

TURRET PUNCH PRESS
EM MI SERIES ^{EX}
EMZ 3510M2/3612M2
EMK 3510M2/3612M2
(AMNC3i FS31i-PB)

OPERATOR'S MANUAL

This product comes standard with:

- Alarm Lists
- Circuit Diagrams
- Installation Manual
- Operator's Manual
- Programming Manual
- Reference Manual



PREFACE

- Before installing, operating, or maintaining this product, carefully read the manual(s) and thoroughly understand the contents.
- Strictly observe the Hazard Information on Machine and the warnings described in the manual(s).
- If you are not sure of how to operate this product, do not operate it by guesswork, but be sure to reread the manual(s) and operate it correctly as described in the manual(s).
- Always keep the manual(s) near this product so that you can reread the manual(s).
- When you transfer this product to another owner, be sure to hand it together with the manual(s) to the new owner.

This manual classifies the hazardous situations into the following levels:

 DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
 WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
 CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
NOTICE	Indicates a potentially hazardous situation which, if not avoided, may result in damage to this product.
NOTE	Indicates not a warning but an item of information which should be known to work.

Operator's Manual:

EM MII Series Turret Punch Press

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CONTENTS

Hazard Information on Machine	1
1. Overall management responsibilities	3
1-1. Reporting plan and applying for permission	3
1-2. Preventing hazards.....	3
1-3. Preventing hazards at stroke ends (moving ends) of machine	3
1-4. Appointing chief operator.....	4
1-5. Posting name of chief operator	4
1-6. Having keys kept by chief operator	4
1-7. Conducting safety and health education	5
1-8. Checking before start of day's work	5
1-9. Special voluntary inspection	6
1-10. Precautions on clothing to wear during operation	6
2. Prohibiting modification of machine	7
2-1. Prohibiting modification of machine and control circuit	7
2-2. Prohibition of change to personal computer-based NC unit.....	8
2-3. Limitation of applications of tools and prohibition of their modification.....	9
2-4. Prohibition of removal of safeguards and of change of their installation position	9
3. Residual risk map peculiar to machine Model: EM30M2 series.....	11
4. Residual risk list peculiar to machine Model: EM30M2 series.....	13
4-1. Installation	13
4-2. Operation	14
4-3. Maintenance	18
5. Warning labels.....	21
6. Measures for preventing hazards around machine.....	24

(Continued on next page.)

Part 1 Description	1-1
1. Identification of machine parts	1-2
2. Specifications	1-4
2-1. Machine	1-4
2-1-1. EMZ3510M2/EMK3510M2	1-4
2-1-2. EMZ3612M2/EMK3612M2	1-5
2-2. NC unit.....	1-6
2-3. Operating environment	1-6
3. Safeguarding functions	1-7
4. Sound level	1-9
 Part 2 Controls	 2-1
1. NC control box	2-2
2. Keyboard (NC control box).....	2-13
3. Barcode reader (option)	2-15
4. Tool ID reader (option)	2-15
5. Carriage control panel.....	2-16
6. Turret control panel	2-17
7. TURRET JOG ON button	2-19
8. Auxiliary control stand (option).....	2-20
9. Tool balancer controls	2-22
10. Machine circuit breaker switch	2-23
11. Foot switch	2-23
12. Data input/output devices.....	2-24
12-1. USB ports	2-24
12-2. Interfaces.....	2-26
 Part 3 Operation	 3-1
1. Preparing and checking before turning on power	3-3
2. Turning on power	3-4
3. Zero-returning	3-5
4. Reading program or programs.....	3-7
4-1. Single-program operation.....	3-7
4-2. Schedule operation	3-8
4-3. Checking shape of part	3-10
5. Checking setup of tools and worksheets	3-11
6. Changing tools	3-13
6-1. Moving necessary turret station to tool change position	3-13
6-2. Changing tools in $\phi 1200$ King type-turret.....	3-15
6-2-1. Changing tools in 1/2" and 1-1/4" standard stations.....	3-15
6-2-2. Changing tools in auto-index stations	3-16
6-2-3. Changing tools in 2", 3-1/2", and 4-1/2" standard stations.....	3-18

6-3. Changing tools in Z type-turret	3-20
6-4. Changing punch with tool balancer	3-21
6-5. Ending tool change	3-22
7. Positioning workclamps	3-23
8. Loading worksheet	3-27
9. Automatic operation	3-29
9-1. Starting automatic operation	3-29
9-1-1. Starting single-program operation	3-29
9-1-2. Starting schedule operation	3-31
10. Manual operation	3-34
11. Checking program	3-35
11-1. Clearing program errors	3-36
12. Operation interruption	3-37
12-1. Stop condition	3-37
12-1-1. STOP button is pressed	3-37
12-1-2. Program stop (M00) or optional stop (M01) is commanded	3-37
12-1-3. Single block function is enabled	3-38
12-1-4. Override detection is enabled	3-38
12-1-5. Repositioning confirmation function is enabled	3-41
12-1-6. Stripping failure is detected	3-42
12-1-7. X-gauge block is raised	3-42
12-1-8. Tool change door is opened	3-42
12-1-9. Workclamps are opened	3-43
12-1-10. TOOL CHANGE keyswitch is turned to ON	3-43
12-1-11. SAFETY DEVICE keyswitch is turned to SETTING	3-43
12-1-12. Protective device is actuated	3-43
12-2. Emergency stop condition	3-44
12-2-1. EMERGENCY STOP button is pressed	3-44
12-2-2. Air pressure drops below specified limit	3-44
12-2-3. X-axis or Y-axis overtravel alarm occurs	3-45
12-2-4. Reset	3-45
12-2-5. Zero-returning after temporary stop of processing	3-45
12-3. Clearing other stop conditions	3-46
13. Setting press operating method	3-47
14. Turning off power (shutting down system)	3-49

(Continued on next page.)

Part 4 Press Axis Control Parameters 4-1

1. Description	4-2
1-1. Press pattern parameters.....	4-3
1-2. Tools	4-4
2. Press pattern parameters.....	4-5
2-1. Punching and nibbling patterns	4-5
2-2. Knockout patterns	4-8
2-3. Marking patterns	4-12
2-4. Slitting patterns.....	4-15
2-5. Forming patterns	4-18
2-6. MPT tapping patterns	4-24
2-7. Parameter value setting ranges	4-26
3. Setting press pattern parameters.....	4-27
4. Trial punching with press pattern	4-29
4-1. Trial punching using Try Forming in utilities	4-29
4-2. Trial punching according to program	4-31
5. Auto timer	4-32
5-1. Setting auto timer	4-33
6. Tap setting	4-34
7. Air blow setting	4-34
8. Bottom position correction by material type and thickness	4-35
8-1. Registering bottom position correction values by material type and thickness.....	4-36
8-2. Recommended operating methods (reference)	4-39
8-3. Operation of press pattern parameters	4-40

Part 5 Maintenance 5-1

1. Daily maintenance.....	5-4
1-1. Maintenance at start of day's work.....	5-4
1-1-1. Checking air system	5-4
1-1-2. Other maintenance items	5-5
1-1-3. Checking operation of protective devices.....	5-8
1-1-4. Checking grease level of automatic grease lubricator for drive axis	5-9
1-1-5. Checking reservoir tray.....	5-10
2. Periodical maintenance.....	5-11
2-1. Every month	5-11
2-1-1. Lubrication	5-11
2-1-2. Cleaning amplifier box air filter	5-12
2-2. Every three months	5-13
2-2-1. Lubrication	5-13
2-2-2. Other maintenance items	5-13

2-3. Every six months	5-13
2-3-1. Electrical wiring	5-13
2-4. Every year	5-14
2-4-1. Changing memory backup batteries	5-14
3. Lubrication	5-16
4. Electrical troubleshooting	5-19
5. Automatic grease lubricator	5-21
5-1. Adding grease to tank	5-22
5-1-1. Bleeding air from automatic grease lubricator ..	5-23
5-1-2. Cleaning reservoir tray of used grease	5-24
6. Maintaining tools	5-26
6-1. Checking tools	5-26
6-2. Lubrication	5-26
6-3. Disassembling and assembling punches (Types A and B)	5-27
6-3-1. Disassembly	5-28
6-3-2. Assembly	5-29
6-4. Removing and installing punch tips (Types C, D, and E)	5-30
6-4-1. Removal	5-30
6-4-2. Installation	5-31
6-5. Regrinding tools	5-31
6-6. Adjusting punch and die height	5-32
6-6-1. Adjusting punch height	5-32
6-6-2. Adjusting die height	5-33
6-7. Adjusting height of NEX III punches	5-34
6-8. Adjusting height of Z style guides	5-37
7. Changing shear plate	5-39
8. Dismantling and scrapping	5-41
8-1. Disposal of machine body	5-41
8-2. Disposal of grease and oil	5-41
8-3. Disposal of electrical parts	5-41

(Continued on next page.)

Part 6 Tooling.....	6-1
1. Turret station arrangement.....	6-2
1-1. 70-station turret (King type-turret)	6-2
1-2. 58-station turret (King type-turret)	6-3
1-3. 58-station turret (Z type-turret)	6-4
1-4. 45-station turret (Z type-turret)	6-5
2. Keys and keyways in tools and turret stations	6-6
2-1. Keys and keyways in tools (standard tools)	6-6
2-2. Keys and keyways in tools (NEX III punches)	6-7
2-3. Keys and keyways in tools (Z style guides)	6-7
2-4. Keys and keyways in turret stations (King type-turret)	6-8
2-5. Keys and keyways in turret stations (Z type-turret).....	6-9
3. Punch-to-die clearance	6-10
4. Punching capacity	6-11
4-1. Maximum punchable hole diameter	6-11
4-2. Minimum punchable hole diameter	6-13
4-3. Punching heavy worksheets.....	6-13
4-3-1. Allowable pressure of tools	6-13
4-3-2. Diameter of holes punchable at allowable pressure	6-14
 Appendix Safety Data Sheets	A-1
Amada Grease EP No.0.....	A-2
Amada AS-46	A-6
Amada Grease SRL	A-10
Shell Tellus Oil SX-Z	A-14
Shell Tellus Oil C32	A-20
Shell Alvania Grease 2.....	A-24
Shell Alvania EP Grease R0	A-28
Shell Alvania Grease RA.....	A-31
Tanoi Shincool 99X-Super.....	A-35

Hazard Information on Machine

The Hazard Information on Machine communicates machine and other hazard information to the user and prompts the employer to perform risk assessment for occupational accident prevention. The residual risk map and residual risk list contain information required to communicate to the employer the hazards that must be made known to the person or organization to whom the employer transfers the machine.

The Hazard Information on Machine forms part of the manual(s). Do not use the machine after understanding the Hazard Information on Machine alone. Be sure to carefully read and understand the manual(s) as well before using the machine.

In addition to the Hazard Information on Machine, the manual(s) also describes warnings in detail for specific tasks. Also comply with the warnings in the manual(s).

The illustrations used in the Hazard Information on Machine are imaginary ones and may be different from the actual conditions, except for the warning labels.

The Hazard Information on Machine and manual(s) classify the hazardous situations into the following levels:

 DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
 WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
 CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

(For contents, refer to next page.)

1. Overall management responsibilities	3
1-1. Reporting plan and applying for permission	3
1-2. Preventing hazards	3
1-3. Preventing hazards at stroke ends (moving ends) of machine	3
1-4. Appointing chief operator.....	4
1-5. Posting name of chief operator	4
1-6. Having keys kept by chief operator	4
1-7. Conducting safety and health education	5
1-8. Checking before start of day's work	5
1-9. Special voluntary inspection.....	6
1-10. Precautions on clothing to wear during operation	6
2. Prohibiting modification of machine	7
2-1. Prohibiting modification of machine and control circuit	7
2-2. Prohibition of change to personal computer-based NC unit.....	8
2-3. Limitation of applications of tools and prohibition of their modification.....	9
2-4. Prohibition of removal of safeguards and of change of their installation position	9
3. Residual risk map peculiar to machine Model: EM30M2 series	11
4. Residual risk list peculiar to machine Model: EM30M2 series	13
4-1. Installation	13
4-2. Operation.....	14
4-3. Maintenance	18
5. Warning labels.....	21
6. Measures for preventing hazards around machine.....	24

1. Overall management responsibilities

1-1. Reporting plan and applying for permission

Reporting plan to Labor Standards Office

Report the plan to install, relocate, or alter the machine to the Chief of the Labor Standards Office.

Have the safety of the machine checked and receive guidance on the safety of the machine.

Reporting machine as specified facility and applying for permission to use machine as specified facility

The machine belongs to the class of specified facilities under the Noise Control Act and Vibration Control Act as well as under the environmental protection ordinances of local governments.

Reporting duties and regulation values vary from region to region. For details, contact the environmental protection office in your area.

1-2. Preventing hazards

Turret punch presses belong to power presses under the Industrial Safety and Health Act. Install protective devices and take safeguard measures for power presses.

Check this Hazard Information on Machine, perform risk assessment, and take necessary safeguard measures.

1-3. Preventing hazards at stroke ends (moving ends) of machine

If workers are subject to hazards at the stroke ends (moving ends) of the machine, take safeguard measures to prevent such hazards.

The workers may collide with the table, carriage or worksheet, may get pinched between the carriage and frame, may get pinched between the table and a surrounding unit, column or shelf, or may get his hand or hands placed on the table collide with the worksheet or carriage.

Completely enclose the machine with safety fences and light curtains. If the worksheets are likely to overhang the table, install an auxiliary table. (Standard-equipped with the interface for SICK light curtains, the machine is ready for their installation.)

1-4. Appointing chief operator

Appoint a qualified chief operator from among the employees who have enough knowledge and experience about the operation of the machine. Instruct the chief operator to perform the duties described below.

Duties of chief operator

- Check the machine and protective devices.
- Take necessary measures when any abnormality is recognized.
- Keep the keys of the keyswitches with him.
- Instruct workers in changing and adjusting tools.
- Practice other items necessary for preventing hazards due to the turret punch press.

1-5. Posting name of chief operator

Post the following information on the machine or in an easy-to-see location near the machine:

- Name of the chief operator

1-6. Having keys kept by chief operator

Some controls are installed as keyswitches to prevent improper or unauthorized operation. Have the keys of the keyswitches kept by the chief operator.

For the positions of the keyswitches, refer to “1. NC control box” in Part 2, Operator’s Manual.



Keyswitches on NC control panel

- PRESS SELECT keyswitch
- OPERATING POSITION keyswitch
- SAFETY DEVICE keyswitch

Keyswitch on turret control panel

- TOOL CHANGE keyswitch

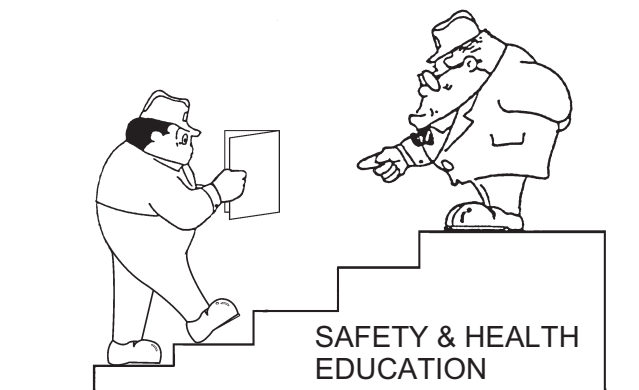
1-7. Conducting safety and health education

Conduct safety and health education to workers who operate the machine for the first time.

Conduct special education for workers who change and adjust the tools.

Conduct safety and health education in compliance with safety laws, regulations, and standards in the country or region of use. Concerning the following items, establish safety and health rules in compliance with the Hazard Information on Machine, and conduct the education and training of operators accordingly:

- Hazardousness and harmfulness of turret punch presses in compliance with the Hazard Information on Machine
- Construction of turret punch presses
- Methods of operating turret punch presses
- Performance of personal protective equipment and safeguards, and methods of handling them
- Emergency measures and evacuation



1-8. Checking before start of day's work

Check the machine before the start of the day's work.

Before the start of the day's work, instruct the chief operator to check the interlock functions, safeguards, and personal protective equipment.

Try to find equipment failures or problems as early as possible. When you find a problem, repair it or take any other necessary measure to prevent an accident.

1-9. Special voluntary inspection

Have voluntary inspection conducted on the machine by qualified personnel once or more per year.

Repair problems found by the inspection, and file the inspection results and repair records.

1-10. Precautions on clothing to wear during operation

Do not wear loose clothing or jewelry when operating the machine.

Otherwise you may be caught in or pulled into the machine.

As dictated by the work to be performed, wear personal protective equipment, such as a safety hat, safety shoes, ear plugs, or gloves. Select such personal protective equipment that complies with specific work safety standards.

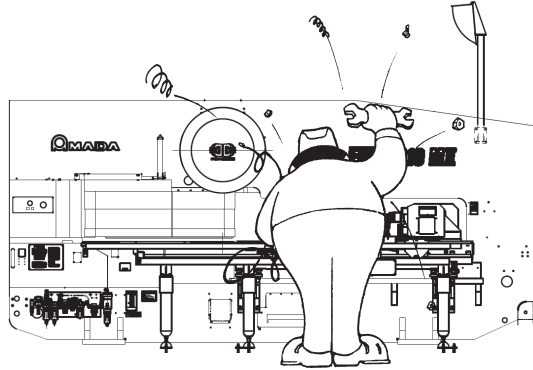


2. Prohibiting modification of machine

2-1. Prohibiting modification of machine and control circuit

Never modify the machine and control circuit.

Doing so will not only cause the failure or breakage of the machine, but also cause the improper operation of the machine.



2-2. Prohibition of change to personal computer-based NC unit

The machine is controlled by a personal computer-based NC unit. Any software or hardware changes may cause the machine to operate improperly and lead to a serious accident.

Strictly observe the following rules:

- Do not add or change any hardware (e.g., memory, SCSI card, PC card, CF card).
- Do not remove or insert boards like the CPU board.
- Do not install or uninstall software.
- Do not change, add, delete, or move Windows files and folders.
- Do not operate on the Windows system files (e.g., control panel and registry file).
- At the startup and shutdown of the NC unit, the following AMNC3i screen appears. Do not touch the screen.



- Do not save files other than programs in the NC unit through a USB flash drive or through another computer connected to the AMNC3i system.
- To prevent infection with computer viruses, do not use USB flash drives and other media that contain files and programs of unknown origin.
- The AMNC3i comes standard with security software. This security software prevents the operation of computer viruses and other malicious software and the execution of software other than that operating in the AMNC3i.

2-3. Limitation of applications of tools and prohibition of their modification

The tools are made for sole use on this machine. Do not use them in any other application. Do not modify them.

If modified, the tools may break, fly off in pieces and injure you.

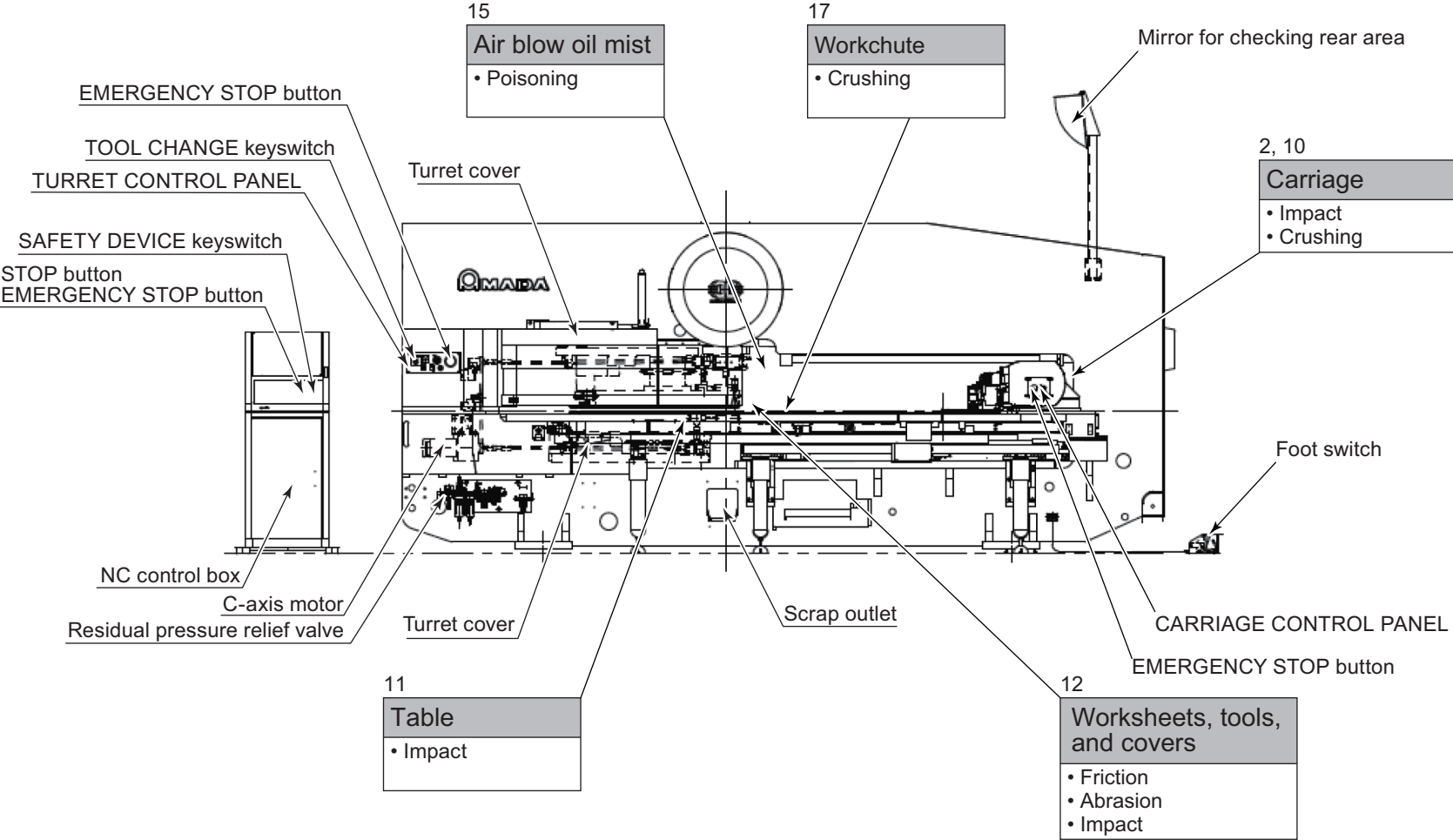
2-4. Prohibition of removal of safeguards and of change of their installation position

Do not remove the safeguards, safety fences, safety mats, and covers, and do not change their installation position.

Do not operate the machine with its interlocks removed.

Doing so may result in a serious accident.

Front view

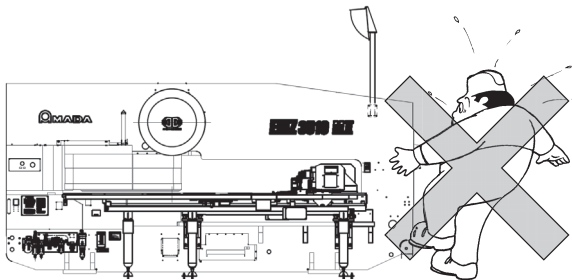


4. Residual risk list peculiar to machine

Model: EM30M2 series

For specific locations of residual risks on the machine, refer to “3. Residual risk map peculiar to machine” described earlier.

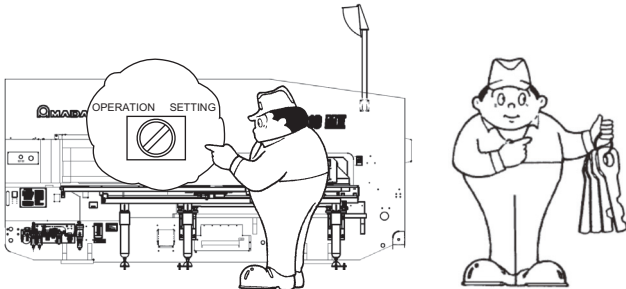
4-1. Installation

1	 WARNING	When lifting and moving machine
► H a z a r d ◄ Machine ► Description ◄ Use appropriate methods and devices to lift and move the machine. Failure to do so may cause the machine to tip or fall. ► Measure ◄ Ask AMADA or a specialized contractor to lift and move the machine. ► Reference ◄ Installation Manual, “3. Lifting”		
2	 WARNING	When installing machine
► H a z a r d ◄ Moving table and carriage ► Description ◄ If you approach the machine or scrap box during operation, you may collide with the moving table or carriage. Also, you may get pinched between the moving table or carriage and the machine frame or a column, shelf or wall. ► Measure ◄ Install a safety fence and a light curtain at a distance of 1600 mm {63 in.} or more from the moving end of the table or carriage. Also, provide a clearance of 500 mm {20 in.} or more from the moving end to the column, shelf or wall.		
		
► Reference ◄ Installation Manual, “12. Installing protective devices”		

3	⚠ WARNING	When installing electrical wiring
► H a z a r d ◀ Machine ► Description ◀ If you fail to install primary power wiring and ground wiring as specified, you may get an electric shock from ground-fault current or may get pinched in a malfunctioning machine. ► Measure ◀ Install primary power wiring and ground wiring as shown on the electric reference drawing.		

4-2. Operation

4	⚠ WARNING	When setting up workclamps
► H a z a r d ◀ Workclamps ► Description ◀ If another worker presses the foot switch while you are moving a workclamp after disconnecting its coupler, you may get your fingers pinched in the workclamp when the workclamp closes. ► Measure ◀ Set up the workclamps alone by yourself. ► Reference ◀ Operator's Manual, Part 3, "7. Positioning workclamps"		

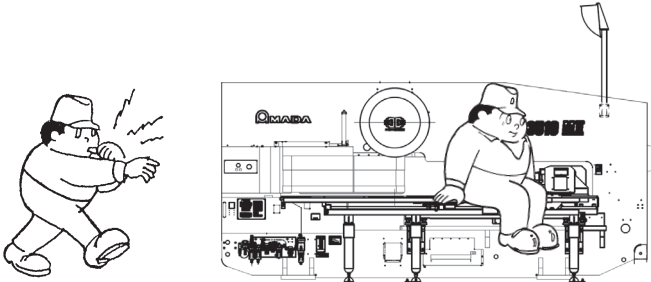
5	⚠ WARNING	When changing tools
► H a z a r d ◀ Moving table ► Description ◀ If another worker inadvertently operates the moving table without noticing that you are changing the tools, you may collide with the moving table. ► Measure ◀ Before you change the tools, turn the SAFETY DEVICE keyswitch to SETTING on the NC control panel and the TOOL CHANGE keyswitch to ON on the turret control panel, remove the keys from the keyswitches, and hand them to the chief operator. The chief operator keeps them with him. ► Reference ◀ Operator's Manual, Part 3, "6. Changing tools"		
 The illustration shows two workers. On the left, a worker in a hard hat and safety glasses is operating a control panel. The panel has a large circular dial with 'OPERATION' and 'SETTING' positions, and a 'TOOL CHANGE' keyswitch. On the right, a chief operator, also in a hard hat and safety glasses, is holding a set of keys. The background shows a large industrial machine with a moving table.		

6	! WARNING	When changing tools
► H a z a r d ◀ Tools and turret ► Description ◀ When you change a tool in the turret or while the turret is rotating, you may get your hands pinched and injured between the tool and the turret. ► Measure ◀ When you change a tool in the turret, do not touch the tool and the turret while the turret is rotating. ► Reference ◀ Operator's Manual, Part 3, "6. Changing tools"		

7	! WARNING	When starting operation
► H a z a r d ◀ Machine ► Description ◀ The machine may fail and operate improperly. ► Measure ◀ While the machine is operating, keep closed the electrical enclosure doors, upper and lower turret covers, and other maintenance doors.		

8	! WARNING	When resuming operation
► H a z a r d ◀ Moving table (particularly at rear of machine) ► Description ◀ If you resume the operation of the machine without noticing another worker around the machine, that worker may collide with the moving table or get pinched in the machine. ► Measure ◀ Before you resume the operation of the machine, carefully check the area around the machine. Pay particular attention to the rear of the machine and other blind spots you cannot see from your normal operating position. ► Reference ◀ Operator's Manual, Part 3, "12. Operation interruption"		
		

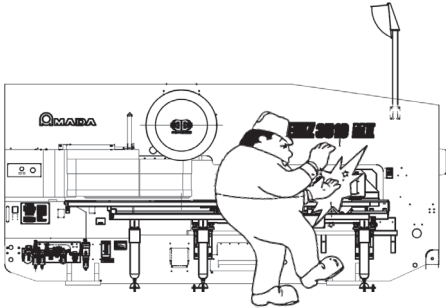
9	 WARNING	When processing long worksheets and zero-returning machine
► H a z a r d ◀ Worksheet being processed ► Description ◀ If a long worksheet overhangs toward the front of the machine while it is being processed or when the machine zero-returns after the worksheet is repositioned automatically, you may collide with the worksheet. ► Measure ◀ Install an auxiliary table. ► Reference ◀ “6. Measures for preventing hazards around machine” described later		

10	 WARNING	When machine is operating
► H a z a r d ◀ Stationary table and carriage ► Description ◀ If you place your hands on or lean against the stationary table, you may get pinched in the carriage and injured. ► Measure ◀ Do not step on or sit on the machine. ► Reference ◀ “6. Measures for preventing hazards around machine” described later		
		

11	 WARNING	When removing scrap box
► H a z a r d ◀ Table ► Description ◀ When you remove the scrap box, you may hit your head on the table. ► Measure ◀ Wear a helmet or work cap.		

12	 WARNING	At occurrence of trouble
▶ H a z a r d ◀ Worksheets, tools, and covers ▶ Description ◀ When you remove a worksheet to clear its processing trouble or slide a tool to clear its stuck condition, you may get your hands injured. Also, you may get your head bumped on a cover or the like during your work. ▶ Measure ◀ Wear work gloves, a helmet and other personal protective equipment.		

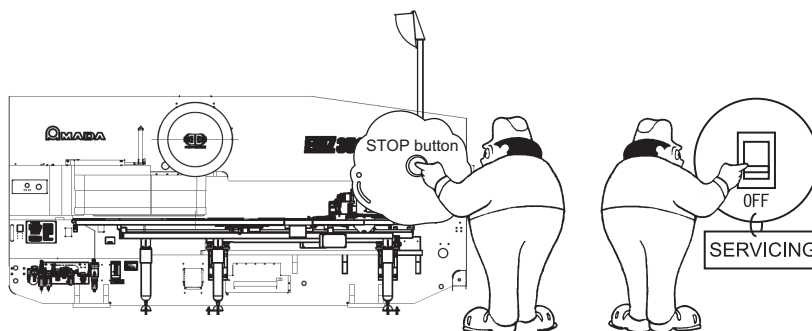
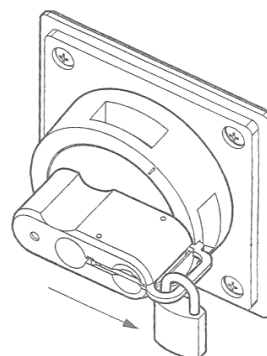
13	 WARNING	At occurrence of trouble
▶ H a z a r d ◀ Machine ▶ Description ◀ If you continue to operate the machine after occurrence of trouble, the machine may malfunction and pinch you, or may cause a fire. ▶ Measure ◀ As soon as you feel danger at the occurrence of trouble during the operation of the machine, press the red EMERGENCY STOP button. When you press the button, you can turn off the power to the machine and stop the machine totally. As soon as you press the button, report the incident to the chief operator. Before you enter the hazardous area of the machine, check that the machine is stopped completely. ▶ Reference ◀ Operator's Manual, Part 2, "1. NC control box" [7] EMERGENCY STOP button		

14	 CAUTION	When setting worksheets
▶ H a z a r d ◀ Workclamps ▶ Description ◀ You may get your fingers pinched in the workclamps. ▶ Measure ◀ When you clamp the worksheet, do not reach to the workclamps. ▶ Reference ◀ Operator's Manual, Part 3, "8 Loading worksheet"		
		

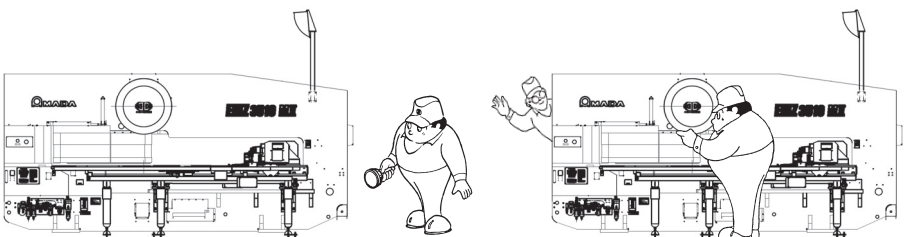
15	 CAUTION	While machine is operating
► H a z a r d ◀ Air blow oil mist ► Description ◀ If you inhale the air blow oil mist for lubricating the tools used during processing, you may be adversely affected. ► Measure ◀ Do not enter the hazardous area of the machine while the machine is operating. Wear a mask or other personal protective equipment.		

4-3. Maintenance

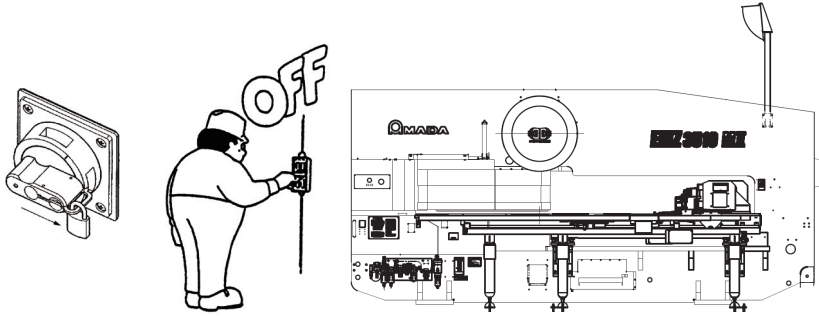
16	 WARNING	When maintaining and adjusting machine
► H a z a r d ◀ Moving table ► Description ◀ While you are performing maintenance or adjustment on the machine, another worker may start and operate the machine without noticing you. ► Measure ◀ Turn the machine circuit breaker switch to OFF and lock it out by attaching a padlock to it, for example, to prevent other workers from inadvertently operating the machine. If it is necessary to turn on the POWER ON/OFF button during the maintenance work, press the STOP button to prevent the machine from being started by mistake. Before performing maintenance or adjustment on the machine, put a sign to inform other workers that you are working on the machine. ► Reference ◀ Operator's Manual, Part 5, Maintenance		



17	 WARNING	When maintaining and adjusting machine
► H a z a r d ◀ Workclamps and workchute ► Description ◀ While you are working on the machine, it may unexpectedly operate under the residual air pressure and injure you. If another worker inadvertently turns on the compressed air to the machine, the machine may operate unexpectedly. ► Measure ◀ Turn the knob of the residual pressure relief valve to the EXH. position to relieve the residual air pressure. Lock out the valve by attaching a padlock through the hole in the knob, for example, to prevent other workers from inadvertently turning on the compressed air to the machine. ► Reference ◀ Operator's Manual, Part 5, Maintenance		

18	 WARNING	When performing maintenance at rear of machine
► H a z a r d ◀ Rear moving table ► Description ◀ If another worker inadvertently operates the table without noticing that you are performing maintenance at the rear of the machine, you may collide with the moving table or get pinched in the machine. ► Measure ◀ Before you enter the moving table area at the rear of the machine, lower the rear open/close table to enable the interlock. Before you resume the operation of the machine, carefully check the area around the machine. Pay particular attention to the rear of the machine and other blind spots you cannot see from your normal operating position. ► Reference ◀ Operator's Manual, Part 5, Maintenance		
		

19	⚠ WARNING	When manually operating or zero-returning carriage
► H a z a r d ◀ Carriage ► Description ◀ If another worker has his hands placed on the carriage cover when you manually operate or zero-return the carriage to perform maintenance, the worker may get his hands pinched between the carriage and carriage cover. ► Measure ◀ Before you manually operate or zero-return the carriage, check that there are no workers around the machine.		

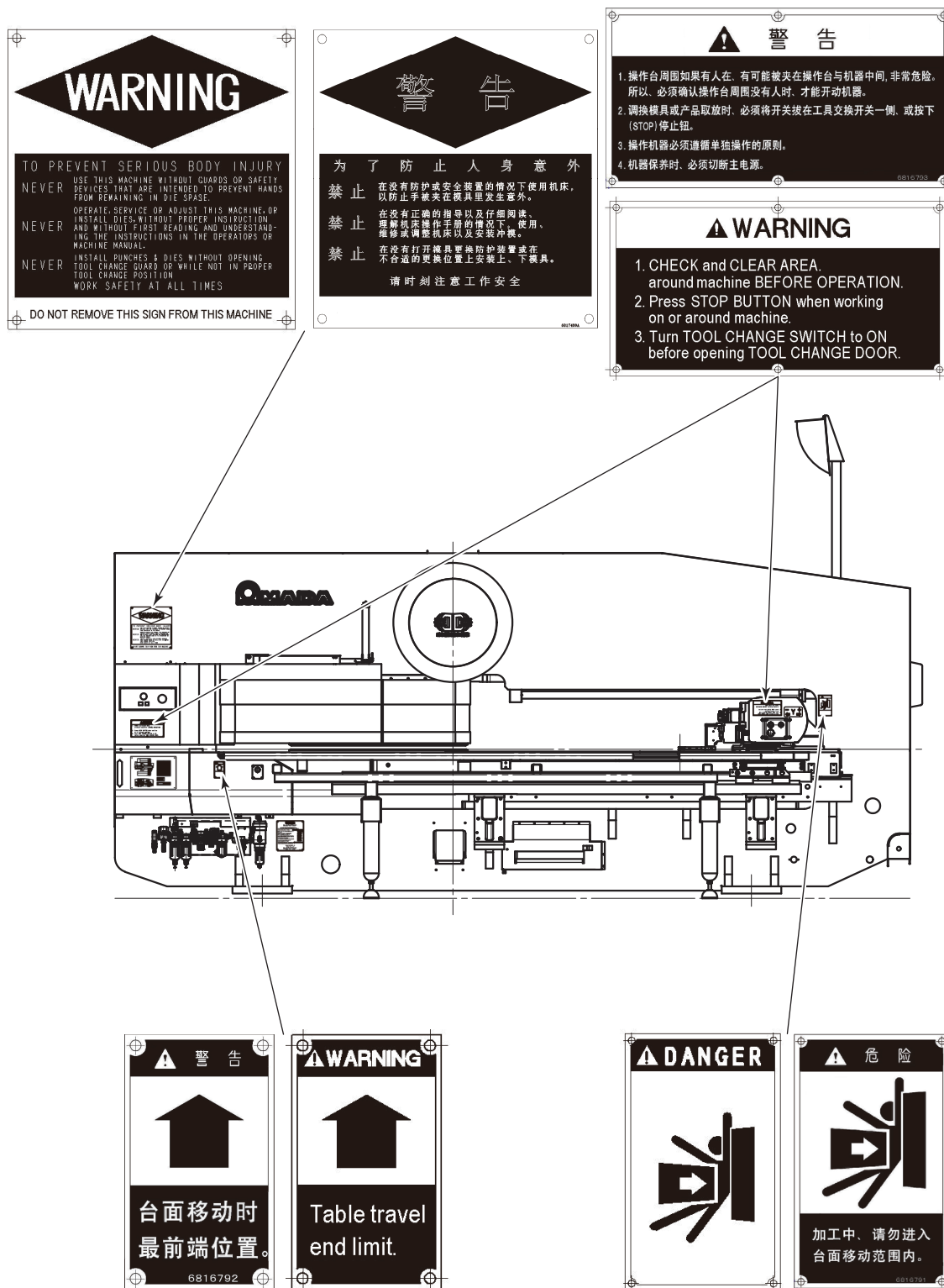
20	⚠ WARNING	When performing maintenance on electrical enclosure
► H a z a r d ◀ Electrical enclosure ► Description ◀ If you touch high-voltage parts in the electrical enclosure, you may get electrocuted. ► Measure ◀ Do not open the door of the electrical enclosure unless you are qualified to perform maintenance on the electrical enclosure. Before you open the door of the electrical enclosure, turn the machine circuit breaker switch to OFF, attach a padlock through the hole in the switch, and turn off the shop circuit breaker switch. Before you perform maintenance on the electrical enclosure, wait for the discharge to be completed.		
		

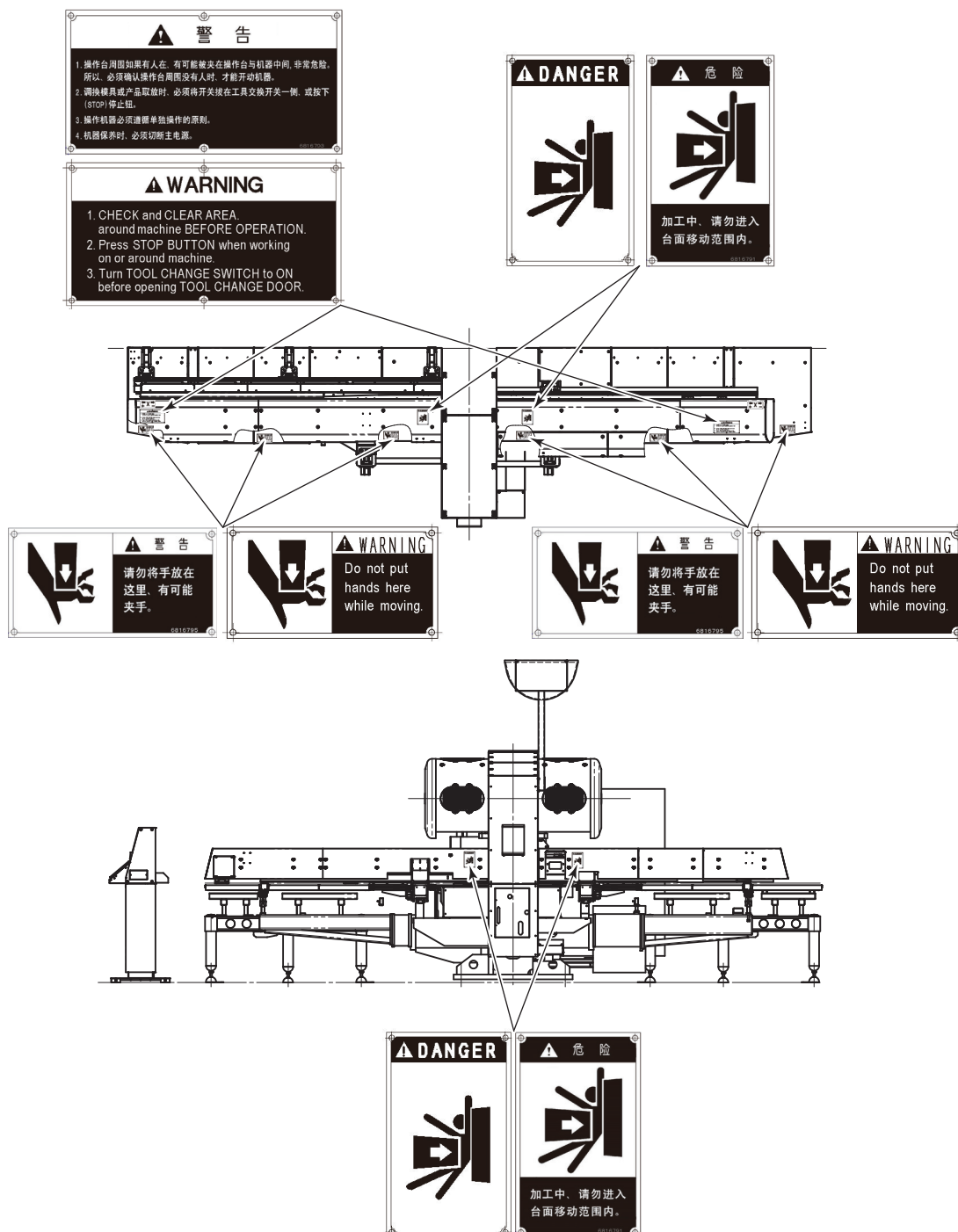
21	⚠ CAUTION	When performing maintenance near servo motors
► H a z a r d ◀ Servo motors ► Description ◀ If you perform maintenance near the servo motors just after stopping the machine operating, you may touch the hot servo motors and get burned. ► Measure ◀ Perform maintenance near the servo motors after they have cooled down. (Perform the maintenance about 20 min after you have turned the machine circuit breaker switch to OFF.)		

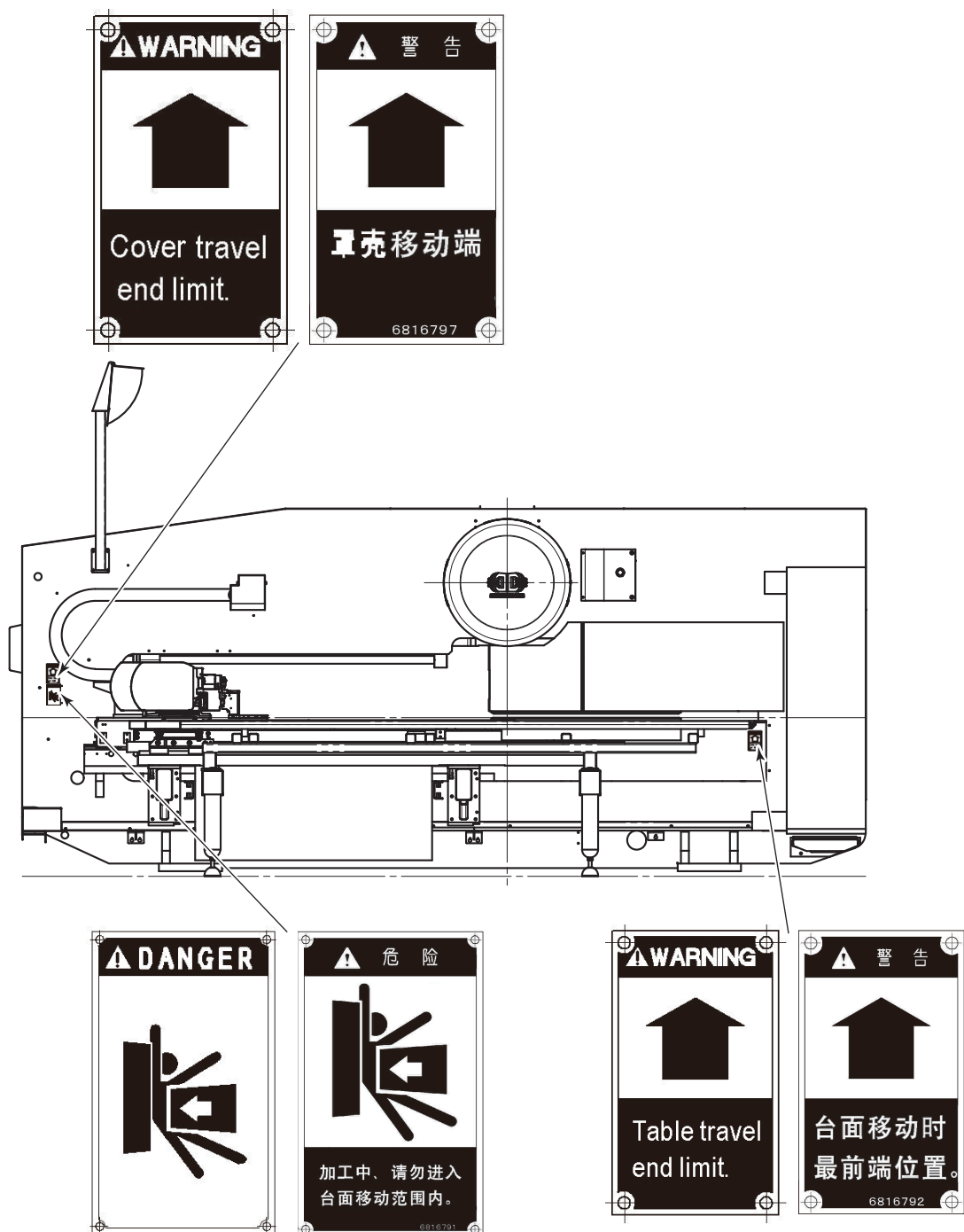
5. Warning labels

Follow the instructions on the warning labels. Keep the warning labels well noticeable and never remove them.

If any warning label is damaged or lost, immediately request AMADA for a new one and attach it to the same position.







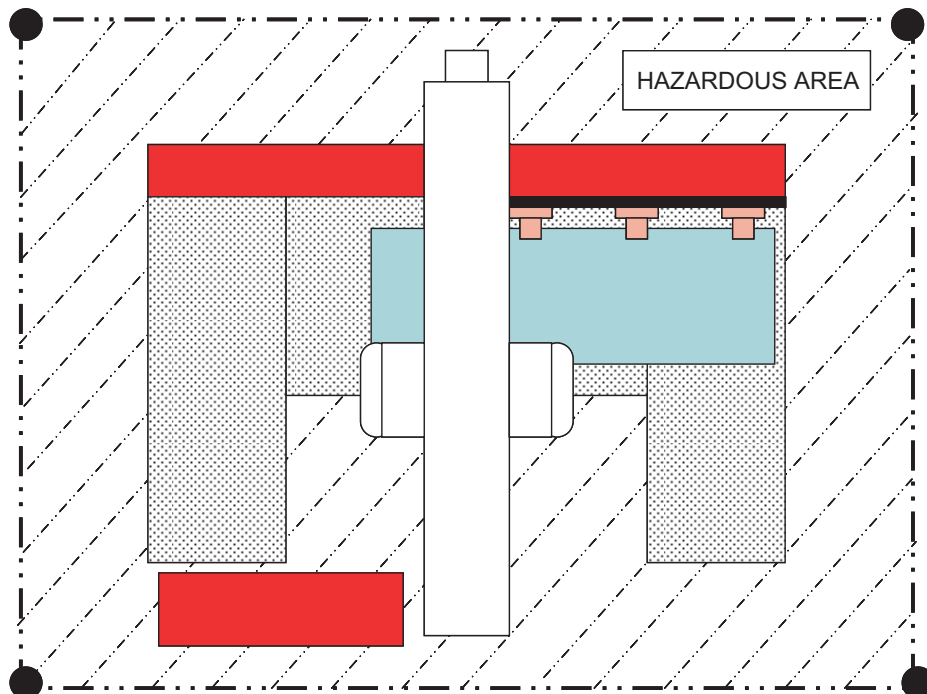
6. Measures for preventing hazards around machine

- During the operation of the machine, workers may collide with the table, carriage or worksheet, may get pinched between the carriage and frame, may get pinched between the table and a surrounding unit, column or shelf, or may get his hand or hands placed on the table collide with the worksheet or carriage. Establish the hazardous area around the machine by considering machine layout and working methods.

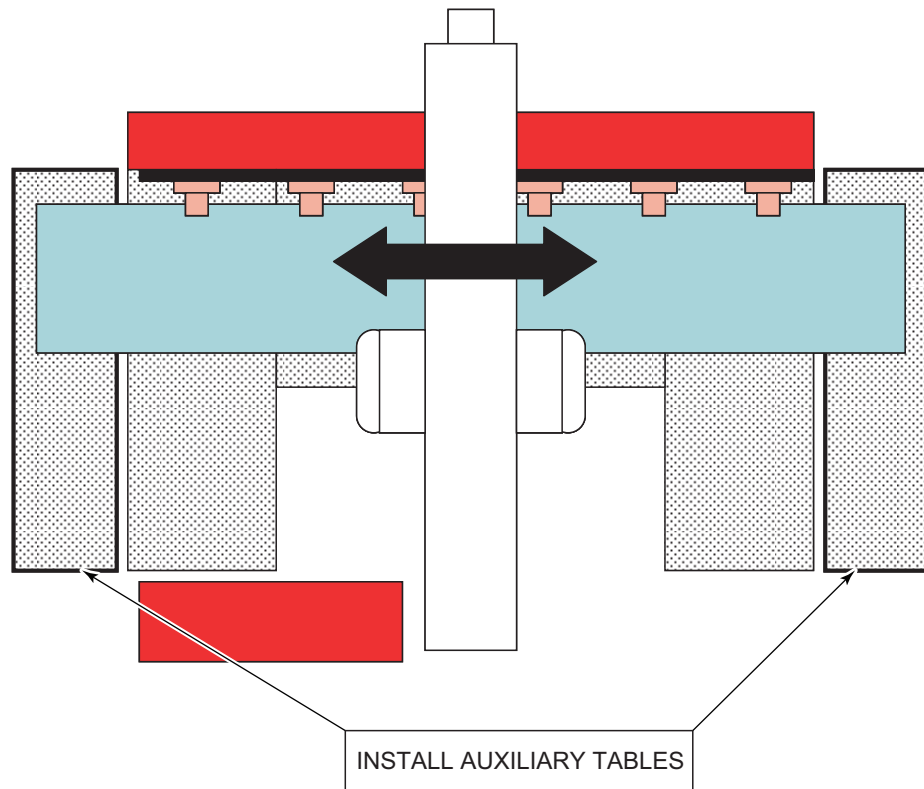
To prevent the workers from entering the hazardous area during the operation of the machine, install the entry prevention fence, light curtain or other protective devices around the hazardous area to prevent these hazards. When entering the hazardous area, be sure to stop the machine and check for safety. Provide a clearance of 500 mm {20 in.} or more from the moving ends (stroke ends) of the machine parts to prevent the worker's body from getting pinched between a moving machine part and a column, shelf or wall.

If the light curtain installation position is too close to the machine, there remains the risk of the worker coming into contact with the table or other moving part before it stops. Observe the specified installation distance.

If there is an obstacle (e.g., a cart) at the moving end of the table or other moving part in the hazardous area, the workers may get pinched between the table or other moving part and the obstacle. Make sure not to put any obstacles in the hazardous area.



- Long worksheets project from the front and rear of the machine during their processing. Particularly when the machine is zero-returning after repositioning the worksheet, the worksheet projects from the front of the machine. The projecting worksheet may strike against you and injure you. When processing such a long worksheet, install auxiliary tables by considering the maximum amount of projection.



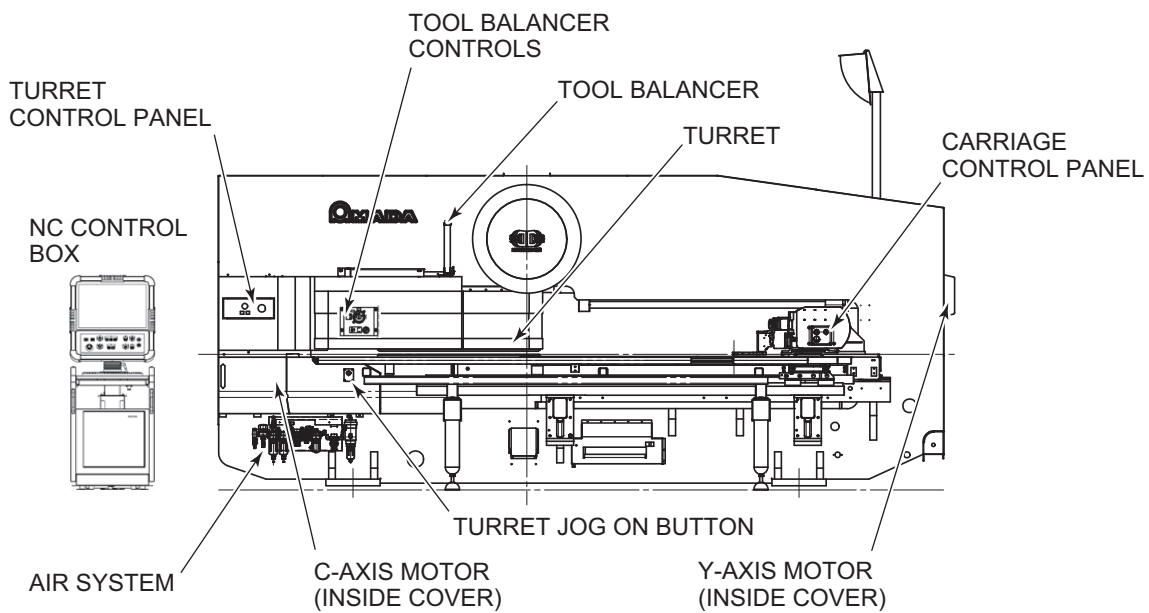
Part 1

Description

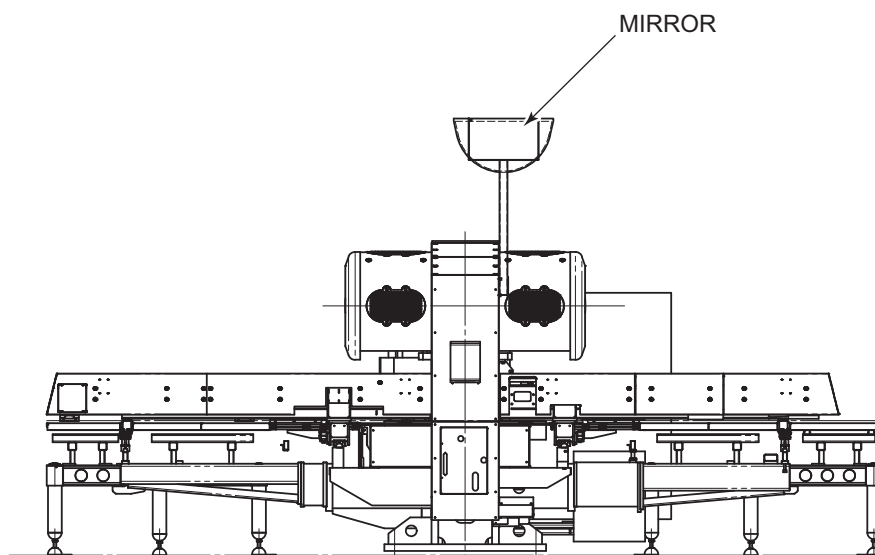
1. Identification of machine parts	1-2
2. Specifications	1-4
2-1. Machine	1-4
2-1-1. EMZ3510M2/EMK3510M2	1-4
2-1-2. EMZ3612M2/EMK3612M2	1-5
2-2. NC unit	1-6
2-3. Operating environment	1-6
3. Safeguarding functions	1-7
4. Sound level	1-9

1. IDENTIFICATION OF MACHINE PARTS

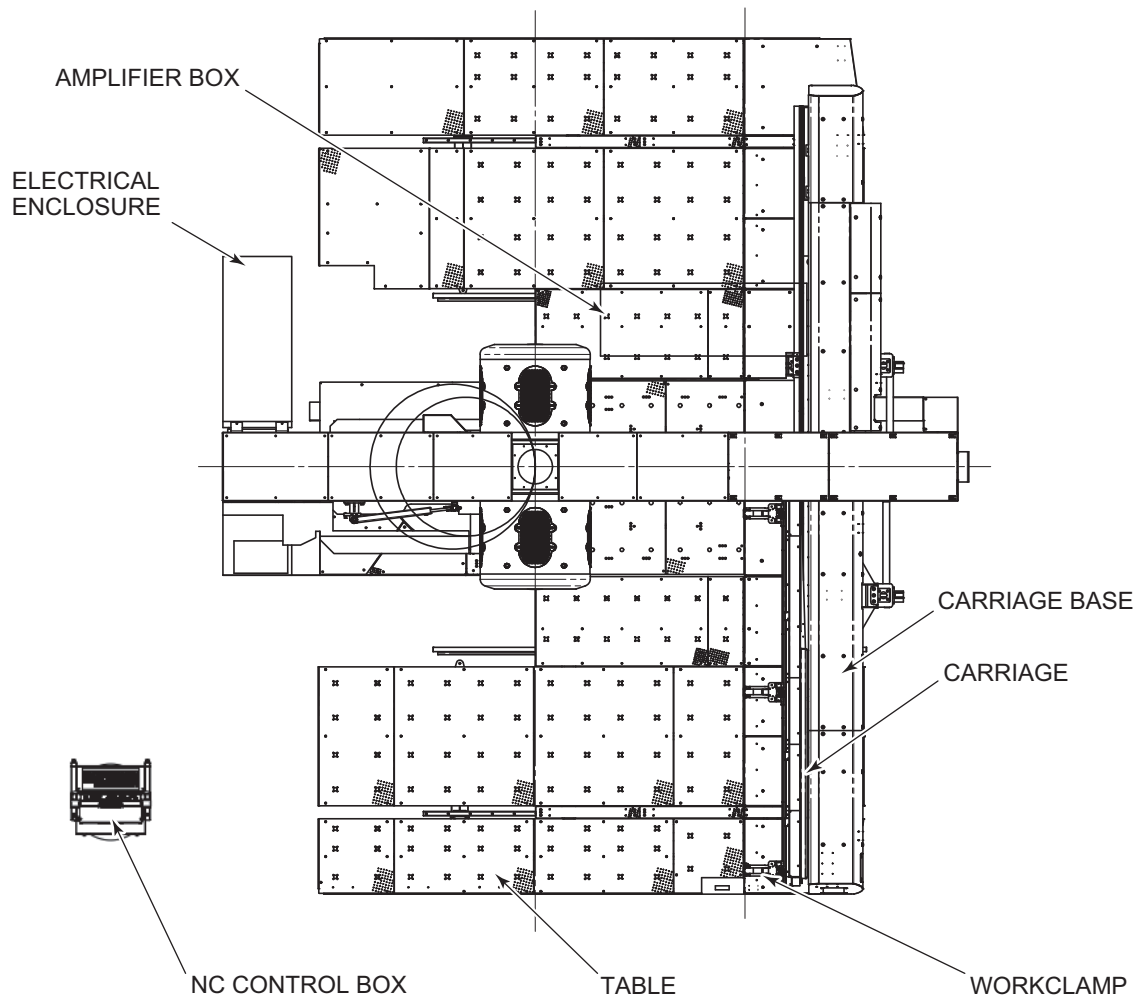
Front view



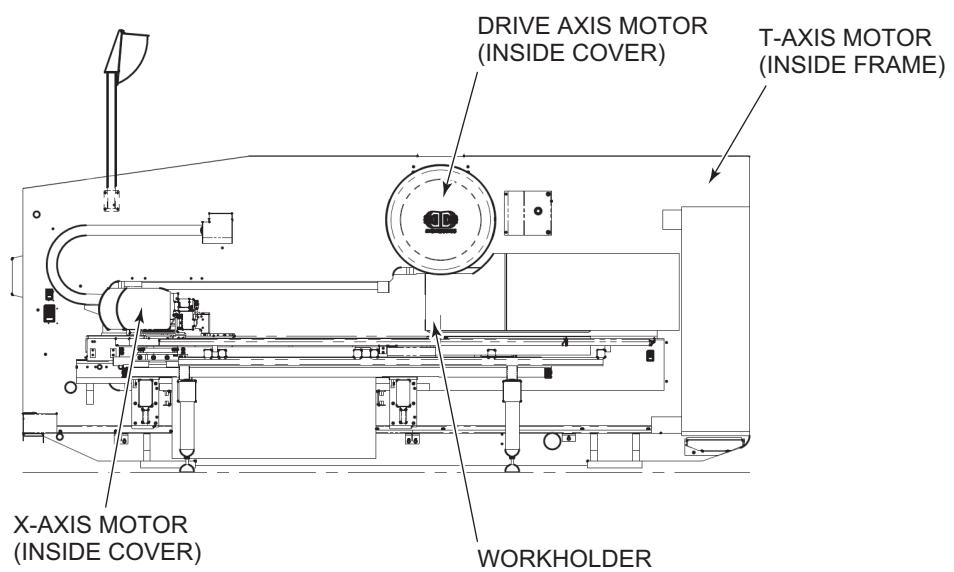
Side view



Top view



Rear view



2. SPECIFICATIONS

2-1. Machine

2-1-1. EMZ3510M2/EMK3510M2

Press capacity	300 kN (33.71 US tons)
Tool storage	45 or 58*** stations (4AI) 58 or 70*** stations (2AI)
Max. sheet size	1270 × 5000 mm (50 × 196.85")
Max. sheet thickness	3.2 mm (0.126")
Max. sheet mass	50 kg (110 lb) at axis speed F1 150 kg (330 lb) at axis speed F4
Y-axis travel	1270 mm (50")
X-axis travel	2500 mm (98.43")
Punching accuracy	±0.1 mm (0.004")*
Strokes per minute	1 mm pitch (5 mm stroke) : 780 min ⁻¹ 25.4 mm pitch (5 mm stroke, X-axis): 500 min ⁻¹ or 420 min ^{-1**} 25.4 mm pitch (5 mm stroke, Y-axis): 330 min ⁻¹ or 320 min ^{-1**}
Max. press stroke length	37 mm (1.456")
Max. feed speed (X-axis)	120 m/min (394 ft/min)
Max. feed speed (Y-axis)	80 m/min (262 ft/min)
Turret speed	30 min ⁻¹
Power supply	25 kVA
SCCR	25 kA
Full load current	85 A
Air supply	250 L/min (8.8 ft ³ /min)
Operating air pressure	0.55 MPa (80 psi)
Length	4997 mm (196.73")
Width	5120 mm (201.57")
Height	2317 mm (91.22") 3242 mm (127.64") mirror installed
Mass	EMZ3510M2: 18500 kg (40793 lb) EMK3510M2: 19000 kg (41895 lb)

*When a 914-mm square sheet is punched.
(Sheet thickness: 2.3 mm)

**When equipped with an optional clamp positioner

***King type-turret (EMK3510M2)

2-1-2. EMZ3612M2/EMK3612M2

Press capacity	300 kN (33.71 US tons)
Tool storage	45 or 58*** stations (4AI) 58 or 70*** stations (2AI)
Max. sheet size	1525 × 6100 mm (60 × 240.15")
Max. sheet thickness	3.2 mm (0.126")
Max. sheet mass	50 kg (110 lb) at axis speed F1 150 kg (330 lb) at axis speed F4
Y-axis travel	1525 mm (60")
X-axis travel	3050 mm (120.07")
Punching accuracy	±0.1 mm (0.004")*
Strokes per minute	1 mm pitch (5 mm stroke) : 780 min ⁻¹ 25.4 mm pitch (5 mm stroke, X-axis): 500 min ⁻¹ or 400 min ^{-1**} 25.4 mm pitch (5 mm stroke, Y-axis): 300 min ⁻¹ or 300 min ^{-1**}
Max. press stroke length	37 mm (1.456")
Max. feed speed (X-axis)	100 m/min (328 ft/min)
Max. feed speed (Y-axis)	80 m/min (262 ft/min)
Turret speed	30 min ⁻¹
Power supply	25 kVA
SCCR	25 kA
Full load current	85 A
Air supply	250 L/min (8.8 ft ³ /min)
Operating air pressure	0.55 MPa (80 psi)
Length	5422 mm (213.46")
Width	6229 mm (245.23")
Height	2317 mm (91.22") 3242 mm (127.64") mirror installed
Mass	EMZ3612M2: 20500 kg (45202 lb) EMK3612M2: 21000 kg (46305 lb)

*When a 914-mm square sheet is punched.
(Sheet thickness: 2.3 mm)

**When equipped with an optional clamp positioner

***King type-turret (EMK3612M2)

2-2. NC unit

Model		AMNC3i (FANUC 31i-PB)
Controlled axes		4 axes (X, Y, T, C) + A-axis (Press)
I/O program code		ISO or EIA
Positioning method		Combination of absolute and incremental systems
Min. dimensional unit		0.001 mm (0.0001"), 0.001°
Memory capacity		125 KB/program (maximum paper tape length of 320 m) 128 MB/total
Display method		21.5-inch color LCD touch screen
External storage device		USB flash drive
Environment	Ambient temperature	5 to 40°C (41 to 104°F)
	Max. relative humidity	75 % without dew condensation
Press pattern		Punching: 3 patterns Nibbling: 1 pattern Forming: 250 patterns Knockout: 10 patterns Marking: 10 patterns Slitting: 4 patterns
Self-diagnostic function		Yes
Built-in clock		Yes
Preparatory functions		1) Function of changing punching speed with time zone 2) Function of changing press up position 3) Standby position (top stroke end) compensating function

2-3. Operating environment

Ambient temperature	5 to 40°C (41 to 104°F)
Max. relative humidity	75 % without dew condensation
Allowable altitude	2000 m
Illumination	Over 500 lux.

3. SAFEGUARDING FUNCTIONS

Overload protective device (AC servo motor)

When AC servo motor overload or fuse blowout produces a servo system alarm, the machine stops immediately. An alarm message to that effect appears on the touch screen of the NC control box.

Prevention of misoperation due to low air pressure

When the air pressure drops below 0.3 MPa, an alarm message to that effect appears on the touch screen of the NC control box, and the machine enters an emergency stop condition.

Overtravel precheck (program check)

Apart from the X- and Y-axes overtravel limit switches, overtravel can be detected in the NC unit without actually moving each axis. Overtravel in this case produces an alarm as program mistake.

Overtravel (X- and Y-axes)

When the X- or Y-axis moves beyond the allowable travel range, the limit switches at the ends of both axes operate and stop the machine immediately. An alarm message to that effect appears on the touch screen of the NC control box.

Strip failure detection

When the punch is stuck in the worksheet and cannot disengage itself from the worksheet or can do so but not early enough, an alarm message to that effect appears on the touch screen of the NC control box, and the machine stops immediately.

Prevention of press drop

The drive axis is provided with a brake mechanism to prevent the press from dropping under its own mass.

Motor protective device

The AC servo motor is equipped with a temperature sensing mechanism. When the AC servo motor reaches the temperature setting, the temperature sensing mechanism stops the AC servo motor.

Workclamp position detection mechanism

When the machine is powered on or the levers on the workclamps are loosened, the positions of the workclamps are detected automatically.

Override detection

When the workclamps enter the override zone, an alarm message to that effect appears on the touch screen of the NC control box, and the machine stops. This function protects the workclamps, worksheets, and tooling.

Stop of machine during tool change

When the SAFETY DEVICE keyswitch on the NC control panel is turned to SETTING, all axes cannot be operated.

When the TOOL CHANGE keyswitch on the turret control panel is turned to ON, such operations as to operate the machine and to move the X- and Y-axes cannot be performed.

However, the turret alone can be operated manually.

Index pins not inserted, disabling punching

If the index pins are not inserted in the turret when the striker has moved completely to the inner, center, or outer track, the press motion cannot be performed.

Inability of workclamps to open during automatic operation

The workclamps cannot open during automatic operation even when the foot switch is pressed to open them. (The workclamps can be opened and closed, however, when a M00 or M001 machine stop command is being executed.)

X-gauge block raised, disabling X- and Y-axes to move

When the X-gauge block is raised, the X- and Y-axes cannot move at all in either the MANUAL or MEMORY mode. When the X-gauge block is raised during automatic operation, the machine stops.

EMERGENCY STOP buttons

As soon as an EMERGENCY STOP button is pressed, the machine stops immediately and totally.

To clear the emergency stop condition, turn the pressed EMERGENCY STOP button clockwise to unlock it, and press the NC RESET button on the NC control panel. After clearing the emergency stop, be sure to resume the operation of the machine, starting with zero-return.

Open/close table

When working in the area between the moving table and electrical enclosure, the operator must push down the open/close table. When the open/close table is opened (pushed down), the machine enters a stop condition.

When entering the open/close table area, be sure to open the open/close table for safety.

4. SOUND LEVEL

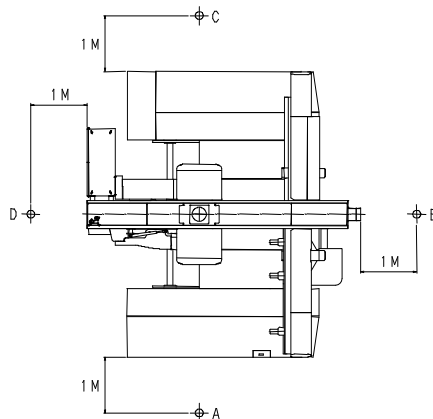
Sound level (measured at position A shown below):

$L_A \text{ eq} = 67.0 \text{ dB (A)}$	No load (Carriage and carriage base move according to program without punching.)
$L_A \text{ eq} = 93.7 \text{ dB (A)}^*$	Mild steel sheet SPCC (JIS), measuring 3.2 mm in thickness and 914 × 914 mm in size, is punched by tool without shear angle
$L_A \text{ eq} = 87.1 \text{ dB (A)}$	Mild steel sheet SPCC (JIS), measuring 1.2 mm in thickness and 914 × 914 mm in size, is punched by tool without shear angle
$L_P \text{ peak} < 130 \text{ dB}$	Mild steel sheet SPCC (JIS), measuring 3.2 mm in thickness and 914 × 914 mm in size, is punched by tool without shear angle

Measuring height: 1.6 m from floor

Measurements made: according to ISO 8500

*102.4 dB (A) > 85 dB (A)



Position A:	100.1 dB (A), maximum level
Position B:	101.2 dB (A)
Position C:	102.4 dB (A)
Position D:	99.2 dB (A)

Machine acoustic power level:

$LWA = 112.24 \text{ dB (A)}$ (167 MW) in full load.

Determination in accordance with ISO 9614-1.

Advice for decreasing sound level

- Keep the operator away from the machine.
- Use a lower press speed and lower axis feed speed.
- Use tools with shear angle.
- Use tools of smaller size.
- Enclose the machine with soundproof walls or the like.

It is also recommended to wear ear protectors.

Part 2

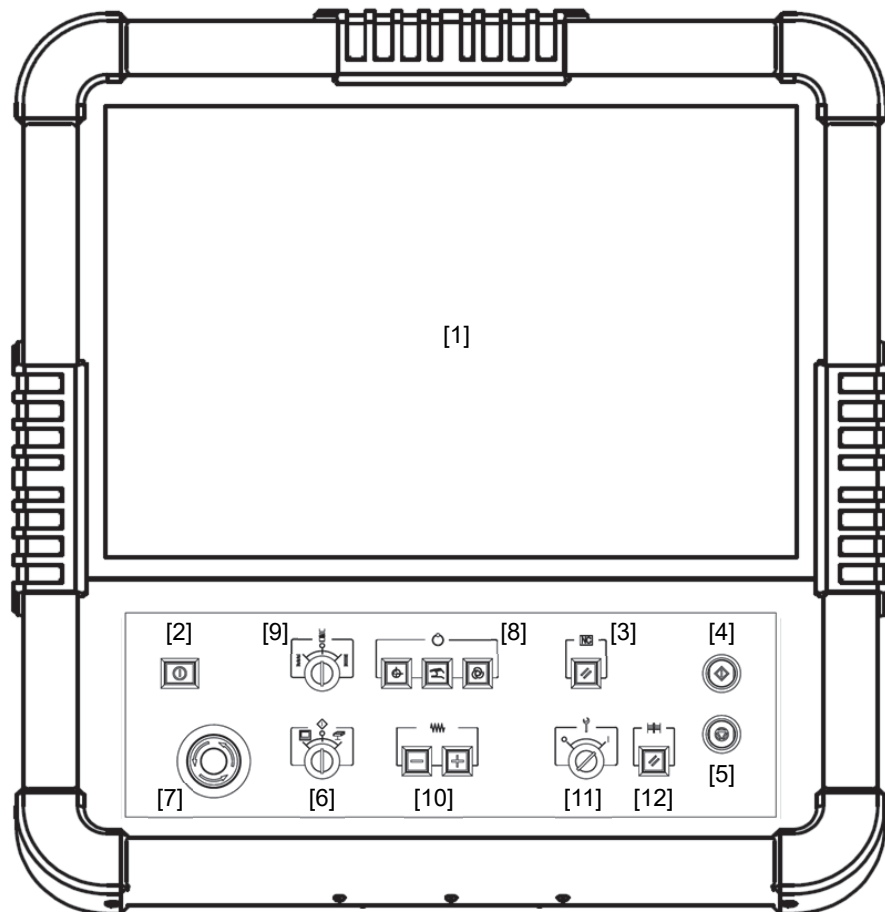
Controls

1. NC control box	2-2
2. Keyboard (NC control box)	2-13
3. Barcode reader (option)	2-15
4. Tool ID reader (option)	2-15
5. Carriage control panel	2-16
6. Turret control panel	2-17
7. TURRET JOG ON button	2-19
8. Auxiliary control stand (option)	2-20
9. Tool balancer controls	2-22
10. Machine circuit breaker switch	2-23
11. Foot switch	2-23
12. Data input/output devices	2-24
12-1. USB ports	2-24
12-2. Interfaces	2-26

1. NC CONTROL BOX

NOTICE

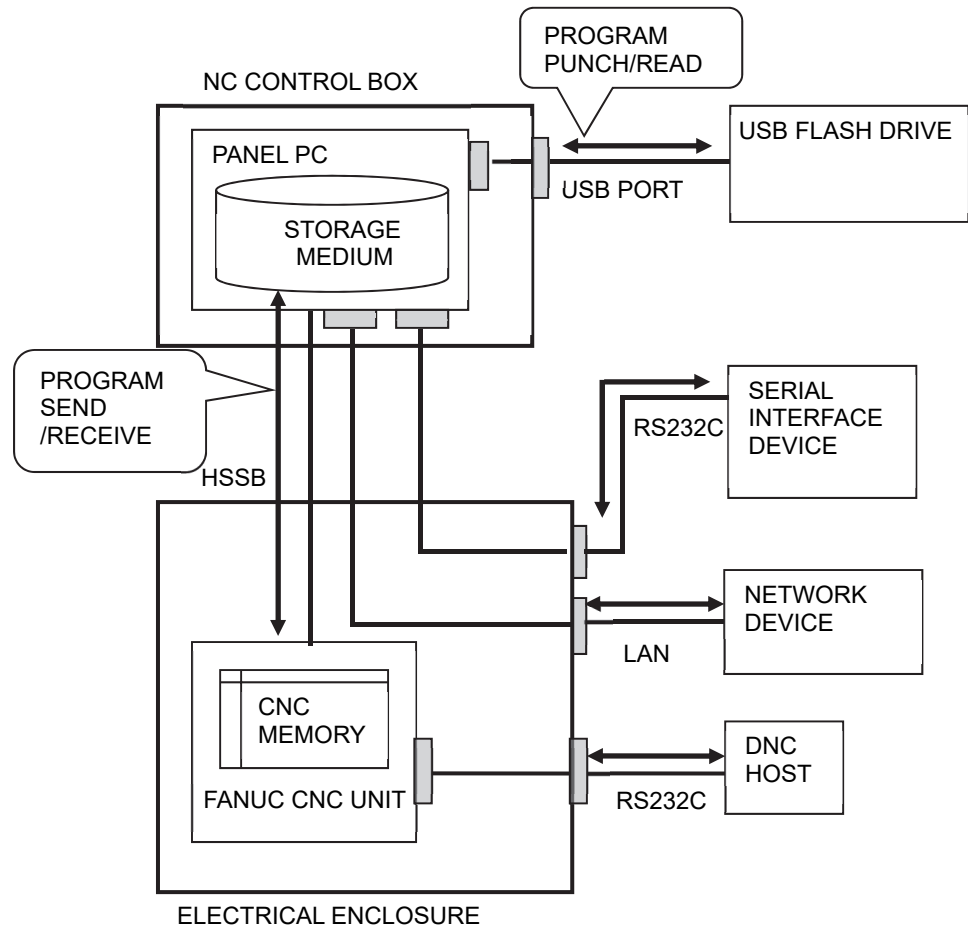
- A PC unit is installed in the NC control box. Do not vibrate, shock, stroke, or sway the NC control box for fear of damaging the PC unit.
- Anchor the NC control box to the floor so that it cannot be moved or tilted. Take the utmost care when moving the machine for relocation or other purposes.



Connecting to PANEL PC and to CNC unit

NOTICE

- The storage medium of the PANEL PC is the USB flash drive of the NC control box. The storage medium of the CNC unit is its memory. Note that the data save-to location varies with the automatic operating mode selected.



<Automatic operating mode is Program or Schedule>

Programs are stored in the PANEL PC. The program for punching each job is selected and transferred to the CNC unit.

<Automatic operating mode is CNC>

Programs are stored in the CNC memory and are only displayed on the PANEL PC.

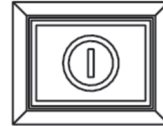
[1] Touch screen

This is a 21.5-inch color LCD touch screen. Press one of the buttons displayed on the screen to select the corresponding function. These functions allow you to set the machine operating controls and to display and edit the programs. You can also check the status of the shape of programmed parts and the tools to be used.

(For the details of the applications, refer to Part 2, Layout of Main Display, in the Reference Manual.)

[2] POWER ON/OFF button (light built in)

Pressed to illuminate the button light and turn on the power of the NC unit. While the NC unit is powered on, pressing the button turns off the power of the NC unit.



When you press the button while the NC unit is powered on, the buzzer continues to sound for 10 seconds.

After 10 seconds, the button flashes and the power-off processing (close process) starts to power off the NC unit and machine. The machine circuit breaker switch automatically changes to TRIP.

You can cancel the close process by pressing the button again while the buzzer is sounding.

NOTICE

- When turning on the power of the NC unit, turn the machine circuit breaker switch on the electrical enclosure to ON and then press the POWER ON/OFF button.
- When the machine circuit breaker switch is turned to OFF with the POWER ON/OFF button illuminated, a fault may occur in the system.
- While the machine is automatically operating or a drive is being written to or read from, do not press the POWER ON/OFF button to turn off the power of the NC unit.

[3] NC RESET button (light built in)

Used to clear an alarm.

When an alarm occurs, the button light flashes and the alarm message appears in the Alarm window.

Remove the cause of the alarm, and press the NC RESET button to clear the alarm with the program returned to the beginning (NC unit reset). The button light extinguishes and the Alarm window closes.

When this button is pressed without the cause of the alarm being removed, the alarm will be cleared with the program returned to the beginning (NC unit reset). The Alarm window remains opening.



NOTE

- When the NC RESET button is pressed while the machine is automatically operating normally, the automatic operation is stopped (the program is reset). Resume the operation starting from zero-return.
- Unless their cause is removed first, some alarms cannot be cleared by pressing the NC RESET button.
Clear such alarms as described in the separate Alarm Lists.

[4] START button (light built in)

Starts the operation of the machine when pressed and illuminated in the MEMORY mode.

Illuminates to indicate that the machine is automatically operating.

Pressed to perform the zero-return when the button flashes and the RETRACT mode is selected.

When the START button on the auxiliary control stand (option) is pressed, the START button on the NC control panel illuminates.



NOTE

- The START button on the auxiliary control stand (option) has the same function as that on the NC control panel.
- When the OPERATING POSITION keyswitch is set at SUB (auxiliary control stand) on the NC control panel, the START button on the auxiliary control stand (option) is enabled.

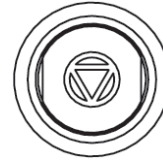
[5] STOP button (light built in)

Pressed to illuminate the button light and stop the operation of the machine.

Pressed again to clear the pause and hold condition. The STOP button is extinguished.

When the machine is stopped due to an alarm, for example, the STOP button is illuminated also.

Clear the alarm, and press the START button to resume the operation.

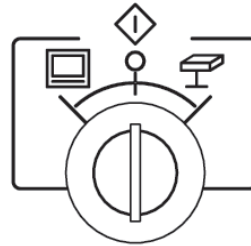


NOTE

- When the STOP button on the auxiliary control stand (option) is pressed, the STOP button on the NC control panel illuminates.
- The STOP button on the NC control panel has the same function as that on the auxiliary control stand (option).

[6] OPERATING POSITION keyswitch

Turned to MAIN to enable the START button on the NC control panel, to SUB to enable the START button on the auxiliary control stand (option), and to OFF to disable the START buttons on the NC control panel and auxiliary control stand (option).



 : MAIN

 : OFF

 : SUB

[7] EMERGENCY STOP button



DANGER

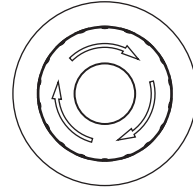
- Before unlocking the EMERGENCY STOP button, be sure to remove the cause of the emergency stop and check for safety around the machine.

Pressed to stop the machine immediately and totally. The NC unit goes into an emergency stop alarm condition.

The button is locked when pressed. To unlock it, turn it clockwise or in the arrow direction.

After pressing the NC RESET button to clear the emergency stop, zero-return all axes before starting the machine for another operation.

For details, refer to “12. Operation interruption” in Part 3, Operation.



NOTE

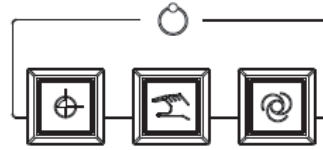
- The EMERGENCY STOP buttons are located on the NC control panel, carriage control panel, turret control panel, and auxiliary control stand (option). The number and location of the EMERGENCY STOP buttons vary with the machine specifications.

[8] MODE buttons

Pressed to select an NC mode.

Each illuminates when the corresponding NC mode is selected.

The RETRACT mode is selected by default when the power of the NC unit is turned on.



- **RETRACT button**

Selects the RETRACT mode to permit the manual zero-return of the X-, Y-, T-, and C-axes.

- **MEMORY button**

Selects the MEMORY mode to permit the execution of a program stored in the memory of the NC unit and editing it.

- **MANUAL button**

Selects the MANUAL mode to permit the manual movement of the X-, Y-, and T-axes or to allow the press operation (only inching operation) with the button under [PANEL] in Common Tools -> [PUNCH] -> [Jog Punch].

- **EDIT button (side panel)**

Used for input and output of programs in the CNC memory.

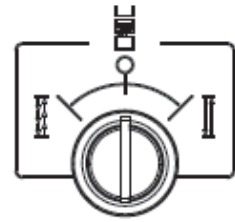


- **MDI button (side panel)**

Do not press this button. This button is used for maintenance purposes.

[9] PRESS SELECT keyswitch

Used to select the press operation pattern as shown in the table below.



⏏ : INCHING

○ : OFF

⏏ : CYCLE

NC mode	Keyswitch position	Press operation pattern
MEMORY	INCHING	The press does not operate at all.
	OFF	
	CYCLE	The press punches one cycle after positioning.
MANUAL	INCHING	The press is ready to inch.
	OFF	The press does not operate at all.
	CYCLE	

● Method of INCHING operation

Check that the striker is over the punch, and turn the PRESS SELECT keyswitch to INCHING.

Illuminate the [ON] button under [PANEL] in Common Tools -> [PUNCH] -> [Jog Punch].

Press the + button on the NC control panel to operate the press. The press operates as long as the button is pressed and held.

NOTICE

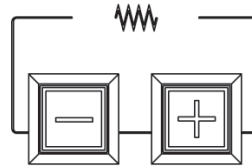
- The inching operation is performed by the AMADA service engineer to inch the press for maintenance purposes. Do not perform the inching operation. Doing so may damage the machine and tools.

NOTE

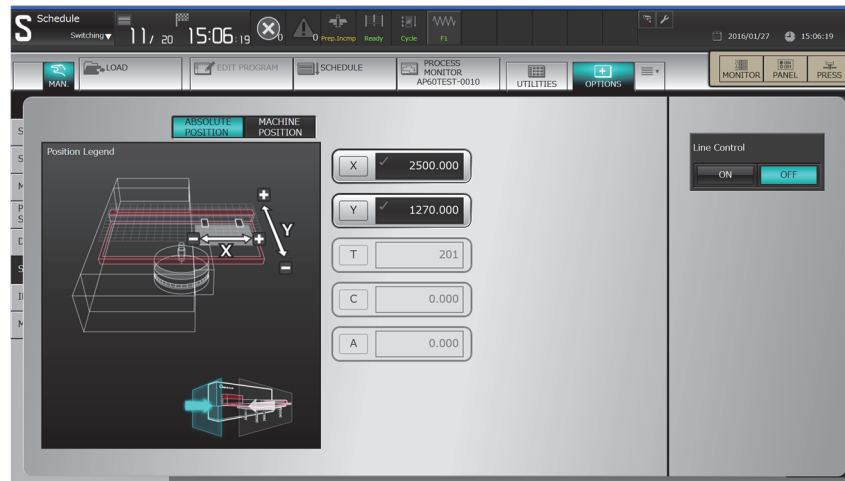
- If the press is not at the top dead center when the inching operation has stopped, the press automatically returns to the top dead center when the NC mode is changed from MANUAL or the NC RESET button is pressed.

[10] FEED buttons

When the MANUAL mode is selected, pressing and holding the + or – button moves the axis selected on the MAN. window in the direction marked on the button.



• Axis Select buttons (X, Y, T)



• Axis speed

When the button indicating the axis speed on [Device indicator] is pressed, the Axis Setting window opens.



Each axis speed corresponding to each speed setting is as below.

Axis speed	Automatic operation (MEMORY & MDI modes)				
	X-axis (EM3510M2)	X-axis (EM3612M2)	Y-axis	T-axis	C-axis
F1	120 m/min {394 fpm}	100 m/min {328 fpm}	80 m/min {262 fpm}	30 min ⁻¹ {rpm}	60 min ⁻¹ {rpm}
F2	90 m/min {295 fpm}	75 m/min {246 fpm}	60 m/min {197 fpm}		
F3	60 m/min {197 fpm}	50 m/min {164 fpm}	40 m/min {131 fpm}	15 min ⁻¹ {rpm}	30 min ⁻¹ {rpm}
F4	30 m/min {98 fpm}	25 m/min {82 fpm}	20 m/min {66 fpm}		
Axis speed	Manual operation (MANUAL mode)				
	X-axis (EM3612M2)	X-axis (EM3510M2)	Y-axis	T-axis	C-axis
F1	5 m/min {16.4 fpm}	5 m/min {16.4 fpm}	5 m/min {16.4 fpm}	3 min ⁻¹ {rpm}	Disabled
F2					
F3					
F4					

NOTE

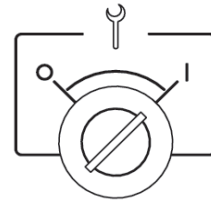
- When the [FA] button is pressed on the Axis Setting window, the mild mode is selected. The mild mode emphasizes the stability of positioning. The X- and Y-axes accelerate and decelerate more slowly. This mode can be selected at all speeds F1 to F4.
- The C-axis does not move in the MANUAL mode.

[11] SAFETY DEVICE keyswitch

Used for preventing the improper operation caused by other workers when you perform the tool change or cleaning of the turret, table, or the like.

When the SAFETY DEVICE keyswitch is turned to SETTING, all axes do not move by the interlock system.

To clear the interlock, turn the SAFETY DEVICE keyswitch to OPERATION.



O : OPERATION

I : SETTING

NOTE

- The key of the SAFETY DEVICE keyswitch can be removed when turned to SETTING.



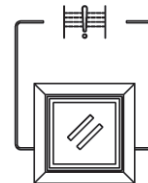
DANGER

- Before performing setup work such as tool change or the like, turn the SAFETY DEVICE keyswitch to SETTING and remove the key from the keyswitch, and carry it with you to prevent another worker from setting the keyswitch to OPERATION by mistake.

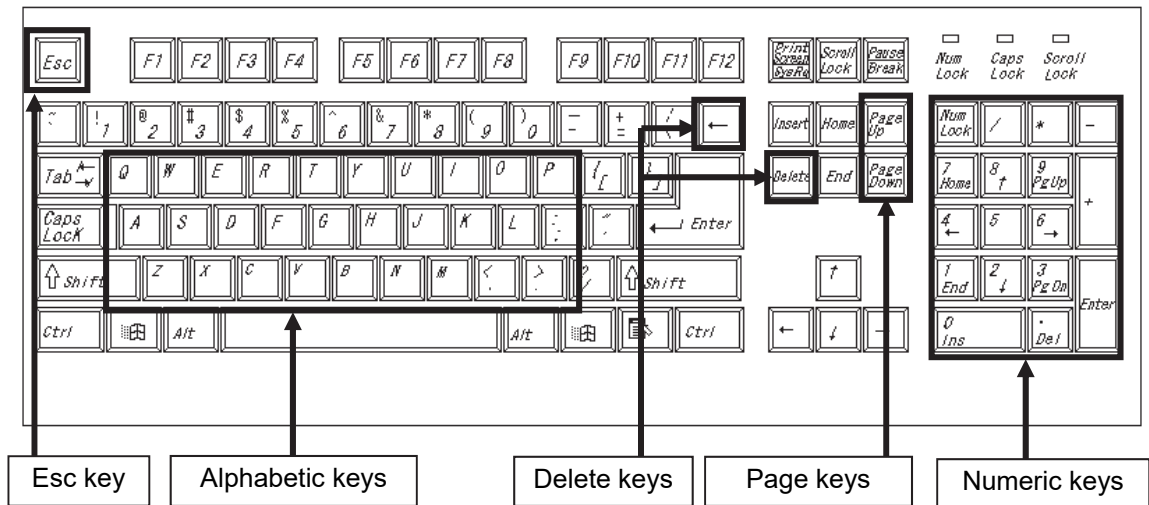
[12] SAFETY DEVICE RESET button

The machine stops and the button light of SAFETY DEVICE RESET button flashes and the button indicating the status of the protective device shows "Not Ready" on [Device indicator] when the protective device operates.

After removing the cause of the operation of the protective device, press the button to extinguish the button light and clear the stop state. The button indicating the status of the protective device shows "Ready" on [Device indicator] and the protective device becomes ready.



2. KEYBOARD (NC CONTROL BOX)



[1] Alphabetic keys

Pressed to enter alphabetic characters or symbols.

[2] Numeric keys

Pressed to enter numerals, the minus symbol (-), and the decimal point (.), among other characters.

[3] Esc key

Pressed to cancel the entry operation.

[4] Delete keys

Pressed to delete a character.

← : Deletes the character before the cursor.

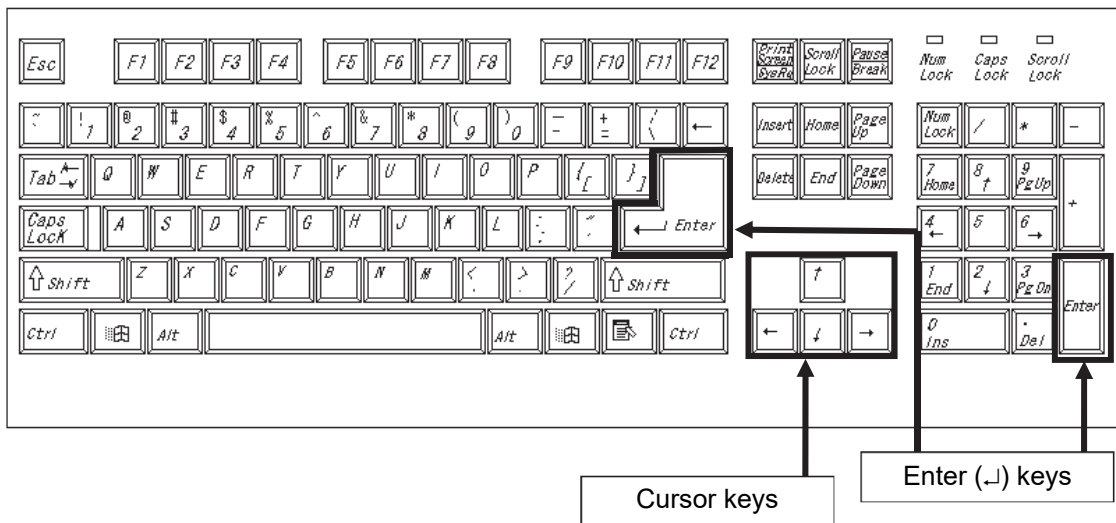
Delete : Deletes the character after the cursor.

[5] Page keys

Pressed to change a display from one page to another.

Page Up : Goes to the previous page.

Page Down : Goes to the next page.



[6] Cursor keys

Pressed to move the cursor on the screen.

- ↑ : Moves the cursor up.
- ↓ : Moves the cursor down.
- ← : Moves the cursor left.
- : Moves the cursor right.

NOTE

- When the cursor is moved after entering a value, the value is stored in memory. Press the Esc key to cancel this entry operation.

[7] Enter (↵) keys

Pressed to store each value in memory.

3. BARCODE READER (OPTION)

Used to read the barcode outputted through the AP100 or ASIS100PCL on the work instruction sheet.



4. TOOL ID READER (OPTION)

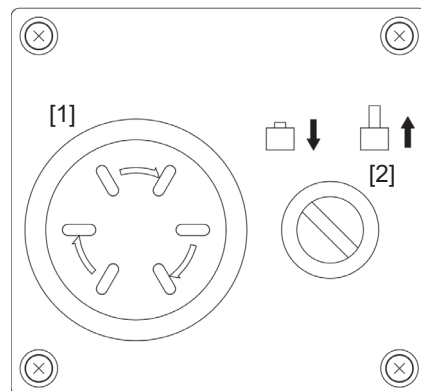
Used to read the DM code marked on the tools.

The tool ID reader is connected to the USB port.

DM code: data matrix



5. CARRIAGE CONTROL PANEL



[1] EMERGENCY STOP button



DANGER

- Before unlocking the **EMERGENCY STOP** button, be sure to remove the cause of the emergency stop and check for safety around the machine.

Pressed to stop the machine immediately and totally. The NC unit goes into an emergency stop alarm condition.

The button is locked when pressed. To unlock it, turn it clockwise or in the arrow direction.

Zero-return all axes before starting the machine for another operation. The machine cannot resume the operation interrupted by the depression of the button. For details, refer to “12. Operation interruption” in Part 3, Operation.

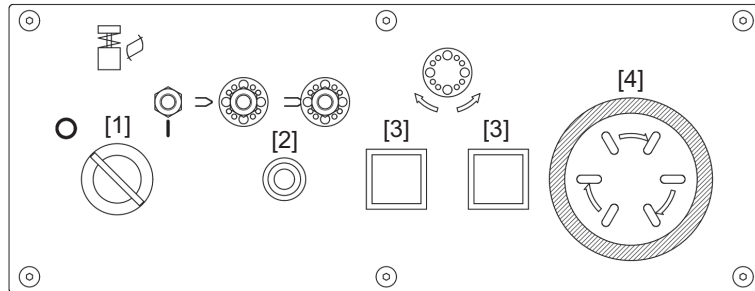
NOTE

- The EMERGENCY STOP buttons are located on the NC control panel, carriage control panel, turret control panel, and auxiliary control stand (option). The number and location of the EMERGENCY STOP buttons vary with the machine specifications.

[2] X-GAUGE BLOCK switch

Turned to UP to raise the X-gauge block and to DOWN to lower the X-gauge block.

6. TURRET CONTROL PANEL



[1] TOOL CHANGE keyswitch

Turned to ON in the MANUAL mode to lock the carriage (X-axis) and carriage base (Y-axis). The turret can be then safely rotated. The key can be removed from the keyswitch in the ON position.

NOTE

- Never turn the switch to ON during the operation of the machine in any NC mode other than MANUAL.

[2] INDEX PIN switch, and IN and OUT lights

The switch is used to operate the turret index pins in the MANUAL mode and is disabled in other NC modes. The pins are inserted in the turret disks by turning the switch to IN to illuminate the IN light. The pins are withdrawn when the switch is turned to OUT to illuminate the OUT light. Normally keep the OUT light illuminated. The switch is spring-returned to the neutral position when it is released.

[3] TURRET JOG buttons

Used to rotate the turret in the MANUAL mode when the TOOL CHANGE keyswitch (see above) is turned to ON. Use the left button to rotate the turret clockwise and the right button to rotate the turret counterclockwise. The turret rotates at 3 min^{-1} . The turret stops and indexes the nearest turret station in its rotational direction when each button is released.

The turret index pins must be out of the turret disks when using these buttons. Press either TURRET JOG button within 0.5 sec after pressing and holding the TURRET JOG ON button (see below).

The TURRET JOG buttons are disabled in NC modes other than MANUAL.

NOTE

- Even if the tool change doors are opened or closed, the turret can be rotated by pressing the TURRET JOG ON button and either TURRET JOG button.

[4] EMERGENCY STOP button

 DANGER	● Before unlocking the EMERGENCY STOP button, be sure to remove the cause of the emergency stop and check for safety around the machine.
---	--

Pressed to stop the machine immediately and totally. The NC unit goes into an emergency stop alarm condition.

The button is locked when pressed. To unlock it, turn it clockwise or in the arrow direction.

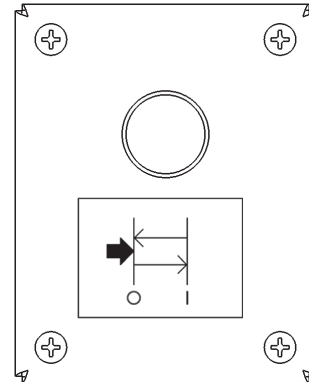
Zero-return all axes before starting the machine for another operation. The machine cannot resume the operation interrupted by the depression of the button. For details, refer to “12. Operation interruption” in Part 3, Operation.

NOTE

- The EMERGENCY STOP buttons are located on the NC control panel, carriage control panel, turret control panel, and auxiliary control stand (option). The number and location of the EMERGENCY STOP buttons vary with the machine specifications.

7. TURRET JOG ON BUTTON

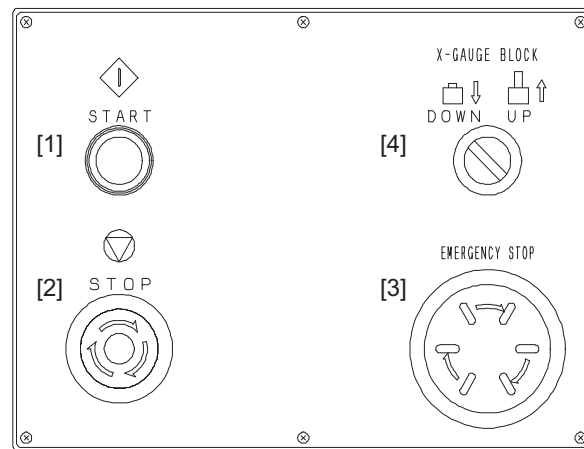
Used to rotate the turret in combination with the TURRET JOG buttons (see above) in the MANUAL mode.



NOTE

- The TURRET JOG ON button has the three positions. Lightly press it to the position 2 to unlock the turret, and further press it to lock the turret again.

8. AUXILIARY CONTROL STAND (OPTION)



[1] START button

Pressed to start the operation of the machine. The START button on the NC control panel illuminates to indicate that the machine is operating. The button illuminates during the automatic operation.

When the START button on the NC control panel is pressed, this button also illuminates.

NOTE

- When the OPERATING POSITION keyswitch is set at SUB (auxiliary control stand) on the NC control panel, the START button is enabled on the auxiliary control stand (option).

[2] STOP button

Pressed to stop the operation of the machine. The STOP button on the NC control panel illuminates when this button is pressed and stays on for the duration of the stopped condition.

The button is locked when pressed. Unlock the button by turning it clockwise. Unless the STOP button is unlocked, the operation cannot be resumed by pressing the START button.

NOTE

- The STOP button on the auxiliary control stand (option) has the same function as that on the NC control panel.

[3] EMERGENCY STOP button



DANGER

- Before unlocking the EMERGENCY STOP button, be sure to remove the cause of the emergency stop and check for safety around the machine.

Pressed to stop the machine immediately and totally. The NC unit goes into an emergency stop alarm condition.

The button is locked when pressed. To unlock it, turn it clockwise or in the arrow direction.

Zero-return all axes before starting the machine for another operation. The machine cannot resume the operation interrupted by the depression of the button. For details, refer to “12. Operation interruption” in Part 3, Operation.

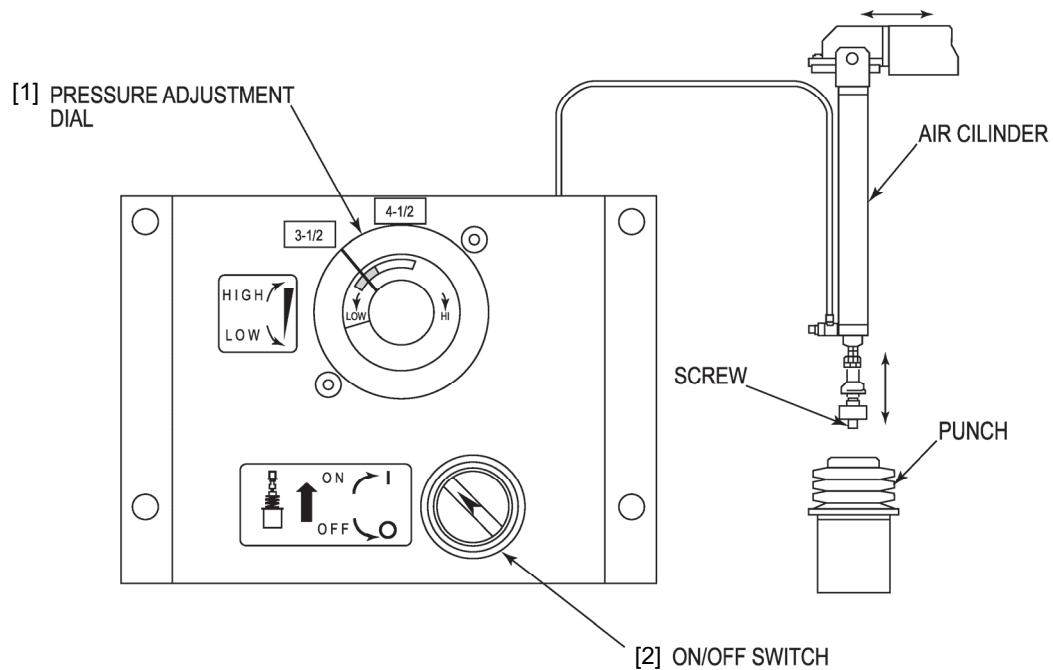
NOTE

- The EMERGENCY STOP buttons are located on the NC control panel, carriage control panel, turret control panel, and auxiliary control stand (option). The number and location of the EMERGENCY STOP buttons vary with the machine specifications.

[4] X-GAUGE BLOCK switch

Turned to UP to raise the X-gauge block and to DOWN to lower the X-gauge block.

9. TOOL BALANCER CONTROLS



The following dial and switch are located behind the upper tool change door (see the figure above) and used to control the tool balancer. The tool balancer supports the mass of a large-diameter (3-1/2" or larger) punch during installation or removal.

[1] Pressure adjustment dial

Used to adjust the lifting force of a large-diameter punch. Turn the dial clockwise to increase the lifting force and counterclockwise to decrease the lifting force.

[2] ON/OFF switch

Used to support a large-diameter punch during installation or removal.

10. MACHINE CIRCUIT BREAKER SWITCH

Used to turn on and off the power of the machine and the NC unit.

The flow of overcurrent automatically turns off the power of the machine and the NC unit.

When the machine circuit breaker switch is turned to OFF, padlock it to prevent the power of the machine from being inadvertently turned on during maintenance, for example.



NOTICE

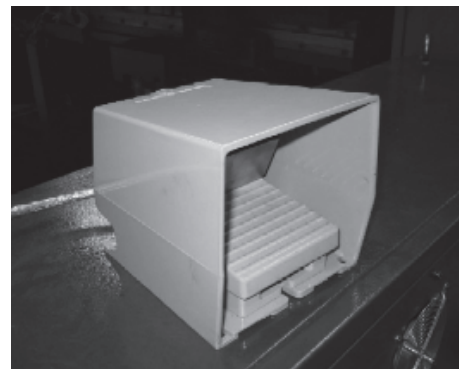
- To turn on the NC unit, first turn the machine circuit breaker switch to ON. Then, press the POWER ON/OFF button on the NC control panel.
- To turn off the NC unit, first press the POWER ON/OFF button. Make sure that the POWER ON/OFF button light goes out or the message "It is now safe to turn off your computer" is displayed. Then, turn the machine circuit breaker switch to OFF.
- If overcurrent flows through the machine circuit breaker during operation, the breaker trips and cuts off the current automatically. Eliminate the cause of the overcurrent and turn the machine circuit breaker switch to ON, if the machine circuit breaker switch is turned off due to overcurrent.

11. FOOT SWITCH

Press the foot switch to open or close the workclamps.

NOTE

- When the foot switch is pressed, the workclamps hold the worksheet. Leave the foot switch pressed for about 2 sec. If the foot switch is released earlier, the workclamps open and release the worksheet.
- When the foot switch is pressed during the automatic operation, the workclamps do not open. When the machine is stopped by the program stop command M00 or M01, however, the workclamps can open.
- The free-motion bearings rise when the workclamps open and lower when the workclamps close.



12. DATA INPUT/OUTPUT DEVICES

12-1. USB ports

Located at the right side of the NC control box.
Remove the cover cap before use.

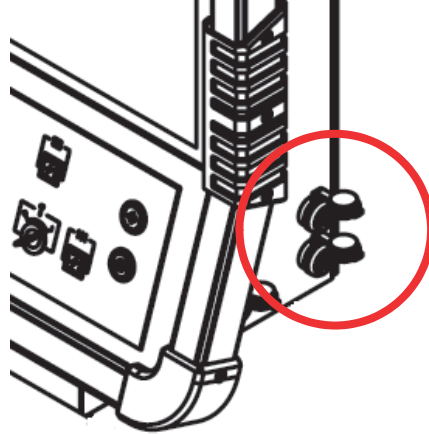
Insert the USB flash drive into the USB port to input and output data and programs between the USB flash drive and NC unit.

Do not make any non-standard connection.

It is recommended to remove the USB flash drive from the USB port when the NC unit is powered off.

If you want to remove the USB flash drive while the NC unit is powered on, refer to "Removing USB flash drives" on the next page.

To use the USB flash drive, specify the drive into which the USB flash drive is inserted.



NOTICE

- The AMNC3i is installed with security software. Take extra care against viruses and other malicious software. Do not connect media of unknown origin into the USB port.

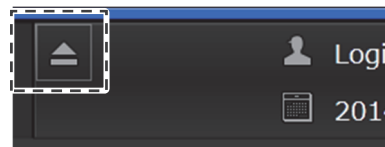
NOTE

- The processing programs saved in the USB flash drive may not be able to be listed on the screen in the SDD format and transfer identifier format, depending on their total capacity or number. In such a case, delete some processing programs saved in the USB flash drive or find processing programs with the search function to show the programs on the screen.
- The processing programs may not be able to be saved in the root directory of a USB flash drive formatted in the FAT16 file system because the number of files that can be saved is predetermined, irrespective of its free capacity.
- Do not connect any device other than the USB flash drive, mouse, and keyboard into the USB port. Some USB flash drive may not operate in the AMNC3i.

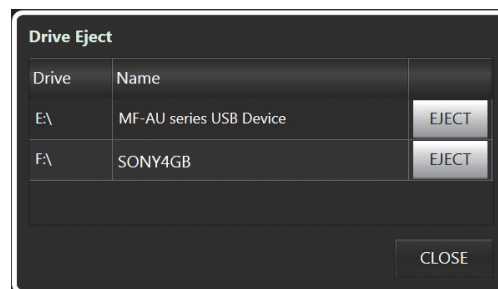
Removing USB flash drives

We advise removing USB flash drives when the power is turned off. If removing the drive when the power is turned on, follow the procedure below.

- 1 Press the eject button in [Notification area].



- 2 When multiple USB drives are connected, the Drive Eject window opens.
Press the [EJECT] button.



- 3 A window opens to indicate that the drive is being removed.
- 4 When the window closes, check that the access indicator on the USB flash drive is not illuminated, and then remove the drive.

12-2. Interfaces

RS232C interface

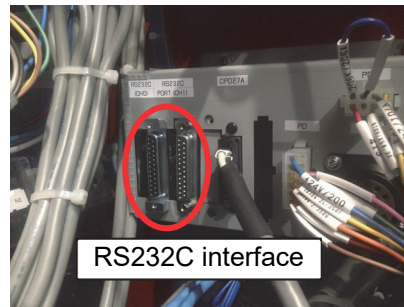
Located in the electrical enclosure.

RS232C (CH0)

Used to connect an external input/output device for data transfer with the NC unit.

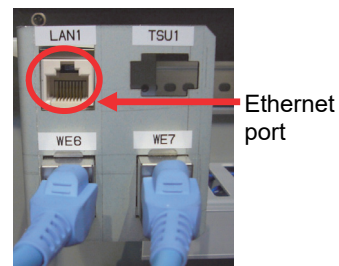
RS232C (CH1)

Used to connect an external input/output device for data transfer with the PANEL PC unit.



Ethernet port

Used for network connection with the AP100 or ASIS100PCL.

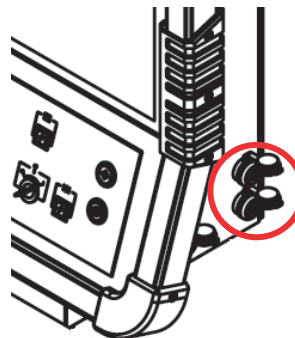


Barcode reader interface

Used for connection of the optional barcode reader.

Use a USB port at the side of the NC control box.

When the machine is network-connected with the AP100 or ASIS100PCL, the optional barcode reader can be used to read the barcode printed on the output document of a part and call the program of the part.



Part 3

Operation

1. Preparing and checking before turning on power	3-3
2. Turning on power	3-4
3. Zero-returning	3-5
4. Reading program or programs	3-7
4-1. Single-program operation	3-7
4-2. Schedule operation	3-8
4-3. Checking shape of part	3-10
5. Checking setup of tools and worksheets	3-11
6. Changing tools	3-13
6-1. Moving necessary turret station to tool change position	3-13
6-2. Changing tools in $\phi 1200$ King type-turret	3-15
6-2-1. Changing tools in 1/2" and 1-1/4" standard stations	3-15
6-2-2. Changing tools in auto-index stations	3-16
6-2-3. Changing tools in 2", 3-1/2", and 4-1/2" standard stations	3-18
6-3. Changing tools in Z type-turret	3-20
6-4. Changing punch with tool balancer	3-21
6-5. Ending tool change	3-22
7. Positioning workclamps	3-23
8. Loading worksheet	3-27
9. Automatic operation	3-29
9-1. Starting automatic operation	3-29
9-1-1. Starting single-program operation	3-29
9-1-2. Starting schedule operation	3-31

(Continued on next page.)

10. Manual operation	3-34
11. Checking program.....	3-35
11-1. Clearing program errors	3-36
12. Operation interruption	3-37
12-1. Stop condition	3-37
12-1-1. STOP button is pressed	3-37
12-1-2. Program stop (M00) or optional stop (M01) is commanded.....	3-37
12-1-3. Single block function is enabled.....	3-38
12-1-4. Override detection is enabled	3-38
12-1-5. Repositioning confirmation function is enabled.....	3-41
12-1-6. Stripping failure is detected.....	3-42
12-1-7. X-gauge block is raised	3-42
12-1-8. Tool change door is opened	3-42
12-1-9. Workclamps are opened	3-43
12-1-10. TOOL CHANGE keyswitch is turned to ON	3-43
12-1-11. SAFETY DEVICE keyswitch is turned to SETTING.....	3-43
12-1-12. Protective device is actuated	3-43
12-2. Emergency stop condition.....	3-44
12-2-1. EMERGENCY STOP button is pressed	3-44
12-2-2. Air pressure drops below specified limit.....	3-44
12-2-3. X-axis or Y-axis overtravel alarm occurs	3-45
12-2-4. Reset	3-45
12-2-5. Zero-returning after temporary stop of processing.....	3-45
12-3. Clearing other stop conditions	3-46
13. Setting press operating method.....	3-47
14. Turning off power (shutting down system).....	3-49

1. PREPARING AND CHECKING BEFORE TURNING ON POWER

 WARNING	● Be sure to check the machine before the start of the day's work. As soon as you find equipment failure or trouble, repair it or take any other necessary measure to prevent an accident.
--	---

Before turning on the power of the machine, turn on the power of the air compressor.

Before starting the day's work, perform the following items. Refer to "1-1. Maintenance at start of day's work" in Part 5, Maintenance.

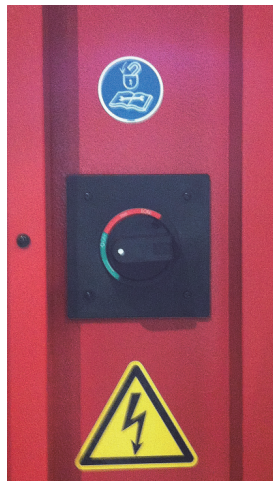
- Check that the main air pressure is 0.55 MPa {80 psi}. If it is not, adjust it to 0.55 MPa {80 psi} as described in "1-1-1. Checking air system" in Part 5, Maintenance.
- Check that the air filter is drained of water.
- Check that the lubricator is properly filled with oil.

2. TURNING ON POWER

Turn on the power of the machine as described below.

- 1 Turn on the shop circuit breaker switch.
- 2 Turn the machine circuit breaker switch on the electrical enclosure to ON.

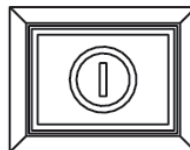
The cooling fans in the electrical enclosure start running.



MACHINE CIRCUIT BREAKER SWITCH

- 3 Press the POWER ON/OFF button on the NC control panel.
- The light of the button comes on to indicate that the power of the NC unit is turned on.

After about 2 min, the initial AMNC3i display appears on the touch screen.



3. ZERO-RETURNING

The NC unit starts in the RETRACT mode and the RET. window appears automatically. Be sure to zero-return first.

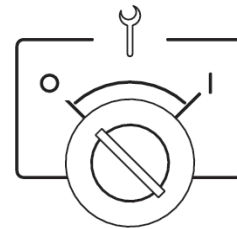


WARNING

- **Before zero-returning the machine, check that there are no workers and obstacles around the machine. Pay particular attention to the rear of the machine.**

Zero-return the machine as described below.

- 1 Turn the SAFETY DEVICE keyswitch on the NC control panel to OPERATION.



O : OPERATION

- 2 Check that the RETRACT button on the NC control panel is illuminated. If it is not illuminated, press the RETRACT button to turn it on.



- 3 Turn the OPERATING POSITION keyswitch on the NC control panel to MAIN (NC control panel).



MAIN : MAIN

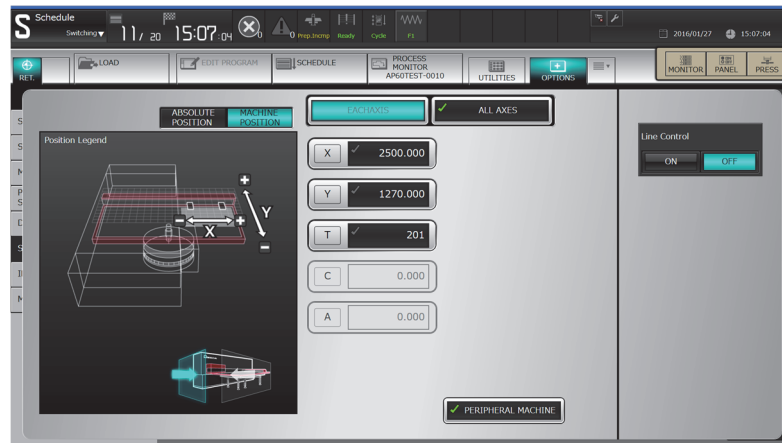
- 4 Check that the workclamps are closed. If they are not closed, press the foot switch to close them. If they are open, the machine cannot be zero-returned.

- 5 With [ALL AXES] selected on the RET. window, press the START button on the NC control panel to automatically zero-return the X-, Y-, T-, and C-axes.

When zero-returning each axis, select the axis you want to zero-return on the RET. window and then press the START button.

Zero-return each axis in the following order.

X-axis → Y-axis → T-axis



NOTE

- If there is another axis which must be zero-return when the [EACHAXIS] button is set to ON and a selected axis is zero-return, another axis which must be zero-return is selected at the same time.
- Select the T-axis to zero-return the T- and C-axes.
- When the RETRACT mode is selected and the RET. window opens, the [ALL AXES] button is selected.

4. READING PROGRAM OR PROGRAMS

Here described is the procedure for reading a program or programs from an input/output device (media). When using another input or output device or barcode reader or creating a new program, refer to Part 9, Editing Programs, in the Reference Manual.

4-1. Single-program operation

When performing the single-program operation of the machine, read the necessary program to the PROCESS MONITOR display as described below.

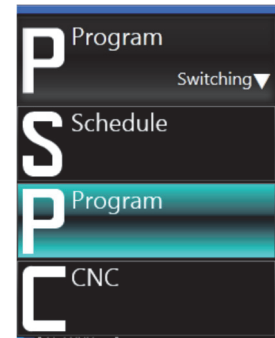
- 1 Press the MEMORY button on the NC control panel to switch the NC mode to MEMORY.



- 2 Select [Switching] -> [Program] in [Status Header area] to switch the operating mode to Program.

NOTE

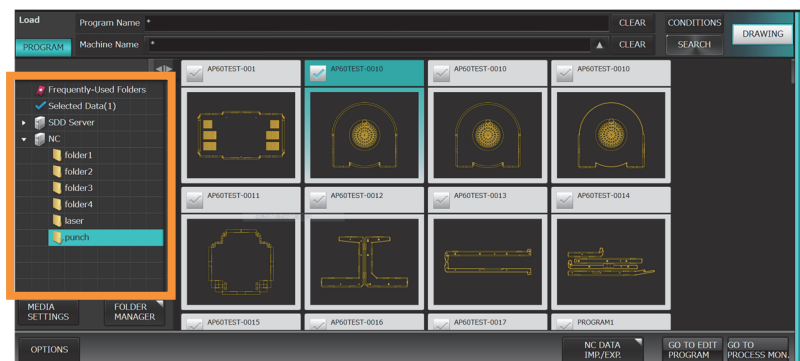
- The operating mode cannot be changed when an automatic operation is running.



- 3 Touch the [LOAD] tab to open the LOAD display.



- 4 In [Media Selection area], select the folder where the target program is saved.



- 5 Select the program.

- 6 To start the processing right away, press the [GO TO PROCESS MON.] button to transfer the program to the PROCESS MONITOR display.



To edit the program, press the [GO TO EDIT PROGRAM] button.

NOTE

- Multiple programs cannot be selected at a time on the EDIT PROGRAM display.

4-2. Schedule operation

When performing the schedule operation of the machine, read the necessary program or programs (jobs) to the SCHEDULE display as described below.

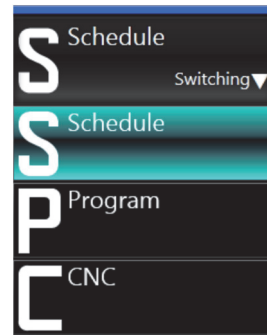
- 1 Press the MEMORY button on the NC control panel to switch the NC mode to MEMORY.



- 2 Select [Switching] -> [Schedule] in [Status Header area] to switch the operating mode to Schedule.

NOTE

- The operating mode cannot be changed when an automatic operation is running.



- 3 To run a schedule operation that uses peripheral equipment, illuminate the [ON] button at [Line Control] in [Operation Settings area] or under [PANEL] in Common Tools -> [PERIPHERAL MACHINE] -> [Line Control].

- 4 Touch the [LOAD] tab to open the LOAD display.



- 5 In [Media Selection area], select the folder where the target program is saved.



- 6 Select the program (job). You can add up to 999 jobs to a schedule.
- 7 Select where to add the selected program to. In this procedure, press the [GO TO SCHEDULE] button to add the program on the schedule list.
- 8 The Process Quantity Input window opens for each job added. The amount of information displayed increases or decreases depending on the configuration of peripheral equipment. Enter the scheduled number of worksheets to be processed and those processed already, and then press the [OK] button.



Process Quantity Input			
Program Name		BTK-CUST-080326-003	
Process Quantity	Schedule	Normal Exit	0
In Rack	In Rack	Reserve In Rack	0
Out Rack	Out Rack	Reserve Out Rack	0
Reserve	Reserve		0
Material Information		Material Type	
Material Name SPC-2.3			
		OK CLOSE	

NOTE

- All jobs can be added to the list by default without performing checks. For details, refer to “2. Adding jobs” in Part 7 in the Reference Manual.
- The program can be added to the schedule list without opening the Process Quantity Input window. For details, refer to “3-4. Optional settings” in Part 5 in the Reference Manual.

- 9 When you finish adding jobs to the schedule list, the SCHEDULE display appears.

No.	Setup	Program Name	Process Quantity	Normal End	Abnormal End	Skip	Status	Schedule Name	Reserve	Material Name	Material Size X
001		PROGRAM1	1	1	0	0	Normal	0000		C-SUSL1.0	2000.000
002		PROGRAM2	1	0	0	0	Not St	0000		AS052-1.0	2000.000
003		PROGRAM2	1	0	0	0	Not St	0000		AS052-1.0	2000.000
004		PROGRAM1	1	0	0	0	Not St	0000		C-SUSL1.0	2000.000
005		PROGRAM2	1	0	0	0	Skip	Not St		AS052-1.0	2000.000
006		PROGRAM1	1	0	0	0	Not St	0000		AS052-1.0	2000.000
007		PROGRAM1	1	1	0	0	Normal	0000		C-SUSL1.0	2000.000
008		PROGRAM2	1	0	0	0	Not St	0000		AS052-1.0	2000.000

No.	Program Name	Process Quantity	Normal End	Abnormal End	Skip	Status	Schedule Name	Reserve	Material Name	Material Size X
1	EXP	1	0	0	0	Not St	0000		SPC1.2	1500.000
2	RENCHU2	1	0	0	0	Not St	0000		SPC1.6	1500.000

- 10 To run the setup calculation, press the [SETUP CALCULATION] button. Icons are placed on jobs that require setups.
- 11 The schedule can be edited. When doing so, consider the result of the setup calculation.

To fix the program, select a job and press the [GO TO EDIT PROGRAM] button.

To change the order in the schedule, use the [EDIT LIST] menu.

0000	SPC1.2	1500.000
0000	SPC1.6	1500.000

NOTE

- For details of editing schedules, refer to Part 7, Preparing Schedules, in the Reference Manual.
- Multiple programs can be selected on the SCHEDULE display.

4-3. Checking shape of part

The part processed by the program read to the EDIT PROGRAM display of program operation or the SCHEDULE display of schedule operation can be drawn to check its shape. For details, refer to “1. To show PROCESS MONITOR display” in Part 6 and “1. Display of PROCESS MONITOR display” in Part 8 in the Reference Manual.

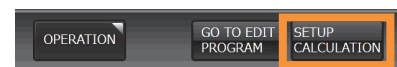
5. CHECKING SETUP OF TOOLS AND WORKSHEETS

When there is a tool or worksheet setup to be made with the program shown on the display, the Setup window automatically opens. When there is no setup to be made, the window does not automatically open.

NOTE

- To automatically show the Setup window, check the necessary setup boxes in the [SETUP CONFIG.] view of the OPTIONS display. For details, refer to “1-2. SETUP CONFIG. view” in Part 15 in the Reference Manual.
- For the detailed procedure of setting up, refer to Part 6, Starting Program Operations, in the Reference Manual.

- 1 If you see a white icon in the Setup column in the schedule list, you need to perform the setup calculation. Press the [SETUP CALCULATION] button.



- 2 If you see one of yellow icons below in the Setup column, press the icon to open the Setup window.



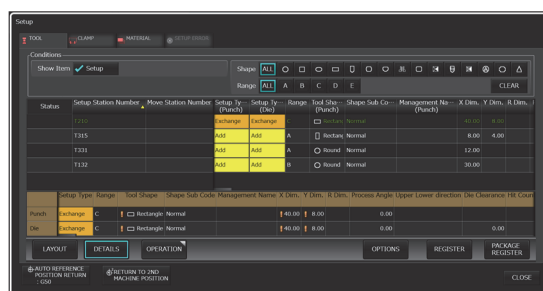
: Tool setup



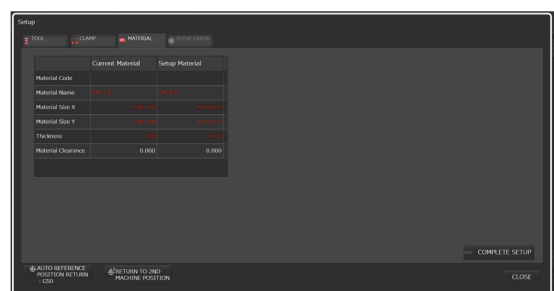
: Worksheet setup



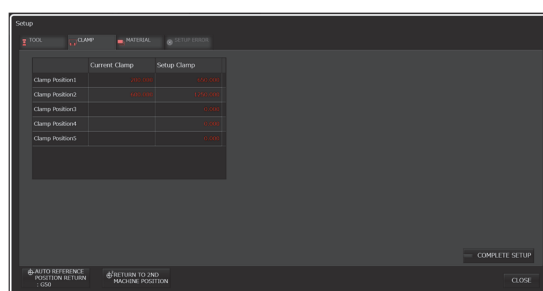
: Workclamp setup



Tool setup ([TOOL] tab)



Worksheet setup ([MATERIAL] tab)



Workclamp setup ([CLAMP] tab)

- 3 Set up the items on the tabs with the red icon on the Setup window.

When the setup is completed, press the [COMPLETE SETUP] button on each tab where you made the setup.

- 4 When all setups are completed, press the [CLOSE] button.
- 5 If you see no icon in the Setup column in the schedule list, it means that the setup procedure is completed.

6. CHANGING TOOLS

 WARNING	● When changing the tools, turn the SAFETY DEVICE keyswitch to SETTING on the NC control panel and the TOOL CHANGE keyswitch to ON on the turret control panel. The chief operator must remove the keys from the keyswitches, keep the keys on himself, and directly instruct the other operator to change the tools. ● Never touch the turret or tools while the turret is rotating. Otherwise you may get injured. ● When changing the tools, take care not to drop the tools or to have the fingers pinched between a turret hole and the edge of a punch guide. ● When changing the tools, wear safety shoes to provide against an accidental drop of the tools that may result in a serious injury.
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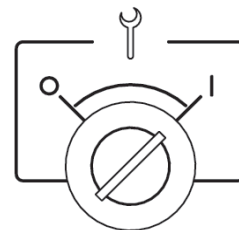
NOTICE

- Before rotating the turret, check that the tools are completely installed in the turret.
- When installing a shaped tool (not a round tool), align the keyway of the punch guide with the key of the upper turret disk so that the punch orients in the same direction as the die.

6-1. Moving necessary turret station to tool change position

Move the turret station where a tool is to be removed or installed to the tool change position as described below.

- 1 Turn the **SAFETY DEVICE** keyswitch on the NC control panel to **SETTING**, and remove the key from the keyswitch.

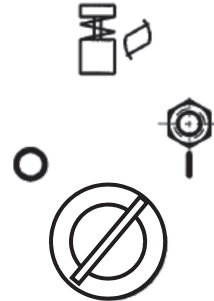


I: SETTING

- 2 Press and illuminate the MANUAL button on the NC control panel.

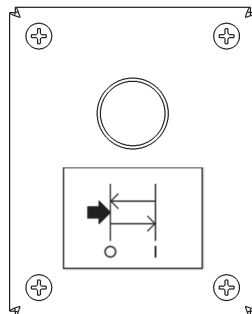


- 3 Turn the TOOL CHANGE keyswitch on the turret control panel to ON, and remove the key from the keyswitch.

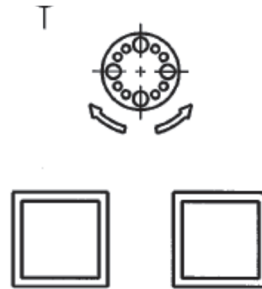


- 4 Turn the INDEX PIN switch on the turret control panel to OUT to remove the turret index pins from the turret.
- 5 While pressing the TURRET JOG ON button on the carriage control panel, press either TURRET JOG button on the carriage control panel.

The turret rotates as long as the two buttons are pressed.



TURRET JOG ON



TURRET JOG

NOTE

- The TURRET JOG ON button is of the enable type. Take care that the button turns off if pressed excessively.

- 6 When the desired turret station approaches the tool change position, release the TURRET JOG ON button and TURRET JOG button.

The turret selects the desired station and stops.

- 7 Open the upper and lower tool change doors.
- 8 Check the turret station number stamped on the top surface of the upper turret disk, and install or remove the tool in the turret station as described on the following pages.

6-2. Changing tools in $\phi 1200$ King type-turret

6-2-1. CHANGING TOOLS IN 1/2" AND 1-1/4" STANDARD STATIONS

NOTICE

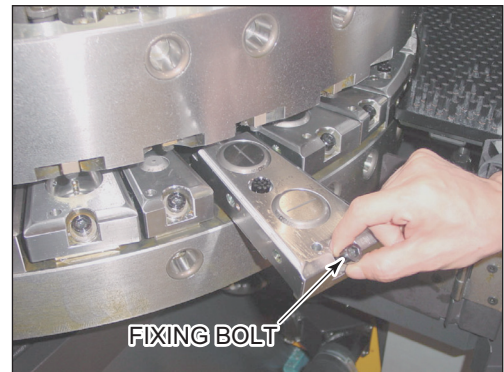
- When installing a shaped tool, align the punch shape with the hole shape of the die, and insert the punch in the upper turret disk. Carefully insert the punch by aligning the punch guide with the hole in the upper turret disk. If the punch is inserted with the punch guide misaligned with the turret hole, the punch guide may be damaged on the side to lead to the galling of the tool.

NOTE

- Before installing punches and dies in the turret, lubricate them with machine oil. For the lubrication points, refer to Part 5, Maintenance.
- Shaped tools cannot be installed in the center track of the 1/2" stations. Round tools can be installed in any tracks.

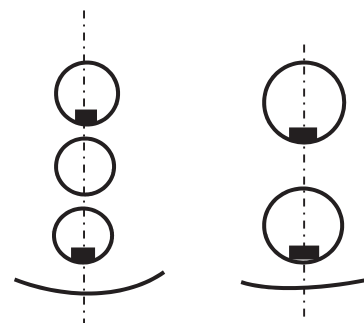
Installing tools

- 1 Loosen the bolt fixing the upper die holder.
- 2 Remove the upper die holder from the lower turret disk.
- 3 Insert the die through the bottom of the upper die holder.
- 4 Install the upper die holder in the lower turret disk.
- 5 Fix the upper die holder with the bolt.
- 6 Insert the punch in the upper turret disk.



NOTICE

- If the punch is inserted with the keyway of the punch guide misaligned with the key in the upper turret disk, the punch guide keyway may be damaged to lead to the galling of the tool.



Removing tools

- 1 Remove the punch from the upper turret disk.
- 2 Loosen the bolt fixing the upper die holder.
- 3 Remove the upper die holder from the lower turret disk.
- 4 Lightly tap the upper part of the die with the standard accessory brass bar. The die is loosened for easy removal.
- 5 Remove the die from the upper die holder.

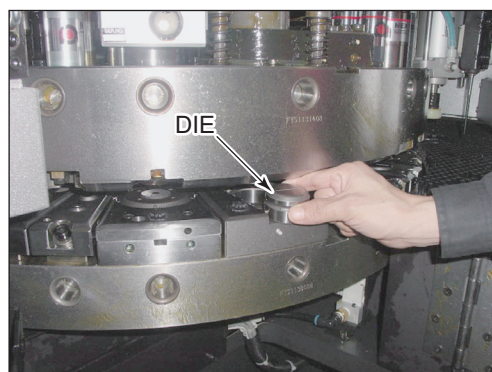
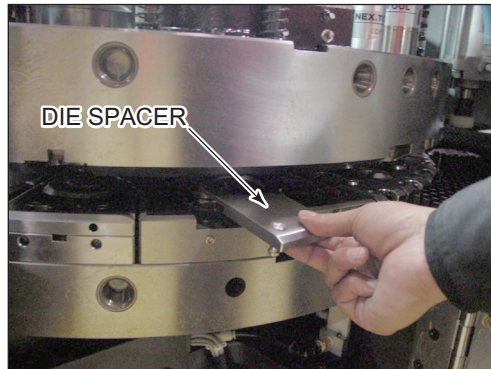
6-2-2. CHANGING TOOLS IN AUTO-INDEX STATIONS

NOTE

- Before installing punches and dies in the turret, lubricate them with machine oil. For the lubrication points, refer to Part 5, Maintenance.

Installing tools

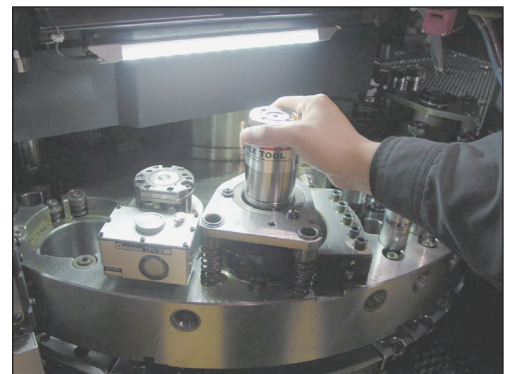
- 1 Loosen the bolt fixing the die spacer.
- 2 Remove the die spacer from the lower turret disk.
- 3 Insert the die in the die holder in the lower turret disk.



- 4 Insert the die remover through the bottom of the lower turret disk.
- 5 Insert the brass bar through the top of the upper turret disk.
- 6 Hold the die with the die remover and brass bar, and fix the die in the die holder.

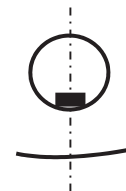


- 7 Install the die spacer, and fix it with the bolt.
- 8 Install the punch in the upper turret disk.



NOTICE

- If the punch is inserted with the keyway of the punch guide misaligned with the key in the upper turret disk, the punch guide keyway may be damaged to lead to the galling of the tool.



Auto-index station

Removing tools

- 1 Remove the punch from the upper turret disk.
- 2 Loosen the bolt fixing the die spacer.
- 3 Remove the die spacer from the lower turret disk.
- 4 Push up the die with the die remover.
- 5 Remove the die from the die holder.

6-2-3. CHANGING TOOLS IN 2", 3-1/2", AND 4-1/2" STANDARD STATIONS

NOTICE

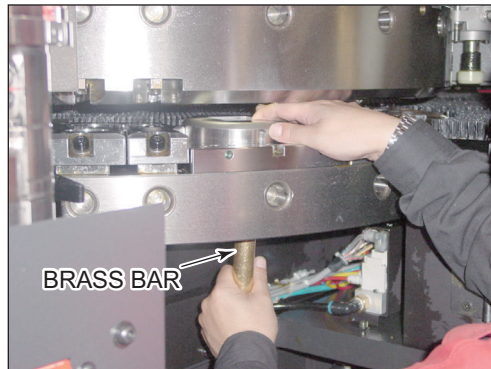
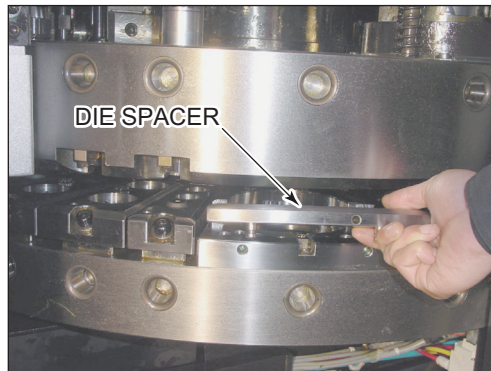
- When installing a shaped tool, align the punch shape with the hole shape of the die, and insert the punch in the upper turret disk. Carefully insert the punch by aligning the punch guide with the hole in the upper turret disk. If the punch is inserted with the punch guide misaligned with the turret hole, the punch guide may be damaged on the side to lead to the galling of the tool. (Especially, the 4-1/2" stations have the upper turret disk key installed at the rear when seen from front. Pay attention to its insert direction.)

NOTE

- Before installing punches and dies in the turret, lubricate them with machine oil. For the lubrication points, refer to Part 5, Maintenance.

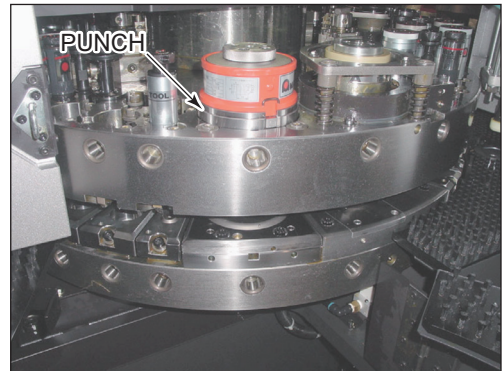
Installing tools

- 1 Remove the die spacer from the lower turret disk.
- 2 Insert the die in the die holder.
- 3 Insert the brass bar through the bottom of the lower turret disk, and fix the die to the die holder with the brass bar.
- 4 Install the die spacer in the lower turret disk.
- 5 Insert the punch in the upper turret disk.



NOTICE

- If the punch is inserted with the keyway of the punch guide misaligned with the key in the upper turret disk, the punch guide keyway may be damaged to lead to the galling of the tool.



Removing tools

- 1 Remove the punch from the upper turret disk.
- 2 Remove the die spacer from the lower turret disk.
- 3 Insert the brass bar into the station from below the lower turret disk.
- 4 Push up the die with the brass bar.
- 5 Remove the die from the clearance between the upper and lower turret disks.

6-3. Changing tools in Z type-turret

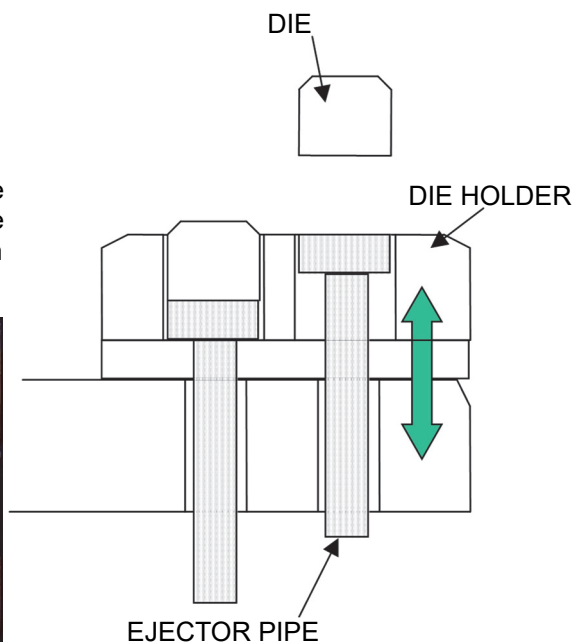
NOTICE

- When installing a shaped tool, align the punch shape with the hole shape of the die, and insert the punch in the upper turret disk. Carefully insert the punch by aligning the punch guide with the hole in the upper turret disk. If the punch is inserted with the punch guide misaligned with the turret hole, the punch guide may be damaged on the side to lead to the galling of the tool.

NOTE

- Before installing punches and dies in the turret, lubricate them with machine oil. For the lubrication points, refer to Part 5, Maintenance.

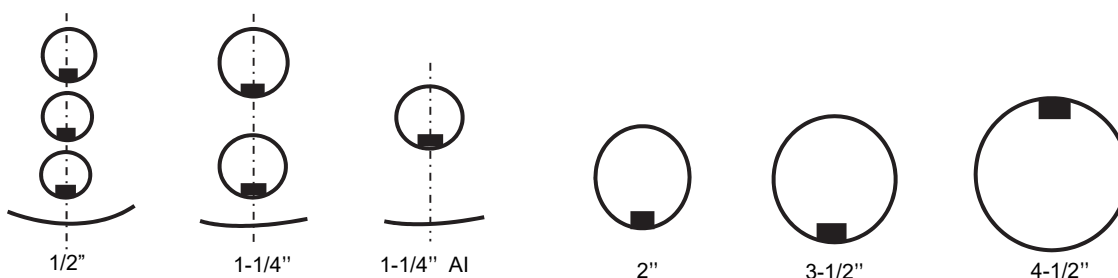
- 1 Lift up the ejector pipe.
- 2 Place the die on the ejector pipe.
- 3 Hold the die with the ejector pipe and one hand, and insert it in the die holder.



- 4 Set the punch.

NOTICE

- When installing a special-shaped tool, align the punch shape with the hole shape of the die, and insert the punch in the upper turret. Carefully insert the punch by aligning the punch guide with the hole in the upper turret. If the punch is installed with the punch guide misaligned with the turret hole, the punch guide may be damaged on the side to lead to the galling of the tool. (Especially, the 4-1/2" stations have the upper turret key installed at the rear when seen from front. Pay attention to its insert direction.)

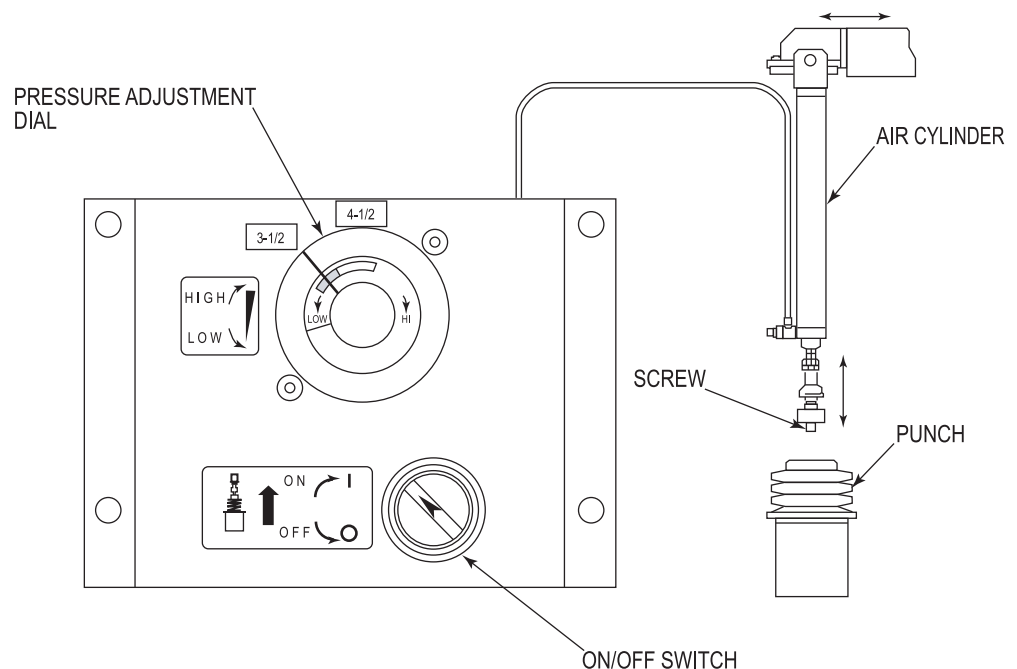


6-4. Changing punch with tool balancer

The tool balancer reduces the handling mass of a large-diameter (3-1/2" or larger) punch with the pull-up force of the air cylinder to facilitate the changing of the punch. While not forgetting to balance the punch, install it in the upper turret disk or remove it from the upper turret disk as described below.

 **CAUTION**

- When changing a punch with the tool balancer, you may have your fingers pinched between the punch and the upper turret disk or may have the punch galled against the upper turret disk. Observe the following cautions:
 - ① Position the upper turret disk so that the turret station in the upper turret disk is center aligned with the screw of the tool balancer. Misalignment tilts the punch and makes it impossible to insert or remove the punch.
 - ② Fully insert the punch into the turret station, loosen the screw of the tool balancer, and remove the tool balancer.
- When changing the tools, wear safety shoes to provide against an accidental drop of the tools that may result in a serious injury.



- 1 Turn the ON/OFF switch on the tool balancer control panel to OFF.
The tool balancer lowers.
 - 2 Lower the threaded portion of the tool balancer, and screw it into the head of the punch.
 - 3 Turn the pressure adjustment dial on the tool balancer control panel fully to LOW.
 - 4 Turn the ON/OFF switch to ON.
 - 5 Turn the pressure adjustment dial to HIGH to balance the punch.
 - 6 Align the punch shape with the hole shape of the die, and insert the punch in the upper turret disk. Carefully insert the punch while aligning the punch guide side keyway with the key in the upper turret disk.
- Or remove the punch from the upper turret disk.

NOTICE

- If the punch is inserted with the punch guide misaligned with the turret hole, the punch guide may be damaged on the side to lead to the galling of the tool. (Especially, the 4-1/2" stations have the upper turret disk key installed at the rear when seen from front. Pay attention to its insert direction.)
- 7 Turn the ON/OFF switch to OFF.
 - 8 Loosen the threaded portion of the tool balancer, and remove it from the head of the punch.
 - 9 After completing the tool change, turn the ON/OFF switch to ON.
The tool balancer rises.

6-5. Ending tool change

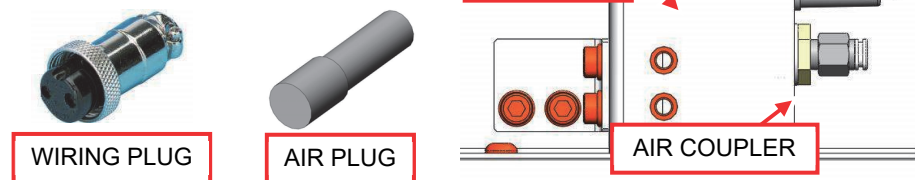
- 1 Close the upper and lower tool change doors.
- 2 Insert the removed key into the TOOL CHANGE keyswitch on the turret control panel, and turn the keyswitch to OFF.
- 3 Insert the removed key into the SAFETY DEVICE keyswitch on the NC control panel, and turn the keyswitch to OPERATION.
- 4 Press the SAFETY DEVICE RESET button on the NC control panel, and check that the button indicating the status of the protective device on [Device indicator] shows "Ready" and that the STOP button extinguishes.

7. POSITIONING WORKCLAMPS

Position the workclamps to suit the size of the worksheet to be processed and the program to be executed, as described below. (See the next page for the movable range of the workclamps and page 3-25 for fitting a workclamp with the junction panel.)

NOTICE

- Check that the junction panel that has no workclamp is secured to the carriage.
- Check that the accessory wiring plug and air plug are inserted in the Y-axis sensor connector and air coupler, respectively, of the junction panel that has no workclamp.



NOTE

- Check the number of workclamps set under [MAINTENANCE] -> [CNC MAINTENANCE] -> [Settings] -> [Number of Clamps]. Use that number of workclamps.
- Each workclamp has a proximity switch installed for checking whether or not its top lever is operated. When the automatic operation of the machine is started after loosening the top lever, the position of the workclamp is read.

1 Press the foot switch to open all workclamps.
An alarm occurs and pauses the machine.

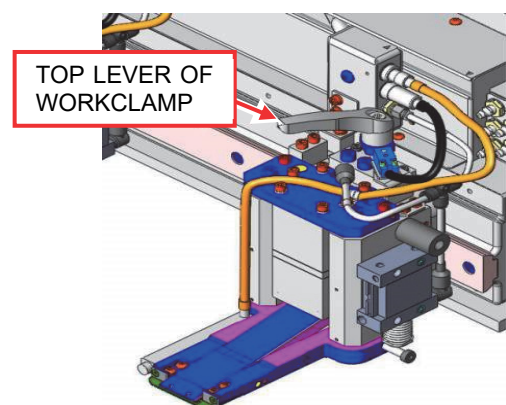
2 Loosen the top lever of each workclamp.

3 To check that the proximity switch of each workclamp has turned off, check that the light on its top surface extinguishes.

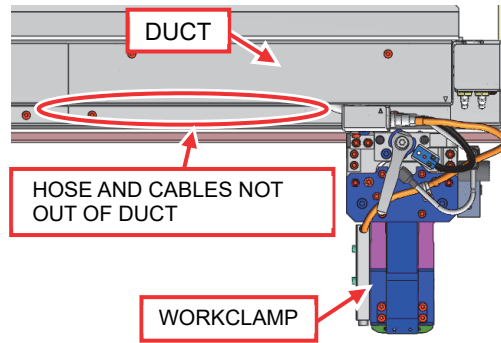
4 Move each workclamp to the desired position.

5 Tighten the top lever of each workclamp.

6 To check that the proximity switch of each workclamp has turned on, check that the light on its top surface illuminates.

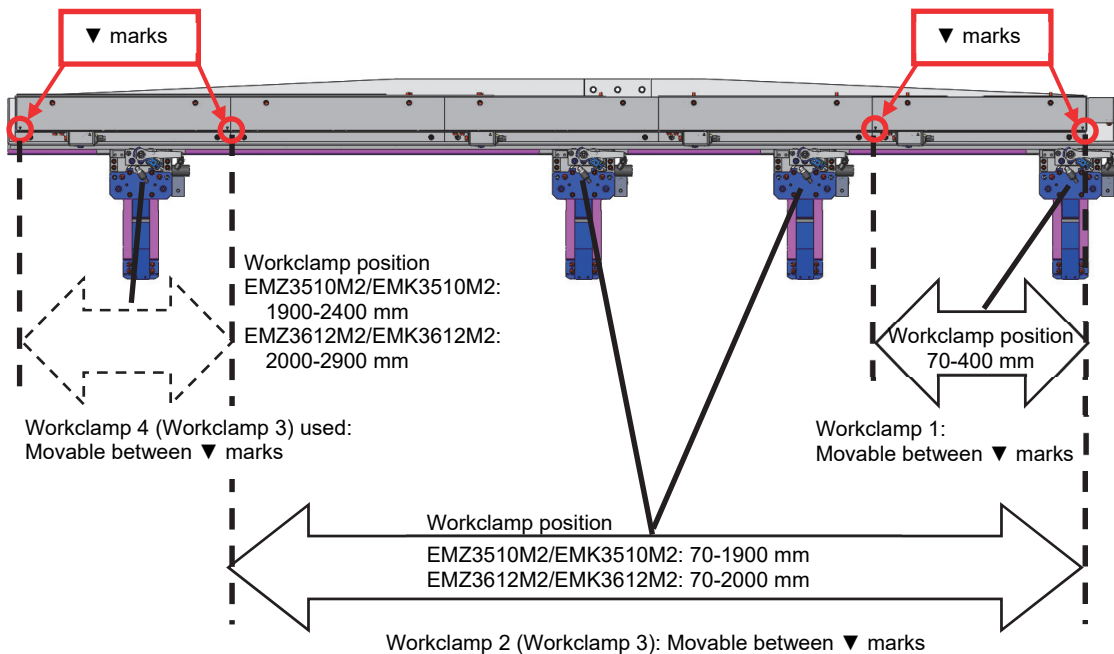


- 7 Check that the hose and cables between each junction panel and the duct do not stick out of the duct. If they do, push them back into the duct.



- 8 Check for safety around the machine, and press the SAFETY DEVICE RESET button on the NC control panel.

Movable range of workclamps



NOTICE

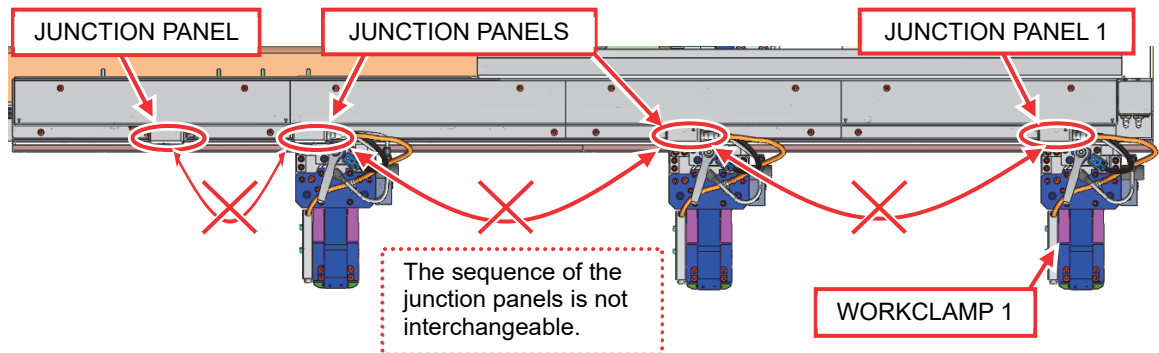
- If a workclamp is positioned outside its movable range, its hose and cables in the duct may be damaged.

Fitting workclamp with junction panel

To fit a workclamp with the junction panel, do as described below.

NOTICE

- If a junction panel is not fitted to a workclamp, secure it to the carriage.
- Be sure to fit the junction panel 1 to the workclamp 1.
- Do not change the sequence of the junction panels. The junction panels have their movable range determined as do the workclamps. If the junction panels are interchanged or positioned outside the movable range, the hoses and cables in the duct may be damaged.

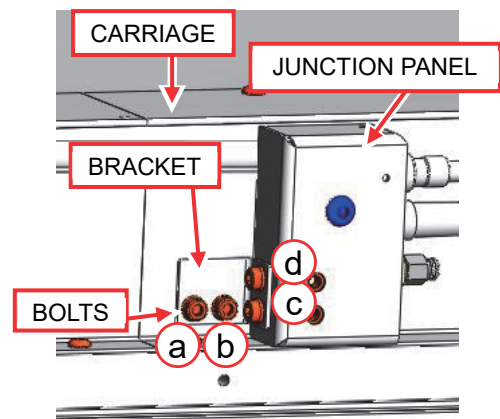


NOTE

- When preparing a workclamp for installation on the junction panel or when separating a junction panel from the workclamp and securing the junction panel to the carriage, do in the reverse order.

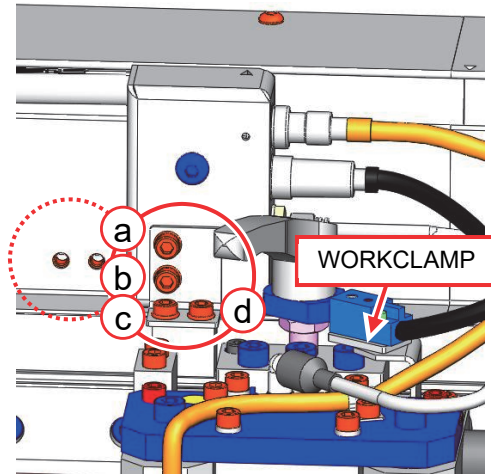
- 1 Press the foot switch to open all workclamps.
An alarm occurs and pauses the machine.

- 2 Remove the four bolts "a" to "d" of the bracket shown right, and separate the junction panel from the carriage.

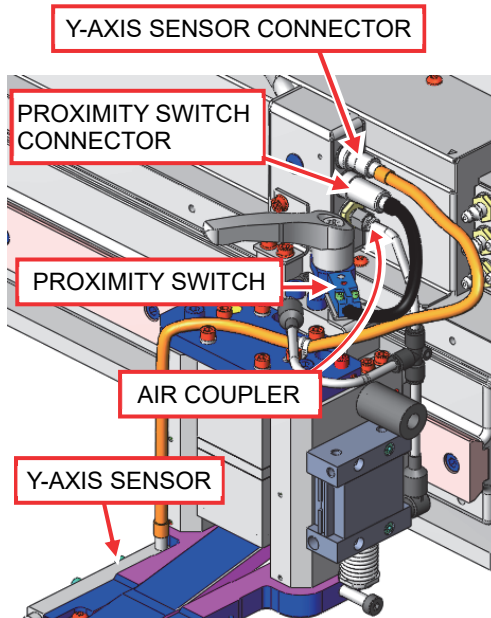


- 3 Move the junction panel to the desired position.
- 4 Loosen the top lever of a workclamp, and move the workclamp to the position of the junction panel.

- 5 Turn the bracket, and temporarily secure it to the front of the junction panel with the two bolts “a” and “b”.
- 6 Temporarily secure the bracket to the workclamp with the two bolts “c” and “d”.
- 7 Tighten the four bolts “a” to “d” to secure the junction panel to the workclamp.



- 8 Connect the hose of the workclamp to the air coupler of the junction panel.
- 9 Connect the proximity switch cable of the workclamp to the proximity switch connector of the junction panel.
- 10 Connect the Y-axis sensor cable of the workclamp to the Y-axis sensor connector of the junction panel.



8. LOADING WORKSHEET



CAUTION

- When clamping a worksheet, take care not to have the fingers pinched in the workclamps.
- When handling a worksheet, wear leather gloves or thick cotton gloves. If you do not wear such gloves, you may get injured at the edges, corners, or burrs of the worksheet.

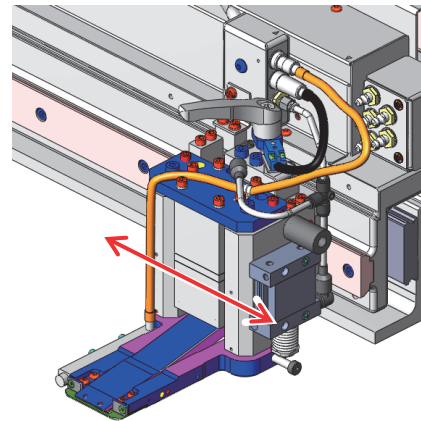
Load the worksheet on the table as described below.

- 1 Check that the workclamps are open.

If the workclamps are closed, press the foot switch to open them.

- 2 Check that the workclamps are positioned according to the worksheet size and the program.

- 3 Place the worksheet on the table.

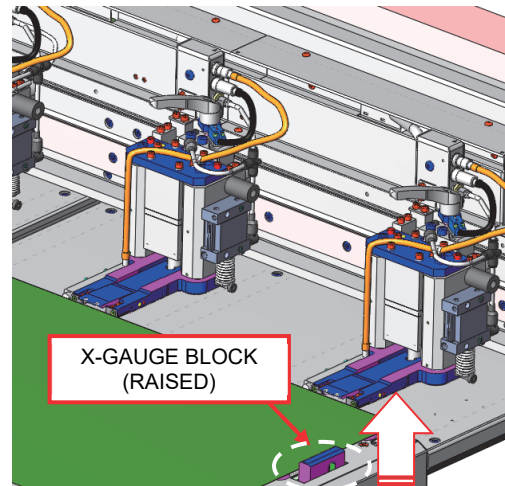


- 4 Illuminate the [UP] button under [PANEL] in Common Tools -> [SETUP] -> [Gauge Block] on the screen, or turn the X-GAUGE BLOCK switch on the carriage control panel to UP.

The X-gauge block rises.

- 5 Push the worksheet against the contact plate of each workclamp.

The worksheet is positioned in the Y-axis direction.



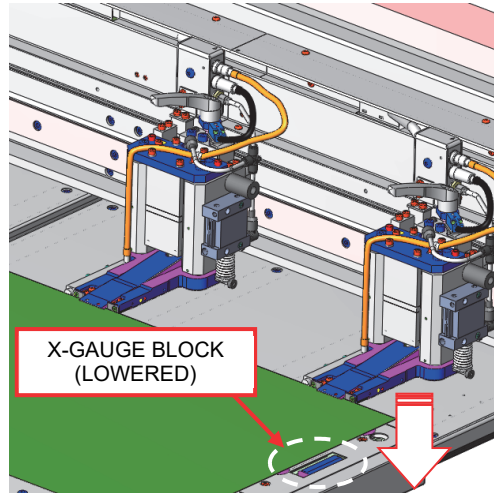
- 6 Push the worksheet against the X-gauge block.
The worksheet is positioned in the X-axis direction.

NOTICE

- Check that the worksheet is positively pushed against the X-gauge block and workclamps.

- 7 Press the foot switch.
The workclamps close and hold the worksheet.

- 8 Illuminate the [DOWN] button under [PANEL] in Common Tools -> [SETUP] -> [Gauge Block] on the screen, or turn the X-GAUGE BLOCK switch on the carriage control panel to DOWN.
The X-gauge block lowers.



9. AUTOMATIC OPERATION

	WARNING	● Before starting the machine, check that there are no workers and obstacles around the machine. Pay particular attention to the rear of the machine.
		● Never enter the travel areas of the machine and worksheet during operation.

	CAUTION	● Before pressing the START button, fully check for safety around the machine.

9-1. Starting automatic operation

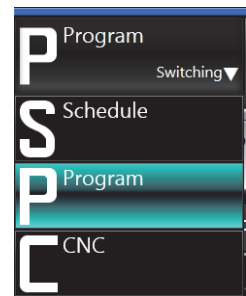
When the preparations for automatic operation are completed, the machine can be automatically operated as described below.

9-1-1. STARTING SINGLE-PROGRAM OPERATION

When the machine is ready for single-program operation, start its single-program operation as described below.

- 1 Check that the SAFETY DEVICE keyswitch on the NC control panel is turned to OPERATION and that the TOOL CHANGE keyswitch on the turret control panel is turned to OFF.

- 2 Select [Switching] -> [Program] in [Status Header area].
Touch the [LOAD] tab to open the LOAD display, and select the program to be executed.



- 3 Press the MEMORY button on the NC control panel to switch the NC mode to the MEMORY mode.
- 4 Set the press speed under [PANEL] in Common Tools -> [PUNCH] -> [Press Speed Settings].
- 5 Set the press top position under [PANEL] in Common Tools -> [PUNCH] -> [Press Top Dead Center]. Usually illuminate the [OFF] button to stop the press at the top stroke end.
- 6 Illuminate the [ON] button under [PANEL] in Common Tools -> [PUNCH] -> [Strip Miss].

- 7 Set the following controls as required on the screen.
- Axis speed (Device indicator)
 - Optional Stop buttons
([PANEL] in Common Tools -> [OPERATION])
 - Block Skip buttons
([PANEL] in Common Tools -> [OPERATION])
 - Single Block buttons
([PANEL] in Common Tools -> [OPERATION])
 - Multiple Settings buttons
([PANEL] in Common Tools -> [OPERATION])
 - Jamming Sensor buttons
([PANEL] in Common Tools -> [OPERATION])
 - Work Chute Sensor buttons
([PANEL] in Common Tools -> [OPERATION]) (OPTION)

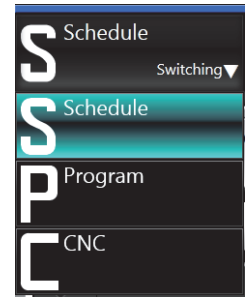
NOTE

- When starting the single-program operation of the machine with a multiple-part processing program, be sure to illuminate any one of the [FIRST], [REM], or [ALL] buttons at [Multiple Settings]. If all of the buttons are extinguished, an alarm will occur during the single-program operation.
 - When the program is using macros by U- and V-codes and not for multiple-part processing, extinguish all of the three buttons at [Multiple Settings]. If any one of the buttons is illuminated, the program will not be properly executed.
- 8 Turn the PRESS SELECT keyswitch on the NC control panel to CYCLE.
- 9 Check for safety around the machine.
- 10 Press the START button on the NC control panel.
- The light of the START button comes on, and the machine starts its single-program operation according to the program displayed on the PROCESS MONITOR display.

9-1-2. STARTING SCHEDULE OPERATION

When the machine is ready for schedule operation, start its schedule operation as described below.

- 1 Check that the SAFETY DEVICE keyswitch on the NC control panel is turned to OPERATION.
- 2 Check that the TOOL CHANGE keyswitch on the turret control panel is turned to OFF.
- 3 Select [Switching] -> [Schedule] in [Status Header area] to switch the operating mode to Schedule.



- 4 The schedule of the programs to be executed is listed on the SCHEDULE display.
- 5 Press the MEMORY button on the NC control panel to switch the NC mode to the MEMORY mode.
- 6 Set the press speed under [PANEL] in Common Tools -> [PUNCH] -> [Press Speed Settings].
- 7 Set the press top position under [PANEL] in Common Tools -> [PUNCH] -> [Press Top Dead Center]. Usually illuminate the [OFF] button to stop the press at the top stroke end.
- 8 Illuminate the [ON] button under [PANEL] in Common Tools -> [PUNCH] -> [Strip Miss].
- 9 Set the following controls as required on the screen.
 - Axis speed (Device indicator)
 - Optional Stop buttons ([PANEL] in Common Tools -> [OPERATION])
 - Block Skip buttons ([PANEL] in Common Tools -> [OPERATION])
 - Single Block buttons ([PANEL] in Common Tools -> [OPERATION])
 - Multiple Settings buttons ([PANEL] in Common Tools -> [OPERATION])
 - Jamming Sensor buttons ([PANEL] in Common Tools -> [OPERATION])
 - Work Chute Sensor buttons ([PANEL] in Common Tools -> [OPERATION]) (OPTION)

NOTE

- When starting the schedule operation of the machine with a multiple-part processing program, be sure to illuminate any one of the [FIRST], [REM], or [ALL] buttons at [Multiple Settings]. If all of the buttons are extinguished, an alarm will occur during the schedule operation.
- When the program is using macros by U- and V-codes and not for multiple-part processing, extinguish all of the three buttons at [Multiple Settings]. If any one of the buttons is illuminated, the program will not be properly executed.

- 10 Turn the PRESS SELECT keyswitch on the NC control panel to CYCLE.
- 11 Check for safety around the machine.
- 12 Press the START button on the NC control panel.

The light of the START button comes on, and the machine starts its schedule operation according to the programs listed on the PROCESS MONITOR display.

NOTE

- Touching the [PROCESS MONITOR] tab to show the PROCESS MONITOR display during the schedule operation allows the current program to be displayed.



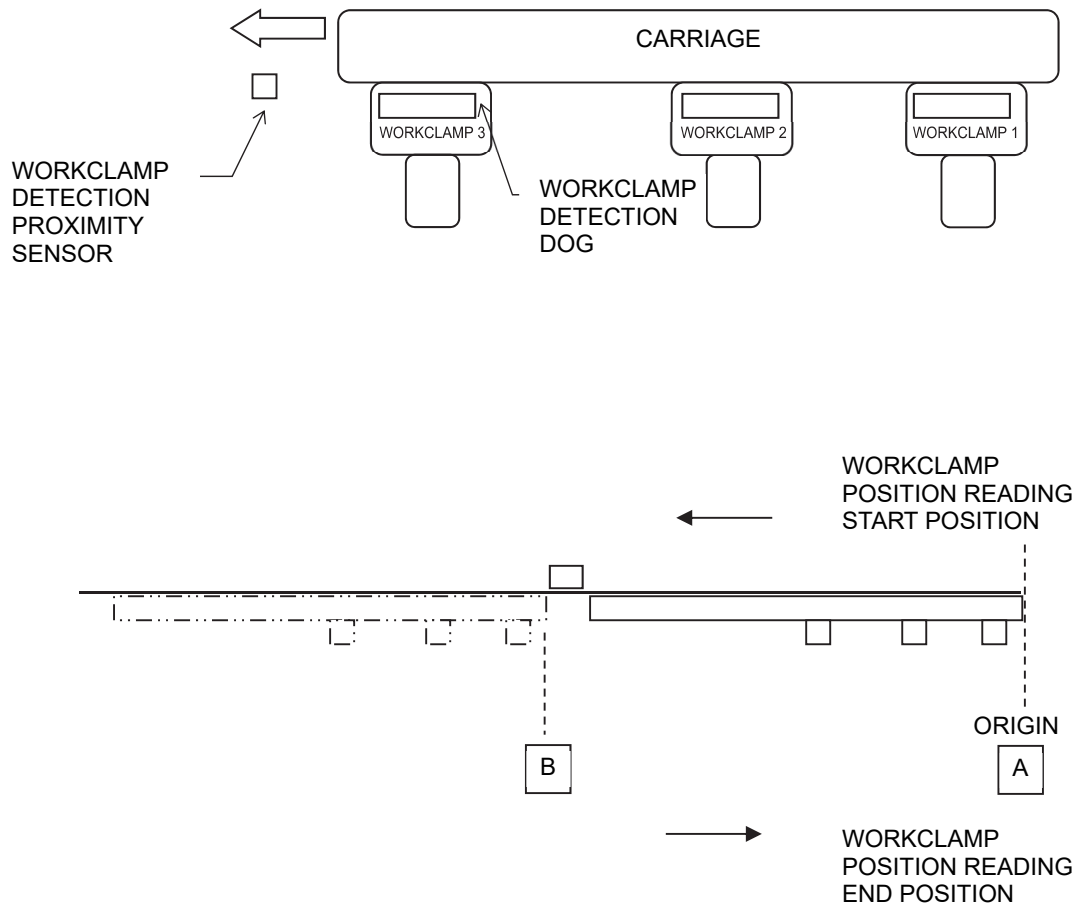
Reading workclamp position

The workclamp position is read at the start of the first program immediately after the machine is powered on. It is not read again until:

- Operation of the workclamp clamp levers
- Emergency stop of the machine
- Manual release of the workclamps (when the optional clamp positioner is used)
- Positioning of the workclamps 50 times by the G05 command (when the optional clamp positioner is used)

Execution of any of the above operations calls for detection of the workclamp position. In this case, the workclamp position is read at the start of the next program.

Reading of the workclamp position starts at the origin A as shown below. The carriage reads the workclamp position as it moves to the stroke end B. The carriage returns to the origin, and the machine starts the punching operation.



10. MANUAL OPERATION



WARNING

- Before manually operating each axis, check that there are no workers around the machine to prevent them from being struck by the movable parts of the machine.

The machine can be operated with the switches on the NC control panel and turret control panel. This mode of operation is used to adjust the machine and check the machine for operation.

- 1 Press and illuminate the MANUAL button on the NC control panel.



- 2 Operate the following controls for the manual operation of the machine.

Control panel	Control	Machine operation	For details, refer to Part 2, Controls.
NC control panel	+ and – buttons	Axis travel	
Turret control panel	INDEX PIN switch	Turret index pin insertion and withdrawal	
	TURRET JOG buttons	Turret rotation	
—	Foot switch	Workclamp open/close	

NOTE

- When using the + and – buttons to move an axis, the axis selected on the MAN. window moves.

11. CHECKING PROGRAM

Program check is the function of checking the program called to the PROCESS MONITOR display to see if it is correctly created concerning:

- Syntax
- Overtravel

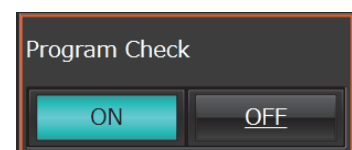
During the program check, the machine does not operate, but since the program is executed in the NC unit, the coordinates of the X-, Y-, T- and C-axes can be checked according to the values displayed on the screen.

The coordinates can be checked on the PROCESS MONITOR display or by the current axes coordinates shown under [MONITOR] in Common Tools -> [CURRENT VALUE]. To check the coordinates on a program block basis, illuminate the [ON] button under [PANEL] in Common Tools -> [OPERATION] -> [Single Block]. The optional stop function and block skip function are also enabled as in normal automatic operation by illuminating the [ON] buttons under [PANEL] in Common Tools -> [OPERATION] -> [Optional Stop] and [Block Skip].

Perform the program check as described below.

- 1 Press and illuminate the RETRACT button on the NC control panel to open the RET. window and check that the check mark is placed on the [ALL AXES] button (or the zero-return is completed).
- 2 Press and illuminate the MEMORY button on the NC control panel.
- 3 Select [Switching] -> [Program] in [Status Header area] to switch the operating mode to Program.
- 4 Touch the [LOAD] tab, and call the program you want to check from the LOAD display to PROCESS MONITOR display.

- 5 Illuminate the [ON] button under [PANEL] in Common Tools -> [OPERATION] -> [Program Check].



At this time, the Alarm window opens to show the warning "COM 2051 PROGRAM CHECK MODE".

Press the [CLOSE] button to close the Alarm window.

- 6 Illuminate the [ON] button at [Single Block] to enable the single block function, as required.
- 7 Press the START button on the NC control panel to start checking the program.

If there is an error, an alarm message appears on the Alarm window. If there are no errors, the program is read to the end to complete the program check.

11-1. Clearing program errors

When a program error is found during the program check, an alarm message is shown on the Alarm window. The description, cause, and remedy of the alarm are displayed. Examine the cause.

Press the NC RESET button to clear the alarm, and correct the program. Recheck the program.

NOTE

- After the program check is complete, illuminate the [OFF] button under [PANEL] in Common Tools -> [OPERATION] -> [Program Check]. The absolute coordinates are preset based on the machine coordinates.

12. OPERATION INTERRUPTION



WARNING

- Before starting the machine (or resuming its automatic operation or zero-returning it), check that there are no workers and obstacles around the machine. Pay particular attention to the rear of the machine.

When any trouble or error occurs during its automatic operation, the machine stops. The machine also stops when a program stop command is executed or when the one of the STOP button(s) or EMERGENCY STOP buttons is pressed.

When the machine stops, the description, cause, and remedy of the stop condition are shown on the Alarm window.

12-1. Stop condition

When the machine stops temporarily, the program can be resumed from the stop position by removing the cause of the stop condition.

12-1-1. STOP BUTTON IS PRESSED

When a STOP button is pressed during its automatic operation, each axis of the machine decelerates and stops.

The STOP button on the NC control panel illuminates, and an alarm message appears on the Alarm window.

Resuming operation

If the machine is in such a condition that it can resume its automatic operation, press again the STOP button to extinguish it, and press the START button.

When the STOP button on the auxiliary control stand (option) is pressed to stop the machine, the automatic operation of the machine cannot be resumed unless the pressed STOP button is turned clockwise (arrow direction) to unlock the button.

If the machine cannot resume its automatic operation, press the NC RESET button to interrupt the operation, and restart the procedure from zero-return.

12-1-2. PROGRAM STOP (M00) OR OPTIONAL STOP (M01) IS COMMANDED

When a stop command in the program is executed, the machine stops, and the STOP button on the NC control panel flashes.

Resuming operation

Press the START button to resume the automatic operation of the machine.

12-1-3. SINGLE BLOCK FUNCTION IS ENABLED

When the [ON] button under [PANEL] in Common Tools -> [OPERATION] -> [Single Block] is illuminated, completing each program block stops the machine and causes the STOP button on the NC control panel to flash.

Resuming operation

Press the START button to resume the automatic operation of the machine.

12-1-4. OVERRIDE DETECTION IS ENABLED

The override detection function detects the position of each workclamp. When the workclamp enters the dead zone region, the override detection function decelerates each axis or stops the machine to prevent the workclamp from being punched.

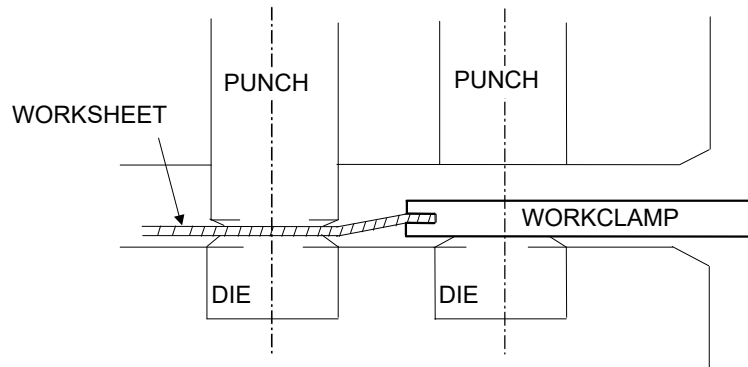
According to the setting under [PANEL] in Common Tools -> [PUNCH] -> [Punching Override], entry of a workclamp into its override region shows "PUN 2040 OVERRIDE" or "PUN 2044 DEAD ZONE" on the Alarm window and stops the machine.

Definitions of dangerous regions

[1] Distortion region

Region where a workclamp rides on an adjacent die or free-motion bearing and the worksheet may be distorted when punched in this condition.

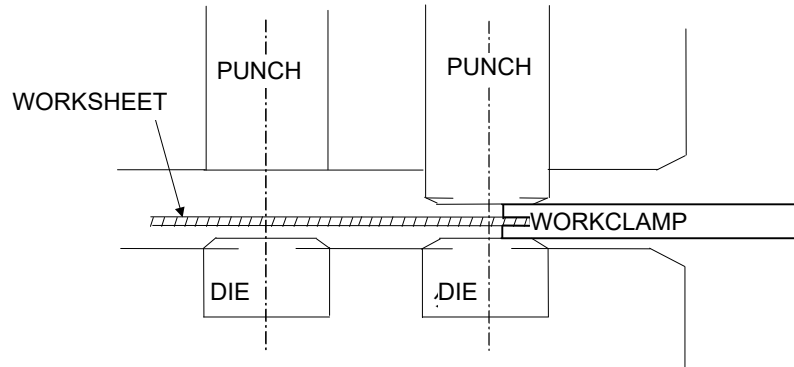
When the [ON] button is illuminated under [PANEL] in Common Tools -> [PUNCH] -> [Punching Override], "PUN 2040 OVERRIDE" appears on the Alarm window and the machine stops.



[2] Dead zone region

Region where a workclamp enters a punching position and is punched itself when the worksheet is punched in this condition.

“PUN 2044 DEAD ZONE” appears on the Alarm window and the machine stops, irrespective of whether the [ON] or [OFF] button is illuminated under [PANEL] in Common Tools -> [PUNCH] -> [Punching Override].



[3] Override region

Distortion region [1] + Dead zone region [2]

[4] External deceleration region

Region where the X- and Y-axes decelerate at a given speed and the punch hits the worksheet, in order to avoid collision between the tools and workclamps.

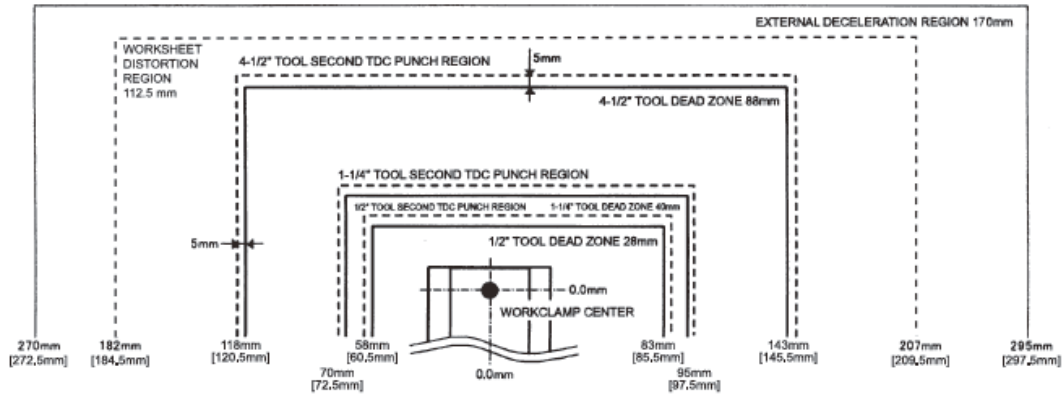
[5] Second TDC region

Region where the punch hits the worksheet from the second top dead center (or from 6 mm below the normal top dead center), in order to avoid collision between the tools and workclamps.

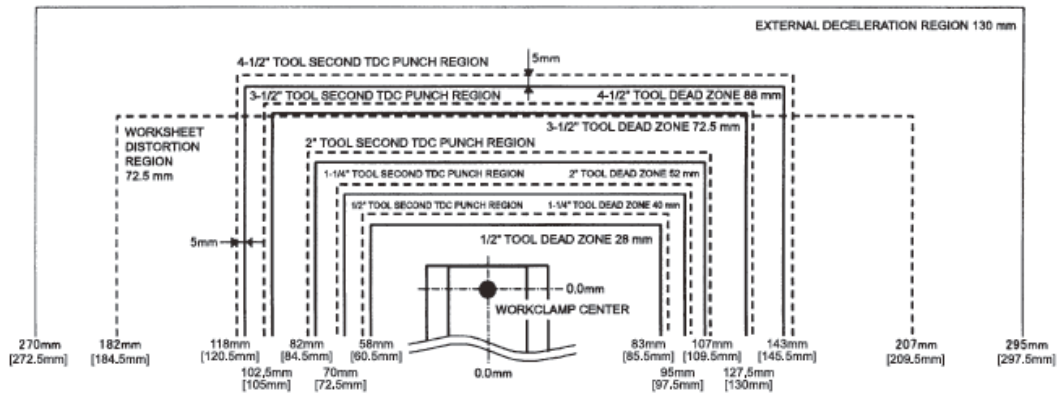
REGION DIAGRAMS

Values enclosed in brackets are applied when optional clamp positioner is used.

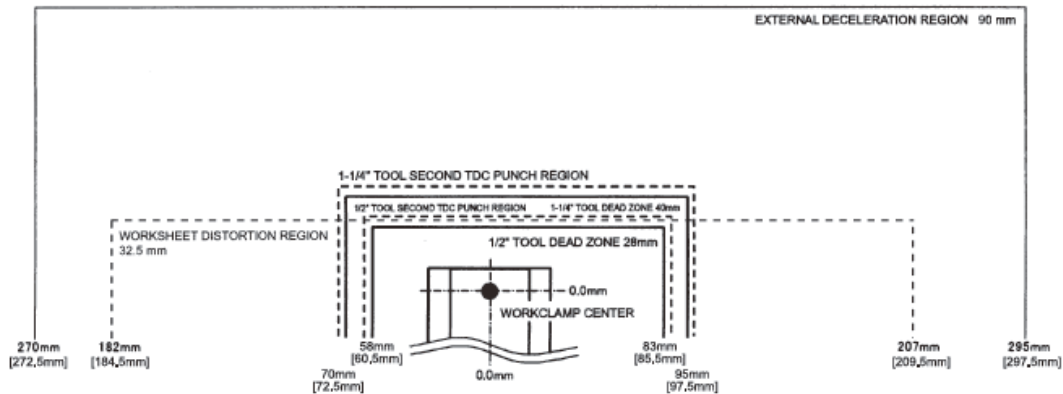
INNER



CENTER



OUTER



Resuming operation

When the workclamps enter the external deceleration region and second TDC region, each axis decelerates, the punch rises, and other procedures are performed as specified for the machine to resume the operation.

When "PUN 2040 OVERRIDE" is shown on the Alarm window, check that the worksheet is not likely to distort, and press the START button on the NC control panel or auxiliary control stand (option) to resume the operation.

If the worksheet is likely to distort, press first the STOP button and then the NC RESET button to interrupt the operation. Change the position of the workclamps or correct the program, and restart the procedure from zero-return.

When "PUN 2044 DEAD ZONE" is shown on the Alarm window, press first the STOP button and then the NC RESET button to interrupt the operation. Change the position of the workclamps or correct the program, and restart the procedure from zero-return.

If punching can be performed even when a workclamp enters the punch guide ID as is the case with nesting tools, illuminate the [ON] button under [PANEL] in Common Tools -> [PUNCH] -> [Dead Zone Punch] and then press the START button to resume the operation.

NOTICE

- Pressing the START button with the [ON] button at [Dead Zone Punch] illuminated punches the worksheet even in the position where the punch may punch a workclamp. Unless it is confirmed that the workclamp will not be punched, never punch the worksheet in that position.

12-1-5. REPOSITIONING CONFIRMATION FUNCTION IS ENABLED

When the [ON] button is illuminated under [PANEL] in Common Tools -> [PUNCH] -> [Punching Override], the override detection function is enabled. When repositioning is then commanded near a workholder, the machine stops. An alarm message appears on the Alarm window.

Resuming operation

When it is confirmed that repositioning does not bring the workclamps into contact with the workholders, press the START button. The workclamps are repositioned.

When a workclamp is likely to contact a workholder, press the NC RESET button to interrupt the operation. Change the position of the workclamp or correct the program, and restart the procedure from zero-return.

12-1-6. STRIPPING FAILURE IS DETECTED

When a stripping failure is detected during its automatic operation, the machine stops. An alarm message appears on the Alarm window.

Resuming operation

 CAUTION	● When handling a worksheet, wear leather gloves or thick cotton gloves. If you do not wear such gloves, you may get injured at the edges, corners, or burrs of the worksheet. ● When leaning into the turret during resuming operation, wear the safety hat for head protection.
--	---

Check that the punch is not jammed and that the worksheet is not displaced from the workclamps. When it is confirmed that the punch is fully raised and that the worksheet is not displaced from the workclamps, press the START button to resume the operation.

When there is a punch or worksheet problem, press the NC RESET button to interrupt the operation, and restart the procedure from zero-return.

12-1-7. X-GAUGE BLOCK IS RAISED

When the [UP] button is illuminated under [PANEL] in Common Tools -> [SETUP] -> [Gauge Block] on the screen or the X-GAUGE BLOCK switch on the carriage control panel is turned to UP during its automatic operation, the X-gauge block rises and the machine stops. An alarm message appears on the Alarm window.

Resuming operation

Illuminate the [DOWN] button at [Gauge Block] on the [PANEL] tab in Common Tools on the screen or turn the X-GAUGE BLOCK switch on the carriage control panel to DOWN to lower the X-gauge block, and press the START button to resume the operation.

12-1-8. TOOL CHANGE DOOR IS OPENED

When either tool change door is opened during its automatic operation, the machine stops. An alarm message appears on the Alarm window.

Resuming operation

Close the tool change door, and press the START button to resume the operation.

12-1-9. WORKCLAMPS ARE OPENED

Usually, the workclamps do not open even when the foot switch is pressed during the automatic operation of the machine. When the foot switch is pressed with the machine stopped for another reason, the workclamps open. An alarm message appears on the Alarm window.

Resuming operation

Press the foot switch to close the workclamps, and press the START button to resume the operation.

When the worksheet is held with the workclamps, it temporarily comes off the workclamps. Check that the worksheet is positioned at the origin of the X-axis before resuming the operation.

12-1-10. TOOL CHANGE KEYSWITCH IS TURNED TO ON

When the TOOL CHANGE keyswitch on the turret control panel is turned to ON during the automatic operation of the machine, the X- and Y-axes are locked. An alarm message appears on the Alarm window.

Resuming operation

Turn the TOOL CHANGE keyswitch on the turret control panel to OFF, and press the START button to resume the operation.

12-1-11. SAFETY DEVICE KEYSWITCH IS TURNED TO SETTING

When the SAFETY DEVICE keyswitch on the NC control panel is turned to SETTING during the automatic operation of the machine, all axes are locked. An alarm message appears on the Alarm window.

Resuming operation

Turn the SAFETY DEVICE keyswitch on the NC control panel to OPERATION, and press the START button to resume the operation.

12-1-12. PROTECTIVE DEVICE IS ACTUATED

When the interlock device of the machine detects an abnormal condition and actuates, the machine enters the safety stop condition and the automatic operation is stopped. An alarm message appears on the Alarm window and the SAFETY DEVICE RESET button flashes.

Resuming operation

Return the interlock device to the original condition, and press the SAFETY DEVICE RESET button to make the interlock device ready.

12-2. Emergency stop condition

When the machine stops in an emergency, the program cannot be resumed. Remove the cause of the emergency stop, zero-return the machine, and restart the automatic operation of the machine with the program.

12-2-1. EMERGENCY STOP BUTTON IS PRESSED

As soon as one of the EMERGENCY STOP buttons is pressed during its automatic operation, the machine comes to a total stop. An alarm message appears on the Alarm window.

NOTE

- After the EMERGENCY STOP button is pressed, the table may move a maximum of 190 mm {7.48 in.} before it stops.

Resetting

Remove the cause of the emergency stop condition, and turn the pressed EMERGENCY STOP button clockwise to unlock it. Press the NC RESET button to close the Alarm window. Restart the procedure from zero-return.

12-2-2. AIR PRESSURE DROPS BELOW SPECIFIED LIMIT

When the air pressure drops below the specified limit during its automatic operation, "COM 2018 AIR PRESSURE" is shown on the Alarm window, and the machine comes to a total stop.

Resetting

Return the air pressure to normal, and press the SAFETY DEVICE RESET button to close the Alarm window. Restart the procedure from zero-return.

12-2-3. X-AXIS OR Y-AXIS OVERTRAVEL ALARM OCCURS

When the X- or Y-axis overtravels, "COM 54 AXIS EMERGENCY STOP" is shown on the Alarm window, and the machine comes to a total stop.

Resetting

- 1 Press and illuminate the MANUAL button on the NC control panel.
- 2 On the MAN. window, select the axis that has overtraveled.
- 3 While pressing the [OT Release] button on the MAN. window, press the FEED button in the direction opposite to the overtravel direction to return the axis to the normal stroke length.
- 4 Release the buttons when the axis returns to the normal stroke length.
- 5 Restart the procedure from zero-return.

12-2-4. RESET

When the NC RESET button is pressed during its automatic operation, the operation is stopped, and the modal data of the NC unit is all cleared.

NOTE

- When the NC RESET button is pressed during its automatic operation, the modal data of the NC unit is cleared to disallow the current operation to be continued. When you have made the reset, zero-return the machine, and perform another automatic operation.

12-2-5. ZERO-RETURNING AFTER TEMPORARY STOP OF PROCESSING

To stop the machine during processing and to zero-return each axis, do as described below.

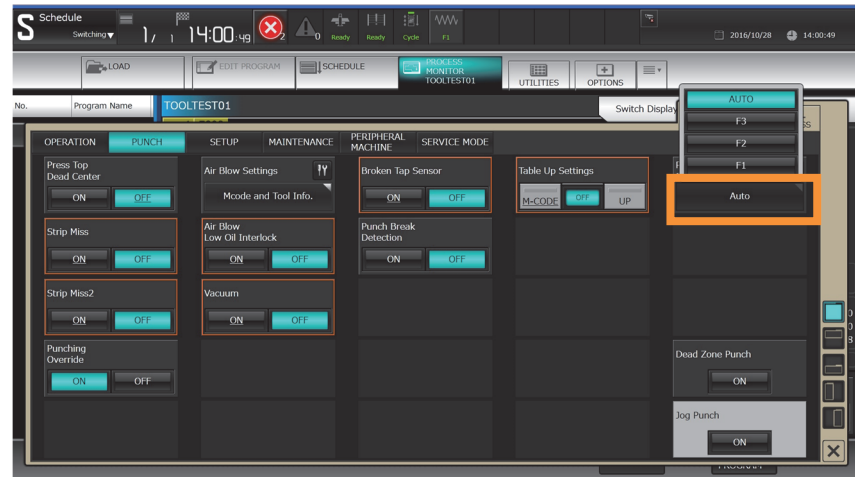
- 1 Press the STOP button on the NC control panel or auxiliary control stand (option).
Each axis of the machine decelerates and stops.
- 2 Press again or turn clockwise the pressed STOP button to clear the stop condition.
- 3 Press the NC RESET button on the NC control panel.
- 4 Press the RETRACT button on the NC control panel to switch the NC mode to RETRACT.
- 5 Zero-return all axes.

12-3. Clearing other stop conditions

When the machine has stopped for another reason, the description, cause, and remedy of the stop condition are shown on the Alarm window. Clear the stop condition as instructed by the message.

13. SETTING PRESS OPERATING METHOD

During the automatic operation of the machine, the press operating method can be set by changing the setting at [Press Speed Settings] as described below. Show the setting under [PANEL] in Common Tools -> [PUNCH] -> [Press Speed Settings].



Manually selecting press speed

Press the button at [Press Speed Settings] to open the pulldown menu, and select one of the press speeds [F1] to [F3] and [Auto]. The press speed (punching speed) automatically set in the NC unit is changed to the selected speed.

F1 is the highest speed for assuring high productivity, and F3 is the lowest speed for alleviating punching noise.

This speed selection is effective for punching pattern commands (M500 and M501), but not for other press pattern commands (forming, marking, knockout, slitting, and nibbling).

Automatically setting press speed

When [Auto] is selected at [Press Speed Settings], the press speed (punching speed) is automatically set to suit the worksheet material and thickness and the tool size.

When selecting [Auto], the time zone selection on the Auto Timer window opened by pressing the option button at the upper right and the use of M681 to M683 (punching speed command) in the program affect the punching speed as shown in the table below.

- M681: Punching speed 1 (high)
- M682: Punching speed 2 (medium)
- M683: Punching speed 3 (low)

Case	Auto Timer setting	Punching speed command (M681 to M683)	Time zone		
			Day	Night	Midnight
1	Enable	No	High speed (Auto)	Medium speed (Auto)	Low speed (Auto)
2		Yes	Speed commanded by M-code		Lowest speed (F3)
3	Disable	No	High speed (Auto)		
4		Yes	Speed commanded by M-code		

Case 1: Auto Timer set to Enable and M681 to M683 “No”

In this case, the NC unit automatically sets the punching speed to suit the worksheet material and thickness and the tool size.

The punching speed automatically changes among high, medium, and low speeds according to the time zones preset on the Auto Timer window.

For the method of setting the time zones, refer to “5. Auto timer” in Part 4, Press Axis Control Parameters.

Case 2: Auto Timer set to Enable and M681 to M683 “Yes”

In this case, the punching speed automatically changes with the time zone. It becomes the speed commanded by an M-code during the day and night, and becomes the lowest (F3) during the midnight.

For the method of setting the time zones, refer to “5. Auto timer” in Part 4, Press Axis Control Parameters.

Case 3: Auto Timer set to Disable and M681 to M683 “No”

In this case, the punching speed does not change with the time zone. It is automatically set to suit the worksheet material and thickness and the tool size.

Case 4: Auto Timer set to Disable and M681 to M683 “Yes”

In this case, the punching speed does not change with the time zone. It is as commanded by an M-code.

14. TURNING OFF POWER (SHUTTING DOWN SYSTEM)

NOTICE

- When turning off the power of the NC unit, follow the specified procedure. If the specified procedure is not followed, the NC unit may fail.
- After the POWER ON/OFF button on the NC control panel is extinguished, turn the machine circuit breaker switch on the electrical enclosure to OFF. If the machine circuit breaker switch is turned to OFF with the POWER ON/OFF button illuminated, a fault may occur in the hard disk system.

End the operation of the machine as described below.

- 1 Press the POWER ON/OFF button on the NC control panel.
For 10 seconds, the POWER ON/OFF button illuminates and a buzzer sounds. After 10 seconds, the POWER ON/OFF button flashes, and the NC unit and machine are powered off after power-off processing. Then the machine circuit breaker switch automatically changes to TRIP.

NOTE

- The power-off processing can be canceled by pressing again the POWER ON/OFF button within the above-mentioned 10 seconds.
- 2 Turn off the power of the air compressor.
 - 3 Turn off the shop circuit breaker switch.

Part 4

Press Axis Control Parameters

Common to EM MII series

1. Description	4-2
1-1. Press pattern parameters.....	4-3
1-2. Tools	4-4
2. Press pattern parameters	4-5
2-1. Punching and nibbling patterns.....	4-5
2-2. Knockout patterns	4-8
2-3. Marking patterns	4-12
2-4. Slitting patterns	4-15
2-5. Forming patterns	4-18
2-6. MPT tapping patterns.....	4-24
2-7. Parameter value setting ranges	4-26
3. Setting press pattern parameters	4-27
4. Trial punching with press pattern	4-29
4-1. Trial punching using Try Forming in utilities	4-29
4-2. Trial punching according to program.....	4-31
5. Auto timer	4-32
5-1. Setting auto timer	4-33
6. Tap setting.....	4-34
7. Air blow setting.....	4-34
8. Bottom position correction by material type and thickness.....	4-35
8-1. Registering bottom position correction values by material type and thickness.....	4-36
8-2. Recommended operating methods (reference)	4-39
8-3. Operation of press pattern parameters	4-40

1. DESCRIPTION

There are the following parameters to control the press axis.

Press pattern parameters

M-codes can be edited under [PRESS] in Common Tools -> [PRESS M-CODE].

Up to 278 press patterns can be registered and can be selected to suit specific punching hits. They are assigned M-codes. Parameters of press patterns, such as the press stroke length and speed, can be set for specific M-codes.

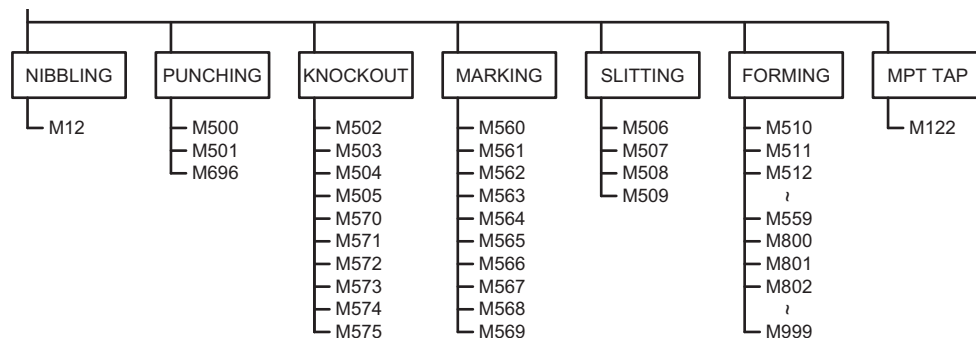
To punch a worksheet with desired press patterns, combine corresponding M-codes into a program, and execute the program.

Bottom position correction by material type and thickness

The bottom position can be corrected by material type and thickness.

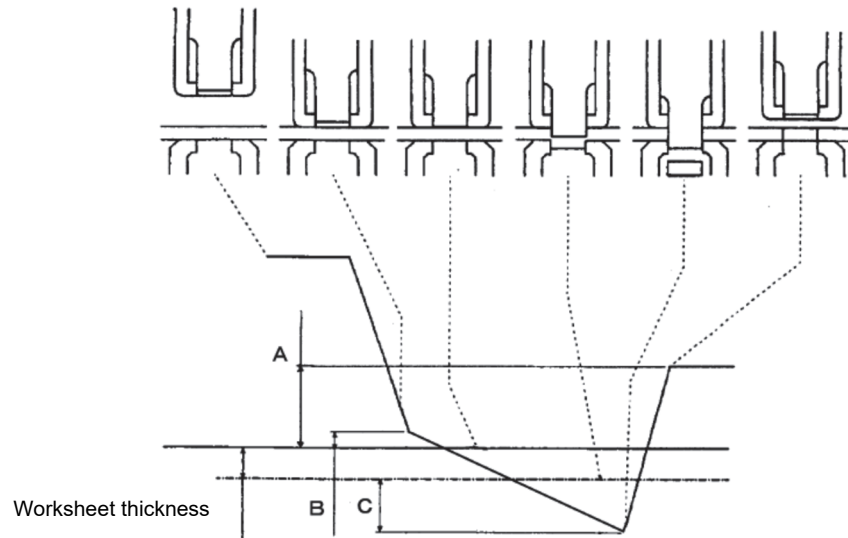
Press [PRESS] in Common Tools -> [PRESS M-CODE] -> [BOTTOM OFFSET MATERIAL] to enter bottom position correction values by material type and thickness for each M-code. This correction function can be used in the knockout, marking, and forming patterns.

Menu of press control-related parameters



1-1. Press pattern parameters

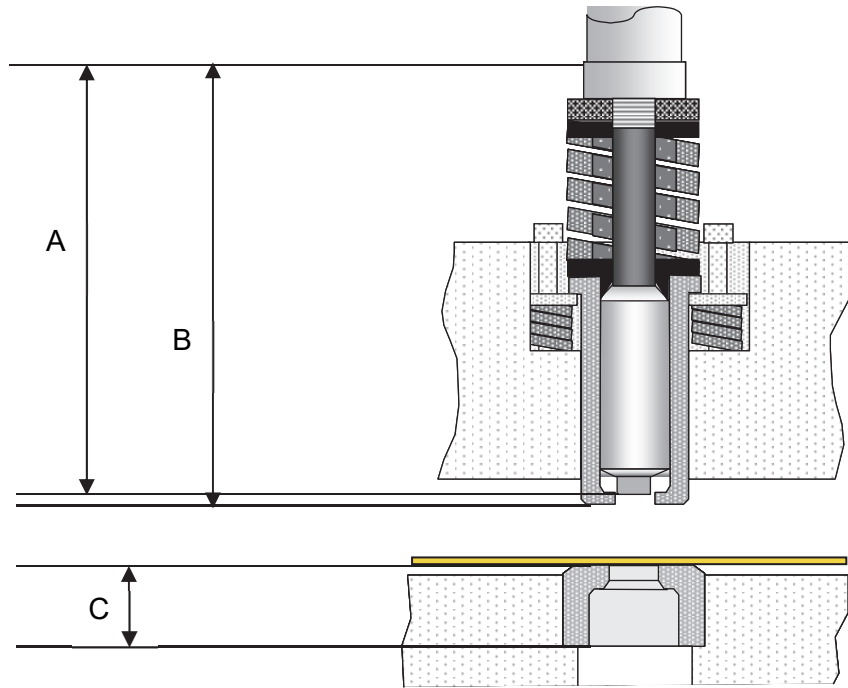
All press patterns operate as shown below.



- | | |
|----------------------|--|
| A: Waiting position: | Position to which the punch rises after each hit during continuous punching |
| B: Slow position: | Position where the punch slows down to punch the worksheet
*Some press patterns do not have this slow position. |
| C: Bottom position: | Position to which the punch lowers after punching through the worksheet |

1-2. Tools

The tool dimensions A to C are defined as shown below.



A: Punch length...Length from punch head to tip

B: Assy length...Length from punch head to tip of punch guide

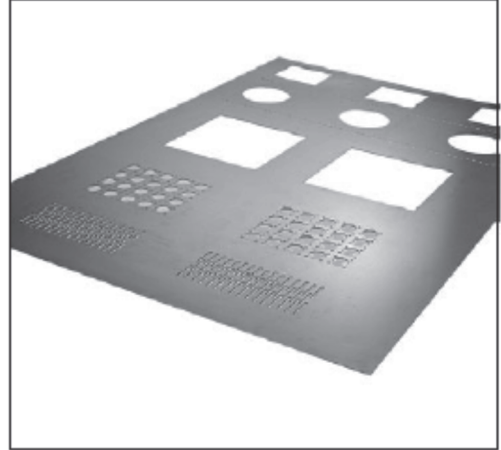
C: Die length...Die length

2. PRESS PATTERN PARAMETERS

2-1. Punching and nibbling patterns

Punching cuts a hole per stroke, while nibbling continuously cuts a shape in many strokes.

Standard punching and nibbling parameters are set in M500, M501 and M696, and M12, respectively. The press operates in these patterns as shown on pages 4-6 and 4-7.



NOTE

- Usually, the press pattern parameters for M500, M501, M696, and M12 need not be changed.

M500: Punching pattern (without shear angle)
A punch with a flat tip is used.

M501: Punching pattern (with shear angle)
A punch with an angled tip is used. The punch tip penetrates 2.5 mm deeper than is the case with M500.

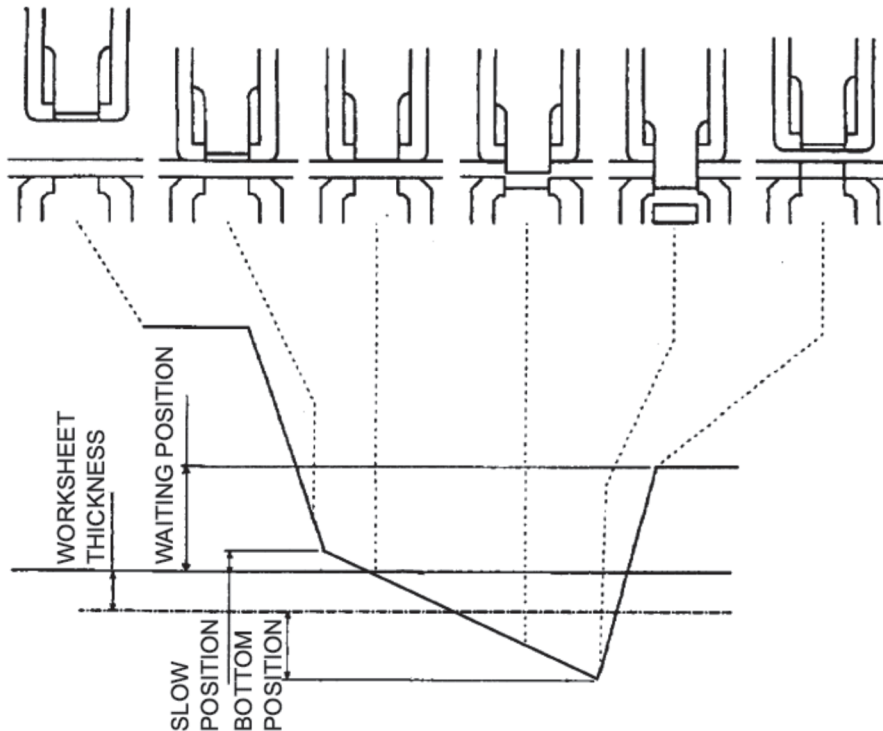
M696: Punching pattern (NEX III punch)
A NEX III punch whose tip matches that of a guide is used.
The press can continuously operate at high speed.
This punching pattern cannot change the press speed.

M12: Nibbling pattern
There is no slow (deceleration) position, so that the press can continuously operate at high speed.

Punching and nibbling parameters

Parameter name	Description
Name	Name composed of 10 alphanumeric characters is assigned to each M-code.
Waiting Position	Punch waiting position for continuous processing with one tool. Set as distance from worksheet top surface.
Slow Position	Punch rapidly moves down to worksheet and processes worksheet at lower speed. Set as distance from worksheet top surface.
Bottom Position	Lower end of punch. Set as distance from die top surface.

Punching (M500, M501) parameter values



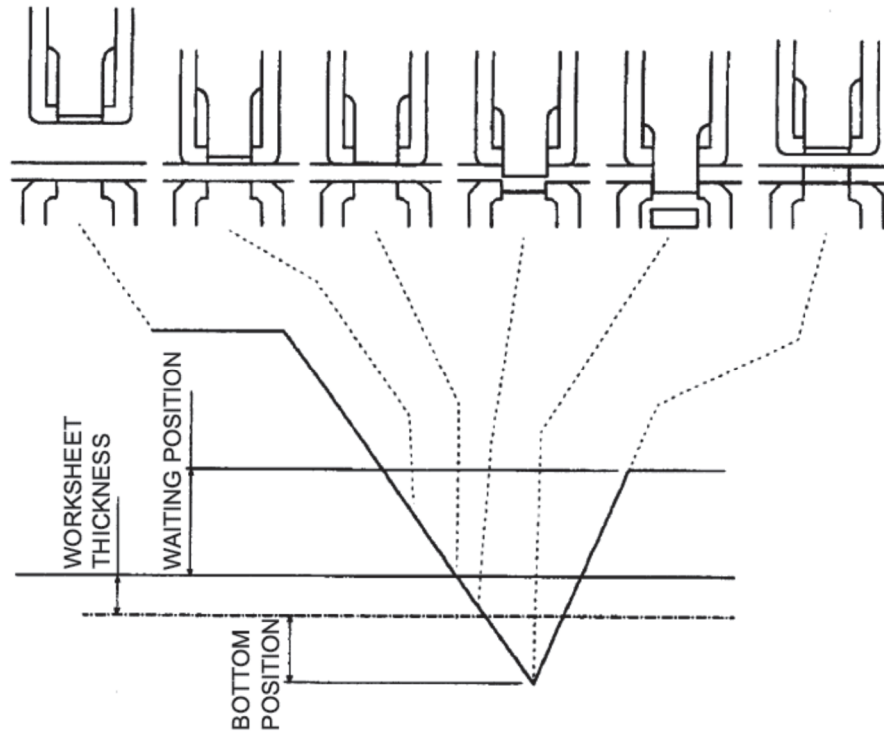
M-code	M500	M501		
Parameter name	Reference setting (recommended setting)		Unit	Setting range
Name	Name composed of 10 alphanumeric characters is assigned to each M-code.			
Waiting Position	3.000		mm	1.000 to 99.999
Slow Position	1.000		mm	0.000 to 99.999
Bottom Position	2.500	5.000	mm	0.000 to 99.999

The worksheet thickness is set by the G06 command in the program.
(Refer to the Programming Manual.)

NOTE

- The press speed changes between high, medium and low with the calculated punching force.
- When [Auto] is selected under [PANEL] in Common Tools -> [PUNCH] -> [Press Speed Settings], the press speed is automatically set to suit the worksheet material and thickness and the tool size.
- With the M500 and M501 punching patterns, the difference between the tooling parameters Assy Length and Punch Length under [PRESS M-CODE] -> [PUNCHING] plus the set value of "Waiting Position" is applied to the actual punch waiting position. When the tooling parameters Assy Length and Punch Length are set to 209.5 mm and 207.5 mm, respectively, for example, the punch waiting position is corrected upward 2 mm from the set value of "Waiting Position".

Punching (M696) and nibbling (M12) parameter values



M-code	M696 and M12		
Parameter name	Reference setting (recommended setting)	Unit	Setting range
Name	Name composed of 10 alphanumeric characters is assigned to each M-code.		
Waiting Position	3.000	mm	1.000 to 99.999
Bottom Position	2.500	mm	0.000 to 99.999

The worksheet thickness is set by the G06 command in the program.
(Refer to the Programming Manual.)

NOTE

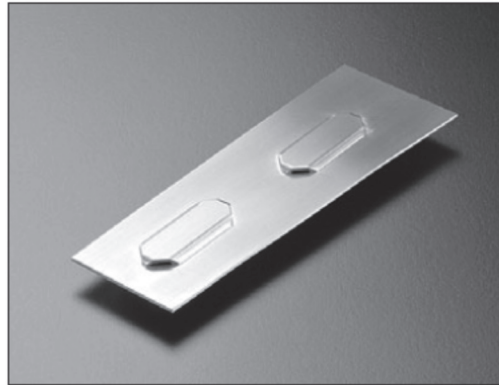
- The nibbling pattern cannot change the press speed.
- With the nibbling pattern, the difference between the tooling parameters Assy Length and Punch Length under [PRESS M-CODE] -> [PUNCHING] plus the set value of "Waiting Position" is applied to the actual punch waiting position. When the tooling parameters Assy Length and Punch Length are set to 209.5 mm and 207.5 mm, respectively, for example, the punch waiting position is corrected upward 2 mm from the set value of "Waiting Position".
- With the M696 punching pattern, the punch waiting position is not corrected.

2-2. Knockout patterns

Knockout is a process in which a hole is punched with scrap attached to the worksheet.

The knockout parameters are as shown in the table below. The press operates according to the parameter settings as shown on page 4-10.

The NC unit can register 10 knockout patterns (M502 to M505 and M570 to M575).



Knockout parameters

Parameter name	Description	Default setting
Name	Name composed of 10 alphanumeric characters is assigned to each M-code.	
Waiting Position	Punch waiting position for continuous processing with one tool. Set as distance from worksheet top surface.	Worksheet thickness plus 5 to 8 mm This value must be so large that punch does not touch worksheet when it stops in waiting position.
Slow Position	Punch rapidly moves down to worksheet and processes worksheet at lower speed. Set as distance from worksheet top surface.	0 mm
Assy Length (Displayed for new method)	Overall length of punching tool. Set as length from punch head to tip of punch guide.	Measure and enter overall Assy length.
Punch Length	Overall punch length. Set as length from punch head to tip.	Measure and enter overall punch length.
Die Length	Die length. Set as die length.	Measure and enter die length.
Die Height (Displayed for old method)	Value automatically calculated from punch length and die length. Usually need not be entered.	271 – punch length – die length (mm)
Bottom Position	Lower end of punch. Set as distance from die top surface.	Set this value to 0 mm, and perform trial punching.* ¹ Gradually increase value while looking at marking condition.
High Speed Knockout* ²	Select from “Normal” for no high-speed knockout or “HI” for high-speed knockout.	Normal

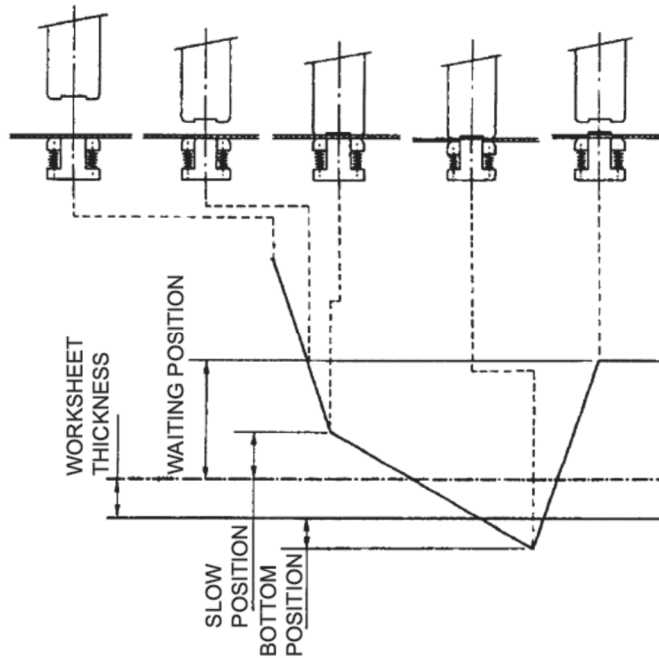
*¹ For trial punching, refer to “4. Trial punching with press pattern” in this Part.

*² High Speed Knockout is a pattern in which the punch moves faster than in a normal knockout pattern. To perform high speed knockout, change the setting to “HI” under [PRESS] in Common Tools -> [PRESS M-CODE] -> [KNOCKOUT] -> [High Speed Knockout].

NOTE

- For the new method, enter the measured values of punch length, Assy length and die length.
- For the old method, enter the measured values of punch length and die length. The die height is automatically calculated and entered, but is not displayed.

Knockout parameter values



M-code	M502 to M505, M570 to M575		
Parameter name	Reference setting (recommended setting)	Unit	Setting range
Name	Name composed of 10 alphanumeric characters is assigned to each M-code.		
Waiting Position	Worksheet thickness plus 5.000 to 8.000	mm	0.100 to 99.999
Slow Position	0.000	mm	-99.999 to 99.999
Assy Length (Displayed for new method)	Measured value	mm	0.000 to 300.000
Punch Length	Measured value	mm	0.000 to 300.000
Die Length	Measured value	mm	0.000 to 99.999
Die Height (Displayed for old method)	Calculated value	mm	0.100 to 99.999
Bottom Position	0.000 (trial punching)	mm	0.000 to 99.999
High Speed Knockout	Normal	—	Normal or HI

NOTE

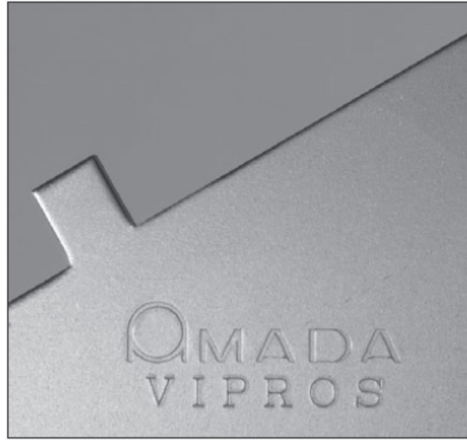
- Set Punch Length and Die Length so that the value of “Die Height” plus “Bottom Position” becomes 36 mm or less. The maximum press stroke length of the machine is 36 mm. When a value that does not meet this condition is entered, an alarm is displayed. One probable cause of the alarm is too small punch length. Enter such a punch length that the press stroke length becomes 36 mm or less.
When the punch length needs to be adjusted, it is recommended to enter a slightly larger punch length so that the bottom position can be finely adjusted.
- Die height is automatically calculated from the entered values of Assy length, punch length, and die length.
- For the new method, enter the measured values of punch length, Assy length and die length.
- For the old method, enter the measured values of punch length and die length. The die height is automatically calculated and entered, but is not displayed.

2-3. Marking patterns

Marking is a process in which a tool is forced into the worksheet to leave a concave mark on the surface of the worksheet.

The marking parameters are as shown in the table below. The press operates according to the parameter settings as shown on the next page.

The NC unit can register 10 marking patterns (M560 to M569).

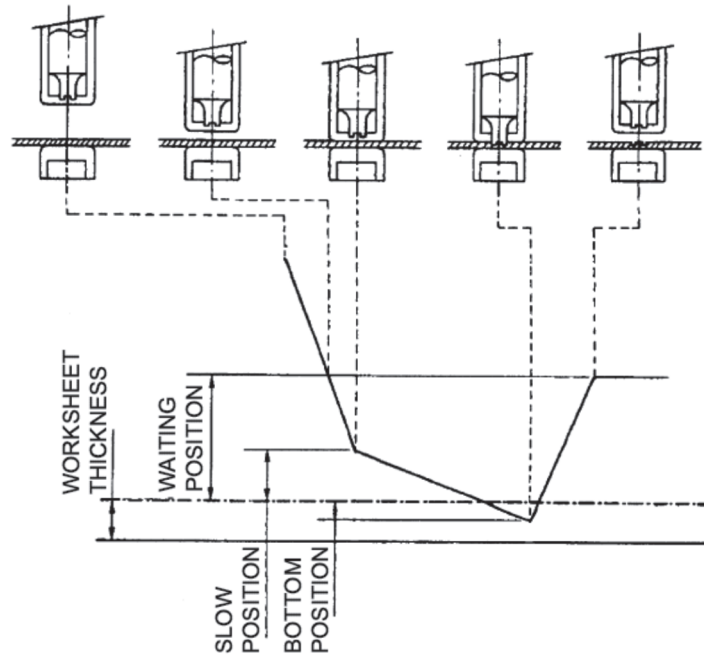


Marking parameters

Parameter name	Description	Default setting
Name	Name composed of 10 alphanumeric characters is assigned to each M-code.	
Waiting Position	Punch waiting position for continuous processing with one tool. Set as distance from worksheet top surface.	5 to 8 mm This value must be so large that punch does not touch worksheet when it stops in waiting position.
Slow Position	Punch rapidly moves down to worksheet and processes worksheet at lower speed. Set as distance from worksheet top surface.	0 mm
Assy Length (Displayed for new method)	Overall length of punching tool. Set as length from punch head to tip of punch guide.	Measure and enter overall Assy length.
Punch Length	Overall punch length. Set as length from punch head to tip.	Measure and enter overall punch length.
Die Length	Die length. Set as die length.	Measure and enter die length.
Die Height (Displayed for old method)	Value automatically calculated from punch length and die length. Usually need not be entered.	271 – punch length – die length (mm)
Bottom Position	Lower end of punch. Set as distance from worksheet top surface.	Set this value to 0 mm, and perform trial punching.*1 Gradually increase value while looking at marking condition.
High Speed Marking	Select “HI” for high-speed marking and “Normal” for no high-speed marking.	Usually Normal

*1 For trial punching, refer to “4. Trial punching with press pattern” in this Part.

Marking parameter values



M-code	M560 to M569		
Parameter name	Reference setting (recommended setting)	Unit	Setting range
Name	Name composed of 10 alphanumeric characters is assigned to each M-code.		
Waiting Position	5.000 to 8.000	mm	0.100 to 99.999
Slow Position	0.000	mm	-99.999 to 99.999
Assy Length (Displayed for new method)	Measured value	mm	0.000 to 300.000
Punch Length	Measured value	mm	0.000 to 300.000
Die Length	Measured value	mm	0.000 to 99.999
Die Height (Displayed for old method)	Calculated value	mm	0.100 to 99.999
Bottom Position	0.000 (trial punching)	mm	0.000 to 99.999
High Speed Marking	Normal	—	Normal or HI

NOTE

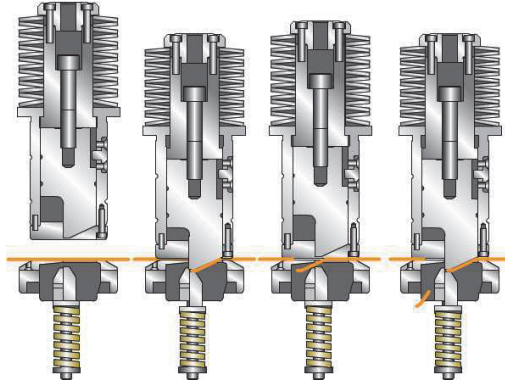
- Set Punch Length and Die Length so that the value of “Die Height” plus “Bottom Position” minus “Worksheet thickness” becomes 36 mm or less. The maximum press stroke length of the machine is 36 mm. When a value that does not meet this condition is entered, an alarm is displayed. One probable cause of the alarm is too small punch length. Enter such a punch length that the press stroke length becomes 36 mm or less.
When there are multiple worksheet thicknesses, adjust the die height by adjusting the punch length so that parts can be formed from thinner worksheets. When the punch length needs to be adjusted, it is recommended to enter a slightly larger punch length so that the bottom position can be finely adjusted.
- Die height is automatically calculated from the entered values of Assy length, punch length and die length.
- For the new method, enter the measured values of punch length, Assy length and die length.
- For the old method, enter the measured values of punch length and die length. The die height is automatically calculated and entered, but is not displayed.
- The high-speed marking pattern is used to mark characters using center punch tools. This mode gives preference to speed and may involve the variation of the bottom position (or marked character appearance). When accuracy is prioritized over speed by using special marking tools, select the normal mode.

2-4. Slitting patterns

Slitting is a process in which a narrow and long hole (slit) is cut from one end with a tool as shown in the figure below. The cut edge is clean and seamless unlike in nibbling.

The slitting parameters are as shown in the table below. The press operates according to the parameter settings as shown on the next page.

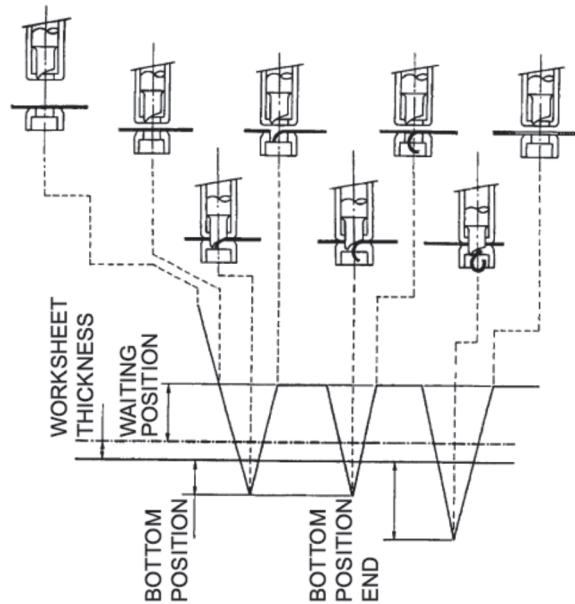
The NC unit can register four slitting patterns (M506 to M509).



Slitting parameters

Parameter name	Description	Default setting
Name	Name composed of 10 alphanumeric characters is assigned to each M-code.	
Waiting Position	Punch standby position for continuous processing with one tool. Set as distance from worksheet top surface.	Refer to the Operator's Manual of slitting tools.
Assy Length (Displayed for new method)	Overall length of punching tool. Set as length from punch head to tip of punch guide.	Measure and enter overall Assy length.
Punch Length	Overall punch length. Set as length from punch head to tip.	Measure and enter overall punch length.
Die Length	Die length. Set as die length.	Measure and enter die length.
Die Height (Displayed for old method)	Value automatically calculated from punch length and die length. Usually need not be entered.	271 – punch length – die length (mm)
Bottom Position	Lower end of punch when it does not drop scrap.	Refer to the Operator's Manual of slitting tools.
Bottom Position End	Lower end of punch when it drops scrap.	Refer to the Operator's Manual of slitting tools.

Slitting parameter values



M-code	M506 to M509		
Parameter name	Reference setting (recommended setting)	Unit	Setting range
Name	Name composed of 10 alphanumeric characters is assigned to each M-code.		
Waiting Position	Refer to the Operator's Manual of slitting tools.	mm	0.100 to 99.999
Assy Length (Displayed for new method)	Measured value	mm	0.000 to 300.000
Punch Length	Measured value	mm	0.000 to 300.000
Die Length	Measured value	mm	0.000 to 99.999
Die Height (Displayed for old method)	Calculated value	mm	0.100 to 99.999
Bottom Position	Refer to the Operator's Manual of slitting tools.	mm	0.000 to 99.999
Bottom Position End	Refer to the Operator's Manual of slitting tools.	mm	0.000 to 99.999

NOTE

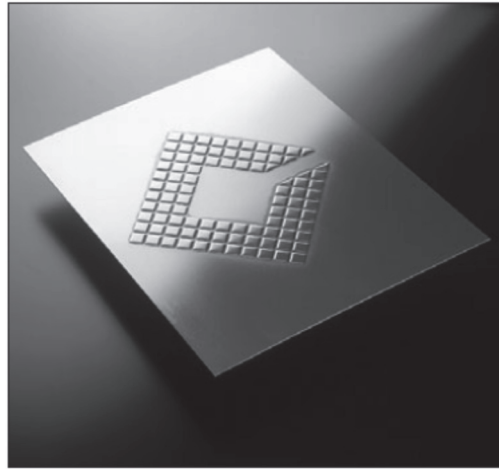
- Set Punch Length and Die Length so that the value of “Die Height” plus “Bottom Position” becomes 36 mm or less. The maximum press stroke length of the machine is 36 mm. When a value that does not meet this condition is entered, an alarm is displayed. One probable cause of the alarm is too small punch length. Enter such a punch length that the press stroke length becomes 36 mm or less.
When the punch length needs to be adjusted, it is recommended to enter a slightly larger punch length so that the bottom position can be finely adjusted.
- Die height is automatically calculated from the entered values of Assy length, punch length and die length.
- For the new method, enter the measured values of punch length, Assy length and die length.
- For the old method, enter the measured values of punch length and die length. The die height is automatically calculated and entered, but is not displayed.

2-5. Forming patterns

Forming is a process in which concave and convex designs are formed on the worksheet with dedicated tools.

The forming parameters are as shown in the table below. The press operates according to the parameter settings as shown on pages 4-20 and 4-22.

The NC unit can register 250 forming patterns (M510 to M559 and M800 to M999).



Forming parameters

Parameter name	Description	Default setting
Name	Name composed of 10 alphanumeric characters is assigned to each M-code.	
Waiting Position	Punch standby position for continuous processing with one tool. Set as distance from worksheet top surface.	Forming height plus 5 to 8 mm This value must be so large that punch does not touch worksheet when it stops in standby position.
Slow Position	Punch rapidly moves down to worksheet and processes worksheet at lower speed. Set as distance from worksheet top surface.	0 mm
Assy Length (Displayed for new method)	Overall length of punching tool. Set as length from punch head to tip of punch guide.	Measure and enter overall Assy length.
Punch Length	Overall punch length. Set as length from punch head to tip.	Measure and enter overall punch length.
Die Length	Die length. Set as die length.	Measure and enter die length.
Die Height (Displayed for old method)	Value automatically calculated from punch length and die length. Usually need not be entered.	271 – punch length – die length (mm)
Forming Cycle Time	Time during which punch is held in bottom position	100 ms
Bottom Position	Lower end of punch. Set as distance from worksheet top surface.	Set this value to 0 mm, and perform trial punching.*1 Gradually increase value while looking at formed designs.

Parameter name	Description	Default setting
Tool Type	Two kinds are available: "Normal" and "High Speed Forming". "High Speed Forming" is used especially for extruding and other forming operations that do not appreciably affect accuracy at the bottom position.	Normal

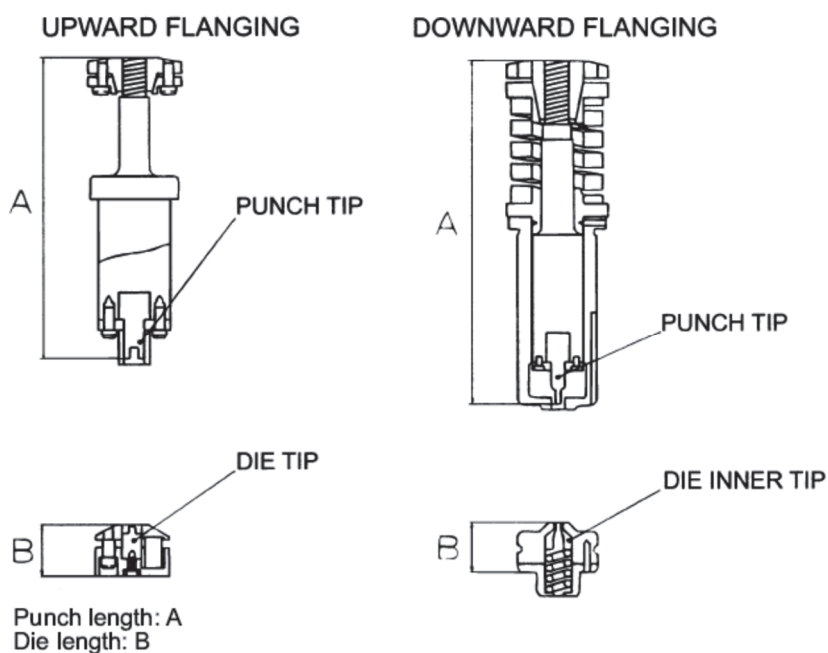
*1 For trial punching, refer to "4. Trial punching with press pattern" in this Part.

NOTE

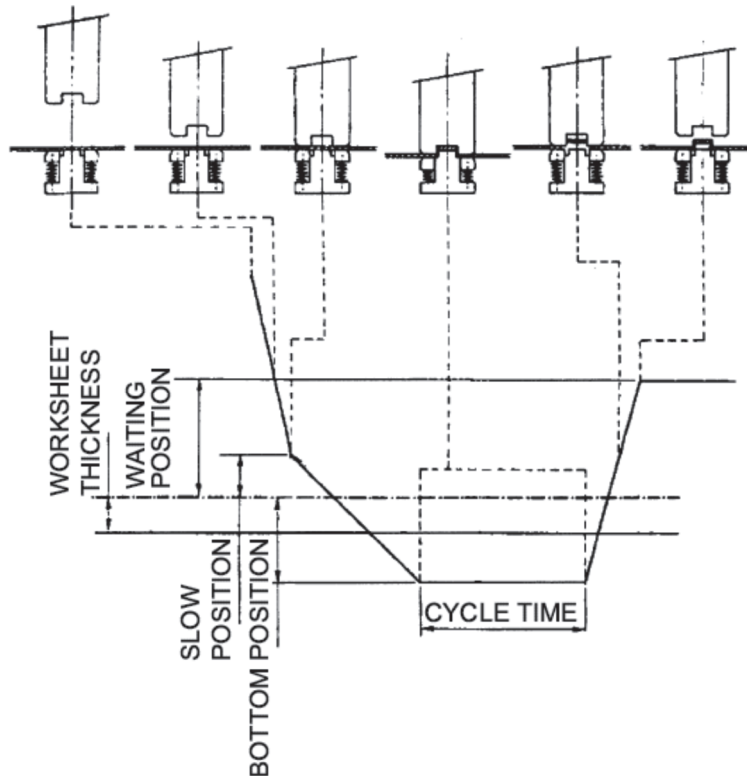
- Do not set the Slow Position parameter when High Speed Forming is selected. The NC unit regards the slow position as zero (0) even if another value is set in the Slow Position parameter.

NOTICE

- Upward forming tools and downward forming tools differ in structure. Measure the punch length and die length by paying attention to this difference.



Forming (normal) parameter values

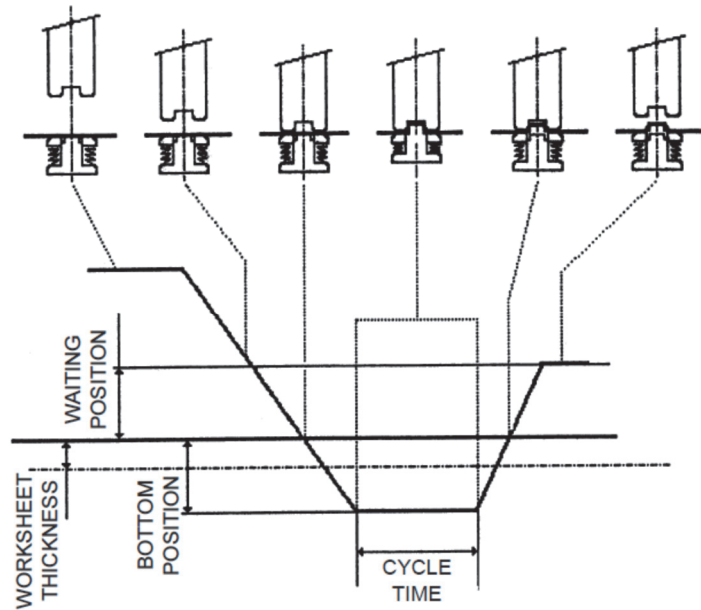


M-code	M510 to M559, M800 to M999		
Parameter name	Reference setting (recommended setting)	Unit	Setting range
Name	Name composed of 10 alphanumeric characters is assigned to each M-code.		
Waiting Position	Forming height plus 5.000 to 8.000	mm	0.100 to 99.999
Slow Position	0.000	mm	-99.999 to 99.999
Assy Length (Displayed for new method)	Measured value	mm	0.000 to 300.000
Punch Length	Measured value	mm	0.000 to 300.000
Die Length	Measured value	mm	0.000 to 99.999
Die Height (Displayed for old method)	Calculated value	mm	0.100 to 99.999
Forming Cycle Time	100	ms	0 to 999
Bottom Position	0.000 (trial punching)	mm	0.000 to 99.999
Tool Type	Normal	—	

NOTE

- Set Punch Length and Die Length so that the value of "Die Height" plus "Bottom Position" minus "Worksheet thickness" becomes 36 mm or less. The maximum press stroke length of the machine is 36 mm. When a value that does not meet this condition is entered, an alarm is displayed. One probable cause of the alarm is too small punch length. Enter such a punch length that the press stroke length becomes 36 mm or less.
When there are multiple worksheet thicknesses, adjust the die height by adjusting the punch length so that parts can be formed from thinner worksheets. When the punch length needs to be adjusted, it is recommended to enter a slightly larger punch length so that the bottom position can be finely adjusted.
- Die height is automatically calculated from the entered values of Assy length, punch length and die length.
- For the new method, enter the measured values of punch length, Assy length and die length.
- For the old method, enter the measured values of punch length and die length. The die height is automatically calculated and entered, but is not displayed.

Forming (High Speed Forming) parameter values



M-code	M510 to M559, M800 to M999		
Parameter name	Reference setting (recommended setting)	Unit	Setting range
Name	Name composed of 10 alphanumeric characters is assigned to each M-code.		
Waiting Position	Forming height plus 5.000 to 8.000	mm	0.100 to 99.999
Assy Length (Displayed for new method)	Measured value	mm	0.000 to 300.000
Punch Length	Measured value	mm	0.000 to 300.000
Die Length	Measured value	mm	0.000 to 99.999
Die Height (Displayed for old method)	Calculated value	mm	0.100 to 99.999
Forming Cycle Time	100	ms	0 to 999
Bottom Position	0.000 (trial punching)	mm	0.000 to 99.999
Tool Type	High Speed Forming	—	

NOTE

- When High Speed Forming is selected, the NC unit regards the slow position as zero (0) even if another value is set in the Slow Position parameter.
- Set Punch Length and Die Length so that the value of "Die Height" plus "Bottom Position" minus "Worksheet thickness" becomes 36 mm or less. The maximum press stroke length of the machine is 36 mm. When a value that does not meet this condition is entered, an alarm is displayed. One probable cause of the alarm is too small punch length. Enter such a punch length that the press stroke length becomes 36 mm or less.
When there are multiple worksheet thicknesses, adjust the die height by adjusting the punch length so that parts can be formed from thinner worksheets. When the punch length needs to be adjusted, it is recommended to enter a slightly larger punch length so that the bottom position can be finely adjusted.
- Die height is automatically calculated from the entered values of Assy length, punch length and die length.
- For the new method, enter the measured values of punch length, Assy length and die length.
- For the old method, enter the measured values of punch length and die length. The die height is automatically calculated and entered, but is not displayed.

2-6. MPT tapping patterns

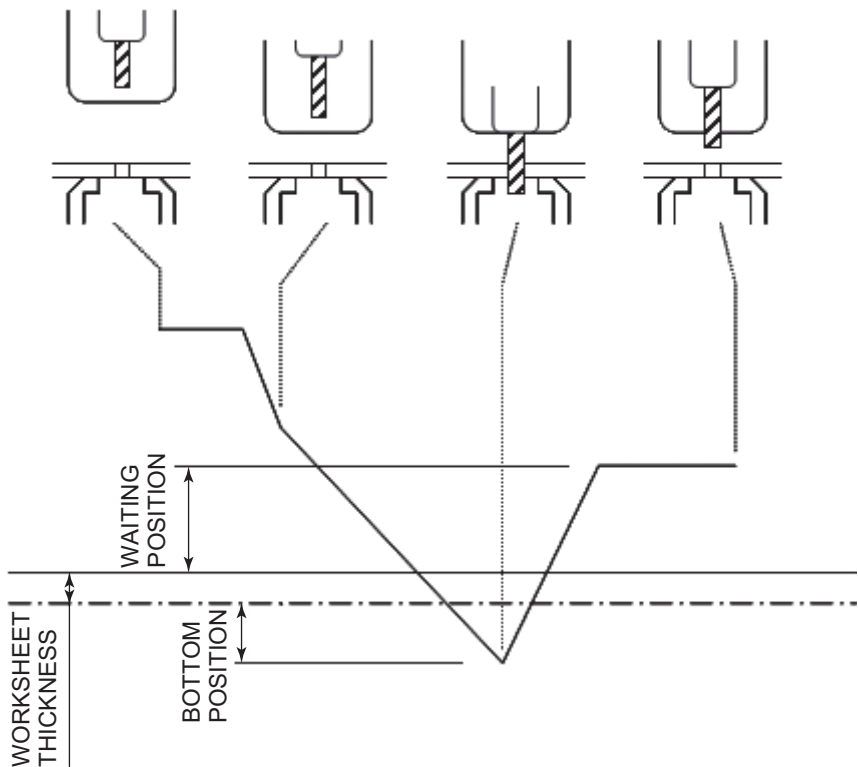
MPT tapping makes threaded holes using special tools (called MPT tapping tools).

The MPT tapping parameters are as shown in the table below. The press operates according to the parameter settings as shown on the next page.

MPT tapping parameters

Parameter name	Description	Default setting
Name	Name composed of 10 alphanumeric characters is assigned.	
Waiting Position	Punch standby position for continuous processing with one tool. Set as distance from worksheet top surface.	5.000 mm
Bottom Position	Lower end of punch. Set as distance from worksheet top surface.	5.000 mm

MPT tapping parameter values



M-code	M122		
Parameter name	Reference setting (recommended setting)	Unit	Setting range
Name	Name composed of 10 alphanumeric characters is assigned.		
Waiting Position	5.000	mm	1.000 to 99.999
Bottom Position	5.000	mm	5.000 to 7.000

2-7. Parameter value setting ranges

Press pattern	Nibbling	Punching			Knockout	Marking	Slitting	Forming	MPT tapping
M-code	M12	M500	M501	M696	M502 to M505 M570 to M575	M560 to M569	M506 to M509	M510 to M559 M800 to M999	M122
Waiting Position (mm)	[3.000] 1.000 to 99.999	[3.000] 1.000 to 99.999	[3.000] 1.000 to 99.999	[3.000] 1.000 to 99.999	0.100 to 99.999	0.100 to 99.999	0.100 to 99.999	0.100 to 99.999	[5.000] 1.000 to 99.999
Slow Position (mm)	—	[1.000] 0.000 to 99.999	[1.000] 0.000 to 99.999	—	-99.999 to 99.999	-99.999 to 99.999	—	-99.999 to 99.999 (Not available for high speed forming)	—
Assy Length (mm)	—	—	—	—	0.000 to 300.000	0.000 to 300.000	0.000 to 300.000	0.000 to 300.000	—
Punch Length (mm)	—	—	—	—	0.000 to 300.000	0.000 to 300.000	0.000 to 300.000	0.000 to 300.000	—
Die Length (mm)	—	—	—	—	0.000 to 99.999	0.000 to 99.999	0.000 to 99.999	0.000 to 99.999	—
Die Height (mm)	—	—	—	—	0.100 to 99.999	0.100 to 99.999	0.100 to 99.999	0.100 to 99.999	—
Forming Cycle Time (ms)	—	—	—	—	—	—	—	0 to 999	—
Bottom Position (mm)	[2.500] 0.000 to 99.999	[2.500] 0.000 to 99.999	[5.000] 0.000 to 99.999	[2.500] 0.000 to 99.999	0.000 to 99.999	0.000 to 99.999	0.000 to 99.999	0.000 to 99.999	[5.000] 5.000 to 7.000
Bottom Position End (mm)	—	—	—	—	—	—	0.000 to 99.999	—	—
High Speed Marking	—	—	—	—	—	Normal/ HI	—	—	—
High Speed Knockout	—	—	—	—	Normal/ HI	—	—	—	—
Tool Type	—	—	—	—	—	—	—	Normal/ High Speed Forming	—

NOTE

- The parameter values are given in the ranges where they can be registered in the NC unit. Determine the actual parameter values by considering the “reference setting” values in the parameter value table of each press pattern and the specifications of the tooling and machine.
- The punching and nibbling patterns have the parameter values enclosed in brackets and set as the default values (recommended values).
- Do not set the Slow Position parameter when High Speed Forming is selected. The NC unit regards the slow position as zero (0) even if another value is set in the Slow Position parameter.

3. SETTING PRESS PATTERN PARAMETERS

Touch the [PRESS] tab in Common Tools, and change to the [PRESS M-CODE] view to show [Edit area] for editing the press M-code.

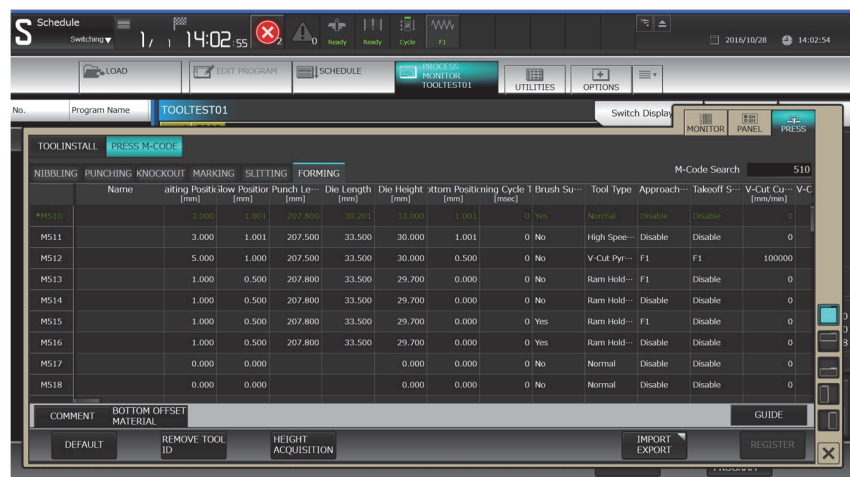
Here you can set the press pattern parameters on an M-code number basis.

Use the accessory keyboard to enter values.

For details of the [PRESS M-CODE] view, refer to Part 11, Editing Press Processing Conditions, in the Reference Manual.

As an entry example, the procedure for setting the forming parameters is described below. Follow the same procedure for setting other press pattern parameters.

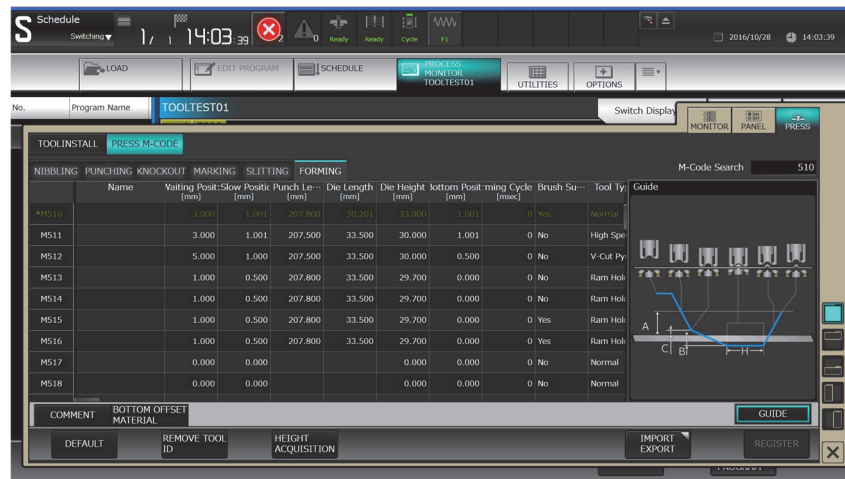
- 1 Touch the [PRESS] tab in Common Tools.
- 2 Press the [PRESS M-CODE] button to show the [PRESS M-CODE] view.
- 3 Touch the [FORMING] tab to open the M-code list for forming pattern.



- 4 Press the M-code line at which you want to set the parameters.
The parameters on the specified M-code line can be changed.

NOTE

- If the M-code to set is not shown in the [PRESS M-CODE] view, scroll the M-code list, or use the M-Code Search field to find the necessary M-code.
- To show the guide for the M-code, set the [GUIDE] button to ON in the [PRESS M-CODE] view. The press pattern of the selected M-code is shown in [Guide area].



- 5 Press the parameter field to set or change, enter the necessary parameter value with the accessory keyboard, and press the $\downarrow$ key.
- 6 Similarly enter the parameter values in the other parameter fields.
- 7 Press the [REGISTER] button in the [PRESS M-CODE] view.

NOTE

- After entering the parameter values in the parameter fields, press the [REGISTER] button in the [PRESS M-CODE] view to register the new parameters in the NC unit.
- Repeat the above procedure from step 4 to set the parameters for other M-codes.

4. TRIAL PUNCHING WITH PRESS PATTERN

Press patterns may be trial punched by using the [Try Forming] utility or a program.

4-1. Trial punching using Try Forming in utilities

Touch the [UTILITIES] tab at the top of the screen to show the UTILITIES display. Select the category and press the [Try Forming] button. Enter the data in the fields on the Try Forming window to perform trial punching.

For details of the Try Forming window, refer to Part 12, Utilities, in the Reference Manual.

Name	Waiting Position [mm]	Slow Position [mm]	Punch Length [mm]	Die Length [mm]	Die Height [mm]	Bottom Position [mm]	Forming
M 520	0.000	0.000	0.000	0.000	0.000	0.000	

Trial punching

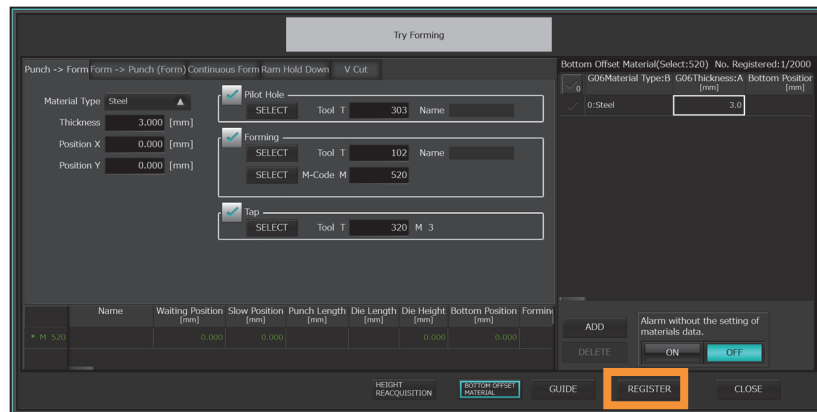
Trial punch a press pattern using the [Try Forming] utility as described below.

NOTICE

- When trying forming, marking, or knockout, set the Bottom Position parameter value to 0. Repeat trial punching several times, and gradually increase the Bottom Position parameter value until an optimum value is obtained.

NOTE

- Slitting cannot be tried using the [Try Forming] utility. Refer to the Operator's Manual of slitting tools.
- When performing trial tapping, be sure to place a check mark on [Pilot Hole] and then enter the T-number for pre-piercing in the Tool T field on the [Punch -> Form] tab. Tapping is not performed when you command tapping without commanding pre-piercing.
- Trial tapping can be performed after forming. In such a case, set the M-Code M and Tool T fields at [Forming] besides the Tool T field at [Pilot Hole]. Processing is performed in the following order. Pre-piercing → Forming → Tapping
- The press pattern of selected M-code is displayed on the bottom of the Try Forming window. When you change the press pattern parameters or bottom position correction value by the material type and thickness, press the [REGISTER] button after changing them.



- 1 Set the worksheet on the machine.
- 2 Press the MEMORY button on the NC control panel to select the MEMORY mode.
- 3 Press the button indicating the axis speed on [Device indicator] to set the axis speed, and select the press speed under [PANEL] in Common Tools -> [PUNCH] -> [Press Speed Settings].
- 4 Touch the [UTILITIES] tab at the top of the screen to show the UTILITIES display. Select the category and press the [Try Forming] button to open the Try Forming window. Enter the trial punch data in the fields on the Try Forming window.
- 5 Press the START button on the NC control panel.
- 6 The worksheet is positioned and punched with the tool with the specified T-number and the press pattern of the specified M-code.



4-2. Trial punching according to program

Try punching according to a program as described below.

- 1 Create one of the following trial punching programs, and load it to the EDIT PROGRAM display.

[For forming, marking, or knockout]

G06 A <u>thickness</u> B <u>material</u> ;	... Worksheet data
G92 X__ Y__;	... Origin setting
M__;	... Press pattern (press mode)
G90 X__ Y__ T__;	... Positioning and punching
M13;	... Press pattern (press mode) cancel
G50;	... Zero-return

[For slitting]

G06 A <u>thickness</u> B <u>material</u> ;	... Worksheet data
G92 X__ Y__;	... Origin setting
M690;	... Air blow
M__;	... Press pattern (press mode)
G90 X__ Y__ T__;	... Positioning and punching
G28 I__ J__ K__;	... Line at angle
M13;	... Press pattern (press mode) cancel
G28 I__ J__ K__;	... Line at angle
G50;	... Zero-return

NOTE

- Enter 0.1 to 6.3 mm (worksheet thickness) in A of G06, and enter either 0 for SPC (mild steel), 1 for SUS (stainless steel) or 2 for AL (aluminum) in B of G06.
 - For the methods of creating a program on the screen and calling it to the screen, refer to Part 5, Preparing Programs, and Part 9, Editing Programs, in the Reference Manual.
- 2 Check that the tool that meets the selected press pattern is installed in the turret station commanded by "T__".
 - 3 Set the worksheet on the machine.
 - 4 Press and illuminate the MEMORY button on the NC control panel to switch the NC mode to MEMORY.
 - 5 Press the button indicating the axis speed on [Device indicator] to set the axis speed, and select the press speed under [PANEL] in Common Tools -> [PUNCH] -> [Press Speed Settings].



- 6 Press the START button on the NC control panel.
- 7 Repeat trial punching while looking at the punching result and gradually increasing the Bottom Position parameter value. Increase the Bottom Position parameter value in 0.1-mm increments for marking and in increments of about 0.5 mm for slitting.
- 8 Check the waiting position of the punch, and adjust its parameter value so that the punch does not touch the worksheet after trial punching.

5. AUTO TIMER

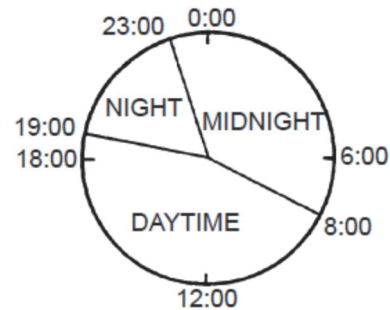
When [Auto] is selected for the press speed (under [PANEL] in Common Tools -> [PUNCH] -> [Press Speed Settings]) and [Auto Timer] is set to [Enable] on the Auto Timer window, the press speed can be automatically reduced to alleviate punching noise in the night and midnight time zones.

To automatically reduce the press speed to prevent night punching noise, set the night and midnight time zones to suit the prevailing situation.

The night and midnight time zones are defaulted at the time of factory shipment as follows:

Night time zone: 19:00 to 23:00

Midnight time zone: 23:00 to 8:00



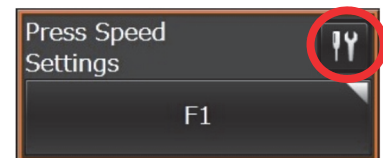
5-1. Setting auto timer

Select [Auto] under [PANEL] in Common Tools -> [PUNCH] -> [Press Speed Settings].

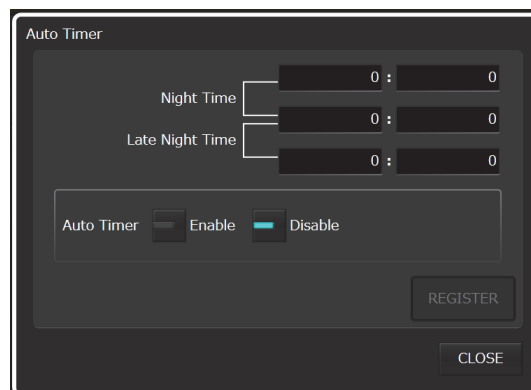
Set the operation start and end times in the Night Time and Late Night Time fields as described below.



- 1 Press the option button at the upper right of [Press Speed Settings] to open the Auto Timer window.



- 2 Using the keyboard, set the operation start and end times in the Night Time and Late Night Time fields.



- 3 Set [Auto Timer] to [Enable] to make the time zone settings effective.
- 4 Press the [REGISTER] button on the Auto Timer window.

6. TAP SETTING

For details of the tap setting, refer to “MPT Tapping Unit and Tapping Tools” in the Accessory Manual.

7. AIR BLOW SETTING

For details of the air blow setting, refer to “Air Blow Unit” in the Accessory Manual.

Air Blow

Tool Size	Oil Discharge Cycle	Count	Oil Supply[%]
A/B	999	0	10
C	999	0	10
D/E	999	0	10
Total Count	999	2	0
Tap	5	3	10

Total Count

ON

OFF

REGISTER

CLOSE

8. BOTTOM POSITION CORRECTION BY MATERIAL TYPE AND THICKNESS

Touch the [PRESS] tab in Common Tools, and change to the [PRESS M-CODE] view. Set the [BOTTOM OFFSET MATERIAL] button to ON to open [Bottom Offset Material area]. The bottom position correction values for the material type and thickness of the worksheets to be processed can be registered in the selected M-code.

NOTE

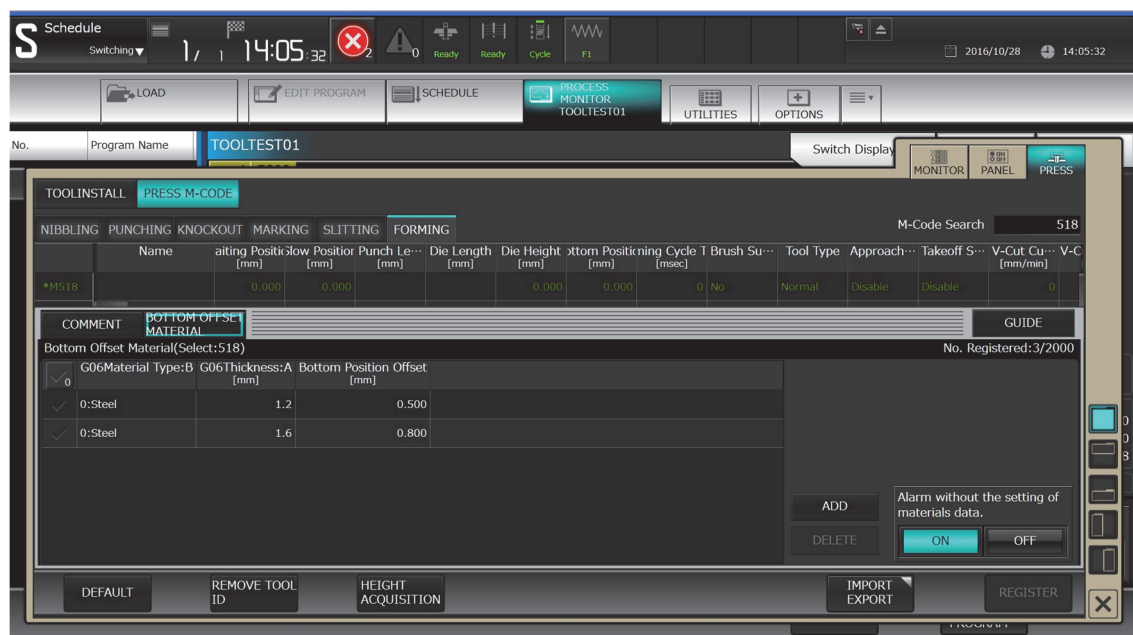
- The bottom position correction values by material type and thickness can be registered only in the knockout, marking, and forming pattern M-codes.
- Up to 2000 bottom position correction values by material type and thickness (or bottom position correction values for all M-codes) can be registered.
- When the M-code has the bottom position correction value by material type and thickness registered, an asterisk (*) is shown at the right of its number in the M-code field.

Actual bottom position for M-code with registered bottom position correction value by material type and thickness

The actual bottom position is the sum of the set bottom position and the bottom position correction value.

Example:

When the material type is mild steel and thickness is 1.2 as shown in the following display for M518, the actual bottom position is 0.000 (Bottom Position field) + 0.500 (Bottom Position Offset field) = 0.500



For details of [Bottom Offset Material area], refer to Part 11, Editing Press Processing Conditions, in the Reference Manual.

8-1. Registering bottom position correction values by material type and thickness

Register bottom position correction values by material type and thickness in an M-code as described below.

- 1 Touch the [PRESS] tab in Common Tools.
- 2 Press the [PRESS M-CODE] button to show the [PRESS M-CODE] view. The [Edit area] is shown.
- 3 Select a press pattern.

The bottom position correction values by material type and thickness can be registered in three types of press pattern M-codes, knockout, marking, and forming pattern M-codes.

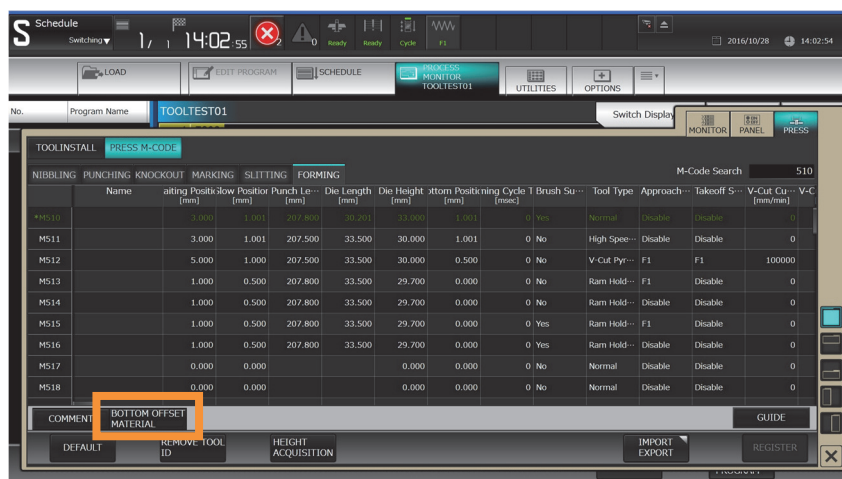


- 4 Press the entry line for the M-code in which you want to register the bottom position correction value by material type and thickness.

NOTE

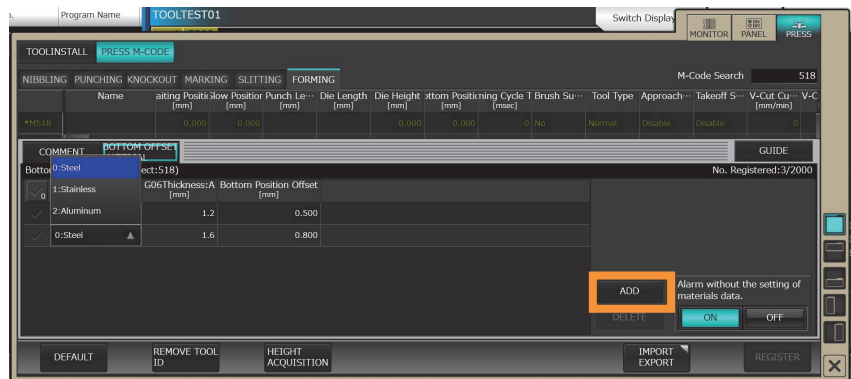
- When the necessary M-code is not shown in the area, scroll the M-code list, or use the M-Code Search field to find the necessary M-code.

- 5 Set the [BOTTOM OFFSET MATERIAL] button to ON.
The [Bottom Offset Material area] opens for the selected M-code.



6 Press the [ADD] button.

The bottom position correction value entry line opens for the selected M-code



7 Select the material type, and enter the thickness and bottom position correction value.

Press the entry field for the thickness or bottom position correction value, enter the relevant data with the accessory keyboard, and press the $\downarrow$ key.

- **G06 Material Type: B:**

Select the material type of the worksheet from among 0 to 2.

0: Steel (mild steel), 1: Stainless (stainless steel),
2: Aluminum

- **G06 Thickness: A:**

Enter the thickness of the worksheet.

- **Bottom Position Offset**

Enter the bottom position correction value.

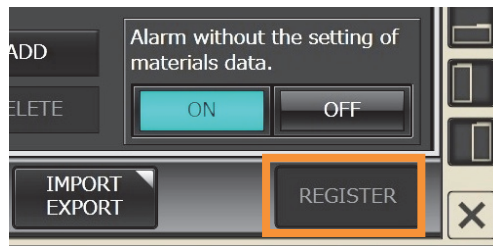
NOTICE

- Determine the optimum bottom position correction value after several trial punching operations. Set the bottom position correction value at 0.000 at first. (When you perform trial punching, use [Try Forming] in the UTILITIES display.)
- When the bottom position correction value is the default value of 0.000, the set Bottom Position parameter value is used to calculate the bottom position. Take care that the bottom position set on the basis of the value entered in the Bottom Position Offset field might cause tool breakage.
(Actual bottom position = Bottom Position parameter value + Bottom Position Offset value)

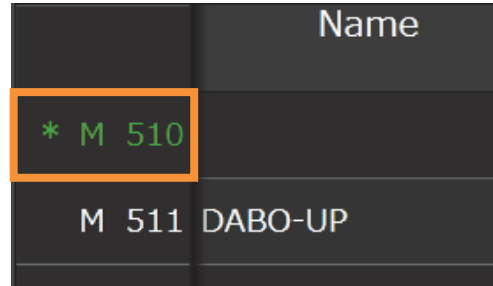
NOTE

- A negative value can be entered as the bottom position correction value. When the sum of the Bottom Position parameter value and the Bottom Position Offset value is negative, an error message is displayed to that effect. If the sum is a negative value, enter such a bottom position correction value that yields a positive sum.

- 8 Press the [REGISTER] button.
The bottom position correction value is registered in the NC unit.



When the M-code has the bottom position correction value registered, an asterisk (*) is shown at the left of its number in the M-code field.



- 9 Illuminate the [ON] button at [Alarm without the setting of materials data.].

When a worksheet is processed with an M-code in which the bottom position correction value by material type and thickness for that worksheet is not registered, an alarm message is displayed to that effect.



NOTICE

- To prevent improper processing, normally have the [ON] button illuminated.

- 10 To close the [Bottom Offset Material area], set the [BOTTOM OFFSET MATERIAL] button to OFF.

8-2. Recommended operating methods (reference)

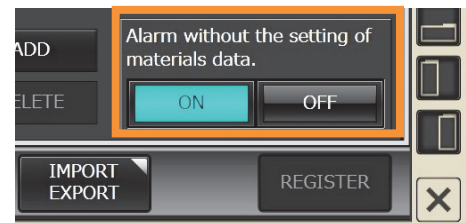
It is recommended to use either of the following methods, depending on whether or not to use the bottom position correction function.

Using bottom position correction function

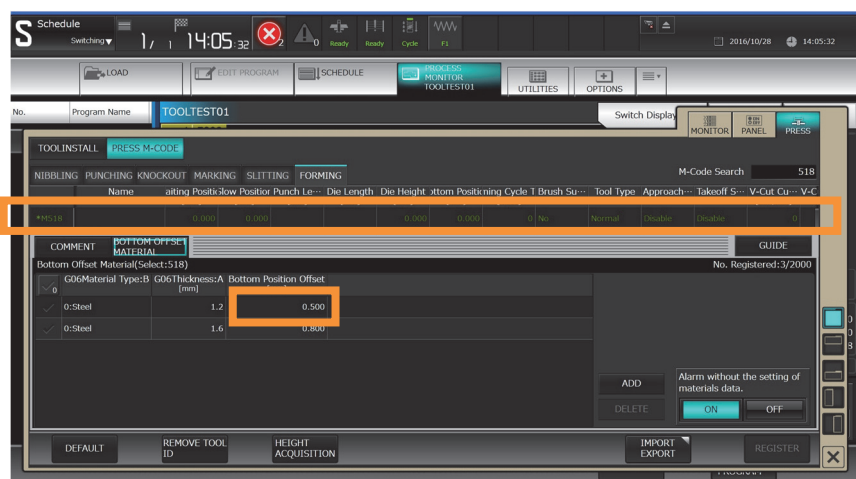
NOTICE

- When the bottom position correction value is the default value of 0.000, the set Bottom Position parameter value is used to calculate the bottom position. Take care that the bottom position set on the basis of the value entered in the Bottom Position Offset field might cause tool breakage.
(Actual bottom position = Bottom Position parameter value + Bottom Position Offset value)

- When the bottom position correction value is to be registered for an M-code, set the Bottom Position parameter to the default value of 0.000. Set the actual bottom position with the bottom position correction value entered in the [Bottom Offset Material area].
- Illuminate the [ON] button at [Alarm without the setting of materials data.] in the [Bottom Offset Material area].



When a worksheet is processed with an M-code in which the bottom position correction value by material type and thickness for that worksheet is not registered, an alarm message is displayed to that effect.



Not using bottom position correction function

As usual, set the bottom position with the Bottom Position parameter for each M-code.

	Name	Waiting Position [mm]	Slow Position [mm]	Assy Length [mm]	Punch Length [mm]	Die Length [mm]	Bottom Position [mm]
M 510	DABO-UP1	3.000	1.000	209.500	207.500	30.000	1.000
M 511	DABO-UP2	3.000	1.000	209.500	207.500	30.000	1.300
M 512	DABO-UP3	3.000	1.000	209.500	207.500	30.000	1.500

8-3. Operation of press pattern parameters

The press pattern parameters may be operated by either of the following two methods:

- Old method: The die height position is manually calculated and entered on the display.
- New method: When you enter the tool information (Assy length, punch length and die length), the die height position is automatically calculated internally.

Types of press pattern parameters to change with operation method

Type of press pattern parameter	Parameter to enter	
	Old method	New method
Knockout parameter	Die Height	Assy Length
Marking parameter	-	Punch Length
Slitting parameter	-	Die Length
Forming parameter		

Changing between old and new methods

Usually, you do not change between the old and new methods. AMADA will make this change.

Part 5

Maintenance



WARNING

- Before maintaining the machine, turn off the shop circuit breaker switch, shut down the compressed air supply, and appropriately relieve the residual air pressure.

If it is necessary to turn on electric power when maintaining the machine, press the STOP button or take any other measure to prevent the machine from being started by mistake.

- Post a sign to notify other workers that the machine is being serviced.
- Before maintaining the machine with the machine circuit breaker switch turned to OFF, padlock the switch in the OFF position to prevent other workers from turning on the power of the machine by mistake.
- When maintaining the machine with the knob of the residual pressure relief valve turned to “EXH.”, padlock the knob in the “EXH.” position to prevent other workers from supplying compressed air to the machine by mistake.

NOTICE

- The machine comes with the following maintenance accessories: Windows Embedded Recovery Disk CD, AMNC3i application CD, and parameter/custom macro USB flash drive. These accessories are required to restore the machine when the machine suffers a fault. Keep them carefully. If you lose them, you will be asked to purchase them from AMADA.

(For contents, refer to next page.)

1. Daily maintenance	5-4
1-1. Maintenance at start of day's work	5-4
1-1-1. Checking air system	5-4
1-1-2. Other maintenance items	5-5
1-1-3. Checking operation of protective devices	5-8
1-1-4. Checking grease level of automatic grease lubricator for drive axis.....	5-9
1-1-5. Checking reservoir tray	5-10
2. Periodical maintenance	5-11
2-1. Every month.....	5-11
2-1-1. Lubrication.....	5-11
2-1-2. Cleaning amplifier box air filter.....	5-12
2-2. Every three months.....	5-13
2-2-1. Lubrication.....	5-13
2-2-2. Other maintenance items	5-13
2-3. Every six months.....	5-13
2-3-1. Electrical wiring	5-13
2-4. Every year	5-14
2-4-1. Changing memory backup batteries	5-14
3. Lubrication	5-16
4. Electrical troubleshooting.....	5-19
5. Automatic grease lubricator	5-21
5-1. Adding grease to tank	5-22
5-1-1. Bleeding air from automatic grease lubricator	5-23
5-1-2. Cleaning reservoir tray of used grease	5-24
6. Maintaining tools.....	5-26
6-1. Checking tools	5-26
6-2. Lubrication	5-26
6-3. Disassembling and assembling punches (Types A and B).....	5-27
6-3-1. Disassembly	5-28
6-3-2. Assembly	5-29
6-4. Removing and installing punch tips (Types C, D, and E)....	5-30
6-4-1. Removal	5-30
6-4-2. Installation	5-31
6-5. Regrinding tools	5-31
6-6. Adjusting punch and die height.....	5-32
6-6-1. Adjusting punch height.....	5-32
6-6-2. Adjusting die height	5-33

6-7. Adjusting height of NEX III punches.....	5-34
6-8. Adjusting height of Z style guides	5-37
7. Changing shear plate.....	5-39
8. Dismantling and scrapping	5-41
8-1. Disposal of machine body	5-41
8-2. Disposal of grease and oil.....	5-41
8-3. Disposal of electrical parts	5-41

1. DAILY MAINTENANCE

1-1. Maintenance at start of day's work

Maintenance is important in operating the machine in the best condition for a long period of time.

Before starting the machine every day, check and maintain the items described below.

1-1-1. CHECKING AIR SYSTEM

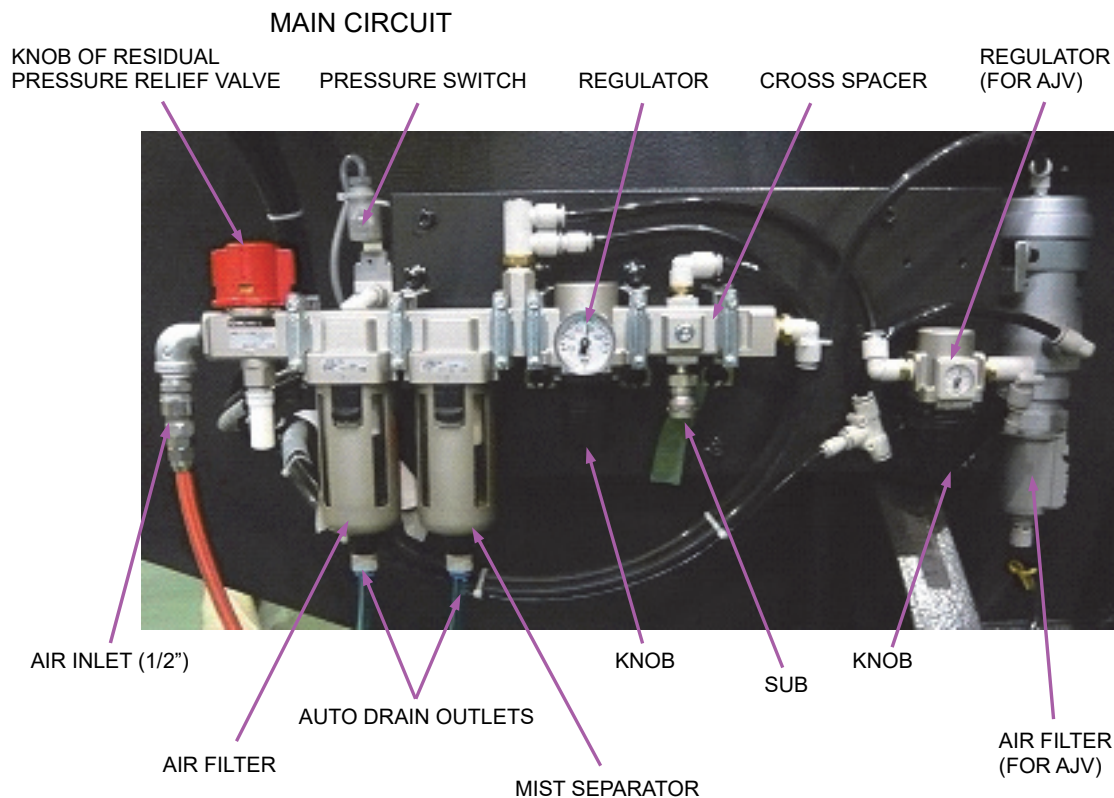
Checking compressed air pressure

Supply compressed air to the machine, and check the respective pressure gauges to see that the compressed air pressure in the main circuit is as specified below and that the compressed air pressure in the air blow circuit (option) is as specified in "Air Blow Unit" in the Accessory Manual.

Main circuit: 0.55 MPa {80 psi}

*Also applies to the optional air jet vacuum (AJV) mechanism

If the compressed air pressure in the main circuit is not as specified, pull out the knob of the regulator, and turn it to set the compressed air pressure at the specified value. Turn the knob clockwise to increase the pressure and counterclockwise to decrease the pressure. After setting the pressure, push in the knob.



Draining water from filter

Check that no water is collected in the filter of the air compressor. If water is collected, drain it as described in the operation manual of the air compressor.

The air filter of the machine is equipped with an automatic drain mechanism.

Checking for air leaks

Check the air hose and pneumatic equipment connections for air leaks.

1-1-2. OTHER MAINTENANCE ITEMS

Check, clean, and lubricate the following parts.

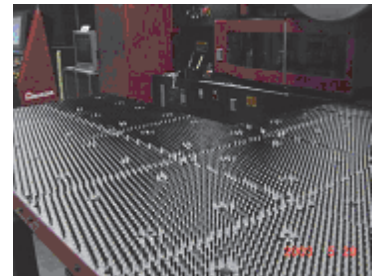
For recommended oils, refer to “Recommended lubricants” in “3. Lubrication” in this Part.

- | | |
|-------------------------------------|--------------------------|
| ● Table | ● Index pin bushings |
| ● X-axis LM guide | ● Punch head top surface |
| ● Y-axis LM guides (front and rear) | ● Upper turret |
| ● Index pins (upper and lower) | ● Lower turret |

Check the following items.

Table

Check that tools (punches and dies) and jigs are not left on the table or remnants and slugs are not left on the table.



Punch head top is not dirty

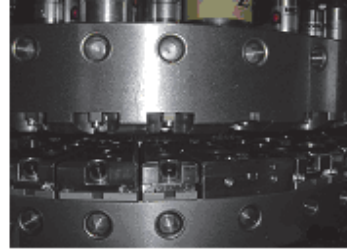
If grease or other foreign matter is deposited on the top surface of the punch head, the strip miss detection function may not properly work. Wipe off the top surface of the punch head with waste cloth.



Die holder top is free of slug

If a slug is present on the top surface of the die holder, it may go under or ride on the worksheet and may cause the worksheet to be punched in the folded condition.

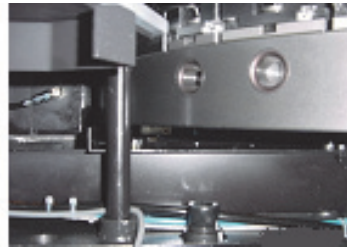
In such a case, the worksheet may be dented, or the tooling may be damaged. Clean the die holder top.



There are no slugs below lower turret

If there are slugs below the lower turret, they may fall into the index cover and cause trouble.

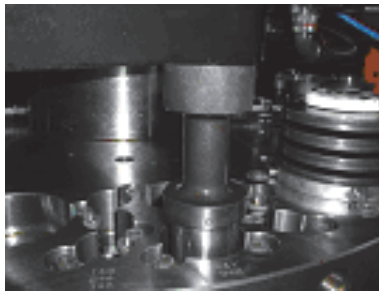
Open the front and rear lower turret covers, and remove the slugs below the lower turret.



Punch is securely installed

If the punch is not securely inserted in the upper turret, it may hit the striker and damage itself as the turret rotates.

If the punch guide is damaged or if the keyway is not aligned with the key, the punch may be jammed in the punch guide. If the punch is damaged, remove its damage with an oilstone or the like, and then insert it. After insertion, lightly push down the punch head to check that the punch slides up and down smoothly.



Die installation

If a die is not securely inserted, it may strike the worksheet.

If a die is not securely inserted, remove the die and check that the die holder outside surface and die seating surface are free of foreign matter or damage. Then, securely insert the die until it bottoms.

No foreign matter is deposited on X-axis, Y-axis, and table LM guides

If foreign matter is deposited on the LM guide, wipe it off with waste cloth. Apply the recommended oil where the LM guide is wiped off.

Recommended oil:

Exxon Mobil Teresstic 33, Exxon Mobil DTE Oil Light, or Shell Tellus Oil 32



X-AXIS LM GUIDE



Y-AXIS LM GUIDE

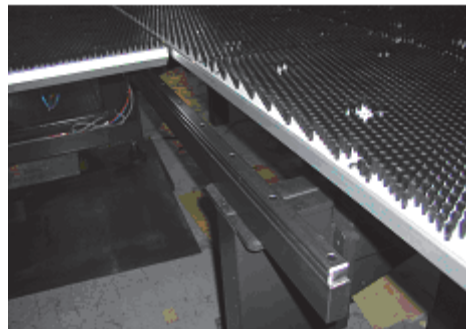


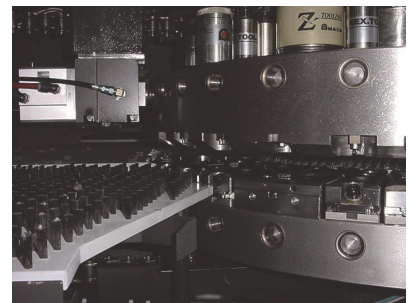
TABLE LM GUIDE

Index pin bushings

Clean and apply the recommended oil.

Recommended oil:

Exxon Mobil Teresstic 33, Exxon Mobil DTE Oil Light, or Shell Tellus Oil 32



Workclamps

Apply the recommended oil to the sliding surfaces of the workclamp.

Recommended oil:

Exxon Mobil Teresstic 33, Exxon Mobil DTE Oil Light, or Shell Tellus Oil 32



Punches

Apply the recommended oil to the punch guide surfaces and punch body.

Recommended oil:

Exxon Mobil Teresstic 33, Exxon Mobil DTE Oil Light, or Shell Tellus Oil 32

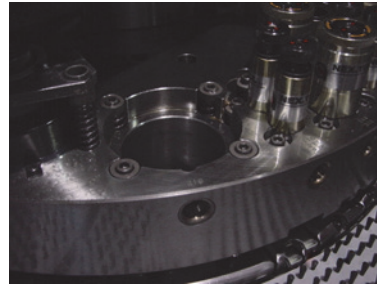
Lifter collars

The lifter collar moves up and down together with the punch during punching.

Apply the recommended oil to the sliding surfaces.

Recommended oil:

Exxon Mobil Teresstic 33, Exxon Mobil DTE Oil Light, or Shell Tellus Oil 32



1-1-3. CHECKING OPERATION OF PROTECTIVE DEVICES

Check the following operations before starting the machine.

- (a) Check if the STOP button on the NC control panel illuminates when each STOP button (on the NC control panel and auxiliary control stand (option)) is pressed.
- (b) Check if the STOP button on the NC control panel illuminates when the tool change door is open.
- (c) Check if the machine stops in emergency when the EMERGENCY STOP button on each control panel is pressed.
- (d) Check if the STOP button on the NC control panel illuminates when the light curtain is interrupted.

1-1-4. CHECKING GREASE LEVEL OF AUTOMATIC GREASE LUBRICATOR FOR DRIVE AXIS

The drive axis press and crankshaft are automatically grease lubricated. Check the grease level of the automatic grease lubricator, and lubricate the automatic grease lubricator if it is low in grease.

NOTICE

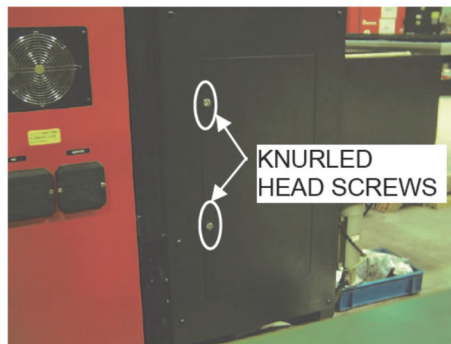
- If the machine is operated with an empty automatic grease lubricator, a lubrication alarm may occur and stop the machine.

The automatic grease lubricator is located in the cover at the T-axis motor side of the machine (or at the electrical enclosure side). Before checking the grease level of the automatic grease lubricator or lubricating it, open the cover. For the procedure for lubricating the automatic grease lubricator and the specified grease, refer to “5. Automatic grease lubricator” later in this Part.

Location of automatic grease lubricator

Remove the circled screws, and open the cover to reveal the automatic grease lubricator as shown below.

T-axis motor side of machine



Automatic grease lubricator



1-1-5. CHECKING RESERVOIR TRAY

The press and crankshaft are automatically grease lubricated by the automatic grease lubricator. The used grease collects in the reservoir tray.

When lubricating the automatic grease lubricator, be sure to remove the reservoir tray and clean it of the collected used grease.

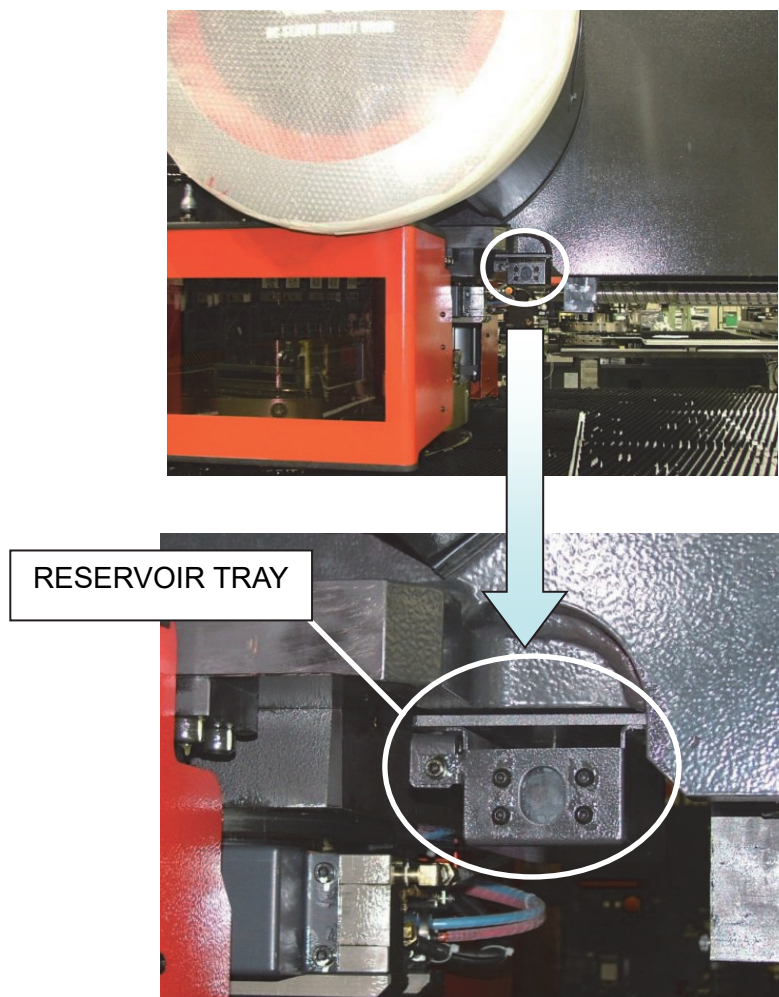
NOTICE

- Unless removed from the reservoir tray, the used grease overfills the reservoir tray and drips down onto the brush table. Before lubricating the automatic grease lubricator, be sure to check the reservoir tray and clean it of the used grease.

NOTE

- When the machine is initially started, the grease takes some time to reach the reservoir tray due to the piping route.

For the procedures for removing the reservoir tray and cleaning it of the used grease, refer to “5-1-2. Cleaning reservoir tray of used grease” later in this Part.



Location of reservoir tray (front of machine)

2. PERIODICAL MAINTENANCE

2-1. Every month

Inspect and maintain machine parts every month as described as well as according to other periodical maintenance programs.

2-1-1. LUBRICATION

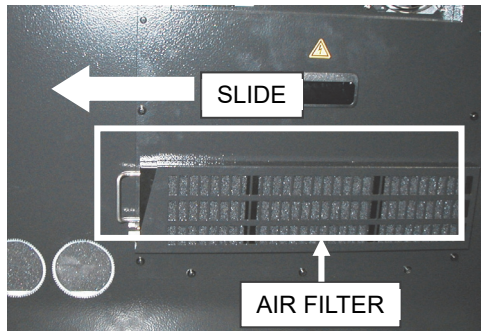
Lubricate the following points with one of the recommended greases. For the lubrication points and recommended greases, refer to “3. Lubrication” in this Part.

- Striker
- X-axis ball nut
- Y-axis ball nut
- Upper/Lower worm axes
- Holder/Die rotation
- Upper/Lower turret index pins
- X-axis guide nut
- Y-axis guide nut
- LM guides under table

2-1-2. CLEANING AMPLIFIER BOX AIR FILTER

The air filter in the air inlet at the rear of the amplifier box can be clogged with dust as it is used. Clean the air filter as described below

- 1 When the power is turned on, press the POWER ON/OFF button to turn it off.
- 2 Turn the machine circuit breaker switch to OFF.
- 3 Slide sideways the air filter at the rear of the amplifier box installed below the rear table, and remove it through the air inlet.
- 4 While lightly shaking the air filter, blow off the dust deposited on the air filter with compressed air from the back of the air filter (or its inside when installed).
- 5 If the air filter is very dirty, soak it in a synthetic detergent solution (2 to 4 g/L) for 5 min or more, and knead it in the solution.



NOTICE

- Do not wring the air filter. After washing it, let it dry in the shade.

- 6 Install the air filter in the air inlet.

NOTICE

- Check that the air filter is securely installed.

2-2. Every three months

Inspect and maintain machine parts every three months as described below as well as according to other periodical maintenance programs.

2-2-1. LUBRICATION

Lubricate the following machine parts. See “3. Lubrication” for their locations and recommended lubricants.

- Upper and lower turret drive chains
- Y-axis gearbox

2-2-2. OTHER MAINTENANCE ITEMS

Check the following items.

Machine is properly leveled

Check that the X- and Y-axes are properly leveled as required to maintain accuracy. For details of the checking procedure, contact AMADA.

Punching accuracy is as specified

Check that the pitch accuracy of holes punched with a single tool is within ± 0.1 mm $\{\pm 0.004$ in. $\}$ in both the X- and Y-axis directions.

Origin accuracy is as specified

Check the accuracy of punched holes from the worksheet edge in both the X- and Y-axes. The edge should be that of a square-cut worksheet.

Lubrication hoses are not damaged

Check that the lubrication hoses are not damaged.

2-3. Every six months

Inspect and maintain machine parts every six months as described below as well as according to other periodical maintenance programs.

2-3-1. ELECTRICAL WIRING

Check the grounding and other cable conductors for loose connections.

2-4. Every year

Inspect and maintain machine parts every year as described below as well as according to other periodical maintenance programs.

2-4-1. CHANGING MEMORY BACKUP BATTERIES

 DANGER	● Ask AMADA to change the backup batteries of the NC unit, servo axis, and drive axis. Changing these batteries involves such dangerous tasks as opening the door of the electrical enclosure with the power to the machine turned on, or going under the table. Do not change the batteries by yourself.
---	---

While the power to the machine is turned off, the contents of the programs, parameters and other data stored in the NC memory and T-, C-, and drive axis origin memories are protected by dedicated batteries. When the batteries run down, the contents stored in the memories may be lost.

Every year or any time when a battery alarm occurs, the associated battery must be changed.

For the batteries used, refer to the following sections.

NC memory battery

 WARNING	● Do not change the NC memory battery by yourself. Ask AMADA to perform this dangerous work.
--	--

NOTICE

- If the power to the machine and NC unit is turned off, the contents of the NC memory will be all lost 30 min after the battery is removed.

When the NC memory battery drops in voltage, the alarm message described below appears on the touch screen. Contact AMADA.

The NC memory battery will be changed by AMADA.

Description of alarm message

COM 4001 NC BATTERY LOW → NC unit battery is low on voltage

NC memory battery: Fanuc lithium battery A02B-0200-K102

The NC memory battery must be changed every year.

Servo axis origin memory batteries



WARNING

- Do not change the servo axis origin memory batteries by yourself. Ask AMADA to perform this dangerous work.

NOTICE

- If the power to the machine and NC unit is turned off, the contents of the servo axis origin memories will be all lost when the batteries are removed.

When the batteries drop in voltage, the alarm message described below appears on the touch screen. Contact AMADA.

The servo axis origin memory batteries will be changed by AMADA.

Description of alarm message

COM 4015 BATTERY (SERVO) → Servo axis origin memory batteries are low on voltage

Servo axis origin memory batteries: Four size D alkaline-manganese batteries (for T- and C-axes)

Drive axis origin memory battery



WARNING

- Do not change the drive axis origin memory battery by yourself. Ask AMADA to perform this dangerous work.

NOTICE

- If the power to the machine and NC unit is turned off, the contents of the drive axis origin memory will be all lost when the battery is removed.

When the drive axis origin memory battery drops in voltage, the alarm message “COM 4015 BATTERY (SERVO)” appears on the touch screen. Contact AMADA.

The drive axis origin memory battery will be changed by AMADA.

Battery: Toshiba Battery ER6V C4 lithium battery × 1

3. LUBRICATION

Lubricate machine parts, add lubricants, or change lubricants as described below during the daily and periodical maintenance operations.

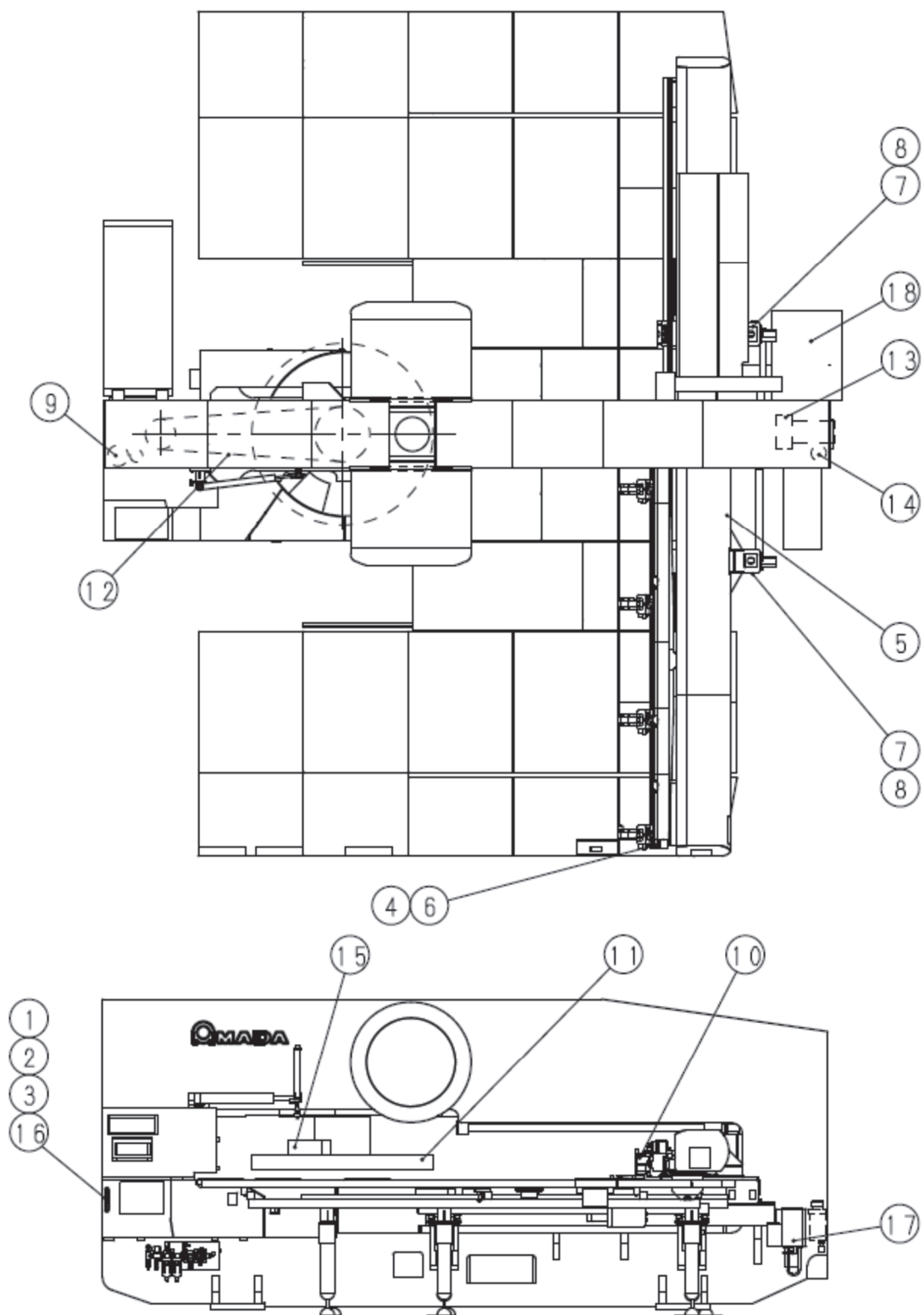
RECOMMENDED LUBRICANTS

- A: Exxon Mobil Teresstic 33, Exxon Mobil DTE Oil Light, or Shell Tellus Oil 32
- B: Exxon Mobil Lidok EP 2, Exxon Mobil Mobilux 2, or Shell Alvania EP Grease 2
- C: Exxon Mobil Lidok EP-0, Exxon Mobil Mobilux EP-0, or Shell Alvania EP Grease R0
- D: AMADA GREASE SRL

NOTE

- For handling the lubricants and their chemical composition and other details, refer to Appendix.

No.	Lubrication point	Type	Source	Frequency
1	Turret index pin (upper)	B	Grease nipple	Monthly
2	Turret index pin (lower)	B	Grease nipple	Monthly
3	Striker	B	Grease nipple	Monthly
4	X-axis ball nut	C	Grease nipple	Monthly
5	Y-axis ball nut	C	Grease nipple	Monthly
6	X-axis guide nut	C	Grease nipple	Monthly
7	Y-axis guide nut	C	Grease nipple	Monthly
8	LM guides under table	C	Grease nipple	Monthly
9	Automatic grease pump	C	Reservoir	Add
10	Workclamps	A	Oil gun	Daily
11	Punches and turret lifter collars	A	Oil gun	Daily
12	Upper and lower turret drive chains	A	Oil gun	Quarterly
13	Y-axis gear box	A	Oil bath	Quarterly
14	Lubricator	A	Oil mist	Replenish
15	Tap gear box	D	Grease nipple	Monthly
16	P&F mechanism	C	Grease nipple	Monthly
17	Oil for repositioning clamp	NCA-250 (Amada)		
18	HYDRAULIC OIL	AS-46 (Amada)		



Some machine parts are equipped with grease nipples.

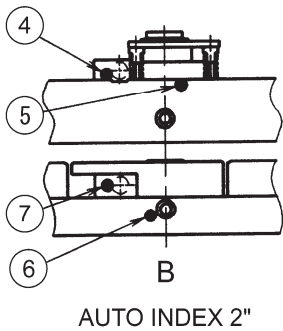
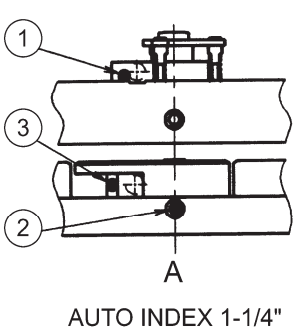
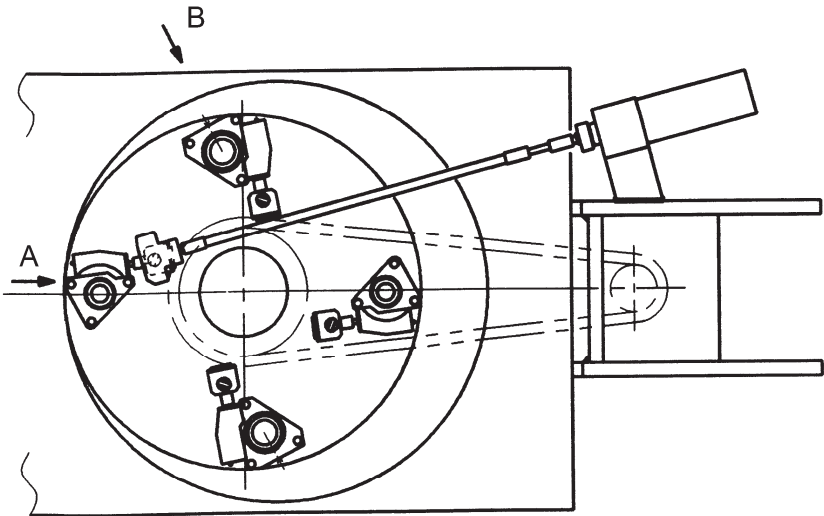
Auto-index devices

Apply one of the recommended lubricants through the grease nipples on the sides of the upper and lower turret disks. The grease nipple on the lower turret disk can be found by removing the die holder.

RECOMMENDED LUBRICANTS

D: Exxon Mobil Beacon 325 or Shell Alvania Grease RA

NOTE					
● For handling the lubricants and their chemical composition and other details, refer to Appendix.					
No.	Lubrication point		Type	Source	Frequency
1	Auto index 1-1/4"	Worm axis (upper)	D	Grease nipple	Monthly
2		Die rotation	D	Grease nipple	Monthly
3		Worm axis (lower)	D	Grease nipple	Monthly
4	Auto index 2"	Worm axis (upper)	D	Grease nipple	Monthly
5		Holder rotation	D	Grease nipple	Monthly
6		Die rotation	D	Grease nipple	Monthly
7		Worm axis (lower)	D	Grease nipple	Monthly



4. ELECTRICAL TROUBLESHOOTING

No.	Trouble	Cause	Remedy
1	NC unit does not turn on.	Fuse at rear of NC unit is blown.	Turn machine circuit breaker switch to OFF, turn off shop circuit breaker switch, and change fuse.
		Machine circuit breaker switch is not set to ON.	Turn it to ON.
2	Message "COM 2018 AIR PRESSURE" is displayed on touch screen.	Air pressure is low.	Adjust air compressor and adjusting valve to specified pressure.
		Pressure switch SP1 is faulty.	Adjust or change it.
3	Machine does not punch.	Machine is stopped.	Clear stop state.
		Index pins are not inserted.	Insert them.
		NC mode is not correct.	Select correct NC mode.
		PRESS SELECT keyswitch is set to OFF.	Turn it to CYCLE.
4	Yellow green square is shown in upper part of icon for punching mode on Device indicator.	Press is not stopped at top dead center.	Press NC RESET button.
5	X- and Y-axes do not operate.	X-gauge block is not lowered.	Lower it.
		Tool change door or doors are open.	Close them.
		Workclamps are open.	Close them.
		STOP button remains pressed.	Press it again or turn it clockwise to clear stop state.

Thermal relays (overload protective relays)

When an overcurrent flows to a motor due to overload, for example, its thermal relay operates to shut off the overcurrent.

Reset the operated thermal relay as described below.

- 1 Press the POWER ON/OFF button to turn of the power of the NC unit.
- 2 Turn the machine circuit breaker switch to OFF.
- 3 Turn off the shop circuit breaker switch.
- 4 Remove the cause of the overload.
- 5 Open the door of the electrical enclosure, and turn on the thermal relay.
- 6 Close the door of the electrical enclosure.
- 7 Turn on the shop circuit breaker switch.
- 8 Turn the machine circuit breaker switch to ON.
- 9 Press the POWER ON/OFF button to turn on the power of the NC unit.

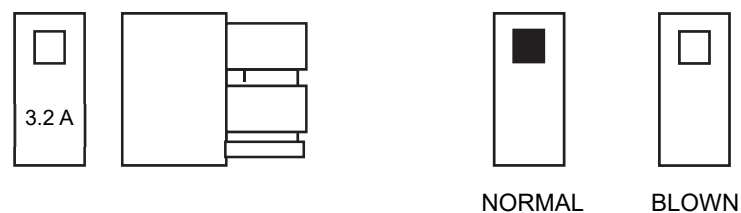
Fuses

The two types of fuses, alarm fuses and circuit protectors, are used in the machine.

Alarm fuses

Alarm fuses changes as shown below when blown.

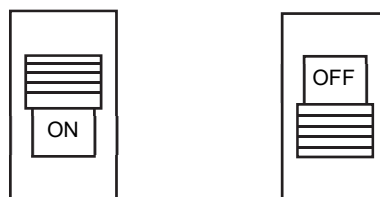
Change the blown fuse with a new one.



Circuit protectors

When an overcurrent flows to a circuit protector, the switch of the circuit protector turns to OFF as shown below.

Remove the cause of the overcurrent, and turn the switch to ON.



5. AUTOMATIC GREASE LUBRICATOR

The drive axis press and crankshaft are grease lubricated by an automatic grease lubricator. The lubrication rate is controlled by the NC unit.

The automatic grease lubricator is located in the cover at the T-axis motor side of the machine (or at the electrical enclosure side). Loosen the knurled head screws, and open the cover. (See the photo right.)

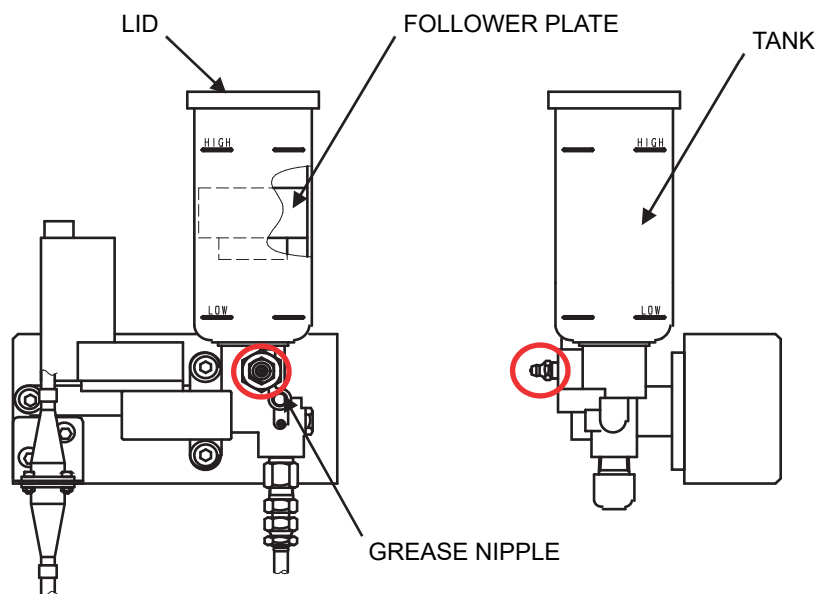


5-1. Adding grease to tank

Add grease to the tank of the automatic grease lubricator through the grease nipple circled in the figure below, using a grease pump.

NOTICE

- Never remove the lid and follower plate from the tank, and add grease from above the tank. Doing so mixes the grease with air and foreign matter and causes the grease supply pump and distribution valve to fail.



NOTE

- The follower plate plays a role in keeping the top grease level flat and allowing the grease level of the tank to be visually checked. HIGH and LOW are marked on the side of the tank. Carefully check these marks when adding grease to the tank.

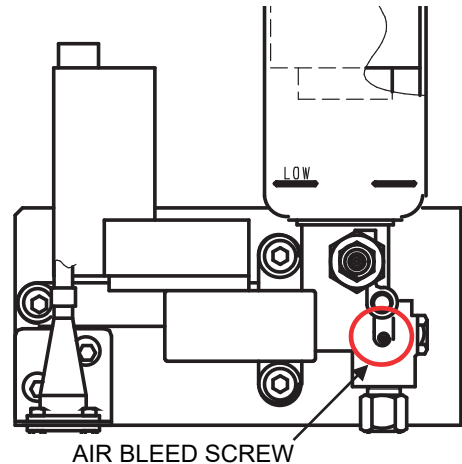
List of specified greases

Model	Manufacturer	Remarks
Lidok EP-0	Exxon Mobil	Specify a 400 cm ³ {13.5 fl.oz.}
Mobilux EP-0		Specify a 400 cm ³ {13.5 fl.oz.}
Alvania EP Grease R0	Shell	Specify a 400 cm ³ {13.5 fl.oz.}

5-1-1. BLEEDING AIR FROM AUTOMATIC GREASE LUBRICATOR

Bleed air from the automatic grease lubricator as described below.
Since air and grease may sometimes spurt out, wear protective goggles when bleeding air from the automatic grease lubricator.

- 1 Remove the second screw (circled in the figure right and called the air bleed screw) below the grease nipple with a flat-blade screwdriver.
- 2 Turn on the machine and NC unit.
- 3 Illuminate the [ON] button under [PANEL] in Common Tools -> [MAINTENANCE] -> [Lubricate Press Axis]. A few seconds later, the [ON] button at [Lubricate Press Axis] extinguishes.



The pump runs, and air bubble-containing grease comes out of the air bleed hole.

Take care that air and grease may sometimes spurt out of the air bleed hole.

- 4 Illuminate the [ON] button at [Lubricate Press Axis] several times until no more air bubble-containing grease comes out of the air bleed hole. When clean grease without air bubbles continuously comes out, the air bleeding procedure is completed.
- 5 Replace the air bleed screw.
- 6 Illuminate the [ON] button at [Lubricate Press Axis] again to check that no grease comes out of the air bleed hole.

5-1-2. CLEANING RESERVOIR TRAY OF USED GREASE

After lubricating the press and crankshaft, the used grease collects in the reservoir tray. When lubricating the automatic grease lubricator, be sure to clean the reservoir tray of the collected used grease.

NOTICE

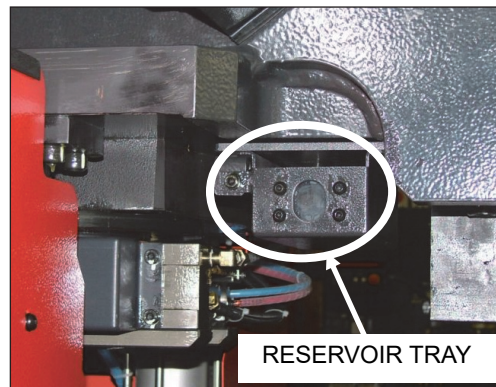
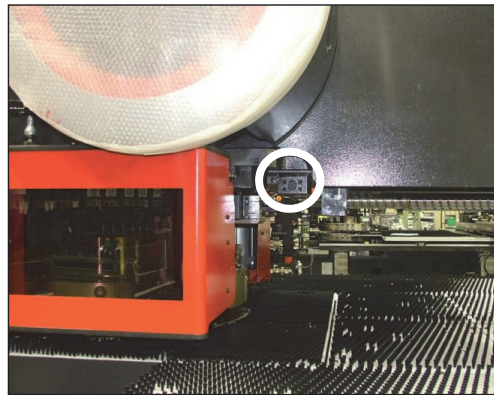
- Unless removed from the reservoir tray, the used grease overfills the reservoir tray and drips onto the brush table.

NOTE

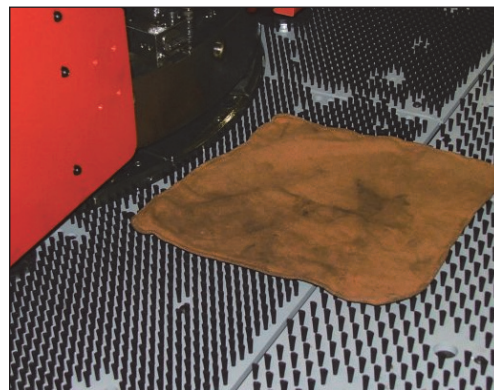
- When the machine is initially started, the grease takes some time to reach the reservoir tray due to the piping route.

Clean the reservoir tray of the used grease as described below.

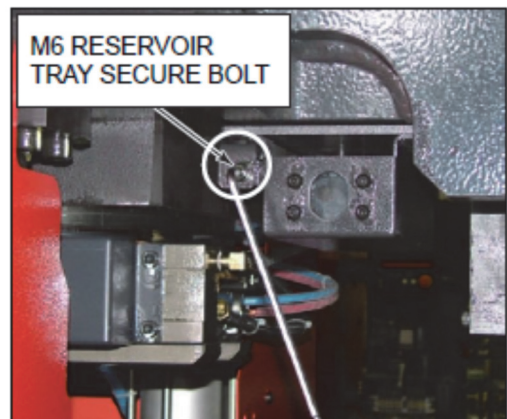
- 1 The reservoir tray is located near the striker at the front of the machine.



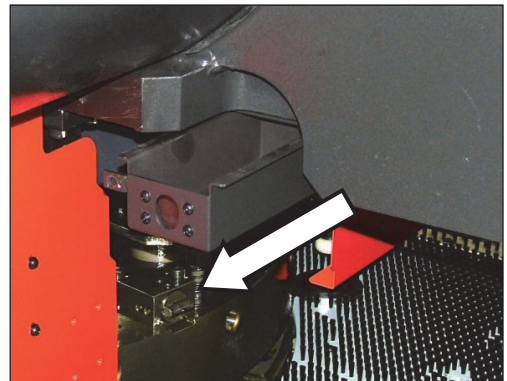
- 2 Place a waste cloth or the like on the brush table to protect it. The used grease may drip onto the brush table.



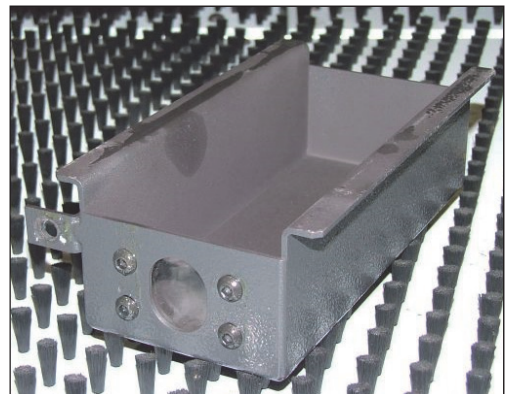
- 3 Loosen and remove the M6 bolt securing the reservoir tray with an Allen wrench (5 mm).



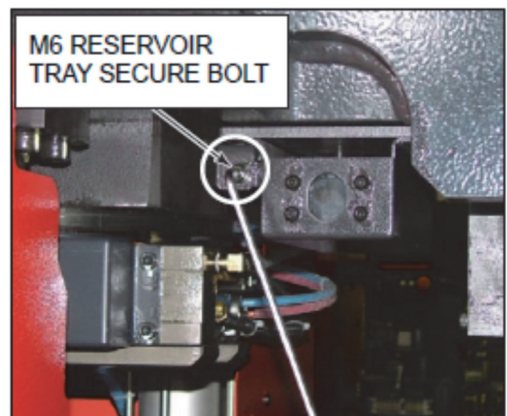
- 4 Pull out the reservoir tray forward.



- 5 Empty the removed reservoir tray of the collected used grease.



- 6 Replace the removed reservoir tray in a reverse procedure. Insert it deep, and securely tighten the M6 bolt to secure it with the Allen wrench (5 mm).



6. MAINTAINING TOOLS

6-1. Checking tools

 WARNING	● If you fail to maintain the tools, not only the tools and machine may break, but also the worksheet may come off the workclamps and fly off the machine. ● When checking the tools, wear safety shoes to provide against an accidental drop of the tools that may result in a serious injury.
--	---

Be sure to observe the following precautions.

- For small-diameter tools (Types A and B), periodically check the punch guide fixing O-rings (retainers) for wear, and change them if necessary.

Recommended O-rings:

P18B for Type A

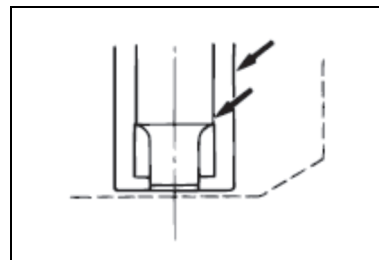
P26B for Type B

- Check the punch guide outside surface for dust buildup, damage, and deformation. If the punch guide is covered with dust, clean it. If the punch guide is damaged or deformed, repair or change it.
- Pass each punch guide through a master gauge to check that the keyway is not damaged or deformed. If the keyway is damaged or deformed, repair or change the punch guide.
- Check the punches and dies for edge wear. If the edge is worn dull, grind it.
- Disassemble each punch, and check that scale is not collected inside. If scale is collected, remove it.
- Check each stripping spring for fatigue. If it is fatigued, change it.

6-2. Lubrication

Before installing the punch in the turret, apply oil to its lubrication points.

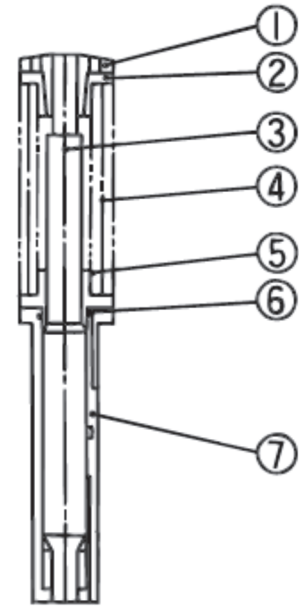
Lubrication points:



6-3. Disassembling and assembling punches (Types A and B)

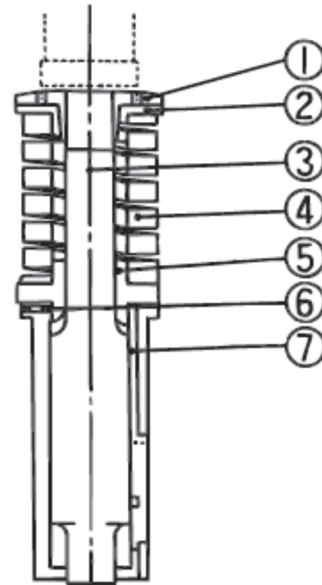
Type A (1/2")

1. Punch head
2. Punch head collar
3. Punch body
4. Stripping spring
5. Retainer collar
6. Retainer ring
7. Punch guide



Type B (1-1/4")

1. Punch head
2. Punch head collar
3. Punch body
4. Stripping spring
5. Retainer collar
6. O-ring (or set screw)
7. Punch guide



6-3-1. DISASSEMBLY

- 1 Remove the punch guide from the punch assembly as shown below. When the punch guide is fastened with the set screw, loosen the set screw, and remove the guide.



When the punch guide is not fastened with the set screw, use the QS pliers to disassemble the punch guide. How to use the QS pliers is described below.

NOTE

- The QS pliers is supplied with the machine. It has two parts. One part is used for Type A (1/2"), and the other is used for Type B (1-1/4").



- (1) Place the QS pliers to the clearance between the retainer collar and the punch guide. The ground surface must be placed on the spring side for easy operation.

Type A



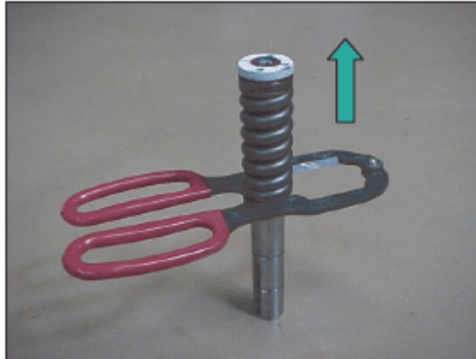
Type B



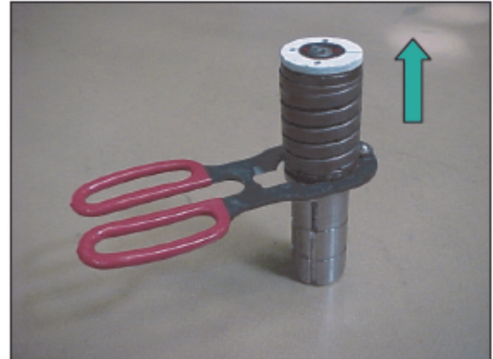
(2) Grip the handle of the QS pliers to the end position.

(3) Remove the punch body from the punch guide.

Type A



Type B



NOTE

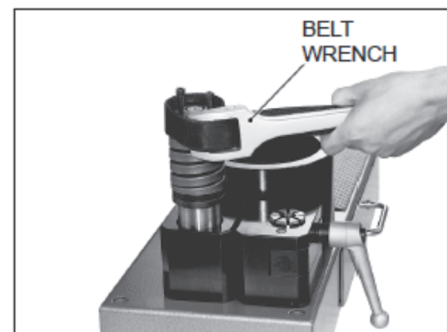
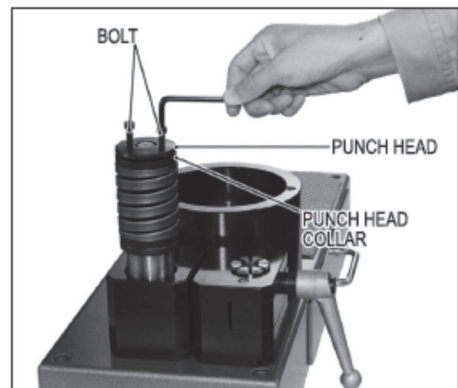
- When using the QS pliers, take care not to get the fingers pinched and injured with the QS pliers.

2 Clamp the punch body in a soft-jaw vise.

3 Install the M5 bolts (for the Type A punch) or the M6 bolts (for the Type B punch) in the two bolt holes in the punch head.

4 Tighten the bolts equally until the clearance between the punch head and its collar is approximately 5 mm (0.2 in.).

5 Loosen the punch head with a belt wrench, and disassemble the punch assembly.

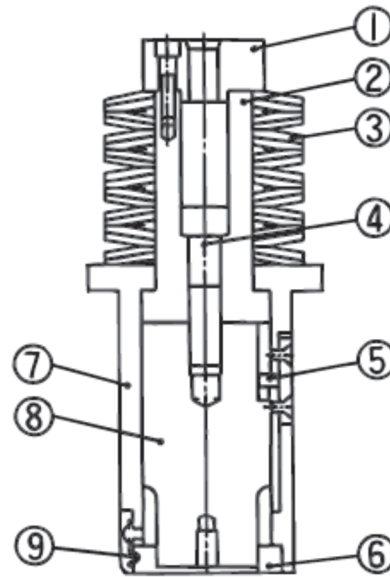


6-3-2. ASSEMBLY

Assemble the retainer collar, stripping spring, punch head collar, and punch head to the punch body. Using the belt wrench, tighten the punch head until the specified punch height is obtained. Apply a coat of oil to the frictional surface of the punch body, and assemble the punch guide to the punch body.

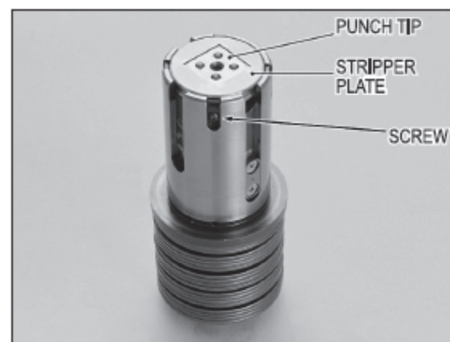
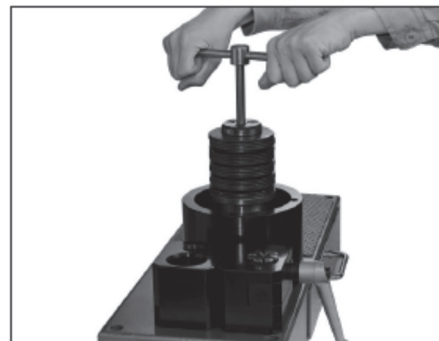
6-4. Removing and installing punch tips (Types C, D, and E)

1. Punch head
2. Punch driver
3. Stripping spring
4. Punch tip clamp bolt
5. Key
6. Stripper plate
7. Punch guide
8. Punch tip
9. Stripper plate spring



6-4-1. REMOVAL

- 1 Clamp the punch assembly in a soft-jaw vise, and loosen the punch tip clamp bolt with a T-wrench.
- 2 Loosen the screws retaining the stripper plate springs, and remove the stripper plate.
- 3 Screw the die remover into the threaded hole of the punch tip, and pull out the punch tip.



6-4-2. INSTALLATION

- 1 Apply a coat of oil to the punch tip, and insert the punch tip into the punch guide.
- 2 Install the stripper plate, and tighten the screws retaining the stripper plate springs.
- 3 Clamp the punch assembly in the soft-jaw vise, and tighten the punch tip clamp bolt securely.

6-5. Regrinding tools

The tools or punches and dies should be reground frequently to extend their service life. Observe the edges of the punch and die to be sure that they are sharp and lustrous. If the edges are rounded or have a frosted appearance, the punch and die should be reground. If grinding is not done frequently at the correct stage of wear, the extra force required by the already frosted edge causes increasingly rapid and intense wear. Proper grinding for one time would be 0.2 mm (0.008 in.) for the punch and 0.1 mm (0.004 in.) for the die. The punch can be ground a maximum of 2 mm (0.08 in.) during its service life, and the die can be ground a maximum of 1 mm (0.04 in.). After the punch and die have been ground, their edges should be finished with an oil stone.

6-6. Adjusting punch and die height

After grinding, the punch and die must be adjusted to their specified height. When adjusting the punch and die height, observe the following instructions:

6-6-1. ADJUSTING PUNCH HEIGHT

Type A and B punches

Turn the punch head with a belt wrench until the specified punch height is obtained.

Specified punch height: 207.5 mm (8.17 in.)

Type C, D and E punches

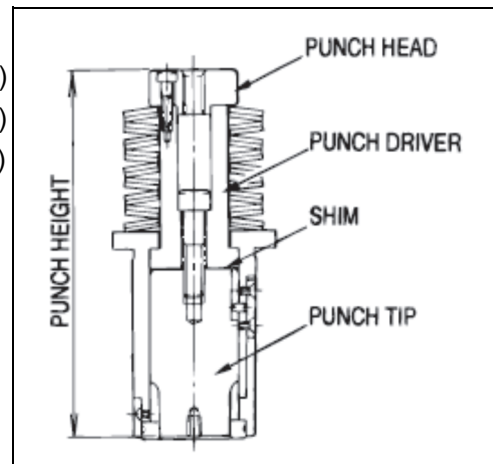
Insert a shim (proportionate to the amount of grinding done) between the punch driver and the punch tip to adjust the punch height to the specification.

Specified punch height:

Type C: 208 mm (8.19 in.)

Type D: 209 mm (8.23 in.)

Type E: 210 mm (8.27 in.)

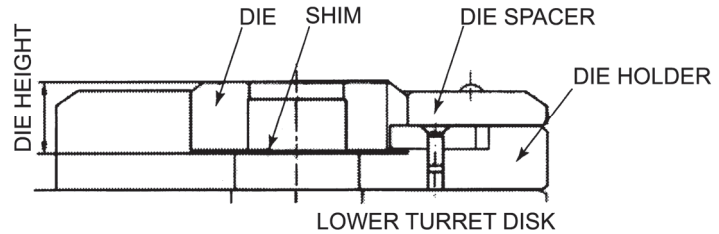


6-6-2. ADJUSTING DIE HEIGHT

Insert a shim (proportionate to the amount of grinding done) between the die holder and the die.

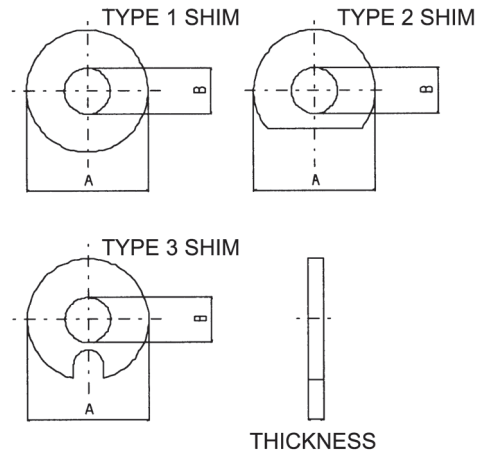
Specified die height:

Types A, B, C, D, and E: 30 mm (1.18 in.)



NOTE

- The above figure (die holder) applies to the King-type turret.



Shim	Type	Size A	Size B	Thickness
For Type C punches	1	40 mm	15 mm	0.4, 0.8, 1.2, 1.6, and 2.0 mm
For Type D punches	3	89 mm	15 mm	Same as above
For Type E punches	3	114 mm	15 mm	Same as above
For Type A dies	1	25 mm	15 mm	0.4, 0.8, and 1.2 mm
For Type B dies	1	47 mm	35 mm	Same as above
For Type C dies	2	88 mm	55 mm	Same as above
For Type D dies	2	125 mm	93 mm	Same as above
For Type E dies	2	158 mm	119 mm	Same as above

6-7. Adjusting height of NEX III punches

Here described is an outline of adjusting the height of NEX III punches. When using the NEX III punches, refer to their operator's manual.

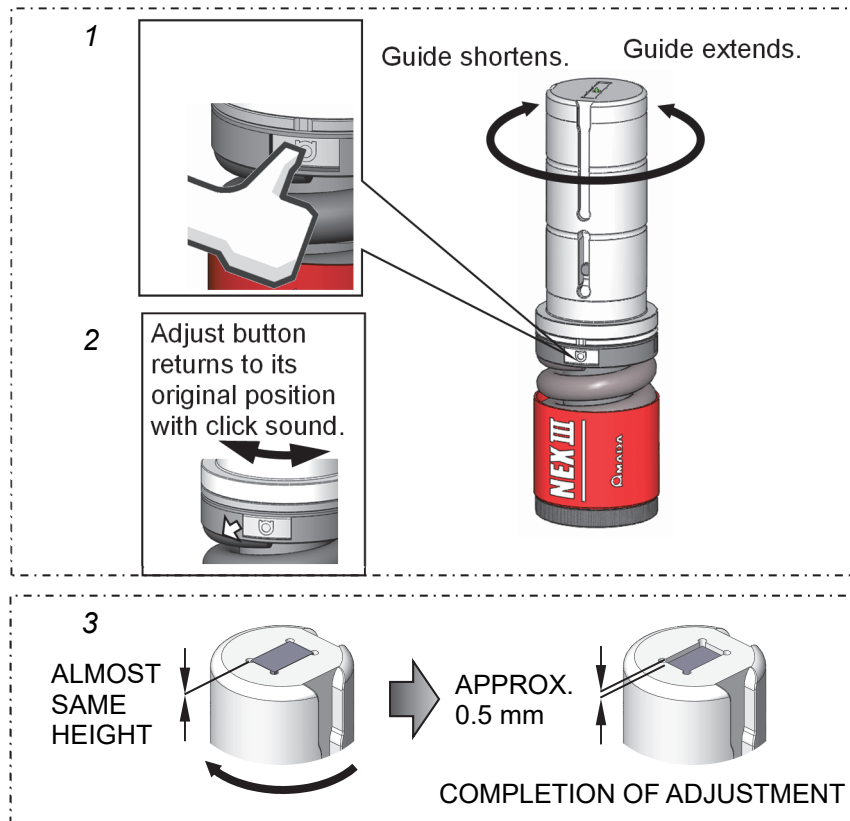
NOTE

- The same use method is applied to the Type A (1/2") and Type B (1-1/4") punches.

- 1 Adjust the punch height by turning the guide while pressing and holding the adjust button.
- 2 Release the adjust button and turn the guide a little. Then, the adjust button returns to its original position with a click sound. Now, the punch height is locked.

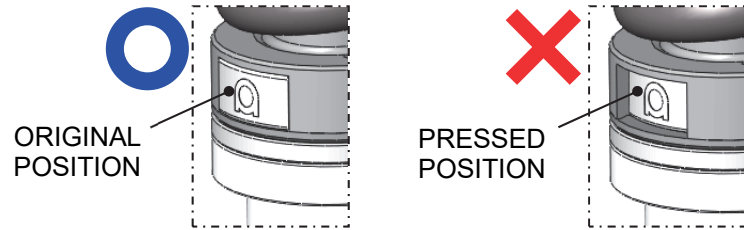
NOTE

- The minimum dimension of the punch height adjustment is 0.15 mm per pitch.
- 3 Align the guide end surface and the punch tip to almost the same height, and turn the guide in its shortening direction while pressing and holding the adjust button. By repeating the operation in Step 2 three or four times, the punch tip surface will shorten approx. 0.5 mm below the guide end surface. Now, the punch height adjustment has completed.



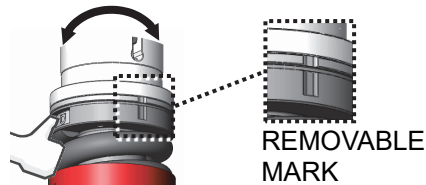
NOTICE

- After the punch height adjustment, check that the adjust button has returned to its original position. When using a punch with the adjust button held pressed, the parts inside the punch may be damaged.

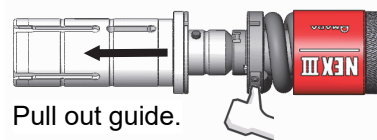


Removing punch body

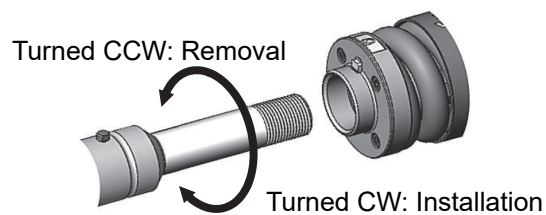
- 1 Turn the guide while pressing and holding the adjust button to match the removable marks on the index plate and the retainer.



- 2 At this position, gently pull out the guide while pressing and holding the adjust button.

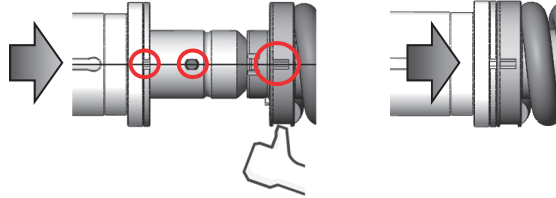


- 3 Turn the punch body counterclockwise (CCW) until it comes off the spring assembly.



Installing punch body

- 1 Insert the punch body into the spring assembly and turn it clockwise (CW) for installation.
- 2 Align the key on the punch body and the removable marks on the index plate and the retainer, and then fully insert the punch body into the guide while pressing and holding the adjust button.

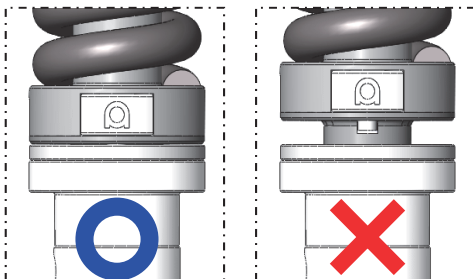


- 3 Adjust the punch height. Refer to “6-7. Adjusting height of NEX III punches” for details.

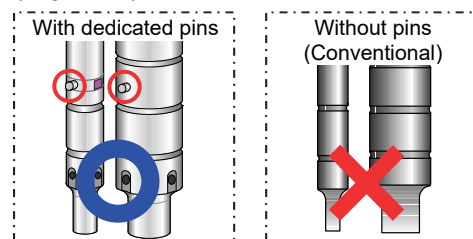
NOTICE

- Before using a punch, check that the spring assembly has been securely installed to the guide. Improper installation may damage the parts inside the punch while it is used. (Figure 1)
- Using a punch with its tip ground more than the specification may damage the punch and the machine.
- For Type A (1/2") and Type B (1-1/4") round punch bodies, use a round punch body with dedicated pins. If a punch body without dedicated pins is used, the punch height may change, damaging the punch and the machine. (Figure 2)

(Figure 1)



(Figure 2)

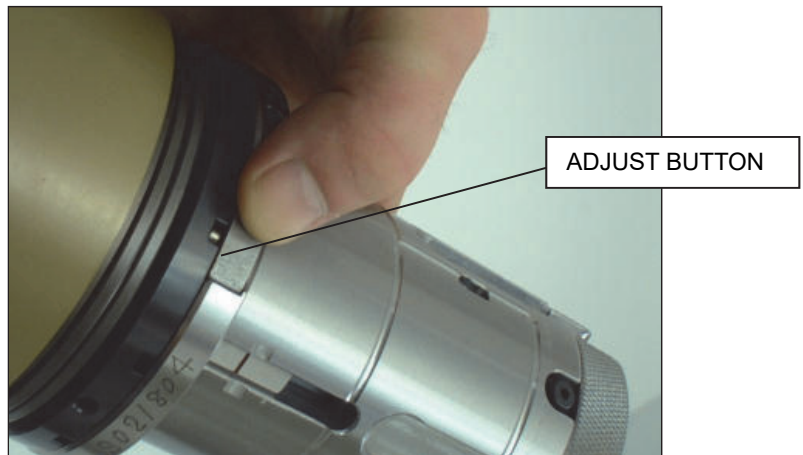


6-8. Adjusting height of Z style guides

Here described are the approximate methods of adjusting the height of Z style guides. When using the Z style guides, refer to their operator's manual.

Type C (2")

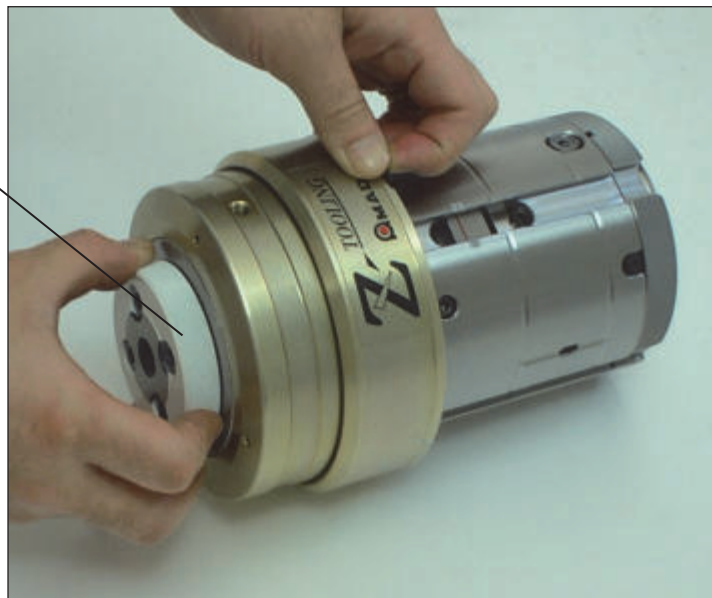
- 1 While pressing and holding the adjust button, turn the punch head to adjust the punch height to 208.0 mm (8.19 in.).
- 2 Release the adjust button, turn the punch head left and right, and check that the punch head clicks and that the adjust button returns to the original position.



Types D (3-1/2") and E (4-1/2")

- 1 While pulling the lock release lever, turn the punch head to adjust the punch height to 209.0 mm (8.23 in.) for Type D and to 210.0 mm (8.27 in.) for Type E.
- 2 Release the lock release lever, turn the punch head left and right, and check that the punch head clicks and that the lock release lever returns to the original position.

TURN PUNCH HEAD



LOCK RELEASE LEVER



7. CHANGING SHEAR PLATE



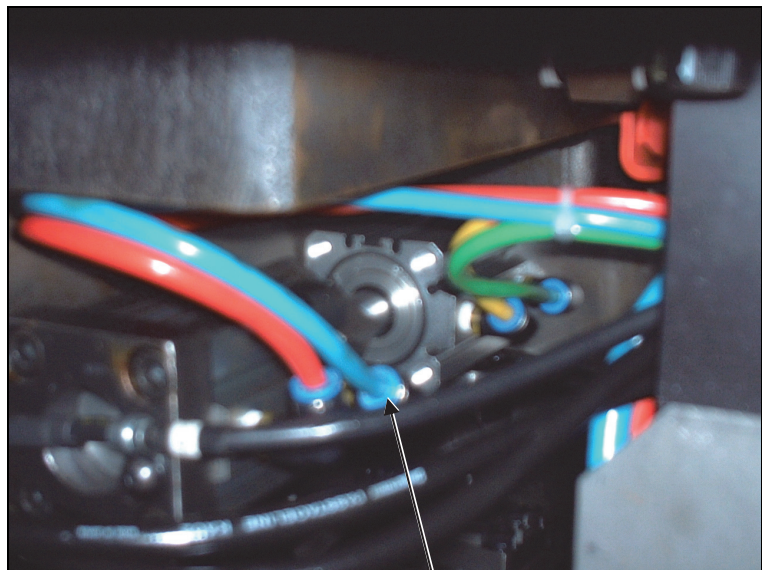
CAUTION

● This work is dangerous. Ask the AMADA service engineer to perform it.

This machine has a shear plate installed between the striker and backup plate for its own protection. When the machine is overloaded during its punching operation, the shear plate breaks to protect the machine from damage.

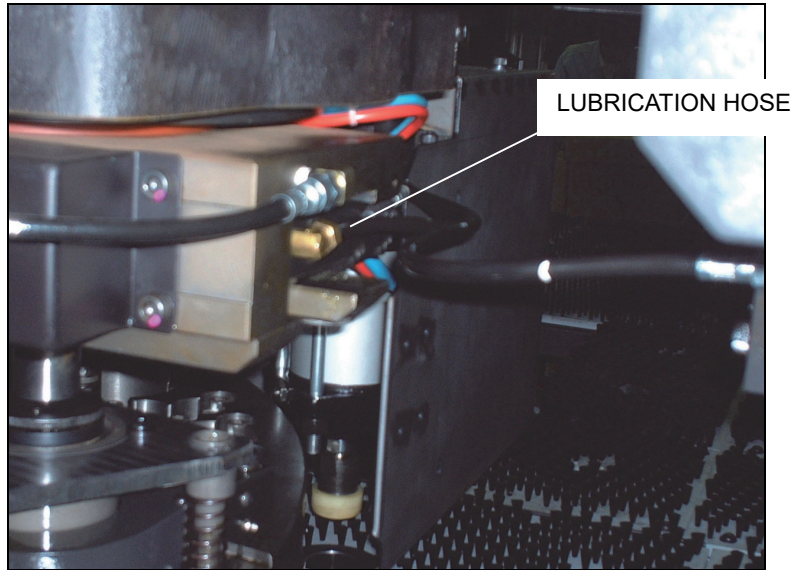
When the shear plate is broken, it must be changed. Contact the AMADA service engineer.

- 1 Remove from the turret the punch installed near the bottom of the striker so that it does not interfere with the removal of the broken shear plate.
- 2 Turn off the power of the NC unit, and turn the machine circuit breaker switch to OFF.
- 3 Turn off the compressed air.
- 4 Remove the air tubes from the four one-touch fittings of the punch positioning air cylinders.



AIR TUBE

- 5 Remove the lubrication hoses and the like.



- 6 Remove the bolts securing the punch holder bracket, and pull out the striker and punch holder together.
- 7 Remove the backup plate.
- 8 Change the broken shear plate.
- 9 Perform steps 1 to 8 above in reverse order to reassemble the removed parts.

NOTE

- Wipe each part clean before reassembly.
 - After reassembly, lubricate the striker with oil.
- 10 Turn on the compressed air.
- 11 Turn the machine circuit breaker switch to ON, and turn on the power of the NC unit.
- 12 Select a tool in the MDI mode, and check that the striker moves smoothly.

8. DISMANTLING AND SCRAPPING

8-1. Disposal of machine body

The body of the machine must be disposed of by a contractor.

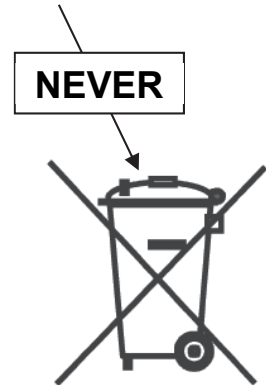
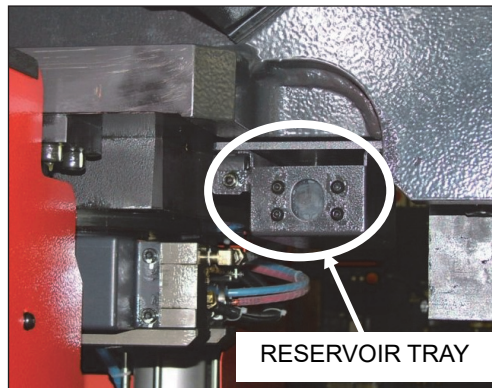
Disassemble parts such as the frame, cover, and table.

Sort the materials into iron, aluminum, and stainless steel and dispose of them appropriately.

8-2. Disposal of grease and oil

The used grease and oil from the machine must be disposed of appropriately by a contractor.

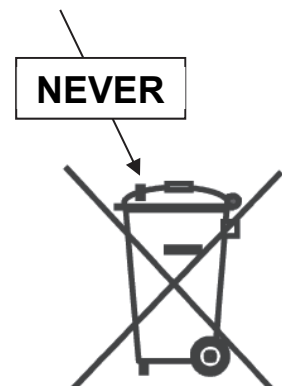
Before the machine components are given to a scrap metal merchant, remove all grease and oil from the components following the requirements of the grease and oil manufacturers.



8-3. Disposal of electrical parts

The control box and other electrical parts must be disposed of appropriately by a contractor.

Before these parts are recycled, remove all batteries and deposit them following the requirements of the manufacturer.



Part 6

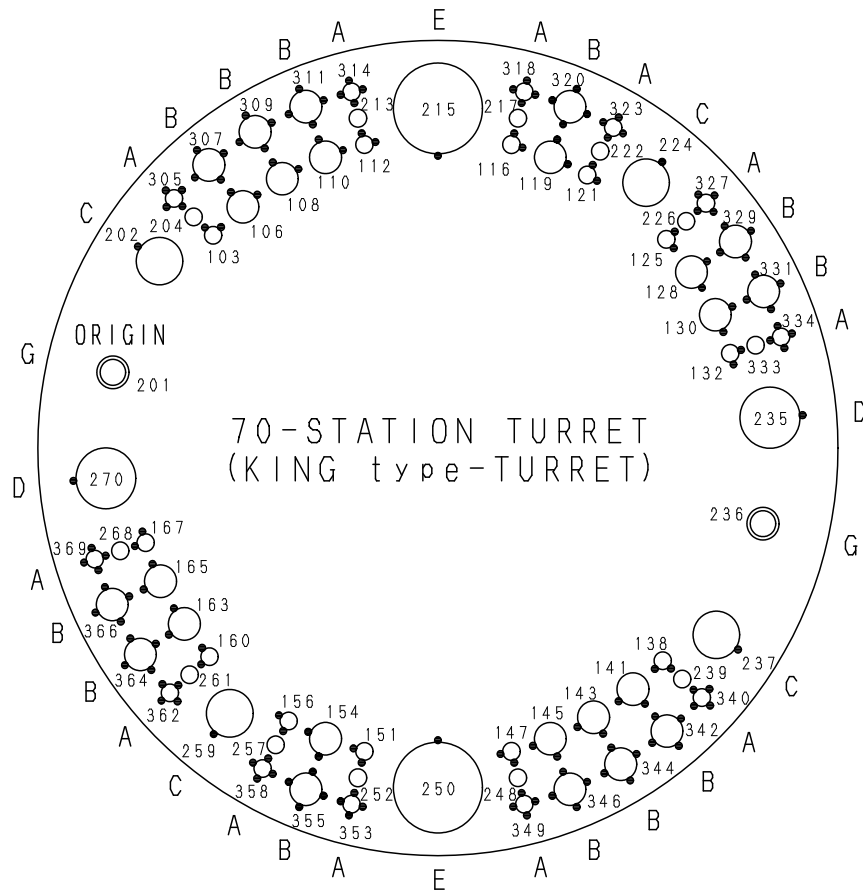
Tooling

Common to EM30 MII series

1. Turret station arrangement	6-2
1-1. 70-station turret (King type-turret)	6-2
1-2. 58-station turret (King type-turret)	6-3
1-3. 58-station turret (Z type-turret)	6-4
1-4. 45-station turret (Z type-turret)	6-5
2. Keys and keyways in tools and turret stations	6-6
2-1. Keys and keyways in tools (standard tools)	6-6
2-2. Keys and keyways in tools (NEX III punches)	6-7
2-3. Keys and keyways in tools (Z style guides)	6-7
2-4. Keys and keyways in turret stations (King type-turret)	6-8
2-5. Keys and keyways in turret stations (Z type-turret)	6-9
3. Punch-to-die clearance	6-10
4. Punching capacity	6-11
4-1. Maximum punchable hole diameter	6-11
4-2. Minimum punchable hole diameter	6-13
4-3. Punching heavy worksheets	6-13
4-3-1. Allowable pressure of tools	6-13
4-3-2. Diameter of holes punchable at allowable pressure	6-14

1. TURRET STATION ARRANGEMENT

1-1. 70-station turret (King type-turret)

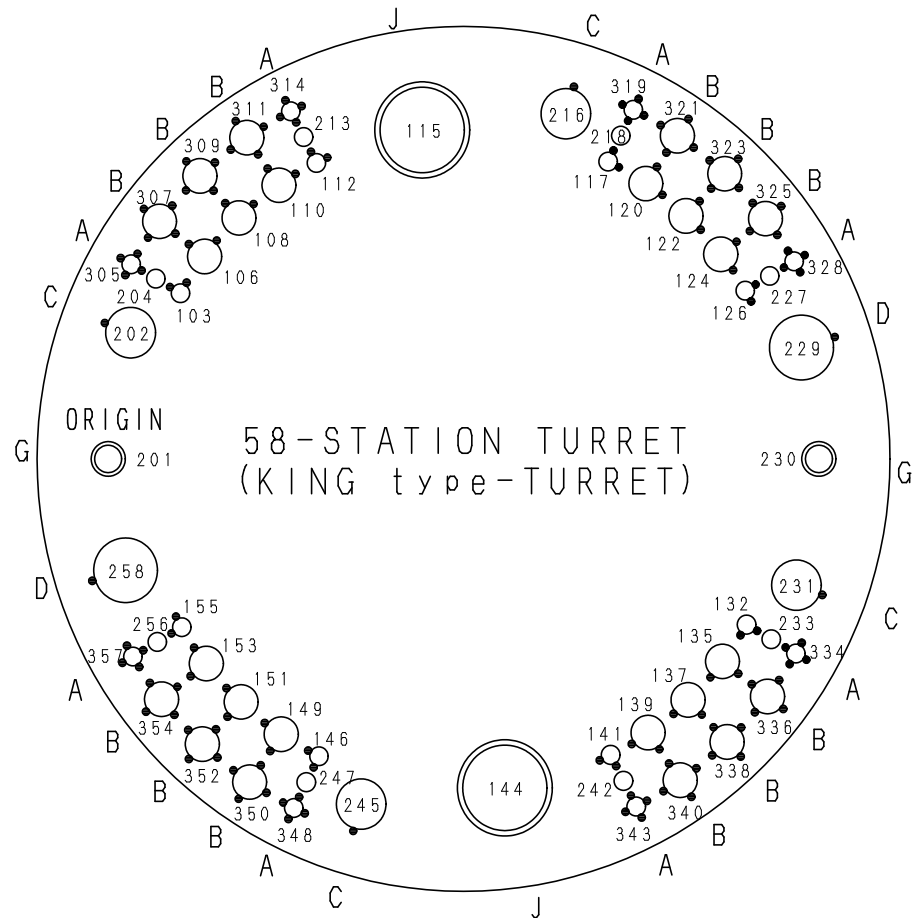


Tool Type	Nominal Tool Size	Standard Punch Size	No. of Stations*
A	1/2"	1.6 – 12.7 mm dia. (0.063" – 0.5" dia.)	36 (24)
B	1-1/4"	12.8 – 31.7 mm dia. (0.501" – 1.25" dia.)	24 (24)
C	2"	31.8 – 50.8 mm dia. (1.251" – 2" dia.)	4 (4)
D	3-1/2"	50.9 – 88.9 mm dia. (2.001" – 3.5" dia.)	2 (2)
E	4-1/2"	89.0-114.3 mm dia (3.501" – 4.5" dia)	2 (2)
G	1-1/4"	12.8 – 31.7 mm dia. (0.501" – 1.25" dia.)	2 (2)

* The numerals in parentheses indicate the number of stations which can accept shaped tools.

G: AUTO-INDEX Station

1-2. 58-station turret (King type-turret)

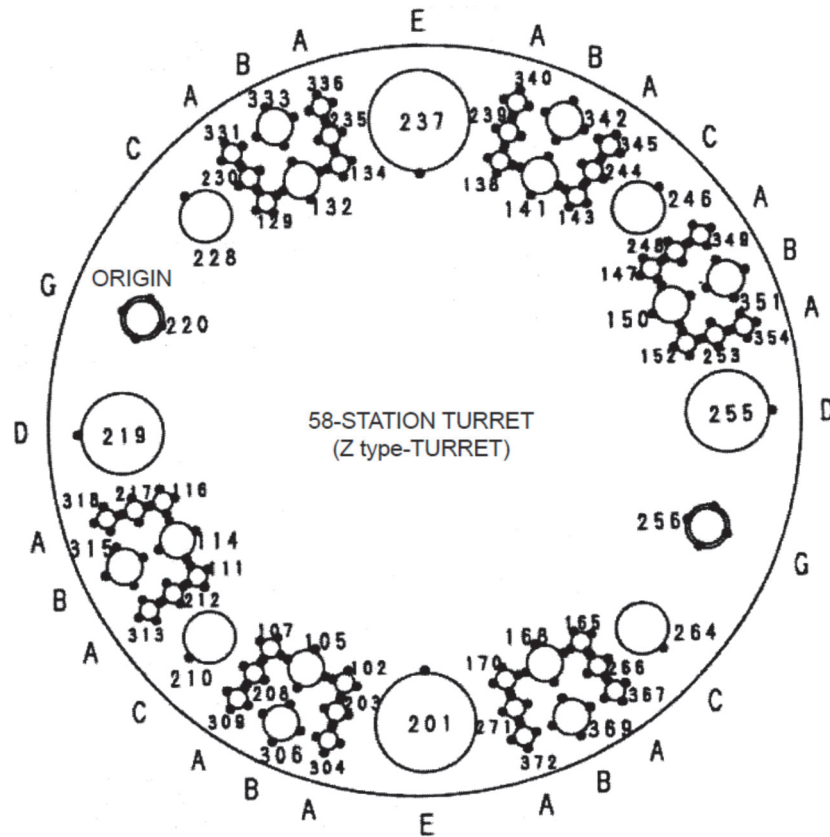


Tool Type	Nominal Tool Size	Standard Punch Size	No. of Stations*
A	1/2"	1.6 – 12.7 mm dia. (0.063" – 0.5" dia.)	24 (16)
B	1-1/4"	12.8 – 31.7 mm dia. (0.501" – 1.25" dia.)	24 (24)
C	2"	31.8 – 50.8 mm dia. (1.251" – 2" dia.)	4 (4)
D	3-1/2"	50.9 – 88.9 mm dia. (2.001" – 3.5" dia.)	2 (2)
G	1-1/4"	12.8 – 31.7 mm dia. (0.501" – 1.25" dia.)	2 (2)
J	4-1/2"	89.0-114.3 mm dia (3.501" – 4.5" dia)	2 (2)

* The numerals in parentheses indicate the number of stations which can accept shaped tools.

G, J: AUTO-INDEX Station

1-3. 58-station turret (Z type-turret)

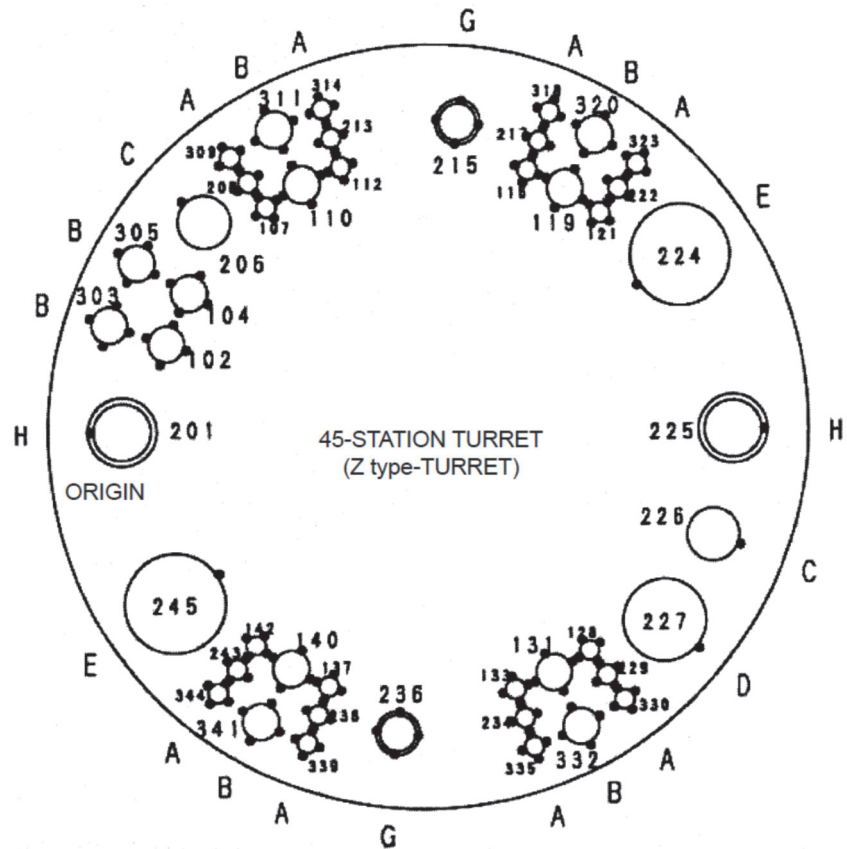


Tool Type	Nominal Tool Size	Standard Punch Size	No. of Stations*
A	1/2"	1.6 – 12.7 mm dia. (0.063" – 0.5" dia.)	36 (36)
B	1-1/4"	12.8 – 31.7 mm dia. (0.501" – 1.25" dia.)	12 (12)
C	2"	31.8 – 50.8 mm dia. (1.251" – 2" dia.)	4 (4)
D	3-1/2"	50.9 – 88.9 mm dia. (2.001" – 3.5" dia.)	2 (2)
E	4-1/2"	89.0-114.3 mm dia (3.501" – 4.5" dia)	2 (2)
G	1-1/4"	12.8 – 31.7 mm dia (0.501" – 1.25" dia)	2 (2)

* The numerals in parentheses indicate the number of stations which can accept shaped tools.

G: AUTO-INDEX Station

1-4. 45-station turret (Z type-turret)



Tool Type	Nominal Tool Size	Standard Punch Size	No. of Stations*
A	1/2"	1.6 – 12.7 mm dia. (0.063" – 0.5" dia.)	24 (24)
B	1-1/4"	12.8 – 31.7 mm dia. (0.501" – 1.25" dia.)	12 (12)
C	2"	31.8 – 50.8 mm dia. (1.251" – 2" dia.)	2 (2)
D	3-1/2"	50.9 – 88.9 mm dia. (2.001" – 3.5" dia.)	1 (1)
E	4-1/2"	89.0-114.3 mm dia (3.501" – 4.5" dia)	2 (2)
G	1-1/4"	12.8 – 31.7 mm dia (0.501" – 1.25" dia)	2 (2)
H	2"	31.8 – 50.8 mm dia (1.251" – 2" dia)	2 (2)

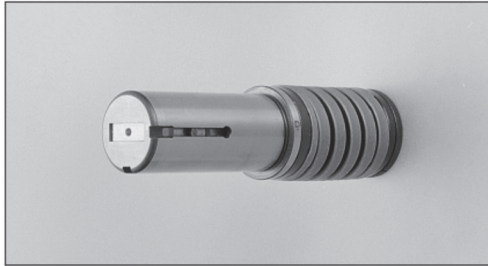
* The numerals in parentheses indicate the number of stations which can accept shaped tools.

G, H: AUTO-INDEX Station

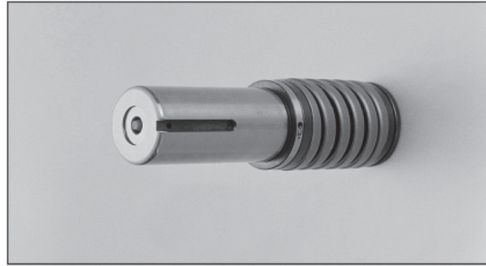
2. KEYS AND KEYWAYS IN TOOLS AND TURRET STATIONS

2-1. Keys and keyways in tools (standard tools)

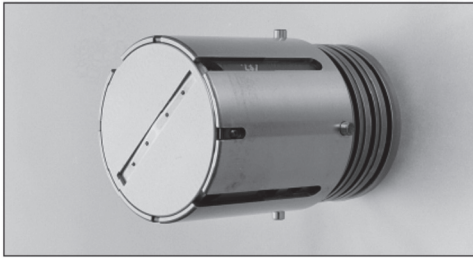
1/2" and 1-1/4" shaped punches:
Two keyways



1/2" and 1-1/4" round punches:
One keyway



2", 3-1/2" and 4-1/2" shaped and round punches:
Two keyways



1/2" and 1-1/4" shaped dies:
One key



1/2" and 1-1/4" round dies:
One key



2", 3-1/2" and 4-1/2" shaped dies:
Two keyways



2", 3-1/2" and 4-1/2" round dies:
One keyway



2-2. Keys and keyways in tools (NEX III punches)

1/2" shaped punches:
Two keyways



1-1/4" shaped punches:
Two keyways



● Round punches have only one keyway.

2-3. Keys and keyways in tools (Z style guides)

2" shaped punches:
Two keyways



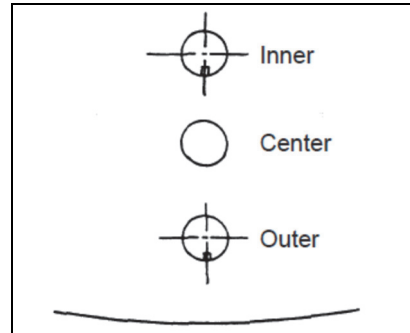
3-1/2" and 4-1/2" shaped punches:
Two keyways



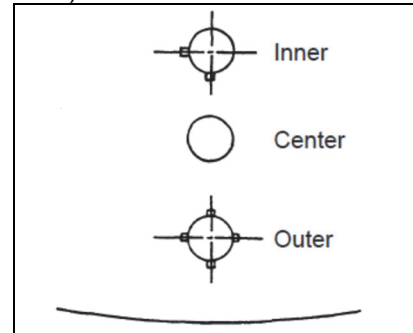
● Round punches have only one keyway.

2-4. Keys and keyways in turret stations (King type-turret)

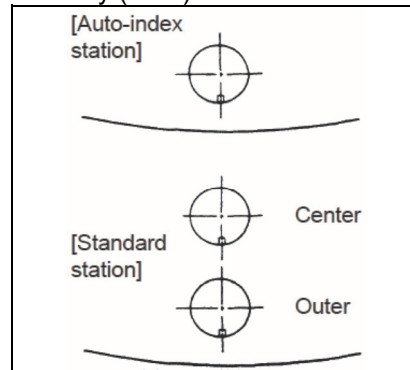
1/2" stations (upper turret disk): One key (270°) in outer track and inner track, and no keys in center track



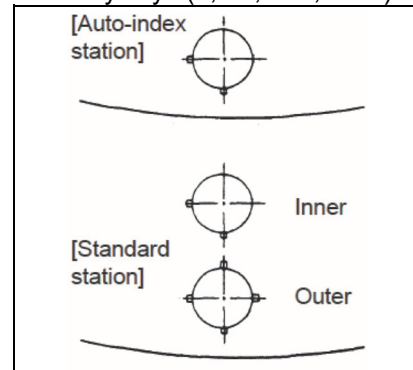
1/2" stations (lower turret disk): Four keyways (0, 90, 180, 270°) in outer track, no keyways in center track, and two keyways (180, 270°) in inner track



1-1/4" stations (upper turret disk): One key (270°)

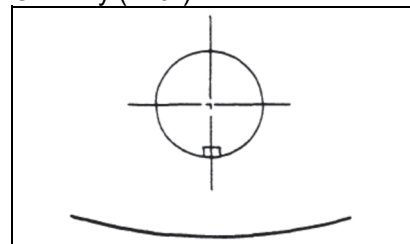


1-1/4" stations (lower turret disk): Four keyways (0, 90, 180, 270°)*

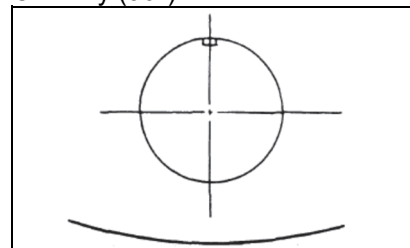


*Two keyways (180, 270°) at auto-index stations

2" and 3-1/2" stations (upper and lower turret disks): One key (270°)

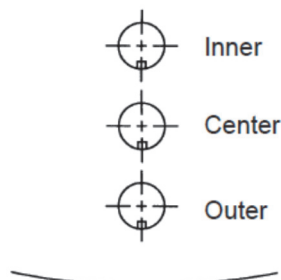


4-1/2" station (upper and lower turret disks): One key (90°)

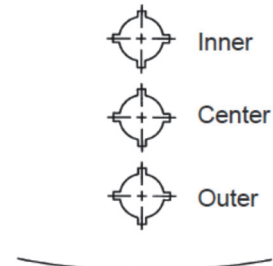


2-5. Keys and keyways in turret stations (Z type-turret)

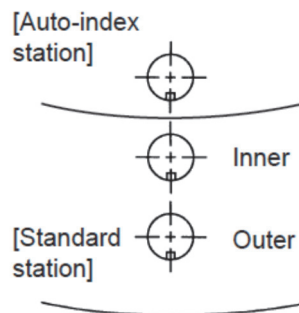
1/2" stations (upper turret disk):
One key (270°) in outer track, center
track and inner track



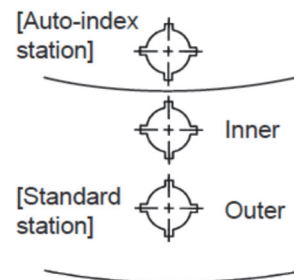
1/2" stations (lower turret disk):
Four keyways (0, 90, 180, 270°) in outer
track, center track and inner track



1-1/4" stations (upper turret disk):
One key (270°)



1-1/4" stations (lower turret disk):
Four keyways (0, 90, 180, 270°)*

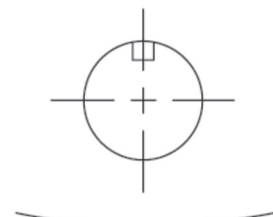


* Four keyways (180, 270°) at auto-index stations

2" and 3-1/2" stations (upper and lower
turret disks):
One key (270°)



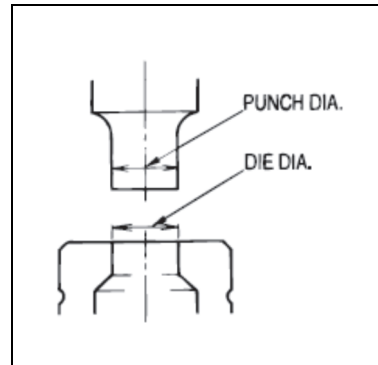
4-1/2" stations (upper and lower turret
disks):
One key (90°)



3. PUNCH-TO-DIE CLEARANCE

The punch-to-die clearance is indicated by the difference between the punch and die diameters. For example, when a 10-mm diameter punch and a 10.3-mm diameter die are used, the clearance is 0.3 mm.

$$10.3 - 10 = 0.3 \text{ (Punch-to-die clearance)}$$



The punch-to-die clearance must be determined according to the thickness and material of the worksheet as shown in the table below.

An excessive or insufficient clearance produces large burrs on the punched part or shortens the tool life. Determine an appropriate clearance as described below.

- The recommended clearance for punching mild steel is 20 to 25% of the worksheet thickness.
- The recommended clearance for punching aluminum is 15 to 20% of the worksheet thickness.
- The recommended clearance for punching stainless steel is 25 to 30% of the worksheet thickness.

Example:

Calculate the clearance for punching a 1.2-mm thick mild steel worksheet as follows:

$$1.2 \text{ mm} \times 0.2 = 0.24 \text{ mm}, 1.2 \text{ mm} \times 0.25 = 0.3 \text{ mm}$$

Thus, the recommended clearance is 0.24 to 0.3 mm.

Worksheet thickness (mm)	Recommended clearance (mm)		
	Mild steel	Aluminum	Stainless steel
0.8	0.15 to 0.2	0.15	0.2 to 0.24
1.0	0.2 to 0.25	0.15 to 0.2	0.25 to 0.3
1.5	0.3 to 0.375	0.225 to 0.4	0.375 to 0.45
2.0	0.4 to 0.5	0.3 to 0.4	0.5 to 0.6
2.5	0.5 to 0.625	0.375 to 0.5	0.625 to 0.75
3.0	0.6 to 0.75	0.45 to 0.6	0.75 to 0.9
3.2	0.65 to 0.8	0.48 to 0.64	0.8 to 0.96
3.5	0.7 to 0.875	0.525 to 0.7	0.875 to 1.05
4.0	0.8 to 1.0	0.6 to 0.8	1.0 to 1.2
4.5	0.9 to 1.125	0.675 to 0.9	1.2 to 1.35
5.0	1.0 to 1.25	0.75 to 1.0	—
5.5	1.1 to 1.375	0.825 to 1.1	—
6.0	1.2 to 1.5	0.9 to 1.2	—

4. PUNCHING CAPACITY

4-1. Maximum punchable hole diameter

The maximum punchable hole diameter is determined by the material and thickness of the worksheet. The punching force required is generally calculated by the following formula:

$$P \text{ (kN)} = \frac{A \text{ (mm)} \times t \text{ (mm)} \times \tau \text{ (N/mm}^2\text{)}}{1000}$$

where, P: Force required

A: Cut edge length

t: Thickness of worksheet

τ : Shearing strength of worksheet

If P does not exceed the press capacity (300 kN), the worksheet is punchable.

Example:

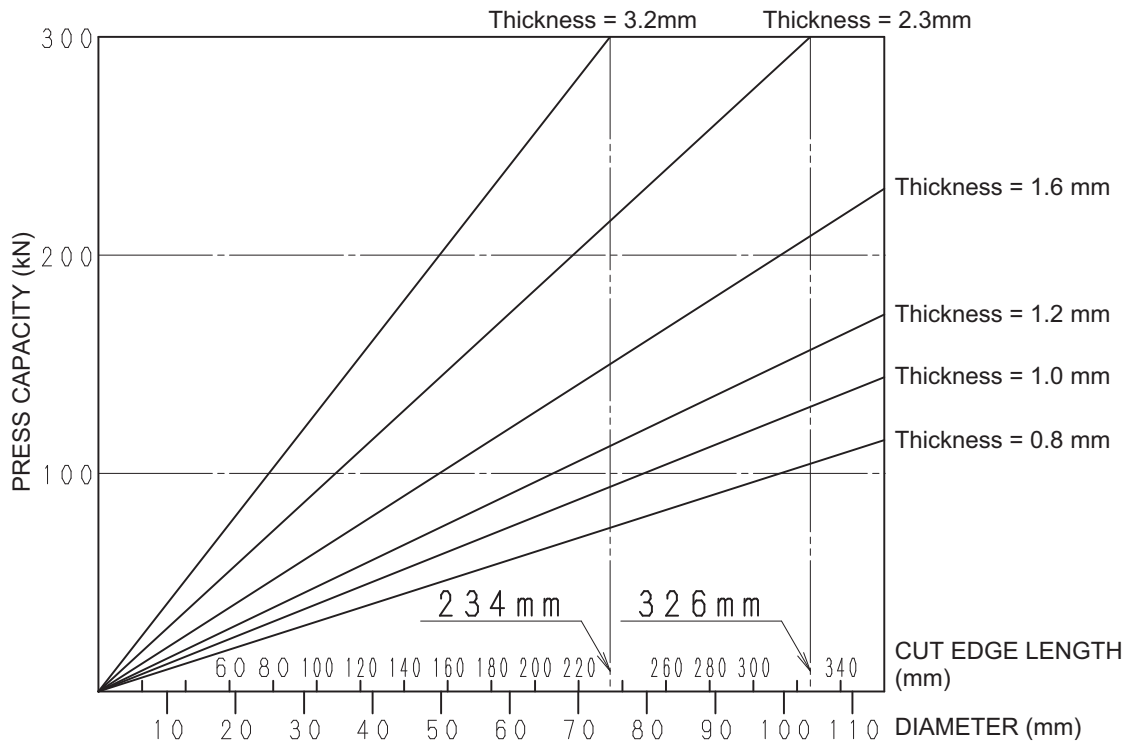
Calculate the maximum punchable hole diameter for a 6-mm thick and 400-N/mm² shearing strength mild steel worksheet as follows:

$$A = P \div (t \times \tau) \times 1000 = 300000 \div (6 \times 400) = 125 \text{ mm}$$

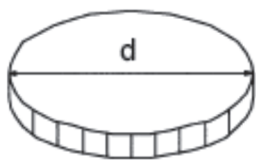
$$125 \div \pi = 39.788\dots$$

Thus, the maximum punchable hole diameter is about 39.7 mm (the cut edge length is about 125 mm).

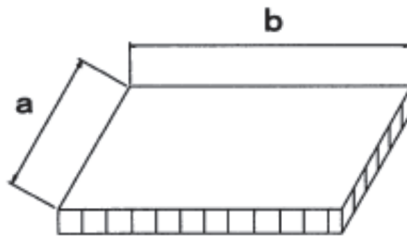
The following graph shows the maximum punchable hole diameters for a variety of worksheet thicknesses. The graph is based on the calculations made for a mild steel with a shearing strength of 400 N/mm².



CUT EDGE LENGTH L:



$$L = \pi d$$



$$L = 2(a + b)$$

4-2. Minimum punchable hole diameter

The following table shows the minimum diameters of punchable holes.

Material	Minimum punchable hole diameter
Mild steel	$1.0 \times t$
Aluminum	$1.0 \times t$
Stainless steel	$2.0 \times t$

t : Thickness of worksheet

Example:

The minimum punchable hole diameter for 2.3-mm thick mild steel is:

$$1.0 \times 2.3 \text{ mm} = 2.3 \text{ mm}$$

4-3. Punching heavy worksheets



WARNING

- Never use tools above their allowable pressure (see the table below). Otherwise they may break and fly off.

When punching heavy worksheets, use tools one size larger than tools used for punching holes of corresponding diameter in light worksheets.

4-3-1. ALLOWABLE PRESSURE OF TOOLS

Tool size	Standard-type tool	Air blow-type tool	Hole diameter for air blow-type tool
Type A (1/2")	60 kN (6 tonf)	45 kN (4.5 tonf)	SPC 3.2 t $\phi 11.5$ SPC 2.0 t $\phi 11.5$
Type B (1-1/4")	170 kN (17 tonf)	160 kN (16 tonf)	SPC 6.0 t $\phi 21.0$ SPC 3.0 t $\phi 28.0$

t: Thickness of worksheet (mm)

4-3-2. DIAMETER OF HOLES PUNCHABLE AT ALLOWABLE PRESSURE

The following tables show the diameters of punchable holes when the shearing strength is assumed to be 400 N/mm² for mild steel and 600 N/mm² for stainless steel.

Unit: mm

	Type A (1/2") Standard		Type A (1/2") Air blow	
Worksheet thickness	Mild steel	Stainless steel	Mild steel	Stainless steel
1.0	φ 12.7	φ 12.7	φ 12.7	φ 12.7
2.0	φ 12.7	φ 12.7	φ 12.7	φ 11.5
3.0	φ 12.7	φ 10.5	φ 12.0	φ 8.0
4.0	φ 11.5	φ 8.0	φ 9.0	NG
5.0	φ 9.5	NG	φ 7.0	NG
6.0	φ 8.0	NG	NG	NG

Unit: mm

	Type B (1-1/4") Standard		Type B (1-1/4") Air blow	
Worksheet thickness	Mild steel	Stainless steel	Mild steel	Stainless steel
1.0	φ 31.7	φ 31.7	φ 30.0	φ 30.0
2.0	φ 31.7	φ 31.7	φ 30.0	φ 30.0
3.0	φ 31.7	φ 30.0	φ 30.0	φ 28.0
4.0	φ 31.7	φ 22.5	φ 30.0	φ 25.0
5.0	φ 27.0	φ 18.0	φ 25.5	φ 17.0
6.0	φ 23.0	φ 15.0	φ 21.0	φ 14.0

Example:

Under the processing conditions shown in the table below, the diameter of punchable holes corresponds to the size of Type B tools (1-1/4"), but use one size larger Type C (2") tools.

Worksheet material	Worksheet thickness (mm)	Hole diameter (mm)
Mild steel (400 N/mm ²)	6.0	12.8 to 31.7
	4.5	12.8 to 31.7
Stainless steel (600 N/mm ²)	4.0	12.8 to 31.7

Appendix

Safety Data Sheets

Common to EM MII series

Amada Grease EP No.0	A-2
Amada AS-46	A-6
Amada Grease SRL	A-10
Shell Tellus Oil SX-Z	A-14
Shell Tellus Oil C32	A-20
Shell Alvania Grease 2	A-24
Shell Alvania EP Grease R0	A-28
Shell Alvania Grease RA	A-31
Tanoi Shincool 99X-Super	A-35

MATERIAL SAFETY DATA SHEET

Note: Read and understand Material Safety Data Sheet before handling or disposing of product.

SECTION 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

NAME OF PRODUCT **AMADA GREASE EPNo.0**
PRODUCT USE **Lubricating grease**
NAME OF COMPANY **AMADA Co. Ltd.**
Address 200 Ishida, Isehara, Kanagawa, Japan
DEPARTMENT Quality Assurance Dept.
TEL 0463-96-3423 FAX 0463-96-3403
EMERGENCY CONTACT Oil Service Division Development Group
TEL 048-281-7767 FAX 048-281-7768
DOCUMENT PREPARED&UPDATED Updated : Oct. 2002

SECTION 2. COMPOSITON/INFORMATION ON INGREDIENTS

COMPOSITION

<u>COMPONENTS</u>	<u>Amount (wt%)</u>
Highly refined petroleum oil	85~95
Thickener(Lithium soap)	< 10
Additives	< 10

JAPANESE COMPOSITION INFORMATION

<u>Labour Safety Law</u> :	<u>Amount (wt%)</u>
169 Mineral oil	90~100%
<u>PRTR Law</u> :	<u>Amount (wt%)</u>
Not Applicable	

SECTION 3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Warning statement:

Caution! Prolonged or repeated contact with skin may cause irritation in some cases.

Precautionary Measures:

Avoid breathing vapor and mist. Keep container closed.
Avoid contact with eyes, skin, and clothing.
Wash thoroughly after handling. Keep away from heat.

Potential health effect:

Eyes: May cause minor irritation.
Skin: May cause minimal skin irritation.
Inhalation: Vapor or mist, in excess of permissible concentrations, or in unusually high concentrations generated from spraying, heating the material, or as from exposure in poorly ventilated areas or confined spaces, may cause irritation of the nose and throat, headache, nausea, and drowsiness.
Ingestion: May cause abdominal discomfort, nausea, or diarrhea.
Sensitization properties: Unknown
Chronic Properties: If prolonged exposure occurs, nausea, headache, diarrhea, and physical discomfort.
Other remarks: None

SECTION 4. FIRST AID MAESURES

Eyes:	Flush immediately with water for at least 15 minutes. Get immediate medical attention.
Skin:	Wash with soap and water. Get medical attention if irritation develops. Launder contaminated clothing before reuse.
Inhalation:	Remove exposed person to fresh air if adverse effects are observed.
Ingestion:	Do not make person vomit unless directed to do so by medical personnel.
Note to physician:	Treat symptomatically.

SECTION 5. FIRE FIGHTIN MEASURES

Flash point (Typical), °C	Not Determined.
Autoignition tempt., °C	Not Determined.
Flammability limits:	Not Determined.
Extinguishing media:	CO ₂ , dry chemical, or foam.
Special fire fighting procedures:	Recommend wearing self-contained breathing apparatus. Water may splattering. Material will float on water.
Unusual fire & explosion hazards:	Toxic fumes, gases or vapors may evolve on burning.
Explosion data:	Material does not have explosive properties.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures in Case of Accidental Release, Breakage or Leakage:

Stop the source of the leak or release. Clean up releases as soon as possible. Contain liquid to prevent further contamination of soil, surface water or groundwater. Clean up small spills using appropriate techniques such as sorbent materials or pumping.

Where feasible and appropriate, remove contaminated soil. Follow prescribed procedures for reporting and responding to larger releases.

SECTION 7. HANDLING AND STRAGE

Do not weld, heat or drill container. Replace cap or bung. Emptied container still contains hazardous material which may ignite with explosive violence if heated sufficiently.

Minimum feasible handling temperatures should be maintained.

Periods of exposure to high temperatures should be minimized.

Water contamination should be avoided.

CAUTION: Do not use pressure to empty drum or drum may rupture with explosive force.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Eye Protection:	Chemical type goggles or face shield optional.
Skin Protection:	Avoid prolonged or frequently repeated skin contact by wearing impervious protective clothing including gloves.
Respiratory Protection:	Wear a breathing mask.
Ventilation:	No special ventilation is usually necessary. However, if operating conditions create high air borne concentrations of this material, special ventilation may be needed.
Other clothing and Equipment:	No special clothing or equipment is usually necessary,
Work practices, hygienic practices:	No information is available.
Other handling and storage requirements:	No information is available.
Protective measures during maintenance of contaminated equipment:	No Data Available.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Odor		Slight odor
Appearance		brown paste
Boiling point	°C	No Data Available
Solubility		Insoluble in water
Density	@15°C, g/cm ³	0.91
Pour point	°C	No Data Available

SECTION 10. STABILITY AND REACTIVITY

Stability:	Stable
Conditions to Avoid:	See the Handling and storage section for further details.
Incompatibility (materials to avoid):	Acids. Oxidizing agents. Halogens and halogenated compounds.
Hazardous Polymerization:	Will not occur
Thermal decomposition:	Smoke, carbon monoxide, aldehydes and other products of incomplete combustion. Hydrogen sulfide and alkyl mercaptans and sulfides may also be released. Under combustion conditions, oxides of the following elements will be formed: Calcium, Sulfur, Zinc.

SECTION 11. TOXICOLOGICAL INFORMATION

Acute Oral:	No Data Available:
Dermal:	No Data Available:
Carcinogen:	OSHA: This material is listed as Group 3 by IARC.
(Base oil)	EU: The classification as a carcinogen need not apply.

SECTION 12. ECOLOGICAL INFORMATION

Biodegradation:	No Data Available
Environmental fate:	This material is not expected to present any environmental problems other than those associated with oil spills.

SECTION 13. DISPOSAL CONSIDERATIONS

Waste Disposal Method:

Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations. Contact local environmental or health authorities for approved disposal of this material.

SECTION 14. TRANSPORT INFORMATION

The description shown may not apply to all shipping situations.

DOT Proper Shipping Name:	Not applicable.
IMDG Proper Shipping Name:	Not applicable.
ICAO Proper Shipping Name:	Not applicable.
TDG Proper Shipping Name:	Not applicable.
NFPA Proper name:	Class 1.
UN Number:	Not applicable.

SECTION 15. REGULATION INFORMATION

JAPANESE REGULATORY INFORMATION

(PRTR) Pollutant Release and Transfer Register.

Industrial Safety and Health Law (Article 57-2, 1, reported objects).

Description of PRTR, Law concerning examination & regulation of manufacture etc. of chemicals, List of chemical name.

Law concerning Industrial Waste Management.

Law concerning marine pollution control and Mineral Oil Effluent Regulation.

Water Pollution Control Law: Oil effluent regulation.

Sewage Water Law: Mineral oil effluent regulation.

Fire Defense Law.

SECTION 16. OTHER INFORMATION

References:

1. Handbook of Toxic and Hazardous Chemicals and Carcinogens (2nd ed.)
2. Registry of Toxic Effects of Chemical Substances (NIOSH, 1983)

Material safety data sheets are provided as reference information on the safe handling of hazardous or harmful materials to companies using such materials. When referring to this data sheet, companies should remember that they must take responsibility for implementing the proper measures for their own particular situations. This data sheet is not a guarantee of safety.

MATERIAL SAFETY DATA SHEET

Note: Read and understand Material Safety Data Sheet before handling or disposing of product.

SECTION 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

NAME OF PRODUCT	AS-46		
PRODUCT USE	Hydraulic fluid		
NAME OF COMPANY	AMADA Co. Ltd.		
ADDRESS	200 Ishida, Isehara, Kanagawa, Japan		
DEPARTMENT	Quality Assurance Dept.		
	TEL	0463-96-3423	FAX 0463-96-3403
EMERGENCY CONTACT	Oil Service Division Development Group		
	TEL	048-281-7767	FAX 048-281-7768
DOCUMENT PREPARED & UPDATED	Updated : Oct. 2004		

SECTION 2. COMPOSITON/INFORMATION ON INGREDIENTS

COMPOSITION

<u>COMPONENTS</u>	<u>Amount (wt%)</u>
Highly refined petroleum oil	–
Additives	–

JAPANESE COMPOSITION INFORMATION

<u>Labour Safety Law</u> :	<u>Amount (wt%)</u>
169 Mineral oil	90~100%
<u>PRTR Law</u> :	<u>Amount (wt%)</u>
Not Applicable	

SECTION 3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Warning statement:

Caution! Prolonged or repeated contact with skin may cause irritation in some cases.

Precautionary Measures:

Avoid breathing vapor and mist. Keep container closed.
Avoid contact with eyes, skin, and clothing.
Wash thoroughly after handling. Keep away from heat.

Potential health effect:

Eyes:	May cause minor irritation.
Skin:	May cause minimal skin irritation.
Inhalation:	Vapor or mist, in excess of permissible concentrations, or in unusually high concentrations generated from spraying, heating the material, or as from exposure in poorly ventilated areas or confined spaces, may cause irritation of the nose and throat, headache, nausea, and drowsiness.
Ingestion:	May cause abdominal discomfort, nausea, or diarrhea.
Sensitization properties:	Unknown
Chronic Properties:	If prolonged exposure occurs, nausea, headache, diarrhea, and physical discomfort.
Other remarks:	None

SECTION 4. FIRST AID MAESURES

Eyes:	Flush immediately with water for at least 15 minutes. Get immediate medical attention.
Skin:	Wash with soap and water. Get medical attention if irritation develops. Launder contaminated clothing before reuse.
Inhalation:	Remove exposed person to fresh air if adverse effects are observed.
Ingestion:	Do not make person vomit unless directed to do so by medical personnel.
Note to physician:	Treat symptomatically.

SECTION 5. FIRE FIGHTIN MEASURES

Flash point (Typical), °C	220(COC)
Autoignition tempt., °C	Not Determined.
Flammability limits:	Not Determined.
Extinguishing media:	CO ₂ , dry chemical, or foam.
Special fire fighting procedures:	Recommend wearing self-contained breathing apparatus. Water may splattering. Material will float on water.
Unusual fire & explosion hazards:	Toxic fumes, gases or vapors may evolve on burning.
Autoignition temperature:	Not determined.
Explosion data:	Material does not have explosive properties.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures in Case of Accidental Release, Breakage or Leakage:

Stop the source of the leak or release. Clean up releases as soon as possible. Contain liquid to prevent further contamination of soil, surface water or groundwater. Clean up small spills using appropriate techniques such as sorbent materials or pumping.

Where feasible and appropriate, remove contaminated soil. Follow prescribed procedures for reporting and responding to larger releases.

SECTION 7. HANDLING AND STRAGE

Do not weld, heat or drill container. Replace cap or bung. Emptied container still contains hazardous material which may ignite with explosive violence if heated sufficiently.

Minimum feasible handling temperatures should be maintained.

Periods of exposure to high temperatures should be minimized.

Water contamination should be avoided.

CAUTION: Do not use pressure to empty drum or drum may rupture with explosive force.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Eye Protection:	Chemical type goggles or face shield optional.
Skin Protection:	Avoid prolonged or frequently repeated skin contact by wearing impervious protective clothing including gloves.
Respiratory Protection:	Wear a breathing mask.
Ventilation:	No special ventilation is usually necessary. However, if operating conditions create high air borne concentrations of this material, special ventilation may be needed.
Other clothing and Equipment:	No special clothing or equipment is usually necessary,
Work practices, hygienic practices:	No information is available.
Other handling and storage requirements:	No information is available.
Protective measures during maintenance of contaminated equipment:	No Data Available.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Odor		Slight odor
Appearance		L1. 0 (ASTM)
Boiling point	°C	No Data Available
Solubility		Insoluble in water
Density	@15°C, g/cm ³	0.873
Pour point	°C	-27.5

SECTION 10. STABILITY AND REACTIVITY

Stability:	Stable
Conditions to Avoid:	See the Handling and storage section for further details.
Incompatibility (materials to avoid):	Acids. Oxidizing agents. Halogens and halogenated compounds.
Hazardous Polymerization:	Will not occur
Thermal decomposition:	Smoke, carbon monoxide, aldehydes and other products of incomplete combustion. Hydrogen sulfide and alkyl mercaptans and sulfides may also be released. Under combustion conditions, oxides of the following elements will be formed: Calcium, Sulfur, Zinc.

SECTION 11. TOXICOLOGICAL INFORMATION

Acute Oral:	No Data Available:
Dermal:	No Data Available:
Carcinogen:	OSHA: This material is listed as Group 3 by IARC.
(Base oil)	EU: The classification as a carcinogen need not apply.

SECTION 12. ECOLOGICAL INFORMATION

Biodegradation:	No Data Available
Environmental fate:	This material is not expected to present any environmental problems other than those associated with oil spills.

SECTION 13. DISPOSAL CONSIDERATIONS

Waste Disposal Method:
Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations. Contact local environmental or health authorities for approved disposal of this material.

SECTION 14. TRANSPORT INFORMATION

The description shown may not apply to all shipping situations.

DOT Proper Shipping Name:	Not applicable.
IMDG Proper Shipping Name:	Not applicable.
ICAO Proper Shipping Name:	Not applicable.
TDG Proper Shipping Name:	Not applicable.
NFPA Proper name:	Class 1.
UN Number:	Not applicable.

SECTION 15. REGULATION INFORMATION

JAPANESE REGULATORY INFORMATION

(PRTR) Pollutant Release and Transfer Register.
Industrial Safety and Health Law (Article 57-2, 1, reported objects).
Description of PRTR, Law concerning examination & regulation
of manufacture etc. of chemicals, List of chemical name.
Law concerning Industrial Waste Management.
Law concerning marine pollution control and Mineral Oil Effluent Regulation.
Water Pollution Control Law: Oil effluent regulation.
Sewage Water Law: Mineral oil effluent regulation.
Fire Defense Law.

SECTION 16. OTHER INFORMATION

References:

1. Handbook of Toxic and Hazardous Chemicals and Carcinogens (2nd ed.)
2. Registry of Toxic Effects of Chemical Substances (NIOSH, 1983)

Material safety data sheets are provided as reference information on the safe handling of hazardous or harmful materials to companies using such materials. When referring to this data sheet, companies should remember that they must take responsibility for implementing the proper measures for their own particular situations. This data sheet is not a guarantee of safety.

MATERIAL SAFETY DATA SHEET

Note: Read and understand Material Safety Data Sheet before handling or disposing of product.

SECTION 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

NAME OF PRODUCT AMADA GREASE SRL
PRODUCT USE Lubricating grease
NAME OF COMPANY AMADA Co. Ltd.
ADDRESS 200 Ishida, Isehara, Kanagawa, Japan
DEPARTMENT Quality Assurance Dept.
TEL 0463-96-3423 FAX 0463-96-3403
EMERGENCY CONTACT Oil Service Division Development Group
TEL 048-281-7767 FAX 048-281-7768
DOCUMENT PREPARED&UPDATED Updated : Oct. 2004

SECTION 2. COMPOSITON/INFORMATION ON INGREDIENTS

COMPOSITION

<u>COMPONENTS</u>	<u>Amount (wt%)</u>
Synthetic ester oil	80~90
Thickener(Lithium soap)	5~15
Additives	<5

JAPANESE COMPOSITION INFORMATION

<u>Labour Safety Law</u> :	<u>Amount (wt%)</u>
Not Applicable	
<u>PRTR Law</u> :	<u>Amount (wt%)</u>
Not Applicable	

SECTION 3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Warning statement:

Caution! Prolonged or repeated contact with skin may cause irritation in some cases.

Precautionary Measures:

Avoid breathing vapor and mist. Keep container closed.
Avoid contact with eyes, skin, and clothing.
Wash thoroughly after handling. Keep away from heat.

Potential health effect:

Eyes: May cause minor irritation.
Skin: May cause minimal skin irritation.
Inhalation: Vapor or mist, in excess of permissible concentrations, or in unusually high concentrations generated from spraying, heating the material, or as from exposure in poorly ventilated areas or confined spaces, may cause irritation of the nose and throat, headache, nausea, and drowsiness.
Ingestion: May cause abdominal discomfort, nausea, or diarrhea.
Sensitization properties: Unknown
Chronic Properties: If prolonged exposure occurs, nausea, headache, diarrhea, and physical discomfort.
Other remarks: None

SECTION 4. FIRST AID MAESURES

Eyes:	Flush immediately with water for at least 15 minutes. Get immediate medical attention.
Skin:	Wash with soap and water. Get medical attention if irritation develops. Launder contaminated clothing before reuse.
Inhalation:	Remove exposed person to fresh air if adverse effects are observed.
Ingestion:	Do not make person vomit unless directed to do so by medical personnel.
Note to physician:	Treat symptomatically.

SECTION 5. FIRE FIGHTIN MEASURES

Flash point (Typical), °C	Not Determined.
Autoignition tempt., °C	Not Determined.
Flammability limits:	Not Determined.
Extinguishing media:	CO ₂ , dry chemical, or foam.
Special fire fighting procedures:	Recommend wearing self-contained breathing apparatus. Water may splattering. Material will float on water.
Unusual fire & explosion hazards:	Toxic fumes, gases or vapors may evolve on burning.
Explosion data:	Material does not have explosive properties.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures in Case of Accidental Release, Breakage or Leakage:

Stop the source of the leak or release. Clean up releases as soon as possible. Contain liquid to prevent further contamination of soil, surface water or groundwater. Clean up small spills using appropriate techniques such as sorbent materials or pumping.

Where feasible and appropriate, remove contaminated soil. Follow prescribed procedures for reporting and responding to larger releases.

SECTION 7. HANDLING AND STRAGE

Do not weld, heat or drill container. Replace cap or bung. Emptied container still contains hazardous material which may ignite with explosive violence if heated sufficiently.

Minimum feasible handling temperatures should be maintained.

Periods of exposure to high temperatures should be minimized.

Water contamination should be avoided.

CAUTION: Do not use pressure to empty drum or drum may rupture with explosive force.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Eye Protection:	Chemical type goggles or face shield optional.
Skin Protection:	Avoid prolonged or frequently repeated skin contact by wearing impervious protective clothing including gloves.
Respiratory Protection:	Wear a breathing mask.
Ventilation:	No special ventilation is usually necessary. However, if operating conditions create high air borne concentrations of this material, special ventilation may be needed.
Other clothing and Equipment:	No special clothing or equipment is usually necessary,
Work practices, hygienic practices:	No information is available.
Other handling and storage requirements:	No information is available.
Protective measures during maintenance of contaminated equipment:	No Data Available.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Odor		Slight odor
Appearance		Light brown paste
Boiling point	°C	No Data Available
Solubility		Insoluble in water
Density	@15°C, g/cm ³	0.97
Pour point	°C	No Data Available

SECTION 10. STABILITY AND REACTIVITY

Stability:	Stable
Conditions to Avoid:	See the Handling and storage section for further details.
Incompatibility (materials to avoid):	Acids. Oxidizing agents. Halogens and halogenated compounds.
Hazardous Polymerization:	Will not occur
Thermal decomposition:	Smoke, carbon monoxide, aldehydes and other products of incomplete combustion. Hydrogen sulfide and alkyl mercaptans and sulfides may also be released. Under combustion conditions, oxides of the following elements will be formed: Calcium, Sulfur, Zinc.

SECTION 11. TOXICOLOGICAL INFORMATION

Acute Oral:	No Data Available:
Dermal:	No Data Available:
Carcinogen:	Not listed IARC, NTP, ACGIH

SECTION 12. ECOLOGICAL INFORMATION

Biodegradation:	No Data Available
Environmental fate:	This material is not expected to present any environmental problems other than those associated with oil spills.

SECTION 13. DISPOSAL CONSIDERATIONS

Waste Disposal Method:
Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations. Contact local environmental or health authorities for approved disposal of this material.

SECTION 14. TRANSPORT INFORMATION

The description shown may not apply to all shipping situations.

DOT Proper Shipping Name:	Not applicable.
IMDG Proper Shipping Name:	Not applicable.
ICAO Proper Shipping Name:	Not applicable.
TDG Proper Shipping Name:	Not applicable.
NFPA Proper name:	Class 1.
UN Number:	Not applicable.

SECTION 15. REGULATION INFORMATION

JAPANESE REGULATORY INFORMATION

(PRTR) Pollutant Release and Transfer Register.

Industrial Safety and Health Law (Article 57-2, 1, reported objects).

Description of PRTR, Law concerning examination & regulation of manufacture etc. of chemicals, List of chemical name.

Law concerning Industrial Waste Management.

Law concerning marine pollution control and Mineral Oil Effluent Regulation.

Water Pollution Control Law: Oil effluent regulation.

Sewage Water Law: Mineral oil effluent regulation.

Fire Defense Law.

SECTION 16. OTHER INFORMATION

References:

1. Handbook of Toxic and Hazardous Chemicals and Carcinogens (2nd ed.)
2. Registry of Toxic Effects of Chemical Substances (NIOSH, 1983)

Material safety data sheets are provided as reference information on the safe handling of hazardous or harmful materials to companies using such materials. When referring to this data sheet, companies should remember that they must take responsibility for implementing the proper measures for their own particular situations. This data sheet is not a guarantee of safety.

Safety Data Sheet

Issued: March 23, 2004

SHELL TELLUS OIL SX-Z

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY

Product name: SHELL TELLUS OIL SX-Z
Product type: Hydraulic oil
Supplier: Showa Shell Sekiyu K.K.
Address: Dalba Frontier Building,3-2,Dalba 2 Chome,
Minato-ku,Tokyo 135,JAPAN
Contact numbers:
Telephone: 03-5531-5766
Telex: J 22373
Fax: 03-5531-5768
Emergency telephone number:
Showa Shell Sekiyu K.K. 03-5531-5766

2. COMPOSITION/INFORMATION ON INGREDIENTS

Preparation description: Blend of synthetic hydrocarbons and additives.
Dangerous components/constituents: On the basis of available information, the components of this preparation are not expected to impart hazardous properties to this product.

3. HAZARDS IDENTIFICATION

Human health hazards: No specific hazards under normal use conditions. Prolonged or repeated exposure may give rise to dermatitis. Used product may contain harmful impurities.
Safety hazards: Not classified as flammable, but will burn.
Environmental hazards: Not readily biodegradable. Expected to have a high potential to bioaccumulate.
Other Information: Not classified as dangerous for supply or conveyance.

4. FIRST AID MEASURES

Symptoms and effects: Not expected to give rise to an acute hazard under normal conditions of use.
First Aid - Inhalation: In the unlikely event of dizziness or nausea, remove casualty to fresh air. If symptoms persist, obtain medical attention.
First Aid - Skin: Remove contaminated clothing and wash affected skin with soap and water. If persistent irritation occurs, obtain medical attention.

First Aid - Eye:	If high pressure injection injuries occur, obtain medical attention immediately. Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
First Aid - Ingestion:	Wash out mouth with water and obtain medical attention. DO NOT INDUCE VOMITING.
Advice to physicians:	Treat symptomatically. Aspiration into the lungs may result in chemical pneumonitis. Dermatitis may result from prolonged or repeated exposure.

5. FIRE FIGHTING MEASURES

Specific hazards:	Combustion is likely to give rise to a complex mixture of airborne solid and liquid particulates and gases, including carbon monoxide, oxides of sulphur, and unidentified organic and inorganic compounds.
Extinguishing media:	Foam and dry chemical powder. Carbon dioxide, sand or earth may be used for small fires only.
Unsuitable extinguishing media:	Water in a jet. Use of Halon extinguishers should be avoided for environmental reasons.
Protective equipment:	Proper protective equipment including breathing apparatus must be worn when approaching a fire in a confined space.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions:	Avoid contact with: skin and eyes.
Personal protection:	Wear impermeable gloves and boots.
Environmental precautions:	Prevent from spreading or entering into drains, ditches or rivers by using sand, earth, or other appropriate barriers. Inform local authorities if this cannot be prevented.
Clean-up methods - small spillage:	Absorb liquid with sand or earth. Sweep up and remove to a suitable, clearly marked container for disposal in accordance with local regulations.
Clean-up methods - large spillage:	Prevent from spreading by making a barrier with sand, earth or other containment material. Reclaim liquid directly or in an absorbent. Dispose of as for small spills.

7. HANDLING AND STORAGE

Handling:	When handling product in drums, safety footwear should be worn and proper handling equipment should be used. Prevent spillages.
Storage:	Keep in a cool, dry, well-ventilated place. Use properly labelled and closable containers. Avoid direct sunlight, heat sources, and strong oxidizing agents.
Storage temperature:	0°C minimum to 50°C maximum.
Recommended materials:	For containers or container linings, use: mild steel or high density polyethylene.
Unsuitable materials:	For containers or container linings, avoid: PVC.
Other information:	Polyethylene containers should not be exposed to high temperatures because of possible risk of distortion.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering control measures:	Use local exhaust ventilation if there is a risk of inhalation of vapours, mists or aerosols.
Occupational exposure standards:	No data available.
Hygiene measures:	Wash hands before eating, drinking, smoking and using the toilet.
Respiratory protection:	Not normally required. If oil mist cannot be controlled, a respirator fitted with an organic vapour cartridge combined with a particulate pre-filter should be used.
Hand protection:	PVC or nitrile rubber gloves.
Eye protection:	Wear safety glasses or full face shield if splashes are likely to occur.
Body protection:	Minimise all forms of skin contact. Wear overalls to minimise contamination of personal clothing. Launder overalls and undergarments regularly.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state:	Liquid at ambient temperature.
Colour:	Pale yellow liquid
Odour:	Characteristic mineral oil
Initial boiling point:	No data available.
Vapour pressure:	< 0.5 Pa at 20°C
Density:	See Table 1
Vapour density (air=1):	> 1 at 20°C
Pour point:	See Table 1
Flash point:	See Table 1
Flammability limit - lower:	1% V/V (typical)

Flammability limit - upper:	10% V/V (typical)
Auto-ignition temperature:	No data available.
Solubility in water:	Negligible

10. STABILITY/REACTIVITY

Stability:	Stable
Conditions to avoid:	Extremes of temperature and direct sunlight.
Materials to avoid:	Strong oxidizing agents
Hazardous decomposition products:	Hazardous decomposition products are not expected to form during normal storage.

11. TOXICOLOGICAL INFORMATION

Basis for assessment:	Toxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the toxicology of similar products.
Acute toxicity - oral:	No data available.
Acute toxicity - dermal:	No data available.
Acute toxicity - Inhalation:	No data available.
Eye Irritation:	Expected to be slightly irritant.
Skin irritation:	Expected to be slightly irritant.
Respiratory irritation:	If mists are inhaled, slight irritation of the respiratory tract may occur.
Skin sensitization:	Not expected to be a skin sensitizer
Carcinogenicity:	Product is based on mineral oils of types shown to be non-carcinogenic in animal skin-painting studies. Other components are not known to be associated with carcinogenic effects.
Mutagenicity:	Not considered to be a mutagenic hazard.
Other Information:	Prolonged and/or repeated contact with this product can result in defatting of the skin, particularly at elevated temperatures. This can lead to irritation and possibly dermatitis, especially under conditions of poor personal hygiene. Skin contact should be minimised. Used oils may contain harmful impurities that have accumulated during use. The concentration of such impurities will depend on use and they may present risks to health and the environment on disposal. ALL used oil should be handled with caution and skin contact avoided as far as possible.

12. ECOLOGICAL INFORMATION

Basis for assessment:	Ecotoxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the ecotoxicology of similar products.
Mobility:	Liquid under most environmental conditions. Floats on water. If it enters soil, it will adsorb to soil particles and will not be mobile.
Persistence/degradability:	No data available.
Bioaccumulation:	Has the potential to bioaccumulate.
Ecotoxicity:	No data available.

13. DISPOSAL CONSIDERATIONS

Waste disposal:	Recycle or dispose of in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the contractor to deal satisfactorily with this type of product should be established beforehand.
Container disposal:	200 litre drums should be emptied and returned to the supplier or sent to a drum reconditioner without removing or defacing markings or labels. Non-reusable small metal and plastic containers should be recycled where possible, or disposed of as domestic refuse.

14. TRANSPORT INFORMATION

Not dangerous for conveyance under UN, IMO, ADR/RID and IATA/ICAO codes.

15. REGULATORY INFORMATION

EC Classification:	Not classified as Dangerous under EC criteria
EINECS (EC):	All components listed or polymer exempt.
TSCA (USA):	All components listed.
MITI(JAPAN):	All components listed.

16. OTHER INFORMATION

Uses and restrictions: For hydraulic applications requiring an anti-wear oil.
Technical contact point: Technical Support Team , Lubricants & Bitumen Division
Technical contact number:
Telephone: 03-5531-5766
Telex: J 22373
Fax: 03-5531-5768

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not be construed as guaranteeing any specific property of the product.

TABLE 1: SHELL TELLUS OIL SX-Z

SHELL TELLUS OIL SX-Z	32	46
Density, kg/m ³ at 15°C	831	834
Pour point, °C	<-40.0	<-40.0
Flash point, °C (COC)	258	262

SAFETY DATA SHEET

SHELL TELLUS OIL C32

1. NAME

PRODUCT: Tellus Oil C32

CHEMICAL NAME: Petroleum Hydrocarbons

2. PRODUCT/INGREDIENT

	<u>percent</u>	<u>toxicity</u>
Tellus Oil C32	100	not available
Severely refined petroleum hydrocarbons	ca.99	oil mist, TWA ACGIH/OSHA 5 mg/m ³ oral LD ₅₀ > 15 g/kg(rat) estimated

Based upon data available to Showa Shell this product is not considered to be carcinogenic under OSHA HAZARD COMMUNICATION STANDARD (29 CFR 1910, 1200) (IARC MONOGRAPH 33).

3. HEALTH INFORMATION

ROUTE OF ENTRY:

Eye contact: Expected, at worst, to be minimally irritating to the skin.

Skin contact: Prolonged or repeated skin contact may cause skin irritation.

Inhalation: No specific information.

Ingestion: No specific information.

SIGNS AND SYMPTOMS:

Irritation as above.

AGGRAVATED MEDICAL CONDITIONS:

Pre-existing skin disorder may be aggravated by exposure to this product.

OTHER HEALTH EFFECTS:

This specific product has not been tested in long-term chronic exposure tests.

Lubricating oils are generally considered to be a low order of acute toxicity to humans and experimental animals. However, the handling procedures and safety precautions in this MSDS should be followed to minimize employee' exposure.

4. OCCUPATIONAL EXPOSURE LIMITS

OSHA		ACGIH		OTHER
PEL/TWA	PEL/CEILING	TLV/TWA	TLV/STEL	
		5 mg/m ³	...	
	(OIL MIST, mineral	Severely refined)		

5. EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT:

Flush with water for 15 minutes while holding eyelids open. Get medical attention.

SKIN CONTACT:

Remove contaminated clothing and wipe excess off. Wash with soap and water or waterless hand cleaner followed by soap and water. Do not re-use clothing until thoroughly cleaned. If irritation persists, get medical attention promptly to prevent serious damage; do not wait for symptoms to develop.

INHALATION:

Remove victim to fresh air and provide oxygen if breathing is difficult. Get medical attention.

INGESTION: Get medical attention.

6. SUPPLEMENTAL INFORMATION

Not identified.

7. PHYSICAL DATA

Boiling Point °C: NA

Specific Gravity: ca. 0.87 at 15/4 °C

% Volatile by wt: NA

Vapour Density: > 1 (air = 1)

Appearance: pale yellow liquid

Solubility in water: negligible

Odour: characteristic odour

8. FIRE AND EXPLOSION HAZARDS

Flash Point (COC) °C: 226

Flammable Limit % vol in air: NA

EXTINGUISHING MEDIA: Use water fog, dry chemical or CO₂.

SPECIAL FIRE FIGHTING PROCEDURES AND PRECAUTIONS:

Do not enter confined fire space without proper protective equipment including a NIOSH approved self-contained breathing apparatus. Cool fire exposed container, surrounding equipment and structures with water.

9. REACTIVITY

Stability: Stable

Hazardous polymerization: Will not occur

Conditions and Materials to avoid: Strong oxidizers

Hazardous decomposition product:

NO_x, SO_x, CO, and other unidentified oxygenates can be formed during combustion.

10. EMPLOYEE PROTECTION

RESPIRATORY PROTECTION:

A NIOSH approved respiratory protection equipment should be used when vapour or mist concentration exceeds applicable standards.

PROTECTIVE CLOTHING:

Use oil resistant gloves and other clothing as minimize skin contact.

VENTILATION: Mechanical equipment

EYE PROTECTION:

Normal industrial eye protection equipment should be employed.

11. ENVIRONMENTAL PROTECTION

SPILL OR LEAK PROCEDURE:

Prevent entry into sewers and waterways. Pick up free liquid for disposal. Absorb small amount on inert material for disposal.

WASTE DISPOSAL:

Dispose of in an appropriate disposal facility in compliance with appropriate regulations.

12. SPECIAL PRECAUTIONS

Store in a cool, dry place with adequate ventilation. Keep away from open flames and high temperature. Minimize skin contact. Wash with soap and water before eating, drinking, smoking or using toilet facilities.

Laundry contaminated clothing before using. Discard leather goods if they cannot be decontaminated. Wash before eating or smoking. Observe good personal hygiene.

13. OTHER REGULATORY

All components of this product are listed on the EPA/TSCA inventory of chemical substances.

The information contained herein is based on the data available to Showa Shell and is believed to be correct. However, Showa Shell makes no warranty, expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Showa Shell assumes no responsibility for injury from the use of the product described herein.

DATE PREPARED: 22nd August, 1994

SAFETY DATA SHEET

SHELL ALVANIA GREASE 2

1. NAME

PRODUCT: SHELL ALVANIA GREASE 2

CHEMICAL NAME: LUBRICATING GREASE

2. PRODUCT/INGREDIENT

	<u>percent</u>	<u>toxicity</u>
SHELL ALVANIA GREASE 2	100	not available
Solvent Refined petroleum hydrocarbons	balance	oil mist, TWAACGIH/OSHA 5 mg/m ³ estimated oral LD ₅₀ > 5 g/kg (rat) estimated dermal LD ₅₀ > 2 g/kg
Lithium hydroxystearate	ca. 9	
Aromatic Amine	1	oral LD ₅₀ 1.6 g/kg (rat)
Sodium Nitrite	0.8	oral LD ₅₀ 180 mg/kg (rat)

Based upon data available to Showa Shell this product is not hazardous under OSHA HAZARD COMMUNICATION (29 CFR 1910, 1200)

3. HEALTH INFORMATION

ROUTE OF ENTRY:

Eye contact: May be irritating to the eyes.

Skin contact: Prolonged or repeated skin contact may cause skin irritation.

Inhalation: No specific information.

Ingestion: No specific information.

SIGNS AND SYMPTOMS:

Irritation as above.

AGGRAVATED MEDICAL CONDITIONS:

Pre-existing skin disorder may be aggravated by exposure to this product.

OTHER HEALTH EFFECTS:

This specific product has not been tested in long-term chronic exposure tests. The handling procedures and safety precautions in this MSDS should be followed to minimize employee' exposure.

4. OCCUPATIONAL EXPOSURE LIMITS

OSHA		ACGIH		OTHER
PEL/TWA	PEL/CEILING	TLV/TWA	TLV/STEL	

No OSHA/PEL or ACGIH/TLV has been established.

5. EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT:

Flush with water for 15 minutes while holding eyelids open. Get medical attention.

SKIN CONTACT:

Remove contaminated clothing and wipe excess off. Wash with soap and water or waterless hand cleaner followed by soap and water. Do not re-use clothing until thoroughly cleaned. If irritation persists, get medical attention promptly to prevent serious damage; do not wait for symptoms to develop.

INHALATION:

Remove victim to fresh air and provide oxygen if breathing is difficult. Get medical attention.

INGESTION: Get medical attention.

6. SUPPLEMENTAL INFORMATION

Not identified.

7. PHYSICAL DATA

Boiling Point °C: NA

Specific Gravity: NA

Vapour Pressure: NA

Vapour Density: NA

Appearance & Odour: amber color, slight odour grease

Solubility in water: insoluble

Melting Point: NA

8. FIRE AND EXPLOSION HAZARDS

Flash Point (COC) °C: 210 for base oil

Flammable Limit % vol in air: LEL:NA ; UEL:NA

EXTINGUISHING MEDIA:

Use water fog, dry chemical or CO₂. Do not use direct stream of water. Product will float and can be reignited on surface water.

SPECIAL FIRE FIGHTING PROCEDURES AND PRECAUTIONS:

Do not enter confined fire space without proper protective equipment including a NIOSH approved self-contained breathing apparatus. Cool fire exposed container, surrounding equipment and structures with water.

9. REACTIVITY

Stability: Stable

Hazardous polymerization: Will not occur

Conditions and Materials to avoid: Strong oxidizers

Hazardous decomposition product:

NO_x, SO_x, CO_x, and other unidentified oxygenates can be formed during combustion.

10. EMPLOYEE PROTECTION

RESPIRATORY PROTECTION:

A NIOSH approved respiratory protection equipment should be used when vapour or mist concentration exceeds applicable standards.

PROTECTIVE CLOTHING:

Use oil resistant gloves and other clothing as minimize skin contact.

11. ENVIRONMENTAL PROTECTION

SPILL OR LEAK PROCEDURE:

Scoop up excess grease. Clean area with appropriate cleaner.

WASTE DISPOSAL:

Dispose of in an appropriate disposal facility in compliance with appropriate regulations.

12. SPECIAL PRECAUTIONS

Store in a cool, dry place with adequate ventilation. Keep away from open flames and high temperature. Minimize skin contact. Wash with soap and water before eating, drinking, smoking or using toilet facilities.

Launder contaminated clothing before using. Discard leather goods if they cannot be decontaminated. Wash before eating or smoking. Observe good personal hygiene.

13. OTHER REGULATORY CONTROL

All components of this product are listed on the EPA/TSCA inventory of chemical substances.

The information contained herein is based on the data available to Showa Shell and is believed to be correct. However, Showa Shell makes no warranty, expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Showa Shell assumes no responsibility for injury from the use of the product described herein.

DATE PREPARED: 8th June, 1993

SAFETY DATA SHEET

SHELL ALVANIA EP GREASE R0

1. NAME

PRODUCT: SHELL ALVANIA EP GREASE R0

CHEMICAL NAME: LUBRICATING GREASE

2. PRODUCT/INGREDIENT

	<u>percent</u>	<u>toxicity</u>
SHELL ALVANIA EP GREASE R0	100	not available
Solvent Refined petroleum hydrocarbons	balance	oil mist, TWA ACGIH/OSHA 5 mg/m ³ oral LD ₅₀ > 5 g/kg (rat) estimated dermal LD ₅₀ > 28 g/kg, TWA 100 mg/m ³
Lithium hydroxystearate	ca. 5	
Lead Naphthenate	2	oral LD ₅₀ 5.1 g/kg (rat)
Sulphurized Fatty Oil	3	oral LD ₅₀ 20 g/kg (rat)

Based upon data available to Showa Shell this product is not hazardous under OSHA HAZARD COMMUNICATION (29 CFR 1910, 1200)

3. HEALTH INFORMATION

ROUTE OF ENTRY:

Eye contact: May be irritating to the eyes.

Skin contact: Prolonged or repeated skin contact may cause skin irritation.

Inhalation: No specific information.

Ingestion: No specific information.

SIGNS AND SYMPTOMS:

Irritation as above.

AGGRAVATED MEDICAL CONDITIONS:

Pre-existing skin disorder may be aggravated by exposure to this product.

OTHER HEALTH EFFECTS:

This specific product has not been tested in long-term chronic exposure tests. The handling procedures and safety precautions in this MSDS should be followed to minimize employee' exposure.

4. OCCUPATIONAL EXPOSURE LIMITS

<u>OSHA</u>		<u>ACGIH</u>		<u>OTHER</u>
PEL/TWA	PEL/CEILING	TLV/TWA	TLV/STEL	

No OSHA/PEL or ACGIH/TLV has been established.

5. EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT:

Flush with water for 15 minutes while holding eyelids open. Get medical attention.

SKIN CONTACT:

Remove contaminated clothing and wipe excess off. Wash with soap and water or waterless hand cleaner followed by soap and water. Do not re-use clothing until thoroughly cleaned. If irritation persists, get medical attention promptly to prevent serious damage; do not wait for symptoms to develop.

INHALATION:

Remove victim to fresh air and provide oxygen if breathing is difficult. Get medical attention.

INGESTION: Get medical attention.

6. SUPPLEMENTAL INFORMATION

Not identified.

7. PHYSICAL DATA

Boiling Point °C: NA

Specific Gravity: NA

Vapour Pressure: NA

Vapour Density: NA

Appearance & Odour: dark brown, slight odour grease

Solubility in water: insoluble

Melting Point: NA

8. FIRE AND EXPLOSION HAZARDS

Flash Point (COC) °C: 220 for base oil

Flammable Limit % vol in air: LEL:NA ; UEL:NA

EXTINGUISHING MEDIA:

Use water fog, dry chemical or CO₂. Do not use direct stream of water. Product will float and can be reignited on surface water.

SPECIAL FIRE FIGHTING PROCEDURES AND PRECAUTIONS:

Do not enter confined fire space without proper protective equipment including a NIOSH approved self-contained breathing apparatus. Cool fire exposed container, surrounding equipment and structures with water.

9. REACTIVITY

Stability: Stable

Hazardous polymerization: Will not occur

Conditions and Materials to avoid: Strong oxidizers

Hazardous decomposition product:

NO_x, SO_x, CO_x, PbO_x and other unidentified oxygenates can be formed during combustion.

10. EMPLOYEE PROTECTION

RESPIRATORY PROTECTION:

A NIOSH approved respiratory protection equipment should be used when vapour or mist concentration exceeds applicable standards.

PROTECTIVE CLOTHING:

Use oil resistant gloves and other clothing as minimize skin contact.

11. ENVIRONMENTAL PROTECTION

SPILL OR LEAK PROCEDURE:

Scoop up excess grease. Clean area with appropriate cleaner.

WASTE DISPOSAL:

Dispose of in an appropriate disposal facility in compliance with appropriate regulations.

12. SPECIAL PRECAUTIONS

Store in a cool, dry place with adequate ventilation. Keep away from open flames and high temperature. Minimize skin contact. Wash with soap and water before eating, drinking, smoking or using toilet facilities.

Launder contaminated clothing before using. Discard leather goods if they cannot be decontaminated. Wash before eating or smoking. Observe good personal hygiene.

The information contained herein is based on the data available to Showa Shell and is believed to be correct. However, Showa Shell makes no warranty, expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Showa Shell assumes no responsibility for injury from the use of the product described herein.

DATE PREPARED: 7th May, 1990

SAFETY DATA SHEET

SHELL ALVANIA GREASE RA

1. NAME

PRODUCT: SHELL ALVANIA GREASE RA

CHEMICAL NAME: LUBRICATING GREASE

2. PRODUCT/INGREDIENT

	<u>percent</u>	<u>toxicity</u>
SHELL ALVANIA GREASE RA	100	not available
Solvent Refined petroleum		oil mist, TWA ACGIH/OSHA 5 mg/m ³
hydrocarbons	balance	oral LD ₅₀ > 5 g/kg (rat) estimated dermal LD ₅₀ > 28 g/kg, TWA 100 mg/m ³
Lithium hydroxystearate		ca 12
Aromatic Amine	1.5	oral LD ₅₀ 1.6 g/kg (rat)
Sodium Nitrites	0.8	oral LD ₅₀ 180 mg/kg (rat)

Based upon data available to Showa Shell this product is not hazardous under OSHA HAZARD COMMUNICATION (29 CFR 1910, 1200)

3. HEALTH INFORMATION

ROUTE OF ENTRY:

Eye contact: May be irritating to the eyes.

Skin contact: Prolonged or repeated skin contact may cause skin irritation.

Inhalation: No specific information.

Ingestion: No specific information.

SIGNS AND SYMPTOMS:

Irritation as above.

AGGRAVATED MEDICAL CONDITIONS:

Pre-existing skin disorder may be aggravated by exposure to this product.

OTHER HEALTH EFFECTS:

This specific product has not been tested in long-term chronic exposure tests. The handling procedures and safety precautions in this MSDS should be followed to minimize employee' exposure.

4. OCCUPATIONAL EXPOSURE LIMITS

OSHA		ACGIH		OTHER
PEL/TWA	PEL/CEILING	TLV/TWA	TLV/STEL	

No OSHA/PEL or ACGIH/TLV has been established.

5. EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT:

Flush with water for 15 minutes while holding eyelids open. Get medical attention.

SKIN CONTACT:

Remove contaminated clothing and wipe excess off. Wash with soap and water or waterless hand cleaner followed by soap and water. Do not re-use clothing until thoroughly cleaned. If irritation persists, get medical attention promptly to prevent serious damage; do not wait for symptoms to develop.

INHALATION:

Remove victim to fresh air and provide oxygen if breathing is difficult. Get medical attention.

INGESTION: Get medical attention.

6. SUPPLEMENTAL INFORMATION

Not identified.

7. PHYSICAL DATA

Boiling Point °C: NA

Specific Gravity: NA

Vapour Pressure: NA

Vapour Density: NA

Appearance & Odour: Amber color, slight odour grease

Solubility in water: Insoluble

Melting Point: NA

8. FIRE AND EXPLOSION HAZARDS

Flash Point (COC) °C: 220 for base oil

Flammable Limit % vol in air: LEL:NA ; UEL:NA

EXTINGUISHING MEDIA:

Use water fog, dry chemical or CO₂. Do not use direct stream of water. Product will float and can be reignited on surface water.

SPECIAL FIRE FIGHTING PROCEDURES AND PRECAUTIONS:

Do not enter confined fire space without proper protective equipment including a NIOSH approved self-contained breathing apparatus. Cool fire exposed container, surrounding equipment and structures with water.

9. REACTIVITY

Stability: Stable

Hazardous polymerization: Will not occur

Conditions and materials to avoid: Strong oxidizers

Hazardous decomposition product:

NO_x, SO_x, CO_x, and other unidentified oxygenates can be formed during combustion.

10. EMPLOYEE PROTECTION

RESPIRATORY PROTECTION:

A NIOSH approved respiratory protection equipment should be used when vapour or mist concentration exceeds applicable standards.

PROTECTIVE CLOTHING:

Use oil resistant gloves and other clothing as minimize skin contact.

11. ENVIRONMENTAL PROTECTION

SPILL OR LEAK PROCEDURE:

Scoop up excess grease. Clean area with appropriate cleaner.

WASTE DISPOSAL:

Dispose of in an appropriate disposal facility in compliance with appropriate regulations.

12. SPECIAL PRECAUTIONS

Store in a cool, dry place with adequate ventilation. Keep away from open flames and high temperature. Minimize skin contact. Wash with soap and water before eating, drinking, smoking or using toilet facilities.

Laundry contaminated clothing before using. Discard leather goods if they cannot be decontaminated. Wash before eating or smoking. Observe good personal hygiene.

13. OTHER REGULATORY CONTROL

All components of this product are listed on the EPA/TSCA inventory of chemical substance.

The information contained herein is based on the data available to Showa Shell and is believed to be correct. However, Showa Shell makes no warranty, expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Showa Shell assumes no responsibility for injury from the use of the product described herein.

DATE PREPARED: 1st June, 1993

MATERIAL SAFETY DATA SHEET

SECTION I

PRODUCT NAME OR NUMBER (as it appears on label) :
TANOI SHINCOOL 99X-SUPER

MANUFACTURER'S NAME SHINCOOL COMPANY LIMITED

ADDRESS 89 NAKASHITA, NARUMI-CHO, MIDORI-KU, NAGOYA 458, JAPAN

HAZARDOUS MATERIAL DESCRIPTION, PROPER SHIPPING NAME, HAZARD CLASS, HAZARD ID NO.
NON HAZARDOUS

ADDITIONAL HAZARD CLASSES (as applicable) : N.A.

CHEMICAL FAMILY: Mixture with sulfurised mineral and lard oils, alcohols, and mineral oil.

FORMULA : It can't be disclosed.

COMMON CODE

EMERGENCY TELEPHONE NO.
052-623-5667 / JAPAN

MANUFACTURER' D-U-N-S NO.

SECTION II — INGREDIENTS (list all ingredients)

CAS REGISTRY NO.	% W	% V	CHEMICAL NAMES	Listed as a Carcinogen in NTP, IARC or OSHA 19108(s) (specify)
	% W. But not exact percentages			
8001-78-3	10-20		Triacyl glycerin	N.A.
67762-55-4	2-10		Sulfurised mineral oil	N.A.
61790-49-6	10-20		Sulfurised lard oil	N.A.
64742-65-0	60-80		Mineral oil	N.A.
8001-79-4	20-30		Alkyl polyester	N.A.
13539-13-4	1-5		Thiazole	N.A.

SECTION III — PHYSICAL DATA

BOILING POINT _____ F 250 C UNAPPLICABLE	SPECIFIC GRAVITY (H ₂ O=1)	0.910
VAPOR PRESSURE : UNAPPLICABLE _____ F 20 C ☐ mm Hg ☐ psi	PERCENT VOLATILE BY VOLUME (%)	< 0.1
VAPOR DENSITY (AIR=1) < 1.0	PERCENT SOLID BY WEIGHT (%)	100
SOLUBILITY IN WATER In-soluble	EVAPORATION RATE (H ₂ O =1)	< 1.0
	pH=	N.A.
APPEARANCE AND ODOR: Lightly brown color, Sulfureous odor	IS MATERIAL: <u>LIQUID</u> SOLID GAS PASTE POWDER	

SECTION IV — FIRE & EXPLOSION HAZARD DATA

FLASH POINT F 160 C	Method used C.O.C.	FLAMMABLE LIMITS	LEL Not det.	UEL Not det.
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EXTINGUISHING MEDIA : CO₂ , FOAM, DRY CHEMICAL EXTINGUISHER

SPECIAL FIRE FIGHTING PROCEDURES : Firefighters should use protective clothing and self contained breathing apparatus

UNUSUAL FIRE AND EXPLOSION HAZARDS : None

SECTION V — HEALTH HAZARD DATA

EFFECTS OF OVEREXPOSURE — Conditions to avoid : None known

THRESHOLD LIMIT VALUE N.A.	PERMISSIBLE EXPOSURE LIMIT N.A.	OTHER LIMIT N.A.
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PRIMARY ROUTES OF ENTRY: Inhalation ☐ Skin contact ☐ Other(specify)

EMERGENCY AND FIRST AID PROCEDURES: Eyes: Wash with plenty water. Seek medical Attention. Skin: Wash with soap and water. If irritation persists, seek medical attention.

SECTION VI — REACTIVITY DATA

STABILITY	UNSTABLE STABLE	CONDITIONS TO AVOID: N.A.
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INCOMPATIBILITY(materials to avoid): Strong acid, alkali and oxidizing materials

HAZARDOUS DECOMPOSITION PRODUCTS: No data

HAZARDOUS POLYMERIZATION	MAY OCCUR	CONDITIONS TO AVOID: N.A.
	WILL NOT OCCUR	

SECTION VI — SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:
Contain spill. Remove to salvage container.

WASTE DISPOSAL METHOD:
Treat as oily waste as government regulations permit.

CERCLA (Superfund) REPORTABLE QUANTITY (in lbs): N.A.

RCRA HAZARDOUS WASTE NO. (40 CFR 261.33) N.A.

VOLATILE ORGANIC COMPOUND (VOC) (as packaged, minus water) : N.A.

☐ Theoretical _____ lb gal N.A.	☐ Analytical _____ lb gal N.A.
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SECTION VII — SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (specify type) : Not required

VENTILATION	LOCAL EXHAUST (Specify Rate) : Not required MECHANICAL (General) (Specify Rate) Not required	SPECIAL : Not required OTHER : Not required
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PROTECTIVE GLOVES (specify type) : Rubber gloves	EYE PROTECTION (specify type) : Safety goggles
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OTHER PROTECTIVE EQUIPMENT: Not required in normal use

SECTION IX — SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Keep it well closed and in cool place. Avoid extreme heat. Store away from heat sources.

OTHER PRECAUTIONS: Avoid direct fire and sunlight

PLEASE COMPLETE QUESTIONNAIRE AND RETURN TO:	NAME (print) SHINNOSUKE YAMAGUCHI
	Signature <i>S. Yamaguchi</i>
	Title PRESIDENT
	Date

AMADA CO., LTD.

200, Ishida, Isehara-shi, Kanagawa 259-1196, JAPAN