Pull the hook on the cap downwards and turn the cap to the left or right sides.)



7) Turn the filter supporter counterclockwise.



8) Replace the element. (For assembly, use reverse order of disassembly.)

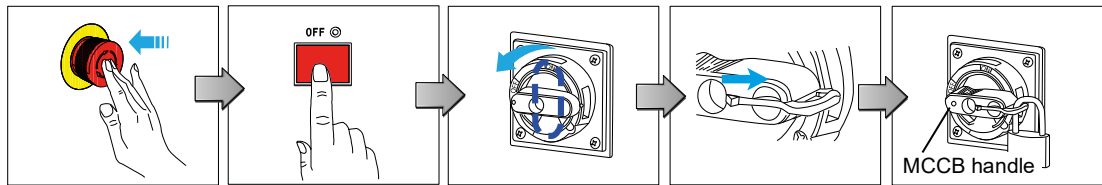


- ✓ When disassembling the cap, be sure to cut off the air. Disassembling the cap without properly cutting off the air may result in injury caused by compressed air.

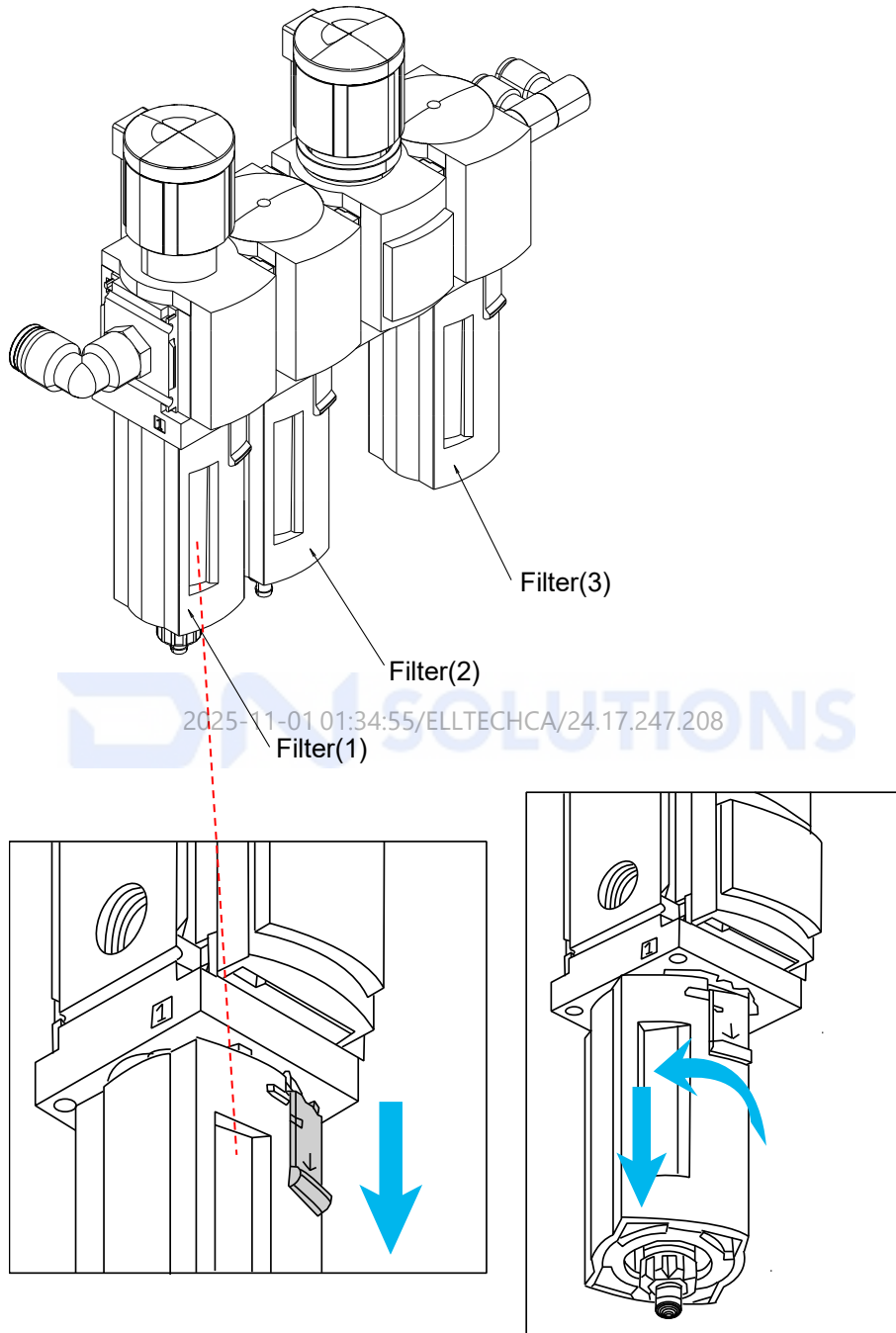


- ✓ Replacement cycle: Biyearly(4000 hours) or pressure drop 0.1 MPa
- ✓ If compressed air quality is not good (due to moisture, impurities, etc.), check the condition from time to time and replace in case of irregularity.

(2) Air filter replacement of the air service unit (Scale_ optional specifications)

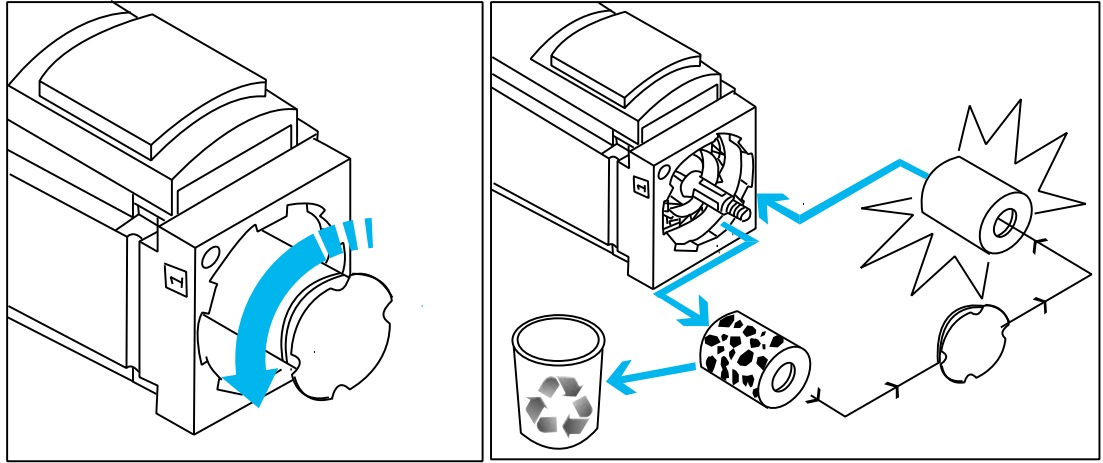


1) Turn the power off and lock the MCCB handle.



2) Pull the filter(1) cap hook downwards, and turn to left or right.

3) Remove the cap downwards.



4) Replace the element. (For assembly, use reverse order of disassembly.)

※ Replace the element of Filter (2) and (3) using the same method.



- ✓ When disassembling the cap, be sure to cut off the air. Disassembling the cap without properly cutting off the air may result in injury caused by compressed air.



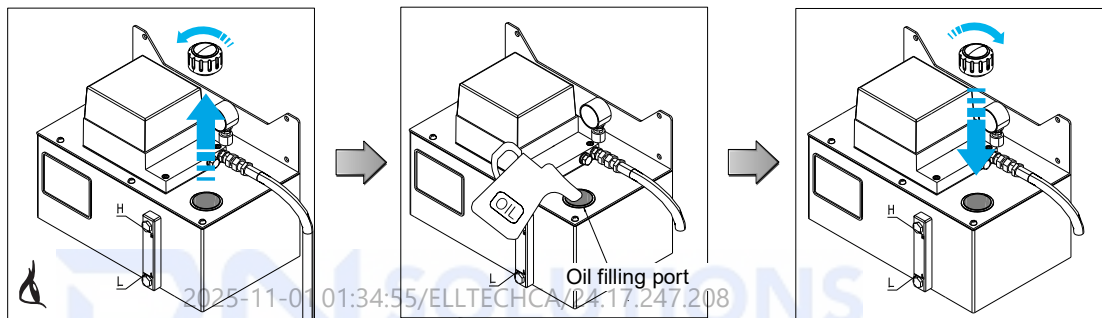
- ✓ Replacement cycle: Biyearly (4000 hours) or pressure drop 0.1 MPa
- ✓ If compressed air quality is not good (due to moisture, impurities, etc.), check the condition from time to time and replace in case of irregularity.

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7. LUBRICATION UNIT

Item	Check point	Remark	After inst.	Daily	Semi-annual	Annual
State	Pressure gauge	1.6 ~ 0.2MPa (227~285psi)	●	●		
	Input voltage of motor	±10%			●	
	Pipings	Check leakage	●	●		
	Bolts and connectors	Check state	●			●
Function	Pump	Check action	●	●		
	Oil distribution	Check state	●	●		
	Pressure switch	Check DGN				●
	Float switch					●
Oil supply	Oil level gauge	Check level	●	●		
Cleaning	Oil filter	Check/cleaning		●		

(1) Replenish lubrication unit oil



- 1) Check the amount of oil with oil level gauge.
- 2) If “L” is approached, open the cap on oil filling port and replenish oil to “H” mark (upper limit) on the oil level gauge.
- 3) Lock the cap.



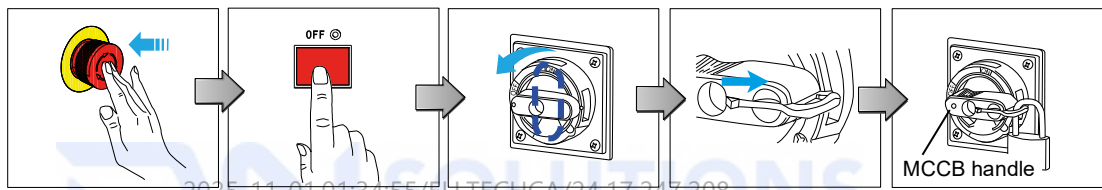
NOTICE

- ✓ If consumed irrationally, check piping or other areas for possible oil leakage.
- ✓ It must not exceed the “H” mark (upper limit) on the oil level gauge.
- ✓ Replenishment cycle: Weekly (50 hours)

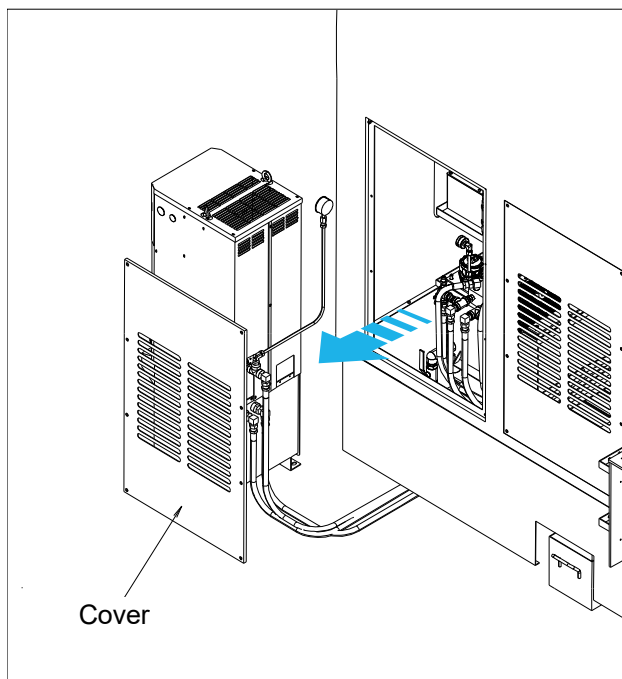
8. HYDRAULIC UNIT

Item	Check point	Remark	After inst.	Daily	Semi-annual	Annual
State	Pressure gauge	5MPa (711psi)	●	●		
	Pressure switch	3MPa (427psi)	●	●		
	Input voltage of motor	±10%			●	
	Pipings	Check leakage	●	●		
	Bolts and connectors	Check state	●			●
Function	Pump action	Check action	●	●		
	Pressure switch	Check DGN				●
Oil supply	Level gauge	Check state	●	●		
	Oil replacement				●	
Cleaning	Inside of tank	Cleaning				●
	Inlet filter	Check/cleaning			●	
	Suction filter					●
	Return filter					●

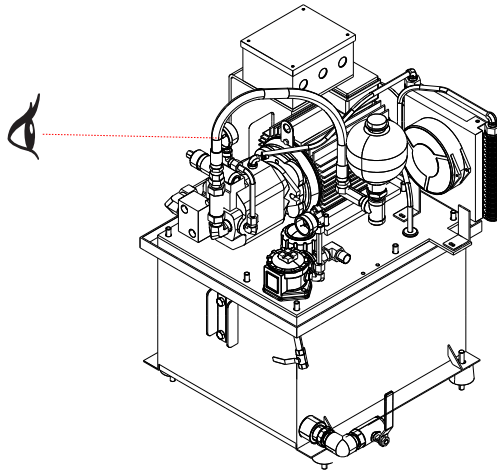
(1) Oil replacement of hydraulic unit



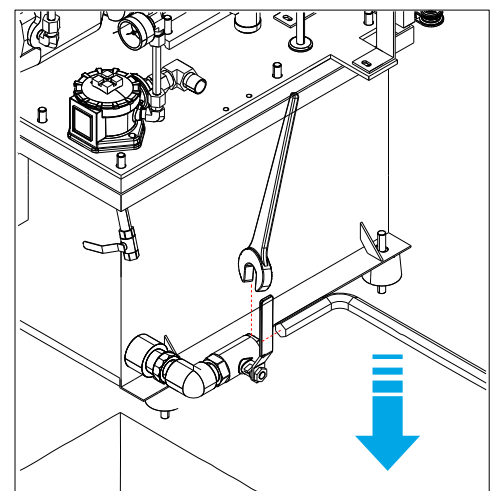
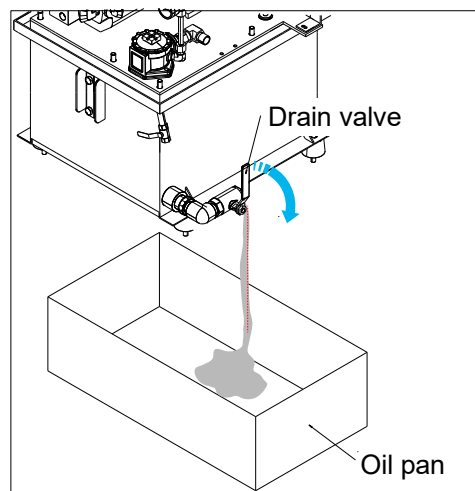
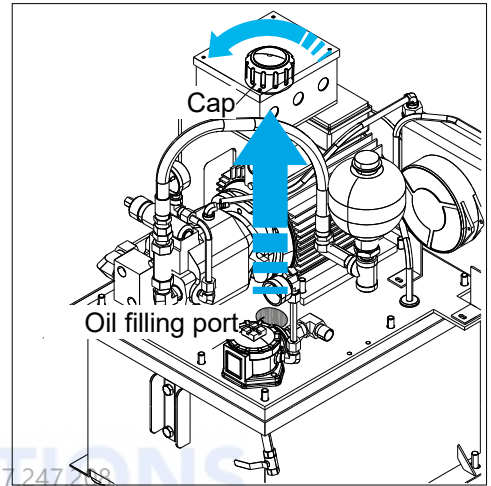
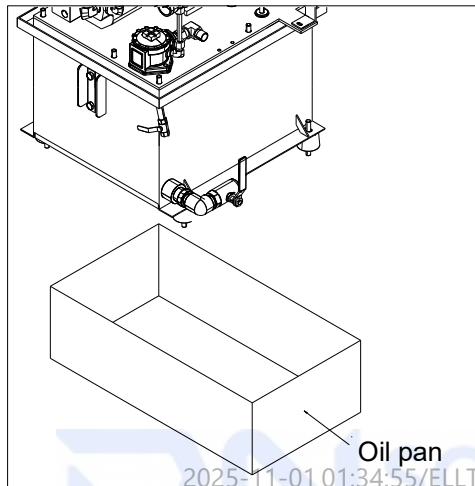
1) Turn the power off and lock the MCCB handle.



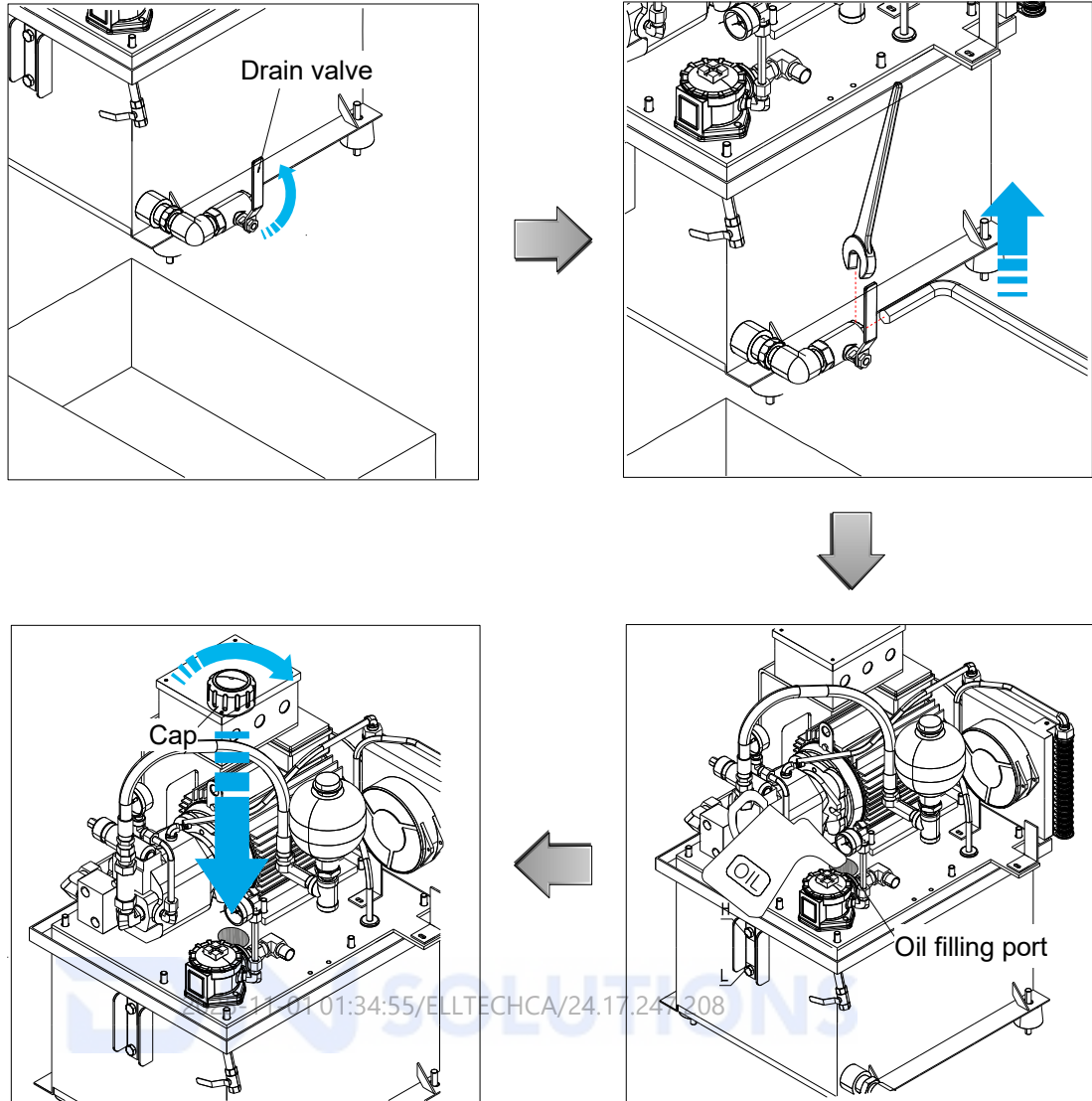
2) Disassemble the cover.



3) Check if the pressure on the pressure gauge reads “0”.



- 4) Place oil pan under the drain plug.
- 5) Open the cap on oil filling port.
- 6) While holding the drain valve with a monkey spanner, unfasten the drain plug.
- 7) Open the drain valve and drain oil.



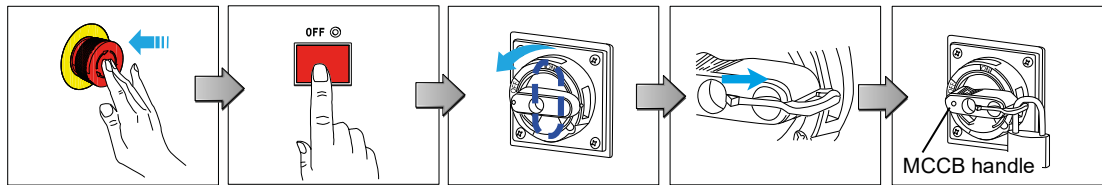
- 8) Lock the drain valve.
- 9) While holding the drain valve with a monkey spanner, lock the drain plug.
- 10) Replenish to "H" mark (upper limit) on oil level gauge with oil can.
- 11) Tighten the cap on oil filling port.
- 12) Dump leaked oil in the designated place.
- 13) Check operation condition, and complete work after assembling the cover if there is no abnormality.



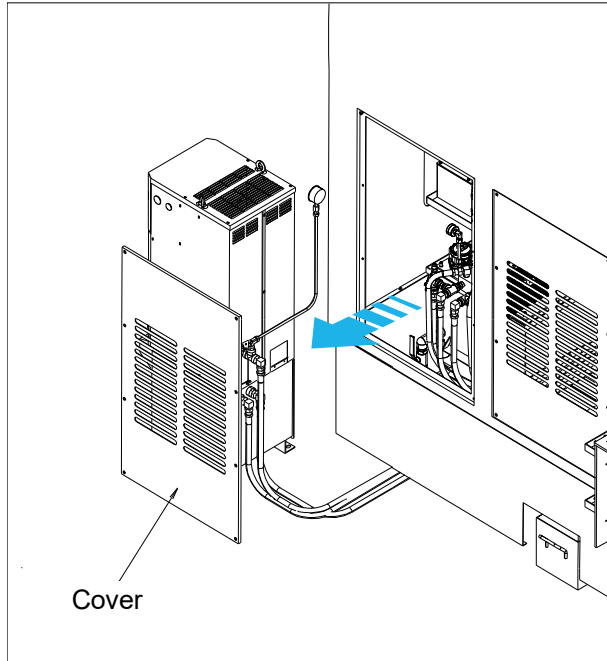
NOTICE

- ✓ Oil, coolant, chips, refrigerant and other industrial waste should be treated strictly in compliance with the safety and environmental protection laws prescribed by the competent national and regional agencies.
- ✓ It must not exceed the "H" mark (upper limit) on the oil level gauge.
- ✓ If the plug is wrapped with Teflon tape, remove the tape completely and assemble by wrapping with new Teflon tape.
- ✓ Replacement cycle: annually (2000 hours)

(2) Clean the hydraulic unit return filter.

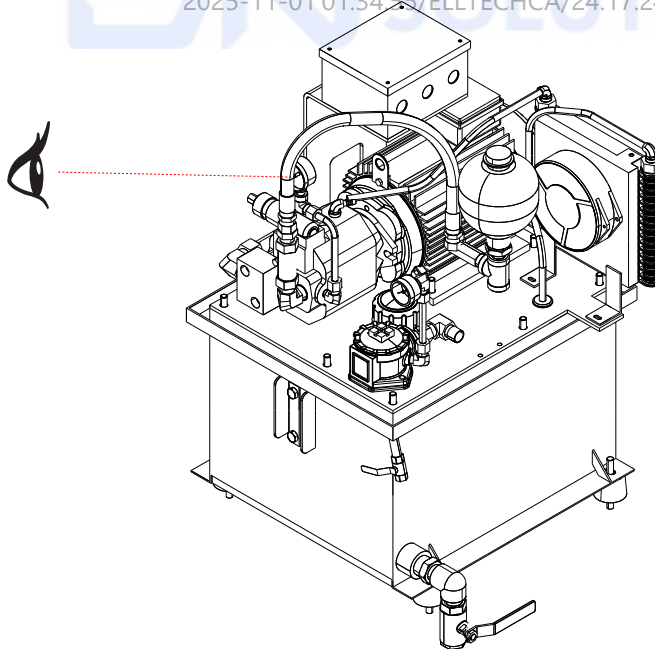


1) Turn the power off and lock the MCCB handle.

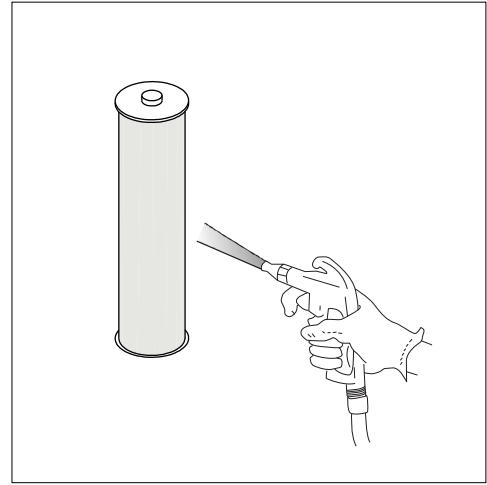
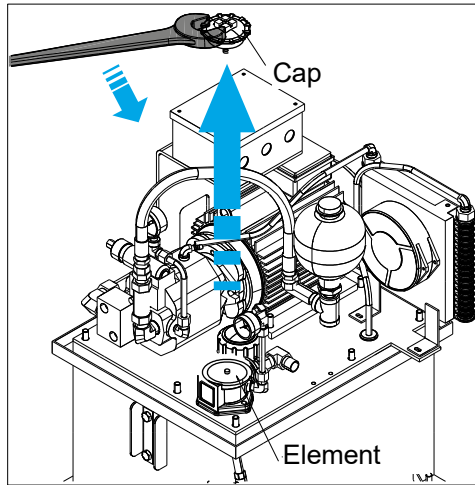


2) Disassemble the cover.

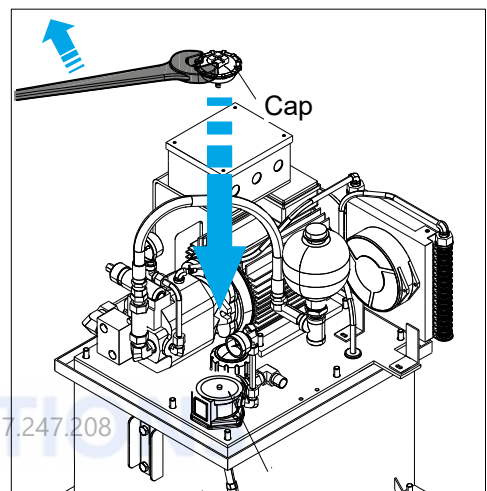
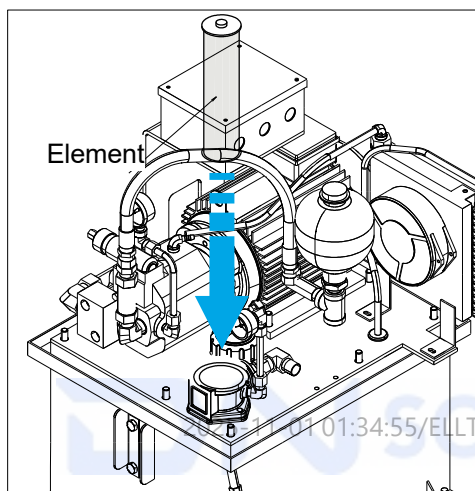
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3) Check if the pressure on the pressure gauge reads "0".



- 4) Disassemble the upper cap fixing the element with a monkey spanner.
- 5) Take out the element and clean the element with compressed air or a brush.

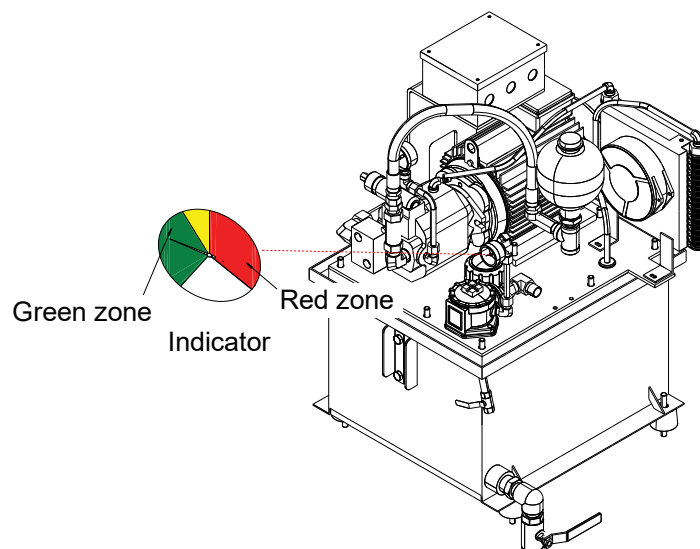


- 6) Insert the element.
- 7) Fasten the cap while paying attention to the O-ring.
- 8) Check the operational status and finish the work if there is no abnormality.

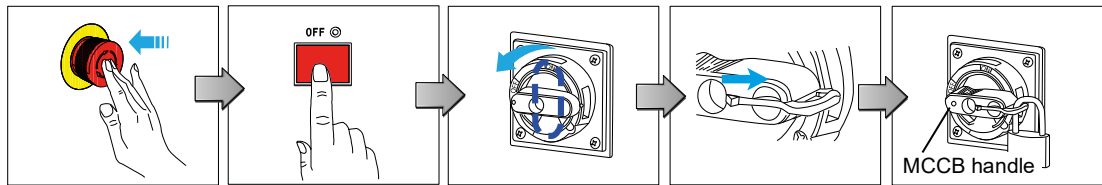


NOTICE

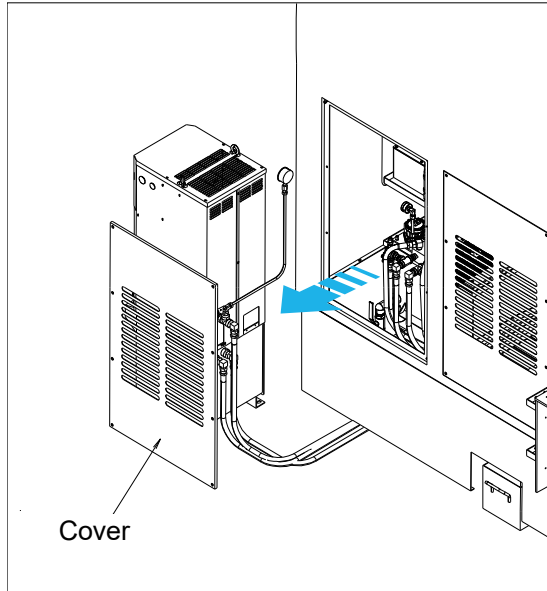
- ✓ Replace the element or O-ring, if damaged.
- ✓ Cleaning cycle: Semi annual(1000 hours) or indicator needle in red zone



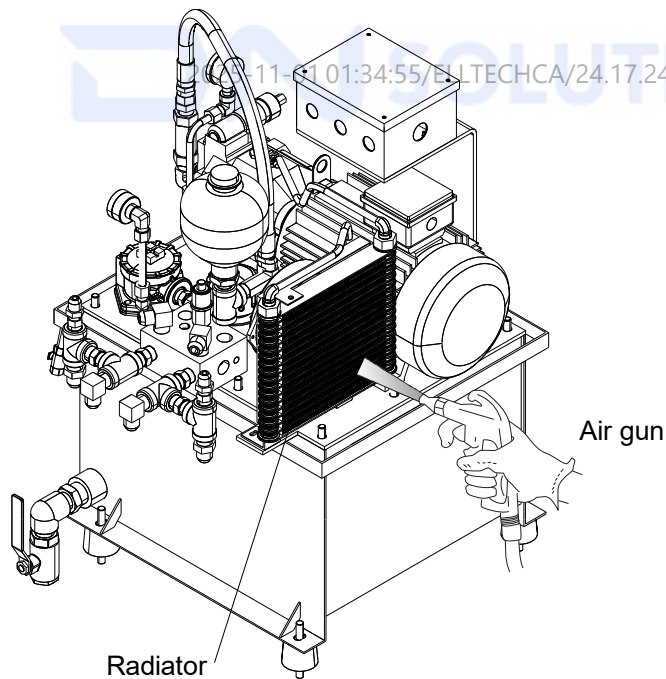
(3) Clean the radiator of the hydraulic unit.



1) Turn the power off and lock the MCCB handle.



2) Disassemble the cover.



3) Clean the radiator with compressed air or a brush.

4) Assemble the cover.



NOTICE

✓ Cleaning cycle: Weekly (50 hours)

9. OIL COOLER

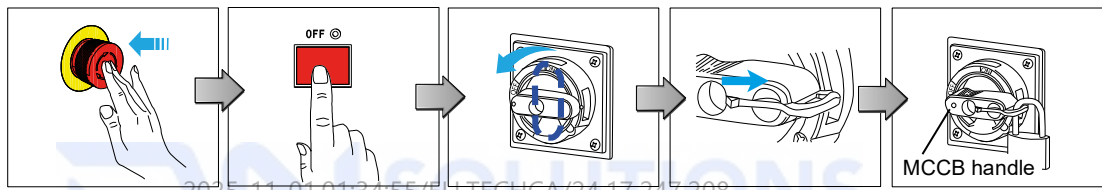
Item	Check point	Remark	After inst.	Daily	Semi-annual	Annual
State	Setting temperature	SV=03	●	●		
	Input voltage to device	±10%			●	
	Pipings	Check leakage	●	●		
	Bolts and connectors	Check state	●			●
Function	Device action	Check state	●	●		
	OP panel	Check function			●	
Oil supply	Level gauge	Check state	●	●		
	Oil replacement				●	
Cleaning	Filter	Check/cleaning		●		



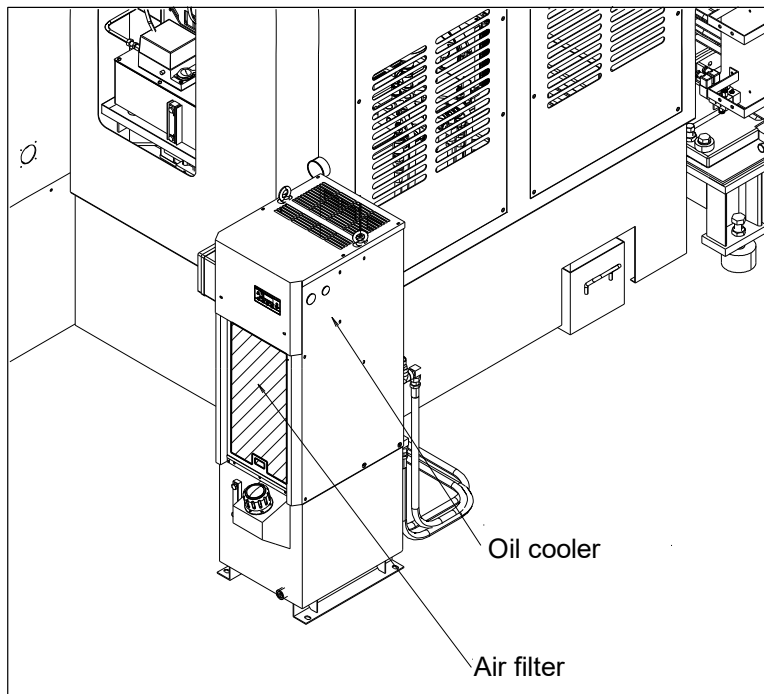
NOTICE

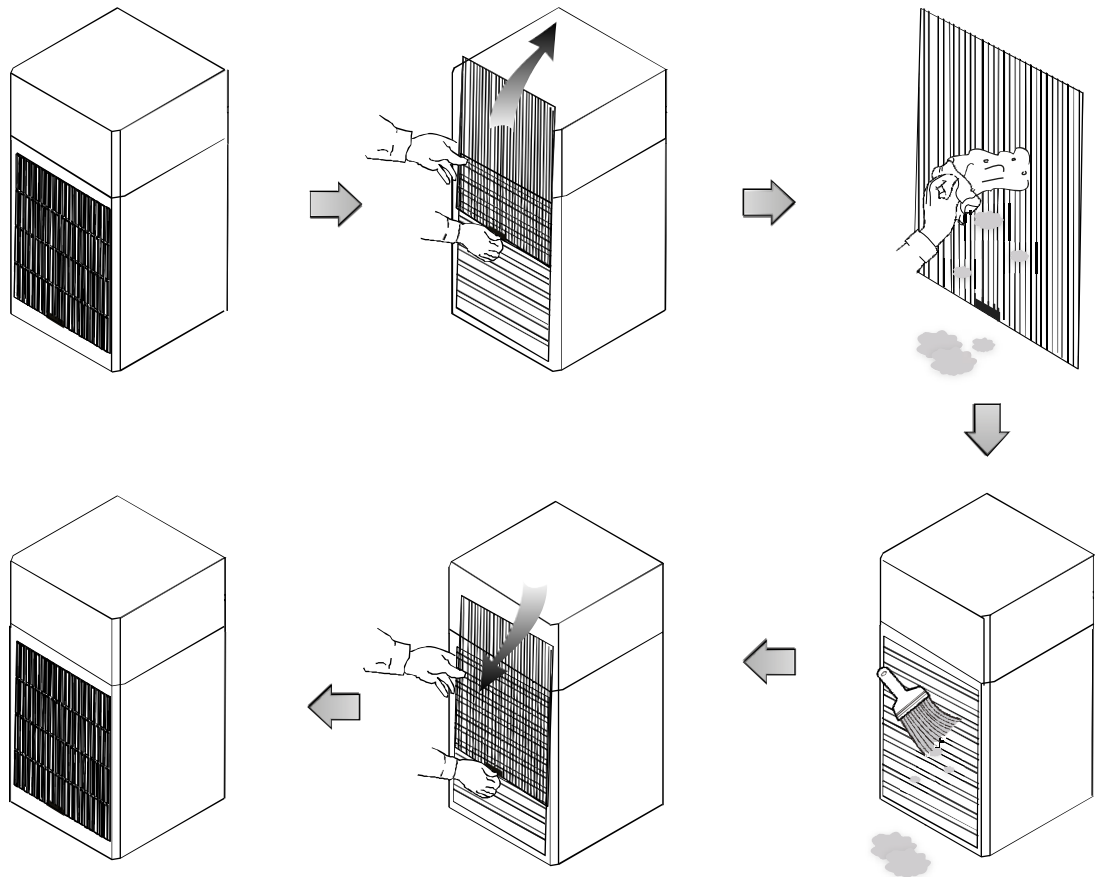
- ✓ Please refer to extra oil cooler instruction for detail check and maintenance.

(1) Clean air filter/condenser of the oil cooler



1) Turn the power off and lock the MCCB handle.





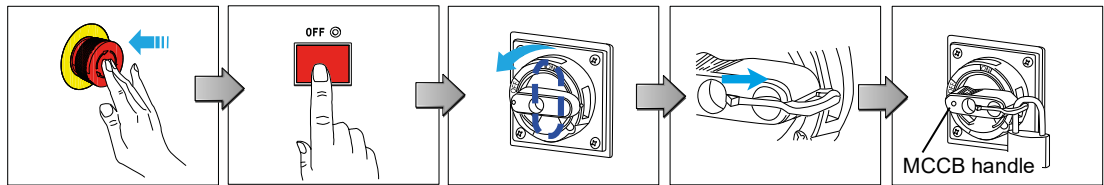
- 2) Push air filter upwards to remove it.
- 3) Clean the air filter using warm water (40 °C or lower) with neutral detergent and then rinse the neutral detergent again with clean water.
- 4) Clean the condenser mesh using a brush or compressed air.
- 5) Dry the air filter. (Use compressed air when necessary)
- 6) Reassemble the air filter after it was completely dried.



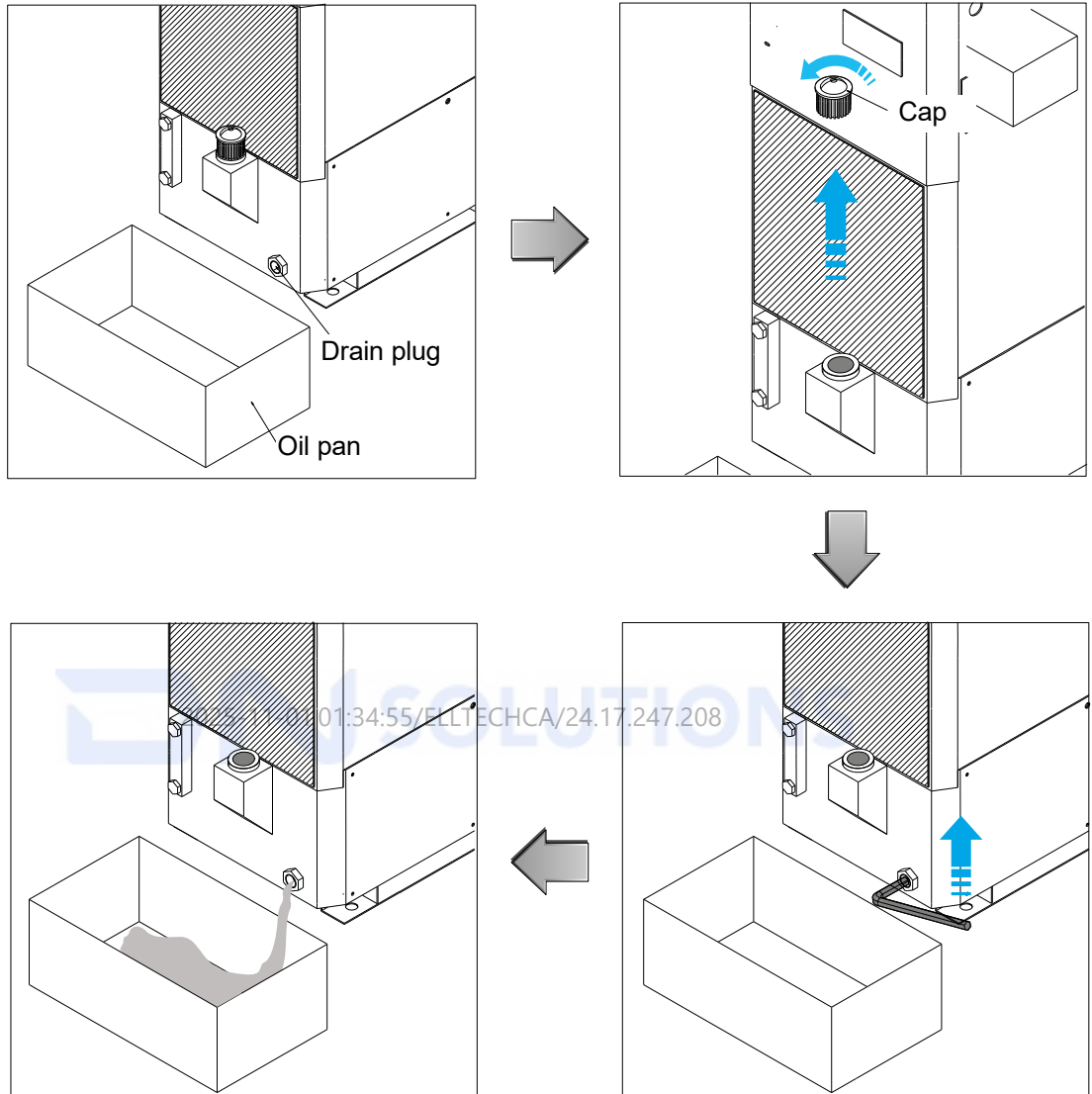
NOTICE

- ✓ The oil cooler's operation panel has air filter cleaning recommending alarm function. When an alarm is triggered, immediately clean the air filter and reset (For details, refer to the oil cooler manual).
- ✓ If performing reset in the oil cooler's operation panel after conducting regular cleaning, an alarm recommending cleaning is not triggered.
- ✓ Do not operate the oil cooler if the air filter is not installed. The oil cooler may malfunction.
- ✓ Do not arbitrarily install filters or obstacles in front of the air intake. Otherwise, the air flow will be disturbed and the cooling performance will be degraded.
- ✓ Cleaning cycle: Weekly (50 hours)

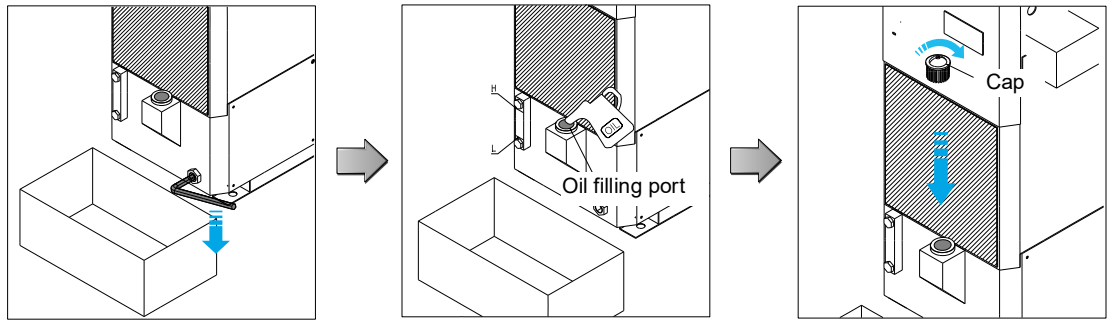
(2) Replace oil cooler oil



1) Turn the power off and lock the MCCB handle.



- 2) Place oil pan in front of drain plug.
- 3) Open the cap on oil filling port.
- 4) Unplug the drain plug and drain oil.



- 5) Lock the drain plug.
- 6) Replenish to “H” mark(upper limit) on oil level gauge with oil can.
- 7) Tighten the cap on oil filling port.
- 8) Dump leaked oil in the designated place.
- 9) Check the operational status and finish the work if there is no abnormality.



- ✓ Oil, coolant, chips, refrigerant and other industrial waste should be treated strictly in compliance with the safety and environmental protection laws prescribed by the competent national and regional agencies.
- ✓ It must not exceed the “H” mark (upper limit) on the oil level gauge.
- ✓ If the plug is wrapped with Teflon tape, remove the tape completely and assemble by wrapping with new Teflon tape.
- ✓ Replacement cycle: annually(2000 hours)

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10. SPLASH GUARD

Item	Check point	Remark	After inst.	Daily	Semi-annual	Annual
State	Surface of cover	Check leakage	●	●		
	Bolts and connectors	Check state	●			●
Function	Each doors	Open and close	●			
	Safety switches for door	Check DGN	●	●		

11. NAME PLATES

Item	Check point	Remark	After inst.	Daily	Semi-annual	Annual
State	Each nameplate	Check attached state	●	●		

12. COOLANT & CHIP DEVICES

Item	Check point	Remark	After inst.	Daily	Semi-annual	Annual
State	Input voltage to motor pump	± 10%	●		●	
	Coolant flowrate	Adjustment		●		
	Pipings	Check leakage	●	●		
	Bolts and connectors	Check state	●			●
Function	Each pump	Check action	●	●		
	Chip conveyor		●	●		
	Screw conveyor action		●	●		
Oil supply	Oil priming	Check state	●			
	Level gauge		●	●		
	Oil replacement				●	
	Chain for chip conveyor	Apply grease				●
Cleaning	Inside of tank	Cleaning			●	
	Filter	Check/cleaning			●	
	Chip conveyor(Daily)	Manual operation		●		
	Chip conveyor(Annual)	Disassemble				●

13. TOOL & WORKPIECE MEASUREMENT DEVICES

Item	Check point	Remark	After inst.	Daily	Semi-annual	Annual
State	Covers and bolts	Check state	●	●		
Function	Pop-up unit UP/DOWN action		●	●		
	Measurement device action		●	●		
	Air blow action		●	●		
Cleaning	Measurement devices	Remove foreign substance	●		●	



NOTICE

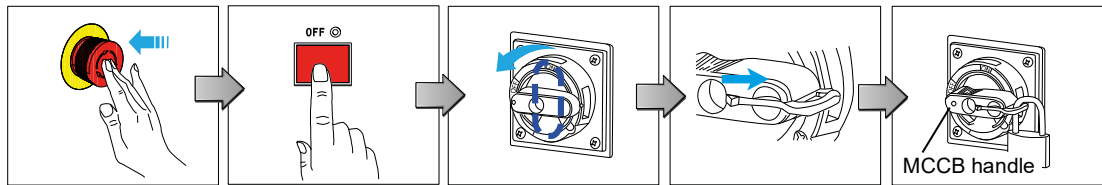
- ✓ For BK9 measuring device, install it in alignment with the measuring tool during initial installation.

14. ELECTRIC DEVICES

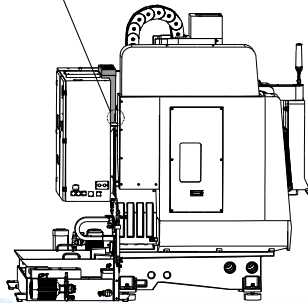
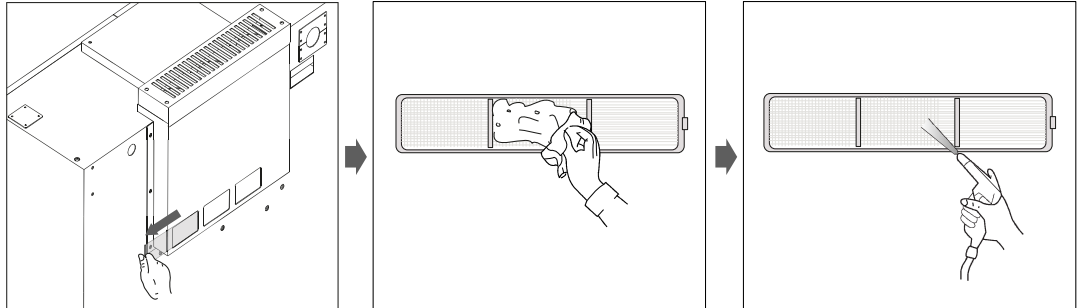
Item	Check point	Remark	After inst.	Daily	Semi-annual	Annual
State	Input voltage	$\pm 10\%$	●		●	
	Bolts and connectors	Check state	●			●
Function	Each emergency stop pushbutton switch	Check DGN	●	●		
	OP. devices	Check function	●	●		
	Signal tower	Check ON/OFF	●	●		
	Work light		●	●		
	Fan of electrical cabinet	Check action	●	●		
Cleaning	Inside of electrical cabinet	Check state			●	



(1) Clean air filter in electrical cabinet.



1) Turn the power off and lock the MCCB handle.



2) Pull the air filter from behind the electrical cabinet.

3) Clean the air filter with neutral detergent and warm water(40 °C or lower).

4) Then wash the neutral detergent away using clean water.

5) Dry the air filter. (Compressed air can be used if necessary)

6) Assemble the air filter after the filter has been completely dried.

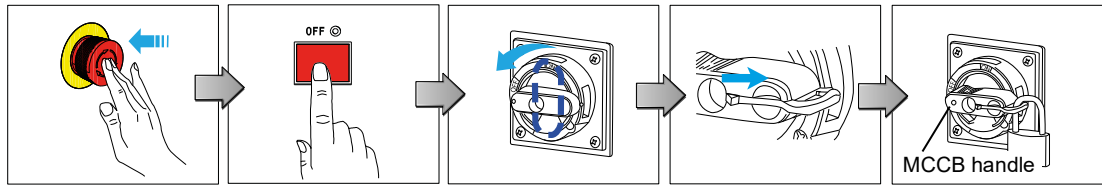


NOTICE

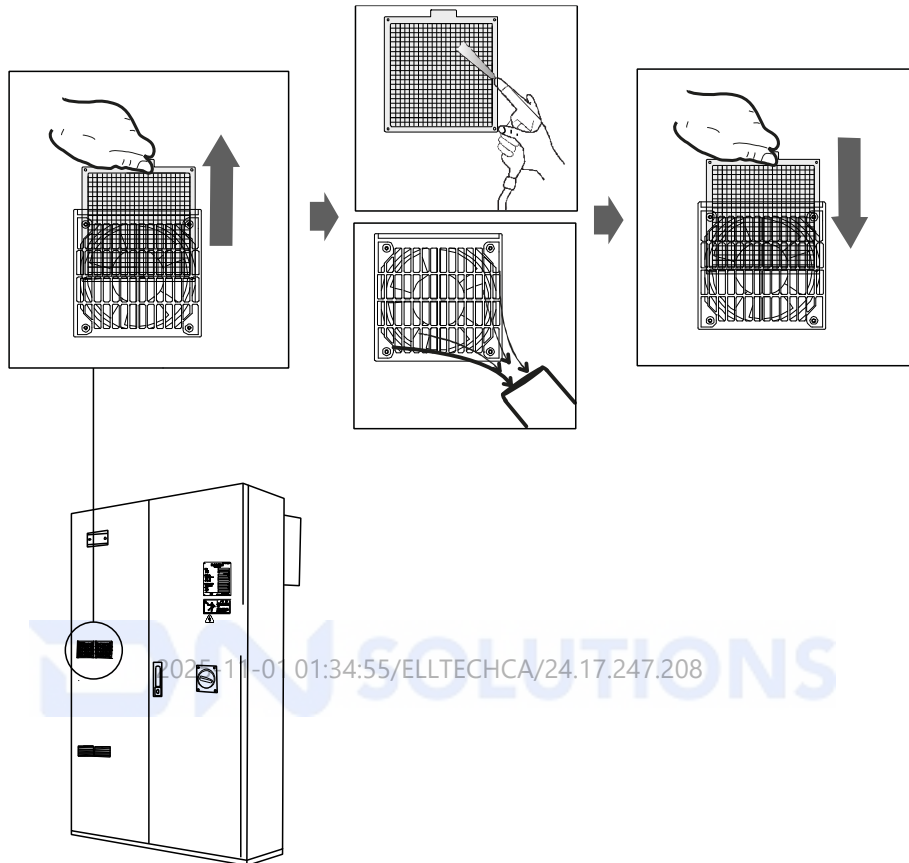
- ✓ If your machine has an air filter, clean it following the steps describe above.
- ✓ Do not arbitrarily install filters or obstacles in front of the air intake. Otherwise, the air flow will be disturbed and the cooling performance will be degraded.
- ✓ Cleaning cycle: Monthly (200 hours)

(2) Check and clean fan

Electrical cabinet fan



1) Turn the power off and lock the MCCB handle.



- 2) Disassemble air filters inside/outside the electrical cabinet door.
- 3) Blow the dust on the air filter using an air gun.
- 4) Check if dust has been removed from the fan.
- 5) Suck dust from the fan using a vacuum cleaner.
- 6) Re-assemble the air filter.
- 7) Turn the machine power ON and check the fan operation.



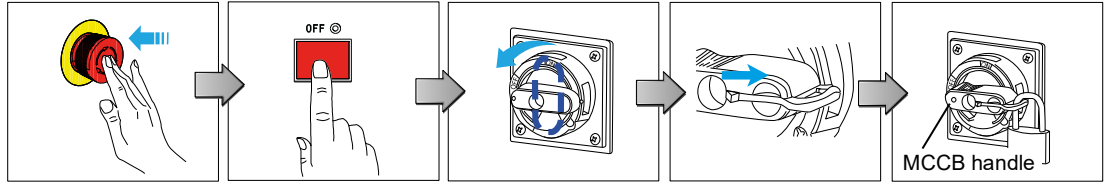
- ✓ Some models do not have fan and/or air filters depending on models.
- ✓ Do not arbitrarily install filters or obstacles in front of the air intake. Otherwise, the air flow will be disturbed and the cooling performance will be degraded.
- ✓ Check/Cleaning cycle: Monthly (200 hours)



Motor Fan

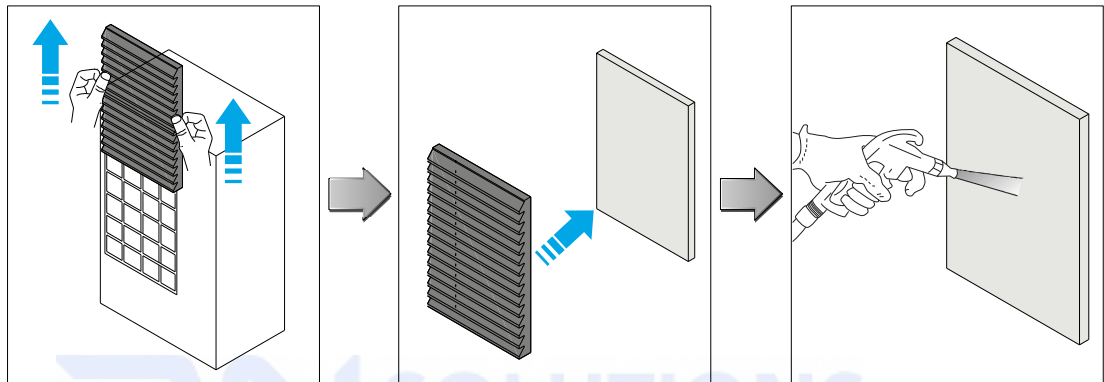
- ✓ The motor fans installed in machine tools are always exposed to contamination and needs regular checkups and cleaning.
- ✓ Check/Cleaning cycle: Monthly (200 hours)

(3) Clean air conditioner filter in electrical cabinet.(optional specifications)

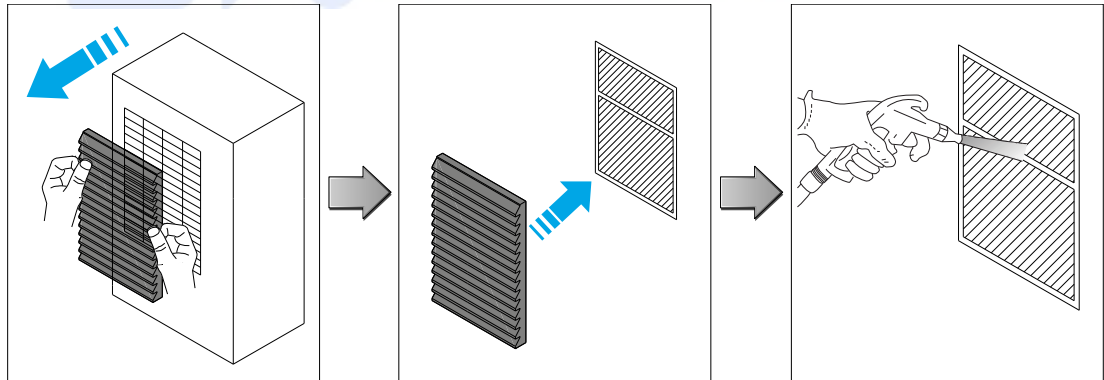


1) Turn the power off and lock the MCCB handle.

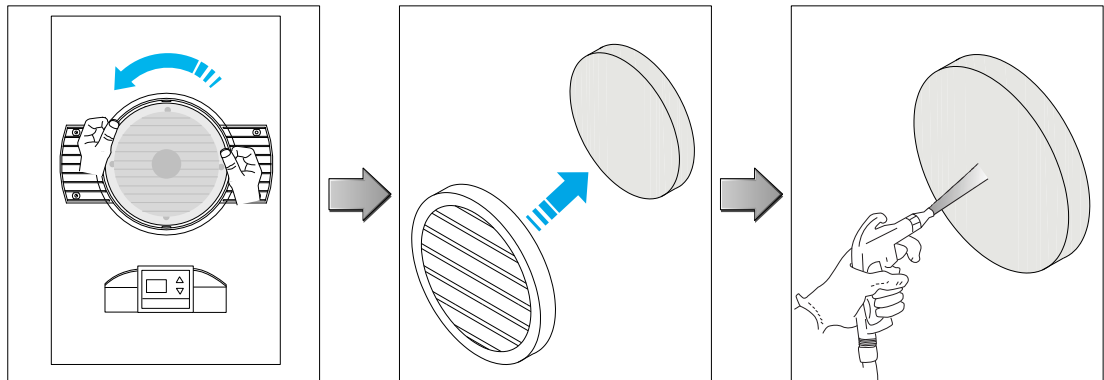
[A type]



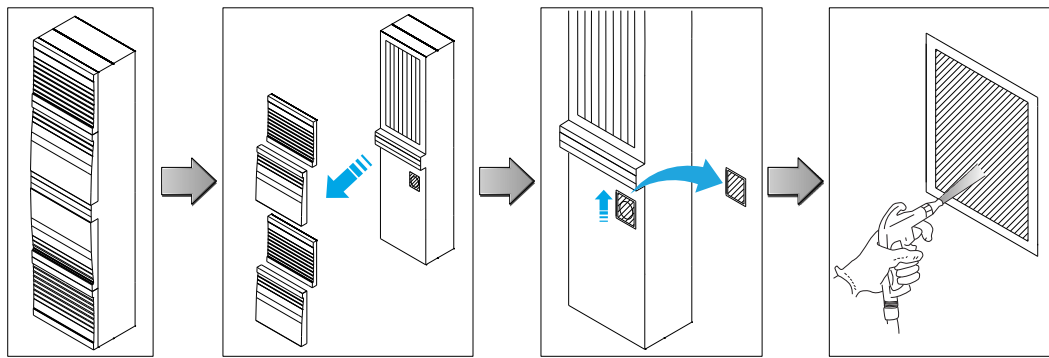
[B type]



[C type]

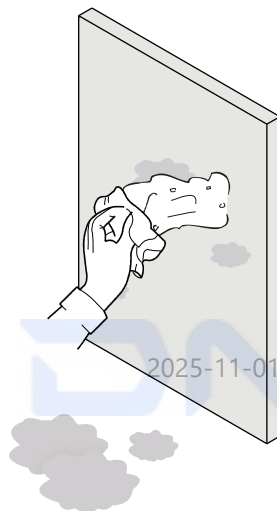


[D type]



- 2) Remove the cover according to the model type.
- 3) Remove the filter.
- 4) Clean the filter with an air gun and assemble it again.

※ When you can't clean the filter with an air gun,



1. Clean the air filter with neutral detergent and warm water(40 °C or lower).
Clean the condenser mesh using a brush or compressed air.
2. Dry the air filter. (Use compressed air when necessary)
3. Reassemble the air filter after it was completely dried.

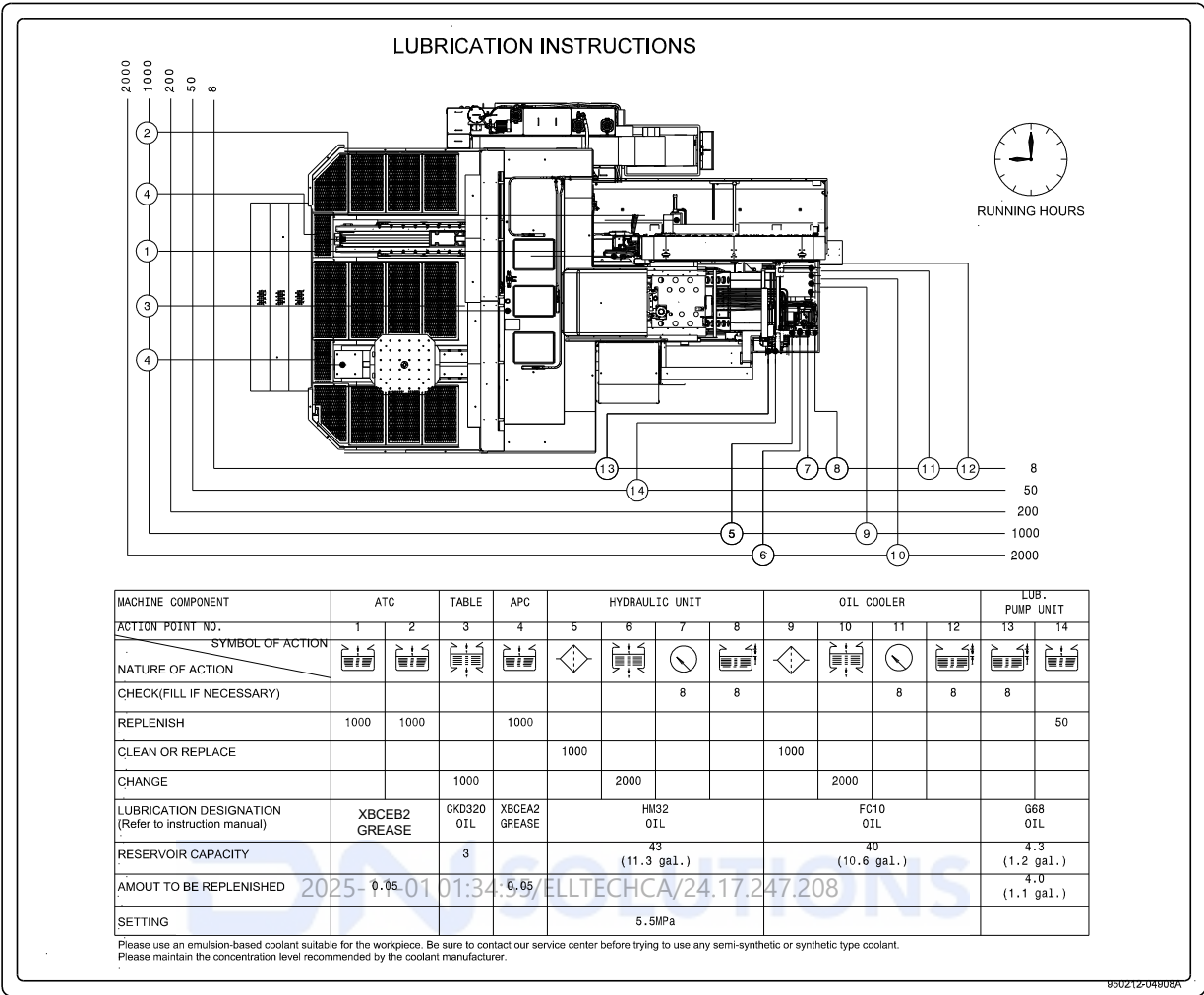


NOTICE

- ✓ Do not arbitrarily install filters or obstacles in front of the air intake. Otherwise, the air flow will be disturbed and the cooling performance will be degraded.
- ✓ There may be differences between models of air conditioners, and some models do not have air filters. For more information, refer to the maker's manual of the air conditioner.
- ✓ Cleaning cycle: Weekly (50 hours)

15. PERIODIC CHECK OF OIL

(1) Oil supply diagram



(2) Comparative oil table

TYPE (ISO CODE)	OIL TYPE		MOBIL	SHELL	TOTAL
	ISO CLASS	DIN CLASS			
BEARING OIL (6743-2)	FC2	CL2	VELOCITE OIL NO. 3	Morlina S2 BL 2	DROSER MS 2
	FC10	CL10	VELOCITE OIL NO. 6	Morlina S2 BL 10	DROSER MS 10
	FC22	CL22	VELOCITE OIL NO. 10	Morlina S2 BL 22	DROSER MS22
	FC32	CL32	DTE OIL LIGHT	Turbo T 32	DROSER MS32
	FD32	HLP32	DTE 24	Tellus S2 M 32	DROSER MS32
SLIDEWAY OIL (6743-13)	G68	CGLP68	VACTRA OIL NO. 2	Tonna S3 M 68	DROSER MS 68
	G220	CGLP220	VACTRA OIL NO. 4	Tonna S3 M 220	DROSER MS 220
HYDRAULIC OIL (6743-4)	HG32	CGLP32	VACUOLINE 1405	Tonna S3 M 32	DROSER MS32
	HG68	CGLP68	VACUOLINE 1409	Tonna S3 M 68	DROSER HX 68
	HM32	HLP32	DTE 24	Tellus S2 M 32	AZZOLA ZS 32
	HM46	HLP46	DTE 25	Tellus S2 M 46	AZZOLA ZS 46
	HM68	HLP68	DTE 26	Tellus S2 M 68	AZZOLA ZS 68
GEAR OIL (6743-6)	CKD68	CLP68	MOBILGEAR 600 XP 68	Omala S2 G 68	CARTER EP 68
	CKD150	CLP150	MOBILGEAR 600 XP 150	Omala S2 G 150	CARTER EP 150
	CKD220	CLP220	MOBILGEAR 600 XP 220	Omala S2 G 220	CARTER EP 220
	CKD320	CLP320	MOBILGEAR 600 XP 320	Omala S2 G 320	CARTER EP 320
	CKS68	CLP HC68	SHC 626	Omala S4 GXV 68	
	CKS150	CLP HC150	SHC 629	Omala S4 GXV 150	CARTER SH 150
	CKS220	CLP HC220	SHC 630	Omala S4 GXV 220	CARTER SH 220
GREASE (6743-9)	XBCEB 0	GP0G-20	MOBILUX EP 0	Gadus S2 V 220 0	MULTIS EP 0
	XBCEB 2	KP2K-20	MOBILUX EP 2	Gadus S2 V 220 2	MULTIS EP 2
	KLUEBER S88 PLUS				
Circulating heat Transfer fluid	KD Finechem BP-802				



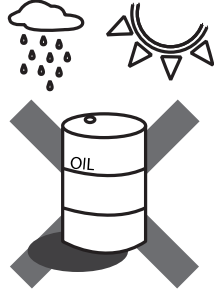
NOTICE

- ✓ The oil type indicates applicable ISO standards along with viscosity.
- ✓ Handling of oil
Please use our recommended oils. Do not mix with other-maker oils. We will not be held responsible for the malfunctions caused due to the use of oils not recommended.
- ✓ Matters to be followed during oil injection
 - ① Please use a dedicated oil jug, and do not use others to refuel.
 - ② Be sure to refuel with the filter attached to the tank filler cap.
 - ③ If oil other than the specified oil is to be refueled or oils have been mixed up, clean the tank piping promptly.
- ✓ Disposal of waste oils
Oil, coolant, chips, refrigerant and other industrial waste should be treated strictly in compliance with the safety and environmental protection laws prescribed by the competent national and regional agencies.

✓ Precaution during storage of oil

If you purchase and store a large amount of oil, please store the oil according to the following precautions. In addition, you are recommended to purchase as much oil as you want to use.

1. Please store the oil in a place where it is not exposed to direct sunlight or rain.



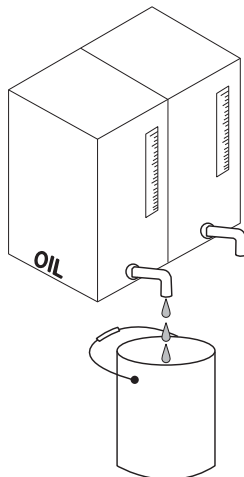
2. Take precautions to protect the stored oil against the inflow of dust or water from the outside.



3. Never use deteriorated oils or oils mixed with foreign matter.



4. If using an intermediate tank, remove dust or moisture from the tank once a year.



NOTICE

Part 7 CHECK POINT AGAINST TROUBLE

In this section, brief and compact information for check point of each unit when its trouble occurs as any form is provided.

In addition to the check points given here, there are some other items which should be checked according to the actual condition of the machine. Please make extra check sheet and schedule, if necessary.

Re-adjustment and maintenance must be followed carefully by maintenance staff or our service man, if anything is observed by inspection. Be sure not to change setting and adjusting value without intention in any case.



NOTICE

- ✓ If adjustment and maintenance is needed, please refer to Section 8 and operation manual.
- ✓ Please refer to operation manual for treating Alarm.

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1. ATC(AUTOMATIC TOOL CHANGER)

(1) Tool change trouble

Item	Check point	Remark
Tool change condition	State and position of each part	
Tool used	Diameter/length/weight	
	Shank and grip part	
	Pull-stud state	
Air state	Supplied state	
Spindle head	Spindle tool clamp/unclamp	
	Orientation stop state	
	Alignment with spindle head	Centering
Abnormal sound	Check its part	
Tool changer	Stop position of cam follower	
	Breakage of cam follower	
	Breakage/jam	Moving parts
	Each switch action	Flickering
	Clearance between dog and switch	
	Tool shake on tool locking	
	Smoothness of tool release	
	Release pin action	
	Breakage of electric parts	
ATC door	ATC door OPEN/CLOSE operation	

(2) Tool magazine rotation trouble

Item	Check point	Remark
Magazine rotation condition	State and position of each part	
Tool used	Diameter/length/weight	
	Shank and grip part	
	Pull-stud state	
Stopping pot position	Stop position of stopping pot	
Abnormal sound	Check its part	
Tool magazine device	Servo. Motor operation	
	Breakage/jam of moving parts	Each part
	Breakage and deformation of pot	
	Each switches operation	
	Clearance between dog and switch	
	Shake of loaded tool	
	Breakage of electric parts	Connection
	Breakage of sol. valve	
	Motor brake operation	'click' sound

(3) Waiting pot moving trouble

Item	Check point	Remark
Moving condition	State and position of each part	
Moving condition	Supplied state	
Abnormal sound	Check its part	
Moving device	Jam of moving parts	
	Cylinder action state and speed	
	Switch operation	
	Clearance between dog and switch	
	Breakage of electric parts	Connection
	Breakage of sol. valve	



NOTICE

- ✓ ATC's operating temperature range is 5 - 50 ℃. In the temperature under 5 ℃, the oil viscosity raises very high and it can be a reason of slower tool rotation speed or malfunction. In a condition with extreme temperature, always check ATC function before an automatic tool change. 5-10 times of ATC warm-up without tool is recommended before operating the machine.
- ✓ When installing tools on the machine, follow the instructions below.
Follow the cutting edge, angle according to the tool mounting instructions.
Only tool conforming to specified standards are to be used.

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2. APC(AUTOMATIC PALLET CHANGER)

Item	Check point	Remark
Pallet change condition	State and position of each part	
Air state	Supplied state	
Hydraulic state	Operation part	
Abnormal sound	Check its part	
Changer device	Cylinder assembly/action/speed	
	Breakage/jam of moving parts	Moving parts
	Each switches action	
	Position between dog and switch	
	HYD. cylinder speed for changer up/down	
	HYD. cylinder state for changer up/down	
	Stopping position of changer arm	
	Pin and hole for positioning	
	Breakage of electric parts	Connection
	Breakage of sol. valve	

3. AXIS SYSTEM

Item	Check point	Remark
Initial condition	Reference point return operation	
Lubrication	Supplied state	
Abnormal sound	Check its position	
Axis system	Switch operation	
	Position between dog and switch	Moving parts
	Ballscrews' assembled state	
	Static accuracy	
	Breakage of electric parts	
	Breakage of servo-motor	

4. SPINDLE HEAD

(1) Tool clamp/unclamp trouble

Item	Check point	Remark
Unclamp condition	State and position of each part	
Air state	Supplied state	
Hydraulic state	Operation state	
Clamp/unclamp device	Switch signal	
	Position between Dog and switch	
	Kicking distance on tool unclamp	0.5mm(0.02in)
	Stroke of unclamp cylinder	15.0mm(0.59in)
	Stroke of draw bar for tool unclamping	9.0mm(0.35in)
	Tool clamp state	Shake
	Tool unclamp speed	
	Inside of spindle taper	Foreign substance & excessive wear
	Breakage of electric parts	Connection
	Breakage of sol. valve	

(2) Spindle orientation trouble

Item	Check point	Remark
Parameter setting	Orientation stop variation	
Orientation device	Deviation between stop position on CW/CCW	
	Support bearings	
	Breakage of electric parts	Connection
Air state	Supplied state	

(3) Spindle drive trouble

Item	Check point	Remark
Rotation condition	State and position of each part	
Shake on rotation	Check its state	Run out
Spindle drive device	Support bearings	
	Preload device state	
	Motor overload	
	Breakage of electric parts	Connection
	Breakage of spindle motor	

5. TABLE

Item	Check point	Remark
Initial condition	Reference point return	
Air state	Supplied state	
Hydraulic state	Operation state	
Abnormal sound	Check its part	
Axis system	Each switch operation	
	Position between dogs and switch	
	Table clamp/unclamp state	
	Static accuracy	
	Breakage of electric parts	Connection
	Breakage of servo motor	
Pallet clamp device	Pallet clamp/unclamp state	
	Air blow	Remove for-eigne substance
	Each switch operation	
	Breakage of electric part	
Surface flatness of parts assembled on top of pallet	Check the bottom surface flatness - Pallet size 630 mm or less: 0.05 mm - Pallet size 800 mm or more: 0.08 mm	

6. AIR SERVICE UNIT

Item	Check point	Remark
Air service unit	Air tank state	Water inflow
	Air leakage	Abnormal sound
	Each valve state	
	Supplying setting pressure	0.54MPa (71psi)
	Pressure switch setting value	0.4MPa (57psi)
	Blocking of filter	
	Extraction of water in filter unit	

7. LUBRICATION UNIT

Item	Check point	Remark
Lubrication unit	Float switch operation	
	Oil leakage in pipings	
	Oil supplied state	
	Each valve state	
	Check oil level	Level gauge
	Pressure switch operation	
	Supplied pressure	Pressure gauge

8. HYDRAULIC UNIT

Item	Check point	Remark
Hydraulic unit	Oil leakage in pipings	
	Check oil level	Level gauge
	Supplied pressure	
	Pressure switch operation	Pressure gauge

9. OIL COOLER

Item	Check point	Remark
Oil cooler	Oil leakage in pipings	
	Setting temperature	SV=03
	Blocking of filter	
	Check oil level	Level gauge

10. COOLANT & CHIP DEVICES

Item	Check point	Remark
Coolant and chip devices	Oil leakage in pipings	Joint
	Check oil level	Level gauge
	Adjustment of flowrate	

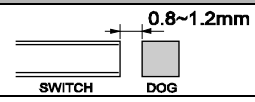
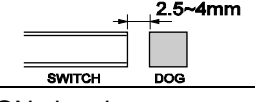


Part 8 DATA FOR ADJUSTMENT/MAINTENANCE

NC machine is a highly efficient production unit having a much higher utilization than manual one. This section deals with the requirements for adjustment/maintenance which must be kept by all users in order to ensure excellent, trouble-free performance and prolonged life.

Adjustment and maintenance must be followed carefully by maintenance staff or our service man, if something wrong is observed by inspection. Be sure not to change setting and adjusting value without intention in any case.

The followings are the basic concepts for adjustment and maintenance, and please refer to section 5, Parts list and Electric/Ladder diagram.

Number	Item	Description
1	Adjustment of proximity switch (Switch dia. Ø12mm)	
2	Adjustment of proximity switch (Switch dia. Ø18mm)	
3	Adjustment of other switch	· Check DGN signal
4	Bolts/screws	· Right thread by Meter system (Except for rotating union for T-S-C)

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1. PRECAUTIONS FOR MAINTENANCE

1.1 Preliminary remarks

This section deals with the maintenance requirements which must be met by every user in order to insure excellent, trouble-free performance and prolonged life.

It also outlines some basic steps to pinpoint possible causes of trouble, together with troubleshooting hints, if your machine is found out of order in any way, or in need of readjustment or repair.

1.2 Particular precautions

Maintenance operation described in this chapter is easy but can expose the operator to risks if not executed in the right way.

For this reason, first to start any kind of job, we recommend to read all of the following indications:

- All of the verification and maintenance operation reported in the following paragraph must be done when machine is in "Maintenance State" as described in chapter 1.3 "Maintenance states".
- Maintenance operation must be done only by authorized and trained operators with basic machine knowledge, check chapter 2.2 "Maintenance Man/Woman" of Section A.
- All of the operation must be done by only one operator to avoid dangerous sequence error of coordination action.
- Never go on top of the machine because it's not built for this purpose.
- Lock always the vertical axis by using wooden blocks or iron bar before any maintenance operation.
- Pay attention to not sparse coolant or other material dangerous for the ambient.
- Use always individual protection device (glasses, gloves, shoes, etc) right for the operation to do.
- Keep clean and ordered inside working area to reduce the risk of forgotten tools on machine moving parts.
- At the end of the operations, all of the fixed and movable guards with interlock and protection device must be fully functional.

1.3 Maintenance state

All of the verification and maintenance operation described in this chapter must be done under specific machine conditions, we can classify them into three machine states:

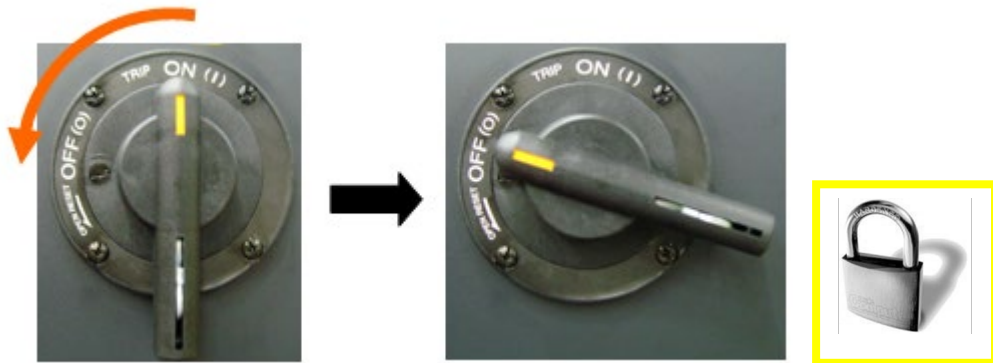
(1) Normal work

Normal work means the full machine operability, all of the energy sources are available and connected, command circuit are active.

(2) Insulation

Insulation state means that all of the energy sources must be off and sectioned:

Close the main switch of electric energy placed on electrical cabinet by rotating it CCW.



It must be possible to lock the switch in OFF position.

(3) Maintenance insulation

Same condition as Insulation, but also the operator must:

- Attach in a well visible position on machine a label with the following sentence:

"MAINTENANCE STATE"

1.4 Check of safety device

At least once every month the following procedure must be executed by machine maintenance operator for safety device verification.

(1) Emergency Switch Push Buttons

For every emergency switch push buttons, set the machine in ready state for normal automatic functionality:

- 1) Without any work piece inside, command cycle start to execute a verified simple program with spindle rotation.
- 2) Press emergency switch push button and verify that machine stop immediately all of the movement.
- 3) Unlock and reset the emergency switch push button and verify if it is possible to regularly restart the machine.
- 4) If something abnormal is found, please contact immediately the authorized service company.

(2) Interlocking Device

For every interlocking device, set the machine in ready state for normal automatic functionality:

- 1) Without any workpiece inside, command cycle start to execute a verified simple program with spindle rotation.
- 2) Try to open the cover and verify if it is locked.
- 3) Stop the working cycle, open the cover and verify if it is impossible to execute command or movements.
- 4) Turn the main modal key selector in manual-maintenance position and verify if it is impossible to command start, the axis speed in jog is max 2000mm/min and spindle jog is max 50r/min or stopped; in this case jog means that the command must be keep pressed, if released the movement immediately stops.
- 5) If something abnormal is found, please contact immediately the authorized service company.

(3) Hydraulic Pipe

All of the hydraulic pipes used in spindle chuck, tailstock, steady rest, tool systems and other device like balancing system must be visually checked to verify the integrity and the absence of damage, leakage due to heavy use.

If something abnormal is found, please contact immediately the authorized service company.

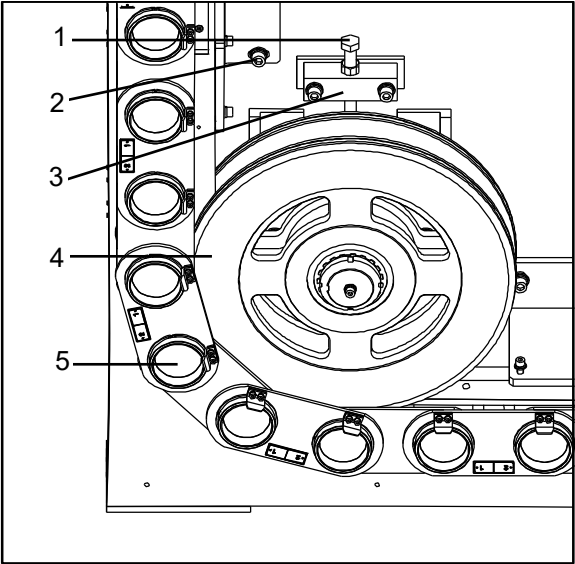
(4) Safety window

Please refer to the description of the safety Guidance.

2. ATC(AUTOMATIC TOOL CHANGER)

Tensioning of the magazine is carried out before shipping. However, it may increase while you are using the magazine. Slight slackness of the magazine chain, it does not matter about the indexing accuracy. However, if the slackness of chain is growing severe, tension should be adjusted by using the tension adjustment bolt.

(1) Adjusting device of tool pot chain tension



Symbol	Description
1	Adjusting bolt for tension control
2	Adjusting nut for tension control
3	Block for tension control
4	Roller for pot guide
5	Tool pot

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3. AXIS SYSTEM

(1) Adjusting reference point

Machine coordinate is established on the basis of home position.

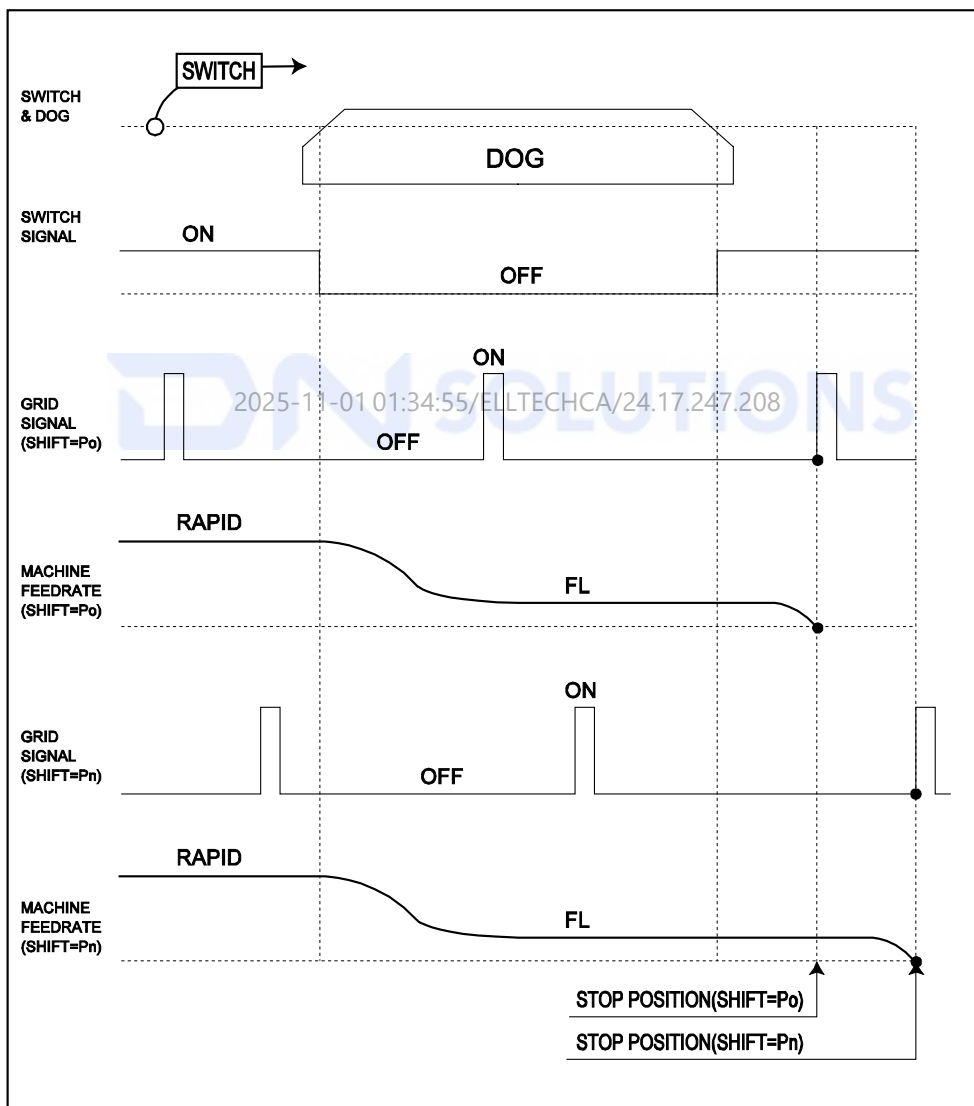
Careful maintenance is necessary not only periodically but also on occasion.

The reference point of this machine is determined accurately by parameter change to shift the grid signal from position detector, and the relation between them is as figure below.

As the figures below, machine is decelerated by the signal of reference deceleration point and stopped by the first grid signal after the extinction of deceleration signal and stop point can be adjusted by the shift of grid signal. The shift value of grid is registered at the parameter no. 508~511 and max. value is 32767.

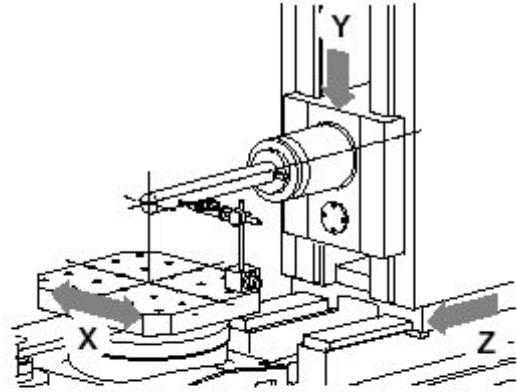
(Please refer to operation manual, parameter sheet.)

And grid shift value() is equivalent to shift of home position. During one revolution of servo motor, the pulse coder generates one grid signal while the machine moves 12mm.

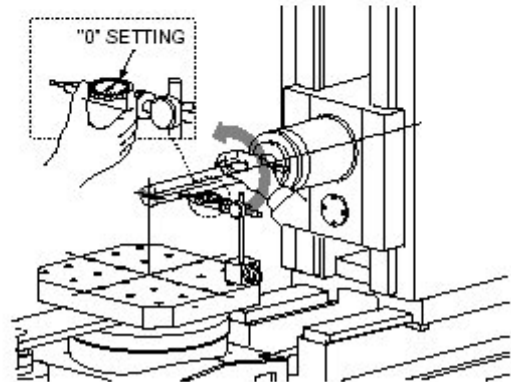


(2) X-axis

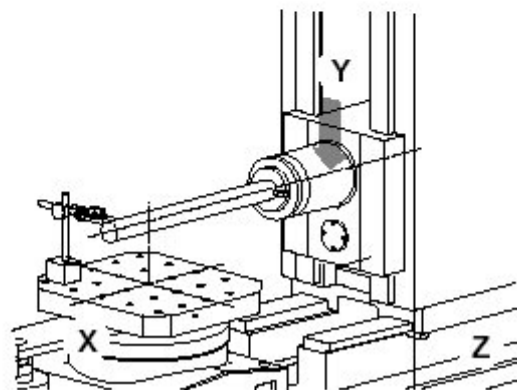
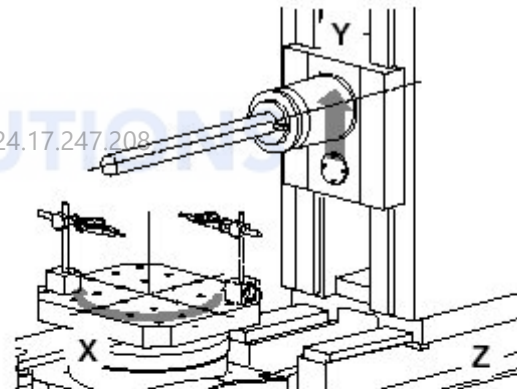
- 1) Mount test bar on the spindle.
- 2) Position table to correspond spindle center with table center.
(i.e. X-axis = 1050.0)



- 3) Position spindle (Y) and column (Z) as illustrated below.
- 4) Set indicator on table and apply to test bar. Rotate test bar by hand to recognize angle which indicates mean value of run-out.
- 5) Observing indicator, traverse Y-axis slowly in HANDLE mode to find Y-value which indicates maximum value, and set indicator to zero at this time.
- 6) Move up the spindle in Y axis and rotate table by 180 ° as shown right.

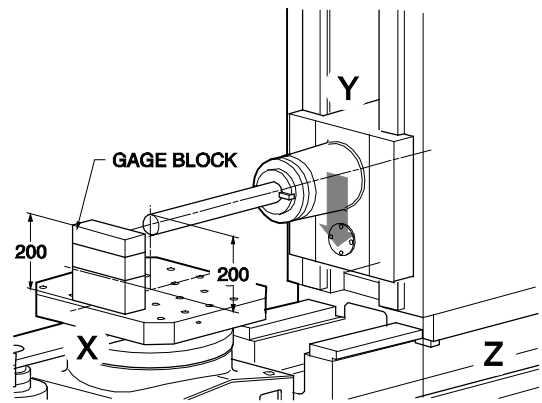


- 7) Turn test bar by 180 ° and return Y-axis.
- 8) Record indicated value. Half of this value is the error of home position.

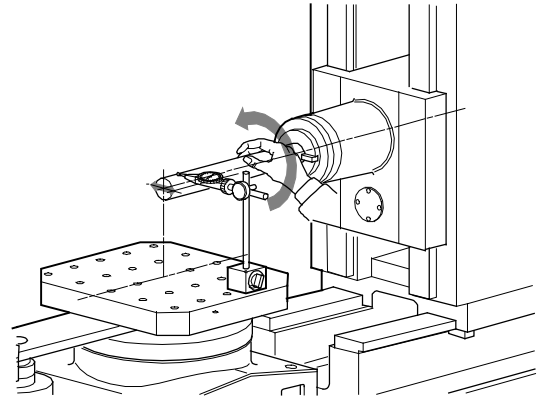


(3) Y-axis

- 1) Mount test bar on the spindle. (Measure diameter of test bar accurately and record.)
- 2) Place gauge blocks on table with L height. (typically 200mm).

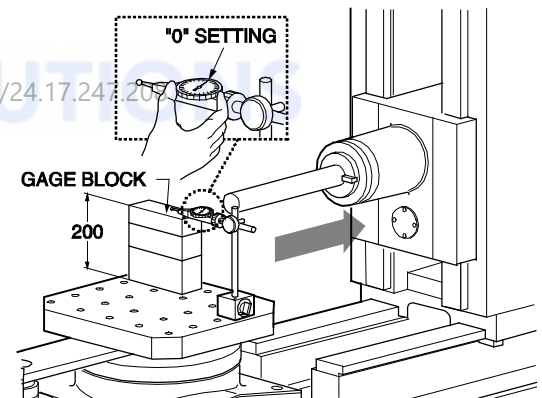


- 3) Calculate Y-coordinate which makes test bar upper side equal to the height of gauge block, and position.



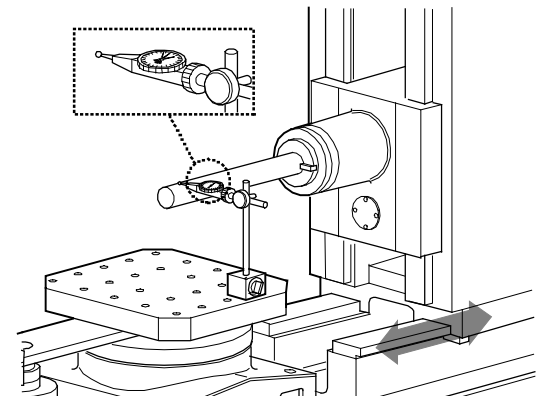
- 4) Set indicator on the table and apply to the top of test bar. Turn test bar to obtain the mean value of runout.

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- 5) Apply indicator to gauge block and set zero.

- 6) Apply indicator to the top of test bar as shown below. Record the value, which is home position error of Y-axis.



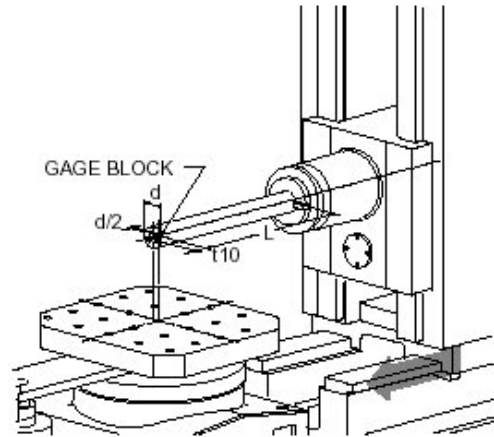
(4) Adjustment of Z-axis home position

Prepare the test bar of which diameter and length are measured accurately.

1) Prepare X-axis home position error data.

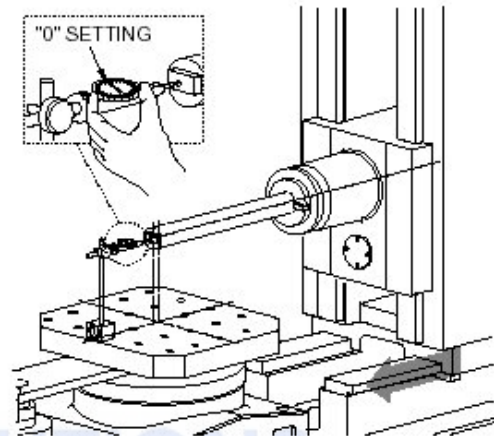
2) Position table to correspond spindle center with table center.

3) Traverse Y-axis to appropriate position (250~300mm from top of table).



4) Mount test bar on the spindle and rotate it to obtain angle which indicates mean value of runout.

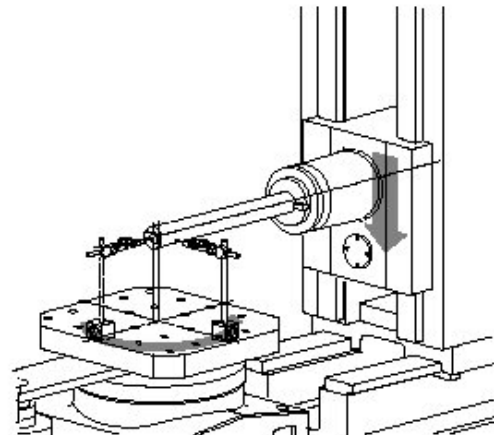
5) Traverse Z-axis as illustrated below.



6) Apply indicator to test bar and traverse Y-axis to the position which indicates half of runout.

7) Attach gauge block of 10mm to the end, apply indicator to block and set zero.

8) Avoid test bar(Y-axis), rotate table by 90° , return test bar and record indicated value. (Refer to next figure.)
Z-axis home position error is given by compensating X-axis error against above recorded value.



(5) Control of travel limit

Limit switches are used to control the limit of travel.

Following items are controlled by switches.

- 1) Reference point return
- 2) Emergency stop
- 3) Position confirm for pallet change

Additionally, function of OVER TRAVEL(OT) is also applied using STORED STROKE LIMIT 1 function of NC unit.

If the machine overpass the travel limit, it will be stopped instantly and be laid OT alarm state.

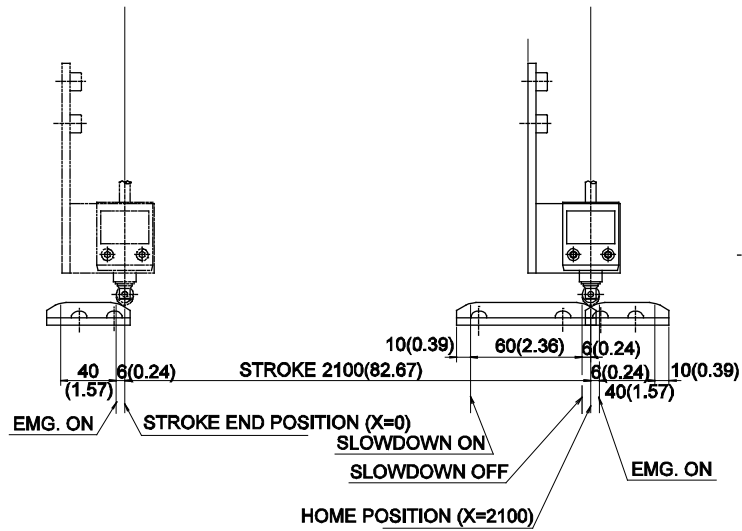
In that case, move the machine to reverse direction by manual operation and press the RESET button on MDI/CRT panel.

OT is installed at 1mm outside of the travel zone and + EMERGENCY STOP at approximately 6mm.



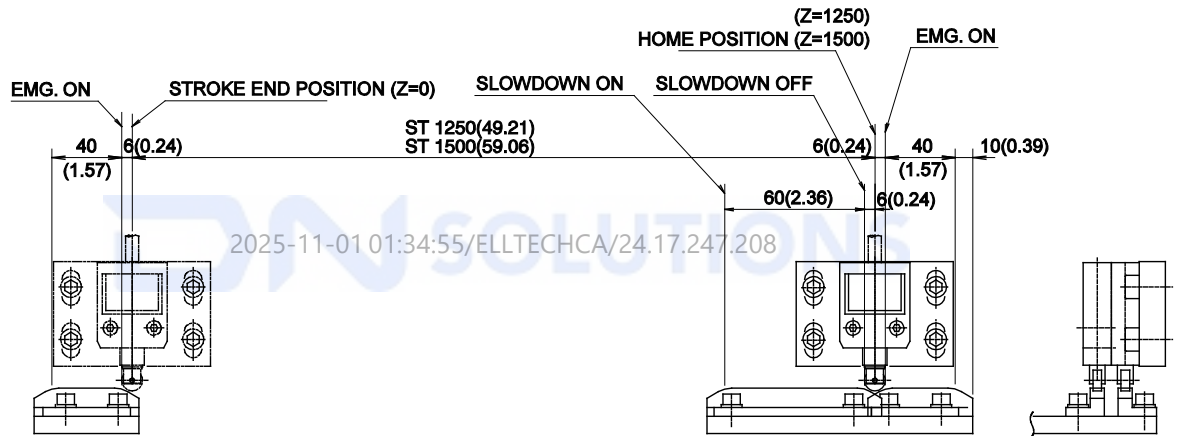
(6) X-axis configuration of limit switch

Unit: mm(inch)



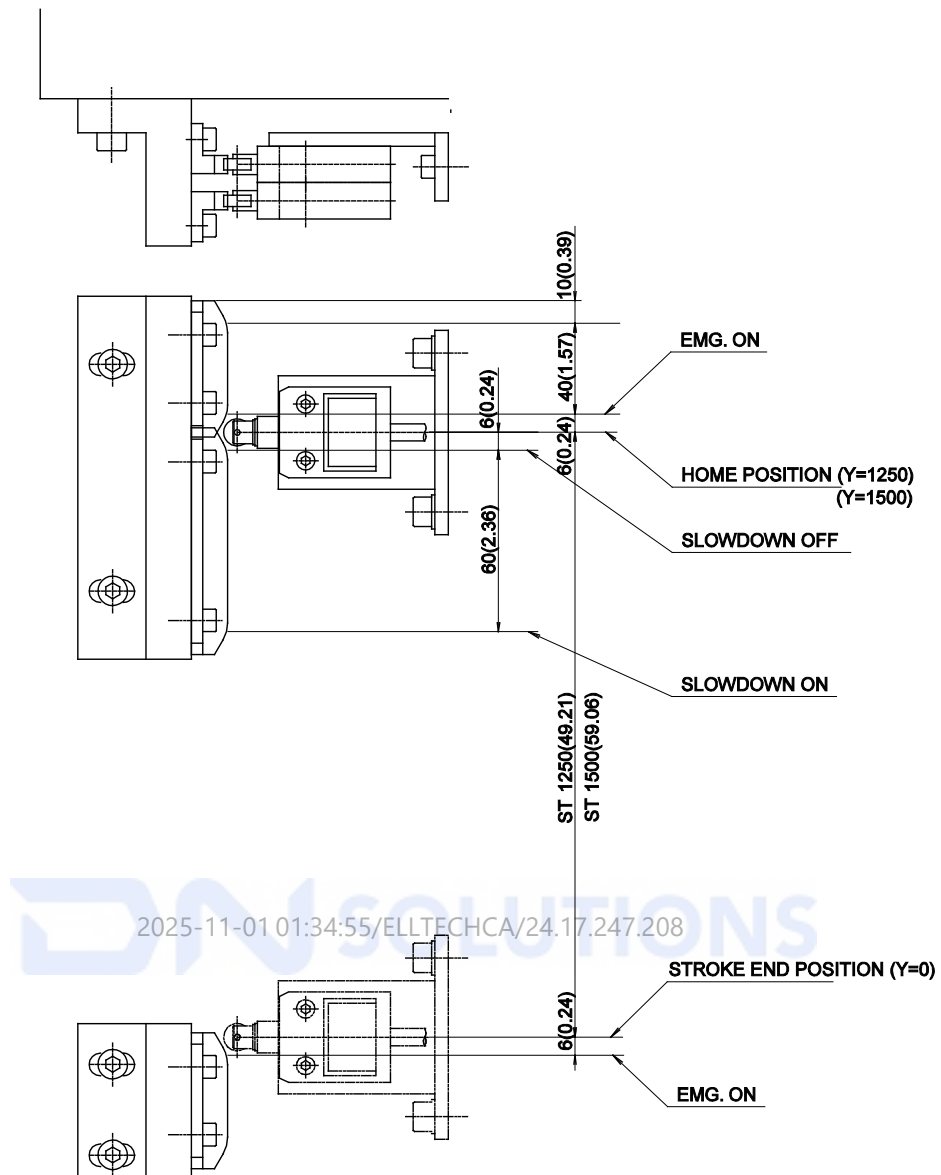
(7) Z-axis configuration of limit switch

Unit: mm(inch)



(8) Y-axis configuration of limit switch

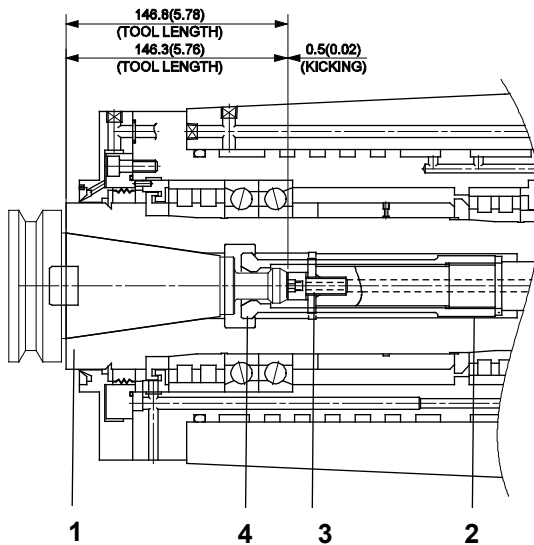
Unit: mm(inch)



4. SPINDLE HEAD

(1) Adjusting tool unclamp

Unit: mm(inch)



Symbol	Description
1	Spindle
2	Push rod
3	Adjusting collar
4	Collet



- ✓ Apply the thread loctite to the bolt against lossening on re-assembling.



- ✓ Figure upper shows the tool unclamping operation.

(2) Adjusting orientation stop position

The orientation stop position can be adjusting finely by changing parameter, and be sure to check the relative position between slots in tool and keys in spindle or changer arm with step operation of ATC to avoid severe collision.

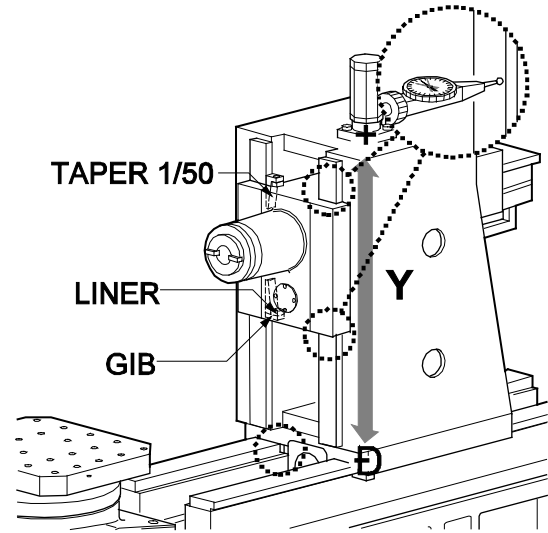
(Please refer to Machine operation manual and parameter sheet.)

5. GIB ADJUSTMENT

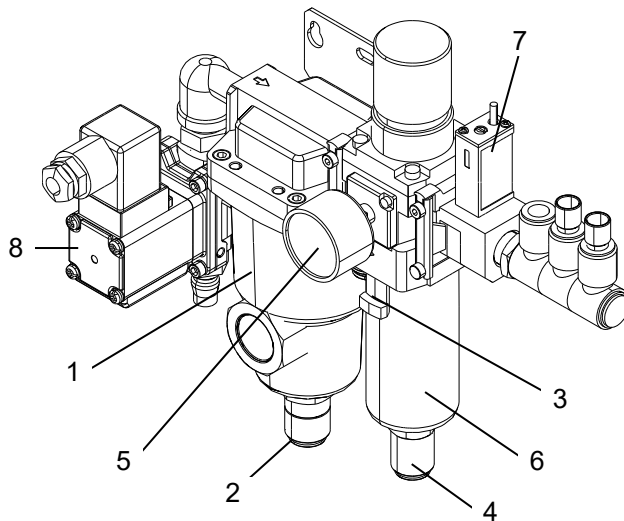
If abnormal shake is observed, adjust gib in the following procedures.

Each axis provide a pair of gib on its guide.

- (1) Traverse to near center of its travel.
- (2) Apply indicators and position by plus traverse.
- (3) Record indicated value A(+) and B(+).
- (4) Position by minus traverse and record indicated value A(-) and B(-).
- (5) Obtain the difference between A(+) and A(-), and B(+) and B(-).
- (6) Remove liner located on the side of larger difference is obtained.
(This difference is represented as D.)
- (7) Measure and record the thickness of the liner, T.
- (8) Necessary amount to press-in gib, p is: $p = (D - 0.005) \times 50(\text{mm})$
- (9) Prepare gauge blocks of T minus P thick.
- (10) Instead of liner, mount gauge blocks and repeat measuring and adjusting until the value D becomes less than 0.01mm.
- (11) Adjust the liner to the thickness of the gauge blocks, and confirm improvement.



6. AIR SERVICE UNIT



Symbol	Description
1	Fitter cover
2	Drain cork
3	Locking latch
4	Pressure adjusting knob
5	Pressure gauge
6	Oiler tank
7	Flowrate adjusting knob
8	Sol. valve

(1) Adjusting air pressure

Step	Operation	Remark
1	Pull down the pressure adjusting knob	
2	Turn to the left or right	-Check pressure gauge(0.54MPa)
3	Push up the adjusting knob	



- ✓ Never change the setting value without intention.

(2) Adjusting flowrate of oiler

Step	Operation	Remark
1	Spindle tool unclamp	- Manual operation
2	Turn the flowrate adjusting knob	- 5 drops/min.
3	Spindle tool clamp	- Manual operation

(3) Oil supply into oiler

Step	Operation	Remark
1	Take apart oil inlet- In air supply	
2	Oil supply	
3	Re-assemble oil inlet	



- ✓ Oiler tank disassembling is possible during cutting off main air supply.

(4) Extract water in filter unit

Step	Operation	Remark
1	Loosen the drain cork	- On air supply
2	Lock the drain cork	



NOTICE

- ✓ Filter cover disassembling is possible during cutting off main air supply.

(5) Cleaning filter

Step	Operation	Remark
1	Cut off air supply	-Sol. valve
2	Disassembling filter cover	- Locking latch
3	Take out filter	- Check state
4	Cleaning filter	- Neutral detergent
5	Fix up filter and cover	
6	Supply air	- Locking cork

(6) Adjusting pressure switch

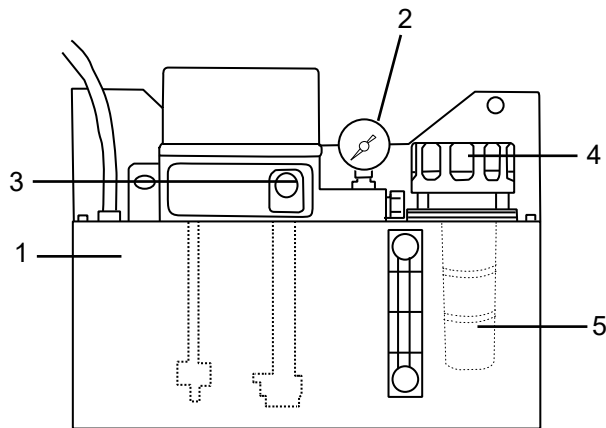
Step	Operation	Remark
1	Adjusting air pressure	- 0.4MPa
2	Adjusting pressure switch	- Adjusting screw - Confirm Alarm state
3	Adjusting air pressure to initial state	- 0.54MPa - Pressure adjusting knob and pressure gauge



WARNING

- ✓ Never forget to adjust the air pressure to initial state after adjusting pressure switch.

7. LUBRICATION UNIT



Symbol	Description
1	Tank
2	Pressure gauge
3	Manual operation button
4	Oil inlet
5	Inlet filter

(1) Checking oil leakage

Step	Operation	Remark
1	Check oil consuming rate	
2	Check/repair leaking position	

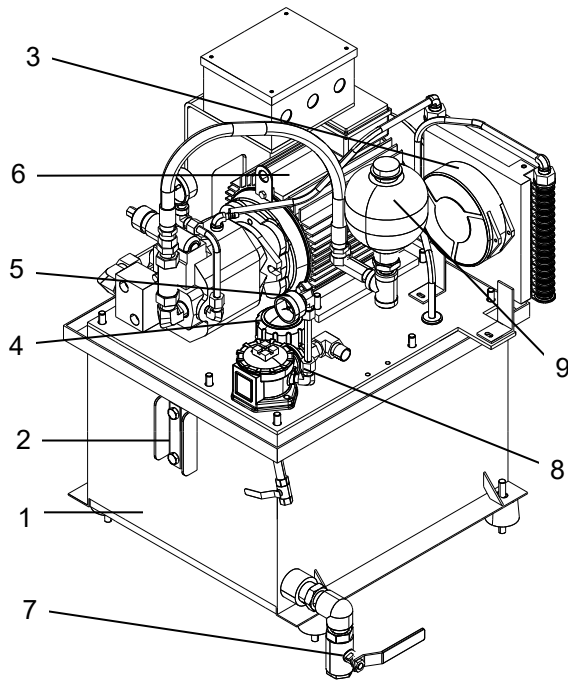
(2) Oil supply

Step	Operation	Remark
1	Loosen the oil inlet	
2	Oil supply	- Clean inlet filter, if necessary
3	Locking the oil inlet	

(3) Cleaning filter

Step	Operation	Remark
1	Loosen the oil inlet	
2	Rake apart inlet filter	- Check state
3	Clean the filter	- Neutral detergent
4	Assemble filter and oil inlet	

8. HYDRAULIC UNIT



Symbol	Description
1	Oil tank
2	Level gauge
3	Radiator
4	Oil inlet
5	Pressure gauge
6	Motor and pump
7	Drain plug
8	Pressure switch
9	Accumulator

(1) Adjusting pressure

Step	Operation	Remark
1	Loosen the fixing nut	- Pressure adjusting device
2	Adjusting the pressure	- Use adjusting bolt - Check pressure gauge (5 MPa)
3	Lock the fixing nut	



✓ Never change the setting value without intention.

(2) Checking oil leakage

Step	Operation	Remark
1	Check oil decrease	- Check oil leakage
2	Check/repair leakage position	
3	Replenish oil	- Oil inlet

(3) Changing oil

Step	Operation	Remark
1	Turn off the main power	- Refer to Machine operation manual
2	Empty the tank	- Drain plug
3	Loosen the oil inlet	- Clean the inlet filter, if necessary.
4	Oil supply	- See oil level gauge
5	Close oil inlet cover	

(4) Cleaning the tank

Step	Operation	Remark
1	Turn off the main power	
2	Empty the tank	- Drain plug
3	Take apart the tank	
4	Clean the tank	- Check the inside filter state
5	Assemble the tank and supply oil	

(5) Adjusting the pressure switch

Step	Operation	Remark
1	Check the setting line	- Pressure switch(3 MPa)
2	Decrease the setting pressure	- Pressure adjusting device - Pressure gauge - Confirm Alarm state
3	Adjust the pressure switch	- Repeat upper step 2. - 3 MPa
4	Reset the pressure	- Pressure gauge(5 MPa)

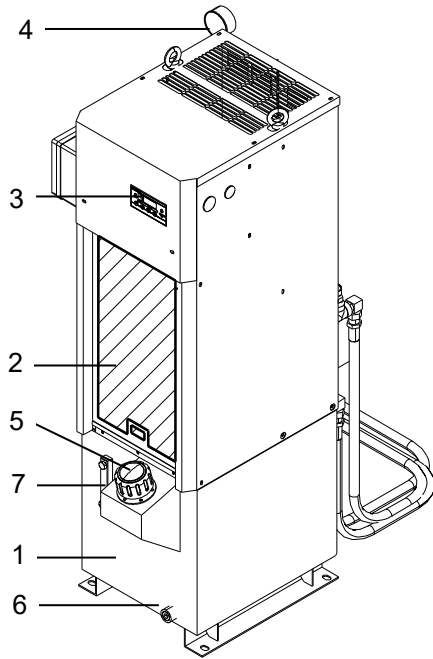


- ✓ Never change the setting value without intention.



- ✓ Refer to 1) to adjust output pressure.

9. OIL COOLER



Symbol	Description
1	Tank cover
2	Filter
3	Operation panel
4	Level gauge
5	Oil inlet
6	Drain plug
7	Pressure gauge
8	Condenser



NOTICE

✓ Refer to extra manual for oil cooler

(1) Cleaning the oil

Step	Operation	Remark
1	Turn off the main power	- Refer to Machine operation manual
2	Take apart the tank cover	- Cover fixing bolt
3	Empty the tank	- Drain plug
4	Lessen the oil inlet	- Inside of tank cover
5	Oil supply	- See the level gauge
6	Reassemble oil inlet and cover	

(2) Cleaning the filter

Step	Operation	Remark
1	Take apart the filter	
2	Clean the filter	- Compressed air, long hair brush - Neutral detergent
3	Clean the condenser	- Compressed air, long hair brush
4	Re-set the filter	

(3) Adjusting the setting temperature

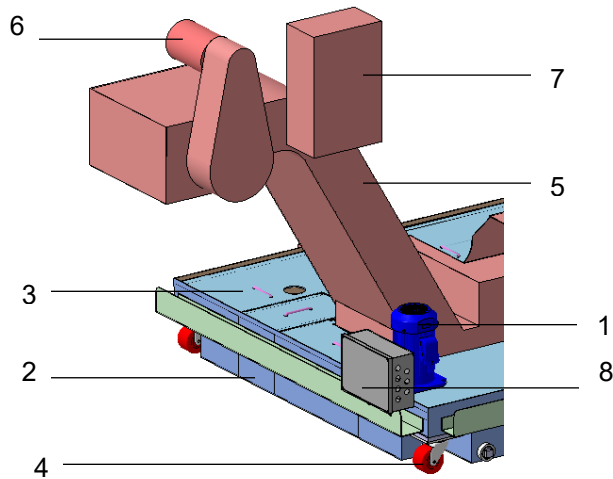
Step	Operation	Remark
1	Confirm 'SV = 03'	- Operation panel
2	Adjust the value, if needed	- Operation panel



- ✓ Never change the setting values without intention.

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10. COOLANT & CHIP DEVICES



Symbol	Description
1	Pump for FLOOD coolant
2	Coolant tank
3	Tank cover
4	Caster
5	Chip conveyor
6	Chip conveyor motor
7	Chip conveyor op. panel
8	Terminal box

(1) Oil supply

Step	Operation	Remark
1	Pull out the tank	- Loosen the stop bolt
2	Supply the coolant	- Level gauge
3	Push in and fix the tank	- Fixing bolt

(2) Adjusting flowrate

Step	Operation	Remark
1	Coolant pump ON	- Manual operation
2	Adjust the flowrate	- Flowrate adjusting cork

(3) Cleaning the coolant tank

Step	Operation	Remark
1	Turn off the main power	- Refer to Machine operation manual
2	Pull out the tank	- Loosen the stop bolt
3	Take apart the tank cover	
4	Empty the tank	- Loosen the drain plug
5	Clean the inside of tank	
6	Assembling the drain plug	
7	Supply	- Oil level gauge
8	Re-assemble inlet and cover	
9	Push in and fix the tank	

(4) Applying grease to the chip conveyor

Step	Operation	Remark
1	Open the motor side cover	
2	Apply the grease to the chain	
3	Close the cover	

(5) Extraction the chips inside of chip conveyor

Step	Operation	Remark
1	Put the waste cloths on the belt	
2	Perform the reverse rotation	- Refer to Machine operation manual
3	Confirm the extraction of both chips and waste cloths	

(6) Cleaning the chip conveyor

Step	Operation	Remark
1	Take apart the conveyor cover	
2	Clean the inside of chip conveyor and re-assemble the cover	

