PREFACE

This manual describes the installation, operation and maintenance of the ARIES 245 CNC Turret Punch Press. Be sure to read it carefully before installing the machine, operating it, or providing maintenance for it to obtain a thorough knowledge of safe and efficient procedures.
TABLE OF CONTENTS

SAFETY PRECAUTIONS vi

PART I DESCRIPTION 1

The principle mechanisms of the machine are outlined.

- Punching mechanism 2
- Punch and die turrets 3
- Table and carriage 4
- Controls 5
- Safety functions 5

PART II CONTROLS 7

The control elements of the machine are described.

- Electrical controls 7
- Main control panel 8
  - Programming keys, etc. 9
  - Machine and NC function control keys, etc. 12
- Indicator lights 17
- Turret control buttons 19
- Floppy disk drive 19
- Auxiliary machine control unit 20

PART III OPERATION 21

The procedure for operating the machine for punching is explained. Reference to the next part "PROGRAM" is necessary.

- Preparing for operation 21
- Mounting tools 24
  - Non-auto-index turret stations 24
  - Auto-index turret stations 26
- Dismounting tools 27
- Mounting worksheet 28
- Punching 29
  - Safety precautions 29
  - AUTO-mode punching 30,
  - MDI-mode punching 37
- Operation interruptions and restarting 33
PART IV  PROGRAM 35

The program which must be used to operate the machine for punching is described. Reference to the separate PROGRAMMING MANUAL is necessary.

Program in disk 35
Program in tape 36
Programming 37
  Registering program name 37
  Entering program data 36
Verifying completed program 41
  Verification without plotting 41
  Verification with plotting 41
Modifying program data 45
  Searching for program or data word 45
  Changing data word 45
  Deleting data word 45
  Inserting data word 45
Program management 46
  Saving program in data disk or tape 46
  Listing program names 47
  Changing program name 47
  Deleting program 46
  Deleting all programs 46
Error messages 49

PART V  ALARMS 50

The alarms that can be caused during various operations and the error messages that are displayed to identify them are explained.

Alarm Nos. 001-199 & 300-399 51
Alarm Nos. 200-299 52
Alarm Nos. 400-539 53
Alarm Nos. 540-599 & 700 53
Alarm Nos. 600 & 800-801 54
Alarm Nos. 900-906 54

PART VI  MAINTENANCE 55

The procedure for the maintenance of the machine is described.

Daily maintenance 55
Monthly maintenance 56
Quarterly maintenance 56
Lubrication 57
Hydraulic oil 58
Press motor V-belts 59
Control cabinet ventilation fans 60
DC servomotors 61
Automatic lubricator 62
Striker shear plate 63
Punches and dies 64
Self-Diagnosis 69
APPENDIXES

1. Installation 77
2. Turret stations and tools 81
   Thick turrets 87
   Thin turrets 88
   Punch-to-die clearance 93
   Minimum hole diameter 93
   Punching capacity 94
3. Specifications 95
   Machine specifications 95
   NC specifications 96
SAFETY PRECAUTIONS

Observe the following safety precautions when you install, operate, or provide maintenance for the machine. Although the ARIES 245 is incorporated with devices that ensure safe operations, it is operated automatically at very high speeds and can be dangerous unless it is operated properly and with the utmost caution.

- Have a qualified electrician carry out all electrical work.
- Do not modify the control circuit or machine parts.
- Inspect the machine before starting the day's work.
- Make it a rule to have a single qualified operator control the machine.
- Never operate the machine with the safety devices removed.
- Never wear a necktie, a muffler, or loose clothing during an operation.
- Clear the area around the machine table — particularly behind the machine — of people and obstacles before starting the machine.
- Stay away from the machine — especially when starting it and during an automatic operation. The table and the carriage operate at fast speeds in both operating directions.
- Also stay away from the machine when working with an oversized worksheet or automatic repositioning is involved. The worksheet may be projected abruptly from the front or rear of the machine.
- Take the necessary precautionary steps whenever work must be done inside the turret head or on the table for a tooling change or scrap removal.
- Turn off the main power switch before inspecting or servicing the machine unless power is absolutely necessary.
PART I: DESCRIPTION

The main machine operating and punching mechanisms and safety functions for the ARIES 245 are described below.
PUNCHING MECHANISM

The press motor drives the flywheel. The rotational force of the flywheel, which is transmitted to the eccentric shaft via the clutch-brake unit, is converted into the vertical motion of the ram. *The* striker mounted on the ram tip strikes a punch, which is mounted in the-upper turret (see next page), as the ram is brought down. The punch pierces the part of the worksheet that is placed over the mating die, which is mounted in the lower turret (see next page) and positioned exactly below the punch.
PUNCH AND DIE TURRETS

The punch turret (or upper turret) and the die turret (or lower turret) are rotated by a DC servomotor by way of sprockets and chains. The indexed turrets are locked by air-operated index pins.

An auto-index turret has two auto-index stations (see Appendix 2, Turret Stations and Tools) that permit the indexing of the tools in these stations as well as the indexing of the turret. The tools in these auto-index stations can be indexed in 0.01° increments through 360° by a DC servomotor by way of drive shafts and air-operated cylinders.
TABLE AND CARRIAGE

The table is divided into three sections. The center section is stationary and the two side sections are driven by a DC servomotor and a ball-screw to travel along the Y-axis. Large free-motion ball bearings are imbedded in all three table sections to ensure smooth movement for the worksheet when it is moved over the table for positioning.

The carriage is installed inside the carriage housing, which is mounted on the movable side tables. Two workclamps are mounted on the carriage to hold a worksheet. The positions of the workclamps are adjustable according to the size of the worksheet. The worksheet can be clamped at its origin coordinates by using the X-gauge block in combination with the workclamps. The carriage is driven by a DC servomotor and a ball-screw to move the workclamps along the X-axis inside the carriage housing, which will move in the Y-axis direction with the side tables when they are driven.

When the worksheet must be repositioned for further punching, it will be held temporarily by the two air-operated workholders, which are installed inside the turret housing, while the workclamps are opened for reclamping.
PART I: DESCRIPTION

CONTROLS

The main machine controls and the numerical controls are contained in one cabinet and the lower section of the cabinet houses the electrical controls. An auxiliary machine control unit is provided on the side of the carriage housing.

A new punching program can be composed by using the keys on the main control panel and executed or saved in a data disk. A program can be loaded in the NC memory from a data disk or tape for execution.

SAFETY FUNCTIONS

The ARIES 245 is provided with the safety functions that are described below to protect the operator from operational hazards and to prevent the machine from being damaged. These functions are provided through the detection of an abnormality or either mechanically or electrically.

Safety mats (optional)
The machine will stop if any of the six mats placed around the machine is stepped on.

Tool change door interlock
The machine will stop if any of the tool change doors or the safety guard has been opened erroneously or for a tool change.

Control cabinet door interlock
The NC will be turned off when the main control cabinet is opened.

Hydraulic system
The machine will stop if the oil pressure has been reduced below the normal operating pressure or the oil temperature has risen abnormally.

Air pressure
The machine will stop if the air pressure has been reduced below the normal operating pressure.

Automatic lubrication system
The machine will stop if an abnormality has been detected in the automatic lubrication system.

DC servomotors
The machine will stop if an overload or abnormality has been detected in any of the DC servomotors.
Table and carriage
The machine will stop to prevent the table or the carriage from overtraveling if it has reached its travel limit.

Workclamps
The machine will stop if either one of the workclamps enters an area in which it may be punched accidentally or if it enters an area in which it may collide with either one of the workholders during the repositioning of the worksheet. The workclamps cannot be opened by the foot switch during normal machine operation.

X-gauge block
The machine will stop if the X-gauge block has been raised erroneously while the machine is being operated. The machine cannot be started if the X-gauge block has not been lowered and stowed under the table.

Press ram
The shear plate in the striker will break to prevent the ram from being damaged if an overload has been exerted on the striker. The machine will stop if the ram-operating crank has not stopped exactly at its top-dead center.

Stripping
The machine will stop if the worksheet has not been stripped off the punch.
The control cabinet contains the electrical controls, numerical controls, and machine controls. The auxiliary machine control unit is located on the side carriage housing.

**ELECTRICAL CONTROLS**

The **CIRCUIT BREAKER SWITCH**, which turns the supply of electric power to the machine on and off, is located on the left side of the control cabinet. This switch will be turned off automatically if an overcurrent is applied.

The **RS-232C CONNECTOR**, which is used to connect a tape reader/puncher that requires an RS-232C interface, is also provided on the left side of the cabinet.

The **FOOT SWITCH**, which opens and closes the workclamps, is connected to the control cabinet and placed in front of the machine. This switch will be disabled when the machine is being operated in the AUTO or MDI mode.

The **CONTROL CABINET INTERLOCK SWITCH** installed on the main control cabinet will turn off the NC automatically if the main control cabinet is opened when this switch is turned to ON. *Keep* the switch turned to ON for normal machine operations.

The various **CONTROL SWITCHES** are located inside the control cabinet. These are the ON/OFF switches for the press motor, **hydraulic pump motor**, turret motor, and auto-index motor — which must be turned to ON for normal machine operations — and the **STOP/EMERGENCY switch** for the optional safety mats that selects the status of the stopped machine (an operational interruption or emergency stop) when a mat is stepped on.
The machine and numerical controls, a CRT display, a floppy disk drive, and indicator lights are installed on the main control panel.

**NC power on (I) and off (O) buttons**  
Located to the left of the CRT display. Press these buttons to turn the numerical controls on and off when the machine CIRCUIT BREAKER SWITCH is turned to ON.

**CRT display**  
Displays program data, operation data, and alarm and error messages.

*See the following pages for the description of the other keys and switches on the main control panel.*
Programming keys, etc.

The keys in the panel section to the right of the CRT display are used for programming, program editing or management, etc.

**POS key**
Displays the program block that is being executed and the current position coordinates when pressed.

**ALARM key**
Displays a message that identifies the current alarm when pressed.

**SET key**
Displays the current NC setup data when pressed in the MDI mode.

**COMND key**
Displays the data entry display when pressed in the MDI mode.

**PRGRM key**
Displays the contents of a program or the data entry display when pressed in the EDIT or AUTO mode.

**PRGRM I/O key**
Displays the program INPUT/OUTPUT menu when pressed in the EDIT mode.
PRGRM CHECK key
Displays the PROGRAM VERIFICATION menu when pressed in the AUTO mode.

Address / G-code keys
These 28 keys are used as address and G-code keys to enter data in the EDIT or MDI mode. The G-code numbers are shown in the lower left corner of the keytops with their corresponding functions or punching patterns shown in the upper section of the keytops. To enter G-codes, these keys must be pressed together with the PATRN (SHIFT) key. To enter the characters and symbols that are shown in the upper left corner of keytops, these keys must also be pressed together with the PATRN (SHIFT) key.

Numeric keys
These numeric keys and the minus sign and decimal point keys are used to enter numeric data in the EDIT or MDI mode.

DELET key
Deletes one word when pressed when the cursor is placed on the address character of the word in the EDIT mode.

ALTER key
Alters one word when pressed when the cursor is placed on the address character of the word and a new word is entered in the EDIT mode.

INSRT key
Inserts a newly entered word when pressed when the cursor is placed on the address character of the word after which the new word is to be inserted in the EDIT mode. This key is also used to enter the keyed-in data as a new block in the program. Compare this with the use of the INPUT key described below.

EOB (;) key
Used to key-in the end-of-block code (;).

PATRN (SHIFT) key
Used in combination with the address/G-code keys (see above). This key will be locked when pressed and must be pressed again to unlock when shifting is no longer required.

CAN key
Erases one keyed-in character in front of the cursor at a time when pressed provided that the keyed-in data have not yet been entered by pressing the INSRT key in the EDIT mode or the INPUT key in the MDI mode.
INPUT key
Used to enter a block of data that has been keyed-in by using the address/G-code keys and numeric keys.

PREV PAGE key
Changes the display to the previous page if there is one.

NEXT PAGE key
Changes the display to the next page if there is one.

Cursorkeys
Each of the four keys moves the cursor in the direction (left, right, up, or down) indicated by the arrow on its keytop.

SRCH key
Used when searching for a program in the AUTO or EDIT mode and for a word or an address in the EDIT mode.

RESET key
Normally used to reset an NC alarm. Alarms other than the program alarms cannot be reset unless the cause of the alarm is first removed. In the AUTO mode, the program will be returned to its beginning when this key is pressed and the machine can then be restarted after all axes have been zero-returned (see page 34). In the MDI mode, the previously entered block of data will be erased when this key is pressed.
Machine and NC function control keys, etc.

The keys, switches, and buttons in the central section of the panel below the CRT display are used for controlling the machine and NC functions.

"FEEDRATE" keys

Select a set of feed and rotation rates from four different combinations (listed below) in the AUTO, MDI, or MANUAL mode. When one of the four keys is pressed to select a set, the LED on the pressed key will be lighted.

<table>
<thead>
<tr>
<th>KEY</th>
<th>MODE</th>
<th>FEEDRATE (X &amp; Y)</th>
<th>TURRETS AI</th>
<th>STATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top</td>
<td>AUTO/MDI</td>
<td>40 m/min</td>
<td>20 rpm</td>
<td>60 rpm</td>
</tr>
<tr>
<td></td>
<td>MANUAL</td>
<td>14 m/min</td>
<td>12 rpm</td>
<td>-</td>
</tr>
<tr>
<td>2nd</td>
<td>AUTO/MDI</td>
<td>30 m/min</td>
<td>20 rpm</td>
<td>60 rpm</td>
</tr>
<tr>
<td></td>
<td>MANUAL</td>
<td>10 m/min</td>
<td>12 rpm</td>
<td>-</td>
</tr>
<tr>
<td>3rd</td>
<td>AUTO/MDI</td>
<td>20 m/min</td>
<td>10 rpm</td>
<td>30 rpm</td>
</tr>
<tr>
<td></td>
<td>MANUAL</td>
<td>7 m/min</td>
<td>3 rpm</td>
<td>-</td>
</tr>
<tr>
<td>Bottom</td>
<td>AUTO/MDI</td>
<td>10 m/min</td>
<td>10 rpm</td>
<td>30 rpm</td>
</tr>
<tr>
<td></td>
<td>MANUAL</td>
<td>3 m/min</td>
<td>3 rpm</td>
<td>-</td>
</tr>
</tbody>
</table>

NOTE: If any of these settings does not agree with the feedrate commanded by an F-code command in the program, the slower of the two feedrates will be applied.

"MODE" keys

The mode of operation for the NC or the machine is selected by these keys. When one of the following six keys is pressed to select a mode, the LED on the pressed key will be lighted.

EDIT key

Permits the entry of data for a program, the editing of an existing program, or the management of programs in the NC memory or data disk.
**AUTO key**
Permits the punching of worksheets according to a program, the verification of a program, or the plotting of a program for verification.

**MDI key**
Permits the entry of data for the parameters and initial setup of the NC or the step-by-step punching of a worksheet by the entry of a block of data at a time.

**MANUAL key**
Permits the feeding of the table or the carriage, the rotation of the turrets, or the manual inching of the ram.

**RETRCT key**
Permits the manual zero-return of the table, carriage, turrets, or auto-index turret stations by operating the JOG keys (see page 14).

**SINGLE key**
Used to stop the machine operation temporarily every time the execution of one block of the program has been completed in the AUTO mode. When the block involves a punching pattern, the machine will be stopped every time one punching operation has been executed in the AUTO mode as well as in the MDI mode. This function is also applicable when program verification is performed. When the function is selected by pressing the key, the LED on the key will be lighted.

**“MULTIPLE PART PUNCHING” keys**
The mode of operation for the execution of a multiple part punching program in the AUTO mode is selected by these keys. When one of the following three keys is pressed to select a function, the LED on the pressed key will be lighted.

**TRIAL key**
Punches only the first part in the lower left corner of the worksheet according to the program.

**POST-TRIAL key**
Punches the remaining parts in the worksheet according to the program when selected after the punching of the first part has been completed in the TRIAL mode.

**FULL key**
Punches all of the parts in the worksheet according to the program.

**OPTNAL STOP key**
The machine will stop when an optional stop (M01) is commanded by the program provided that this key has been pressed and its LED is lighted.
**BLOCK SKIP key**
A block in the program which begins with an optional block skip command (I) will be ignored and will not be executed provided that this key has been pressed and its LED is lighted.

**OVERRIDE key**
The workclamp override detecting function and the worksheet repositioning detecting function are enabled when the LED on this key is lighted. The LED on the key will be lighted to automatically select these functions when the power is turned on. If the functions are preferred only for the first worksheet, press the key to blink the LED, which will then be unlighted to disable the functions after the first worksheet has been processed. Press the key again whenever the functions are required thereafter.

**PRGRM PROTECT key**
The PRGRM and PRGRM/O keys (see page 9) are disabled to protect the program in the NC memory from being altered or erased erroneously when this key has been pressed and its LED is lighted. When a program is protected, it can be displayed only in the AUTO mode.

**STRIP MISS key**
The stripping failure detecting function in the AUTO or MDI mode is enabled when this key has been pressed and its LED is lighted. This function should remain in effect during normal operations.

**LUB key**
Operates the automatic lubricator to lubricate the ram parts when pressed. Press this key every time the machine has been started and when the LUBICATION indicator light (see page 18) is lighted.

**"JOG" keys**
These keys are used to feed or zero-return the table or the carriage, or zero-return the turrets and auto-index stations. The +X, +Y, and TURRET keys are effective in the RETRACT mode and can be pressed simultaneously. The keys other than the TURRET key are effective in the MANUAL mode and the table or the carriage can be moved in the direction indicated on a key for as long as the key is kept depressed.

**+X key**
Feeds the carriage in the +X direction in the MANUAL mode or zero-returns the carriage in the RETRACT mode. The LED on the key will be lighted when the carriage has been zero-returned.

**–X key**
Feeds the carriage in the -X direction in the MANUAL mode.
+Y key
Feeds the table in the +Y direction in the MANUAL mode or zero-returns the table in the RETRCT mode. The LED on the key will be lighted when the table has been zero-returned.

-Y key
Feeds the table in the -Y direction in the MANUAL mode.

TURRET key
Zero-returns the turrets as well as the auto-index stations in the RETRCT mode. The LED on the key will be lighted when zero-return has been completed.

OVERRISE CONFIRMATION key
Restarts the machine after it has been stopped due to the detection of a suspected workclamp override when pressed in the AUTO or MDI mode.

**CAUTION**
Do not press this key until visually confirming that punching can be safely continued. Modify the program if it is determined that punching cannot be safely resumed.

PUNCH key
Inches the ram when pressed in the MANUAL mode with the index pins in the turrets and the PRESS SELECT switch (see below) turned to INCHING. Operates the ram for one cycle of punching when pressed in the MDI mode with the PRESS/SELECT switch turned to CYCLE. Also in the MDI mode and with the PRESS SELECT switch turned to INCHING, the ram can be inched by pressing this key after performing one cycle of punching.

PRESS SELECT switch
This switch sets the mode of operation for the ram. The switch can be turned by using its key. Insert the key in the switch and turn it to one of the three following positions, as required:

- **CYCLE position**
  Operates the ram for one cycle of punching in the AUTO or MDI mode when the worksheet is positioned. This switch position is not used in the MANUAL mode.

- **INCHING position**
  Operates the ram for one cycle of punching in the MDI mode when the worksheet is positioned. (The ram can be inched by pressing the PUNCH key after punching.) Inches the ram in the MANUAL mode when the PUNCH key is pressed. The ram will not be operated in the AUTO mode but the other AUTO-mode operations will not be affected.

- **OFF position**
  The ram will not be operated in any of the machine operating modes.
TOOL CHANGE switch
This switch provides safety during a tool-change operation. The switch can be turned by using its key. Insert the key in the switch and turn it to one of the two following positions, as required:

ON position
The TOOL CHANGE SWITCH indicator light (see page 18) is lighted and the press motor is stopped when the switch is turned to this position. Only the turrets can then be rotated in the MANUAL mode.

OFF position
Cancels the above condition.

START button
Starts a punching operation when pressed in the AUTO or MDI mode. A program check operation can also be started by pressing this button in the AUTO mode. The button will be lighted in green when pressed. The button will be unlighted when either one of the above operations is completed and the STOP button (see below) will then be lighted.

STOP button
Stops either one of the above operations when pressed during its execution. The button will be lighted in red when pressed and unlighted when the START button is pressed.

EMERGENCY button
Stops the machine instantly when pressed in any of the machine operating modes. The button will be locked when pressed and must then be unlocked by turning it clockwise. After an emergency stop, it is necessary to zero-return the table, carriage, turrets, and auto-index stations.
The indicator lights (LEDs) in the lower left section of the panel indicate the status of the machine and the NC.

**NC READY**
Lights when the NC is ready for operation. Is unlighted when the power is turned off, an NC alarm is actuated, the EMERGENCY button is pressed, or an emergency stop is actuated for the machine.

**TOP DEAD CENTER**
Lights when the ram is stopped at its top dead center. Is unlighted if the ram is not stopped at its top dead center. (The machine will be stopped at this time.)

**ORIGIN**
Lights when the table, carriage, turrets, and auto-index stations have been zero-return in the RETRACT mode. Unless this light is lighted, punching cannot be performed in the AUTO or MDI mode.

**AUTOMATIC OPERATION**
Lights when an operation has been started by pressing the START button in the AUTO or MDI mode.

**OIL FILTER**
Lights when the machine is stopped due to an abnormality in the filter in the hydraulic system.

**PROGRAM STOP**
Lights when the machine is stopped by a program stop (M00) or optional stop (M01) command.

**OVERRIDE**
Lights when the machine is stopped due to the detection of a suspected workclamp override.
INDEX PIN IN
Lights when the index pins are inserted in the turrets.

AIR DOWN
Lights when the machine is stopped due to reduced operating air pressure.

HYDRAULIC UNIT
Lights when the machine is stopped due to an abnormality in the hydraulic system.

NC ALARM
Lights when the machine is stopped due to an abnormality in the NC.

STOP SWITCH
Lights when the machine is stopped by the STOP button on the main or auxiliary control panel.

LUBRICATION
Lights when the machine is stopped due to insufficient automatic lubrication.

CLAMP OPEN
Lights when the workclamps are opened but will not light when the workclamps are opened during an automatic worksheet repositioning operation. When this indicator lamp is lighted, the machine cannot be operated in the AUTO, MDI, or RETRCT mode but can be operated in the MANUAL mode.

TOOL CHANGE SWITCH
Lights when the TOOL CHANGE switch is turned to ON.

TOOLCHANGE DOOR
Lights when the machine is stopped because a tool change door or the safety guard has been opened.

X-GAUGE BLOCK
Lights when the machine is stopped because the X-gauge block has been raised.

STRIPPING
Lights when the machine is stopped due to a stripping failure.

REPOSITIONING POSITION
Lights when interference is presumed between the workclamps and the workholders and the machine is stopped for confirmation during an automatic worksheet repositioning operation.
**Turret control buttons**

The following three buttons in the lower right section of the panel are used to control the turrets in the MANUAL mode.

**"TURRET" rotating buttons**
The upper button rotates the upper and lower turrets clockwise when pressed and the lower button rotates them counterclockwise when pressed. The turrets will be stopped at the nearest station when either button is released.

**"INDEX PIN" button**
Inserts the index pins into the upper and lower turrets when pressed and withdraws them from the turrets when pressed again.

**Floppy disk drive**
The acrylic cover is interlocked with the drive and the drive will be disabled when the cover is opened. Insert or remove a 3.5" double-sided, double-density, floppy disk only when the NC is turned on and the LED below the unit is not blinking.

**The LED will blink when the drive is being operated to read or write a disk. Do not open the acrylic cover when the LED is blinking. A disk can be ejected from the drive by pressing the central section to the right of the slot when the LED is not blinking. Keep the acrylic cover closed when a disk is loaded or after a disk is removed.**
AUXILIARY MACHINE CONTROL UNIT

The auxiliary machine control unit is installed on the operator side of the carriage housing. The three buttons on the unit have the same functions as their counterparts on the main control panel.

START button
Starts a punching operation when pressed in the AUTO or MDI mode. A program check operation can also be started by pressing this button in the AUTO mode. The button will be lighted in green when pressed. The button will be unlighted when either one of the above operations is completed and the STOP button (see below) will then be lighted.

STOP button
Stops either one of the above operations when pressed during its execution. The button will be locked and lighted in red when pressed. The button can be unlocked by turning it clockwise. The button will be unlighted when the START button is pressed.

OVERRIDE CONFIRMATION button
Restarts the machine after it has been stopped due to the detection of a suspected workclamp override when pressed in the AUTO or MDI mode.

CAUTION Do not press this button until visually confirming that punching can be safely continued. Modify the program if it is determined that punching cannot be safely resumed.
PART III: OPERATION

Prepare and operate the machine in the manner described below after inspecting the machine for the day's operation* and by observing the safety precautions*.

* See page 55, DAILY MAINTENANCE
* * See page 29, SAFETY PRECAUTIONS

PREPARING FOR OPERATION

1. Turn the CIRCUIT BREAKER switch to ON. The five ventilating fans in the control cabinet will be started.

2. Press the nC POWER ON button. The press motor and the hydraulic pump motor will then be started.

3. Confirm that the NC READY and TOP DEAD CENTER indicator lights as well as the LEDs on the bottom FEEDRATE key, MODE RETRACT key, OVERRIDE key, and STRIP MISS key are lighted.

The position display will appear on the CRT screen upon completion of the NC self-diagnosis, which requires about 40 seconds from the time that the power has been turned on.

This display will show the sequence number (NOOOO), carriage position (X1270.00), table position (Y1000.00), turret station number (TO), and auto-index station angle (C0.00).

4. Press the JOG +X and +Y keys. The LEDs on these keys will be lighted when the table and the carriages have been zero-returned.

5. Press the JOG TURRET key. The LED on the key will be lighted when the turrets and the auto-index stations have been zero-returned.

6. Confirm that the ORIGIN indicator light is lighted.
7 Change to the MDI mode and press the SET key to show the first page of the display for the setting of the NC functions and parameters.

Seven items are shown on this display. The previously accumulated results are shown for the three items listed below. They can be reset to zero by entering zero and pressing the INPUT key for each item at this time or any time during an operation as required. The cursor can be moved to the next item by operating the cursor key.

- Number of punched worksheets
- Number of hours of NC operation
- Number of hours of machine operation in AUTO or MDI mode

The four parameter items listed below can be set or reset by entering zero or one as required and pressing the INPUT key. The set parameters will then become effective for all successive operations.

- Decimal point for numerical data
  0: A decimal point followed by two zeros (three zeros in inches) will be added after the last digit of the entered numerical data for internal processing when there is no decimal point in the data.
  1: The entered numerical data will be multiplied by 1/100 (11000 in inches) for internal processing when there is no decimal point in the data.

- Unit for numerical data
  0: Millimeters
  1: Inches

- Code used for tape-punching
  0: EIA
  1: ISO

- Deletion of macroinstructions
  0: Macroinstructions will be saved when the system is reset or the power is turned off.
  1: Macroinstructions will be deleted when the system is reset or the power is turned off.
The second page of the display, which shows the accumulated number of hits for every turret station, can be shown by pressing the NEXT PAGE key.

<table>
<thead>
<tr>
<th>SETTING DATA NO. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUMBER OF TOOL HITS</td>
</tr>
<tr>
<td>T NO.</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>16</td>
</tr>
<tr>
<td>17</td>
</tr>
<tr>
<td>18</td>
</tr>
<tr>
<td>19</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>21</td>
</tr>
<tr>
<td>22</td>
</tr>
<tr>
<td>23</td>
</tr>
</tbody>
</table>

These numbers can also be reset to zero by entering zero and pressing the INPUT key for each station at this time or any time during an operation as required. The cursor can be moved to the next item by operating the cursor key.

8 Load a punching program in the NC memory by having it read from a data disk or tape. A program can also be composed on the main control panel. Punching can also be performed step by step by entering one block of data at a time without using a complete program.

- See page 35, PROGRAM IN DISK
- See page 36, PROGRAM IN TAPE
- See page 37, PROGRAMMING
- See page 31, MDI-MODE PUNCHING
MOUNTING TOOLS

Mount the punches and dies that are required to execute the punching program now in the NC on the upper and lower turrets. The tools must be mounted in a different manner in the non-auto-index stations and the auto-index stations, as described below. If punches and dies that were used in a previous operation are still mounted on the turrets, check to confirm whether or not they conform to the programmed tooling and change them as required.

Non-auto-index turret stations

Mount the dies and then the punches in the non-auto-index stations in the following manner:

1. Confirm that the table and the carriage are returned to their zero positions.
2. Press the MODE MANUAL key.
3. Turn the TOOL CHANGE switch to ON.
4. Open the safety guard.
5. Rotate the turrets to place the required stations in the tool-change position by operating one of the TURRET ROTATING buttons.
6. Open the toolchange doors.
7. Loosen the lock bolf of the upper dieholder in the die (lower) turret station and then remove the dieholder from the station (see figures).
8. Apply machine oil to the outer surface of the die to be mounted. But do not oil the top and bottom of the die.
9 Insert the die into the dieholder by mating the die key (or keyways) with one of the dieholder keyways (or key), as shown in the figure.

10 Replace the dieholder in the station and tighten the lock bolt.

11 Clean the hole in the punch (upper) turret station and apply machine oil to the inner surface of the hole.

12 Apply machine oil to the guiding surface of the punch to be mounted. *But do not oil the top and bottom of the punch.*

13 Insert the punch into the station by aligning its contour to that of the die in the mating station of the die turret and by mating one of the punch keyways (or key) with the punch station key (or keyways), as shown in the figure.

14 Visually confirm that the contours of the mounted die and punch are aligned properly.

15 Repeat steps 5 to 14 to mount any additional sets of tools, as required.
Auto-index turret stations

Mount the dies and then the punches in the auto-index stations in the following manner:

1. Confirm that the table and the carriage are returned to their zero positions.
2. Press the MODE/Manual key.
3. Turn the TOOL CHANGE switch to On.
4. Open the safety guard door.
5. Rotate the turrets to place the required stations in the tool-change position by operating one of the TURRET ROTATING buttons.
6. Open the toolchange doors.
7. Remove the dieholder cover from the die (lower) turret station, loosen the flanged bolt on the die spacer, and then remove the die spacer (see figures).

8. Apply machine oil to the outer surface of the die to be mounted. But do not oil the top and bottom of the die.
9. Insert the die into the dieholder by mating the key on the die with one of the keyways in the dieholder gear (see figure).
10 Replace the die spacer by inserting its pin into the groove in the dieholder and tighten the flanged bolt.

11 Replace the dieholder cover by placing it on the die stand on the inner side of the station and drop the two indexing pins into their holes in the turret.

12 Clean the hole in the punch (upper) turret station and apply machine oil to the inner surface of the hole.

13 Apply machine oil to the guiding surface of the punch to be mounted. But do not oil the top and bottom of the punch.

14 Insert the punch into the station by aligning its contour to that of the die in the mating station of the die turret and by mating one of the punch keyways (or key) with the punch station key (or key ways), as shown in the figure.

15 Visually confirm that the contours of the mounted die and punch are aligned properly.

16 Repeat steps 5 to 15 to mount any additional sets of tools, as required.

DISMOUNTING TOOLS

The tools can be dismounted from the turret stations by first performing steps 1 to 6 above and then following the procedures described below:

Non-auto-index turret stations

7 Remove the punch from the station.

8 Loosen the lock bolt of the upper dieholder in the die turret station, remove the dieholder from the station, and then remove the die from the dieholder.

Auto-index turret stations

7 Remove the punch from the station.

8 Remove the dieholder cover from the die turret station, loosen the flanged bolt on the die spacer, remove the die spacer, and then remove the die from the dieholder.
Mounting Worksheet

Mount the worksheet on the table in the manner described below when the program is ready and the tools have been mounted.

1. Confirm that the ORIGIN indicator light and the LEDs on the JOG +X, +Y, and TURRET keys are lighted to indicate that the table, carriage, turrets, and auto-index stations are at their zero positions.

2. Position the workclamps on the carriage according to the program and the size of the worksheet. Loosen the lever at the top of each workclamp to unlock it, manually slide it to the required position on the carriage, and then lock it in position by tightening the lever.

3. Press the MODE AUTO key.

4. Open the workclamps by depressing the foot switch.

5. Raise the X-gauge block.

6. Place the worksheet on the table with its X-axis edge in the workclamps and its Y-axis edge in contact with the X-gauge block. This positions the worksheet at its zero positions.

7. Close the workclamps by depressing the foot switch.

8. Lower the X-gauge block.

The machine is now ready to perform a punching operation.
PUNCHING

The punching operation can be performed in the AUTO mode according to the program in the NC memory or in the MDI mode by entering data step by step in the manner described below.

Safety precautions

Be sure to observe the following safety precautions when operating the machine. The machine will be operated automatically at very high speeds and can be dangerous unless it is operated properly and with the utmost caution.

- Make it a rule to have a single qualified operator control the machine.
- Never operate the machine with the safety devices removed.
- Never wear a necktie, a muffler, or loose clothing during an operation.
- Clear the area around the machine table — particularly behind the machine — of people and any obstacles before starting the machine.
- Stay away from the machine — especially when starting it and during an automatic operation. The table and the carriage operate at fast speeds in both operating directions.
- Also stay away from the machine when working with an oversized worksheet or automatic repositioning is involved. The worksheet may be projected abruptly from the front or rear of the machine.
- Take necessary precautionary steps whenever work must be done inside the turret head or on the table for a tooling change or scrap removal.
- Turn off the main power switch before inspecting or servicing the machine unless power is absolutely necessary.
AUTO-MODE PUNCHING

1 Check to ensure that all axes have been zero-returned and that the ORIGIN indicator light is lighted.

2 Press the MODE AUTO key.

3 Display the program, which is in the NC memory and to be executed, if it is not displayed by pressing the PRGRM key.

   NOTE: If the required program is not displayed, press the SRCH key to display the list of program names, key-in the name of the required program or place the cursor on the number for the program, and then press the INPUT key.

4 Confirm that the following indicator lights are not lighted:

   AIR DOWN, HYDRAULIC UNIT
   NC ALARM, STOP SWITCH
   LUBRICATION, CLAMP OPEN
   TOOL CHANGE SWITCH, TOOL CHANGE DOOR
   X-GAUGE BLOCK, STRIPPING
   REPOSITIONING POSITION

5 Press the STRIP MISS key to light its LED.

6 Turn the PRESS SELECT switch to CYCLE.

7 Set the conditions for the program execution and the machine operation by operating the following keys as required:

   SINGLE, OPTNAL STOP, BLOCK SKIP, OVERRIDE
   FEEDRATE, MULTIPLE PART PUNCHING

   NOTE: The workclamp override detecting function must be enabled when a newly composed program is used.

8 Press the START button to start punching.

WARNING Stay away from the table when starting the operation. The table and the carriage will be moved at fast speeds as soon as the operation is started and the worksheet may be projected from the table abruptly. Also be sure that no people are present in the area surrounding the machine.

9 As soon as the worksheet has been punched according to the program, the machine will be stopped, the STOP button and the ORIGIN indicator light will be lighted, the AUTOMATIC OPERATION indicator light will be unlighted, and the beginning of the program will be displayed.
**MDI-MODE PUNCHING**

The manner of entering data to perform punching in the MDI mode is the same as that for composing a program. See page 37, Programming.

1. Press the MODE MDI key.

2. Press the COMND key to show the data entry display.

3. Key-in the X and Y coordinates and the turret station number for the tool to be used. The keyed-in data will be shown in the lower section of the display.

4. Press the INPUT key if the keyed-in data are correct. The input data will then appear in the upper section of the display. If any error is found in the data at this time, press the RESET key to erase the data, key-in the correct data, and then press the INPUT key again.
Confirm that the conditions for executing the data and operating the machine are properly provided in the same manner that was described for operation in the AUTO mode.

NOTE: The workclamp override detecting function must also be enabled for the operation in the MDI mode.

Press the START button to start punching.

Stay away from the table when starting the operation. The table and the carriage will be moved at fast speeds as soon as the operation is started and the worksheet may be projected from the table abruptly. Also be sure that no people are present in the area surrounding the machine.

As soon as the worksheet has been punched according to the entered block of data, the machine will be stopped and the STOP button will be lighted.

Enter the next block of data and repeat the same procedure.

To end the operation, key-in "G50", press the INPUT key, and then press the START button. All axes will be zero-returned and the ORIGIN indicator light will be lighted.
OPERATION INTERRUPTIONS AND RESTARTING

An operation in the AUTO or MDI mode will be interrupted, the machine will stop, and the corresponding indicator light will be lighted or unlighted if any one of the conditions listed below is effected. The manner of restarting the machine or resuming the operation, which differs depending on the cause, is described for each cause. In every case, it must be confirmed that the conditions have been normalized before restarting the machine or resuming the operation.

- **EMERGENCY button has been pressed.**
  Remove the cause of the emergency stop, unlock the EMERGENCY button, zero-return the table, carriage, turrets, and auto-index turret stations, replace the worksheet with a new one, and restart from the beginning.

- **STOP button has been pressed.**
  Remove the cause of the stop, and, if conditions allow, press the START button to resume the operation.

- **X-gauge block has been raised erroneously.**
  Lower the block and press the START button to resume the operation.

- **Safety guard or a tool-change door has been opened erroneously.**
  Close the guard or door and press the START button to resume the operation.

- **Stripping failure has been caused.**
  (a) Remove the cause (insufficient clearance between punch and die, defective punch spring, etc.), zero-return the table, carriage, turrets, and auto-index turret stations, reclamp the worksheet or replace it with a new one, and restart from the beginning.
  (b) If the worksheet is stripped off the punch and the worksheet is clamped properly in the workclamps despite the stop, the failure was transient and the operation may be resumed by pressing the START button.

- **Ram did not stop at its top dead center.**
  Turn the NC power off and turn it on again. Press the MODE MANUAL key, insert the index pins in the turrets by pressing the INDEX PIN button, and then turn the PRESS SELECT switch to INCHING. Press the PUNCH button repeatedly to inch the ram until it reaches its top dead center and the TOP DEAD CENTER indicator light is lighted. Turn the PRESS SELECT switch back to CYCLE and withdraw the index pins from the turrets Press the RESET key, zero-return the table, carriage, turrets, and auto-index turret stations, replace the worksheet with a new one, and restart from the beginning.
• **NC alarm has been caused.**
  
  (a) The NC ALARM indicator light is lighted while the NC READY indicator light remains lighted: Identify the cause of the alarm on the display, remove the cause, press the RESET key, zero-return the table, carriage, turrets, and auto-index turret stations, replace the worksheet with a new one, and restart from the beginning.

  (b) The NC ALARM indicator light is lighted and the NC READY indicator light is unlighted: If the cause of the alarm is an overtravel, retract the axis along which overtravel occurred by 200 to 300 mm (8 to 12") by operating the appropriate JOG key, zero-return the table, carriage, turrets, and auto-index turret stations, replace the worksheet with a new one, and restart from the beginning. If the cause of the alarm is other than overtravel, the fault is in the NC system.

• **Workclamp override has been detected.**
  
  If it can be confirmed that the workclamps will not interfere with the tools, press the OVERRIDE CONFIRMATION key to resume the operation. If interference is likely to occur, the program must be modified.

• **Possible workclamp interference with workholders has been detected.**
  
  If it can be confirmed that the workclamps will not interfere with the workholders, press the START button to carry out repositioning and resume the operation. If interference is likely to occur, the program must be modified.

• **Program stop (M00) has been effected.**
  
  Press the START button to resume the operation.

• **Optional stop (M01) has been effected.**
  
  Press the START button to resume the operation.

• **Single block has been completed.**
  
  Press the START button to execute the next block.

• **Malfunction has been caused in the automatic lubrication system.**
  
  Remove the cause, press the LUB key, and press the START button to resume the operation.

• **Operating air pressure has been reduced.**
  
  Correct the condition, zero-return the table, carriage, turrets, and auto-index turret stations, replace the worksheet with a new one, and restart from the beginning.

• **Abnormality has been caused in the hydraulic system.**
  
  Remove the cause, zero-return the table, carriage, turrets, and auto-index turret stations, replace the worksheet with a new one, and restart from the beginning.

• **Abnormality has been caused by the filter in the hydraulic system.**
  
  Remove the cause and press the START button to resume the operation.
In step 8 of the procedure to prepare the machine for a punching operation (see page 23), the loading of a program in the NC memory is required. This program can be a previously composed-punching program that has been saved in a data disk or punched in tape. Or a new punching program can be composed by using the main control panel and can then be saved in a data disk or punched in tape if the program is to be used again. The required procedures are described below.

A punching operation can also be performed step by step by entering one block of data for punching a hole or a pattern of holes at a time from the main control panel. The required data and the manner of data entry are basically identical to the composition of a new punching program. For a description of the procedure, see page 37, Programming, and page 31, MDI-mode Punching.

**PROGRAM IN DISK**

When the punching program to be used is stored in a data disk, load the program in the NC memory in the following manner:

1. Press the PRGRM PRTECT key to unlight its LED if it is lighted.
2. Open the acrylic cover of the disk drive. Insert the data disk that contains the required program into the drive slot with the arrow mark on the disk on the left side and in the direction indicated by the arrow on the disk. Then close the cover.

3. Press the MODE EDIT key and then the PRGRM I/O key to display the PROGRAM INPUT/OUTPUT menu.

4. Place the cursor on "READ A (disk)" and press the INPUT key to display the names of the programs contained in the disk. If there are more than 64 program names, press the NEXT PAGE key to show the next display page.
5 Place the cursor on the number for the name of the required program or key-in its name, and then press the INPUT key. If more than one program is to be used, their names can be specified at the same time by entering a slash (/) between the program names. (The total number of characters that can be keyed-in, however, is 128 including slashes.)

6 As soon as the INPUT key has been pressed and the designated program or programs is read into the NC memory, the display will change to show a list of the names of the programs in the NC.

7 The first designated program is now ready for execution. The data disk may be removed by opening the cover and pressing the ejection button.

PROGRAM IN TAPE

When the punching program to be used is stored in tape, load the program in the NC memory in the following manner:

1 Connect the tape reader, which is equipped with an RS232C interface, to the RS232C connector on the control cabinet.

2 Set the tape in which the program to be used is punched in the tape reader.

3 Press the PRGM PROTECT key to unlight its LED if it is lighted.

4 Press the MODE EDIT key and then the PRGMI/O key to display the PROGRAM INPUT/OUTPUT menu.

5 Place the cursor on "READ B (tape) and press the INPUT key. The next display will then be shown.

6 Key-in the program name and press the INPUT key. The tape will now be read and the program will be loaded in the NC memory.
PROGRAMMING

A punching program can be composed by operating the keys on the main control panel in the manner described below. Refer to the separate PROGRAMMING MANUAL for the details on the required program format.

A name must be given to a program and registered before the data for the program can be entered. The completed program can then be checked for verification, which can also be performed while plotting the work on the display according to the programmed data.

Registering program name

A program name must begin with an alphabet character and be composed of up to eight alphanumeric characters. The name can be entered and registered in the following manner:

1. Press the PRGRM PROTECT key to unlight its LED if it is lighted.
2. Press the MODE EDIT key and then the PRGRM key to show the program name registration display.
3. If there are no programs in the NC memory and no program is shown on the display, key-in the program name and press the INPUT key to register the name. If there are programs in the NC memory and a previously used program is shown on the display, press the SRCH key to display a list of the names of the programs in the NC memory, and then key-in the program name and press the INPUT key to register the name.

In both cases, the data entry display will be shown when the program name has been registered.
Entering program data

Data can be entered for the new program by using the address/G-code and numeric keys on the main control panel when its name has been registered and the data entry display is shown. Different procedures are employed to enter data when only the address and numeric keys are used and when they are used in combination with the G-code keys.

Using address and numeric keys only

Key-in the address and data for one block (line) of the program by using the alphanumeric keys. The keyed-in characters will be shown character by character in the lower section of the display each time a key is pressed. If an error is found in the keyed-in data, use the CAN key to erase the data character by character from the last entered character and then reenter the correct data. Press the EOB (;) key to end the block.

EXAMPLE: G92 X1 270, Y1000.;
Press the INSRT key if the keyed-in data are correct. The data will then be input and shown in the upper section of the display.

The cursor should be on the ";" at the end of the program line that has just been input at this time. Key-in and input the successive blocks of data in the same manner.

When the number of program lines has filled one page of the display or when reference must be made to a different page, operate the PREV PAGE and NEXT PAGE keys as necessary to change the pages. Press the MODE AUTO key to return to the start of the program.

To modify the input program data or lines, see page 45, Modifying Program Data.
Using G-code keys

Press the PATRN (SHIFT) key to enable the use of the G-code keys. The word PATTERN will be shown in the upper right corner of the display to indicate that the G-code keys are effective.

Press the key for the required G-code (G92 in the following example), which will then be shown in the lower section of the display. A prompt will appear above the displayed G-code at this time. The prompt may contain address characters and one of them may be blinking ("X" in the following example).

EXAMPLE: G92 X1270. Y1000.;

Key-in data for the blinking address (1270. for the blinking X in the example). It is not necessary to key-in the address character. Any erroneous keyed-in data can be erased character by character by the CAN key and then reentered. Press the INPUT key if the keyed-in data are correct.

Then key-in data for the next address (1000. for the now blinking Y in the example), and press the INPUT key if the keyed-in data are correct. It is unnecessary to enter the EOB (;) code at the end of the block.

Then press the INSRT key to input the block of the keyed-in data, which will then be shown in the upper section of the display.

If the entry of data can be omitted for a blinking address, simply press the INPUT key for the address, which will then be deleted from the lower section of the display.
Two G-code commands in one block

EXAMPLE: G90 G70 Y300.;

Enter G90 by pressing the corresponding G-code key and then G70 since G90 requires no data.

Press the INPUT key for address X because the entry of data can be omitted. Key-in 300. for address Y and press the INPUT key. Press the INPUT key for address T because the entry of data can also be omitted. Then press the INSRT key.
VERIFYING COMPLETED PROGRAM

The contents of a newly composed program can be verified either by plotting or not plotting the work on the display before using the program for an actual punching operation.

Verification without plotting

The program can be verified more quickly by not plotting the work when it is not necessary to check the positions of holes, etc.

Press the MODE AUTO key and then the PRGRM CHECK key to display the PROGRAM CHECK menu:

Select item 2 by placing the cursor on the item number and pressing the INPUT key. The program will now be listed on the display. Then press the START button to start the verification. The message PROGRAM CHECK on the display will stop blinking when the verification is completed.

If an error has been found during the verification, the NC ALARM indicator light will be lighted and the error will be displayed for identification. See page 45, Modifying Program Data and page 49, Error Messages.

The program verification session will be terminated when G50 is commanded in the program or when the RESET key is pressed.

NOTE: The STOP and START buttons and the SINGLE key can be used during this session.

Verification with plotting

The program can be verified and the work can be plotted on the display according to the program at the same time. To enable program verification with plotting, the plotting parameters must be set in advance. These parameters determine the worksheet size, workclamp positions, and tools in use and can either be set on the plotting parameter display or through the data entry display.
(a) **PLOTTING-PARAMETER DISPLAY**

Select item 3 on the **PROGRAM CHECK** menu by placing the cursor on the item number and pressing the **INPUT** key to show the next display.

For the worksheet size, key-in its X dimension, press the **INPUT** key, key-in its Y dimension, and press the **INPUT** key. For each workclamp, key-in its X coordinate and press the **INPUT** key. For each of the tools in use, key-in its turret station number, contour code, X dimension, Y dimension, and angle. Press the **INPUT** key for each entry. Press the **RESET** key to return to the **PROGRAM CHECK** menu.

(b) **DATA-ENTRY DISPLAY**

If the data entry display is not shown, press the **MODE EDIT** key and then the **PRGRM** key to show the display. The plotting parameters which are to be set in this session must be placed at the start of the program. Press the **PATRN (SHIFT)** key and then press the ***/S** key to show the **PLOTTING PARAMETER** menu.

The parameters that must be set are the same as those shown above. Place the cursor on the required item number and press the **INPUT** key to show a prompt. Enter data in the same manner as that of the G-code key data entry. Repeat the procedure by selecting the successive items on the **PLOTTING PARAMETER** menu. Upon completion of the session, press the **MODE AUTO** key and then the **PRGRM CHECK** key to show the **PROGRAM CHECK** menu. (If plotting was performed prior to this session and the power has been kept turned on, the previous plotting display will appear on the screen temporarily at this time.)
Specifying magnification

On the PROGRAM CHECK menu, select item 1 and press the INPUT key to show the magnification setting display.

The area in the worksheet which can be plotted on the display will be restricted according to the specified magnification as follows:

<table>
<thead>
<tr>
<th>MAG.</th>
<th>AREA IN WORKSHEET (X x Y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>x1</td>
<td>3000 x 1500 mm</td>
</tr>
<tr>
<td>x2</td>
<td>1500 x 750 mm</td>
</tr>
<tr>
<td>x3</td>
<td>1000 x 500 mm</td>
</tr>
<tr>
<td>x6</td>
<td>500 x 250 mm</td>
</tr>
<tr>
<td>x15</td>
<td>200 x 100 mm</td>
</tr>
<tr>
<td>x30</td>
<td>100 x 50 mm</td>
</tr>
<tr>
<td>x60</td>
<td>50 x 25 mm</td>
</tr>
</tbody>
</table>

NOTE 1: The lower left corner of the worksheet will be the reference point for plotting regardless of the magnification ratios unless the reference point is shifted to specify a different area for plotting.

Place the cursor on "1" for x1 magnification, press the INPUT key, and then press the START button to start the plotting for program verification. The message PLOTTING will blink during the plotting process. As soon as the process is completed, the display will be returned to the PROGRAM CHECK menu.

If an error has been found during the verification, the NC ALARM indicator light will be lighted and the error will be displayed for identification. See page 45, Modifying Program Data and page 49, Error Messages.

NOTE: The STOP and START buttons and the SINGLE key can be used during the program verification session.

To plot an area in the displayed drawing, place the cursor on the required magnification value and press the INPUT key. The specified magnification value will then blink and the cursor will be shifted down to the next line for the specification of the area. The four corners of the plotting area will also be indicated on the display.
Shift the reference point by keying-in the reading on the horizontal scale for the new position on the X-axis and that on the vertical scale for the Y-axis and then pressing the INPUT key for each entry. The reference point can also be shifted to a new position by first pressing the INPUT key twice, operating the cursor keys to move the point, and then pressing the INPUT key again. Then press the START button to start plotting.
MODIFYING PROGRAM DATA

The data in a punching program can be modified in the manner described below when it is displayed in the EDIT mode. When making a modification, press the **PRGM** key to unlight its LED if it is lighted.

Searching for program or data word

Press the **SRCH** key in the AUTO or EDIT mode to show the list of program names, place the cursor on the number for the program or key-in the program name, and then press the **INPUT** key to display the program that requires modification.

To search for a data word or an address character that must be modified or checked in a program, key-in the word or address and then press either the cursor-up or **cursor-down** key to start the search. The first word or address that is being searched for will be shown and the cursor will be placed on the address character. The word can then be modified in the manner described below. To search for another occurrence of the same word or address, or another word or address, key-in the required word or address and then press the cursor-up or cursordown key again.

Changing data word

Place the cursor on the address character of the data word to be changed in the EDIT mode. Key-in the new address character and data. Press the **ALTER** key if the keyed-in word is correct. The original word in the program will then be replaced by the newly keyed-in word.

Deleting data word

Place the cursor on the address character of the data word to be deleted in the EDIT mode. Press the **DELET** key to delete the word from the program.

Inserting data word

Place the cursor on the address character of the data word after which a new data word is to be inserted in the EDIT mode. Key-in the new word and press the **INSRT** key. The new word will then be inserted in the program following the word that has been specified by the placement of the cursor on its address character.
PROGRAM MANAGEMENT

The saving of a newly completed program or programs in the NC memory in a data disk or disks or tape, the listing of the names of the programs in the NC memory or a data disk, the changing of the name of a program, and other program management operations can be performed by employing the PROGRAM INPUT/OUTPUT menu.

Saving program in data disk or tape

The program or programs in the NC memory can be saved in a data disk or punched in tape in the following manner:

1. Press the PRGRM PROTECT key to unlight its LED if it is lighted.
2. Select the EDIT mode and then press the PRGRM 110 key to display the PROGRAM INPUT/OUTPUT menu.

   PROGRAM I/O
   1 READ
   2. STORE/PUNCH IA. MEMORY-FLOPPY
   . DELETE JA: MEMORY
   4. RENAME (A: MEMORY B: FLOPPY)
   5. LIST (A: MEMORY B: FLOPPY)
   6. FORMAT JA: MEMORY B: FLOPPY

3. Place. the cursor on “A” (disk) or “B” (tape) in the STORE/PUNCH menu and then press the INPUT key to display the names of the programs in the NC memory. Use the NEXT PAGE and PREV PAGE keys to display other pages if necessary.

4. Place the cursor on the number for the name of the program which is to be saved in the data disk in the drive or punched in the tape set in the puncher that is connected to the RS232C interface. Or key-in the program name. Then press the INPUT key.

   NOTE: If more than one program is to be saved, key-in the program names by inserting a slash (/) between the names. The total number of characters that can be entered is 128 (including slashes).

5. Upon completion of the saving of a program or programs in a disk, the display will change to a list of the names of the programs in the disk, including the newly saved program or programs. If a program has been punched in tape, the list of the names of the programs in the NC memory will remain unchanged.

6. Press the CAN key to return to the PROGRAM INPUT/OUTPUT menu. Repeat the procedure for the next saving or punching operation as required.
Listing program names

The names of the programs in the NC memory or a data disk can be listed on the display in the following manner:

1. Press the PRGRM PROTECT key to unlight its LED if it is lighted.
2. Select the EDIT mode and then press the PRG/VO key to display the PROGRAM INPUT/OUTPUT menu.
3. Place the cursor on "A" (NC memory) or "B" (disk) for the LIST menu and then press the INPUT key to display the names of the programs in the NC memory or the data disk in the drive. Use the NEXT PAGE and PREV PAGE keys to display other pages if necessary.
4. Press the CAN key to return to the PROGRAM INPUT/OUTPUT menu.

Changing program name

The name of a program in the NC memory or a data disk can be changed in the following manner:

1. Press the PRGRM PROTECT key to unlight its LED if it is lighted.
2. Select the EDIT mode and then press the PRG/VO key to display the PROGRAM INPUT/OUTPUT menu.
3. Place the cursor on "A" (NC memory) or "B" (disk) for the RENAME menu and then press the INPUT key to display the names of the programs in the NC memory or the data disk in the drive. Use the NEXT PAGE and PREV PAGE keys to display other pages if necessary.
4. Key-in the current program name, a slash (/), and the new name.
5. Press the INPUT key. The current program name will then be replaced by the new name.
6. Press the CAN key to return to the PROGRAM INPUT/OUTPUT menu. Repeat the procedure for the next change as required.
Deleting program

A program in the NC memory or a data disk can be deleted in the following manner:

1. Press the \texttt{PRGRM PROTECT} key to unlight its LED if it is lighted.
2. Select the EDIT mode and then press the \texttt{PRGRM VO} key to display the \texttt{PROGRAM INPUT/OUTPUT} menu.
3. Place the cursor on “A” (NC memory) or “B” (disk) for the DELETE-menu and then press the \texttt{INPUT} key to display the names of the programs in the NC memory or the data disk in the drive. Use the NEXT PAGE and PREV PAGE keys to display other pages if necessary.
4. Place the cursor on the number for the name of the program to be deleted or key-in the name of the program.
   
   \textbf{NOTE:} If more than one program are to be deleted, key-in the program names by inserting a slash (\textbackslash{}) between the names. The total number of characters that can be entered is 128 (including slashes).
5. Press the \texttt{INPUT} key. The program will be deleted and its name will be erased from the displayed list.
6. Press the \texttt{CAN} key to return to the \texttt{PROGRAM INPUT/OUTPUT} menu. Repeat the procedure for the next deletion as required.

Deleting all programs

All programs in the NC memory or a data disk can be deleted in the following manner:

\textbf{NOTE:} The data disk will be initialized when all of the programs in it are erased.

1. Press the \texttt{PRGRM PROTECT} key to unlight its LED if it is lighted.
2. Select the EDIT mode and then press the \texttt{PRGRM VO} key to display the \texttt{PROGRAM INPUT/OUTPUT} menu.
3. Place the cursor on “A” (NC memory) or “B” (disk) for the FORMAT menu and then press the \texttt{INPUT} key to display the names of the programs in the NC memory or the data disk in the drive. A confirmation prompt will also appear in the bottom of the display.
4. Key-in 1 (YES) if all of the programs are to be deleted. The programs will be deleted completely and all of the program names will be erased from the list. Key-in 2 (NO) to cancel the session.
   
   \textbf{NOTE:} When all of the programs are designated to be deleted from the data disk, a reading error will be caused but can be ignored.
Error messages

An error during a program management procedure will be identified by the following messages:

NOT FOUND
CAUSE: Specified program name cannot be found.

FILE ALREADY EXISTS
CAUSE: Same program name already exists, or an illegal slash has been entered at the end of a program name.

MEMORY OVERFLOW
CAUSE: Number of programs or program length exceeds the capacity of memory or disk.

WRITE ERROR
CAUSE: Disk is not in drive, or not formatted, or damaged and program cannot be saved.

READ ERROR
CAUSE: Disk is not in drive, or not formatted, or damaged and program cannot be read from disk. Tape is not properly set or a parity check error has been caused and program cannot be read from tape.

FDC COMMUNICATION ERROR
CAUSE: Disk is destroyed. FDC cannot transmit or does not respond. Undefined command has been entered, or check sum error has been caused.

ERROR OPERATION
CAUSE: More than one slash or no slash is entered between program names. Tape punch/read has been commanded although tape puncher/reader is not connected. Optional I/O device has been selected although it is not connected.

DISK NOT READY
CAUSE: Disk drive door is open.

WRITE PROTECTED
CAUSE: Disk is write-protected.
PART V

ALARMS

When an alarm is caused and the NC ALARM indicator light on the main control panel is lighted, the alarm number and a short message will be displayed on the CRT screen to identify the cause of the alarm.

Alarm numbers and the categories of alarms are as follows:

- 001-199 & 300-399: Program-related alarms.
- 200-299: Overtravel alarms.
- 400-439: Servo-system-related alarms.
- 600: Auto-index station-related alarms.
- 800-801: Clutch-related alarms.
- 900-906: Sequence-related alarms.

See the following pages for the description of each alarm.
Alarm Nos. 001-199 & 300-399

These alarms are caused by errors in the program data. The NC READY indicator light will remain lighted when any of these alarms is actuated.

<table>
<thead>
<tr>
<th>No.</th>
<th>MESSAGE</th>
<th>CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>TH ALARM</td>
<td>Illegal number of punching holes.</td>
</tr>
<tr>
<td>002</td>
<td>TV ALARM</td>
<td>Illegal number of characters.</td>
</tr>
<tr>
<td>004</td>
<td>NO ADDRESS</td>
<td>Address missing.</td>
</tr>
<tr>
<td>005</td>
<td>NO DATA</td>
<td>Data missing following address</td>
</tr>
<tr>
<td>006</td>
<td>SIGN ERROR</td>
<td>Invalid minus sign.</td>
</tr>
<tr>
<td>007</td>
<td>(. ) ERROR</td>
<td>Invalid decimal point</td>
</tr>
<tr>
<td>010</td>
<td>ILL. G CODE</td>
<td>Illegal G-command.</td>
</tr>
<tr>
<td>077</td>
<td>SUB PRGRM</td>
<td>Same subprogram has been called more than 2 times.</td>
</tr>
<tr>
<td>078</td>
<td>SUB PRGRM</td>
<td>Subprogram not found under specified number.</td>
</tr>
<tr>
<td>144</td>
<td>T, M CODE</td>
<td>T- and M-commands in same block.</td>
</tr>
<tr>
<td>146</td>
<td>ILL. T CODE</td>
<td>Illegal T-command.</td>
</tr>
<tr>
<td>147</td>
<td>PITCH ERR.</td>
<td>Excessive nibbling increment</td>
</tr>
<tr>
<td>149</td>
<td>G22 Q, J</td>
<td>Q&lt;0, punching distance ≤0 or ≤J for G22</td>
</tr>
<tr>
<td>155</td>
<td>G67 I, J</td>
<td>P≤0, or Q≤0, or I&lt;3P, or J&lt;3Q for G67.</td>
</tr>
<tr>
<td>158</td>
<td>G76 Q,L,D</td>
<td>Q≤0, or Q&lt;0, or Cبار length, or I≤0, or D≤0 for G76.</td>
</tr>
<tr>
<td>159</td>
<td>G79 Q,L,D</td>
<td>Q&lt;0, or Q&lt;0, or Q&gt;1, or D&gt;0 for G79.</td>
</tr>
<tr>
<td>171</td>
<td>G73 Q</td>
<td>Error in Q-data for G73.</td>
</tr>
<tr>
<td>172</td>
<td>U,V G73</td>
<td>Illegal G73 between U- and V-macros.</td>
</tr>
<tr>
<td>173</td>
<td>U,V G77</td>
<td>G77 commanded again during execution of G77.</td>
</tr>
<tr>
<td>183</td>
<td>NO PATTERN</td>
<td>Pattern not in memory has been called.</td>
</tr>
<tr>
<td>185</td>
<td>MACRO NO.</td>
<td>An attempt has been made to store another macro during macro-storing. Or V-command has been entered despite absence of macros. Or noncorresponding U- and V-macro numbers have been specified.</td>
</tr>
<tr>
<td>186</td>
<td>MACRO NO.</td>
<td>Error has been committed when calling macros.</td>
</tr>
<tr>
<td>187</td>
<td>OVERFLOW</td>
<td>Macro-storing overflow.</td>
</tr>
<tr>
<td>188</td>
<td>MACRO NO.</td>
<td>Macro not in memory has been called.</td>
</tr>
<tr>
<td>189</td>
<td>MACRO 3</td>
<td>Error has been committed when calling macros. Or an attempt has been made to store more than 16 macros under numbers 90 to 99.</td>
</tr>
<tr>
<td>191</td>
<td>G75,76 Q</td>
<td>Error in Q-data for G75 or G76.</td>
</tr>
<tr>
<td>193</td>
<td>SETTING 0</td>
<td>G75 or G76 has been commanded though zero multiple part punching has been commanded.</td>
</tr>
<tr>
<td>194</td>
<td>G75,76 ERR</td>
<td>G75 or G76 has &amp;en commanded for macro.</td>
</tr>
<tr>
<td>196</td>
<td>G98–G75,76</td>
<td>G75 has been commanded though P=0 or G76 has been commanded through K=0 for G98.</td>
</tr>
<tr>
<td>197</td>
<td>G98–G76,Q</td>
<td>&quot;Q&quot; is not 1 or 3 for G76 though P=0 for G98. Or &quot;Q&quot; is not 1 or 2 for G75 though K=0 for G98.</td>
</tr>
</tbody>
</table>
Different signs have been assigned to P- and Q-data for G66.
Extra code-words in single-code block.
Illegal address word or no address word.
Data other than X and Y have been entered between M12 and M13, or T-command has been entered during nibbling.
Invalid M-command.
T-or M-command has been entered in GO4 block.
T-or M-command has been entered in G93 or G72 block.
MI2 or MI3 has been entered in MDI mods.
Stack overflow.
T-command missing in positioning-command block.
Number of characters in block has exceeded 128.
Error in numerical data format.
Error in number of digits.
Invalid numerical data.
Numerical data have exceeded upper limit.
Pattern storing overflow.
Number of address words in block has exceeded limit.
Plotting-parameter tool data has exceeded limit (36).

Alarm Nos. ZOO-299

These alarms are caused by the overtravel of the carriage (X-axis) or the table (Y-axis). The NC READY indicator light will be unlighted when any of these alarms is actuated.

<table>
<thead>
<tr>
<th>No.</th>
<th>MESSAGE</th>
<th>CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>210</td>
<td>X +OT</td>
<td>+X overtravel limit switch has been actuated.</td>
</tr>
<tr>
<td>211</td>
<td>X -OT</td>
<td>-X overtravel limit switch has been actuated.</td>
</tr>
<tr>
<td>212</td>
<td>x +LIMIT1</td>
<td>+X stroke limit switch 1 has been actuated.</td>
</tr>
<tr>
<td>213</td>
<td>X -LIMIT1</td>
<td>-X stroke limit switch 1 has been actuated.</td>
</tr>
<tr>
<td>220</td>
<td>Y +OT</td>
<td>+Y overtravel limit switch has been actuated.</td>
</tr>
<tr>
<td>221</td>
<td>Y - OT</td>
<td>-Y overtravel limit switch has been actuated.</td>
</tr>
<tr>
<td>222</td>
<td>Y +LIMIT1</td>
<td>+Y stroke limit switch has been actuated.</td>
</tr>
<tr>
<td>223</td>
<td>Y - LIMIT1</td>
<td>-Y stroke limit switch 1 has been actuated.</td>
</tr>
</tbody>
</table>
### Alarm Nos. 400–539

These alarms are caused by errors or abnormalities in the servo-system. The NC READY indicator light will be unlighted when any of these alarms is actuated.

<table>
<thead>
<tr>
<th>No.</th>
<th>MESSAGE</th>
<th>CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>SERVO ALM</td>
<td>Abnormality in servo-system.</td>
</tr>
<tr>
<td>426</td>
<td>X COUNTER</td>
<td>X-axis tolerance counter overflow.</td>
</tr>
<tr>
<td>427</td>
<td>Y COUNTER</td>
<td>Y-axis tolerance counter overflow.</td>
</tr>
<tr>
<td>441</td>
<td>X+LIMIT</td>
<td>+X stroke limit has been exceeded.</td>
</tr>
<tr>
<td>442</td>
<td>Y+LIMIT</td>
<td>+Y stroke limit has been exceeded.</td>
</tr>
<tr>
<td>446</td>
<td>X-LIMIT</td>
<td>-X stroke limit has been exceeded.</td>
</tr>
<tr>
<td>447</td>
<td>Y-LIMIT</td>
<td>-Y stroke limit has been exceeded.</td>
</tr>
<tr>
<td>530</td>
<td>DPR ALARM</td>
<td>DPR not ready.</td>
</tr>
<tr>
<td>531</td>
<td>PCLX ALARM</td>
<td>PCL not ready for X-axis.</td>
</tr>
<tr>
<td>532</td>
<td>PCLY ALARM</td>
<td>PCL not ready for Y-axis.</td>
</tr>
<tr>
<td>533</td>
<td>PCLT ALARM</td>
<td>PCL not ready for T-axis.</td>
</tr>
<tr>
<td>534</td>
<td>PCLC ALARM</td>
<td>PCL not ready for C-axis.</td>
</tr>
</tbody>
</table>

### Alarm Nos. 540-499 & 700

These alarms are caused during the self-diagnosis that is performed after the power has been turned on. The NC READY indicator light will be unlighted when any of these alarms is actuated.

<table>
<thead>
<tr>
<th>No.</th>
<th>MESSAGE</th>
<th>CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>540</td>
<td>PC ALARM</td>
<td>PC not ready.</td>
</tr>
<tr>
<td>541</td>
<td>542</td>
<td>X-axis wiring disconnection.</td>
</tr>
<tr>
<td>543</td>
<td>Y-axis wiring disconnection.</td>
<td></td>
</tr>
<tr>
<td>544</td>
<td>Taxis wiring disconnection.</td>
<td></td>
</tr>
<tr>
<td>550</td>
<td>C-axis wiring disconnection.</td>
<td></td>
</tr>
<tr>
<td>555</td>
<td>SWC ALARM</td>
<td>SWC not ready.</td>
</tr>
<tr>
<td>560</td>
<td>CRTC ALARM</td>
<td>CRTC not ready.</td>
</tr>
<tr>
<td>570</td>
<td>FDCALARM</td>
<td>FDC not ready.</td>
</tr>
<tr>
<td>580</td>
<td>MEMORY ERR.</td>
<td>Memory abnormal&amp; (resettable by total erasure).</td>
</tr>
<tr>
<td>581</td>
<td>MEMORY ERR.</td>
<td>Memory defective.</td>
</tr>
<tr>
<td>700</td>
<td>EM. STOP</td>
<td>Emergency stop.</td>
</tr>
</tbody>
</table>
Alarm No. 600

This alarm is caused by the entry of a C-command for a non-auto-index turret station. The NC READY indicator light will be unlighted when the alarm is actuated.

<table>
<thead>
<tr>
<th>NO.</th>
<th>MESSAGE</th>
<th>CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>600</td>
<td>AI ALARM</td>
<td>C-command has been entered for non-auto-index turret station.</td>
</tr>
</tbody>
</table>

Alarm Nos. 800 & 801

These alarms are caused by an abnormality in the clutch system. The NC READY indicator light will be unlighted when any of these alarms is actuated.

<table>
<thead>
<tr>
<th>NO.</th>
<th>MESSAGE</th>
<th>CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>OIL PRESS.</td>
<td>Oil pressure reduction.</td>
</tr>
<tr>
<td>801</td>
<td>OIL TEMP.</td>
<td>Oil temperature rise.</td>
</tr>
</tbody>
</table>

Alarm Nos. 900–906

These alarms are caused by errors or abnormalities in the sequence of operations. The NC READY indicator light will be unlighted when alarms 900,901 and 902 are actuated but will remain lighted when alarms 903 to 906 are actuated.

<table>
<thead>
<tr>
<th>No.</th>
<th>MESSAGE</th>
<th>CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>900</td>
<td>CRANK OVER</td>
<td>Ram has not stopped at its top dead center.</td>
</tr>
<tr>
<td>901</td>
<td>AI CLAMP</td>
<td>Auto-index station has not been unclamped.</td>
</tr>
<tr>
<td>902</td>
<td>AI CLAMP</td>
<td>Auto-index station has not been damped.</td>
</tr>
<tr>
<td>903</td>
<td>ORIG. SET</td>
<td>START button has been pressed though axes have not been zero-returned.</td>
</tr>
<tr>
<td>904</td>
<td>LS ERROR</td>
<td>Abnormal origin-limit switch operation.</td>
</tr>
<tr>
<td>905</td>
<td>TEMP. ERR</td>
<td>Abnormal temperature in NC unit.</td>
</tr>
<tr>
<td>906</td>
<td>PRESS ERR</td>
<td>Punching not performed in given amount of time.</td>
</tr>
</tbody>
</table>
Perform the inspection and maintenance operations described below to ensure trouble-free machine operations.

**DAILY MAINTENANCE**

- Drain the accumulated water in the air filter by opening the drain cock.
- Confirm that 5 kg/cm² (71 psi) is provided for the air system on the pressure gauge. Adjust the regulator to provide the proper pressure if necessary.
- Inspect the air system to confirm that there is no air leakage.
- Confirm that the five ventilation fans in the control cabinet are turned on when the machine circuit breaker switch is turned to ON (see page 60).
- Confirm that the press motor, hydraulic pump motor, and servomotors operate without abnormal noise.
- Check the oil level in the air system lubricator and the grease level in the automatic lubricator (see page 62) and replenish as required.
- Inspect the automatic lubricator system to confirm that there is no leakage.
- Inspect the cables, hoses, and pipes for damage and loose fittings.
- Inspect the following parts and clean them to remove metal fragments, etc. as required:
  - Turret surfaces
  - Index pin holes in turrets
  - Index pins
  - Clamps for auto-index turret stations
  - Table top
  - Table and carriage guide bars
- Check each punch and die to confirm that it is not worn.
- Confirm that all punches and dies are firmly mounted on the turrets.
- Lubricate the parts listed in the lubrication chart (see page 57).
- Press the LUB key on the main control panel after turning on the machine.
MONTHLY MAINTENANCE

- Check the press motor V-belts for wear and cracks. Also check the belt tension and provide the proper tension as required (see page 59).
- Check the oil-supply rate from the air system lubricator. Adjust the lubricator, if necessary, to apply the oil at a rate of one drop for every 5 strokes of the turret index pins.
- Check the ventilation fans in the control cabinet for abnormal noise and damage. Clean the fans as required (see page 60).
- Clean the air filters on the control cabinet (see page 60).
- Check the oil level in the hydraulic oil tank. The level should be above the middle level on the gauge.
- Lubricate the parts listed in the lubrication chart (see page 57).

QUARTERLY MAINTENANCE

- Change the hydraulic oil and the line filter after the initial 3 months of operation. Change the oil and the filter once every year thereafter. See page 58 for the procedure.
- Check the servomotor brushes for wear and change them if necessary. See page 61 for the procedure.
- Check the levelness of the machine and correct it as required.
- Inspect the punching accuracy and correct it as required.
- Lubricate the parts listed in the lubrication chart (see page 57).
LUBRICATION

Lubricate the parts or replenish the grease and oil or change the oil as described below.

**PART**  | **FREQUENCY**  | **LUBRICANT** (see below)
---|---|---
1. Carriage guide nut (nipple) | Once/month | B
2. Carriage ball-screw nut (nipple) | Once/month | D
3. Carriage gearbox (bath) | Once/3 mos. | A
4. Table guide nut (nipple) | Once/month | B
5. Table ball-screw nut (nipple) | Once/month | D
6. Table gearbox (bath) | Once/3 mos. | A
7. Workclamp bearings (oiler) | Once/day | A
8. Auto-index guide bushings (nipple) | Once/day | C
9. Auto-index gearbox (bath) | Once/3 mos. | A
10. Turret drive chain (oiler) | Once/day | A
11. Automatic lubricator pump (nipple) | Replenish* | C
12. Air system lubricator (oiler) | Replenish** | A
13. Tools & Litter collar (oiler) | Once/day | A
14. Hydraulic oil (tank) | Change** | E
15. Auto-index station spur gears (oiler) | Once/day | A
16. Punches (oiler) | Once/day | A

* See page 62.  ** See page 79.  *** See page 58.

**Recommended oils and greases**

A: MOBIL DTE Oil Light or SHELL Tellus Oil 32
B: MOBIL Mobilplex 2 or SHELL Alvania 2
C: MOBIL Mobilplex EPO or SHELL Alvania EP-RO
D: ESSO Lithtau 1 (E P1)
E: ISO VG 32 R&O MOBIL DTE 13 or SHELL Tellus Oil T32
HYDRAULIC OIL

Change the hydraulic oil and the line filter in the manner described below after the initial 3 months of operation and once every year thereafter. ISO VG32 R&O grade hydraulic oil (MOBIL DTE13 or SHELL Tellus Oil T32) is recommended.

1. Turn the machine circuit breaker switch to OFF.
2. Remove the cover from the hydraulic unit.
3. Remove the drain plug from the oil tank to drain the oil.
4. Detach the line filter from the cup and remove the accumulated oil from the cup.
5. Replace the O-ring and then attach a new filter to the cup.
6. Fill the tank with new oil until the level rises above the middle level on the gauge.
PRESS MOTOR V-BELTS

Provide the proper tension for the press motor V-belts in the manner described below. The proper tension exists when the belts can be depressed inward by the thumb by about 10 mm (0.4") at the middle of the span between the flywheel and the motor pulley.

To adjust the tension, loosen the four bolts (A) that clamp the motor base, screw-in the two adjustment bolts (B) to increase the tension of the belt, and then tighten the four clamp bolts.
CONTROL CABINET VENTILATION FANS

Five ventilation fans are installed in three locations inside the control cabinet (see figure). Unless they are functioning properly, the temperature in the cabinet will rise and can adversely affect the control circuits, which employ heat-sensitive ICs and transistors. Inspect the fans for abnormal noise, damage, accumulated dust, etc. once every month.

There are two air filters on the control cabinet which must be cleaned once every month. Detach both filters by removing their clips and then blow away the accumulated dust or wash them in lukewarm water with a 5% concentration of neutral detergent, rinse them in water, and dry them in the shade.
DC SERVOMOTORS

The brushes which are used with the DC servomotors are expendable and must be changed before their lengths have been worn down to the limit (see figure) that is marked on the brushes, or whenever a brush is damaged. Check the brushes for wear and damage at least once every 3 months.

NOTE: There are four brushes for each servomotor. Be sure to replace each brush in the same direction and in the same position. Also change all four brushes at the same time and be sure that they are of the same material and quality.

To change a brush, remove the brush-holder cap together with the O-ring, and remove the old brush. Remove the inspection hole cap and blow compressed dry air (below 1 kg/cm² or 14.2 psi) into the hole to thoroughly clean the inside of the motor by removing the accumulated carbon powder. Mount the new brush after confirming that it is free of oil and water. Replace the brush-holder cap while maintaining a tightening torque of 13 kg cm or 0.94 ft-lb. Lightly apply adhesive on the circumference of the inspection hole cap and replace the cap on the hole. Repeat this procedure for the remaining three brushes.

**CAUTION** *Exercise caution when applying the adhesive to ensure that no adhesive is allowed to drop inside the hole.*

Run-in the new brushes by operating the servomotor (see note below) in which the brushes have been changed at its slowest speed for 10 seconds at a time and several times in both its normal and reverse directions. Also check to ensure that the servomotor operates normally at this time.

NOTE: Remove the worksheet first if the brushes have been changed for the carriage or table drive motor before performing the run-in operation.
AUTOMATIC LUBRICATOR

The press crank bearings and connecting rods are lubricated by the electric lubrication pump installed on the machine frame. The pump will operate once when the LUB key on the main control panel is pressed and will then operate automatically once every 4000 hits thereafter. The amount of grease applied per pump operation is 2.4 cc (0.08 oz).

If any of the pipes becomes clogged or the grease in the tank has been consumed, the machine will be stopped and the LUBRICATION indicator light on the main control panel will be lighted. The tank can be refilled through its nipple with MOBIL Mobilplex EPO or SHELL Alvania EP-RO grease. Be sure that the grease is free of air and foreign matter.
STRIKER SHEAR PLATE

The shear plate for the striker can be changed in the following manner if it has been sheared due to an overload:

1. Remove the punch positioned below the striker to provide room for the changing of the shear plate.

2. Turn on the machine and NC.

3. Press the MODE MANUAL key and turn the PRESS SELECT switch to INCHING. Confirm that the index pins are inserted into the turrets at this time.

4. Press the PUNCH key to lower the striker close to its bottom dead center.

5. Turn off the machine and NC.

6. Loosen the three bolts (A in the figure) that clamp the holder and pull out the striker together with the backup plate.

7. Loosen the bolt (B in the figure) and detach the backup plate and the shear plate.

8. Install the new shear plate, reassemble the striker, and replace the striker on the ram. Also remount the punch that was removed in step 1.
**PUNCHES AND DIES**

Keep the punches and dies in good condition at all times to ensure accurate and efficient punching as well as a long tool life in the manner described below.

**Lubrication**

Apply machine oil to each punch and die before mounting it on a turret and again before starting each day’s operation. The figure shows the parts to which the oil should be applied.

**Inspection**

Inspect the condition of the turret-mounted punches and dies as frequently as possible. Also inspect their overall condition by disassembling them regularly. The disassembling procedure for punches is described below.

If the cutting edge of a punch or die appears to be dull or has a frosty appearance, regrinding must be performed. Be sure to regrind the punches and dies as often as possible to ensure the highest punching accuracy.

It is also necessary to remove any accumulated scale from the punches and to change any stripping spring that has become fatigued.
Disassembling punches

(a) The following procedure applies to the 1/2" or 1-1/4" punches for a thick turret and 1-1/4" punches for a thin turret. (See Appendix 2: Turret Stations & Tools for the details on the two types of thick turrets and two types of thin turrets that are available for the ARIES 245.)

1. Remove the punch guide from the dismounted punch (fig. "a"). For a 1-1/4" punch for a thick turret, loosen the set screw that retains the punch guide (fig. "b").

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

3. Screw M5 bolts (for a 1/2" punch) or M6 bolts (for a 1-1/4" punch) into the two bolt holes in the punch head. Tighten them equally until the clearance between the punch head and its collar is approximately 5 mm (0.2").

4. Loosen the punch head with a pipe wrench and disassemble the punch assembly.

To reassemble the punch, replace the retainer collar, stripping spring, punch head collar, and punch head on the punch body. Then clamp the body in the vise and tighten the punch head by using the pipe wrench until the specified punch height (see below) is obtained. Apply machine oil to the surface of the punch body and replace the punch guide on the punch body.
The following procedure applies to the 2" or 3-W punches for a thick or thin turret.

1. Clamp the punch in a soft-jaw vise and loosen the bolt that clamps the punch tip.

2. Loosen the screws that clamp the stripper plate springs and remove the stripper plate.

3. Screw an M8 bolt into the threaded hole in the punch tip and pull the punch tip out of the punch guide.

To reassemble the punch, place a shim on the punch driver to provide the specified punch height (see below) if necessary, apply machine oil to the punch tip, insert it into the punch guide, replace the stripper plate, tighten the screws that clamp the stripper plate springs, clamp the punch body in the vise, and tighten the punch tip clamping bolt firmly.

**Regrinding**

Limit the normal amount of metal removal in one regrinding operation to 0.2 mm (0.008" for a punch and 0.1 mm (0.004") for a die. The maximum metal removal allowable during the life of a punch or die is 2 mm (0.08") for a punch and 1 mm (0.04") for a die.

Be sure to finish the cutting edge of a reground punch or die by using an oil stone. Adjustment must also be made to provide the proper height for a reground punch or die (see below).
Height adjustment

The height of a punch or die that has been disassembled or reground must be adjusted to the specified heights that are listed below.

**SPECIFIED PUNCH HEIGHTS**

<table>
<thead>
<tr>
<th>Punch Size</th>
<th>Thick Turrets</th>
<th>Thin Turrets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot; punches</td>
<td>207.5 mm (8.17&quot;)</td>
<td>-</td>
</tr>
<tr>
<td>1-1/4&quot; punches</td>
<td>207.5 mm (8.17&quot;)</td>
<td>139.7 mm (5.53&quot;)</td>
</tr>
<tr>
<td>2&quot; punches</td>
<td>208.0 mm (8.19&quot;)</td>
<td>139.5 mm (5.49&quot;)</td>
</tr>
<tr>
<td>3-1/2&quot; punches</td>
<td>209.0 mm (8.23&quot;)</td>
<td>140.0 mm (5.513&quot;)</td>
</tr>
</tbody>
</table>

**1/2" and 1-1/4" punches for thick turrets**

For these punches, the specified height can be obtained by turning the punch head with a pipe wrench.

**2" and 3-1/2" punches for thick or thin turrets**

For these punches, the specified height can be obtained by inserting a shim (see below) between the punch tip and the punch driver.

**SPECIFIED DIE HEIGHTS**

The specified height for the 1/2", 1-1/4", 2" and 3-W dies for both thick and thin turrets is 30 mm (1.18").

For these dies, the specified height can be obtained by inserting a shim (see below) between the die and the die holder.
SHIMS FOR PUNCHES AND DIES

The following shims are available for the adjustment of the punch or die height:

**Shims for punches and dies in thick turret**

<table>
<thead>
<tr>
<th>SHIM</th>
<th>TYPE</th>
<th>SIZE A</th>
<th>SIZE B</th>
<th>THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>For 2&quot; punches</td>
<td>1</td>
<td>40 mm</td>
<td>15 mm</td>
<td>0.4, 0.8, 1.2, 1.6, &amp; 2.0 mm (0.016, 0.031, 0.047, 0.063, 0.079&quot;)</td>
</tr>
<tr>
<td>For 3-1/2&quot; punches</td>
<td>3</td>
<td>89 mm</td>
<td>15 mm</td>
<td>Same as above.</td>
</tr>
<tr>
<td>For 1/2&quot; dies</td>
<td>1</td>
<td>25 mm</td>
<td>15 mm</td>
<td>0.4, 0.8, &amp; 1.2 mm (0.016, 0.031, &amp; 0.047)</td>
</tr>
<tr>
<td>For 1-W dies</td>
<td>1</td>
<td>47 mm</td>
<td>35 mm</td>
<td>Same as above.</td>
</tr>
<tr>
<td>For 2&quot; dies</td>
<td>2</td>
<td>88 mm</td>
<td>55 mm</td>
<td>Same as above.</td>
</tr>
<tr>
<td>For 3-1/2&quot; dies</td>
<td>2</td>
<td>125 mm</td>
<td>93 mm</td>
<td>Same as above.</td>
</tr>
</tbody>
</table>

**Shims for punches and dies in thin turret**

<table>
<thead>
<tr>
<th>SHIM</th>
<th>TYPE</th>
<th>SIZE A</th>
<th>SIZE B</th>
<th>THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>For 2&quot; punches</td>
<td>1</td>
<td>40 mm</td>
<td>15 mm</td>
<td>0.4, 0.8, 1.2, 1.6, &amp; 2.6 mm (0.016, 0.031, 0.047, 0.063, &amp; 0.079&quot;)</td>
</tr>
<tr>
<td>For 3-1/2&quot; punches,</td>
<td>3</td>
<td>89 mm</td>
<td>15 mm</td>
<td>Same as above.</td>
</tr>
<tr>
<td>For 1-1/4&quot; dies</td>
<td>1</td>
<td>47 mm</td>
<td>35 mm</td>
<td>0.4, 0.8, &amp; 1.2 mm (0.016, 0.031, &amp; 0.047)</td>
</tr>
<tr>
<td>For 2&quot; dies</td>
<td>2</td>
<td>88 mm</td>
<td>55 mm</td>
<td>Same as above.</td>
</tr>
<tr>
<td>For 3-1/2&quot; dies</td>
<td>2</td>
<td>125 mm</td>
<td>93 mm</td>
<td>Same as above.</td>
</tr>
</tbody>
</table>

For further information regarding the punches, dies, and turrets, refer to APPENDIX 2: Turret Stations & Tools.
SELF-DIAGNOSIS

The status (0 or 1) of the input/output signals between the NC and the machine can be self-diagnosed and the results will be displayed on the screen.

Press the PATRN (SHIFT) key and then the ALARM key—the procedure is the same in any operation mode. The status will be indicated for each address. The displayed pages of the results can be changed by using the PREV PAGE and NEXT PAGE keys.

See the following pages for the definition of each address shown on the displayed pages.
### "DIAGNOSTIC"

#### DI

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>001</th>
<th>014</th>
<th>012</th>
<th>011</th>
<th>010</th>
<th>019</th>
<th>018</th>
</tr>
</thead>
<tbody>
<tr>
<td>*LOT+X</td>
<td>YOR</td>
<td>LHSY</td>
<td>LHSX</td>
<td>LTC</td>
<td>WREP</td>
<td>W*STP2</td>
<td>WSPI</td>
</tr>
<tr>
<td>Overtravel y-axis override: (manual mode)</td>
<td>Y-axis origin deceleration</td>
<td>X-axis origin deceleration</td>
<td>Tool change door open</td>
<td>Rep_confirmation ON/OFF</td>
<td>stop (safety mat)</td>
<td>index pin IN</td>
<td></td>
</tr>
</tbody>
</table>

#### ADDRESS

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>001</th>
<th>016</th>
<th>015</th>
<th>014</th>
<th>013</th>
<th>012</th>
<th>011</th>
<th>010</th>
</tr>
</thead>
<tbody>
<tr>
<td>P/S PAN</td>
<td>P/S WC</td>
<td>P/S WH</td>
<td>W*STPI</td>
<td>*HDPS</td>
<td>WTRL</td>
<td>WTRR</td>
<td>WCST1</td>
<td></td>
</tr>
<tr>
<td>Air pressure down</td>
<td>Work clamp</td>
<td>Work holder</td>
<td>Stop switch</td>
<td>Oil pressure down</td>
<td>Turret rotation c c w</td>
<td>Turret rotation c w</td>
<td>Start switch</td>
<td></td>
</tr>
</tbody>
</table>

#### ADDRESS

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>002</th>
<th>0127</th>
<th>0126</th>
<th>0125</th>
<th>0124</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPRM</td>
<td>LWTC</td>
<td>LMDFX</td>
<td>W*EM</td>
<td>WORC</td>
<td>*HDFL</td>
</tr>
<tr>
<td>Strip miss</td>
<td>Tool change</td>
<td>Press motor OFF</td>
<td>Emergency stop</td>
<td>Override confirmation</td>
<td>Fitter abnormal</td>
</tr>
<tr>
<td>Oil temperature up</td>
<td>Turret ON/OFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### ADDRESS

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>002</th>
<th>0121</th>
<th>0120</th>
<th>0119</th>
<th>0118</th>
<th>0117</th>
<th>0116</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBL</td>
<td>LCMD</td>
<td>*LLBNA</td>
<td>LLP</td>
<td>LIDX</td>
<td>*LOT-Y</td>
<td>*LOT+Y</td>
<td>*LOT-X</td>
</tr>
<tr>
<td>Auto-index Equipped/Non</td>
<td>C-axis command</td>
<td>Lubrication completion</td>
<td>X-gauge block</td>
<td>Auto-index ON/OFF</td>
<td>Overtravel (-Y)</td>
<td>Overtravel (+Y)</td>
<td>Overtravel (-X)</td>
</tr>
</tbody>
</table>

#### ADDRESS

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>003</th>
<th>0147</th>
<th>0146</th>
<th>0145</th>
<th>0144</th>
<th>0143</th>
<th>0142</th>
<th>0141</th>
<th>0140</th>
</tr>
</thead>
<tbody>
<tr>
<td>*LSG</td>
<td>WCYC</td>
<td>WINCH</td>
<td>LMHDX</td>
<td>W*STPO</td>
<td>WCST0</td>
<td>LSPOB</td>
<td>LSPOA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety guard</td>
<td>Press select CYCLE</td>
<td>Press select INCHING</td>
<td>Hydraulic motor OFF</td>
<td>Slop switch (NC)</td>
<td>Start switch (NC)</td>
<td>Lower index pin (OUT)</td>
<td>Upper index pin (OUT)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### ADDRESS

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>003</th>
<th>0139</th>
<th>0138</th>
<th>0137</th>
<th>0136</th>
<th>0135</th>
<th>0134</th>
<th>0133</th>
<th>0132</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSPIB</td>
<td>LSPIA</td>
<td>LNBS</td>
<td>WFWS</td>
<td>START</td>
<td>LCU</td>
<td>SALM</td>
<td>AORX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower index pin (IN)</td>
<td>Upper index pin (IN)</td>
<td>Nibbling start</td>
<td>Work clamp</td>
<td>Axis start</td>
<td>Top dead center</td>
<td>Servo alarm</td>
<td>Override (X)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADDRESS</td>
<td>I63</td>
<td>I62</td>
<td>I61</td>
<td>I60</td>
<td>I59</td>
<td>I58</td>
<td>I57</td>
<td>I56</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td></td>
</tr>
<tr>
<td>004</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LCOF</td>
<td>LEFX</td>
<td>*LHST</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reserved</td>
<td>Reserved</td>
<td>Reserved</td>
<td>Reserved</td>
<td>Reserved</td>
<td>Clutch OFF</td>
<td>Punching completion aux.</td>
<td>T-axis origin deceleration</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>I55</th>
<th>I54</th>
<th>I53</th>
<th>I52</th>
<th>I51</th>
<th>I50</th>
<th>I49</th>
<th>I48</th>
</tr>
</thead>
<tbody>
<tr>
<td>004</td>
<td>LWSD</td>
<td>LWSN</td>
<td>*LHSC</td>
<td>IPC</td>
<td>CPDB</td>
<td>CPDA</td>
<td>CPUB</td>
<td>CPUA</td>
</tr>
<tr>
<td></td>
<td>Work chute down</td>
<td>Work chute nominal</td>
<td>C-axis origin deceleration</td>
<td>Auto-index position confirmation</td>
<td>Lower auto-index clamp dose</td>
<td>Lower auto-index clamp open</td>
<td>Upper auto-index clamp close</td>
<td>Upper auto-index clamp open</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>I66</th>
<th>I65</th>
<th>I64</th>
</tr>
</thead>
<tbody>
<tr>
<td>005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ENST2</td>
<td>ENST1</td>
<td>EPNS</td>
</tr>
<tr>
<td></td>
<td>Multiple part punching program 2</td>
<td>Multiple part punching program 1</td>
<td>Multiple part punching program</td>
</tr>
</tbody>
</table>

**PART VI: MAINTENANCE**
<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>015</th>
<th>014</th>
<th>013</th>
<th>012</th>
<th>011</th>
<th>010</th>
<th>009</th>
<th>008</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>P En</td>
<td>SWH</td>
<td>swc</td>
<td>SHP</td>
<td>SICLP</td>
<td>sws</td>
<td>SAFV</td>
<td>HPM</td>
</tr>
<tr>
<td>Press enable</td>
<td>Workholder</td>
<td>Work clamp</td>
<td>Index pin</td>
<td>Auto-index clamp</td>
<td>Work chute</td>
<td>Safely valve</td>
<td>Hydraulic motor start aux.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>007</th>
<th>006</th>
<th>005</th>
<th>004</th>
<th>003</th>
<th>002</th>
<th>001</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>CMDX</td>
<td>OTR</td>
<td>ALM</td>
<td>APM</td>
<td>EMX</td>
<td>PSTL</td>
<td>PSPL</td>
</tr>
<tr>
<td>C-axis command</td>
<td>Overtravel release</td>
<td>Lub.motor start command</td>
<td>Press motor start aux.</td>
<td>Emergency stop</td>
<td>Start</td>
<td>Stop</td>
<td>CNC ready</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>031</th>
<th>030</th>
<th>029</th>
<th>028</th>
<th>027</th>
<th>026</th>
<th>025</th>
<th>024</th>
</tr>
</thead>
<tbody>
<tr>
<td>002</td>
<td>PBNA</td>
<td>PSP</td>
<td>PNAL</td>
<td>PHEM</td>
<td>PPAN</td>
<td>LUBS</td>
<td>PSHI</td>
<td></td>
</tr>
<tr>
<td>Lubrication slop</td>
<td>Stop switch</td>
<td>NC ar m</td>
<td>Hydraulic unit abnormal</td>
<td>Air pressure down</td>
<td>Reserved</td>
<td>Reserved</td>
<td>Index pin</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>023</th>
<th>022</th>
<th>021</th>
<th>020</th>
<th>019</th>
<th>018</th>
<th>017</th>
<th>016</th>
</tr>
</thead>
<tbody>
<tr>
<td>002</td>
<td>PORD</td>
<td>PMOO</td>
<td>PHFL</td>
<td>POP</td>
<td>PZRA</td>
<td>PCU</td>
<td>PRDY</td>
<td></td>
</tr>
<tr>
<td>Override</td>
<td>Program stop</td>
<td>Filler abnormal</td>
<td>Automatic operation</td>
<td>Reserved</td>
<td>Origin retract completion</td>
<td>Top dead center</td>
<td>NC ready</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>047</th>
<th>046</th>
<th>045</th>
<th>044</th>
<th>043</th>
<th>042</th>
<th>041</th>
<th>040</th>
</tr>
</thead>
<tbody>
<tr>
<td>003</td>
<td>RLY</td>
<td>SSR2</td>
<td>SSR1</td>
<td>LPU</td>
<td>MPUN</td>
<td>HFN</td>
<td>OP</td>
<td>SMCL</td>
</tr>
<tr>
<td>Resved</td>
<td>Resved</td>
<td>Resved</td>
<td>X-gauge block up</td>
<td>Manual punching</td>
<td>X,Y-origin retract completion</td>
<td>Automatic operation</td>
<td>Strip miss clear</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>039</th>
<th>038</th>
<th>037</th>
<th>036</th>
<th>035</th>
<th>034</th>
<th>033</th>
<th>032</th>
</tr>
</thead>
<tbody>
<tr>
<td>003</td>
<td>STON</td>
<td>STCL</td>
<td>PREP</td>
<td>PSM</td>
<td>PLP</td>
<td>PTC</td>
<td>PTCNG</td>
<td>PW C</td>
</tr>
<tr>
<td>Strip miss ON</td>
<td>Stall clear</td>
<td>Repositioning confirmation</td>
<td>Strip miss</td>
<td>X-gauge block &quot;P&quot;</td>
<td>Toot change door open</td>
<td>Toot change switch</td>
<td>Work clamp open</td>
<td></td>
</tr>
</tbody>
</table>
### DI IMAGE

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>Y 15</th>
<th>Y 14</th>
<th>Y 13</th>
<th>Y 12</th>
<th>Y 11</th>
<th>Y 10</th>
<th>Y 9</th>
<th>Y 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>PSTM</td>
<td>PSBK</td>
<td>PNSTA</td>
<td>PNSTR</td>
<td>PNSTT</td>
<td>PBDT</td>
<td>POPS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Strip miss</td>
<td>Single block</td>
<td>Multiple part punching full</td>
<td>Multiple part punching post trial</td>
<td>Multiple part punching trial</td>
<td>Block skip</td>
<td>Optional stop</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>Y 7</th>
<th>Y 6</th>
<th>Y 5</th>
<th>Y 4</th>
<th>Y 3</th>
<th>Y 2</th>
<th>Y 1</th>
<th>Y 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Turret origin</td>
<td>Y-axis origin</td>
<td>X-axis origin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>Y 31</th>
<th>Y 30</th>
<th>Y 29</th>
<th>Y 28</th>
<th>Y 27</th>
<th>Y 26</th>
<th>Y 25</th>
<th>Y 24</th>
</tr>
</thead>
<tbody>
<tr>
<td>002</td>
<td>PF4</td>
<td>PF3</td>
<td>PF2</td>
<td>PF1</td>
<td>POVR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Axis feedrate</td>
<td>Axis feedrate</td>
<td>Axis feedrate</td>
<td>Axis feedrate</td>
<td>Override confirmation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>Y 23</th>
<th>Y 22</th>
<th>Y 21</th>
<th>Y 20</th>
<th>Y 19</th>
<th>Y 18</th>
<th>Y 17</th>
<th>Y 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>002</td>
<td>PPRT</td>
<td>PEDT</td>
<td>PMEM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PZRN</td>
</tr>
<tr>
<td></td>
<td>Program protect</td>
<td>Edit mode</td>
<td>Memory mode</td>
<td></td>
<td>MDI mode</td>
<td>Manual mode</td>
<td>Retract mode</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>Y 47</th>
<th>Y 46</th>
<th>Y 45</th>
<th>Y 44</th>
<th>Y 43</th>
<th>Y 42</th>
<th>Y 41</th>
<th>Y 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>003</td>
<td>KEY</td>
<td>RPRT</td>
<td></td>
<td>+C</td>
<td>-T</td>
<td>+T</td>
<td>-Y</td>
<td>+Y</td>
</tr>
<tr>
<td></td>
<td>Program protect</td>
<td>Write protect</td>
<td>Axis direction input (+C)</td>
<td>Axis direction input (-T)</td>
<td>Axis direction input (+T)</td>
<td>Axis direction input (-Y)</td>
<td>Axis direction input (+Y)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>Y 39</th>
<th>Y 38</th>
<th>Y 37</th>
<th>Y 36</th>
<th>Y 35</th>
<th>Y 34</th>
<th>Y 33</th>
<th>Y 32</th>
</tr>
</thead>
<tbody>
<tr>
<td>003</td>
<td>+X</td>
<td>+X</td>
<td>EDT</td>
<td>MEM</td>
<td>D</td>
<td>J</td>
<td></td>
<td>ZRN</td>
</tr>
<tr>
<td></td>
<td>Axis direction input (+X)</td>
<td>Axis direction input (+X)</td>
<td>Edit mode</td>
<td>Memory mode</td>
<td>MDI mode</td>
<td>Manual mode</td>
<td>Reltract mode</td>
<td></td>
</tr>
</tbody>
</table>
### ADDRESS 004

<table>
<thead>
<tr>
<th>Address</th>
<th>Y63</th>
<th>Y62</th>
<th>Y61</th>
<th>Y60</th>
<th>Y59</th>
<th>Y58</th>
<th>Y57</th>
<th>Y56</th>
</tr>
</thead>
<tbody>
<tr>
<td>T- command cancel</td>
<td>C- command cancel</td>
<td>M-function lock</td>
<td>Machine lock</td>
<td>C-axis interlock</td>
<td>T-axis interlock</td>
<td>Y-axis interlock</td>
<td>X-axis interlock</td>
<td></td>
</tr>
</tbody>
</table>

### ADDRESS 004

<table>
<thead>
<tr>
<th>Address</th>
<th>Y55</th>
<th>Y54</th>
<th>Y53</th>
<th>Y52</th>
<th>Y51</th>
<th>Y50</th>
<th>Y49</th>
<th>Y48</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP</td>
<td>ST</td>
<td>SBK</td>
<td>PFL</td>
<td>MPS</td>
<td>MNS</td>
<td>PFW</td>
<td>CPS</td>
<td></td>
</tr>
</tbody>
</table>

**Automatic operation stop**

**Automatic operation start**

**Single block**

**Press start lock**

**Manual press Start**

**Manual continuous press select**

**Press start stand-by**

**One cycle press select**

### ADDRESS 005

<table>
<thead>
<tr>
<th>Address</th>
<th>Y79</th>
<th>Y78</th>
<th>Y77</th>
<th>Y76</th>
<th>Y75</th>
<th>Y74</th>
<th>Y73</th>
<th>Y72</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil temperature up</td>
<td>Oil pressure down</td>
<td>Internal reset</td>
<td>Reset and rewind</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### ADDRESS 005

<table>
<thead>
<tr>
<th>Address</th>
<th>Y71</th>
<th>Y70</th>
<th>Y69</th>
<th>Y68</th>
<th>Y67</th>
<th>Y66</th>
<th>Y65</th>
<th>Y64</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crank overrun</td>
<td>Buzzer</td>
<td>Servo OFF (C)</td>
<td>Servo OFF (T)</td>
<td>Servo OFF (Y)</td>
<td>Servo OFF (X)</td>
<td>M-function completion</td>
<td>T-function completion</td>
<td></td>
</tr>
</tbody>
</table>

### ADDRESS 006

<table>
<thead>
<tr>
<th>Address</th>
<th>Y95</th>
<th>Y94</th>
<th>Y93</th>
<th>Y92</th>
<th>Y91</th>
<th>Y90</th>
<th>Y89</th>
<th>Y88</th>
</tr>
</thead>
<tbody>
<tr>
<td>*ESP</td>
<td>PCE</td>
<td>F4</td>
<td>F3</td>
<td>F2</td>
<td>F1</td>
<td>IDXM4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Emergency stop**

**PC error**

**Feedrate selection F4**

**Feedrate selection F3**

**Feedrate selection F2**

**Feedrate selection F1**

**Auto-index message 4**

### ADDRESS 006

<table>
<thead>
<tr>
<th>Address</th>
<th>Y87</th>
<th>Y86</th>
<th>Y85</th>
<th>Y84</th>
<th>Y83</th>
<th>Y82</th>
<th>Y81</th>
<th>Y80</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDXM3</td>
<td>IDXM2</td>
<td>IDXM1</td>
<td>IDXA5</td>
<td>IDXA4</td>
<td>IDXA3</td>
<td>IDXA2</td>
<td>IDXA1</td>
<td></td>
</tr>
</tbody>
</table>

**Auto-index message 3**

**Auto-index message 2**

**Auto-index message 1**

**Auto-index alarm 5**

**Auto-index alarm 4**

**Auto-index alarm 3**

**Auto-index alarm 2**

**Auto-index alarm 1**
### ADDRESS 001

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>x 15</th>
<th>x 14</th>
<th>x 13</th>
<th>x 12</th>
<th>X 11</th>
<th>x 10</th>
<th>x 9</th>
<th>X 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>WF4</td>
<td>WF3</td>
<td>WF2</td>
<td>WF1</td>
<td>W-K</td>
<td>W+Y</td>
<td>W-x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### ADDRESS 002

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>x 7</th>
<th>X 6</th>
<th>x 5</th>
<th>x 4</th>
<th>x 3</th>
<th>x 2</th>
<th>X 1</th>
<th>X 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>W+T</td>
<td>WEDT</td>
<td>WMEM</td>
<td>WMDI</td>
<td>WMAN</td>
<td>WZRN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edit mode</td>
<td>Auto mode</td>
<td>MDI mode</td>
<td>Manual mode</td>
<td>Retract mode</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### ADDRESS 003

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>x31</th>
<th>x30</th>
<th>X 29</th>
<th>X 28</th>
<th>X 27</th>
<th>X 26</th>
<th>X 25</th>
<th>X 24</th>
</tr>
</thead>
<tbody>
<tr>
<td>WCTRL</td>
<td>WOTR</td>
<td>WRST</td>
<td>WPLT</td>
<td>WSBK</td>
<td>W*STP</td>
<td>WCST1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reset switch</td>
<td>Overtravel release switch</td>
<td>Reset switch</td>
<td>Program protect switch</td>
<td>Single block switch</td>
<td>Stop switch</td>
<td>Start switch</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### ADDRESS 004

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>X 23</th>
<th>X 22</th>
<th>X 21</th>
<th>X 20</th>
<th>X 19</th>
<th>X 18</th>
<th>X 17</th>
<th>X 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>WPUN ,</td>
<td>WSTM</td>
<td>WMLK</td>
<td>WORC</td>
<td>WLST</td>
<td>WOR</td>
<td>WBTD</td>
<td>WOPS</td>
<td></td>
</tr>
<tr>
<td>Punch switch</td>
<td>Strip miss ON/OFF switch</td>
<td>Program check switch</td>
<td>Override confirmation</td>
<td>Lubrication switch</td>
<td>Override ON/OFF switch</td>
<td>Block skip switch</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### ADDRESS 005

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>X 47</th>
<th>X 46</th>
<th>X 45</th>
<th>X 44</th>
<th>X 43</th>
<th>X 42</th>
<th>X 41</th>
<th>X 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA</td>
<td>TIE</td>
<td>PFX</td>
<td>SORY</td>
<td>SPRL</td>
<td>PCK</td>
<td>RST</td>
<td>AL</td>
<td></td>
</tr>
<tr>
<td>NC ready</td>
<td>Turret indexing completion</td>
<td>Press start signal</td>
<td>Y-axis override</td>
<td>Strip miss stop signal</td>
<td>Program check</td>
<td>Control system reset</td>
<td>Control system alarm</td>
<td></td>
</tr>
</tbody>
</table>

### ADDRESS 006

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>X 39</th>
<th>X 38</th>
<th>X 37</th>
<th>X 36</th>
<th>X 35</th>
<th>X 34</th>
<th>X 33</th>
<th>X 32</th>
</tr>
</thead>
<tbody>
<tr>
<td>OP</td>
<td>SA</td>
<td>STL</td>
<td>SPL</td>
<td>ZPC</td>
<td>ZPT</td>
<td>ZPY</td>
<td>ZPX</td>
<td></td>
</tr>
<tr>
<td>Automatic operation</td>
<td>Servo ready</td>
<td>Automatic operation running</td>
<td>Automatic operation holding</td>
<td>Origin retract completion C</td>
<td>Origin retract completion T</td>
<td>Origin retract completion Y</td>
<td>Origin retract completion X</td>
<td></td>
</tr>
<tr>
<td>ADDRESS</td>
<td>X 63</td>
<td>X 62</td>
<td>X 61</td>
<td>X 60</td>
<td>X 59</td>
<td>X 58</td>
<td>X 57</td>
<td>X 56</td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>004</td>
<td>M00</td>
<td>M01</td>
<td>M02</td>
<td>M30</td>
<td>DEN</td>
<td>TF</td>
<td>MF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Program stop</td>
<td>Optional stop</td>
<td>End of tape</td>
<td>Reset and rewind</td>
<td>End of pulse distribution</td>
<td>I-code received</td>
<td>M-code received</td>
<td></td>
</tr>
<tr>
<td>ADDRESS</td>
<td>x 55</td>
<td>x-54.</td>
<td>x 53</td>
<td>X 52</td>
<td>x51</td>
<td>X 50</td>
<td>x 49</td>
<td>X 48</td>
</tr>
<tr>
<td>004</td>
<td>M28</td>
<td>M24</td>
<td>M22</td>
<td>M21</td>
<td>M18</td>
<td>M14</td>
<td>M12</td>
<td>M1</td>
</tr>
<tr>
<td>M-function</td>
<td>M-function</td>
<td>M-function</td>
<td>M-function</td>
<td>M-function</td>
<td>M-function</td>
<td>M-function</td>
<td>M-function</td>
<td>M-function</td>
</tr>
<tr>
<td></td>
<td>BCD code</td>
<td>BCD code</td>
<td>BCD code</td>
<td>BCD code</td>
<td>BCD code</td>
<td>BCD code</td>
<td>BCD code</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>X 79</th>
<th>X 78</th>
<th>X 77</th>
<th>X 76</th>
<th>X 75</th>
<th>X 74</th>
<th>X 73</th>
<th>X 72</th>
</tr>
</thead>
<tbody>
<tr>
<td>005</td>
<td>ACK</td>
<td>RP2C</td>
<td>RP3T</td>
<td>RP2T</td>
<td>T38</td>
<td>T34</td>
<td>T32</td>
<td>T31</td>
</tr>
<tr>
<td></td>
<td>CNC ready</td>
<td>Reference point (second) C</td>
<td>Reference point (third) T</td>
<td>Reference point (second) T</td>
<td>T-function BCD code</td>
<td>T-function BCD code</td>
<td>T-function BCD code</td>
<td>T-function BCD code</td>
</tr>
<tr>
<td>ADDRESS</td>
<td>x 71</td>
<td>x 70</td>
<td>X 69</td>
<td>X 68</td>
<td>X 67</td>
<td>X66</td>
<td>X 65</td>
<td>X 64</td>
</tr>
<tr>
<td>005</td>
<td>T28</td>
<td>T24</td>
<td>T22</td>
<td>T 2 1</td>
<td>T18</td>
<td>T14</td>
<td>T12</td>
<td>T11</td>
</tr>
<tr>
<td></td>
<td>T-function BCD code</td>
<td>T-function BCD code</td>
<td>T-function BCD code</td>
<td>T-function BCD code</td>
<td>T-function BCD code</td>
<td>T-function BCD code</td>
<td>T-function BCD code</td>
<td>T-function BCD code</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>X 95</th>
<th>X 94</th>
<th>X 93</th>
<th>X 92</th>
<th>x91</th>
<th>X90</th>
<th>X89</th>
<th>X88</th>
</tr>
</thead>
<tbody>
<tr>
<td>006</td>
<td>DACS</td>
<td>MPUN</td>
<td>STCL</td>
<td>NST2</td>
<td>NST1</td>
<td>SMLC</td>
<td>ESEND</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Disk drive access</td>
<td>Manual press selection</td>
<td>Start clear</td>
<td>Multiple part punching 2</td>
<td>Multiple part punching 1</td>
<td>Strip miss: clear</td>
<td>Search end</td>
<td></td>
</tr>
<tr>
<td>ADDRESS</td>
<td>X 87</td>
<td>X 86</td>
<td>X 85.</td>
<td>X 84</td>
<td>X 83</td>
<td>X 82</td>
<td>X81</td>
<td>X 80</td>
</tr>
<tr>
<td>006</td>
<td>ESC</td>
<td>EST</td>
<td>ESY</td>
<td>ESX</td>
<td>MCC</td>
<td>MCT</td>
<td>MCY</td>
<td>MCX</td>
</tr>
<tr>
<td></td>
<td>In position C</td>
<td>In position T</td>
<td>In position Y</td>
<td>In position X</td>
<td>Motion command C</td>
<td>Motion command T</td>
<td>Motion command Y</td>
<td>Motion command X</td>
</tr>
</tbody>
</table>
INSTALLATION

The ARIES 245 should be installed according to the instructions described below and by following the instructions of the AMADA engineer.

Location and foundation

Be sure to provide ample space around the machine to permit easy operation, maintenance, and work handling, as well as for the installation of an air compressor, the storage of tools, etc.

Take extra precautions to isolate the machine from any nearby equipment that produces vibration or dust. Also, keep the machine at least 3 m (10') away from any equipment that produces electrical interference (welders, drills, sanders, etc.).

Provide a firm, level concrete floor for the installation of the machine according to the foundation plan provided by AMADA. Before positioning the machine, place the six base plates that are supplied with the machine under the machine in the positions in which it will come into contact with the floor.

Use a crane to lift and position the machine, which weighs 7500 kg (16600 lb). Attach wire ropes to the rib that is located under the top cover of the machine (see figure) and balance the machine carefully. Lift and lower the machine slowly and carefully while protecting it from impacts.

Unclamping

The control cabinet and the carriage are clamped for protection during transportation (see figures) and must be unclamped after the machine has been positioned on the floor.

1. Detach the two brackets that clamp the carriage by removing the bolts.
2. Remove the four eyebolts from the front and rear of the machine.
3. Remove the two bolts that clamp the bracket to the top of the control cabinet and loosen the two bolts that clamp the bracket to the frame.
Cleaning

Remove the rust preventive from the surfaces of the machine by using cleaning oil and then apply machine oil to the parts from which the preventive has been removed.

**WARNING** Never use a scraper or solvents that may damage the coated surfaces of the machine.

**Leveling**

Level the machine in the manner described below.

1. Place levels on the top of the upper (punch) turret in the X- and Y-axis directions.
2. Loosen and raise the two jack bolts ("D" in the figure) as necessary until they are not in contact with the base plates placed under them.
3. Level the machine in both directions by providing shims under the four machine legs and adjusting the four jack bolts ("C" in the figure) so that the machine is leveled to within ±0.03 mm in both directions. Then clamp the jack bolts with their nuts.
4. Tighten the two jack bolts to bring them into contact with the base plates and clamp the bolts with their nuts. Do not tighten these bolts excessively since doing so will affect the levelness that was obtained in the above step.
5. Remove the front cover from the bottom of the control cabinet to expose the four antivibration bolts. Turn the bolts to provide uprightness for the cabinet and a gap of 5 mm (0.2") between the bottom of the cabinet and the rubber plate on the top of the bracket. Then tighten the lock nuts for the bolts.
6. Move the bracket to provide a gap of 5 mm (0.2") between the top of the cabinet and the bottom of the bracket and then clamp the bracket with its two bolts.
Filling hydraulic oil tank

Detach the cover from the hydraulic unit to expose the hydraulic oil tank and remove the rubber packing from the inside of the filler cap. Fill the tank with 40 liters (10.6 US gal) of an ISO VG32 R&O grade oil or to the middle of the level gauge. Replace the filler cap and then the cover.

Air connections

The machine requires a supply of more than 80 liters (21 US gal) of compressed air per minute for the operation of the workclamps and workholders. Install an air compressor with an output of over 0.75 kW as close to the machine as possible and use an air hose or pipe with an inside diameter of 1/4" in order to obtain maximum efficiency.

Connect the air compressor with the hose or pipe to the 1/4" inlet of the air control equipment, which is located on the rear of the machine.

Provide the required operating air pressure of 5 kg/cm² (71 psi) by loosening the locknut for the adjustment knob and turning the knob clockwise to increase or counterclockwise to decrease the pressure, which can be read on the pressure gauge. Tighten the locknut after the adjustment.

The lubricator in the air control equipment drops oil into the outgoing air to supply the oil in mist form to the air line. The required amount of oil is one drop per 5 insertion/withdrawal movements of the turret index pins. Turn the adjustment screw on the lubricator clockwise to decrease or counterclockwise to increase the frequency of the oil supply. Replenish the oil as necessary to maintain its level in the reservoir. Not less than 5 mm (0.2") above the bottom end of the vinyl tube which is provided in the reservoir.

- SHELL Tellus Oil 32 or MOBIL DTE Oil Light
Electrical connections

**WARNING** *All electrical work must be carried out by a qualified electrician in order to prevent accidents or damage.*

- Use a three-phase power cable with a capacity of at least 11 kVA to supply power from the shop circuit breaker to the electrical control unit of the machine.

- Change the connections of the terminals for the transformer and the press motor according to the power-supply voltage. Also change the thermal relays or their settings, fuses, and noise filters according to the power-supply voltage.

- Confirm that the connection has been properly made by inspecting the rotational direction of the press motor. The ram indicator should rotate in the clockwise direction.

- Connect the six safety mats (optional) to the machine.

- The alignment of the punch and die, turrets must be inspected and confirmed by the AMADA engineer before any trial operation.
TURRET STATIONS & TOOLS

Four types of turrets are available for the ARIES 245.

**Thick 20-station turret**

Stations T8 and T17 are auto-index (AI) stations. Station T8 is the turret origin. See below for the specifications of the tool-stations.

![Diagram of turret stations]

**T2-7 & '13-l 5 (9 stations):**
For 1/2" dia. tools to punch 1.6–12.7 mm (0.063–0.5") dia. holes.

**T9-11 & 18-20 (6 stations):**
For l-114" dia. tools to punch 12.8-31.7 mm (0.501-l .25") dia. holes.

**T16 (1 station):**
For 2" dia. tools to punch 31.8–50.8 mm (1.251 to 2.0") dia. holes.

**T1 & 12 (2 stations):**
For 3-1/2" dia. tools to punch 50.9–88.9 mm (2.001–3.5") dia. holes.

**T8 & 17 (2 AI stations):**
For 1-W dia. tools to punch 12.3-31.7 mm (0.501-l .25") dia. holes.
**Thick 24-station turret**

This turret has no auto-index stations. Station T1 is the turret origin. See below for the specifications of the tool-stations.

- **T2-7 & 14-19 (12 stations):**
  For 1/2" dia. tools to punch 1.6-12.7 mm (0.063-0.5") dia. holes.

- **T9-12 & 21-24 (8 stations):**
  For 1-1/4" dia. tools to punch 12.8-31.7 mm (0.501-1.25") dia. holes.

- **T8 & 20 (2 stations):**
  For 2" dia. tools to punch 31.8-50.8 mm (1.251 to 2.0") dia. holes.

- **T1 & 13 (2 stations):**
  For 3-1/2" dia. tools to punch 50.9-88.9 mm (2.001-3.5") dia. holes.
1/2" TOOLS

1. Punchhead
2. Punchheadcokr
3. Punch body
4. Stripping spring
5. Retainer collar
6. Punch guide
7. Guide key
8. Die
9. Die holder
10. Die key
11. Lift ring
12. Lift spring
13. Shoulder screw
1-1/4" TOOLS

1. Punch head
2. Punch head collar
3. Punch body
4. Stripping spring
5. Punch guide
6. Guide key
7. Die
8. Die holder
9. Die key
10. Shoulder screw
11. Lift ring
12. Lift spring
APPENDIX 2: TURRET STATIONS & TOOLS

2" & 3-1/2" TOOLS

1. Punch head
2. Punch driver
3. Stripping spring
4. Shoulder screw
5. Lift ring
6. Lift spring
7. Punch guide
8. Guide key
9. Die
10. Die holder
KEYS/KEYWAYS IN TURRET STATIONS

1/2" stations (punch turret)
1 key
(270°)

1/2" stations (die turret)
4 keyways
(0, 90, 180, & 270°)

1-1/4" stations (punch turret)
1 key
(270°)

1-1/4" stations (die turret)
4 keyways
(0, 90, 180, & 270°)

2' stations (both turrets)
1 key
(270°)

3-1/2' stations (both turrets)
1 key
(270°)
### KEYS/KEYWAYS IN PUNCHES

**1/2 & 1-W' punches** (shaped)  
2 keyways

- ![Diagram of 1/2 & 1-W' punches (shaped)](image)

**1/2 & 1-1/4" punches** (round)  
1 keyway

- ![Diagram of 1/2 & 1-1/4" punches (round)](image)

**2 & 3-1/2" punches** (shaped & round)  
2 keyways

- ![Diagram of 2 & 3-1/2" punches (shaped & round)](image)

### KEYS/KEYWAYS IN DIES

**1/2 & 1-1/4" dies** (shaped)  
1 key

- ![Diagram of 1/2 & 1-1/4" dies (shaped)](image)

**1/2 & 1-1/4" dies** (round)  
No key

- ![Diagram of 1/2 & 1-1/4" dies (round)](image)

**2 & 3-1/2" dies** (shaped)  
2 keyways

- ![Diagram of 2 & 3-1/2" dies (shaped)](image)

**2 & 3-1/2" dies** (round)  
1 keyway

- ![Diagram of 2 & 3-1/2" dies (round)](image)
Thin 18-station turret

Stations T6 and T15 are auto-index (AI) stations. Station T6 is the turret origin. See below for the specifications of the tool-stations.

T2–5, 7–9, 11–14 & 16–18 (14 stations):
For 1 1/4" dia. tools to punch 0.8-31.7 mm (0.031-l .25") dia. holes.

T1 & 10 (2 stations):
For 3 1/2" dia. tools to punch 31.8-88.9 mm (1.251-3.5") dia. holes.

T6 & 15 (2' AI stations):
For 1 1/4" dia. tools to punch 0.8-31.7 mm (0.031-l .25") dia. holes.
**Thin 20-station turret**

This turret has no auto-index stations. Station \( T_1 \) is the turret origin. See below for the specifications of the tool-stations.

\[
\begin{align*}
T_2-5, 7-10, 12-15 & \quad \text{&} \quad 17-20 \ (16 \ \text{stations}) : \\
& \quad \text{For } 1 \ -\ 1/4" \ \text{dia. tools to punch } 0.8-31.7 \ \text{mm (0.031-1.25") dia. holes.}
\end{align*}
\]

\[
\begin{align*}
T_{6} \ & \quad \text{&} \quad 16 \ (2 \ \text{stations):} \\
& \quad \text{For } 2" \ \text{dia tools to punch } 31.8-50.8 \ \text{mm (1.251-2.0") dia. holes.}
\end{align*}
\]

\[
\begin{align*}
T_{11} \ & \quad \text{&} \quad 11 \ (2 \ \text{stations):} \\
& \quad \text{For } 3-1/2" \ \text{dia. tools to punch } 50.9-88.9 \ \text{mm (2.001-3.5") dia. holes.}
\end{align*}
\]
1-1/4" TOOLS

1. Punch head
2. Punch head collar
3. Stripping spring
4. Punch body
5. Punch guide
6. Shoulder screw
7. Lift ring
8. Lift spring
9. Die
10. Die holder
2" & 3-1/2" TOOLS

1. Punch head
2. Stripping spring
3. Punch guide
4. Guide key
5. Shoulder screw
6. Lift ring
7. Lift spring
8. Die
9. Dieholder
KEYS/KEYWAYS IN TURRET STATIONS

1-1/4" stations (punch & die turrets)
4 keyways
(0, 90, 180, 270°)

2 & 3-1/2" stations (punch & die turrets)
1 key
(270°)

KEYS/KEYWAYS IN PUNCHES

1-1/4" punches (shaped)
1 key

2 & 3-1/2" punches (shaped & round)
2 keyways

1-1/4" punches (round)
No key

KEYS/KEYWAYS IN DIES

1-1/4" dies (shaped)
1 key

2 & 3-1/2" dies (shaped)
2 keyways

1-1/4" dies (round)
No key

2 & 3-1/2" dies (round)
1 keyway
**Punch-to-die clearance**

The punch-to-die clearance is the difference in the diameters of the punch and the die that are used in combination. The proper clearance must be determined according to the material and thickness of the worksheet to be punched (see table below). The clearance can be obtained by subtracting the punch diameter from the die diameter.

\[
Punch\to\text{die clearance} = \text{Die diameter} - \text{Punch diameter}
\]

**SUGGESTED PUNCH-TO-DIE CLEARANCES**

<table>
<thead>
<tr>
<th>THICKNESS</th>
<th>MILDSTEEL</th>
<th>ALUMINUM</th>
<th>STAINLESS STEEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8-1.6 mm</td>
<td>0.15-0.3 mm</td>
<td>0.15-0.3 mm</td>
<td>0.2-0.35 mm</td>
</tr>
<tr>
<td>(0.031-0.062&quot;)</td>
<td>(0.006-0.012&quot;)</td>
<td>(0.006-0.012&quot;)</td>
<td>(0.008-0.014&quot;)</td>
</tr>
<tr>
<td>1.6-2.3 mm</td>
<td>0.3-0.4 mm</td>
<td>0.3-0.4 mm</td>
<td>0.4-0.5 mm</td>
</tr>
<tr>
<td>(0.062-0.090&quot;)</td>
<td>(0.012-0.156&quot;)</td>
<td>(0.012-0.156&quot;)</td>
<td>(0.156-0.020&quot;)</td>
</tr>
<tr>
<td>2.3-3.2 mm</td>
<td>0.4-0.6 mm</td>
<td>0.4-0.5 mm</td>
<td>0.5-0.7 mm</td>
</tr>
<tr>
<td>(0.090-0.125&quot;)</td>
<td>(0.012-0.023&quot;)</td>
<td>(0.012-0.020&quot;)</td>
<td>(0.020-0.027&quot;)</td>
</tr>
<tr>
<td>3.2-4.5 mm</td>
<td>0.6-0.9 mm</td>
<td>0.5-0.7 mm</td>
<td>0.7-1.2 mm</td>
</tr>
<tr>
<td>(0.125-0.176&quot;)</td>
<td>(0.023-0.035&quot;)</td>
<td>(0.020-0.027&quot;)</td>
<td>(0.027-0.047&quot;)</td>
</tr>
</tbody>
</table>

**Minimum hole diameter**

The minimum diameter of the holes that can be punched can be calculated for different types of worksheet material and thicknesses as follows:

For mild steel: Thickness x 1.0.
For aluminum: Thickness x 1.0
For stainless steel: Thickness x 2.0
**Punching capacity**

The required punching force \( P \) can be determined by the shearing strength \( G \), thickness \( t \) of the worksheet, and the circumference \( A \) when punching a round hole, or the total of all sides \( A \) when punching a rectangular hole. The force can be calculated as follows:

\[
P \text{ (metric tons)} = \frac{A \text{ (mm)} \times t \text{ (mm)} \times G \text{ (kg/mm}^2\text{)}}{9000}
\]

Punching can be performed provided that the calculated value of \( P \) does not exceed the machine's press capacity of 20 metric tons (22 US tons).

**Worksheet Material:** MILD STEEL (SHEARING STRENGTH: 40 KG/MM²)

**Circumference**

\[ A = \pi d \]

\( (\pi = 3.14) \)

**Total of all sides**

\[ A = 2(a + b) \]
**SPECIFICATIONS**

**Machine specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press capacity</td>
<td>20 metric tons (22 US tons)</td>
</tr>
<tr>
<td>Max. worksheet thickness</td>
<td>4.5 mm (0.177&quot;)</td>
</tr>
<tr>
<td>Carriage travel (X x Y)</td>
<td>1270 x 1000 mm (50 x 403)</td>
</tr>
<tr>
<td>Max. worksheet size (xx Y)</td>
<td>2540 x 1000 mm (100 x 40&quot;)</td>
</tr>
<tr>
<td>Punching accuracy</td>
<td>±0.10 mm (0.004&quot;)</td>
</tr>
<tr>
<td>Press stroke</td>
<td>32 mm (1.26&quot;)</td>
</tr>
<tr>
<td>No. of press strokes</td>
<td>300 strokes/min</td>
</tr>
<tr>
<td>Punching hit rate</td>
<td>180 hits/min at 25 mm (1&quot;) pitch</td>
</tr>
<tr>
<td>Press motor</td>
<td>3.7 kW</td>
</tr>
<tr>
<td>No. of-turret stations</td>
<td>20 (including 2 auto-index stations) or 24 (without auto-index stations) for thick turrets</td>
</tr>
<tr>
<td></td>
<td>18 (including 2 auto-index stations) or 20 (without auto-index stations) for thin turrets</td>
</tr>
<tr>
<td>Turret rotating speed</td>
<td>20rpm</td>
</tr>
<tr>
<td>Auto-index speed</td>
<td>60 rpm</td>
</tr>
<tr>
<td>Table feed rate</td>
<td>40 m/min (131 fpm)</td>
</tr>
<tr>
<td>Required power supply</td>
<td>11 kVA (including NC)</td>
</tr>
<tr>
<td>Required air supply</td>
<td>5.0 kg/cm² (71 psi)</td>
</tr>
<tr>
<td>Overall width</td>
<td>2700 mm (106.3&quot;)</td>
</tr>
<tr>
<td>Overall depth</td>
<td>3784 mm (149.0&quot;)</td>
</tr>
<tr>
<td>Overall height</td>
<td>1950 mm (76.8&quot;)</td>
</tr>
<tr>
<td>Weight</td>
<td>7500 kg (16600 lb)</td>
</tr>
</tbody>
</table>
### Specifications

<table>
<thead>
<tr>
<th></th>
<th>AMADAN 04PA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
<td>X, Y, T and C (3 simultaneously controlled)</td>
</tr>
<tr>
<td><strong>Controlled axes</strong></td>
<td>Absolute/incremental</td>
</tr>
<tr>
<td><strong>Dimensioning system</strong></td>
<td>0.01 mm or 0.001&quot;</td>
</tr>
<tr>
<td><strong>Min. incremental unit</strong></td>
<td>±999999.99 mm or 99999.999</td>
</tr>
<tr>
<td><strong>Programmable dimensions</strong></td>
<td>By encoders</td>
</tr>
<tr>
<td><strong>Position detection</strong></td>
<td>12&quot; CRT character display</td>
</tr>
<tr>
<td><strong>Built-in display</strong></td>
<td>40K or 128 programs. Equivalent to approx. 100 m (328) of tape. Memory backup provided.</td>
</tr>
<tr>
<td><strong>Internal memory</strong></td>
<td>Built-in disk drive. 3.5&quot; double-sided, double-density micro-floppy disk used for storage of 800K or 128 programs. Equivalent to approx. 2000 m (6560') of tape.</td>
</tr>
<tr>
<td><strong>External memory</strong></td>
<td>RS232C</td>
</tr>
<tr>
<td><strong>Ambient temperature</strong></td>
<td>0 to 45°C (32 to 113°F) for operation. -20 to +60°C (-68 to +140°F) for storage.</td>
</tr>
<tr>
<td><strong>Max. ambient humidity</strong></td>
<td>80% RH (without dew formation)</td>
</tr>
</tbody>
</table>