INSTRUCTION & OPERATION MANUAL

NC VERTICAL MILLING MACHINE

Model Millmaster ST-N

SHIZUOKA MACHINE TOOL CO., LTD .

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Data NO, 8201

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1. DESIGN PHILOSOPHY

The SHIZUOKA MILLMASTER ST-N has been completed as highly economical NC milling machine.
This machine standarizes 3-axis simultaneous control, linear interpolation and circular interpolation through CNC control system.
This machine has been well designed while considering the following points.

1.Adapting for all types of machining processing
The table is designed wide and its tape control travel is taken as large as possible. Therefore large single workpiece or several small one can be accomodated at one set up. The spindle speed is designed to get wide range, the best conditions can be selected for the various cutter and work material.

2.High speed and precise machining
In order to achive high speed cutting for a long period and low speed heavy cutting, and to provide high precision machining at the same time, special attention is paid to the spindle bearings and all the slideways and structure design.

3.Easy operation
Easy operation is an important objective for this a small size NC milling machine. This machine has centealized the major controls on the pendant panel and was designed so that the operator can easily reach the workpiece on the table and set it accurately.

THE SHIZUOKA MILLMASTER ST-N was developed through our accumulated experience in the manufacture of milling machine during the past forty years. We are sure this machine will be the answer to the customer for its high productivity and precision.
We earnestly advise you to read this instruction manual before attempting to start operating. If questions arise with respect to operate this machine, please contact your distributor or SHIZUOKA MACHINE TOOL COMPANY.

2. MACHINE OUTLINE

1) SPECIFICATIONS

MACHINE

Working surface (Length x Width)		: $43^{1}/_{4}$ x 11"
Table travel longitudinal	(X)	: $27^{1}/_{2}$"
cross	(Y)	: $13^{3}/4$"
Vertical	(Z)	: $5^{1}/2$" (Quill)
(manual)		: $15^{3}/4$"(Knee)
Max. loading capacity		: 220lbs .
Spindle nose		: NST. NO. 40

Spindle speed (60HZ),

Low speed	: 85-505rpm
High Speed	: 635-3800rpm

note; Low and high speed selection can be made by the knob on the right side of head.

Jog Feed rate,

longitudinal	: 0-120ipm
cross	: 0-120ipm
vertical	: 0-120ipm

Rapid traverse,

longitudinal	: 200ipm
cross	: 200ipm
vertical	: 120ipm

Distance between spindle center and colum : $13^{7}/8$"

Distance between spindle end and table top	: $4\frac{1}{3}$---20"
Spindle drive motor	: AC 3KW (4HP)
Feed motor (DC servo motor)	: FANUC Model 0 (X,Y,Z)
Coolant pump motor	: 100W (0.13HP)
Automatic lubrication pump motor	: 2.5W
Accuracy (Table itself)	
Positioning	: $\pm$0.001" per 12"
Repeatability	: $\pm$0.0002"
Power supply	: AC 220V +10% -15% 50/60 Hz $\pm$1 Hz, 3Ø 6KVA

note; Other voltage is not available, please specify what voltage is required.

Machine net weight : Approx. 3300 lbs.

STANDARD ACCESORIES

(1) Coolant equipment

(2) Automatic lubrication system

(3) Draw-bars with $\frac{5}{8}$" - 11 threads

(4) Spanners and wrenches

(5) Leveling bolts and pads (4 sets)

NUMERICAL CONTROL

Model	:	FANUC SYSTEM 6MB
Least input increment	:	0.0001" per pulse
Minimum programmable dimension	:	0.0001"
Controlled axis	:	3 axes (X,Y,Z)
Number of axis controlled simultaneously	:	3 axes
Linear interpolation	:	3 axes
Circular interpolation	:	XY.YZ.ZX plain
Designation of feed rate	:	4 digit direct feed coding (manual override 0-200%)
Max. programmable dimension	:	Linear dimension X,Y,Z ±9999.9999"
	:	Circular dimension Radius X,Y,Z ±9999.9999"
Driving unit	:	DC Servo Motor Model O (X,Y,Z)
Permissible ambient temperature	:	32-113°F(0-45°C)
Power supply	:	AC 220/440V +10% -15% 50/60HZ ±1HZ 3ø

STANDARD SPECIFICATION

(1) Incremental /Absolute input

(2) 4 digit direct feed coding

(3) Linear and Circular interpolation

(4) Backlash compensation for 3 axes

(5) Combined use of Absolute/Incremental programming
(Switchable by G code)

(6) Manual data input and CRT character display

(7) Tool length offset/ Cutter radius compensation C
32 sets are stored in memory through the MDI and CRT unit.

(8) Fixed cycle (G 73.74 , G 80 - 89)

(9) Feed rate override,in increments of 10% in a range from 0 to 200%

(10) Dwell time circuit (G04)

(11) Optional block skip

(12) Single block

(13) Full range floating zero

(14) Dry-run

(15) Mirror image,using the MDI & CRT unit X,Y

(16) Buffer storage

(17) Z axis command cancel

(18) EIA (RS-244A) / ISO (R-840) switching, using the MDI & CRT unit

(19) Sequence number display , using the MDI & CRT unit

(20) Sequence number search, using the MDI & CRT unit

(21) Alarms, using the MDI & CRT unit

(22) Position display by CRT unit

(23) Machine lock

(24) Feed hold

(25) Manual slide movement button (Jog, Step, Rapid)

(26) Manual/Automatic return to zero

(27) Subprogram

(28) Part program storage & editing 132ft (20m)

(29) Radius programing on arc

(30) Decimal point programing

(31) Manual pluse generator

(32) Auxilliary function lock

(33) M functions

M00 : Program stop

M02 : End of program

M03 : Spindle start

M04 : Spindle start, reverse

M05 : Spindle stop

M07 : Coolant ON

M09 : Coolant OFF

M10 : Quill clamp ON

M11 : Quill clamp OFF

M12 : Optional Function

M30 : End of program

M98 : Maintape to Subtape

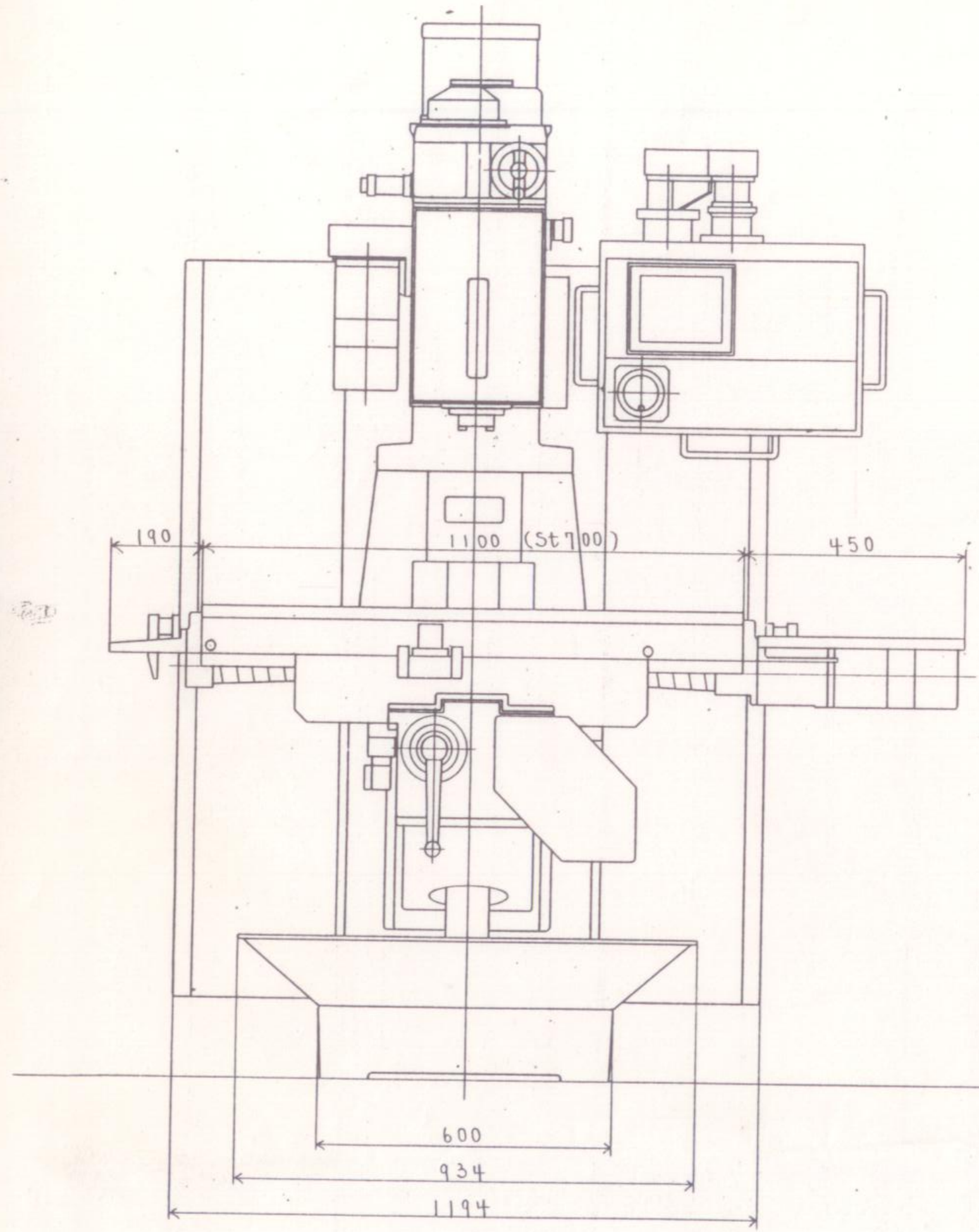
M99 : Subtape to Maintape

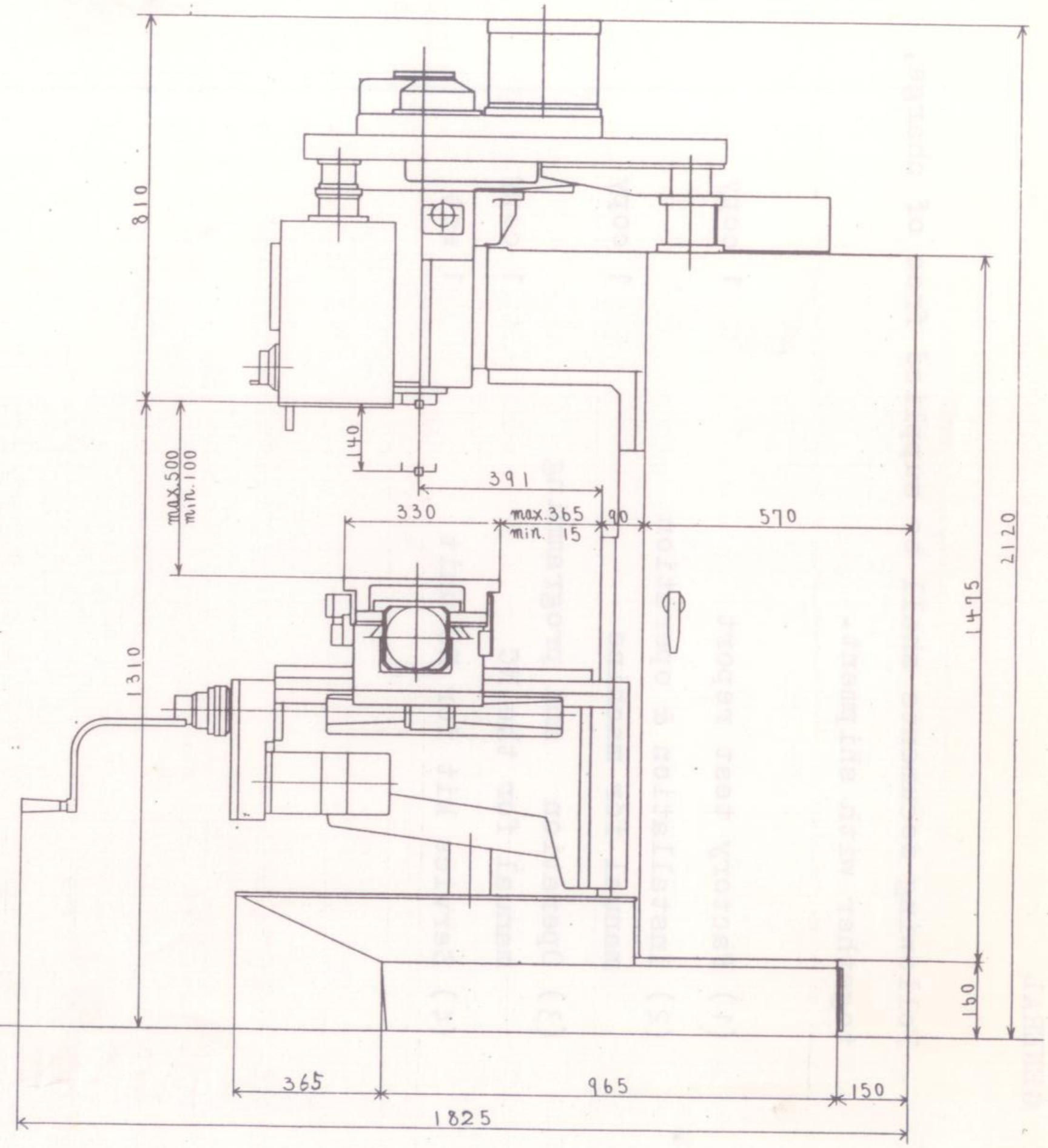
GENERAL

Following documents shall be supplied free of charge, together with shipment.

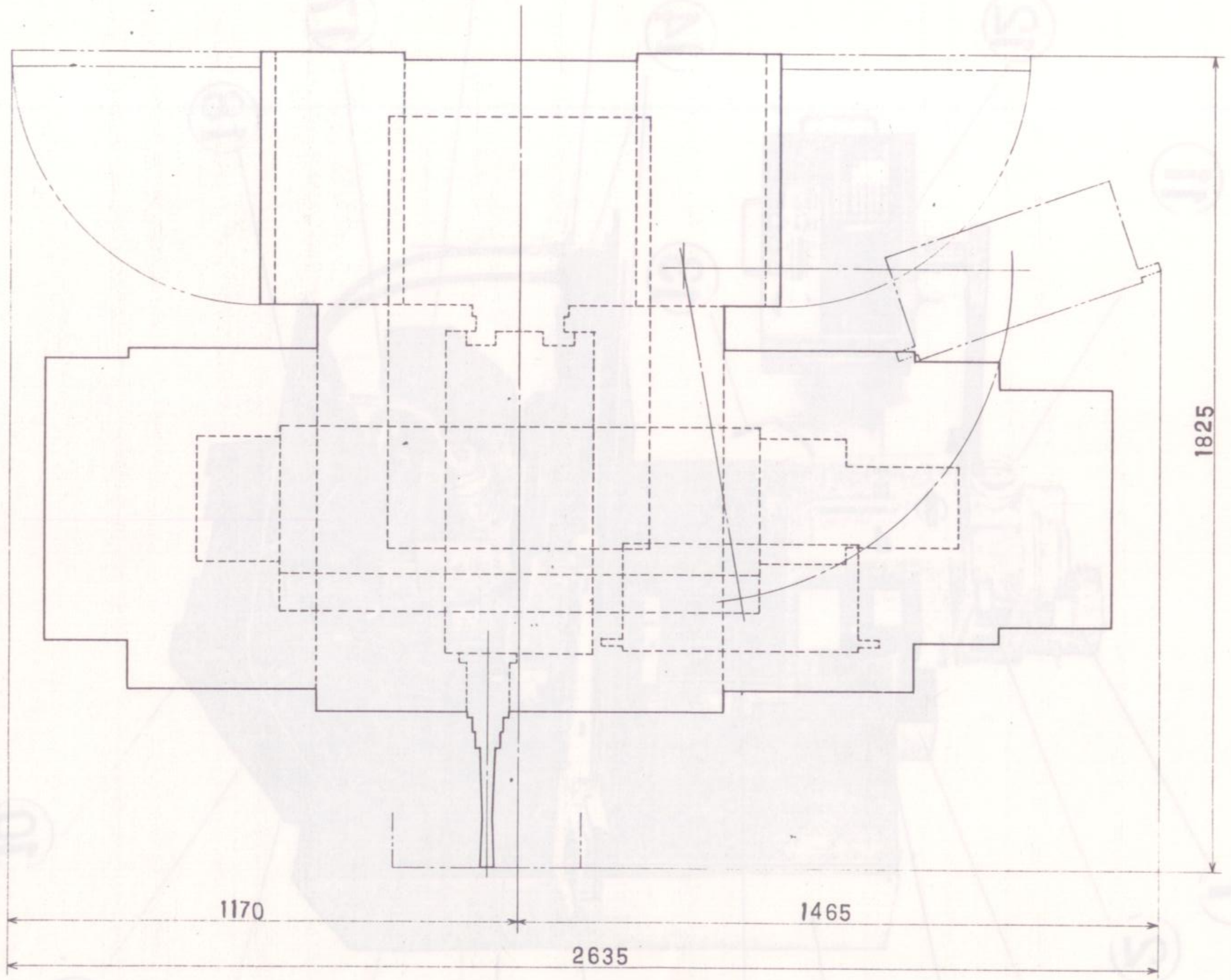
(1) Factory test report	1 copy
(2) Installation & operation manual for machine	1 copy
(3) Operation and programming manual for the NC	1 copy
(4) Service kit for NC unit	1 set

2) Machine Feature

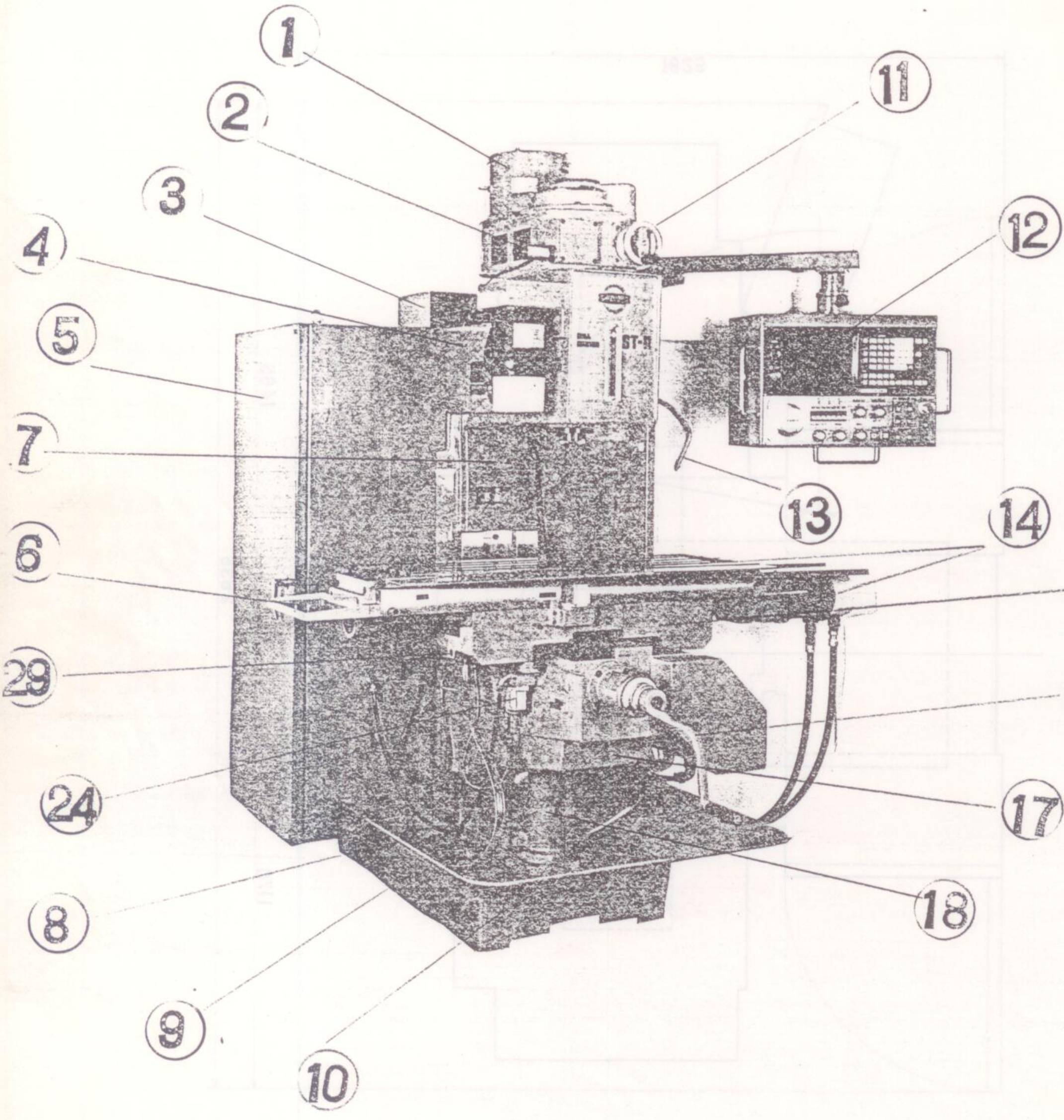




3) Floor Plane



4) Main Parts Name



1. Spindle motor

Voltage : 220/200V

Out put power : 4HP

2. Air cylinder for spindle brake

Maker : SMC

Type : CMB 30-25

3. Connection box for air & electrical wire

4. Ram

5. NC Control box

Voltage : 220V/200V

Frequency : 50/60HZ $\pm$ 1HZ

Capacity : 6KVA

Ground : Resistance less than 100

Ground wire dia 1/8" dia or larger

6. Sub table

7. Column

8. Oil pan

9. Coolant oil return hose

10. Base

11. Spindle speed change handle

12. Pendant pannel

* Details are shown in section of OPERATION (P.34)

13. Coolant - equipment

* Details is shown in section of Coolant equipment (P.34)

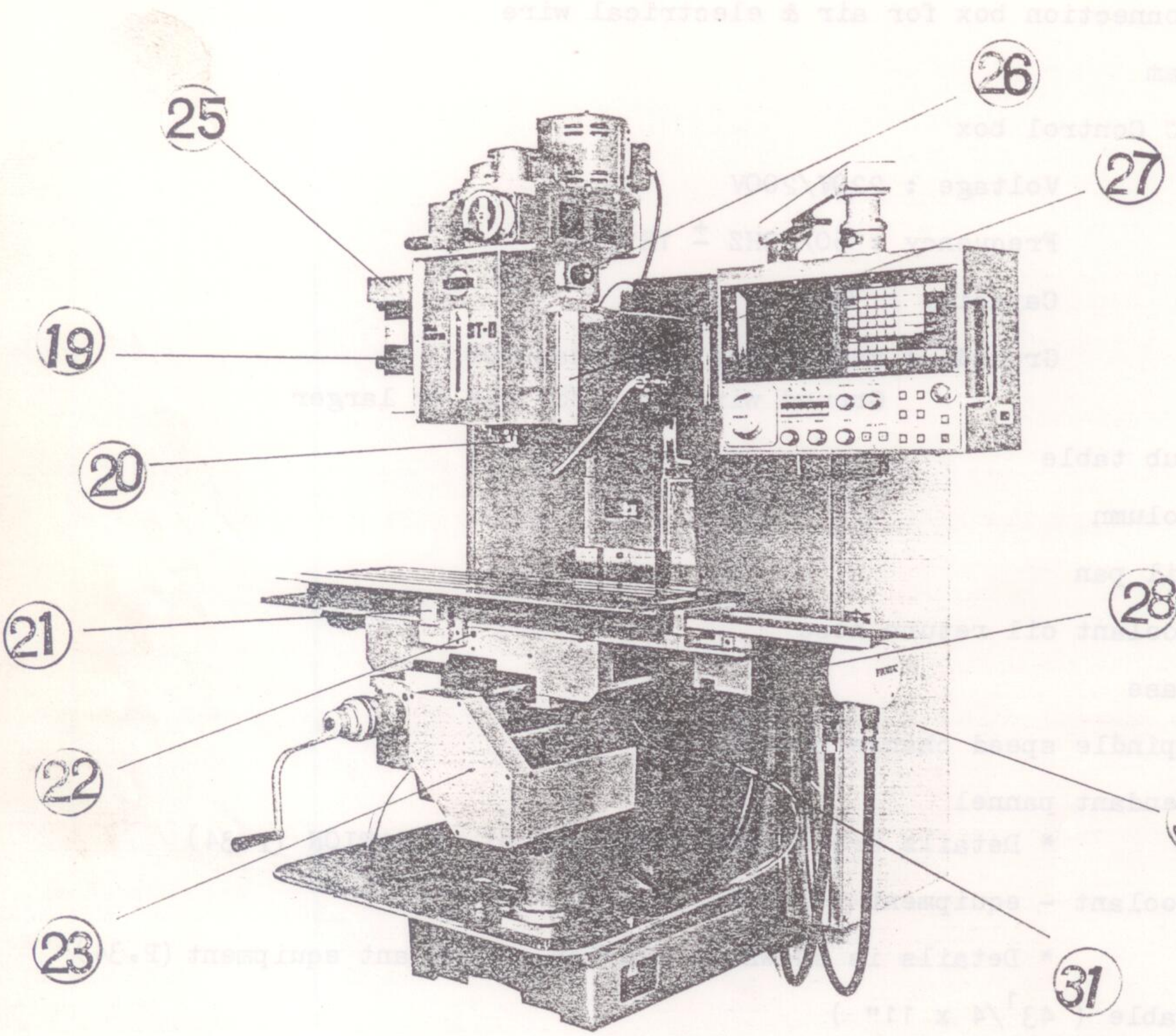
14. Table ($43^{1}/4$ x 11")

15. Saddle

16. Crank for knee elevating

17. Knee

18. Support for knee elevating screw


25
26
27
19
20
21
22
23
28
30
31

19. Z-axis feed motor

Maker : FUJITSU FANUC Type : Model O

20. Spindle

Taper : NST no,40

21. Limit switch for X-axis

Maker : OMRON Type :4SBD-4-1

22. Table clamp bolt

* This bolt is used for only when transporting machine or disassembling. In operating time this bolt must be loosen.

23. Y-axis feed motor and gear box

Maker : FUJITSU FANUC Type : Model O

24. Limit switch for Y-axis

Maker : OMLON Type : 4SBD-4-1

25. Pully case fof Z-axis

26. H-L change Knob

27. Quill clamp air cylinder

Maker : SMC Type : CMD 30-25

28. X-axis feed motor

maker : FUJITSU FANUC Type : Model O

29. Saddle clamp bolts (1)

* This bolt is used for only when transporting machine.

In operating time this bolt must be loosen.

30. Control box

NC servo and control box

Voltage : 220V/200V

Frequency:50/60HZ ±1HZ

Capacity : 6KVA

Ground

Resistance less than 100

Ground wire dia 1/8" dia or larger.

31. Knee clamp bolts (2)

* In operating time by crank this two bolts must be loosen.

3. NC FUNCTIONS

) Programing

NC tape is prepared in accordance with the procedures shown below.

Drawing

↓

Machining plan

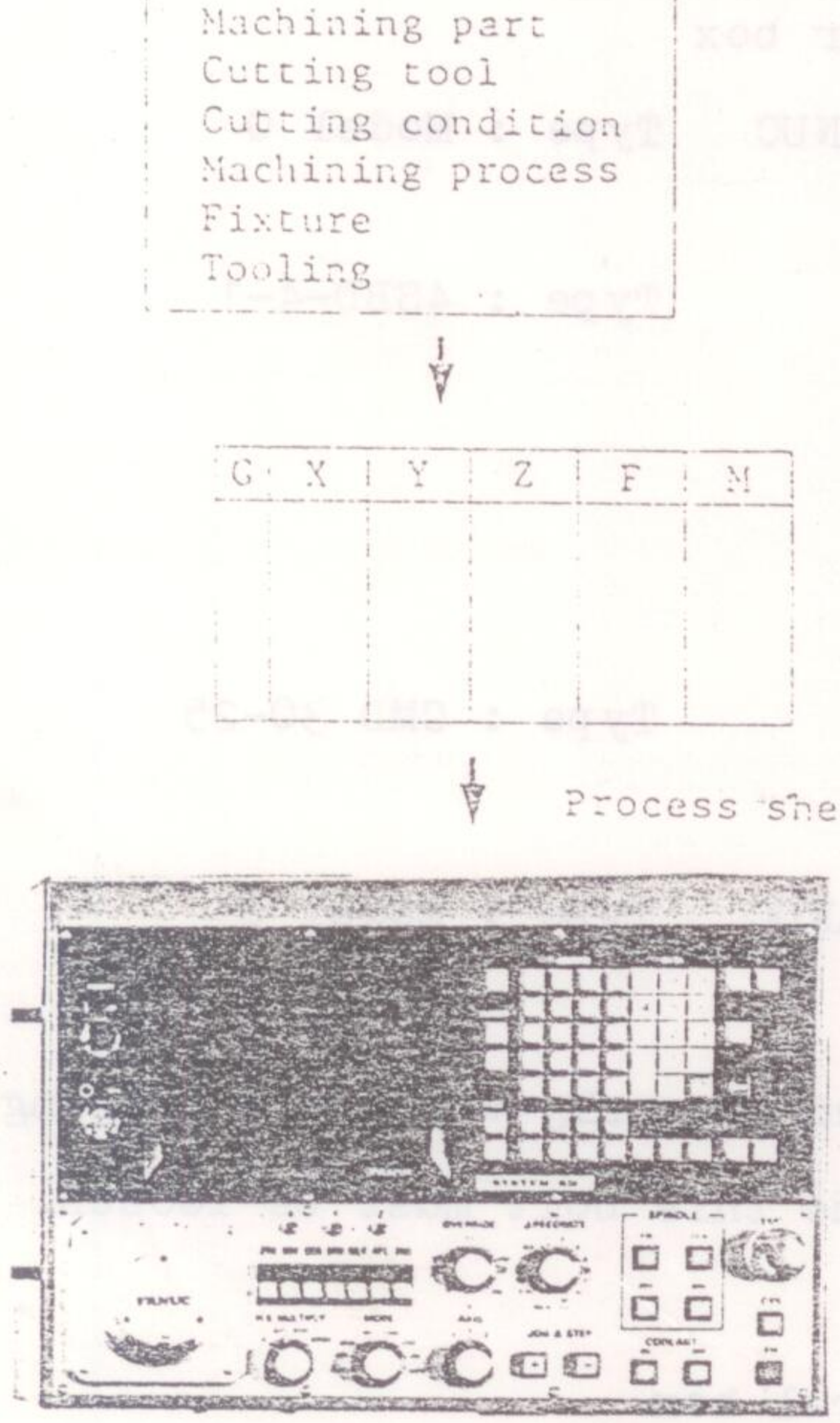
↓

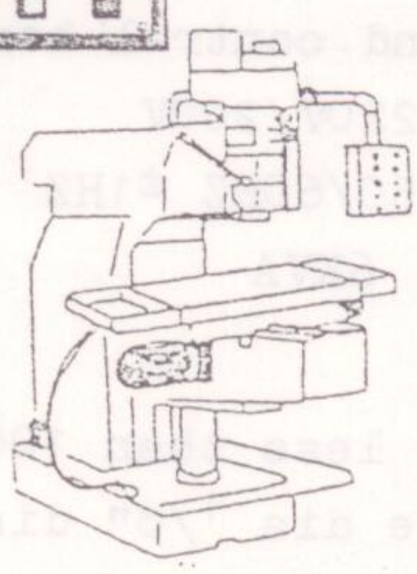
Machining part
Cutting tool
Cutting condition
Machining process
Fixture
Tooling

↓

G	X	Y	Z	F	M

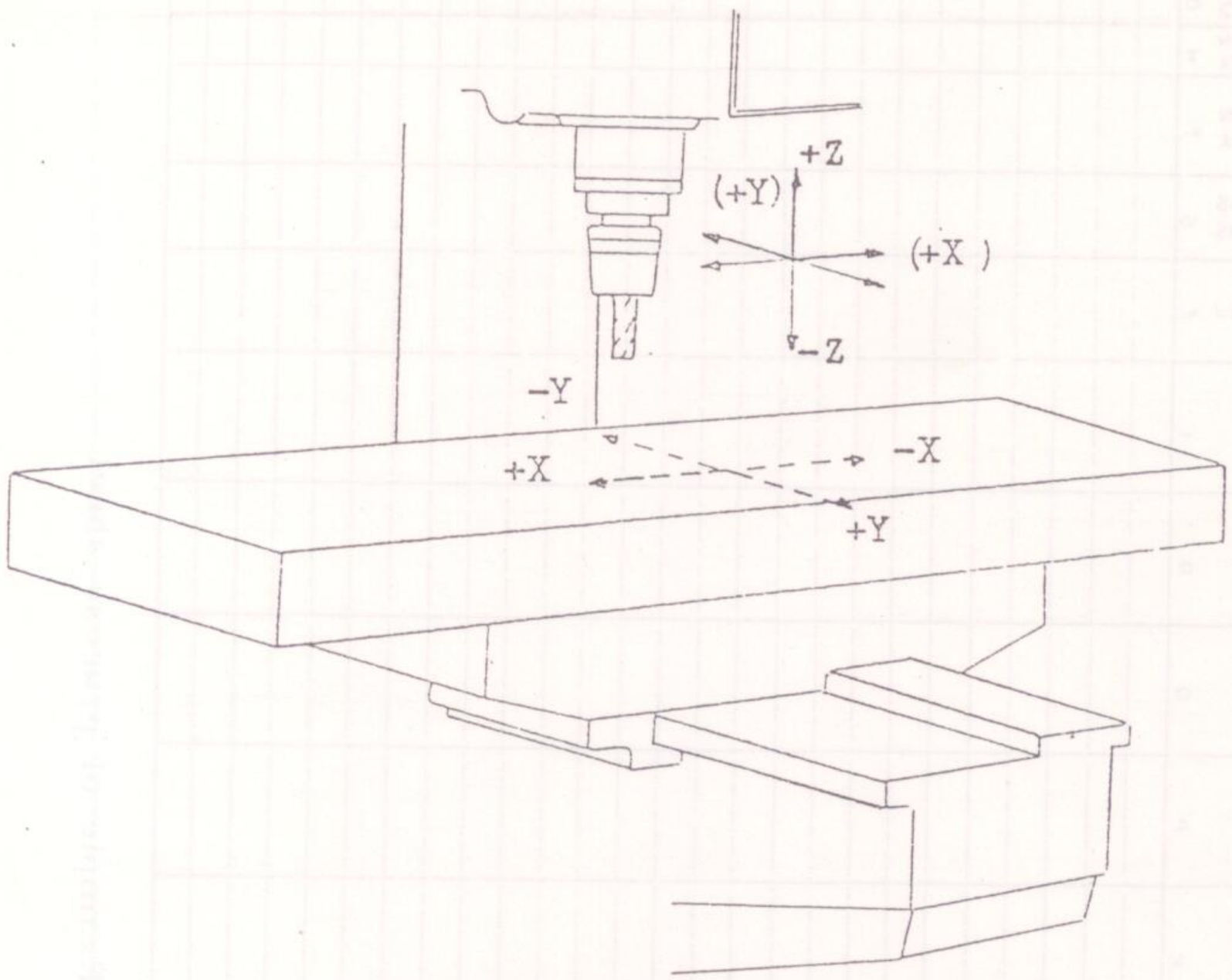
↓ Process sheet





SHIZUOKA NC milling machine

For the Model MILLMASTER ST-N / FANUC 6MB milling machine, programming must be made for the tool path.
X,Y, and Z axes are specified below.



X, Y, and Z Axes Dimensions

Moving direction

+Z	means	tool up
-Z	means	tool down
+X	means	the table moves to the operator's left (the tool moves to the operator's right)
-X	means	the table moves to the operator's right (the tool moves to the operator's left)
+Y	means	the table moves towards the operator (the tool moves away from the operator)
-Y	means	the table moves away from the operator (the tool moves towards the operator)

PART NUMBER	
PART NAME	
PROGRMMER	
DATE	

PROCESS SHEET PAGE OF

OPTIONAL BLOCK SKIP	SEQUENCE NUMBER N( )	PREPARATORY FUNCTION G	X-AXIS MOTION X	Y-AXIS MOTION Y	Z-AXIS MOTION Z	4th-AXIS MOTION 4th	ARC CENTER I	ARC CENTER J	ARC CENTER K	CYCLE PARAM P	CYCLE PARAM Q	CYCLE PARAM R	CYCLE PARAM L	FEEDRATE F	SPINDLE SPEED S	TOOL NUMBER T	TOOL OFFSET NUMBER H	CUTTER COMP NUMBER D	MISCELLANEOUS FUNCTION M	END OF BLOCK	REMARKS

Example of process sheet

The ISO and EIA codes can be used in FANUC 6M NC.
Selection between ISO and EIA can be done by the MDI (manual data input) and DPL unit.

ISO code										EIA code										Meaning
	8	7	6	5	4		3	2	1		8	7	6	5	4		3	2	1	
0			○	○		○				0				○		○				Numeral 0
1	○		○	○		○			○	1						○			○	" 1
2	○		○	○		○		○		2						○		○		" 2
3			○	○		○		○	○	3				○		○		○	○	" 3
4	○		○	○		○	○			4						○	○			" 4
5			○	○		○	○		○	5				○		○	○		○	" 5
6			○	○		○	○	○		6				○		○	○	○		" 6
7	○		○	○		○	○	○	○	7						○	○	○	○	" 7
8	○		○	○	○	○				8					○	○				" 8
9			○	○	○	○			○	9				○	○	○			○	" 9
A		○			○			○		a			○	○		○			○	Angular dimension around X axis
B		○			○		○			b			○	○		○		○		Angular dimension around Y axis
C		○	○		○		○	○		c			○	○	○	○		○	○	Angular dimension around Z axis
D		○			○	○				d			○	○		○	○			Cutter conpensation number
E		○	○		○	○		○		e			○	○	○	○	○		○	
F		○	○		○	○	○			f			○	○	○	○	○	○		F function (feed function)
G			○		○	○	○	○		g			○	○		○	○	○	○	G function (preparatory function)
H		○		○	○					h			○	○		○	○			Tool offset number
I		○	○		○	○			○	i			○	○	○	○	○		○	X-axis element of arc center, etc
J		○	○		○	○		○		j			○		○	○			○	Y-axis element of arc center, etc
K		○		○	○		○	○		k			○		○	○		○		Z-axis element of arc center, etc
L		○	○		○	○	○			l			○			○		○	○	Fixed cycle number
M		○		○	○		○		○	m			○		○	○	○			M function (miscellaneous function)
N		○		○	○		○	○		n			○			○	○		○	Secuence number
O		○	○		○	○		○	○	o			○			○	○	○		Same as N in normal direction (EIA)
P			○	○		○				p			○		○	○	○	○	○	Dwell in Fixed cycle, Dwell, Program copy
Q		○	○		○			○		q			○		○	○				Step dimension or sift value in Fixed cycle, Program copy
R		○	○		○		○			r			○			○	○		○	Point R in Fixed cycle, Program copy or sub ioop
S			○		○		○	○		s				○	○	○		○		S function (spindle-speed function)
T		○	○		○	○				t				○		○		○	○	T function (tool function)
U			○		○	○		○		u				○	○	○				Secondary motion dimension parallel to X
V			○		○	○	○			v				○		○	○		○	Secondary motion dimension parallel to Y
W		○	○		○	○	○	○		w				○		○	○	○		Secondary motion dimension parallel to Z
X		○	○		○	○				x				○	○	○	○	○	○	Primary X motion dimension
Y			○		○	○			○	y				○	○	○				Primary Y motion dimension
Z			○		○	○		○		z				○		○			○	Primary Z motion dimension
DEL		○	○	○	○	○	○	○	○	Del		○	○	○	○	○	○	○	○	** Delete (punching errors)
NUL						○				Blank						○				** No hole
BS	○				○	○				BS				○		○		○		** Back space
HT					○	○			○	Tab				○	○	○	○	○		Tabiator
LF or NL					○	○		○		CR or EOB	○					○				End of Block (*)
CR	○				○	○	○		○											
SP	○		○			○				SP				○		○				** Space
%	○		○			○	○		○	ER					○	○		○	○	Starting program, Stopping search
(				○	○	○														Control Out
)	○		○		○	○			○											Control In
+			○		○	○		○	○	+			○	○	○	○				** Pogitive direction
−			○		○	○	○		○	−			○			○				Negative direction
:				○	○	○	○		○											Same as N in normal direction (ISO)
/	○		○		○	○	○	○	○	/				○	○	○			○	Optional block skip

** Ignored by NC equipment. An alarm is given for a blank character position in significant information in the EIA code.

2) M Functions

Command is made by 2-digit numbers following M.

M00 Program stop

Control read this code, machine's axis motion is stopped.
(Spindle is not stopped.)
Next start can be made by the Cycle Start switch.
(Another M code is not cancelled)

M02 End of program

Control read this code, machine's every actions are stopped.
(Control is reseted.)

M03 Spindle Motor ON (CW)

M04 Spindle Motor ON (CCW)

M05 Spindle Stop

Be sure to command M05 before change the direction of spindle rotation.

M07 Coolant Motor ON

M09 Coolant Motor OFF

Coolant motor can be stopped by control reset in tape operation.

M10 Quill Clamp ON

Control read this code, quill is clamped.
Z-axis can not move while quill is clamping.

M11 Quill Clamp OFF

Control read this code, quill clamp is released.

M12 Optional Function

Customer can use this Function for requirement.
(Wire ring and equipment is necessary.)

M30 End of program

Same as M02

IN case of tape-reader with reels (OPTION).

Control read this code, machine's every actions are stopped.

Control is reseted and rewind the NC tape.

M98 Main tape to Sub-tape

Control read this code, a sub tape permits returning to a main tape.

M99 Sub tape to Main tape

Control read this code, a sub tape permits returning to a main tape.

Note

* No two M function can take place on same block.
* M function is operated after table motion finished.
* If other M code is commanded, machine will stop and can not move next block.

3) F Function

* Feed rate command is made specified directly in a number code in inch/min. following address F.
* Feed rates designated by tape are shown when override on the control panel is set at 100%.
* Feed rate can be varied by NC command but also further decreased to 0% from 100% or increased to 200% by override. (Feed rates for tapping cycle G84 cannot be varied by override.)

Feed command range

MILLMASTER ST-N use feed range

5- 1200 mm/min (F5 - F1200)
0.05 - 120 inch/min (F5 - F12000)

example

	mm
F450	450 mm/min
F1200	1200 mm/min
	inch
F4.5	4.5 inch/min
F12	12 inch/min

4) G Function

Preparatory functions

G code	Group	Function	Basic/ Option
G00		Positioning (Rapid traverse)	B
G01	01	Linear interpolation (Cutting feed)	B
G02		Circular interpolation (Clockwise)	B
G03		Circular interpolation (Counterclockwise)	B
G04	00	Dwell	B
G10		Offset value setting	0
G17		XY plane selection	B
G18	02	ZY plane selection	B
G19		YZ plane selection	B
G20	06	Inch data input	B
G21		Metric data input	B
G27		Reference point return check	B
G28	00	Return to reference point	B
G29		Return from reference point	B
G40		Cutter radius compensation cancel	B
G41	07	Cutter radius compensation left	B
G42		Cutter radius compensation right	B
G43		Tool length compensation + direction	0
G44	08	Tool length compensation - direction	0
G49		Tool length compensation cancel	0
G45		Tool offset expansion	B
G46	00	Tool offset reduction	B
G47		Tool offset duoble expansion	B
G48		Tool offset double reduction	B

G code	Group	Function	Basic / Option
G73		Peck drilling cycle	B
G74		Counter tapping cycle	B
G80		Canned cycle cancel	B
G81		Drilling cycle, spot drilling cycle	B
G82		Drilling cycle, counter boring cycle	B
G83	09	Peck drilling cycle	B
G84		Tapping cycle	B
G85		Boring cycle	B
G86		Boring cycle	B
G87		Back boring cycle	B
G88		Boring cycle	B
G89		Boring cycle	B
G90	03	Absolute input	B
G91		Incrememtal input	B
G92	00	Programming of absolute zero point	B
G98	10	Return to initial point level	B
G99		Return to R point level	B

(Note 1) The G code marked are initial G codes in turning power on or after pushing the reset button.
For G00, G01, G43, G44, G49, G94 and G95, the initial G codes can be selected by parameter setting.
For G20 and G21, the G code before tirning power off or pushing the reset button remains.

(Note 2) The G codes of group 00 are not modal.
They are effective in the commanded block.

(Note 3) If a G code not listed in the table is commanded, an alarm (No.010) is displayed. If an option is not provided and the corresponding G code is commanded, an alarm (No. 010) is displayed, However, G38 and G39 are ignored.

(Note 4) A number of G codes can be specified in the same block.
When a number of G codes of the same group are specified, the G code specified later is effective.

(Note 5) If the G code of group 01 is commanded in the canned cycle mode, the canned cycle is automatically cancelled (G80).
However, G codes of group 01 are not affected by the G codes of canned cycles.

4. INSTALLATION OF MACHINE

1) Foundation

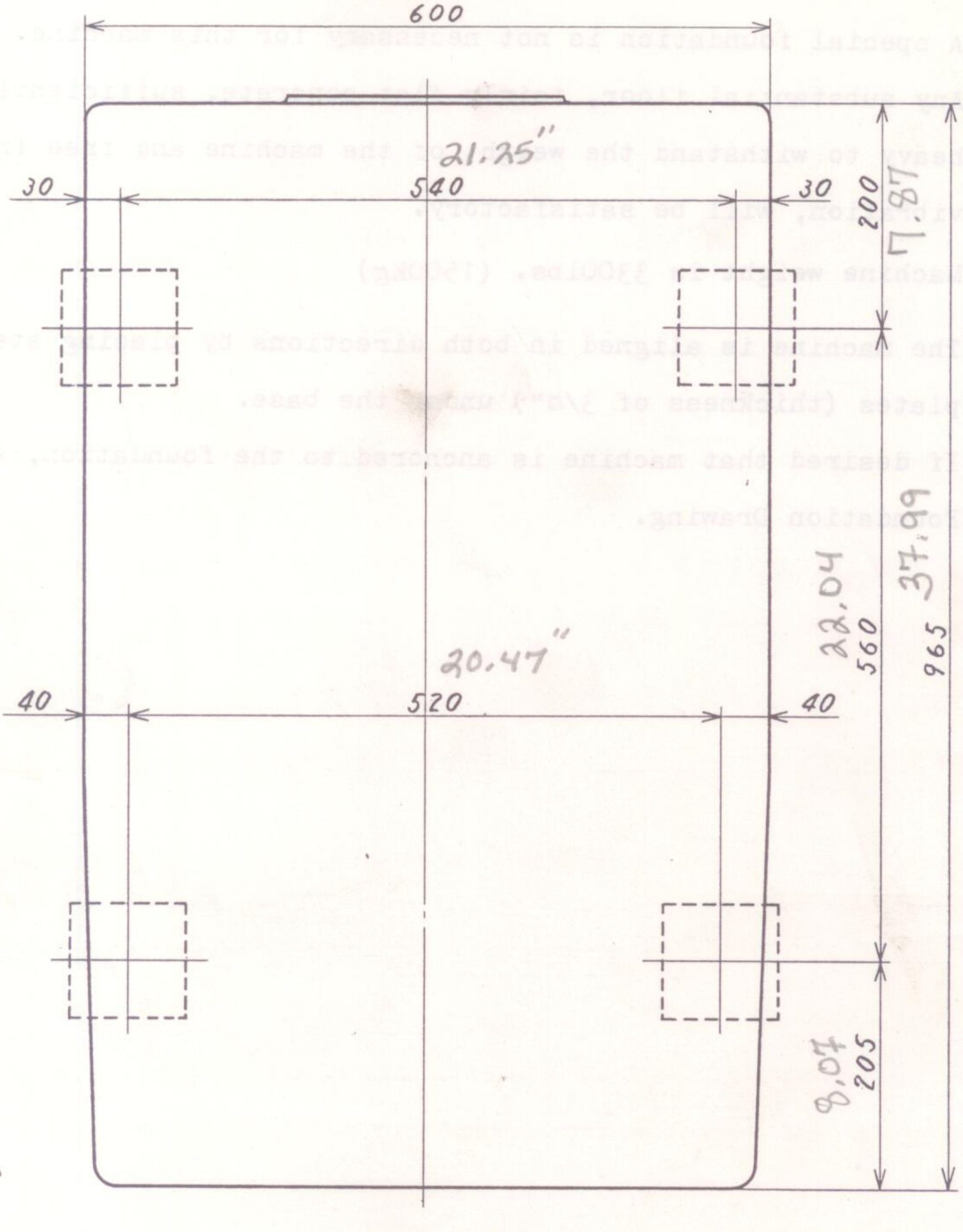
A special foundation is not necessary for this machine.

Any substantial floor, fairly flat concrete, sufficiently heavy to withstand the weight of the machine and free from vibration, will be satisfactory.

Machine weight is 3300lbs. (1500Kg)

The machine is aligned in both directions by placing steel plates (thickness of 3/8") under the base.

If desired that machine is anchored to the foundation, see Foundation Drawing.


23.62
600
21.25"
30
540
30
200
7.87
37.99
965
20.47"
40
520
40
560
22.04
205
8.07

2) Levelling

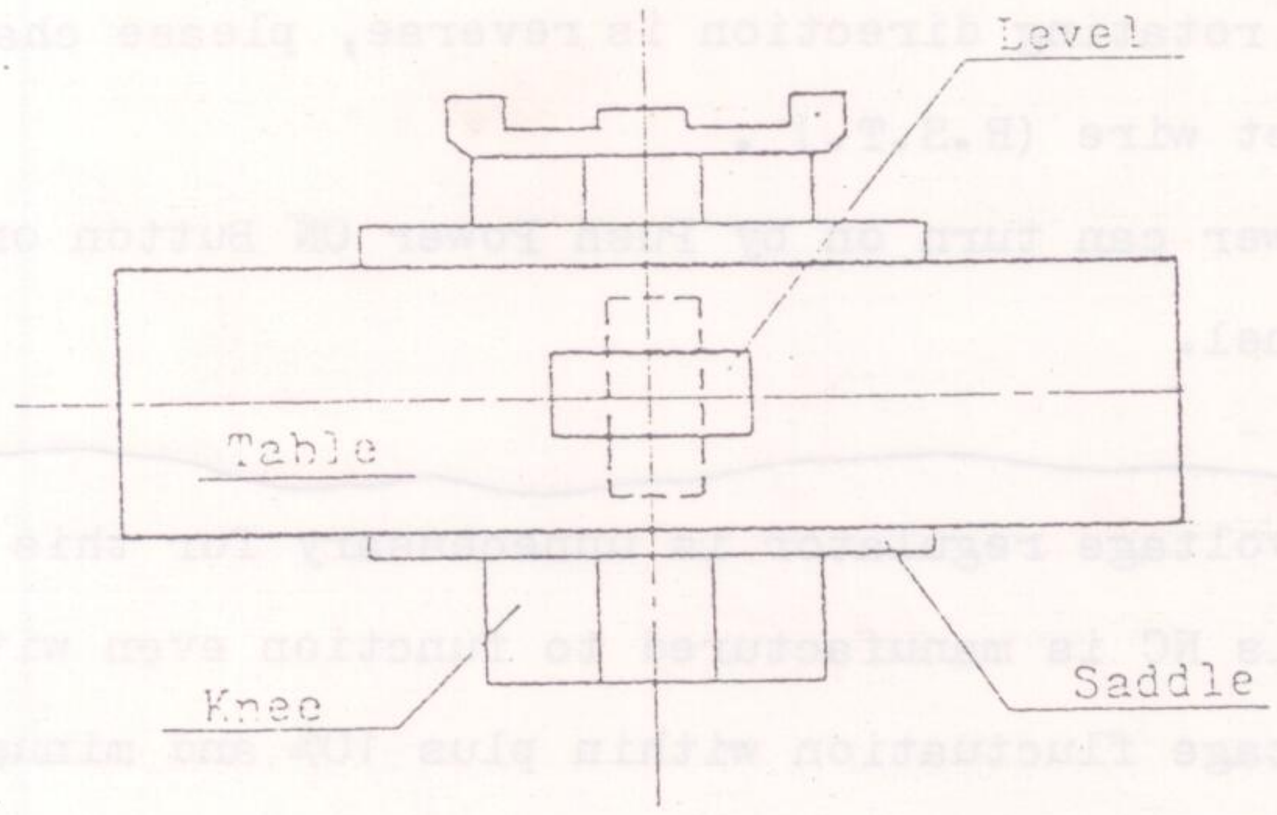
Levelling of the machine, a very important factor, must be carefully done to ensure first class working condition and to produce quality and precision product.

Use a precision level for this operation.

Care should be taken that the machine table and the levelling instrument are clean and free from burrs.

Level longitudinal and cross direction on the table while adjusting 4 levelling bolts on the base.

Then the machine must be checked occationally to be sure that level is maintained.



Levelling

4) Connecting the Electric Source

1) Electric power supply of AC220/200 within a fluctuation range
+10% and -15% 60HZ ± 1HZ.
3 phase,
6KVA, must be prepared by the customer.
Connecting terminal is situated in the electric control box on the right side of column. Connect three inlet wire with R.S.T. and Ear thing wire of your inlet with G on the power terminal

In case of this voltage is not available, please consult with your distributor or SHIZUOKA.

(Important)

* Bofore turn on control power check the phase rotating direction by phase checker.
If spindle rotating direction is reverse, please change the phase by the inlet wire (R.S.T.) .
Control power can turn on by Push Power ON Button on the control display panel.

(Remarks)

* Automatic voltage regulator is unnecessary for this machine, because this NC is manufactured to function even with a power supply voltage fluctuation within plus 10% and minus 15%.

ii) Compressed Air

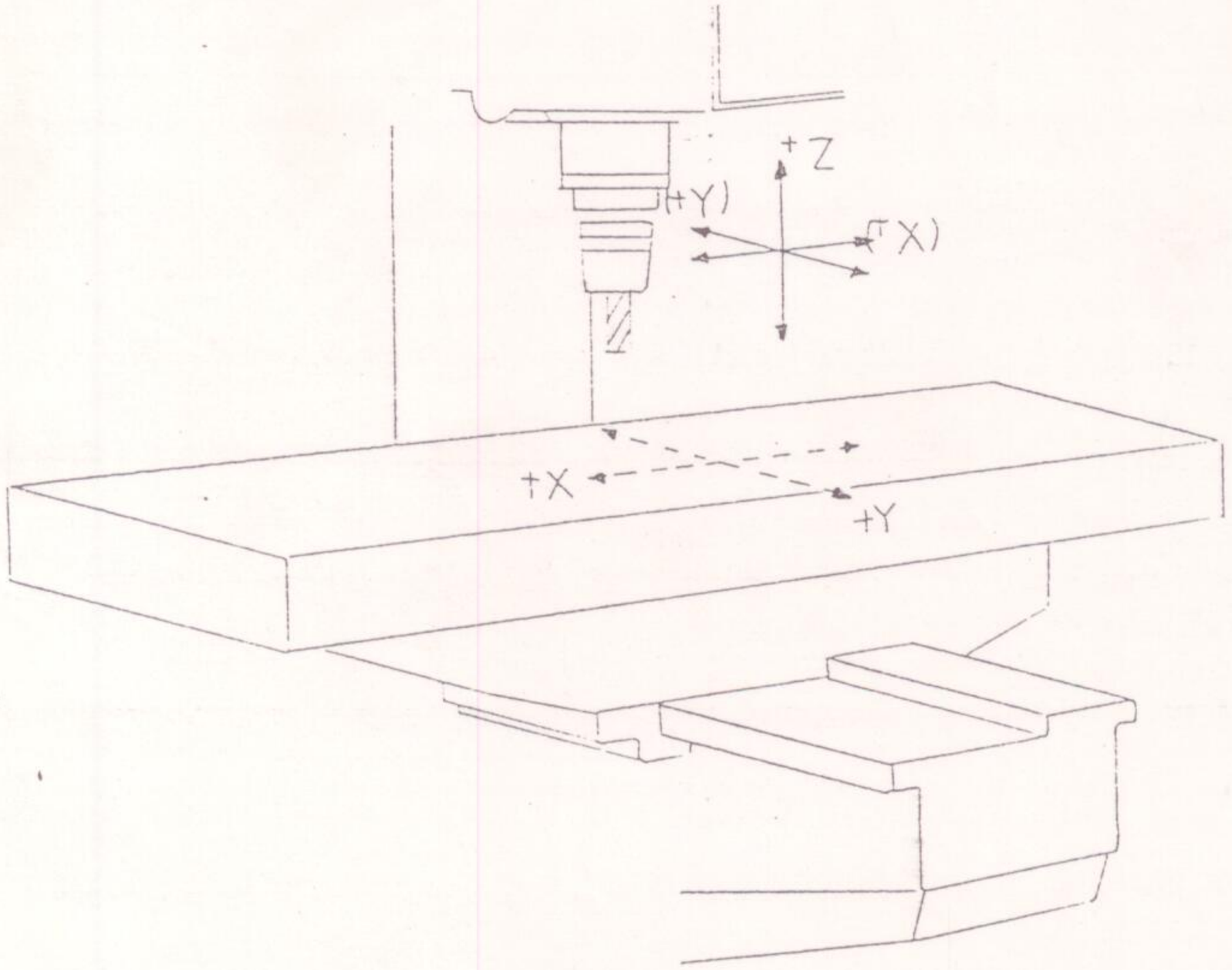
Dry and clean compressed air of 65-71 Ibs/in^2 (4.5 - 5 Kg/cm^2) is required which is used for spindle brake and quill clamp.

5. CONSTRUCTION OF MACHINE

MILLMASTER ST-N consists of these principal parts; table for X direction movement, saddle for Y direction movement, head that contains the quill and spindle for Z direction movement, ram and knee that move by manual handle, and stationary column and base.
Max, loading capacity of this machine is 220 Ibs,

1) Moving Direction

The directions of each axis are established as shown following figure. The programmer thinks of the cutter or spindle moving and the workpiece stationary; also, it is assumed his position is at the operator control station, looking out at the workpiece from the spindle.



X,Y and Z - Axes Dimensions

For example, X direction movement (+) means the table moves to the left as viewed from the front of the machine, the programmer thinks of the spindle moving to the right.

For Y direction, (+) means the table and saddle move forward, he thinks of the spindle moving to the back.

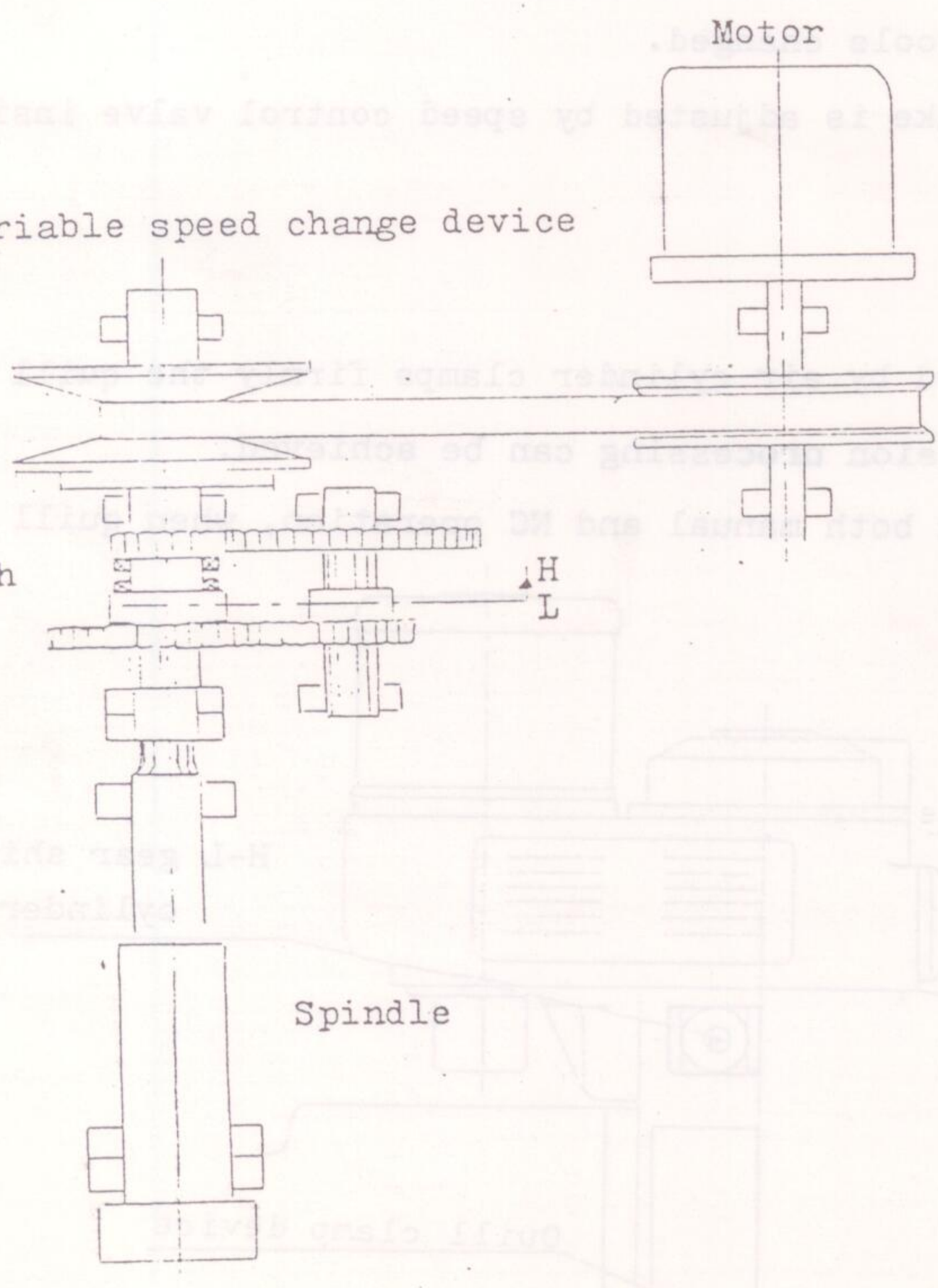
For Z direction, spindle moves up for (+) and the cutter moves away from workpiece.

Reiterating, it is important at all times to think of the cutter as moving to establish the (+) and (-) relationship.

2) Head

i) Spindle and Drive Mechanism

The main bearings of spindle are composed with two angular contact bearings which are well lubricated and properly pre-loaded. As this minimizes the heat generation and amplifys rigidity, stabilized precision processing can be achived. Also, high speed cutting for a long period and low speed heavy cutting can be achieved. Spindle is driven by 4 HP motor with our unique belt type variable drive system and H-L gear train. Best work condition can be selected for the various cutter and work material through the wide range speed.



Spindle and Drive Mechanism

ii) Spindle Speed change device

Spindle speed change is operated by turning the speed change handle for belt type variable drive system and changing the H-L gear shift device.

This device is operated by the H-L gear shift knob.

In order to prevent from gear damage, do not shift the H-L gear when spindle is rotating .

Automatic spindle speed change operation according to S code is an option.

iii) Spindle Brake

As soon as the main motor is turned off, the spindle brake actuated by air cylinder is operated to stop the spindle immediately.

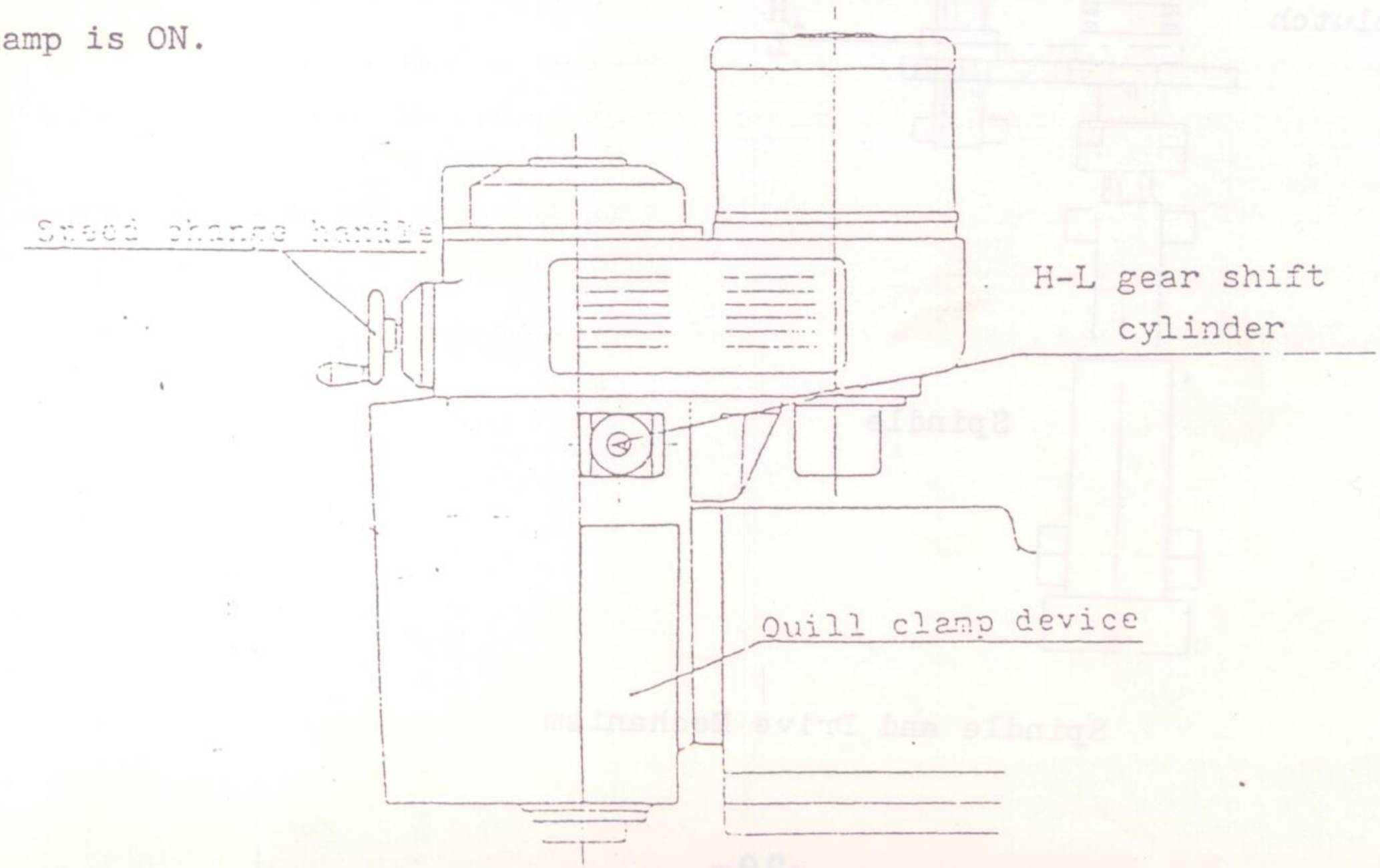
This brake is also used to prevent the spindle from rotating when the tool holders and tools changed.

Operating speed of brake is adjusted by speed control valve inside of solenoid box.

iv) Quill Clamp

As this device actuated by air cylinder clamps firmly the quill to head, stabilized precision processing can be achieved.

Quill can not be moved both manual and NC operation, when quill clamp is ON.



3) Colum, Ram and Knee

Column, ram and knee are of box type structure.

The solid rigid substructure with box type column, ram, knee and saddle, and extra wide square way (hardened and finish ground) eliminates any hints of machine lock while in operation.

4) Table

The table 43 1/4 X 13 is wide and its tape control travel is 27 1/2 X 13 3/4. Large single workpiece or several small ones can be accommodated at one set up.

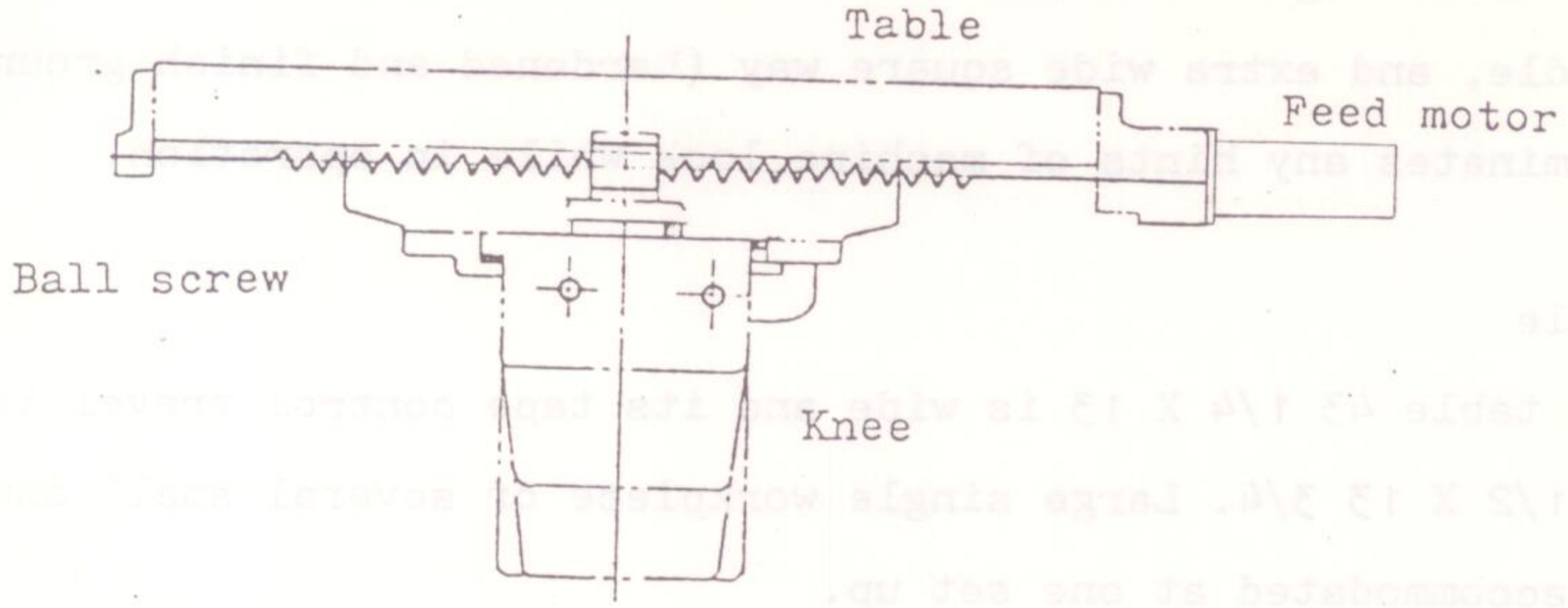
5) Feed Mechanism

The feed screws on each axis are incorporated with anti-backlash precision ball nut lead screws, and automatically timed pump lubrication system provides metered oil at selected intervals to all functionpoints. Therefore, stick-slip is eliminated and this insures long and consistent machine life and accuracy.

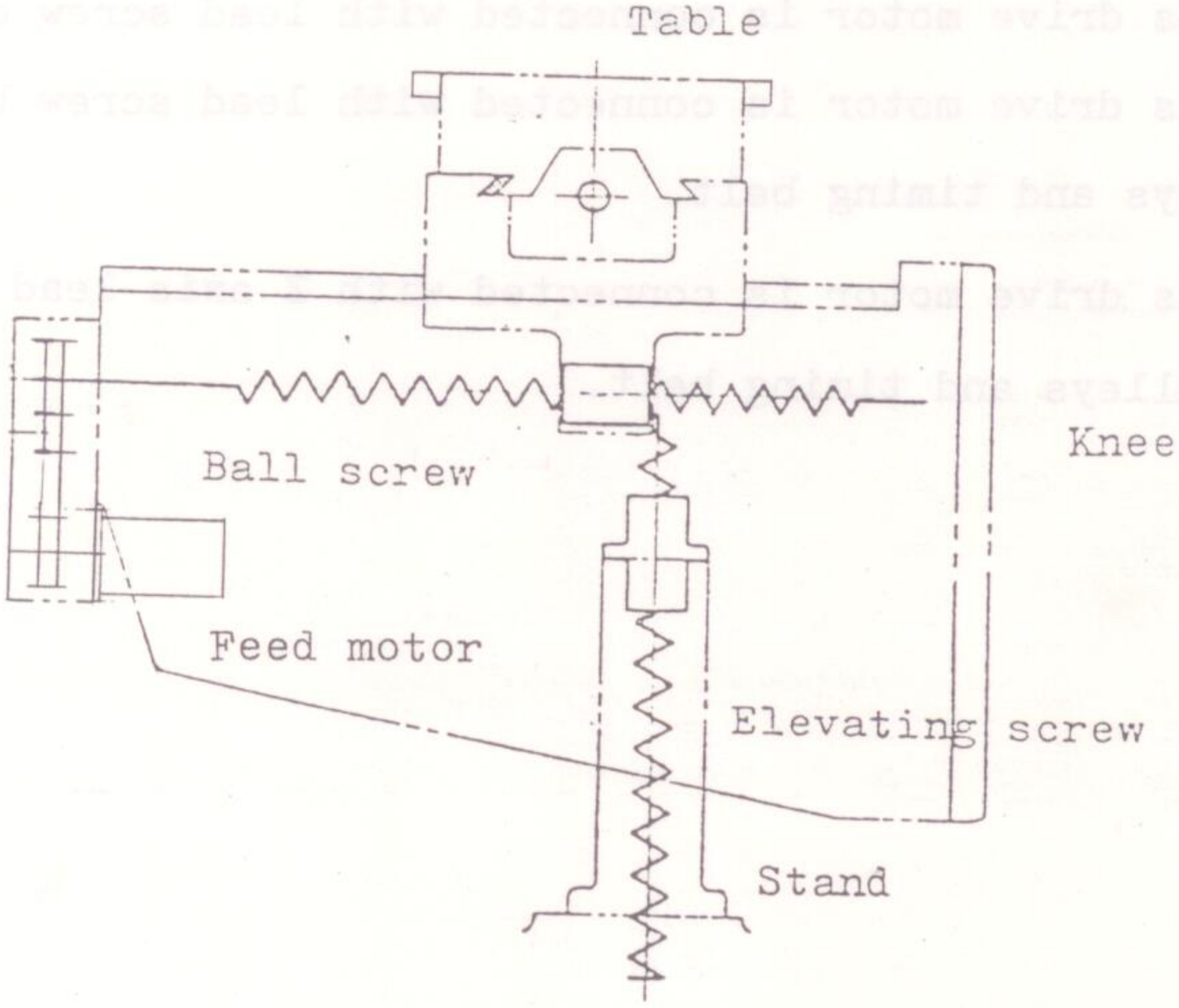
X axis drive motor is connected with lead screw direct.

Y axis drive motor is connected with lead screw by a pair of pulleys and timing belt.

Z axis drive motor is connected with Z axis lead screw by a pair of pulleys and timing belt.

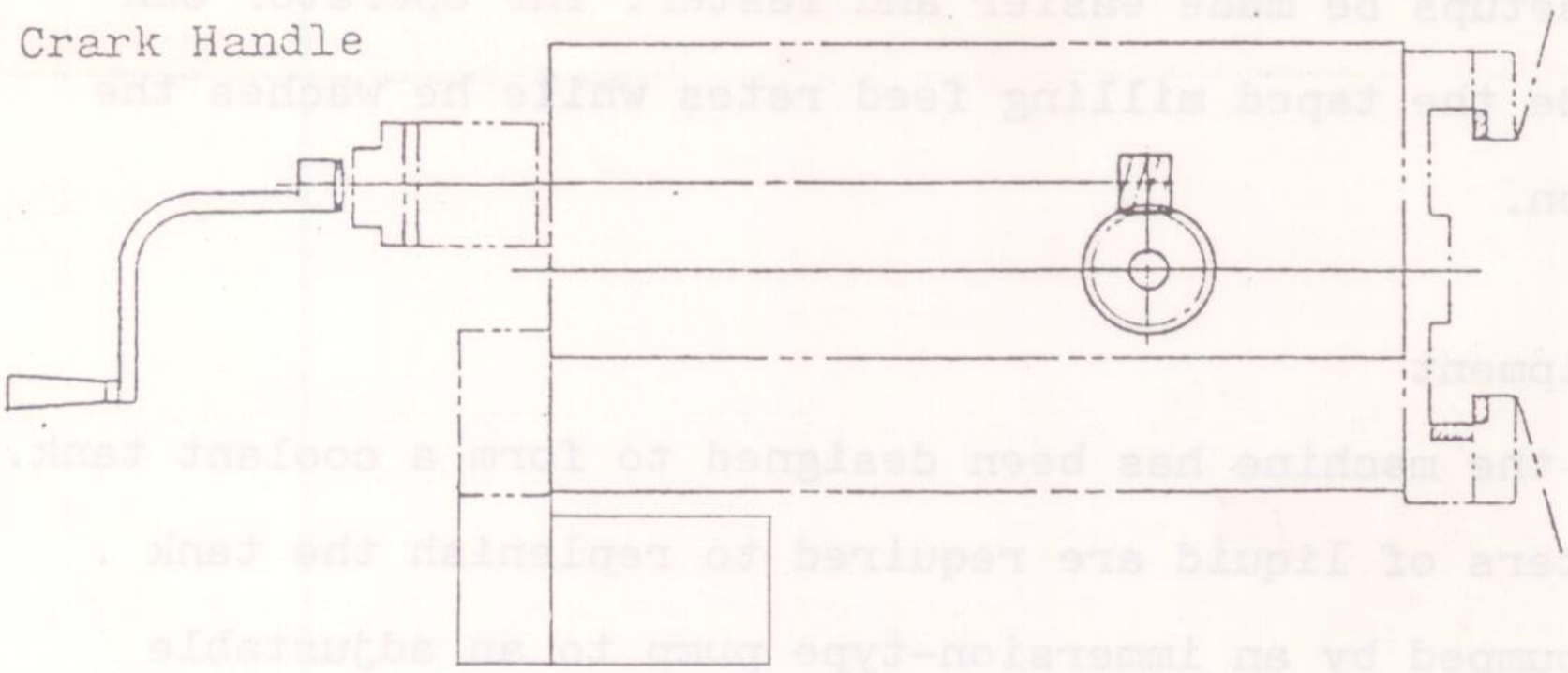


X axis Feed Mechanism

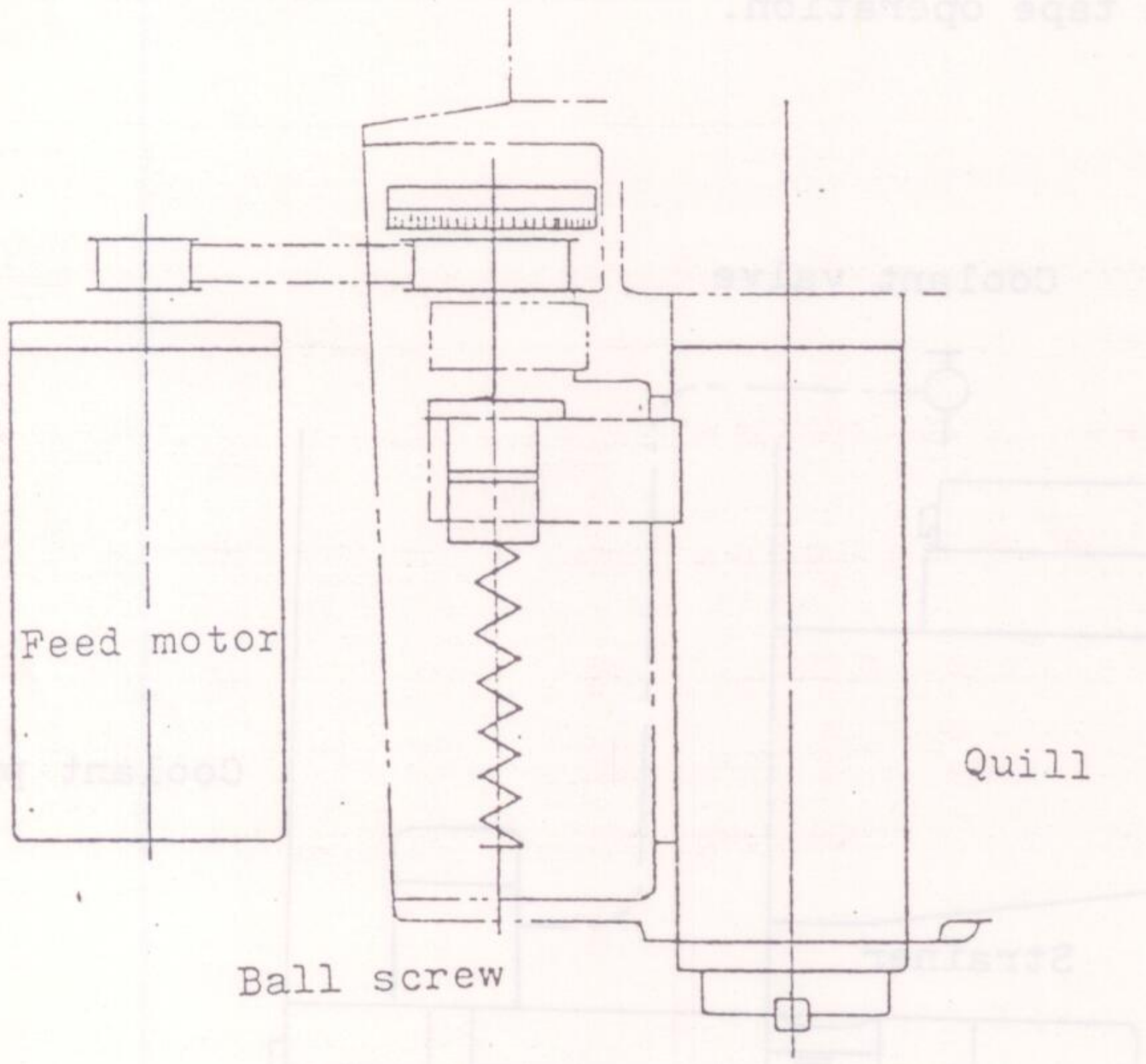


Y axis Feed Mechanism

Knee elevating Mechanism



Knee elevating Mechanism



Z axis Feed Mechanism

6) Pendant Operating Panel

Major control are centralized on the pendant panel.

The pendant swings to the most convenient operation position.

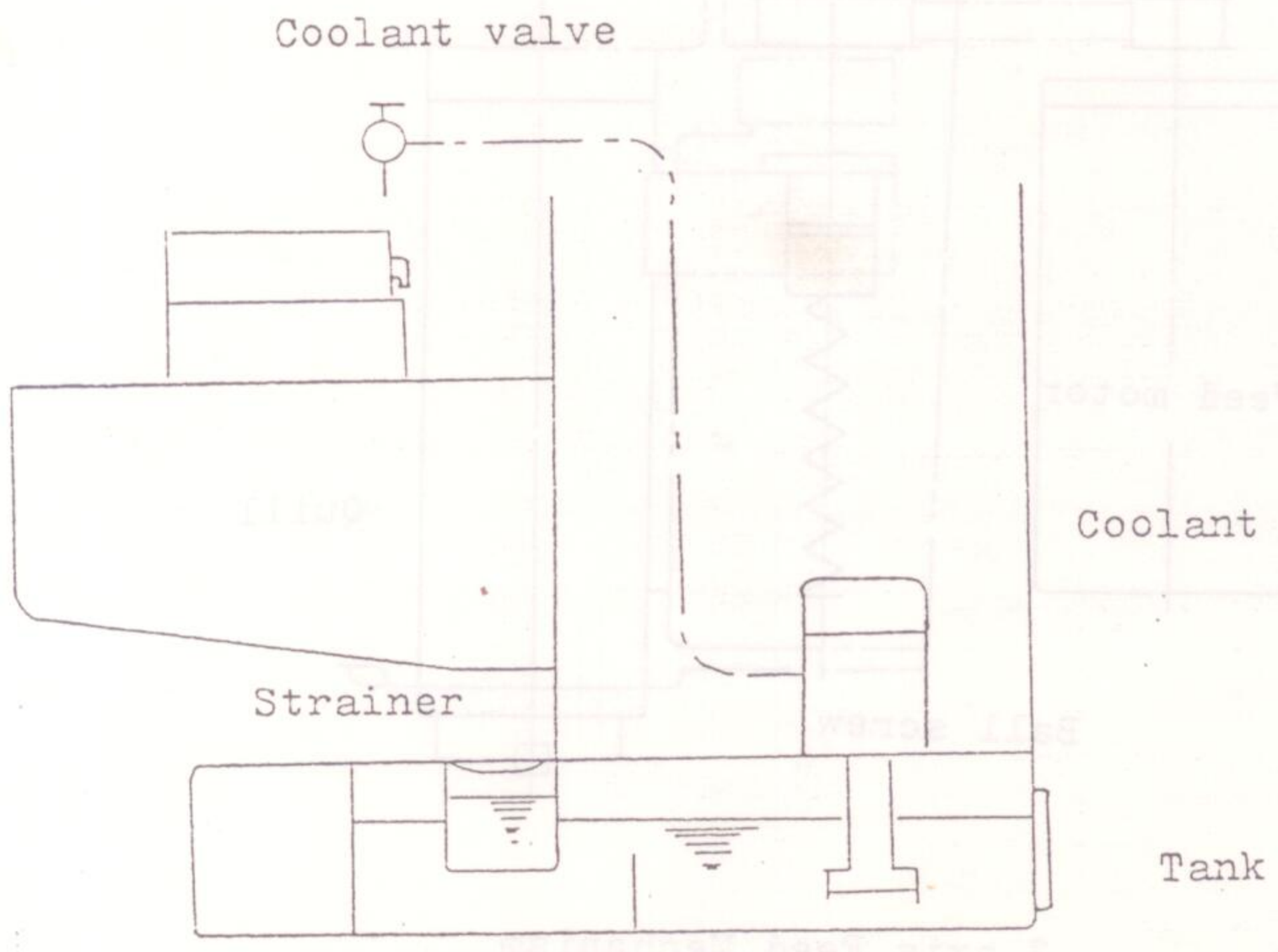
Therefore, setups be made easier and faster. The operator can also override the taped milling feed rates while he waches the cutter action.

7) Coolant Equipment

The base of the machine has been designed to form a coolant tank.

Approx liters of liquid are required to replenish the tank .

Coolant is pumped by an immersion-type pump to an adjustable nozzle through hose line and onto the workpiece. Coolant collects in the channels of the table and is fed back into the tank through the draining hose. Chips are held back by filters built into the table. Coolant pump is operated by the switch on the control panel and M function in tape operation.



Coolant Equipment

8) Lubrication

Lubrication is one of the important object, especially for this kind of NC machine.

It eliminates the stick-slip and insures long and consistent machine life and accuracy.

Please take a special attention to these items mentioned below.

i) Automatic Lubrication System

All slideways are supplied with oil from the automatic lubrication pump on the left side of column.

Intermittent time type pump is operated on time / 15 minutes.

The capacity of pump is 0.4 wine gallons (1.5 liters) and 1 shot flow is 100 - 300 minims (0.5 - 2cc).

The recomended lubricant is MOBIL VACTRA OIL NO,2.

ii) Other Lubrication

Bearing and ball-screw are already given grease before leaving our factory.

Other oil is not necessary for them.

If some needs occur, please consult your maintenance engineer or SHIZUOKA.

Please use unti-inflammable cutting oil while operating this machine.

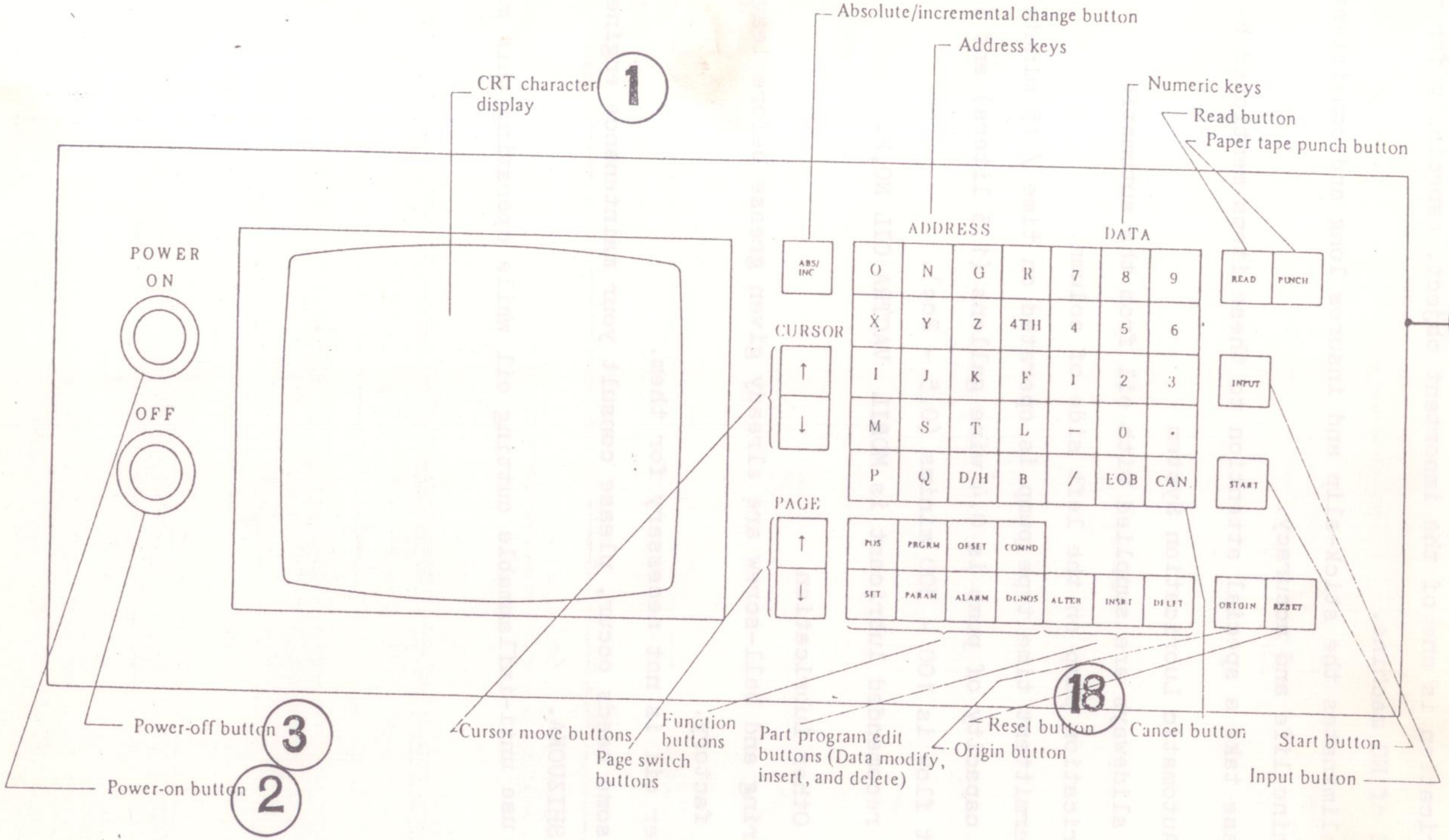
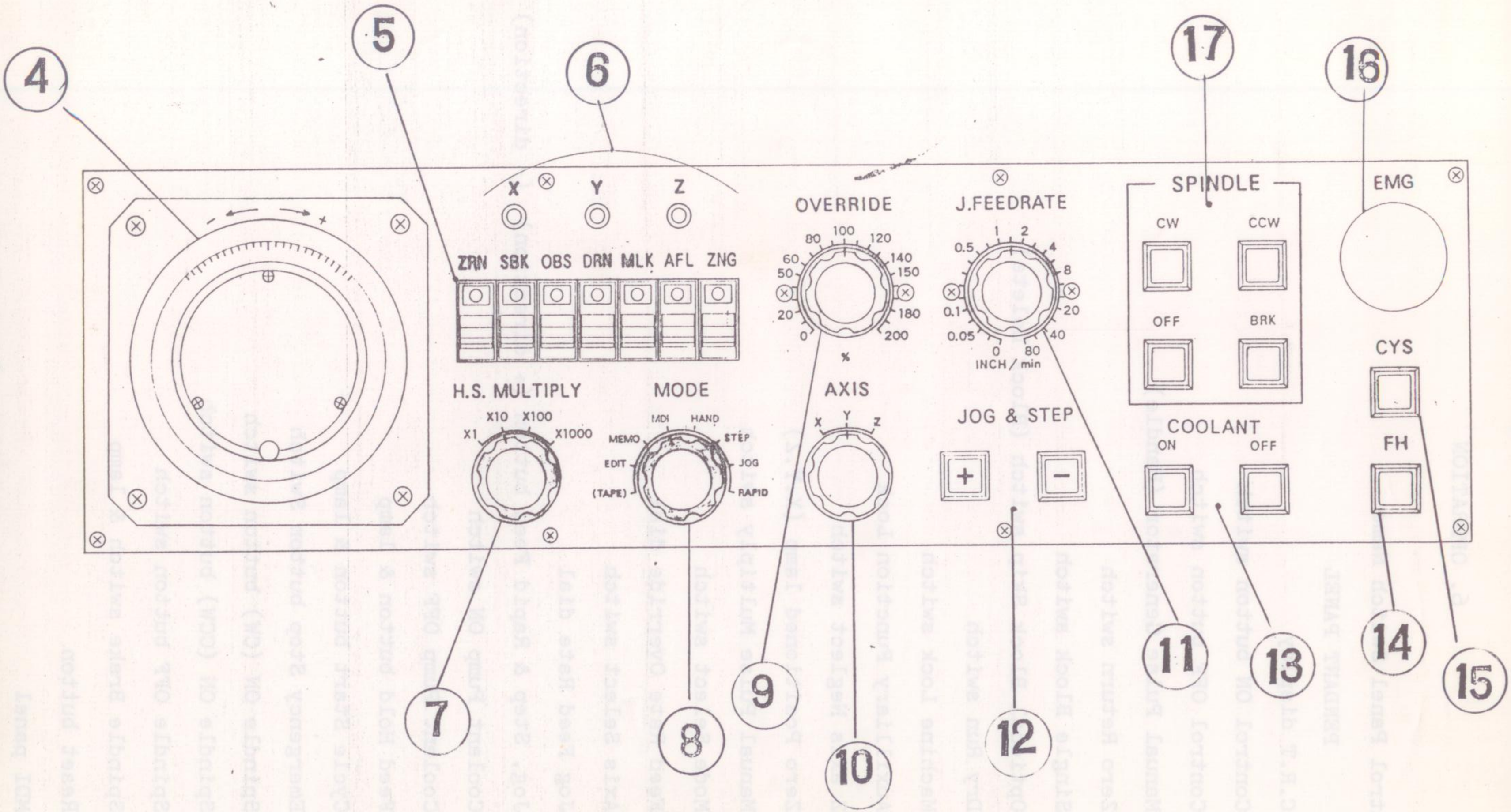


Fig. 5.1 CRT character displayed MDI & DPL panel


4
5
6
17
16
X
Y
Z
ZRN SBK OBS DRN MLK AFL ZNG
OVERRIDE
J.FEEDRATE
SPINDLE
CW
CCW
OFF
BRK
EMG
CYS
FH
H.S. MULTIPLY
X1 X10 X100 X1000
MODE
MDI HAND STEP JOG RAPID (TAPE) EDIT MEMO
AXIS
JOG & STEP
COOLANT
ON
OFF
7
8
9
10
11
12
13
14
15

6. OPERATION

1) Control Panel Switch Name

PENDANT PANEL

1. C.R.T display
2. Control ON button switch
3. Control OFF button switch
4. Manual Pulse Generator (Handle)
5. Zero Return switch

   Single Block switch

   Optional Block Skip switch (Block Delete)

   Dry Run switch

   Machine Lock switch

   Auxilliary Function Lock

   Z axis Neglect switch
6. Zero Positioned lamp (X.Y.Z)
7. Manual Pulse Multiply switch
8. Mode Select switch
9. Feed Rate Override dial
10. Axis Select switch
11. Jog Feed Rate dial
12. Jog, Step & Rapid Feed button (+ direction) (- direction)
13. Coolant Pump ON switch

13. Coolant Pump OFF switch

14. Feed Hold button & lamp
15. Cycle Start button & lamp
16. Emergency Stop button Switch
17. Spindle ON (CW) button switch

    Spindle ON (CCW) button switch

    Spindle OFF button switch

    Spindle Brake switch & lamp
18. Reset button
19. MDI panel

2) Pendant control panel

Major control panel switchs are centralized on this pendant control panel. When machine main power switch is ON (back side of control box) Coolant OFF switch and Spindle OFF switch ON pendant panel are illuminated. Operator can recognize machine power ON by these lamps. Switches, buttons, dials and lamp functions are specified below. (Detail NC function refer to NC operation manual.)

1. CRT display

CRT character display can simultaneously display various types of data, complete with explanatory sentences. (NC command data,Current position, Alarm signal etc)

2. Control ON Switch

NC control can stant by pushing this switch.
After pushing this switch, several seconds after some information are coming on CRT display.

3. Control OFF Switch

NC control can turn off by pushing this switch.
note : Make sure turning off NC power befor turning off main power switch.

4. Manual Pulse Generator

By the use of manual pulse generator, fine adjustment feed is available for the machine tool.
Set Mode select switch to HANDLE position.
Select the movable axis by axis select switch.
Rotate the handle of manual pulse generator.
clockwise rotation .....+ direction
counterclockwise rotation .....- direction
Movement amount is changeable by Manual Pulse Multiply switch.
- See section of Manual Pulse Multiply.-

5. Zero Return Switch (ZRN)

With this switch ON, and with the mode select switch at Jog, each axis, if moved to the zero point direction by the Jog button, moves at rapid traverse and stops at the zero point, and Zero Position Lamp lights up.

Single Block Switch (SBK)

Single Block function controls to stop at the end of each block.
If push the Cycle Start Button, resumes the operation and operation stops again at the next end of block.

Optional Block Skip Switch (BDT) *Block Delete

This function selectively ignores information of one block with slash code.

Dry Run Switch (DRN)

If this switch is set to on in the auto operation (Tape, MDI, Memory) an F function specified on tape is ignored and is switched to the Jog feed rate.
A rapid traverse command at Dry Run operation can be effective or ineffective by MDI unit .
(Be settled ineffective at factory bilt.)

Machine Lock Switch (MLK)

If this switch is set to ON.
Move command pulses are suppressed to the machine side.
Consequently, by all operation, the position display is updated as specified, but the machine does not move.
The M & S functions, however, are executed.

Auxiliary Function Lock (AFL)

With this switch at ON, and with mode select switch at auto operating position (Tape, MDI, Memory), if control read M & S functions signals are neglected to machine side.

Z- axis Neglect Switch (ZNG)

If this switch is set to ON, a Z-axis command can be ignored .
This function is effective when checking the content of an tape command in writing using a pen .

6. Zero Position Lamps

These lamps are useful when returned to zero position.

7. Manual Pluse Multiply Switch (MANUAL PULSE MULTIPLY)

With the mode select switch at the STEP or HANDLE, this switch is used to multiply a movement amount per pulse by x1, x10, x100,x1000.

increment system	x1	x10	x100	x1000
INCH system	0.0001inch	0.001inch	0.01inch	0.1inch
METRIC system	0.001mm	0.01mm	0.1mm	1mm

* Remark (with the mode select switch at the HANDLE)

increment system	x1	x10	x100	x1000
INCH system	0.0001inch	0.001inch	0.001inch	0.001inch
METRIC system	0.001mm	0.01mm	0.01mm	0.01mm

8. Mode Select Switch (MODE)

This switch is used to specify an operational mode.

EDIT; Set the switch to this position to use memory editing function and data input directly to memory.

MEMO; (Memory)
When executing control commands stored in bubble memory, set the switch to this position.

MDI; (Manual Data Input)
Set the switch to this position to perform Manual Data Input.

TAPE; (option)
Set the switch to this position to perform an operation by tape.

HANDLE; By the use of a manual pulse generator (Handle), fine adjustment feed is available for the machine tool.
Set the switch to this position to perform an operation by handle.

STEP; Push one of the Jog & Step buttons (+ or -) with the switch at any position, and the machine will be able to be moved step by step in the corresponding direction.
(See Manual Pulse Multiply switch.)

JOG; Push one of the JOG & Step buttons (+ or -) with the switch at this position and Axis select switch at any position, and while the Jog & Step button is still pushed, the machine will be able to be moved continuously in the corresponding direction.
The feed rate is set on the Jog Feed Rate dial.

RAPID; Push one of the Jog & Step buttons (+ or -) with the switch at this position and Axis select switch at any position, and while the Jog & Step button is kept pushed, the machine will be able to be moved rapidly and continuously in the corresponding direction.

9. Feed Rate Override Dial (FEED RATE OVERRIDE)

Feed rate can be varied by auto operation (Tape, MDI, Memory) command, but also further decreased to 0% from 100% or increased to 200% in increments of 10% in a range from 0 to 200% by this switch.
Feed rate designated by tape are shown when the override on the control panel is set at 100%.
Feed rates for tapping cycle cannot be varied by this dial.

10. Axis Select Switch (AXIS)

When Mode select switch selects manual operation, movement axis is selected by this switch.

11. Jog Feed Rate Dial (FEED RATE)

This dial can be used to set a feed rate in twenty five stages in a Jog or Dry Run operation.

* Feed Speed

INCH system (inch/min.)

0	0.04	0.06	0.08	0.1	0.15	0.2	0.3	0.4
0.6	0.8	1.0	1.5	2.0	2.8	4.0	5.5	8.0
10	15	20	28	40	55	80		

METRIC system (mm/min)

0	1.0	1.4	2.0	2.7	3.7	5.2
7.2	10	14	20	27	37	52
72	100	140	200	270	370	520
720	1000	1400	2000			

12. Jog, Step & Rapid Feed Button (JOG & STEP)

If this button is pushed in a jog or step, or rapid mode, the machine can be moved in an appropriate direction.

+ ..... + direction

- ..... - direction

13. Coolant Pump (ON , OFF) Switch (COOLANT)

By pushing ON switch, coolant pump motor is turned on in all operation.
This coolant ON, OFF switches are effective even in Auto operation.
This switch can released by turning CW with pushing.

Note; * Make sure before releasing this switch, remove fault causes.
* After the button is released, reference point return by manual is necessary.

14. Feed Hold Button & Lamp (FEED HOLD)

If this button is pushed during auto operation (Tape, MDI, Memory) initiated by the cycle atart button, the feed is stopped after reduction and the lamp light up.
M and S function is not affected by push this button.
Restant can be made by the Cycle Start button.
Note; Spindle ON (CW, CCW) Switch and Spindle OFF switch are effective in this stage. But can not re-start spindle is not previous condition (ON , OFF).

15. Cycle Start Button & Lamp (CYCLE START)

Push and release this button in auto operation (Tape, MDI, Memory) to activate the machine.
When this button is pushed, the display lamp lights up, and an appropriate operation is executed.

16. Emergency Stop Button (EMG.)

This button is used at emergency time to stop the machine.
Every action is stopped immediately by pushing this switch.
And also be reseted control unit.

17. Spindle Brake Switch & Lamp (SPINDLE BRAKE)

This switch is to actuate the brake cylinder valve.
ON (lamp is ON) .....Spindle is clamped
OFF (lamp is OFF)....Spindle is free
When this switch is ON, while spindle is rotating the brake is released but when the spindle stop is commanded, the brake is effective.
Note; In Auto operation this switch is ignored but spindle brake is always on condition.

17. Spindle ON (CW , CCW) Button

By pushing this switch (CW , CCW), the spindle is revolving to clockwise (counter clockwise) direction.

CW .... Clockwise direction
CCW .... Counter clockwise direction

This switch is ignored while in auto operation (Tape, MDI, Memory) is running.

17. Spindle OFF button (OFF)

If this button is pushed in manual operation, spindle motor is stop.
When auto operation (Tape, MDI, Memory), use M05 (spindle stop).

18. Reset Button (RESET)

If this button is pushed, machine's every action is stopped and reseted control unit.

* All axis will stop
* Spindle will stop (not brake)
* Coolant pump will stop
* Quill will un-clamp

19. MDI Panel

3) Operating Spindle Spee Change

The spindle speed is changed by the following operation.
Spindle speed change can be infinitely variable.
After ensuring that the main motor is running and the spindle rotating, spindle speed change is operated by turning the change handle unitil the required speed is indicated on the speed dial.
Either of two speed ranges may be selected by engaging or disengaging the back gear in high or low.
Note; In order to prevent from gear damage, the H-L gear shift is not operated during the spindle is rotating.

4) Operating Knee Movement

Knee Movement

The knee may be positioned by first loosening the clamp bolts on the right side of knee and then turning the crank handle.
Knee is elevated 0.2inch per one turn of the crank.
After the knee is positioned tighten the clamp bolts.
The total stroke is 15 3/4. (400mm)

5) Travel Test

After the machine has been properly installed, check as follows.

1. Wash off the protective grease with white spirit, or similar solvent, and apply lubricating oil to exposed slideways.
2. Release all clamp bolts on the machine.
   Table clamp bolts 1
   Saddle clamp bolts.....1
   Quill clamp lever.....1
   *Quill clamp is actuated by air cylinder automatically.
   Knee clamp bolts.....2
   *Knee clamp bolts is better clamped when machine is running.
3. After ensuring that nothing is conflicting to table movement saddle movement and quill movement, then move the all carriages in full range of travel and make sure that all slideways are smooth.

6) Remarks of Operation

1. The machine is used complessed air but even if the air is not supplied or shorten, machine is not stopped but brake of spindle and Quill clamp is not actuated.

2. Spindle and Coolant pump can be operate without NC control power ON . Best attention is necessary for those switch.
3. Z axis movement commands are ignored when M10 (Quill Clamp) was operated. Make sure to command M11 (Quill Unclamp) before operating Z axis .

7) Manual Intervention

The machine can intervene while Auto operation.

1. In case of changing breaked tool in Auto operation is as follows.

a, Stop the axis feed by pushing Feed Hold switch.
b, Stop the Spindle by manual spindle stop switch.
c, Make sure of Z axis coordinates position.
d, Set Handle mode by Mode select switch, and move Z axis to +.
(not to confrict with work piece.)
e, Change the tool and check length is correct.
Start the spindle by manual spindle ON switch.
f, Back to the position -c,- by Handle.
g, Back to the Mode to previous position (Tape or Memory) and push cycle start switch. Note; In this case MDI intervention is not abailable.

2. In other case

In case of stopping the Axis feed by using Single Block Switch, MDI intervention and manual intervention are effective.
But if some information is remaining in Buffer storage, some complicated operation is necessary so before operating MDI check the information in Buffer storage.
-more detail consult to Fanuc operating manual-

7. MAINTENANCE & CHECK

The operator maintains & check the following points.

(Detail control maintenance & check refer to NC Operating Manual)

Cycle	Item
	* Air Pressure check 4.5 - 5Kg/cm^2 (65 - 71 ibs/in^2) * Electric check (lamp, etc) * Lubrication oil level check * Cleaning the tape reader (optopn)
Weekly	* Oil supply for Lubrication pump * recommended oil refer to oil Guide Rable * Cleaning the tape path (control) .... option .tape holder .capstar roller .stop shoe .pinch roller
Every Two Month	* Ajust X and Y jib

Oil Guide Table

	Lubricating System	Recommended oil
Slideway Lubrication	Forced automatic timed pump.	Vactra Oil No,2 (Mobil) Shell Oil T33 (Shell) Daphne Multiway 52 (IDEMITSU)
Coolant Oil		

* Other oil is not necessary for this machine.

To prolong machines accuracy and life, operator need to take care of the following points.

1.Preparation before operating the machine

Automatic lube, pump must be pumped 2 or 3 times by hand.

2.Preparation before tuning off power

Table and saddle must be located at center of knee and saddle.

*If some troubles occur, please consult maintenance engineer or your distributor or SHIZUOKA .

8. IMPORTANT

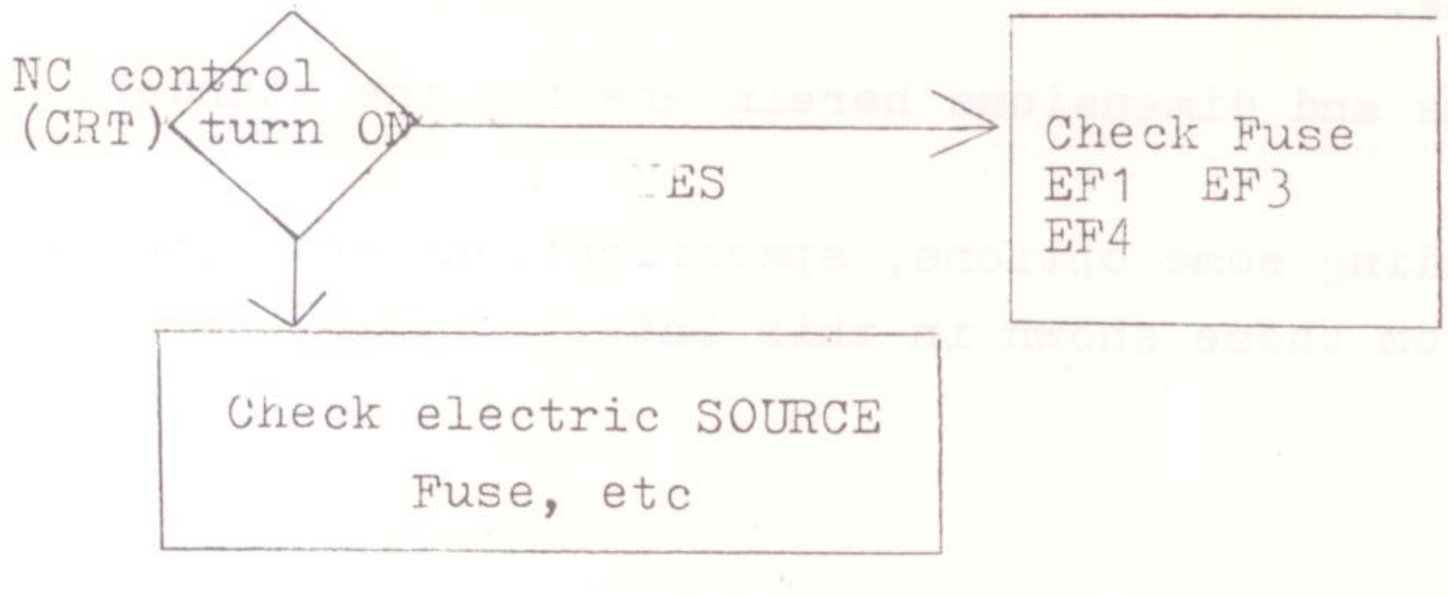
* Specifications and dimensions herein are subject to change without notice.

* Specifications and dimensions herein are for the standard type model 。
  In case of adding some options, specifications and dimensions may differ from those shown in this Data。

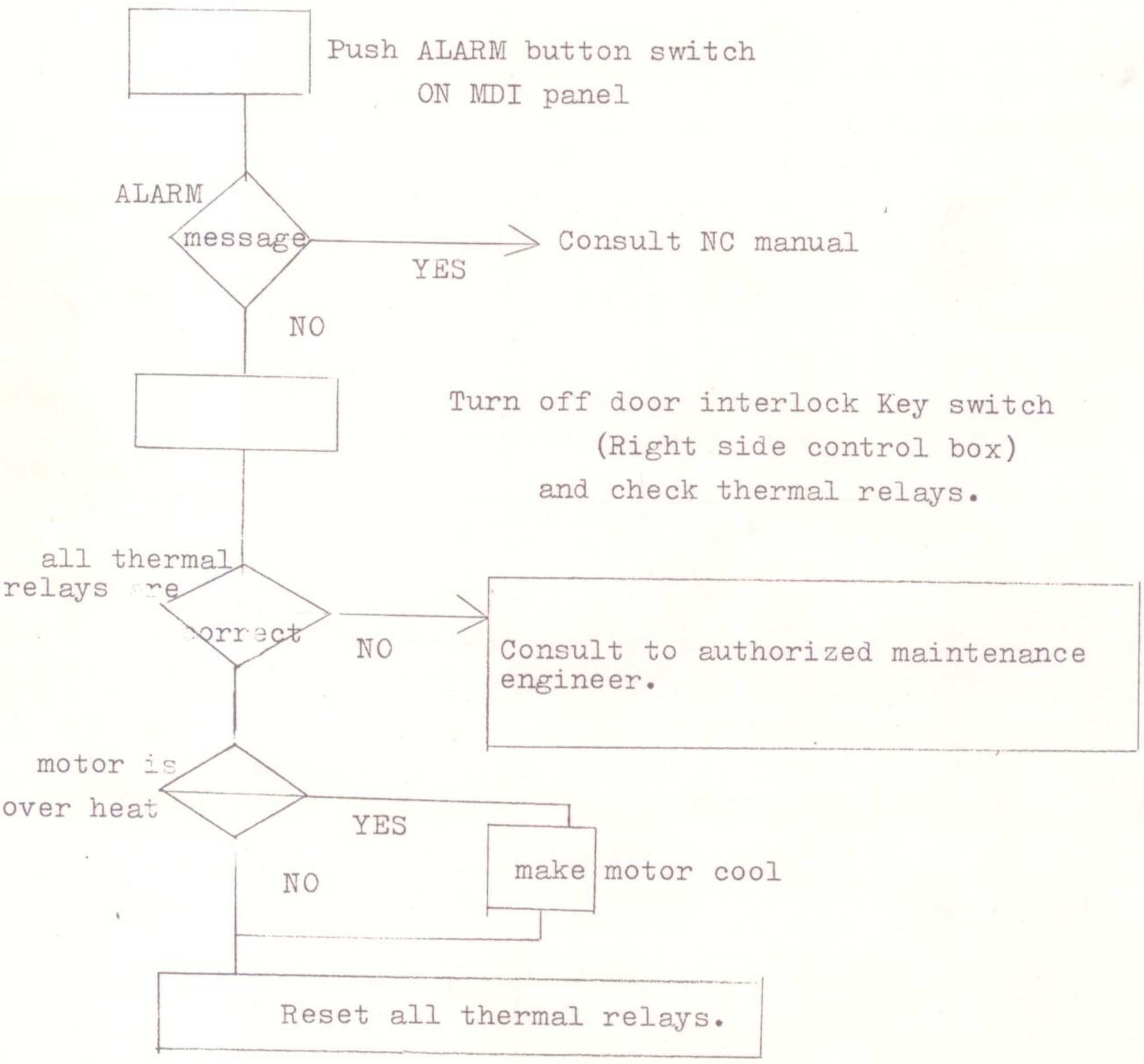
9. Appendix

Trouble Shooting

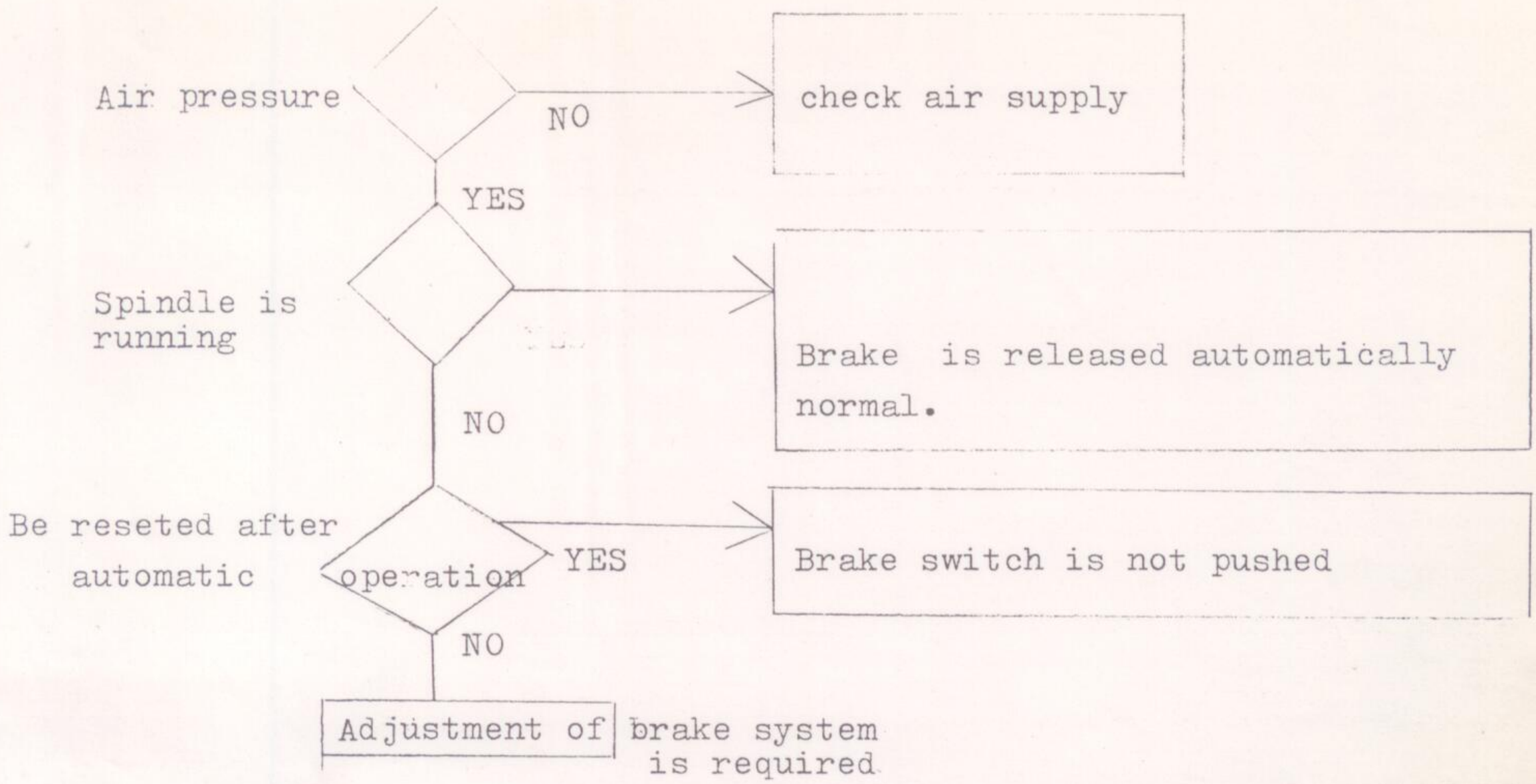
1) All the lampson Pendant panel are not light up.



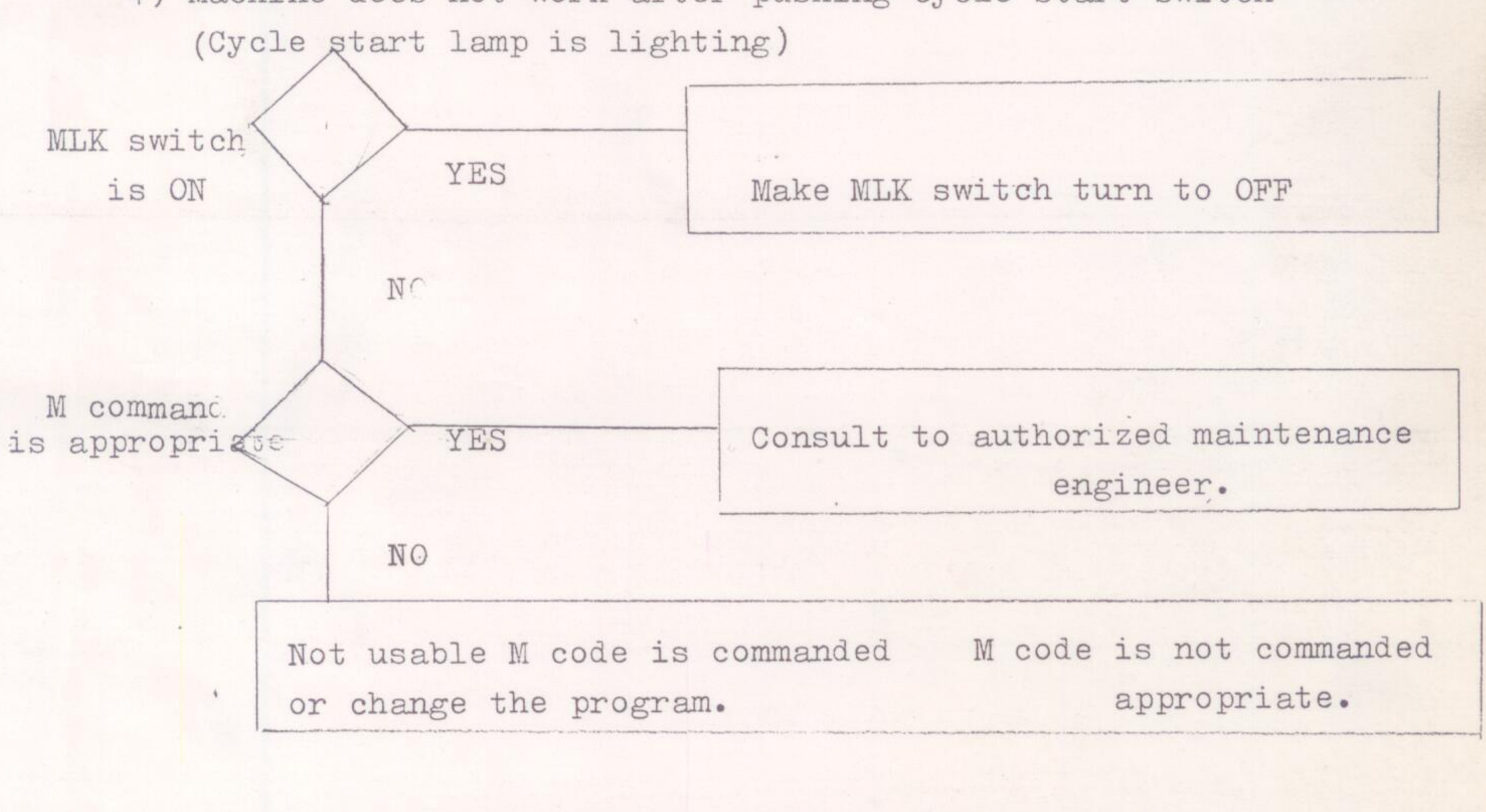
2) CRT shows NOT READY



3) Spindle brake is not effect.



4) Machine does not work after pushing cycle start switch (Cycle start lamp is lighting)



* When opening control box with door interlock switch off, main electric is still supplied. Then when checking Fuse or some electric component, best attention is required.
* When changing electric component, make sure to turn off main power.
* When closing control box, make sure to turn on the door interlock switch.