



# **Wadkin**

**OPERATING AND MAINTENANCE  
INSTRUCTIONS**

# **UX/CNC2 ROUTER**

Whilst every effort has been made to ensure that the information contained in this publication is accurate and up-to-date, Wadkin plc cannot accept any responsibility for any damage that may be caused as a result of omissions or errors contained herein.



# **BE CAREFUL**

## **THIS MACHINE CAN BE DANGEROUS IF IMPROPERLY USED**

Always use guards.

Keep clear of the spindle until  
rotation has ceased.

Always operate as instructed and in  
accordance with good practice.

Read the instruction manual.



## HEALTH & SAFETY

### SAFETY OF WOODWORKING MACHINES

Woodworking machines can be dangerous if improperly used. The wide range of work of which they are capable, requires adequate safeguarding arrangements against possible hazards.

Many injuries to machinists are caused by carelessness or failure to use the guards provided or to adjust them correctly.

WADKIN PLC supply machinery designed for maximum safety which they believe, as a result of thorough testing, minimizes the risks inevitable in their use. It is the user's responsibility to see that the following rules are complied with to ensure safety at work:

1. The operation of the machine should conform to the requirements of the Woodworking Machines Regulations 1974. All guards should be used and adjusted correctly.
2. Only safe methods of working should be adopted as given in the Health & Safety Work Booklet No. 41, "Safety in the Use of Woodworking Machines", (obtained from Her Majesty's Stationery Office) and as advised by Wadkin plc.
3. Only personnel trained in the safe use of a machine should operate it.
4. Before making adjustments or clearing chips, etc. the machines should be stopped and all movement should have ceased.
5. All tools and cutters must be securely fixed and the speed selected must be appropriate for the tooling.

SAFETY IS OUR WATCHWORD BUT THE USER MUST COMPLY WITH THE ABOVE RULES IN HIS OWN INTEREST. WE WOULD BE PLEASED TO ADVISE ON THE SAFE USE OF OUR PRODUCTS.

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SECTION 1  
SPECIFICATION

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SPECIFICATION

## BASIC MACHINE

Longitudinal traverse	(X axis)	1300mm	51 inch
Cross traverse	(Y axis)	815mm	32 inch
Vertical traverse	(Z axis)	250mm	10 inch
Head rise and fall	pneumatic	100mm	4 inch
	screw	150mm	6 inch
Table area		1385mmx890mm	54½ inch x 35 inch
Table height		915mm	36 inch
Throat capacity		915mm	36 inch
Spindle nose to table distance			
	max	250mm	10 inch
	min	zero	zero
Table feedrates (X and Y axes)		0-10m/min	400 inch/min
Table rapid traverse rate		12m/min	472 inch/min
Repeatability		0.05mm	0.002 inch
Floor space		2680mmx2525mm	106 inch x 100 inch
Overall height		2170mm	86 inch

## HEAD DETAILS

**FOUR-SPEED HEAD**  
**Type LC**

Spindle speeds		6,000; 9,000; 12,000; 18,000 rev/min
Spindle power (continuous)		3 ; 4.5 ; 6 ; 9 kW 4 ; 6 ; 8 ; 12 hp
Spindle taper	standard alternatives	Wadkin 20° Inclusive No. 2 Morse Taper No. 3 Morse Taper
Air supply		0.788 to 0.845 m <sup>3</sup> /min free air at 5.6 kgf/cm <sup>2</sup>  (28 to 30ft <sup>3</sup> /min at 80 lbf/inch <sup>2</sup> )

**HIGH SPEED HEAD**  
**Type F**

Spindle speeds		18,000 ; 24,000 rev/min
Spindle power (continuous)		2.35 ; 3 kW 3 ; 4 hp
Spindle power (intermittent)		6kW 8hp
Spindle taper	standard alternative	Wadkin 20° Inclusive No. 2 Morse Taper
Air supply		0.113 to 0.169 m <sup>3</sup> /min free air at 5.6 kgf/cm <sup>2</sup>  (4 to 6ft <sup>3</sup> /min at 80 lbf/inch <sup>2</sup> )

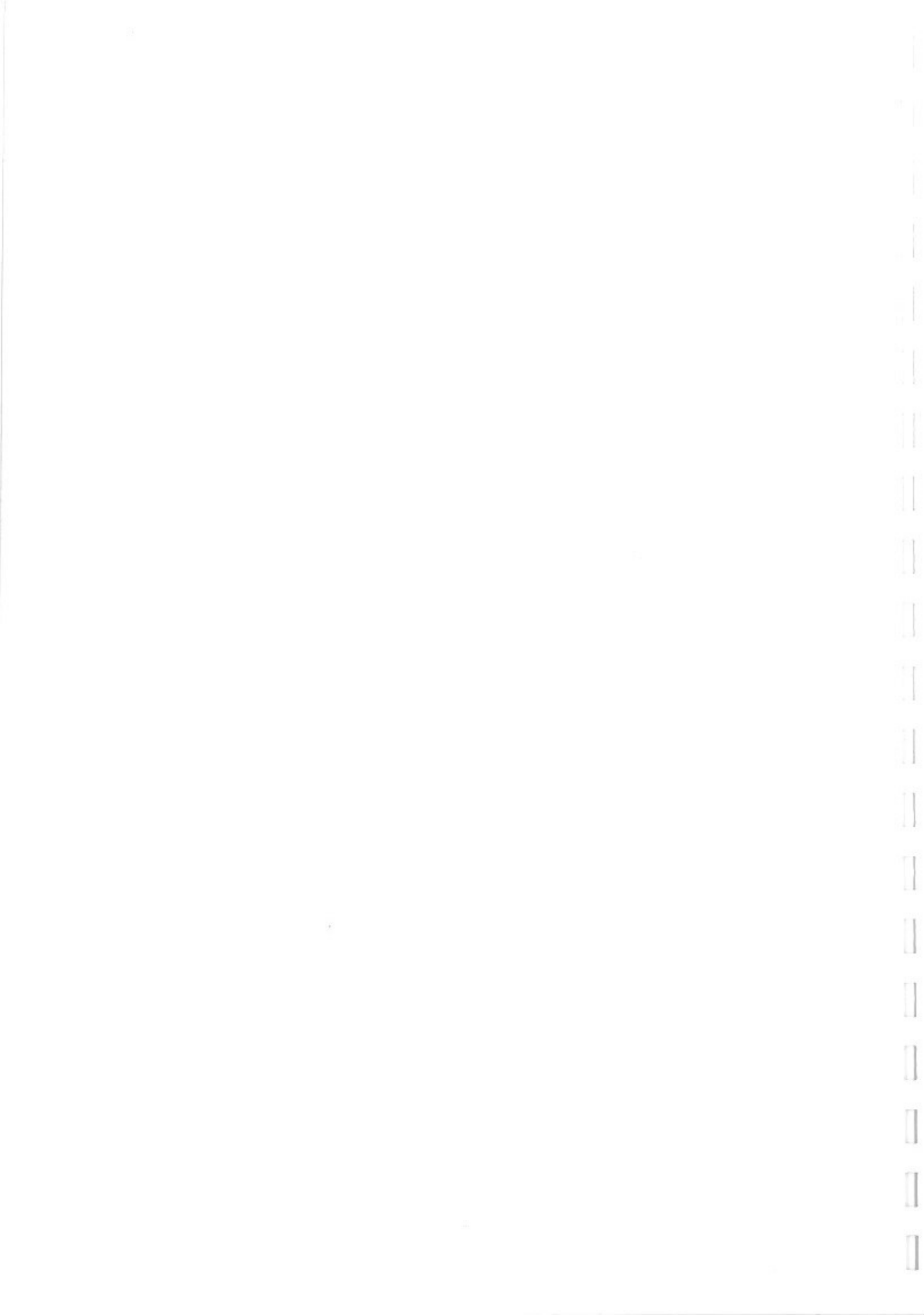
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## DESCRIPTION

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## SECTION 2

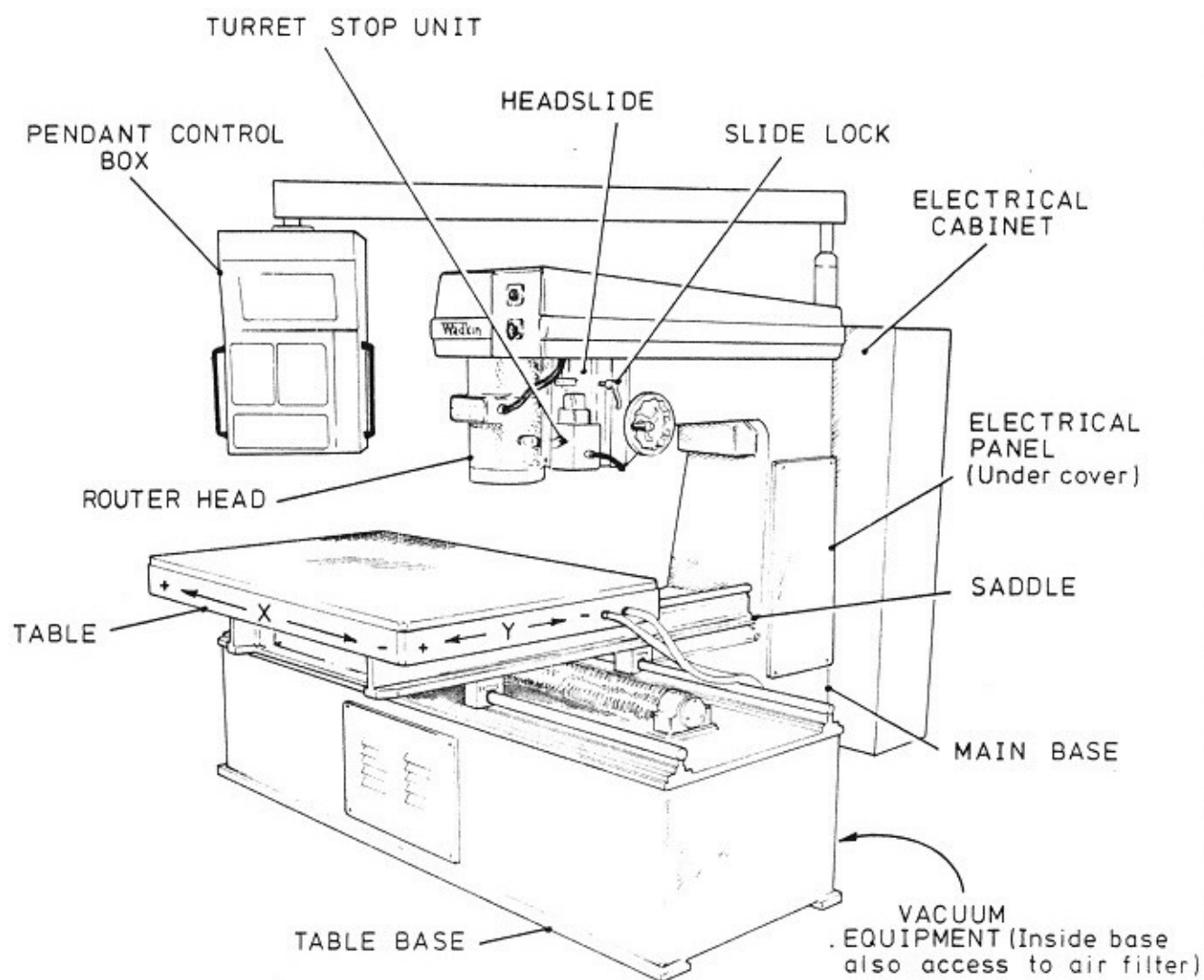
### DESCRIPTION

#### INTRODUCTION

The Wadkin UX/CNC routing machine is designed for accurate, high-speed, continuous contouring operations on wood and plastic. The machine operates under computerised numerical control (CNC) giving optimum performance with a high level of reliability.

The machine comprises a robust base unit, which supports the head-slide and high-speed router head. The machine table/saddle assembly is mounted on a separate base unit rigidly attached to the main base. The table has two axes of movement; front to rear - Y axis, and left to right - X axis.

The main components of the machine are more fully described overleaf, and separately illustrated in Section 7.



GENERAL VIEW OF MACHINE

## MAIN BASE

The main base is a heavy iron casting which is rigidly bolted to the machine foundations. The base supports the headslide and has the electrical cabinet bolted to its rear face.

## HEADSLIDE

The headslide is mounted on the front face of the main base upper extension. The assembly comprises two dovetail slideways giving two independent methods of controlling the head vertical movement.

The rear slide is used to set the spindle height in relation to the workpiece and is raised and lowered by means of a handwheel mounted on the right-hand side of the main base. The handwheel drives a screw via the worm and wheel arrangement mounted at the rear of the headslide assembly.

A manually operated slide lock prevents rear slide movement once the correct height has been set.

The front slide is automatically raised and lowered by means of a pneumatic cylinder. A manually adjustable six-position turret stop mounted at the right-hand side of the front slide is used to set the head depth.

(Note: This is the standard method of depth control. A description of optional depth control methods is given later in this section.)

## ROUTER HEADS

Two types of router head are available with this machine. Both are driven by a floor-mounted frequency changer, the required speeds being selected by means of switches on the machine control panel.

The heads are built to standard Wadkin designs. The spindle of the router is also the rotor unit of the routerhead motor assembly and is supported in high-precision ball bearings.

### Four-speed Head - Type LC

The type LC routerhead has speeds of 6,000, 9,000, 12,000 and 18,000 rev/min.

A forced air cooling system ensures that the router head is relatively quiet in operation and assists in maintaining low running temperatures over long periods of machining. An air pressure switch in the air supply line protects the router in the event of insufficient air flow. A solenoid valve controls the air supply such that the air flow is provided only when the router motor is switched on.



The standard head has a Wadkin 20° taper bore, cutters or tool adaptors being retained in the spindle by means of a drawbolt. Parallel bore collets and special cutters as supplied by Wadkin Limited, can also be used. A spindle lock is provided to prevent spindle rotation whilst changing cutters, and a microswitch inside the router head top cover inhibits spindle operation whilst the cover is removed for toolchanging purposes.

A hand-operated brake is provided enabling the spindle to be quickly brought to rest after being switched off.

### **High-Speed Head - Type F**

The type F fan-cooled routerhead has speeds of 18,000 and 24,000 rev/min.

The standard routerhead has a Wadkin 20° taper bore, cutters or tool adaptors being retained in the spindle by means of a chuck nut and collets. A spindle lock is provided to prevent spindle rotation whilst changing cutters and a microswitch provides an electrical interlock, switching off the frequency changer when the lock is operated.

A hand-operated brake is provided enabling the spindle to be quickly brought to rest after being switched off.

### **TABLE/SADDLE**

The table/saddle assembly is mounted on a substantial fabricated steel base, which is rigidly attached to the main base and bolted to the machine foundations.

The base carries the hardened precision ground steel bars on which the saddle moves and also supports the X-axis ballscrew.

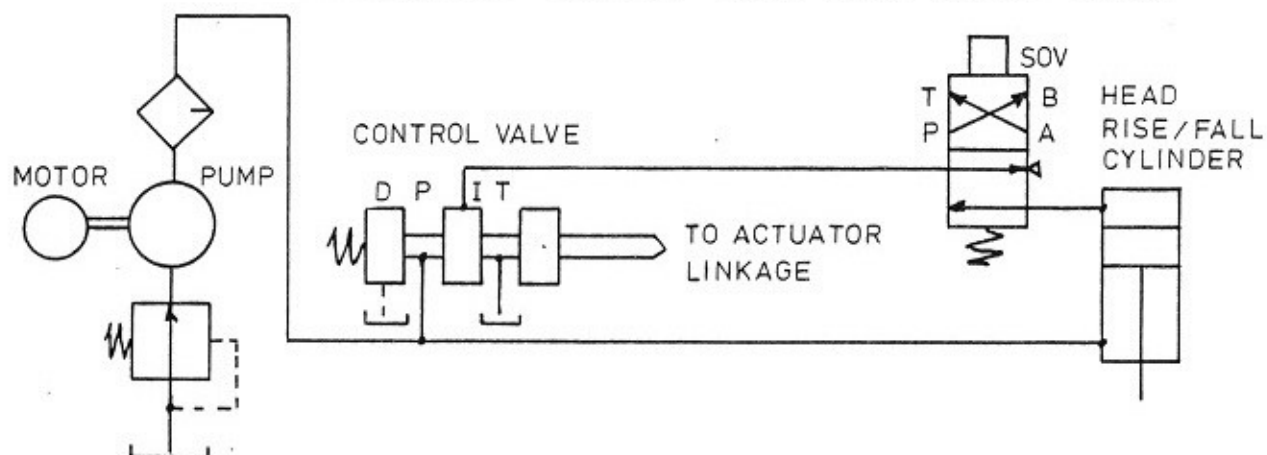
#### **Saddle**

The saddle is fitted on its underside with two pairs of anti-friction recirculating ball bushings which ride on the bars fitted to the base. The upper surface of the saddle carries similar bars on which the table moves, and also supports the Y axis ballscrew and drive motor.

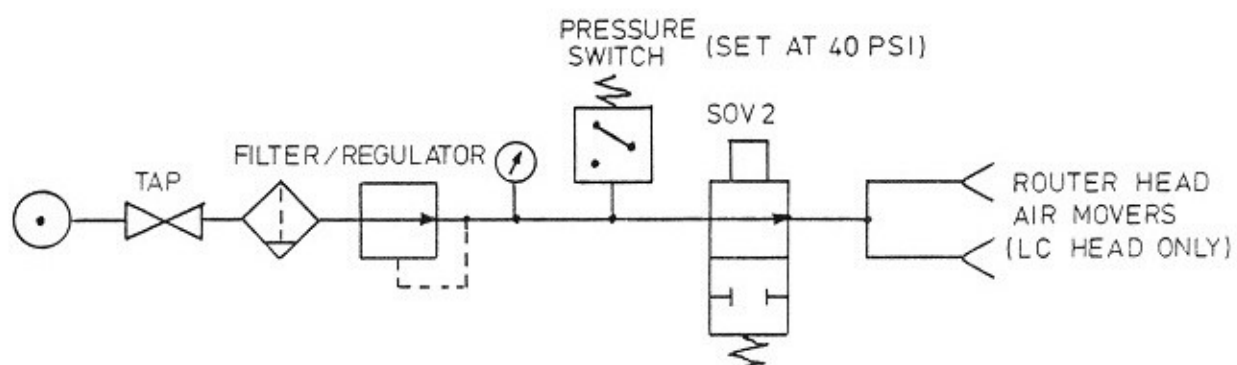
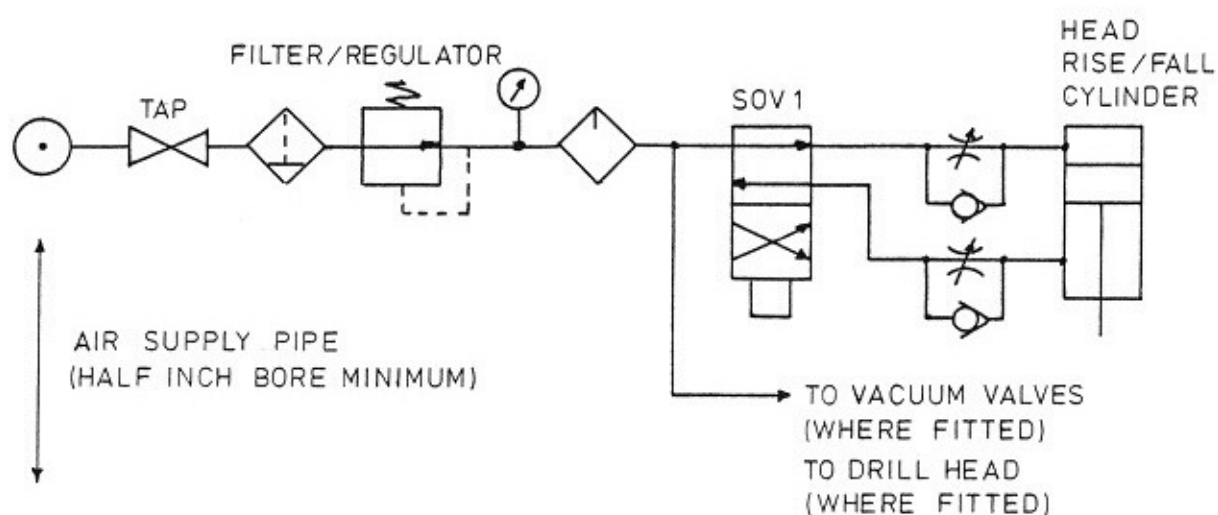
#### **Table**

The cast-iron table is similarly fitted with ball bushings on its underside which ride on the bars of the saddle. The upper surface of the table is fitted with a substantial plywood sheet which can be drilled to accept workholding fixtures.

## HYDRAULIC CIRCUIT (FLOATING HEAD ONLY)



## PNEUMATIC CIRCUIT



## AXIS DRIVES

Both the X and Y axes are driven in a similar manner, by a pre-loaded high-precision recirculating ballscrew. Each ballscrew is driven by a d.c. servo motor under full control of the CNC system. A ballnut attached to the axis, moves the axis linearly along its slideways as the ballscrew rotates.

## PNEUMATIC SYSTEM

The headslide rise and fall cylinder is pneumatically operated. Pressurised air is routed from the connection point on the left-hand side of the main base, via a filter, regulator and lubricator unit to a solenoid operated valve (SOV1), located under the main base top cover. With the solenoid energised, air is routed to the upper chamber of the cylinder and the head is lowered. With the solenoid de-energised, air is routed to the lower chamber of the cylinder, and the head is raised. (Fail-safe condition: the head will automatically rise away from the workpiece in the event of a power failure.)

## LC Head Air Supply

Where the LC type head is fitted, a further air supply connection point is provided for the forced air cooling system. Pressurised air is routed from the air connection point via a filter/regulator unit to valve SOV2. The solenoid is energised to provide an air supply to the router head whenever the head is running. A pressure switch provides an electrical interlock to switch off the routerhead should the air supply fail, or fall below  $2.8 \text{ kgf/cm}^2$  ( $40 \text{ lbf/in}^2$ ). A feedhold condition is caused if this occurs.

## ELECTRICAL EQUIPMENT

The machine's electrical equipment comprises the CNC System, axis servo drive units, router motor and frequency changer and associated power supplies, relays and contactors.

The power supply units, axis servo drive unit, fuses and control relays are mounted in the electrical cabinet attached to the rear of the main base.

Cables to the pendant control panel and CNC System (mounted within the control panel) are routed from the top of the electrical cabinet.

The frequency changer and routerhead control contactors and overloads are mounted on a separate panel housed within the right-hand side of the main base.

**WARNING:** This panel is not isolated when the door is opened. Always isolate the machine using the main isolator on the electrical cabinet before opening the side panel door.

The electrical circuit diagrams for the machine are included in Section 6 - Fault Finding.

### OPTIONAL EQUIPMENT

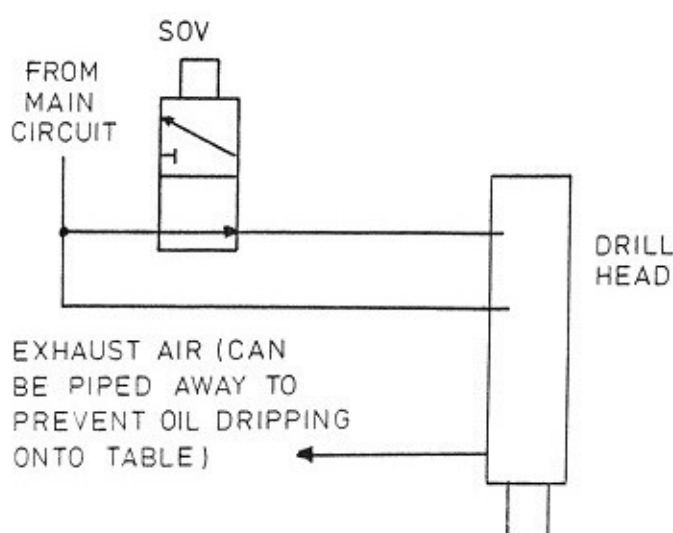
The optional equipment described below may not be fitted to all machines.

#### Drilling Head(s)

One or two drilling heads may be fitted enabling components to be drilled as well as profiled on the same machine. The maximum size of drill shank that can be used is 13mm dia.

The drill head is a self-contained, pneumatically-operated unit controlled by a single solenoid valve. When a 'Drill' command is programmed, the solenoid is energised to start the automatic drill cycle. The drill starts up and feeds into the work until it reaches a pre-set depth. It then retracts (upwards) and operates a micro-switch to signal that the cycle is complete. (Refer to the programming format at the end of Section 4 for the 'Drill' commands.)

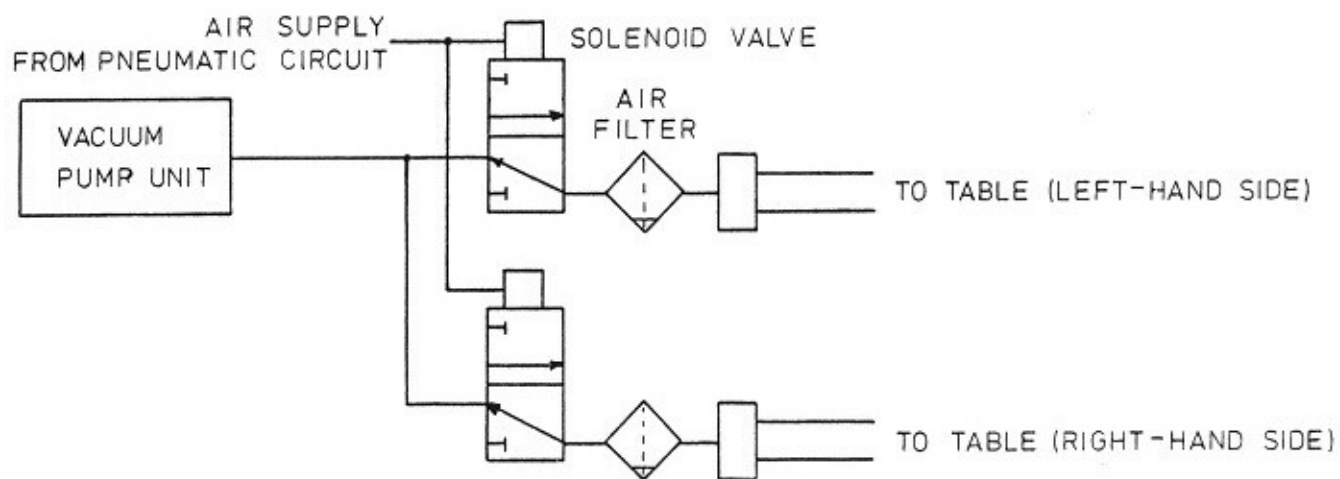
#### DRILL HEAD PNEUMATIC CIRCUIT



NOTE CIRCUIT FOR SECOND DRILL HEAD (WHERE FITTED) IS IDENTICAL.



## VACUUM CIRCUIT



The drill heads are fitted at the left-hand side of the routerhead, with the drill spindle centrelines co-incident with the router spindle centreline in the Y axis. The first drill head is 210mm from the routerhead, and the second drill head (where fitted) is 105mm from the first (in X axis).

**Note:** The drill heads cannot be fitted if the floating head option is supplied.

### Vacuum Pump

The vacuum pump provides suction for component clamping. The vacuum system is separately piped to the right and left-hand halves of the table allowing work to be clamped over either half or over the whole area.

The vacuum system is controlled by means of push buttons on the pendant control panel. When clamping is selected, a vacuum sensing switch inhibits axis movement until sufficient vacuum is generated to hold the components securely in place. Control panel lamps indicate the current state of the system.

The vacuum pump and controlling solenoid valves are located inside the right-hand end of the table base. (Remove cover at rear for access.) Full details of the pump are given in the manufacturer's literature at the end of this manual.

### Vacuum Table

A matrix patterned vacuum table can be fitted in place of the standard plywood table allowing components to be vacuum clamped without using special fixtures. The upper surface of the table has a pattern of grooves into which a rubber sealing strip (optional) may be fitted to provide an efficient seal between the table and component.

**Note:** The table must be used in conjunction with the vacuum pump option.

### CNC Controlled Depth Stops

An automatically controlled six-position depth stop arrangement can be fitted in place of the standard manually controlled stops. The required stop is programmed using an M code, and a small motor rotates the stop turret to the correct position. Magnetically operated reed switches (one for each stop position) indicate that the required position has been attained.

### **Floating Head**

The height of the cutter in relation to the upper surface of the workpiece can be kept constant by means of a floating head arrangement. The unit comprises a probe which controls a hydraulic servo valve, in turn controlling the head rise and fall cylinder. The standard pneumatic cylinder is replaced by a hydraulic cylinder when this option is fitted. A small hydraulic power pack, comprising a reservoir, pump and associated filter and pressure gauge provides the motive power for the unit.

**Note:** The floating head option is mounted on the left-hand side of the routerhead, and cannot be fitted if drill heads are supplied, or with the LC head.

### **Hydro-check Unit**

The hydro-check unit is a self-contained hydraulic cylinder mounted on the right hand side of the routerhead. The piston of the cylinder bears on the selected turret stop and acts as a damper on head vertical movement giving precise control over the last 25mm or 50mm of the head down stroke. The rate of descent may be adjusted by means of the slotted brass adjuster on top of the cylinder.

### **Routex Hood**

The routex hood is designed for use with an extraction system, and helps keep the work area free from dust and chippings. The hood is bolted to the underside of the router head dust cap and completely encloses the sides of the cutter. The front half is hinged and may be lifted clear to enable cutter changing.

SECTION 3INSTALLATION

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### SECTION 3

## INSTALLATION

### INTRODUCTION

In nearly all instances machine installation is performed at the customer's site by an experienced member of Wadkin's installation and commissioning team. It is normal practice however for the customer to prepare the machine site, and provide the required electrical and air supplies. A foundation plan for the particular machine is provided well in advance of machine delivery.

Normally, the machine will be delivered in an almost fully assembled and prealigned state. However, certain items forming part of the machine will have been disconnected and stored separately to simplify transit. Typically, the general state of the machine when delivered, will be as follows:

- (1) Frequency changer disconnected and stored separately.
- (2) The table will be positioned centrally.
- (3) The head is fully lowered and is packed to the table which provides support for the head during transit.

## FOUNDATION AND INSTALLATION NOTES

### Foundation (refer to foundation plan supplied separately).

The machine should be sited on a solid concrete floor at least 150mm thick. The positions of the rawlbolt holes and jacking points are given on the foundation drawing specific to the particular machine.

### Lifting and Positioning

To lift the machine use suitable slings as shown on the foundation plan supplied for the machine.

Locate the machine over the foundation bolt holes and gently lower the machine into position. Remove the lifting bars and chains. Check that the machine is approximately level ensuring that the jacking screws are not fully tightened down so that further adjustment can be made when re-assembly is completed.

## REASSEMBLY AND CONNECTION OF SERVICES

The machine should now be fully re-assembled and brought into an operational state as follows:-

- (1) Locate the frequency changer in a convenient position to ensure a good air flow and bolt to the floor if required. Connect up the supply wires.

**Note:** Do not position the frequency changer immediately to the rear of the machine as this will restrict access to the electrical cabinet.

- (2) Ensure that all superfluous packing is removed from the machine.
- (3) Connect the electrical supply to the main isolator in the electrical cabinet. (Cable entry is via a removable plate at the lower right-hand side of the cabinet.) Ensure that the machine is properly earthed.
- (4) To check that the phase connections are correct, start up the machine and spindle and observe the direction of rotation. If this is incorrect, change over any two of the three-phase input wires.

**Note:** Remove any cutting tools, collets, drawbar or spindle chuck nut before starting the spindle.

**FINAL LEVELLING**

(This is normally carried out by Wadkin engineers.)

Centralise the table with respect to both its X and Y axes and check the levels.

- (1) Using a 250mm precision level, re-check the table along both the X and Y axes adjusting the jacking screws as necessary to obtain the required accuracy.
- (2) When the correct levels are achieved, tighten the foundation bolts and re-check the levels to ensure no distortion has taken place.





SECTION FOUR

## OPERATION

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## SECTION FOUR

### OPERATION

#### INTRODUCTION

The operating instructions given in this manual are intended as a general guide for machine operators. Specific instructions for particular workpieces should be given on the operator's worksheet normally provided with each machining program. Reference should also be made to the Control System Operating Manual for further details of system controls and operating procedures.

In accordance with good workshop practice it is important that the machine, particularly the worktable and spindle, is kept clean and free from dust and chippings. Planned preventive maintenance is also important, in that it enables the necessary short periods of downtime to be predicted, and helps avoid the possibility of a major breakdown.

Simple daily maintenance procedures may be carried out by the operator at a convenient time (beginning or end of shift). Details of these and other maintenance procedures are given in Section 5.

This manual will cross refer to the Control System Manual where appropriate, but will duplicate information where considered necessary for the convenience of the reader.

The machine is operated from the pendant control panel. The spindle Speed Select controls are mounted on the head for operator convenience.

It should be noted that some of the panel controls described are optional and are not fitted to all machines.

## PENDANT CONTROL PANEL

The following controls are located on the Pendant Control Panel:

### CRT DISPLAY (optional)

The CRT (Cathode Ray Tube) is used to display information relevant to the currently selected operating mode, e.g. tool offsets, current program, etc.

### AXIS POSITION DISPLAY

Displays the present axis position relative to machine zero. (One line for each axis.)

**NOTE:** If the axis position registers have been preset (G92) the zero reading will not coincide with machine reference zero. At reference zero the preset positions will be shown.

### ALPHA-NUMERIC DISPLAY

Displays the currently selected address (in MDI Mode) and any active error codes. The LED display on the right of the alpha-numeric display lights to indicate that the system is operating in the incremental mode.

## KEYBOARD

The keyboard controls are used to select the operating mode of the machine, to enter numerical data and to initiate certain actions. The two-coloured keys have a dual function as follows:-

When pressed singly the lower (green) portion is active enabling the input of figures (0-9), the decimal point and minus (-) sign. The system assumes plus (+) if the minus sign is not pressed.

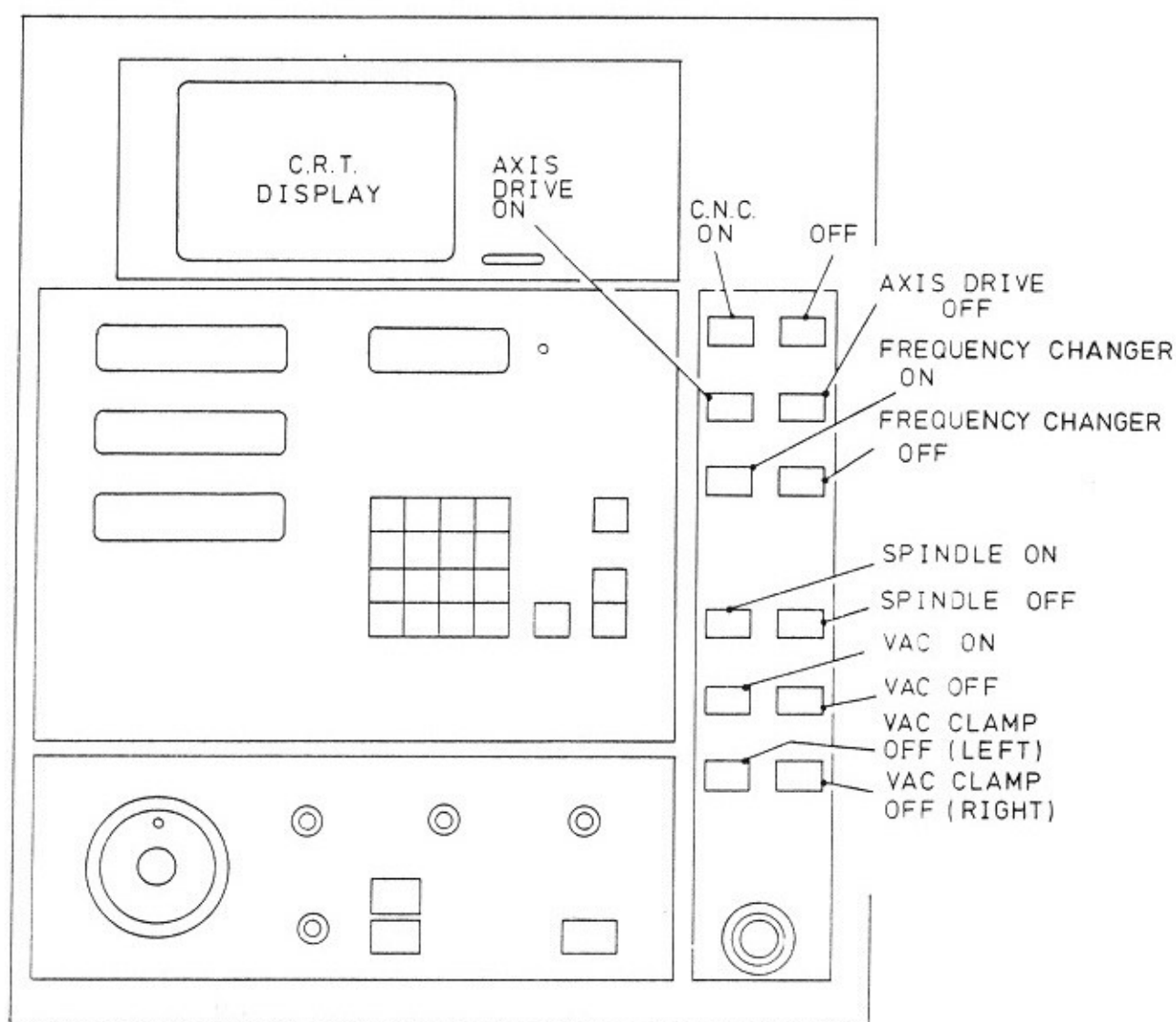
With the MODE control held depressed, pressing one of the above keys activates the relevant mode (yellow).

The machine must be in Automatic Mode before the Single Block Mode can be activated. To cancel the Single Block Mode the key must be pressed a second time (MODE button held depressed) to revert to the Automatic Mode.

The following Modes (from the top left) are available:-

### AUTOMATIC (7)

Enables continuous operation from the stored machining program.



CONTROL PANEL

SINGLE BLOCK (8)	Enables operation from the stored machining program. One block is executed when Cycle Start is pressed twice.
	<b>NOTE:</b> The Single Block Mode must be entered and exited via the Automatic Mode as described above.
MANUAL DATA INPUT (9) (MDI)	Enables manual insertion of data via the keyboard. Any data thus inserted is not stored and is actioned after two depressions of the Cycle Start button.
REFERENCE POINT (4)	Enables the selected axis (or axes) to be returned to machine zero.
MANUAL (5)	Enables the controls on the Manual panel, i.e. enables jog operations.
TEACH IN (6)	Enables the controls on the Manual panel. In the Teach In Mode the axes are moved to the required positions and these positions may then be stored. The path between subsequent positions may be described as either a straight line or an arc, thus enabling a machining program to be produced by moving a pointer round a template or sample component.
INSERT (1)	This mode enables the insertion of blocks or whole programs into storage using the keyboard controls.
BLOCK DISPLAY (2)	Enables the display of selected blocks or programs as described in the Control System Operating Manual.
MODIFICATION (3)	Enables modification or deletion of stored blocks or programs.
PART PROGRAM LOAD (0)	Enables loading of part programs via the data interface.
PART PROGRAM OUTPUT (-)	Enables the output of stored part programs via the data interface.
TOOL COMPENSATION (.)	Enables input or display of tool length and radius compensation values.

- A+1** This control is used to increment the currently selected address. The address sequence is G,X,Y,Z,F,S,M,T.
- N+1** This control is used to increment the block number by 1 (one) in the Block Display, Insert, and Modification Modes.
- CLEAR** Operation of this pushbutton clears data which has been entered into the display store.
- TRANSFER/ENTER** Operation of this pushbutton transfers entered data into storage, or initiates the entered block modification or deletion. The key also acts as an End of Block (EOB) character when storing manually inserted data.
- CONTROL RESET** Used to reset the control system.
- NOTE:** If used in cycle, feedhold must be active.
- CYCLE START** Operation of this pushbutton initiates action in the selected Mode.
- NOTE:** The control must be pressed twice in most applications.
- FEED HOLD** Operation of this pushbutton stops all axis movement without loss of position control.
- Machining is resumed on depression of the Cycle Start button.
- NOTE:** When in cycle, feedhold must be active prior to using the Control Reset button.
- MANUAL PANEL**
- The Manual sub-panel contains the axis movement controls used in the Manual and Teach In Modes. The controls are inoperative in all other modes.
- HANDWHEEL** Turning the handwheel in the + or - direction moves the selected axis accordingly. The handwheel can also be used to control simultaneous movement of two axes, (one



leading, one trailing), according to the selection made.

## AXIS SELECTOR

This six-position selector switch is used to select either a single axis to be controlled by means of the handwheel or jog buttons, or a combination of two axes to be controlled by the handwheel only.

## SUB MODE SELECTOR

This nine-position switch is used to select one of the following manual operation modes:-

**Handwheel 2 axes** - one main and one trailing axis moved by means of the handwheel.

**Handwheel 1 axis** - single axis moved by means of the handwheel.

**Jog Rapid** - single axis moved at rapid traverse rate by means of the jog buttons.

**Jog Feed** - single axis moved at selected feedrate by means of the Jog buttons.

**Jog Increment** (1 - 10,000 increments)- selected axis moves one increment each time Jog + or Jog - is pressed.

## % FEEDRATE

This control is used to modify the selected jog feedrate. It can also be used to override the programmed feedrate or rapid traverse rate in Automatic and Single Block Modes of operation.

## TRAILING ANGLE

This control is used to select the angle between the main axis and the trailed axis when using the handwheel for two-axis control. The control also selects the direction of the trailed axis in relation to that of the main axis.

+ = same direction as main axis.

- = opposite direction to main axis.

JOG +  
JOG -

With Jog Feed or Rapid selected, the selected axis moves in the appropriate direction whilst Jog + or Jog - is held depressed. Movement ceases when the button is released. With a jog increment selected, the selected axis moves one increment each time Jog + or Jog - is pressed.

**ARC**

This control is used in the Teach In Mode to define an arc between selected points. The control is activated by holding it depressed whilst pressing Cycle Start.

The transition between linear and circular movement must be tangential, (therefore no radius need be specified) and the control takes the shortest path between the two points, therefore determining the direction of circular movement.

**MACHINE CONTROLS**

The basic start-up and disable controls, together with machine warning lamps, are grouped on a sub-panel on the right-hand side of the pendant panel.

**CNC ON  
CNC OFF**

These two controls are used to switch the main power supplies to the control system and machine. The integral lamps indicate the present status.

**AXIS DRIVE ON  
AXIS DRIVE OFF**

The axis drive contactor is controlled by these two pushbuttons. Integral lamps indicate the drive state. Should a servo fault occur, the axis drives will be switched off automatically.

**FREQUENCY CHANGER  
ON ; OFF**

These two pushbuttons are used to start and stop the frequency changer.

The lamp within the On button lights when the frequency changer is running.

**SPINDLE ON/OFF  
(LC Head only)**

These two pushbuttons are used to start and stop the spindle. The lamp within the On button lights when the spindle is running.

**Note:** The spindle will not start unless the speed selector switch is set to zero.

**VACUUM PUMP  
ON/OFF  
(Optional - not  
fitted to all machines)**

These two pushbuttons are used to switch the vacuum pumps on and off. The lamp within the On lamp lights when the vacuum pump motor is running.

**CLAMP ON/OFF  
LEFT ; RIGHT**

These two latching pushbuttons control the left and right hand table vacuum clamps. The integral lamps light when the clamps are on.

Pressing the buttons a second time (integral lamps off) switches off the clamps.

**Note:** The lamps light only when sufficient vacuum is generated to hold the work securely. A feedhold is generated until the above condition is satisfied.

**EMERGENCY STOP**

Operation of this pushbutton switches off the machine. The head is retracted. The vacuum pump remains on, however, to maintain a secure clamp.

**HEAD CONTROLS**

The spindle speed select controls are mounted on the head for operator convenience.

**SPEED SELECT  
(F head only)**

This three-position switch is used to select the required spindle speed.

- 0 = off
- 1 = 18,000 rev/min
- 2 = 24,000 rev/min

**RANGE SELECT  
SPEED SELECT  
(LC head only)**

These two three-position switches are used to select the required spindle speed.

- 0 = off
  - 1 = low range (6,000 ; 12,000)
  - 2 = high range (9,000 ; 18,000)
- 
- 0 = off
  - 1 = low speed (6,000 ; 9,000)
  - 2 = high speed (12,000 ; 18,000)

Diagrams on the router head indicate the switch positions for each speed.

**STARTING-UP THE MACHINE**

The machine should be started up as follows:-

- (1) Close the main isolator. The 'CNC Off' and 'Drive Off' lamps light.

- (2) Ensure that the Emergency Stop button is reset.
- (3) Press the CNC On pushbutton.
- (4) Press the Axis Drive On pushbutton and hold depressed until the integral lamp lights.
- (5) Press Mode and Reference Point. The display reads 'REF X?'.
- (6) Press Enter. The display now reads 'REF Y? X'.
- (7) Press Enter. The display now reads 'REF Z? XY'.
- (8) Press Cycle Start twice. The X and Y axes will now move to their reference points.

Using the above method, the axes may be referenced singly or simultaneously, as required. Until the machine has been referenced only low jog can be used on X and Y axes. Any attempt at MDI or Auto operation of the machine will result in either 'TRAVEL' or 'AXIS???' messages being displayed.

If any axis is already at its reference position it must be moved away using the jog controls, prior to carrying out the reference sequence.

#### LOADING TOOLS (F-HEAD ONLY)

Tools are held in the router spindle by means of a chuck nut.

Before changing tools the spindle must be stopped then locked using the mechanical lock provided. With the lock operated, the spindle drive is disabled.

The chuck nut can then be released using the spanner provided.

**NOTE:** The spanner provided is designed to give the correct torque for tightening the chuck nut. Do not modify the spanner or use an extension.

#### WARNING

In the interests of operator safety the following points should be observed.

1. Always stop the spindle before changing a tool.
2. Always operate the spindle lock before changing a tool.

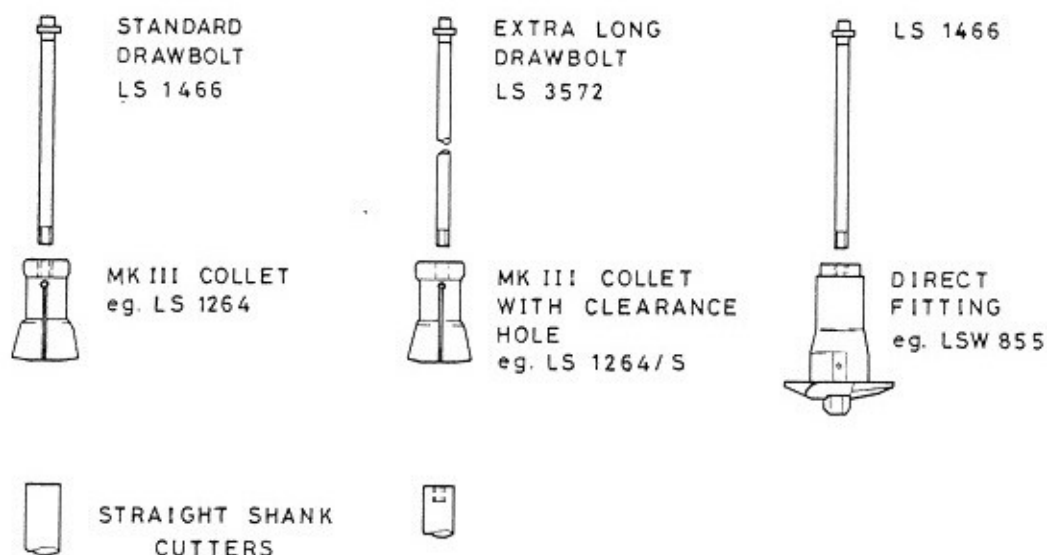
3. Never leave the spanner on the chuck nut after changing a tool.
4. Ensure that sufficient of the cutter shank parallel section is held in the collet, i.e. that the cutter is secure.
5. Ensure collets and nut faces are clean.

#### LOADING TOOLS (LC HEAD ONLY)

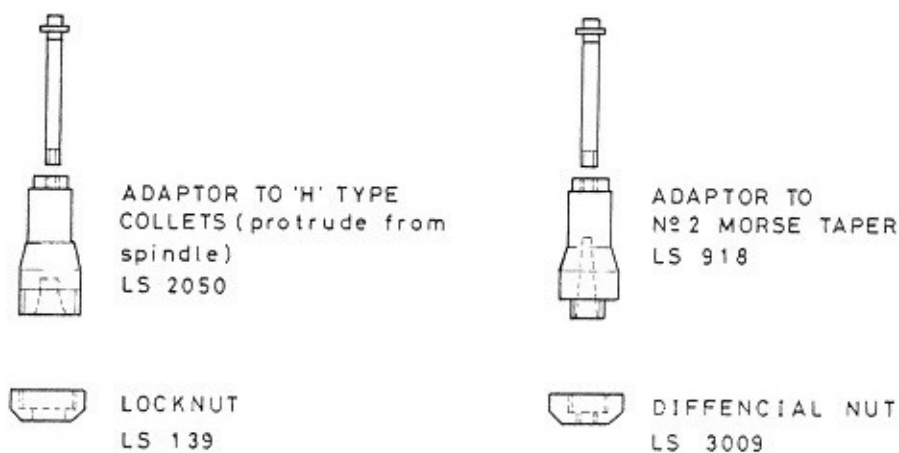
To load a tool proceed as follows:

- (1) Ensure that the spindle is stationary and switched off.
- (2) Engage the spindle lock (pull out, rotating spindle until lock engages.)
- (3) Release the routerhead top cover for access to the drawbar.
- (4) Offer the tool collet into the spindle nose. Rotate the tool and collet until the collet engages with the spindle dogs and is correctly aligned in the spindle nose taper.
- (5) Screw the appropriate drawbar\* for the tool in use into the collet using the spanner provided. Under no circumstances should a longer spanner or extension tube be used to tighten the drawbar. Single-handed pressure on the spanner provided is sufficient for correct drawbar tightening. Ensure that the collet faces and drawbar threads are clean before securing them in the spindle.
- (6) Replace the routerhead top cover and tighten the holding screws. (The spindle cannot be started whilst the cover is released.)
- (7) Unlock the spindle.

\* An extended drawbar may be used with clearance collets. This must not be used with standard equipment - **DAMAGE TO THE MACHINE OR PERSONAL INJURY COULD RESULT.**



SUITABLE CUTTER SHANK SIZES 1/4"inch (6mm)  
UP TO 7/8 inch (22.5mm) DIA



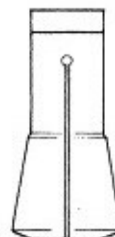
CUTTER FIXINGS LC HEAD  
(see tooling catalogue for  
part Nºs to different sizes)



CUTTER WITH  
Nº2 MORSE TAPER  
SHANK  
eg. LSW 814



'H' TYPE COLLET  
eg. LS 886



'J' TYPE COLLET  
eg. LS 800

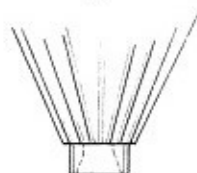
ABOVE COLLETS CAN BE USED WITH CUTTER SHANKS UP TO 9/16inch(14mm)DIA

BOTH TYPES OF HEAD CAN BE SUPPLIED WITH A Nº2 MORSE TAPER SPINDLE AND COMPOUND NUT.

THE LC HEAD CAN ALSO BE SUPPLIED WITH A Nº3 MORSE TAPER.



DRAWBOLT  
LS 1466



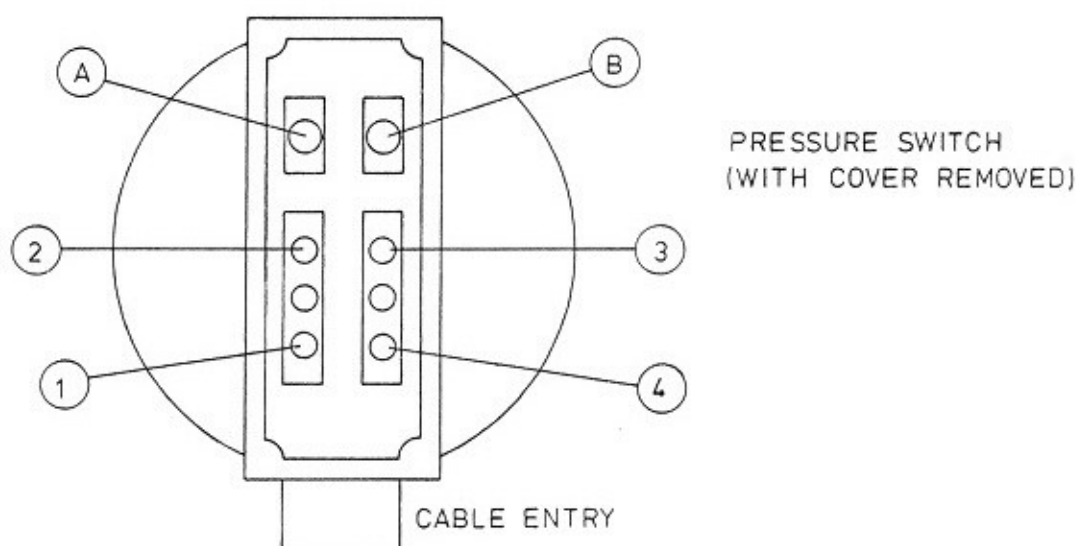
'F' HEAD WITH  
'H' OR 'J' TYPE  
COLLETS



LOCKNUT LS 139  
FOR 'H' TYPE  
COLLETS

## CUTTER FIXINGS

# SETTING VACUUM SYSTEM PRESSURE SWITCHES (Where applicable)



Switch P1		Switch P2	
<u>Terminal</u>	<u>Cable Colour</u>	<u>Terminal</u>	<u>Cable Colour</u>
1	Red/White	1	Grey/Blue
2	Grey	2	Orange/Black
3	Black/White	3	Green/Red
4	Red/Black	4	Red/Blue

The vacuum system pressure switches are set to an average value before despatch to the customer. If porous materials are to be clamped, it may be necessary to adjust the switches as described below.

The switches are located behind a cover plate on the left-hand side of the main base unit. Switch P1 controls the left-hand half of the clamping system, and P2 the right-hand half.

To determine whether the switches require adjustment, proceed as follows:

- (1) Place the component on the vacuum table or fixture (left- or right-hand side as required) and press the Vacuum 'On' button and the appropriate Clamp 'On' button.

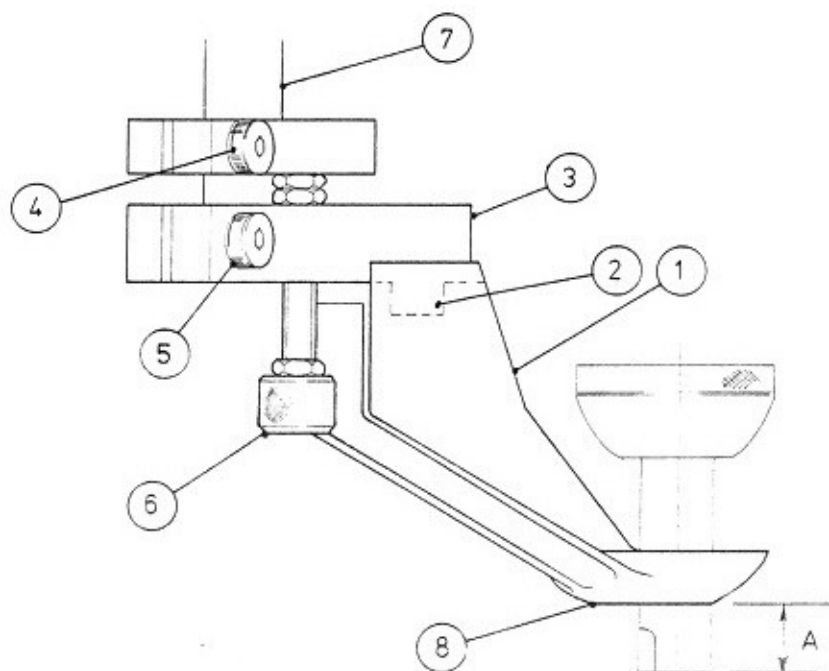


- (2) If the component is securely held but the Clamp 'On' button is not illuminated and a feedhold condition exists, the pressure switch(es) should be adjusted as given below.

If the component is not securely held, it is too porous and should be clamped by an alternative method.

- (3) Remove the access plate from the left-hand side of the main base and identify the relevant pressure switch P1 or P2. Remove the switch cover.
- (4) Identify the adjusting screws (A and B on the diagram).
- (5) Slowly rotate screw A anti-clockwise until the lamp within the Clamp 'On' button lights.
- (6) Slowly rotate screw B anti-clockwise until the 'Feedhold' message is cleared from the readout.
- (7) Repeat the above procedure for the other half of the table if required.

#### SETTING THE FLOATING HEAD FOLLOWER DEPTH (where applicable)



The floating head follower should be set to give the required depth of cut (A) as follows:

- (1) Check that the required tool is securely fixed in the spindle.
- (2) Attach the follower shoe (1) to the block (3) using the cap head screws (2) provided.
- (3) Slacken cap head screws (4) and (5) and slide the whole assembly on shaft (7) until height A is set approximately at the required depth of cut.
- (4) Tighten the upper screw (4).
- (5) Lower the head and place a block of timber such that it supports the follower on face (8).
- (6) Use screw (6) to make any further adjustment to the depth of cut.
- (7) Tighten the lower screw (5).
- (8) Raise and lower the follower to check that it does not foul the spindle nut. (If fouling does occur - use a longer cutter and reset accordingly).
- (9) Ensure that the turret stop is set to allow for movement of the floating head.

#### STARTING UP THE SPINDLE

Ensure that the cutters are balanced before carrying out the instructions below.

#### F HEAD

- (1) Ensure that the Brake/Lock knob is in its free position.
- (2) Ensure that the cutter is securely held.
- (3) Turn the speed selection switch to 0.
- (4) Press the Frequency Changer On pushbutton.
- (5) Press the Spindle On pushbutton.
- (6) Select low speed (1) and allow the head to run up to speed, then select high speed (2) if required.

## LC HEAD

- (1) Ensure that the Brake/Lock knob is in its free position.
- (2) Ensure that the cutter is securely held, and the drawbolt cover is secured in position.
- (3) Turn the speed selection switch to 0.
- (4) Press the Frequency Changer On pushbutton.
- (5) Press the Spindle On pushbutton.
- (6) Select low speed (1) and allow the head to run up to speed, then select high speed (2) if required.

Select the speeds according to the diameter of the cutter in use.  
IF IN DOUBT - ASK!!

## LOADING A PROGRAM

The machine cannot be operated directly from a tape program. The program must first be stored in the control system memory.

Programs may be loaded manually via the keyboard or automatically from an external cassette or paper tape reader. Full details are given in the Control System Operating Manual.

A stored program may be output onto paper tape or cassette provided that compatible equipment is available.

## OPERATING PROCEDURES

The following procedures are intended solely as a guide to basic methods of machine operation. Slight variations from these procedures may occur depending on the machine options chosen. Full details of system operation, editing procedures, etc., are given in the system manufacturer's handbook, but the simpler procedures are included in this manual for operator convenience. If in doubt, consult the worksheet, or tape readout sheets supplied with each tape program.

## MANUAL (Jog)

Manual operation is used to position the machine axes prior to carrying out a program, e.g. the table may be moved to facilitate workpiece loading.

**MANUAL JOG** - used to move the machine where exact positioning is not required.

**1. Using the handwheel:**

- (a) Start-up the machine as previously described.
- (b) Press mode and manual (5). The manual panel controls are now operative.
- (c) Select the required axis or axes.
- (d) Select 'Handwheel 1 axis' or 'Handwheel 2 axes' as required.
- (e) Select the required trailing angle if two axes are being positioned simultaneously.
- (f) Select the % feedrate required.
- (g) Turning the handwheel now causes movement of the selected axis (or axes).

**2. Using the Jog buttons:-**

- (a) Start-up the machine as previously described.
- (b) Press Mode and Manual (5). The manual panel controls are now operative.
- (c) Select the required axis.
- (d) Select the required Jog feedrate (feed or rapid).
- (e) Select the % feedrate required.
- (f) Press Jog + or Jog -. The selected axis moves in the appropriate direction until the button is released.

**3. Incremental Jog:-**

- (a) Select Manual Mode.
- (b) Select the required axis.
- (c) Select the required increment.
- (d) Select the required % feedrate.
- (e) Press Jog + or Jog -. The selected axis moves one increment each time Jog + or Jog - is pressed.

Fully automatic machining commences and continues until the program is stopped by one of the following:

- (a) End of program reached.
- (b) Stop code programmed.
- (c) Different mode selected.
- (d) Feedhold pressed.
- (e) End of traverse reached.
- (f) Occurrence of a fault condition.

#### TEACH IN

The Teach In Mode is used to generate a program from a drawing, template or previously machined component. A full example is given in the Control System Operating Manual.

Generally, the mode is used to define axis movements as follows:

- (a) Move the axes to their start points (P1) using Jog or MDI, as previously described.
- (b) Press Mode and MDI (9) then key in G37 and Enter, to access the program memory.
- (c) Press Mode and Teach In (6).
- (d) Key in the required block number at which data storage is to be started. Entering 999 will automatically select the first available block.

**WARNING:** If a block number is entered which is lower than the last block, the memory will be cleared from that block onwards, e.g. selecting block 1 will clear the whole memory.

- (e) Using the manual panel controls (Manual Mode Select, Axis Select, Jog buttons or Handwheel) move the axes to the next designated point (P<sub>2</sub>).
- (f) If the last two points P<sub>1</sub> and P<sub>2</sub> are to be joined by a straight line, press Cycle Start to enter the required co-ordinates.
- (g) If the last two points are to be joined by an arc, (tangential entry) simultaneously press the Arc and Cycle Start buttons.
- (h) Repeat (e), (f) and (g) until the axis movement program is complete.

- (b) Incorrect positioning of workpiece.
- (c) Programming error.

If during Jog operations any axis reaches its travel limit the appropriate Jog control is disabled and movement is enabled at slow feedrate only in the opposite direction, (i.e. + if the axis is at a negative travel limit and - if the axis is at a positive travel limit).

If under fault conditions any axis exceeds its travel limit a microswitch operates and the system forces the selection of Manual Mode. The appropriate axis and direction are displayed.

In this case select 'Jog Slow' and move the axis away from the limit using the appropriate manual controls. (Axis select, Jog + or Jog -).

The cause of a travel limit condition should always be ascertained and the fault corrected before machining is continued.

PROGRAM FORMAT

## List of Contents

	Page
MACHINE CAPACITIES AND AXIS DIRECTIONS . . . . .	1
G CODES . . . . .	2
COMPLETE FORMAT . . . . .	3
M CODES . . . . .	4

MACHINE CAPACITIES AND AXIS DIRECTIONS

Table Size X - 1385mm

Y - 890mm

Axis Capacities X - 1300mm

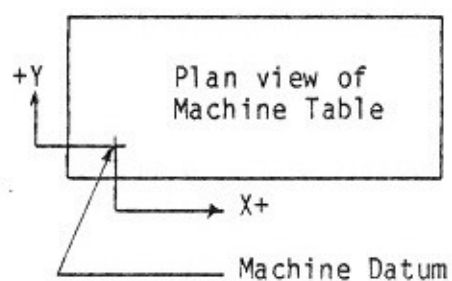
Y - 815mm

Spindle nose to table top: minimum - zero  
maximum - 250mm

Rapid Traverse 12 m/min

Feedrates 0 - 10m/min

Axis Directions





COMPLETE FORMAT

ADDRESS	INCH	MET.	DESCRIPTION
*A	3	3	Jump Address
*B	2	2	Repetition Factor (G22, G23)
*C	2	2	Sub Program No.
D	3.4	4.3	Not used
F	3.1	4	Feedrate
G	2	2	G Function
H	2	2	Dwell in 0.1 Steps (G04)
L	3.4	4.3	Not used
M	2	2	Miscellaneous Function
N	3	3	Block No.
S	4	4	Not used
*T	2	2	Tool & Comp No.
X	3.3	4.2	Axis Positioning
Y	3.3	4.2	Axis Positioning
Z	3.3	4.2	Radius

\* A1 to A999  
 B0 to B99  
 C1 to C90 & C96 - C99  
 T1 to T24

**Note:** Whilst all the above functions are available on the standard control system, the functions listed below are not required:-

D (Incremental Peck Feed)  
 L (Total cutting depth)  
 S (Spindle speeds)  
 Z (Axis positioning)

SECTION 5

## ROUTINE SERVICING

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INTRODUCTION .. .. .	1
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WEEKLY MAINTENANCE . .. .	2
MONTHLY MAINTENANCE .. .. .	2
HALF YEARLY MAINTENANCE .. .. .	2
YEARLY MAINTENANCE . .. .	3
INSTRUCTIONS FOR FLOATING HEAD SYSTEM .. .. .	3
LUBRICATION SCHEDULE .. .. .	

## SECTION 5

### ROUTINE SERVICING

#### INTRODUCTION

The maintenance procedures outlined in this manual are intended as a guide to the amount of maintenance required to keep the machine in good working order. The periods stated assume single 8-hour shift working, and should be reduced accordingly if the machine is being used on a 2 or 3-shift system. All maintenance carried out should be recorded as this enables future needs to be anticipated and maintenance practises to be modified with experience on a particular machine.

Most of the daily checks may be carried out by the machine operator, but all other maintenance should be performed by appropriately skilled technicians.

When carrying out maintenance or repairs, the following points should be observed:-

- (1) All exposed pipe or hose ends should be blanked off to prevent dirt entering the system.
- (2) When checking for electrical faults ensure that all equipment leads and instrument probes are suitably insulated.
- (3) When carrying out major repairs or dismantling ensure that the machine is isolated from the electrical supply. If possible, remove the main fuses, so that the machine cannot be switched on inadvertently.
- (4) Always keep the doors of cabinets containing electrical equipment closed to prevent the ingress of chips and dirt.

- (3) Clean the contacts of the motor and frequency changer contactors on the electrical panels. Do not file the contacts - this only accelerates wear.

**WARNING:** Ensure that the machine is isolated from the electrical supply. Do not allow dust and chippings to enter the electrical enclosures.

- (4) Check the operation of the axis travel limit switches. (Refer to Section 6 - Fault Finding for electrical details.)
- (5) Check the frequency changer brush gear and slip rings.
- (6) Check the head brake pad for wear.
- (7) Check the axis drive motor belt tension (X and Y axes). The maximum deflection allowed at the centre of the belt (thumb pressure only) is 5mm. If a greater deflection is obtained, the belts may be tensioned by loosening the four bolts in the slotted holes on the motor mounting plate and sliding the plate and motor to obtain the correct tension. Tighten the bolts securely after adjustment has been carried out.

#### YEARLY MAINTENANCE

- (1) Dismantle the X and Y axis ballscrew end bearings and ballnuts. Clean and re-pack with Shell Alvania R3.

- (2) **Floating head only**

Drain the hydraulic power pack reservoir and refill with Shell Tellus 37 Oil. Change the powerpack filter element.

- (3) Check the frequency changer brushes and replace if necessary.

- (4) **Vacuum Pump only**

Check the vacuum pump vanes for wear. (Refer to the manufacturer's literature provided.)

#### GENERAL INSTRUCTIONS FOR HEPWORTH FLOATING HEAD SYSTEM

The power pack is situated under the machine top cover. The unit comprises a pump, motor, filters, tank (reservoir); check valve assembly and oil level sight glass.

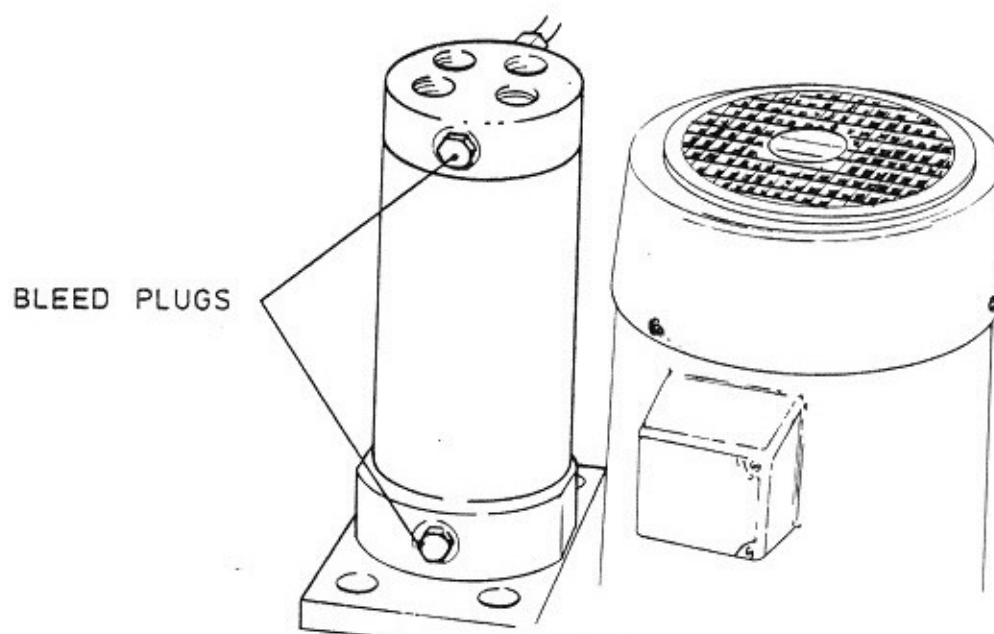
For transportation the system is drained of hydraulic oil and the oil is supplied in a separate cannister. Therefore before commissioning, the system must be filled and primed.

IF AIR IS SUSPECTED IN THE SYSTEM IT WILL BE NECESSARY TO BLEED THE UNIT.

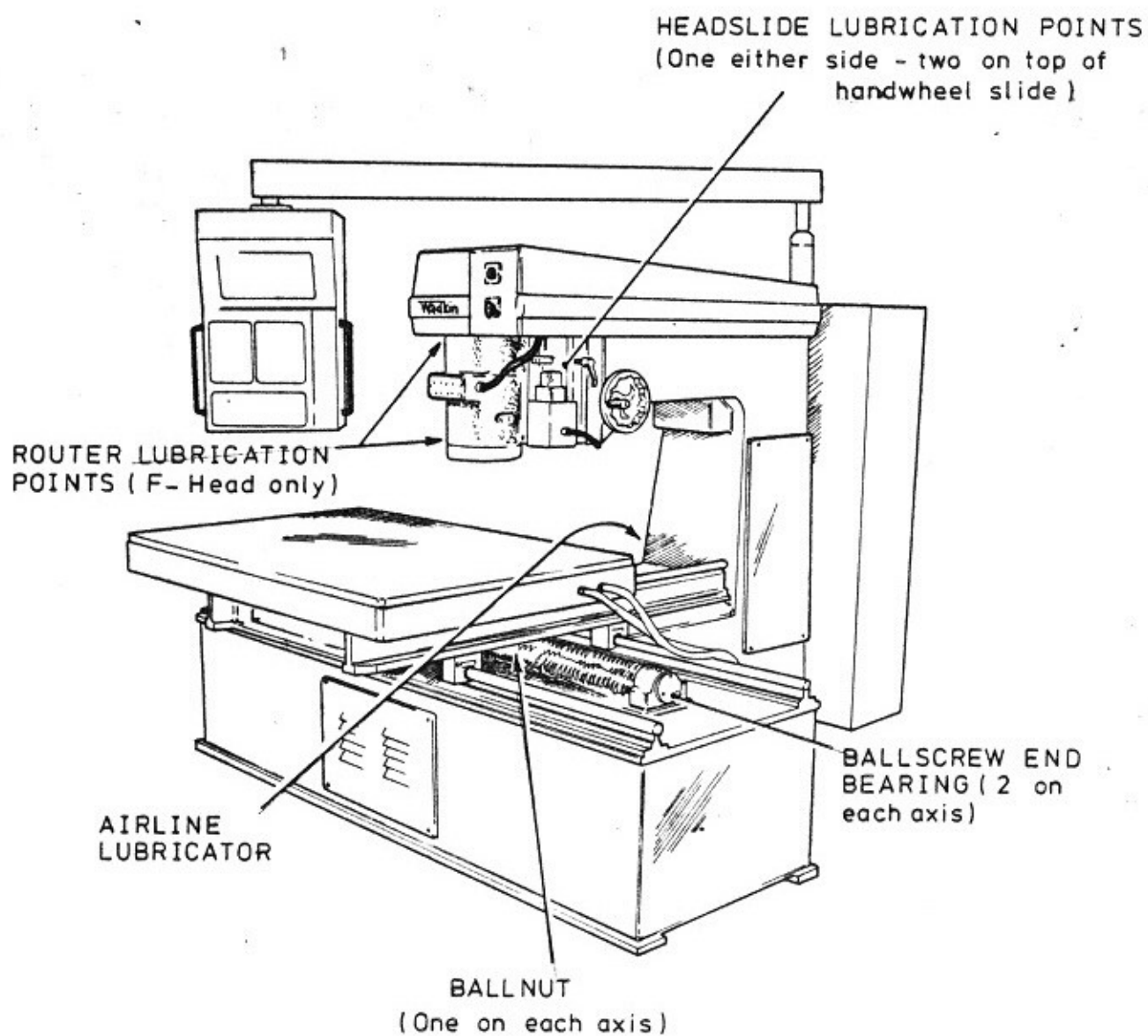
To bleed the system proceed as follows:

Move the head to the bottom of the stroke and remove the top plug from the cylinder. Raise the head to the top of the stroke, thus expelling a small amount of fluid. Keep the head at the top of the stroke and replace the top plug before removing the bottom plug. Lower the head to the bottom of the stroke, expelling fluid from the lower hole, then refit the bottom plug.

The system should now be primed and ready to run.



Refer to Section 6 - Fault Finding for further instructions.



MACHINE LUBRICATION POINTS

SECTION 6FAULT FINDING

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Router fails to start (LC head) .. .. .	6
Vacuum pump motor fails to start .. .. .	10
Vacuum clamp failure .. .. .	11
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MACHINE FAULT MESSAGES . . . . .	15
CHECKING TRAVEL LIMIT SWITCH OPERATION . . . . .	18
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ELECTRICAL CIRCUIT DIAGRAMS .. .. .	

## SECTION SIX

### FAULT FINDING

#### INTRODUCTION

The procedures outlined in this section are intended as a guide to the location of possible machine faults.

All fault finding procedures should be carried out by appropriately skilled engineers, having due regard for personal safety. The machine must be electrically isolated before any item is disconnected.

Where tests are to be performed on live equipment, all test probes, instrument leads etc., must be suitably insulated.

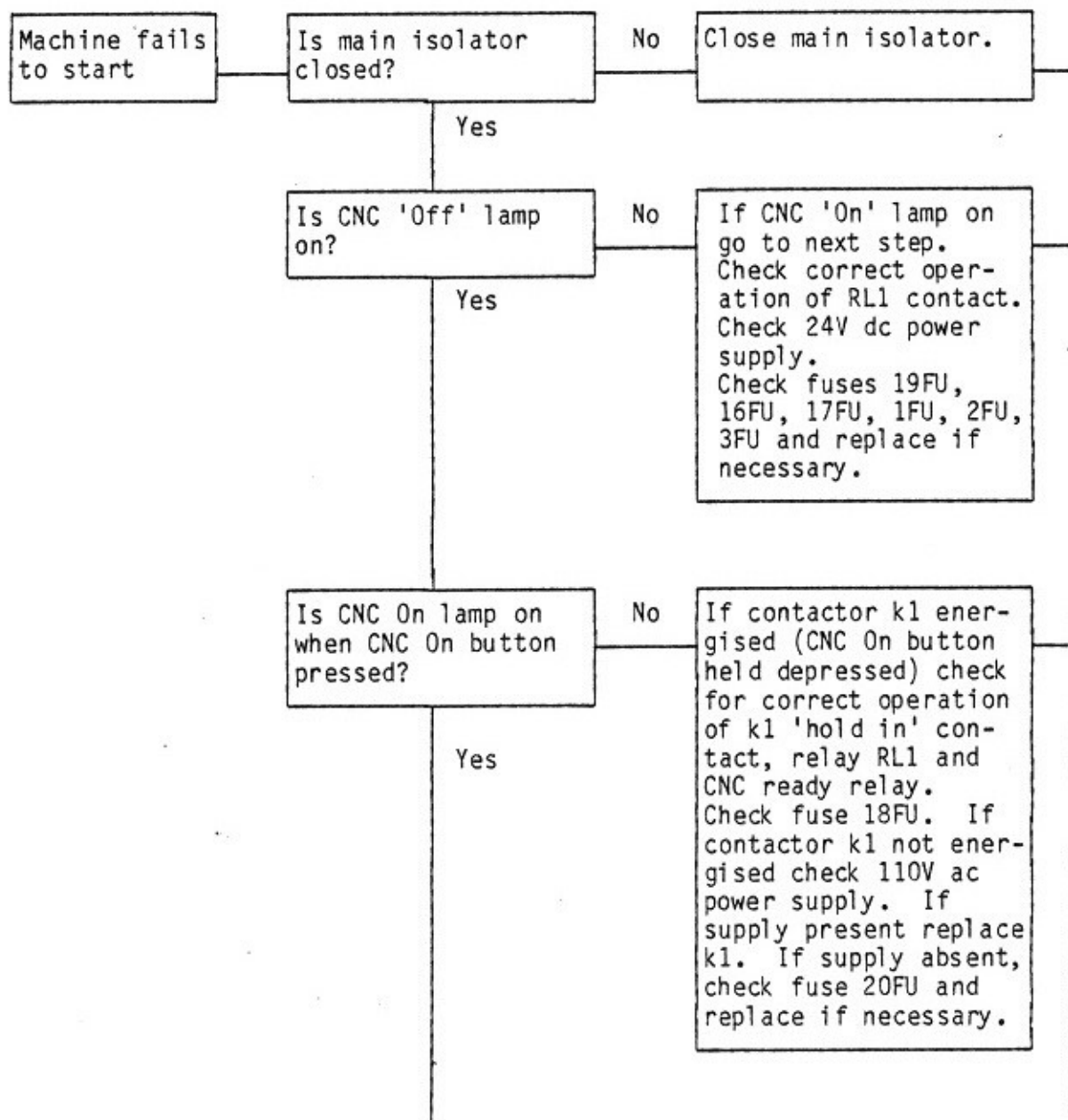
Note that the machine and control system electronic circuitry can be damaged by incorrectly applied high voltages and currents. Suitable instruments for use with the machine are an oscilloscope or multimeter - NEVER use a battery and buzzer (or bell) or a 'Megger' for checking cable continuity.

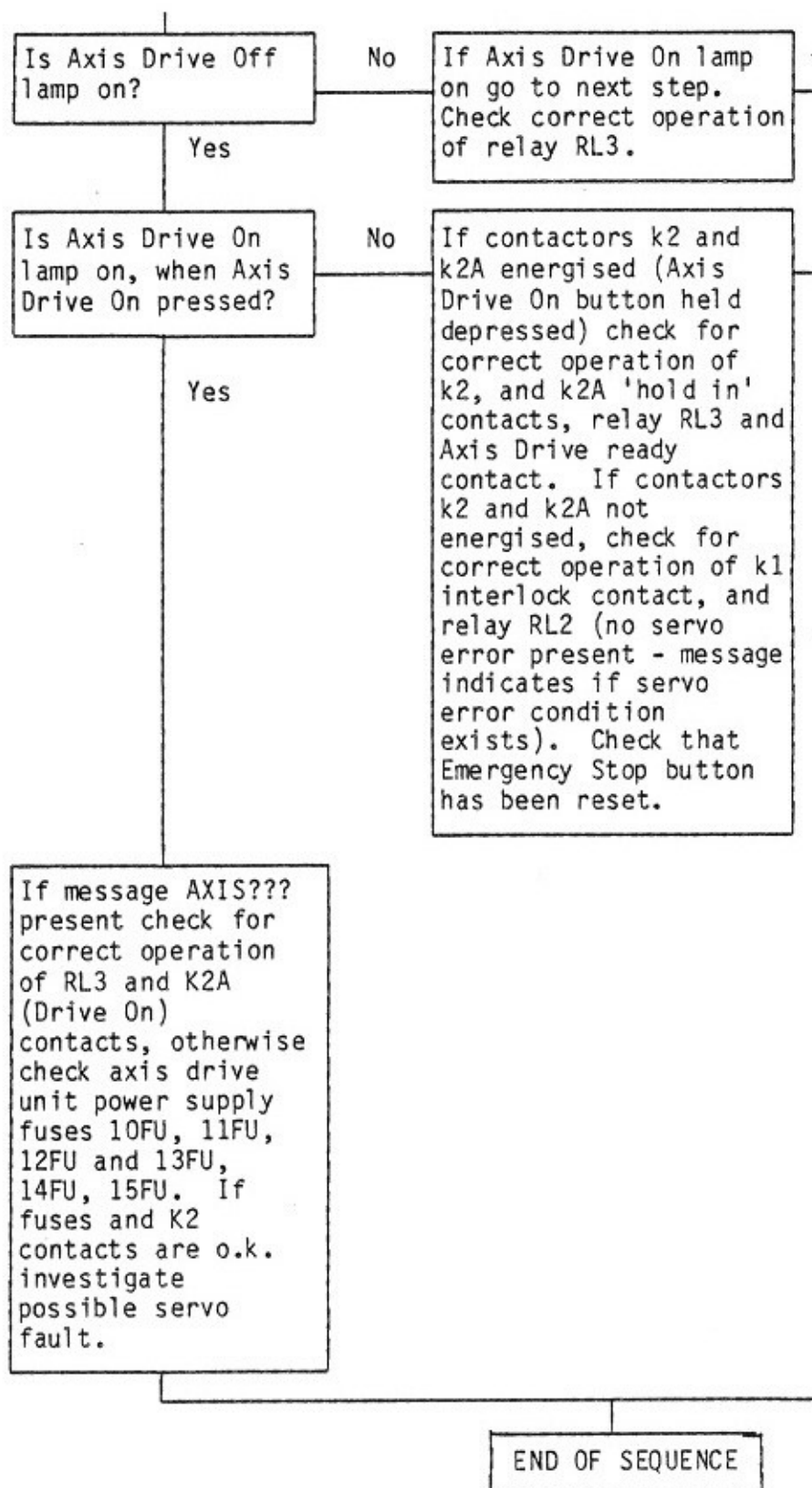


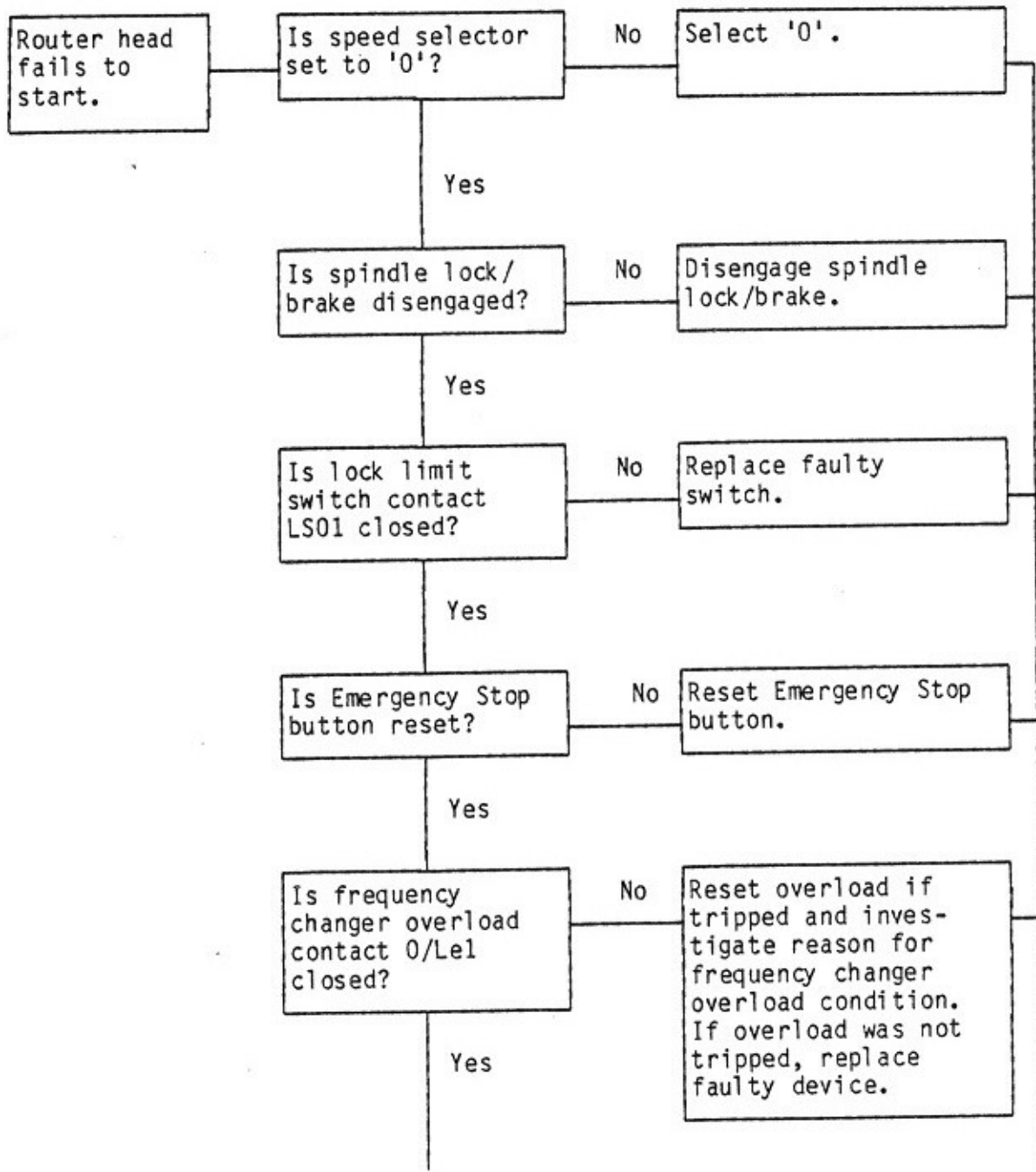
## START FAILURE CHECK SEQUENCES

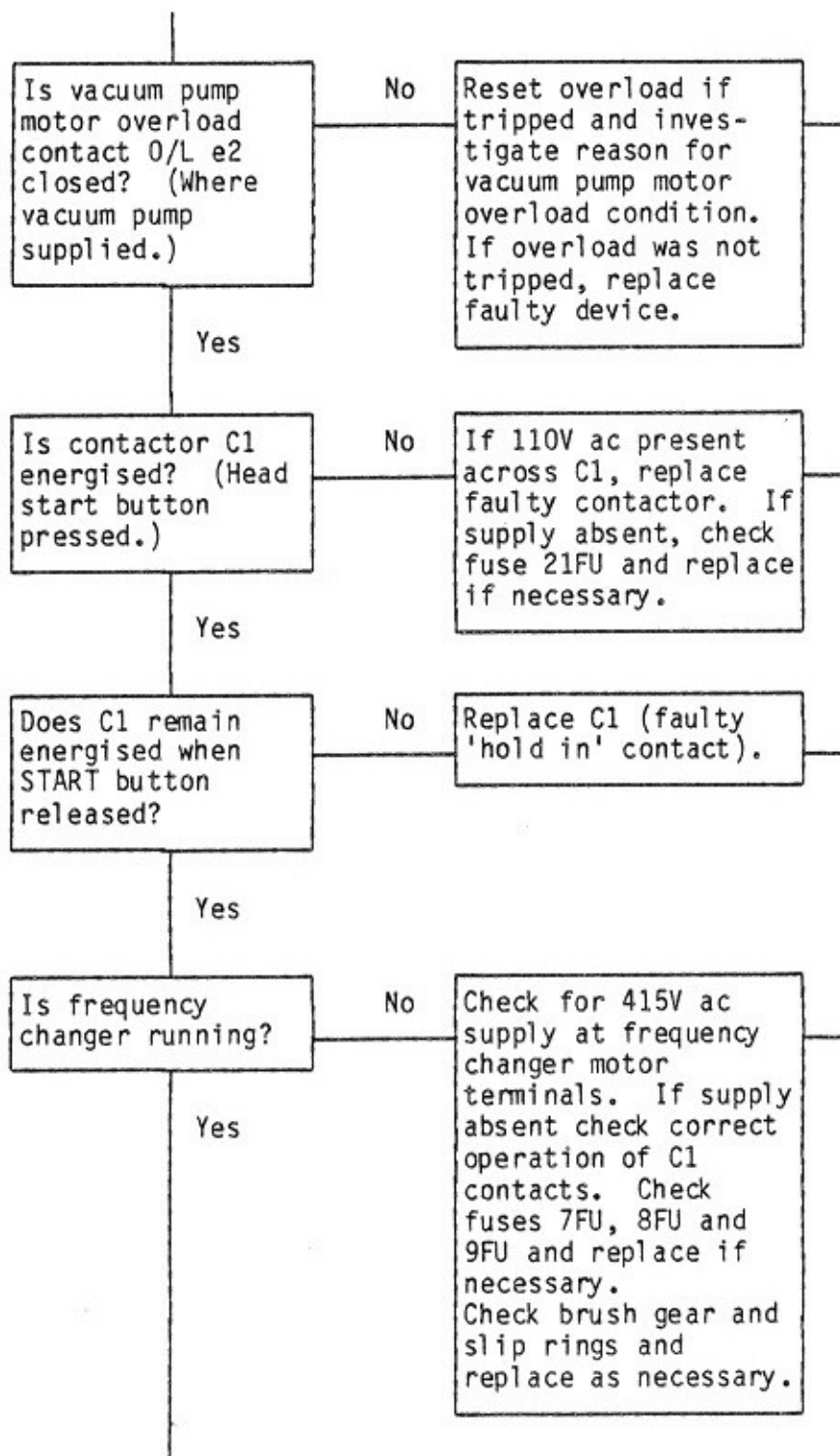
The following sequences should be used in conjunction with the electrical circuit diagrams at the end of this section.

## MACHINE FAILS TO START





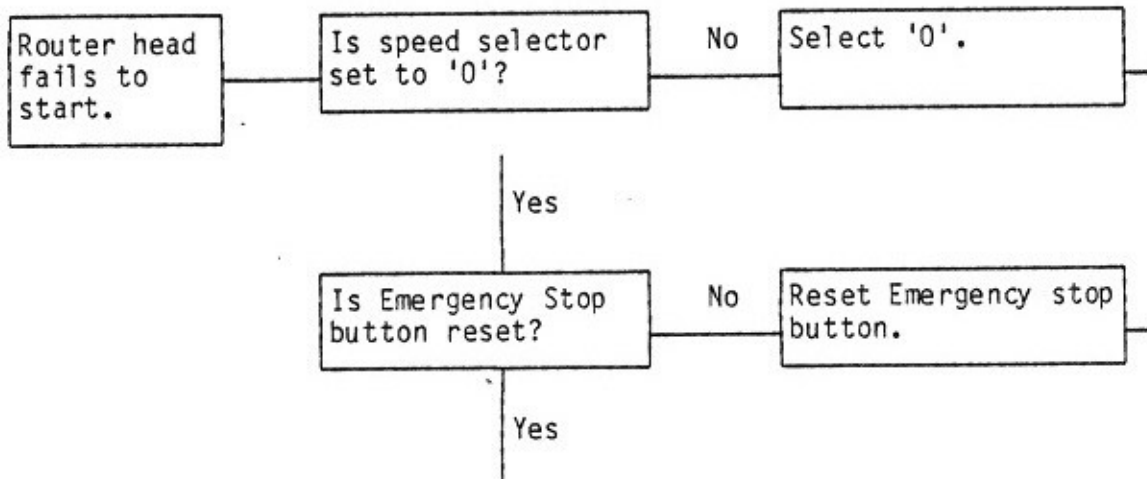
**ROUTER HEAD FAILS TO START  
(F-head only)**

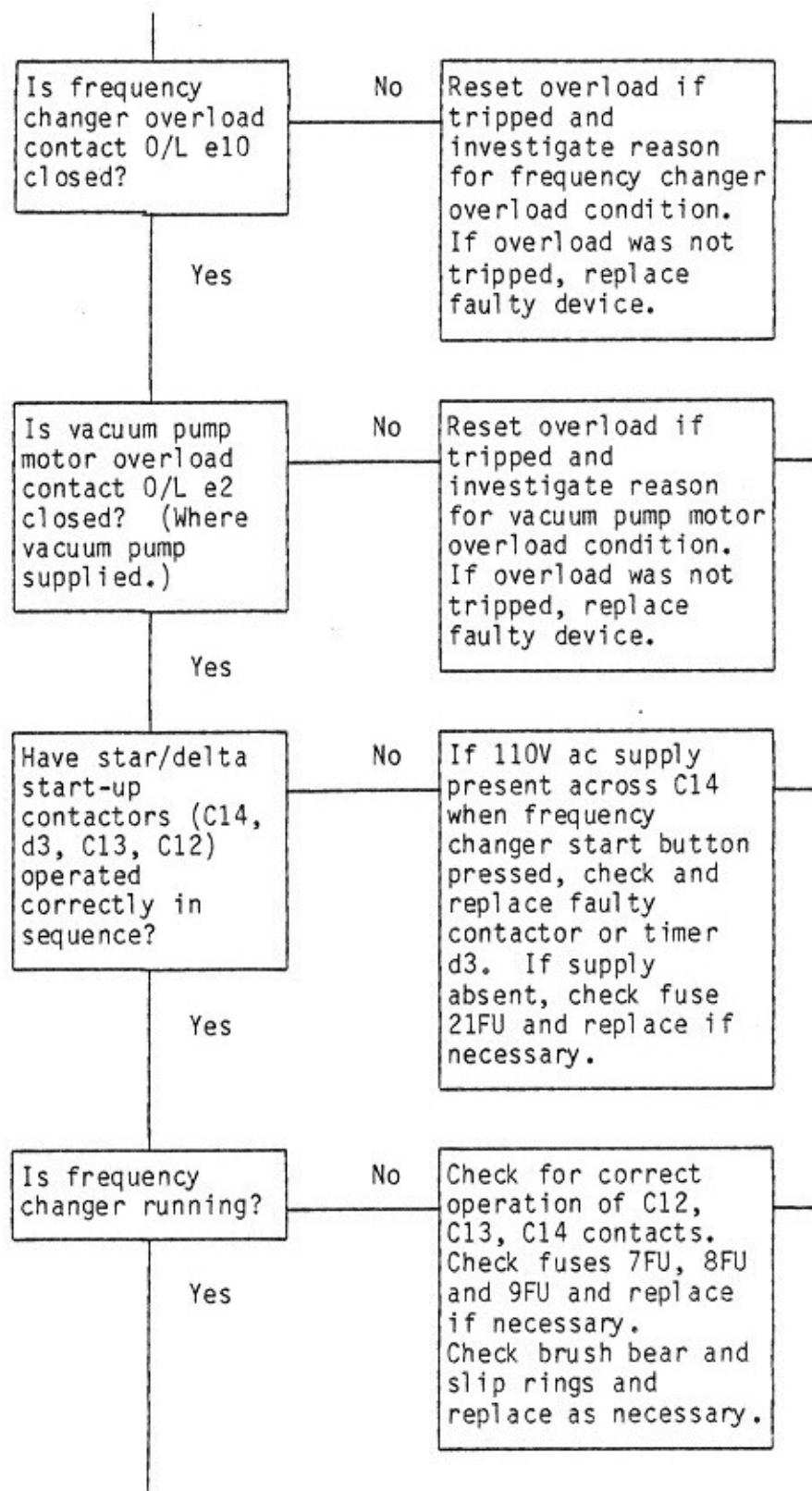


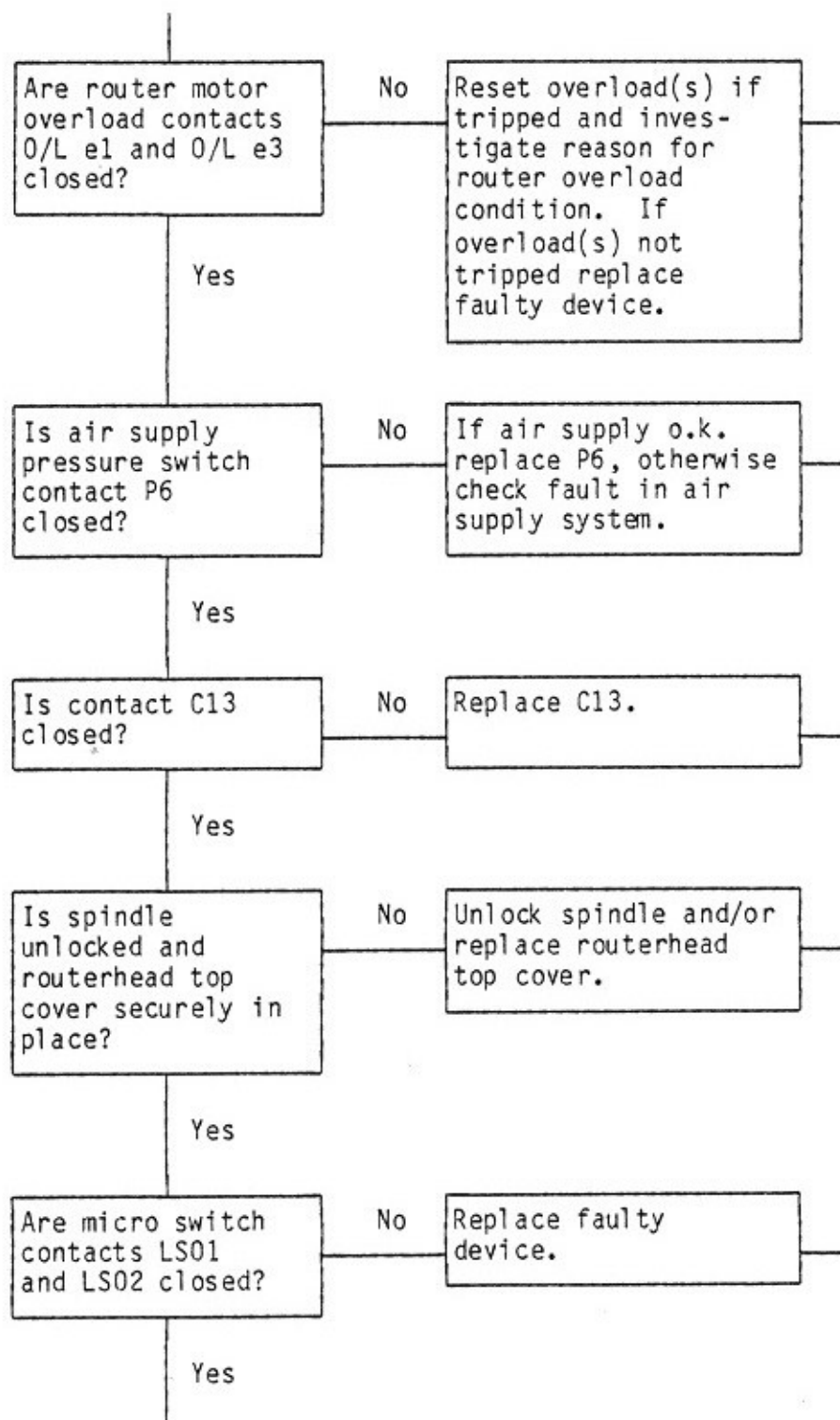
If all contactors and speed selection switch are correctly operated consult Wadkin Ltd., before attempting to identify a router fault. As the router supply voltage and frequency are both variable, standard 50Hz instruments should not be used to check the frequency changer output.

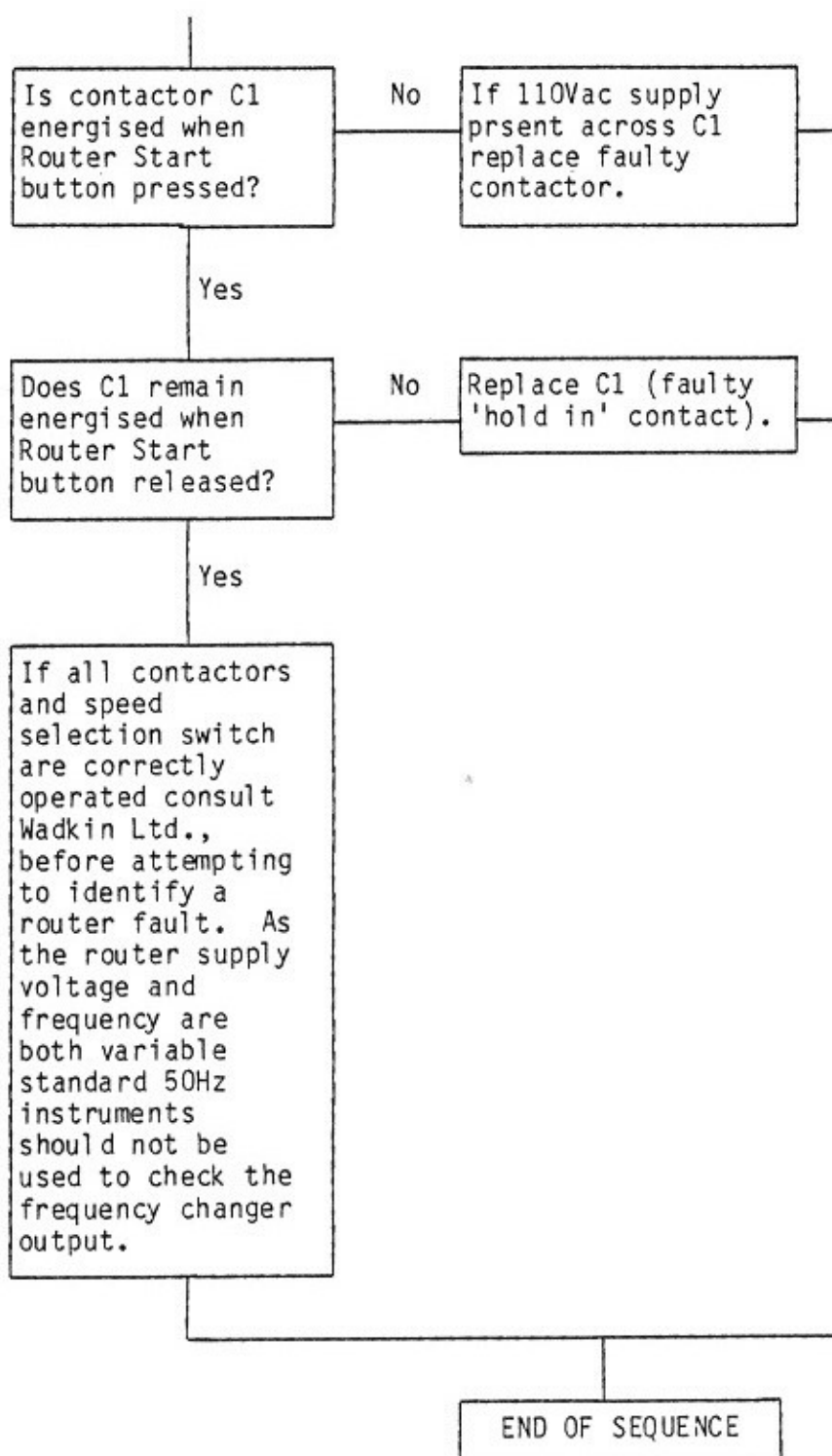
END OF SEQUENCE

#### Router Head Fails to Start (LC-Head only)

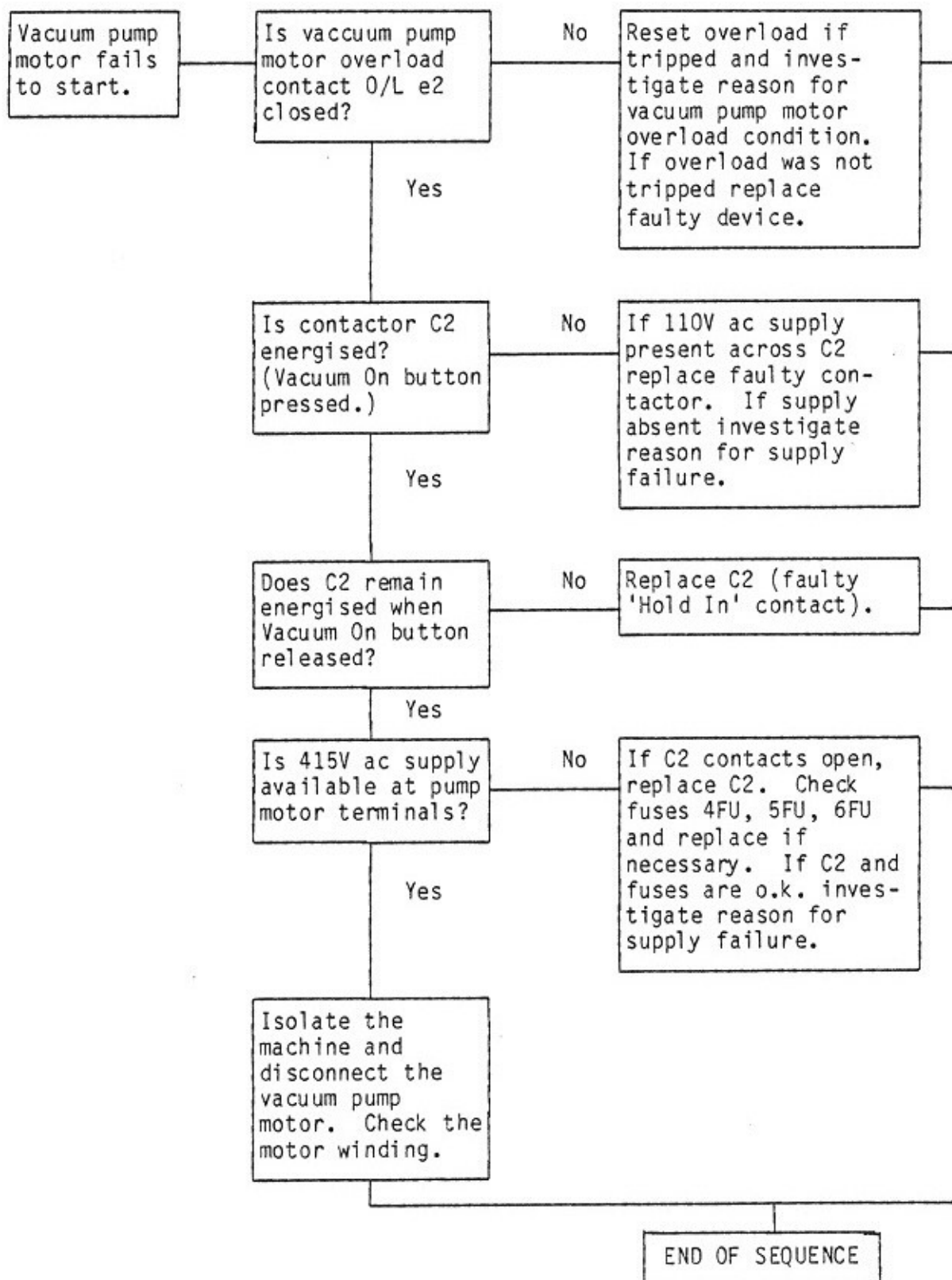






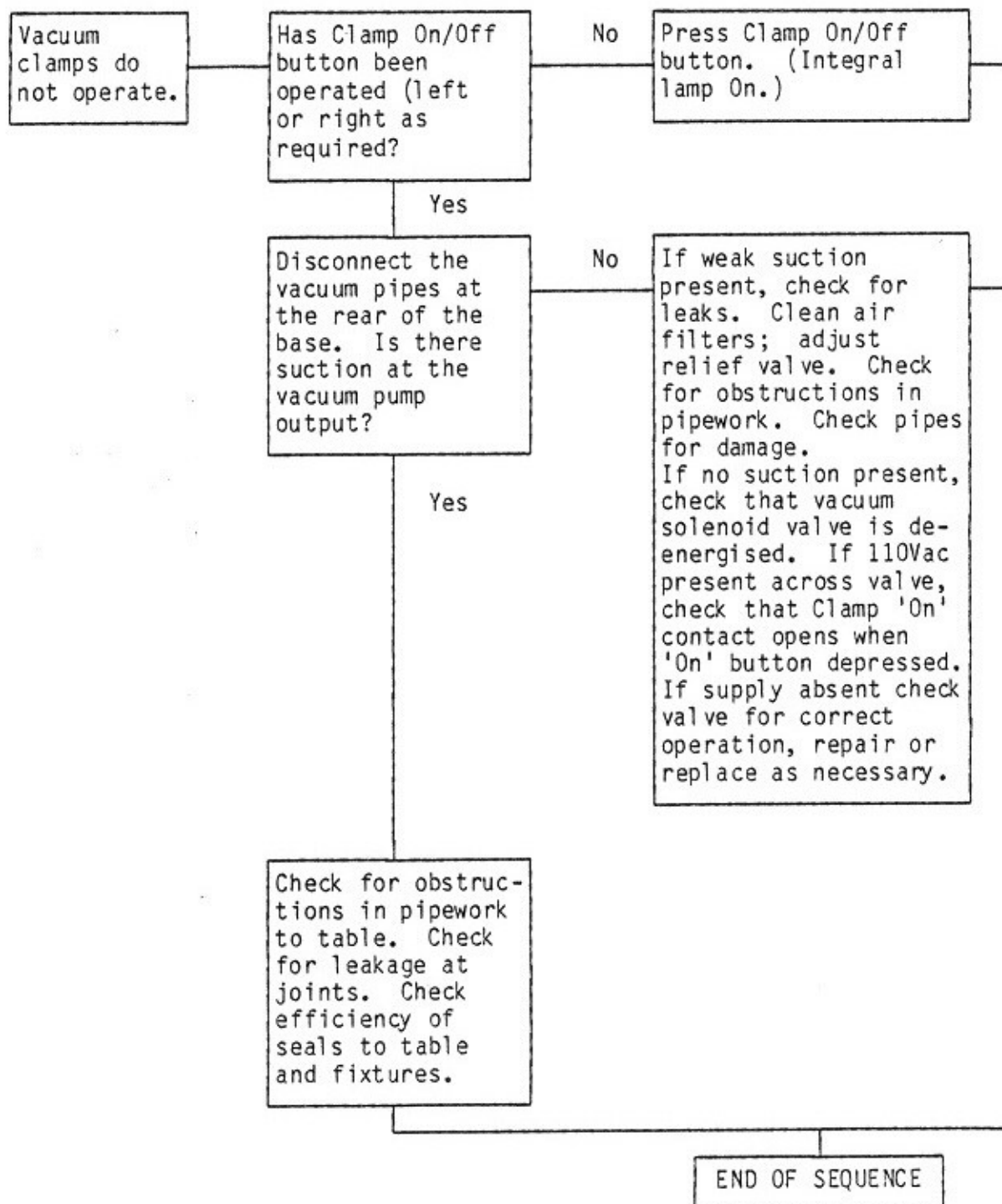


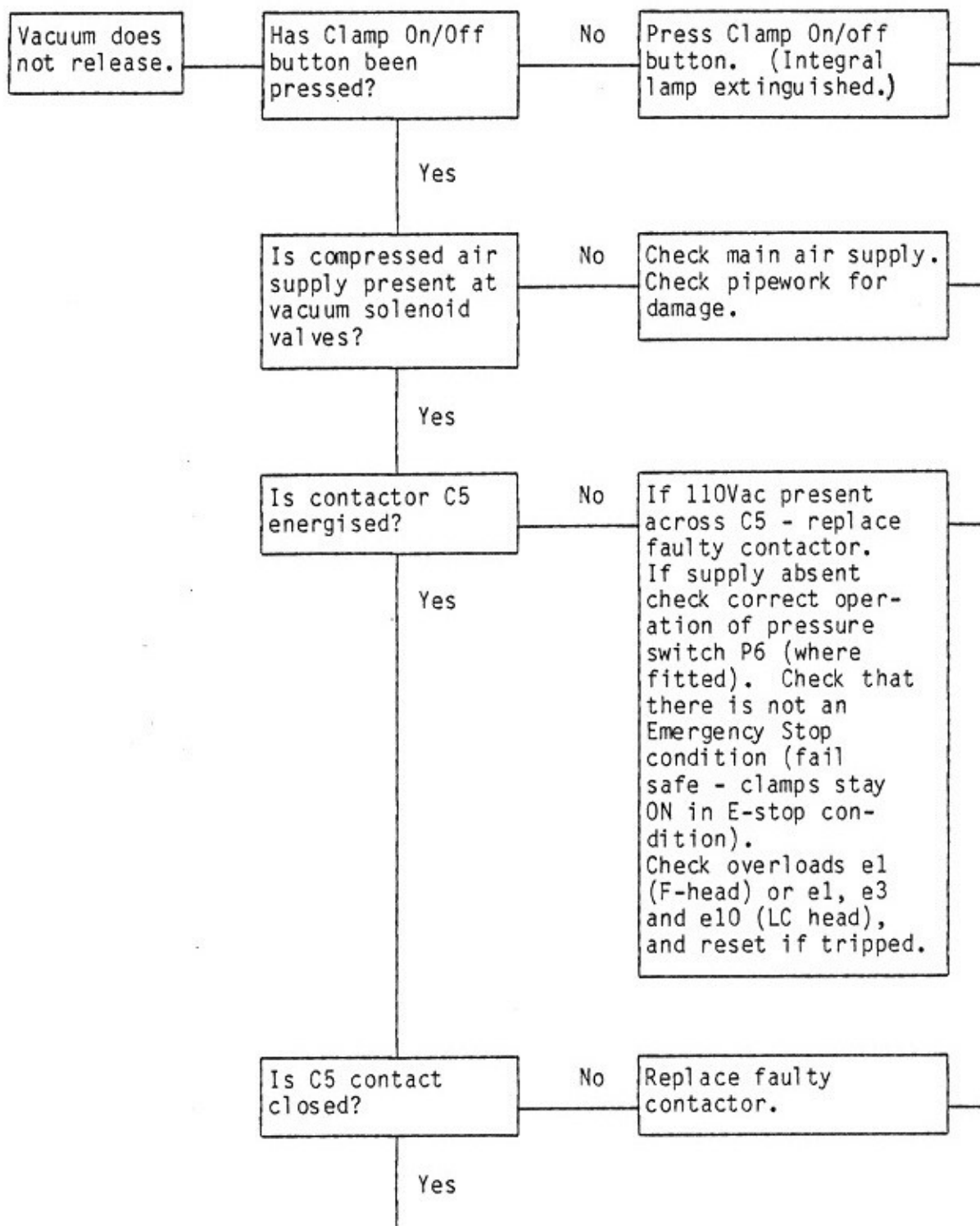


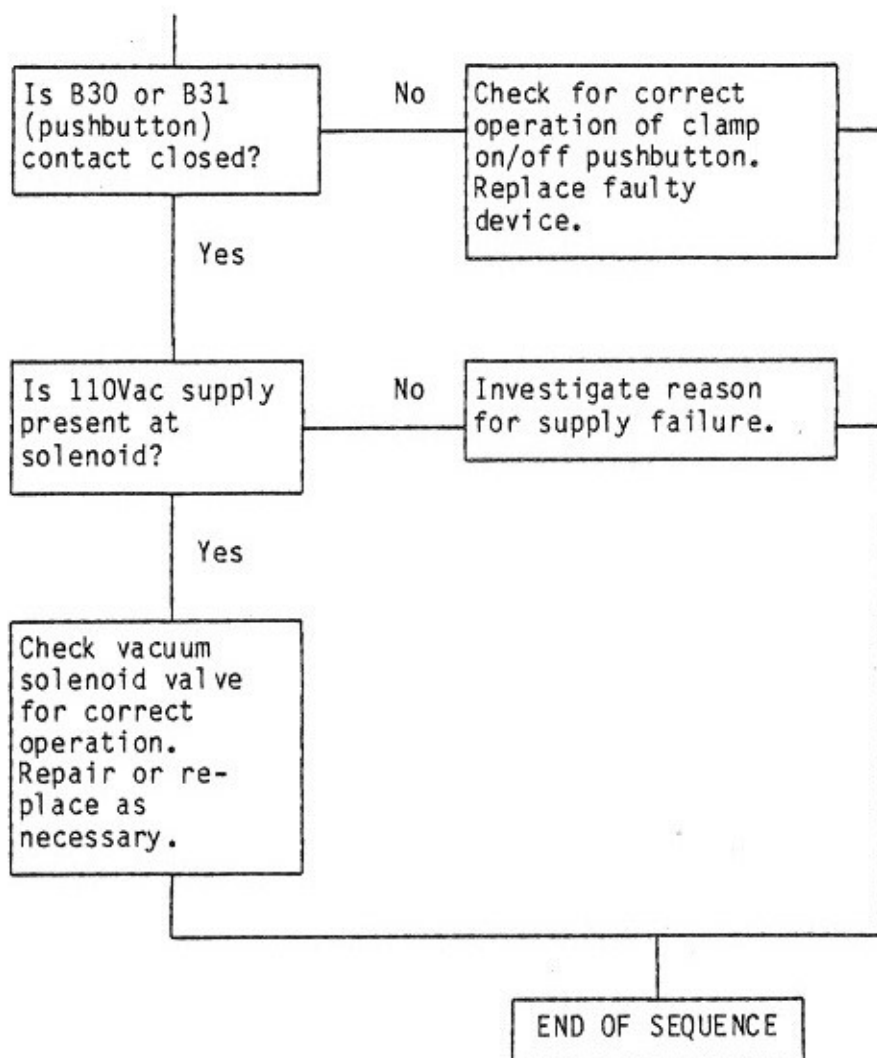


## VACUUM CLAMP FAILURE

If the vacuum pump runs but the clamps do not operate check the following:







## INSTRUCTIONS FOR FLOATING HEAD UNIT

FAULT	CAUSE	REMEDY
EXCESSIVE PUMP NOISE.	WRONG DIRECTION OF PUMP ROTATION	OBSERVE ARROW ON PUMP MOTOR CASE - DIRECTION OF ROTATION MUST CORRESPOND.
	LOW OIL LEVEL	FILL TANK TO LEVEL ON SIGHT.
	RESTRICTED STRAINER	CLEAN STRAINER.
	RESERVOIR BREATHER BLOCKED	CLEAN BREATHER.
SYSTEM EXCESSIVELY HOT	PUMP OPERATED AT HIGHER PRESSURE THAN REQUIRED.	SET TO 350 PSI.
	EXCESSIVE PUMP SLIPPAGE. (INABILITY TO MAINTAIN PRESSURE)	REPLACE PUMP.
SLUGGISH OPERATION	EXTERNAL EQUIPMENT NOT ADJUSTED PROPERLY	NB* WHEN STARTING FROM COLD OPERATION WILL BE SLUGGISH. RUN PUMP FOR 20 MINS TO WARM UP.
	DIRT PARTICLES IN OIL	FLUSH OUT AND REPLACE FLUID.
ELECTRIC MOTOR OVERLOAD	LOW VOLTAGE OR ONE PHASE FAULTY	QUALIFIED ELECTRICIAN TO CHECK.
	MOTOR WIRED FOR WRONG VOLTAGE	CHECK FOR CORRECT CONNECTION.

## MACHINE FAULT MESSAGES

The control system gives two types of fault message. One appears in clear text and describes machine or operator errors. The second type of fault message comprises an error number relating to a programming error. Full details of the fault messages are given in the Control System Manual. The messages and causes are listed below for operator convenience.

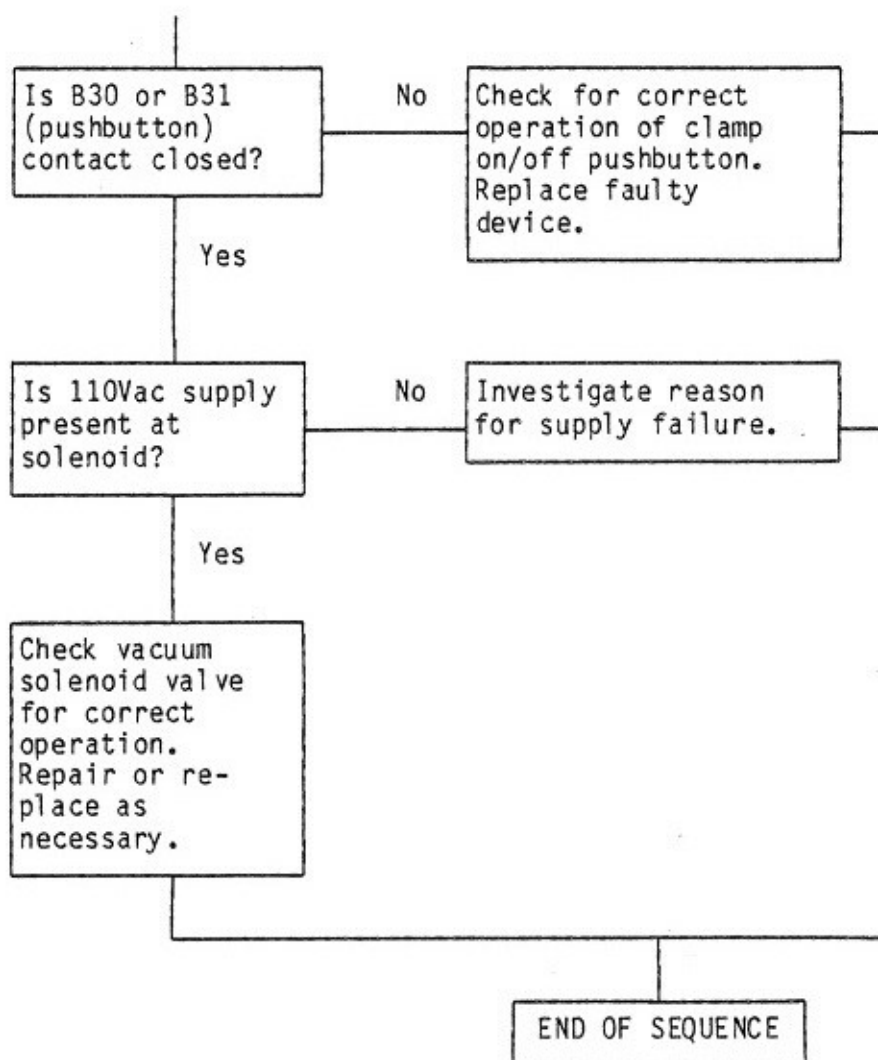
### Messages in Clear Text

<b>ERROR N-ADDR</b>	N-address is incorrect, for instance N-address is lower than the lowest block to be output.
<b>PARITY</b>	Parity error in the part program store, or operating error during reading in.
<b>ERR+X+Y+Z</b>	Limit switch or limit of field of operation has been reached in the displayed axis and direction.
<b>SERVO XYZ</b>	Servo error in the displayed axes.
<b>TRANSMIT</b>	Transfer error from the sequencer to the axis card (hardware fault).
<b>RECEIPT</b>	Transfer error from the axis card to the sequencer (hardware fault).
<b>BREAK CY</b>	Input signal 'Transfer Allow' is missing, therefore stop at the end of the block.
<b>FEED HOLD</b>	Input signal 'Axis Allow' is missing, therefore immediate stop.
<b>ERR SBLOC</b>	Programmed S-or M-output is already being used (M or S-functions are programmed in two consecutive blocks and the output of the M or S-function programmed first has not yet been completed).
<b>TRAVEL</b>	<p>No traverse to reference point has been carried out after mains ON, when limit switch has been programmed or</p> <p>software limit switch or limitation of field of operation activated, with the actual position being outside the permitted range or</p> <p>3D interpolation has been programmed on a 2½D version or no traverse to reference point has been carried out after inch/metric switching or</p> <p>the maximum travel range has been exceeded.</p>

ERR MEM	Fault in part program store (e.g. battery fault).
AXIS???	Interface signal 'Drive On' missing.
FRAMING	Character format incorrect (during reading in) or no device connected for formatted output.
UND BLOCK	The entered character is not permitted with the control.
NOT OK	Parameter number > 26, or incorrect editing of parameters.

## Error Codes

ERROR 1	G5 has been programmed with radius.
ERROR 2	G4 has been programmed without an H-value (externally).
ERROR 3	G1, G2, G3, G5, G61, G62, G63, G65, G81-85 have been programmed with axis address, but without F-value.
ERROR 4	G25, 26, 27, 74 or 92 has been programmed without axis address.
ERROR 5	A subprogram has been called up which is not in store.
ERROR 6	More than 5-fold subprogram nesting has been programmed.
ERROR 7	After a jump back from the subprogram into the main program no M2, M30 has been found at the end of the main program.
ERROR 8	A G-code has been programmed which is not defined.
ERROR 9	Max. interpolation distance is being exceeded, or G2, 3, 62 or 63 are being used in MDI without radius value, or not both interpolating axes have been moved before G5, 65 or G2, 3, 62, 63 without radius value.
ERROR 10	A change in radius compensation (G40, G41, G42) has been programmed although the next movement is circular.
ERROR 11	While cutter radius compensation was active (G41, G42) a new radius compensation was called up during a circular movement.
ERROR 12	G40 'Cancelling Cutter Radius Compensation' has been programmed although the next movement is circular.





## INSTRUCTIONS FOR FLOATING HEAD UNIT

FAULT	CAUSE	REMEDY
EXCESSIVE PUMP NOISE.	<p>WRONG DIRECTION OF PUMP ROTATION</p> <p>LOW OIL LEVEL</p> <p>RESTRICTED STRAINER</p> <p>RESERVOIR BREATHER BLOCKED</p>	<p>OBSERVE ARROW ON PUMP MOTOR CASE - DIRECTION OF ROTATION MUST CORRESPOND.</p> <p>FILL TANK TO LEVEL ON SIGHT.</p> <p>CLEAN STRAINER.</p> <p>CLEAN BREATHER.</p>
SYSTEM EXCESSIVELY HOT	<p>PUMP OPERATED AT HIGHER PRESSURE THAN REQUIRED.</p> <p>EXCESSIVE PUMP SLIPPAGE. (INABILITY TO MAINTAIN PRESSURE)</p>	<p>SET TO 350 PSI.</p> <p>REPLACE PUMP.</p>
SLUGGISH OPERATION	<p>EXTERNAL EQUIPMENT NOT ADJUSTED PROPERLY</p> <p>DIRT PARTICLES IN OIL</p>	<p>NB* WHEN STARTING FROM COLD OPERATION WILL BE SLUGGISH. RUN PUMP FOR 20 MINS TO WARM UP.</p> <p>FLUSH OUT AND REPLACE FLUID.</p>
ELECTRIC MOTOR OVERLOAD	<p>LOW VOLTAGE OR ONE PHASE FAULTY</p> <p>MOTOR WIRED FOR WRONG VOLTAGE</p>	<p>QUALIFIED ELECTRICIAN TO CHECK.</p> <p>CHECK FOR CORRECT CONNECTION.</p>

## MACHINE FAULT MESSAGES

The control system gives two types of fault message. One appears in clear text and describes machine or operator errors. The second type of fault message comprises an error number relating to a programming error. Full details of the fault messages are given in the Control System Manual. The messages and causes are listed below for operator convenience.

### Messages in Clear Text

<b>ERROR N-ADDR</b>	N-address is incorrect, for instance N-address is lower than the lowest block to be output.
<b>PARITY</b>	Parity error in the part program store, or operating error during reading in.
<b>ERR+X+Y+Z</b>	Limit switch or limit of field of operation has been reached in the displayed axis and direction.
<b>SERVO XYZ</b>	Servo error in the displayed axes.
<b>TRANSMIT</b>	Transfer error from the sequencer to the axis card (hardware fault).
<b>RECEIPT</b>	Transfer error from the axis card to the sequencer (hardware fault).
<b>BREAK CY</b>	Input signal 'Transfer Allow' is missing, therefore stop at the end of the block.
<b>FEED HOLD</b>	Input signal 'Axis Allow' is missing, therefore immediate stop.
<b>ERR SBLOC</b>	Programmed S-or M-output is already being used (M or S-functions are programmed in two consecutive blocks and the output of the M or S-function programmed first has not yet been completed).
<b>TRAVEL</b>	<p>No traverse to reference point has been carried out after mains ON, when limit switch has been programmed or</p> <p>software limit switch or limitation of field of operation activated, with the actual position being outside the permitted range or</p> <p>3D interpolation has been programmed on a 2½D version or no traverse to reference point has been carried out after inch/metric switching or</p> <p>the maximum travel range has been exceeded.</p>

ERR MEM	Fault in part program store (e.g. battery fault).
AXIS???	Interface signal 'Drive On' missing.
FRAMING	Character format incorrect (during reading in) or no device connected for formatted output.
UND BLOCK	The entered character is not permitted with the control.
NOT OK	Parameter number > 26, or incorrect editing of parameters.

## Error Codes

ERROR 1	G5 has been programmed with radius.
ERROR 2	G4 has been programmed without an H-value (externally).
ERROR 3	G1, G2, G3, G5, G61, G62, G63, G65, G81-85 have been programmed with axis address, but without F-value.
ERROR 4	G25, 26, 27, 74 or 92 has been programmed without axis address.
ERROR 5	A subprogram has been called up which is not in store.
ERROR 6	More than 5-fold subprogram nesting has been programmed.
ERROR 7	After a jump back from the subprogram into the main program no M2, M30 has been found at the end of the main program.
ERROR 8	A G-code has been programmed which is not defined.
ERROR 9	Max. interpolation distance is being exceeded, or G2, 3, 62 or 63 are being used in MDI without radius value, or not both interpolating axes have been moved before G5, 65 or G2, 3, 62, 63 without radius value.
ERROR 10	A change in radius compensation (G40, G41, G42) has been programmed although the next movement is circular.
ERROR 11	While cutter radius compensation was active (G41, G42) a new radius compensation was called up during a circular movement.
ERROR 12	G40 'Cancelling Cutter Radius Compensation' has been programmed although the next movement is circular.

- ERROR 13 Tool number 'T0' or larger than 24 (larger than 16) has been programmed.
- ERROR 14 'F0' has been programmed as feedrate value (F-word) (external programming).
- ERROR 15 Subprogram call-up (G22, G23) has been programmed with A = 0 or without a number (external programming).
- ERROR 16 A jump instruction (G20, G21, M30) has been programmed with address '0' or without address.
- ERROR 17 The first movement after switching planes (G17, G18, G19) is a circular one.
- ERROR 18 A tool compensation (G41, G42, G43) has been called up without a tool number (T).
- ERROR 21 With G41, G42 being active, one of the axes in the active plane (G17, G18, G19) has been programmed together with G74 (automatic traverse to reference point).
- ERROR 22 With G41, G42 being active, a conditional subprogram call-up (G23) has been programmed.
- ERROR 23 With G41, G42 being active, a change of plane has been programmed with 'G17', 'G18' or 'G19'.
- ERROR 24 With G41, G42 being active, M2, M30 (end of program) has been programmed.
- ERROR 25 With G41, G42 being active, a conditional jump (G21) has been programmed.
- ERROR 26 The next block number is larger than 999 or negative or not stored in the memory.
- ERROR 27 With G41, G42 being active, the control cannot find any programmed axis movements in order to calculate the cutter path.
- ERROR 28 Within a selected subprogram a jump has been programmed with G20, G21, which would result in endless repetition of this subprogram.
- ERROR 29 There has been no 'M2' or 'M30' programmed at the end of the active main program, or the program memory is empty.
- ERROR 30 The tool radius is too large for the programmed contour angle, or incorrect programming of G40.

ERROR 31	The programmed radius is too small.
ERROR 40	'G41' or 'G42' has been entered in MDI mode.
ERROR 41	'G2', 'G3', 'G62' or 'G63' has been entered in MDI mode without specifying the radius.
ERROR 42	In 'Teach In' mode an arc has been stored as the first movement (no tangent).
ERROR 43	A modification of the effective compensation R or L has been programmed (%60) with path compensation being active.
ERROR 45	The used parameter is '0', for instance division by 0.
ERROR 46	The used parameter is negative, for instance square root from a negative number.
ERROR 47	A non-defined %-code has been programmed.
ERROR 50	M30 has been programmed without address word (ext. programming).
ERROR 51	Parametric function cannot be carried out with given data.
ERROR 61	Port number larger than 15 has been programmed.
ERROR 62	M-function is to cancel another M-function (which is not defined as a decoded (function) (error with 'Edit M-Fcns').

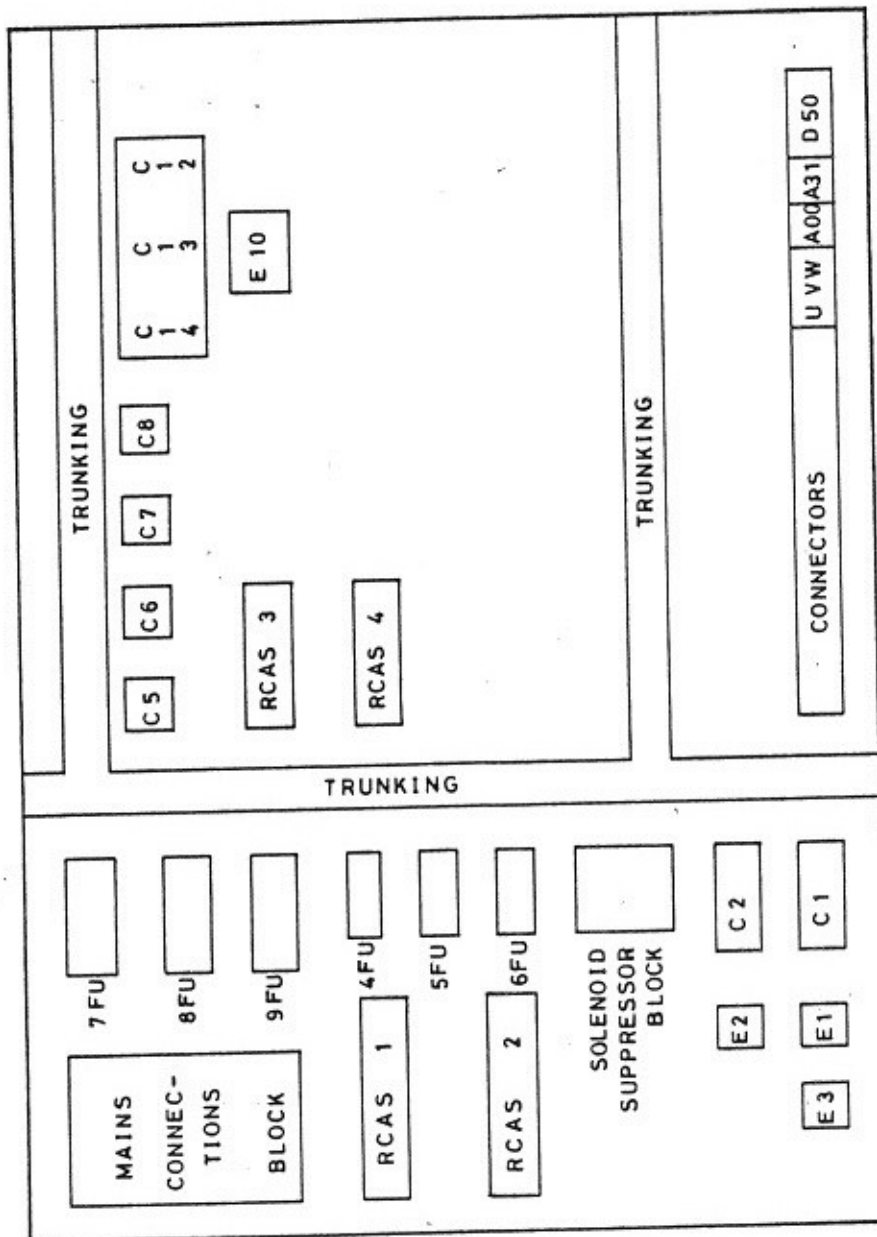
#### CHECKING TRAVEL LIMIT SWITCH OPERATION

The ultimate overtravel limits should not normally operate during machining, but must be operative under fault conditions. For this reason it is recommended that the axis travel limit switches are checked for correct operation every six months.

Manually operate the X axis positive overtravel limit switch and check that the message 'ERR +X' is displayed. Press 'Control On' and repeat for each axis (two switches per axis).

## FUSE LIST

<u>NO.</u>	<u>RATING</u>	<u>TYPE</u>
1FU	50A	HRC
2FU	50A	"
3FU	50A	"
4FU	10A	SAKS3 1½ inch
5FU	10A	"
6FU	10A	"
7FU	35A	SAKS5 Klippon
8FU	35A	"
9FU	35A	"
10FU	20A	SAKS5 Klippon
11FU	20A	"
12FU	20A	"
16FU	10A	SAKS3 1½ inch
17FU	10A	"
18FU	5A	SASK3 1½ inch
19FU	5A	"
20FU	5A	"
21FU	2A	SAKS3 1½ inch



MAINS CONTROL PANEL LAYOUT UX/CNC/LC

PANEL W3

SECTION 7

ILLUSTRATED PARTS LIST

NOTE

If ordering spare parts  
always quote the machine  
type and serial number.

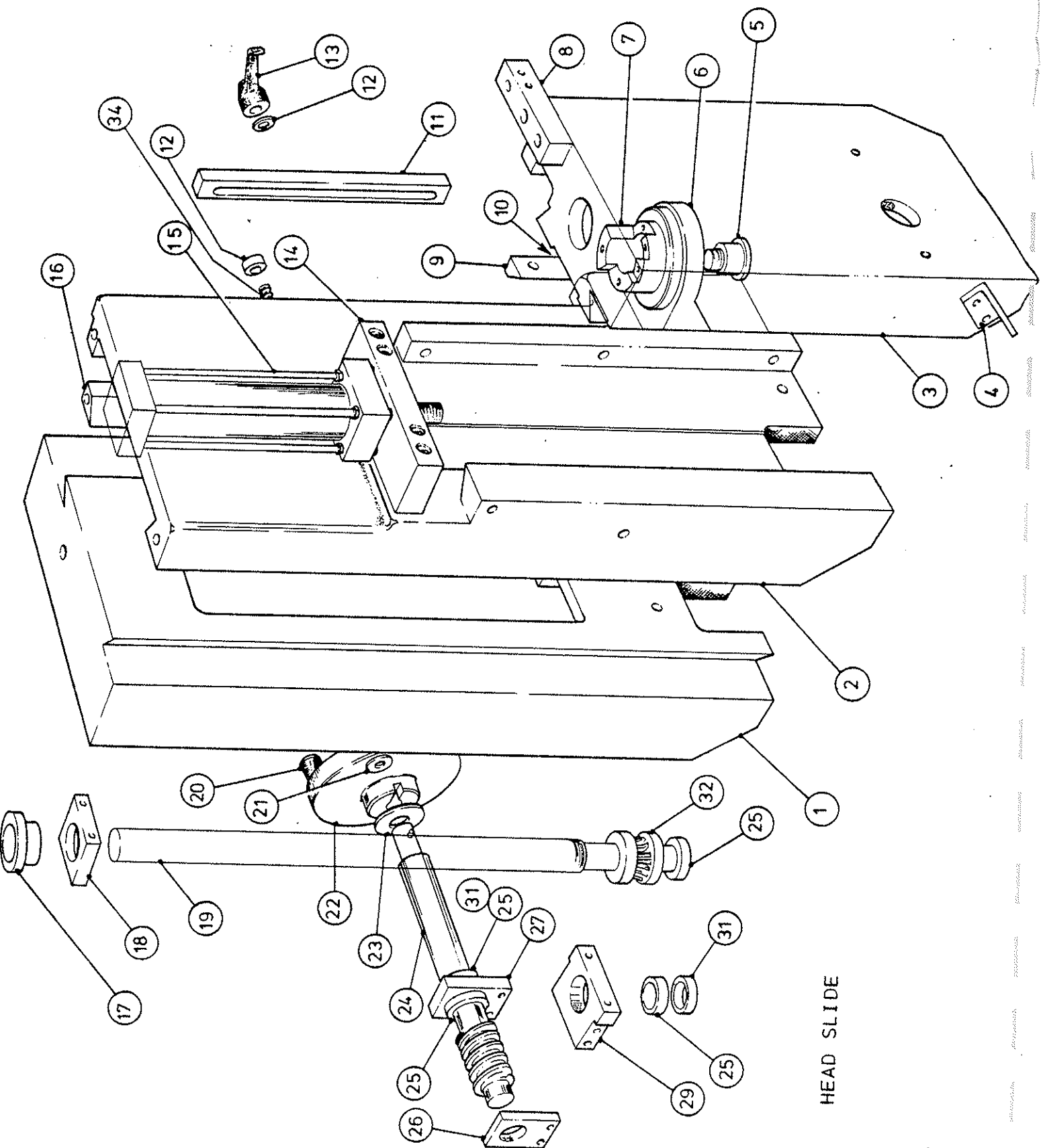


# HEAD SLIDE

## Key to Illustration

Item	Description	Part No.	Item	Description	Part No
1.	Frame slide	UX 1001	21.	Bearing retaining washer	UX 1112
2.	Intermediate slide	UX 1002	22.	Head rise and fall handwheel	UX 1045
3.	Motor head slide	UX 1003	23.	Handwheel shaft bearing	UX 1040
4.	Hose bracket	UX 1093	24.	Head raising worm shaft	UX 1010
5.	Turret stop swivel pin	UX 1018	25.	Bearing (4 off)	
6.	Turret stop bracket	UX 1020	26.	Wormshaft bracket L.H.	UX 1088
7.	Turret stop	UX 1019	27.	Wormshaft bracket R.H.	UX 1008
8.	Turret stop screw bracket	UX 1087	28.	Pin	
9.	Slide trapping strip	UX 1011	29.	Head rise and fall block	UX 1007
10.	Head cylinder adaptor piece		30.	Oilite bush	
11.	Slide locking strip	UX 1338	31.	Locking collar	UX 1262
12.	Slide locking collar	UX 1337	32.	Worm wheel	UX 1009
13.	Locking handle		33.	12mm washer	
14.	Head cylinder support bracket	UX 1389	34.	12mm stud	
15.	Head cylinder				
16.	Slide trapping strip	UX 1031	*	Oiling points.	
17.	Head raising nut	UX 1006			
18.	Head raising nut bracket	UX 1005			
19.	Head raising screw	UX 1011			
20.	Handle				

Nov. '83

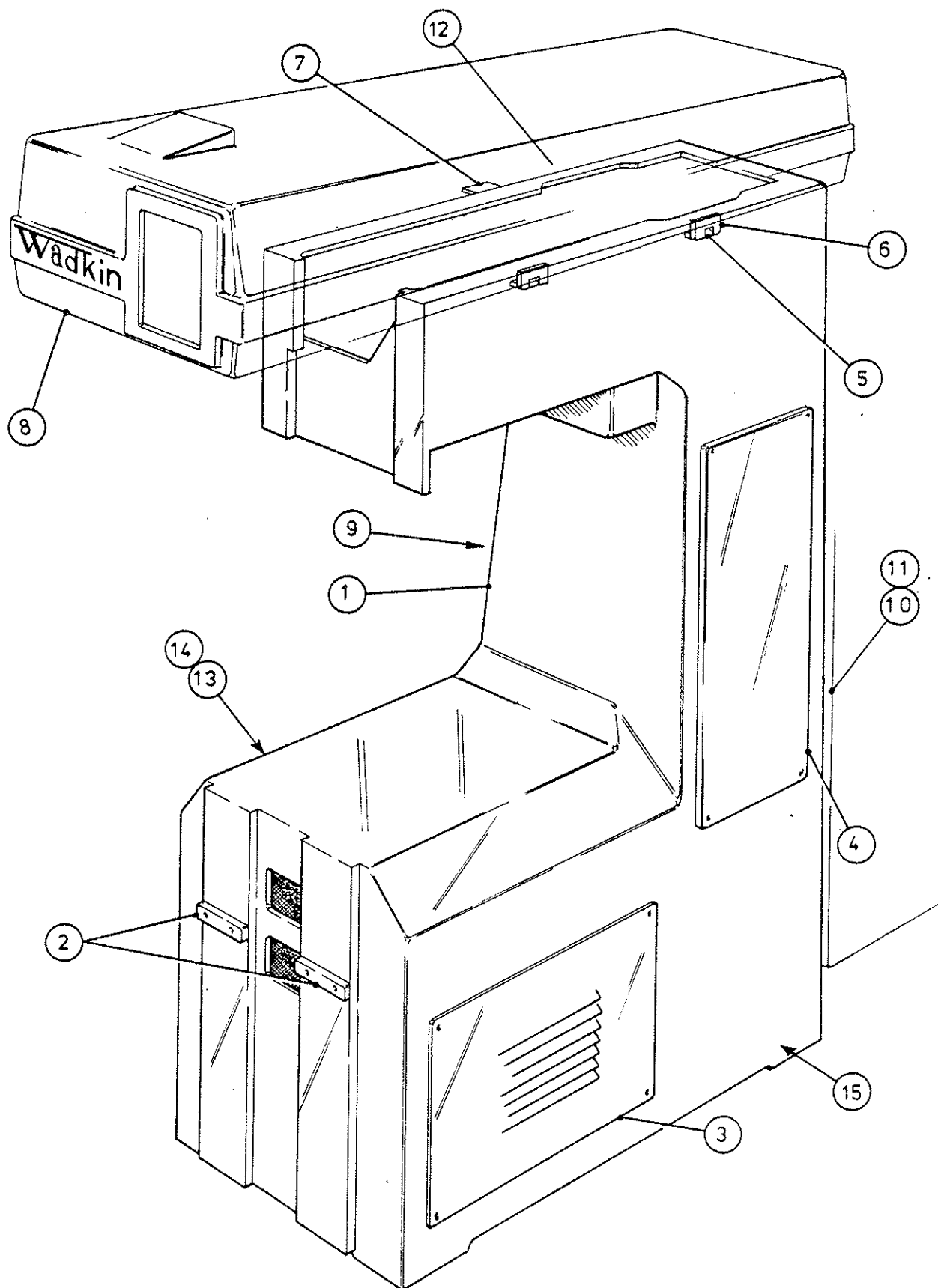


HEAD SLIDE

## MAIN BASE

### Key to Illustration

Item	Description	Part No.
1.	Main base	UX 1000
2.	Table base key	UX 3171
3.	Cover	UX 1038
4.	Electrical box door	UX 1350
5.	Hinge (Base)	UX 1396
6.	Hinge (Hood)	UX 1395
7.	Guard clamp bracket	UX 1051
8.	Top guard	UX 1381
9.	Panel cover	UX 1042
10.	Electrical cabinet	UX 3151/1
11.	Spacer (not shown - 8 off)	UX 3195
12.	Top guard strap (not shown)	UX 3278
13.	Cable chain (not shown)	
14.	Cable chain bracket (not shown)	UX 3167
15.	16mm jacking bolts and locknuts - 4 off (not shown)	



MAIN BASE

TABLE & SADDLE ASSEMBLY

Key to Illustration

Item	Description	Part No.	Item	Description	Part No
1.	Saddle	UX 3160	21.	Locknut (SKF KM4)	UX 3107
2.	Linear bearing housing	UX 3166	22.	Locknut washer (MB 4)	UX 3106
3.	Bearing (Barden 20-20mm)		23.	Packing plate	UX 3169
4.	Linear bearing retainer	UX 3113	24.	Bearing housing (N.D.E.)	
5.	Linear bearing shaft	UX 3109	25.	Limit switch mounting plate	
6.	Bearing locknut	UX 3121	26.	Timing belt (Kenyon 330 H100)	
7.	Locknut washer (MB 5)		27.	Timing belt pulley (2 off)	UX 3148
8.	Thrust cap 'Y'	UX 3123	28.	Taper lock bush	
9.	Bearing (ARN B 2512)		29.	Motor	
10.	Grease retainer	UX 3120	30.	Taper lock bush	
11.	Motor mounting plate	UX 3125	31.	Bellows	UX 3117
12.	Bearing housing (D.E.)	UX 3105	32.	70-90 Jubilee clip	
13.	Ballscrew and nut	UX 3104	33.	Belt guard	UX 3163
14.	Nut housing	UX 3161	34.	Belt guard cover	UX 3164
15.	Packing plate	UX 3115	35.	Limit switch BNS 519 C4 R12 62-11	
16.	Table (wood)	UX 3158	36.	Limit switch stop plate (Y axis)	UX 3170
17.	Table (casting)	UX 3100	37.	Rails	UX 3173
18.	Grease retainer (2 off)	UX 3118	38.	Cams 520 - UB25	
19.	Bearing SKF 6304				
20.	Dustcap	UX 3119			

Aug. '83

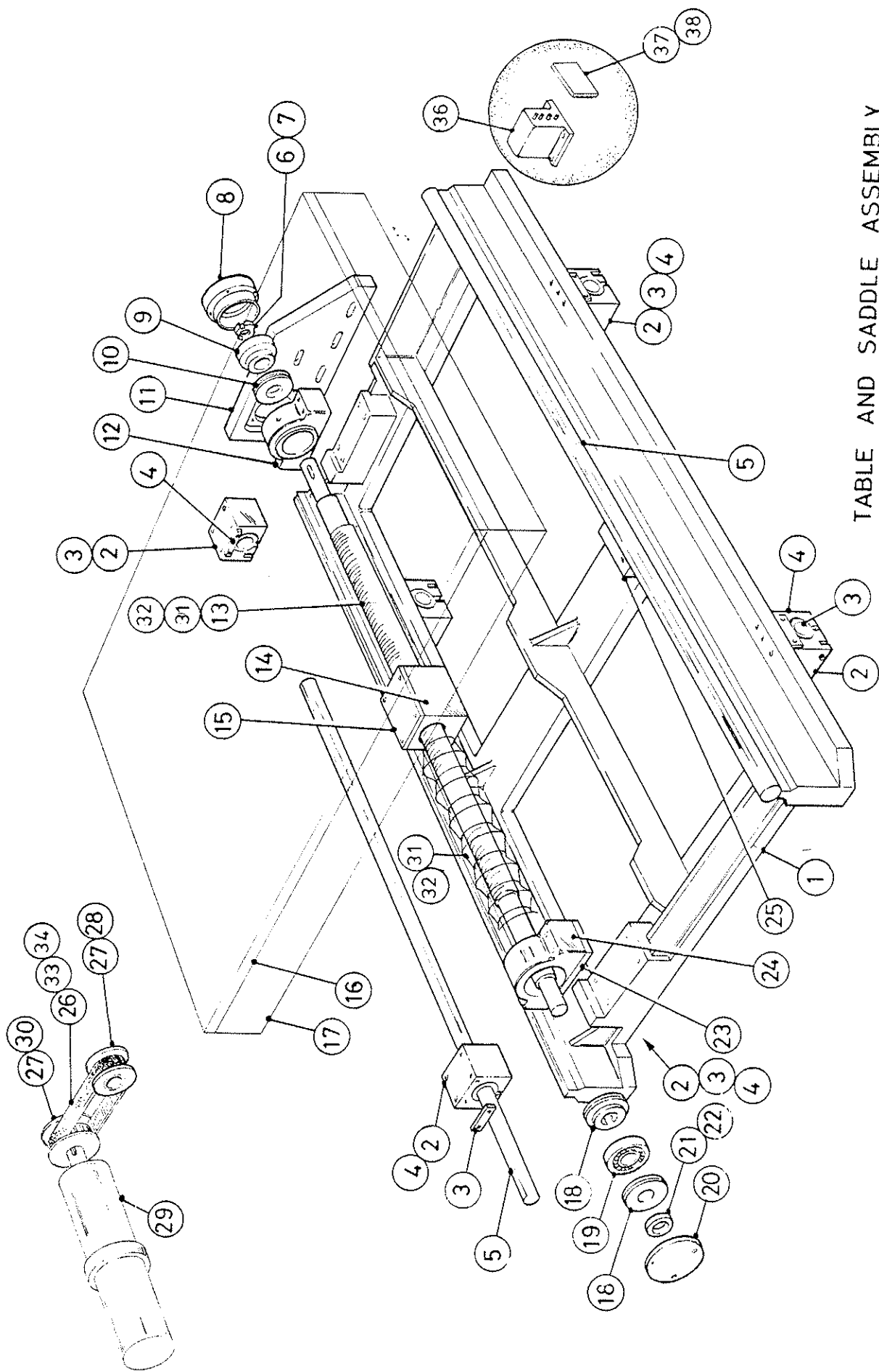


TABLE AND SADDLE ASSEMBLY

# TABLE BASE

## Key to Illustration

Item	Description	Part No.	Item	Description	Part No
1.	Base	UX 3102/2	21.	Taper lock bush	UX 3124
2.	Dustcap	UX 3119	22.	Motor mounting plate	UX 3132
3.	Locknut	(KM4)	23.	Motor Bosch (444, 3, 20, 99)	UX 3133
4.	Locknut washer	(MB4)	24.	Jacking screw	UX 3134
5.	Bearing	(SKF 6304)	25.	Jacking screw locknut	UX 3130
6.	Grease retainer		26.	Seating plate	UX 3107
7.	Linear bearing shaft (2 off)	UX 3118	27.	Cover	UX 3116
8.	Bearing housing	UX 3108	28.	Packing plate	
9.	Ballscrew and nut	UX 3106	29.	Bellows	
10.	Nut housing	UX 3103	30.	70-90 Jubilee clip	
11.	Packing plate	UX 3161			
12.	Bearing housing	UX 3115	31.	Belt guard	UX 3126
13.	Grease retainer	UX 3105	32.	Belt guard cover	UX 3127
14.	Bearing (NANDELLA ARNB 2572)	UX 3120	33.	Limit switch BNS 519 C4 R12 62-11	
15.	Locknut washer	(MB5)			
16.	Locknut				
17.	Thrust cap	UX 3122			
18.	Taper lock bush				
19.	Belt pulley				
20.	Timing belt (KENYON 330H100)				

Nov. '83

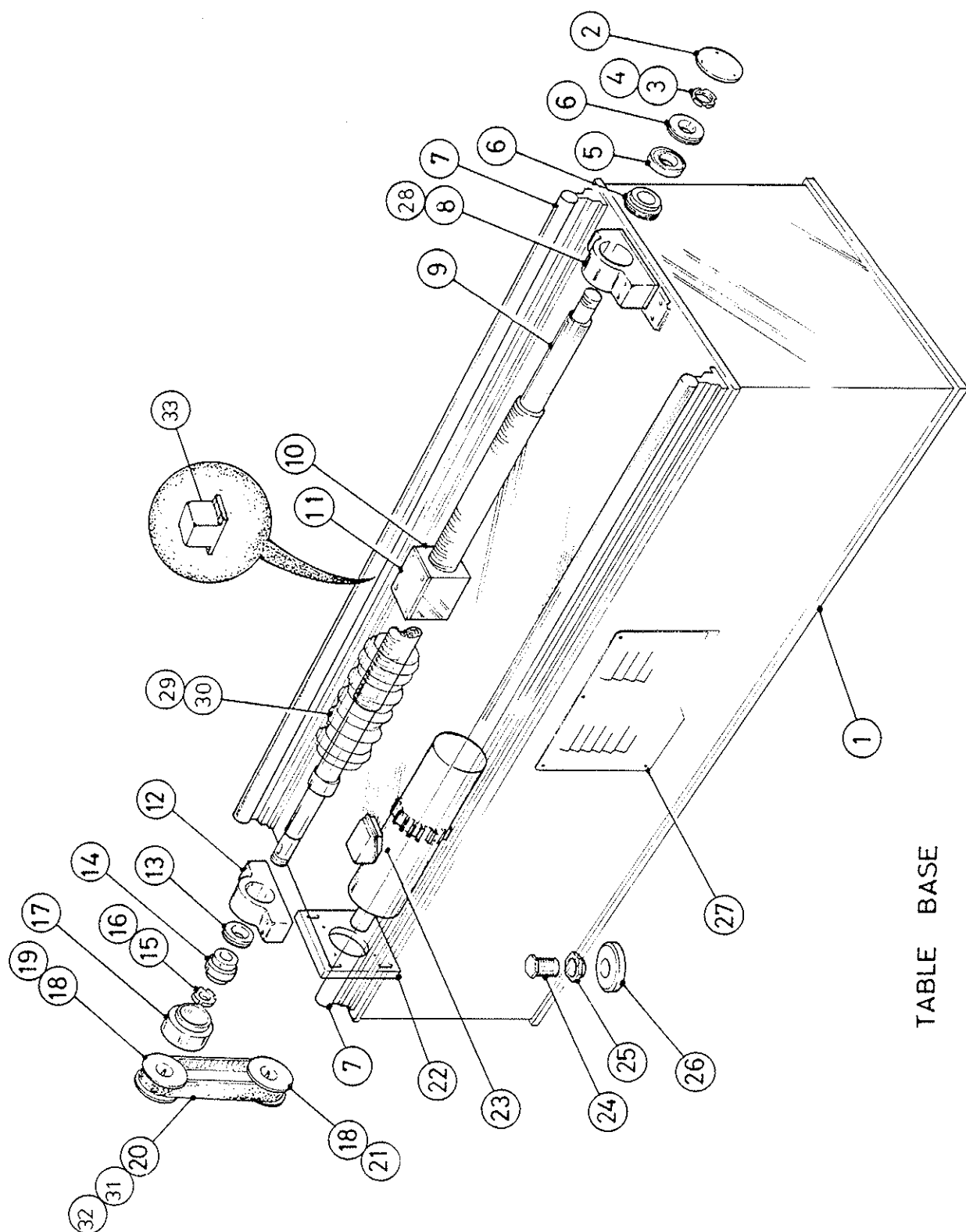


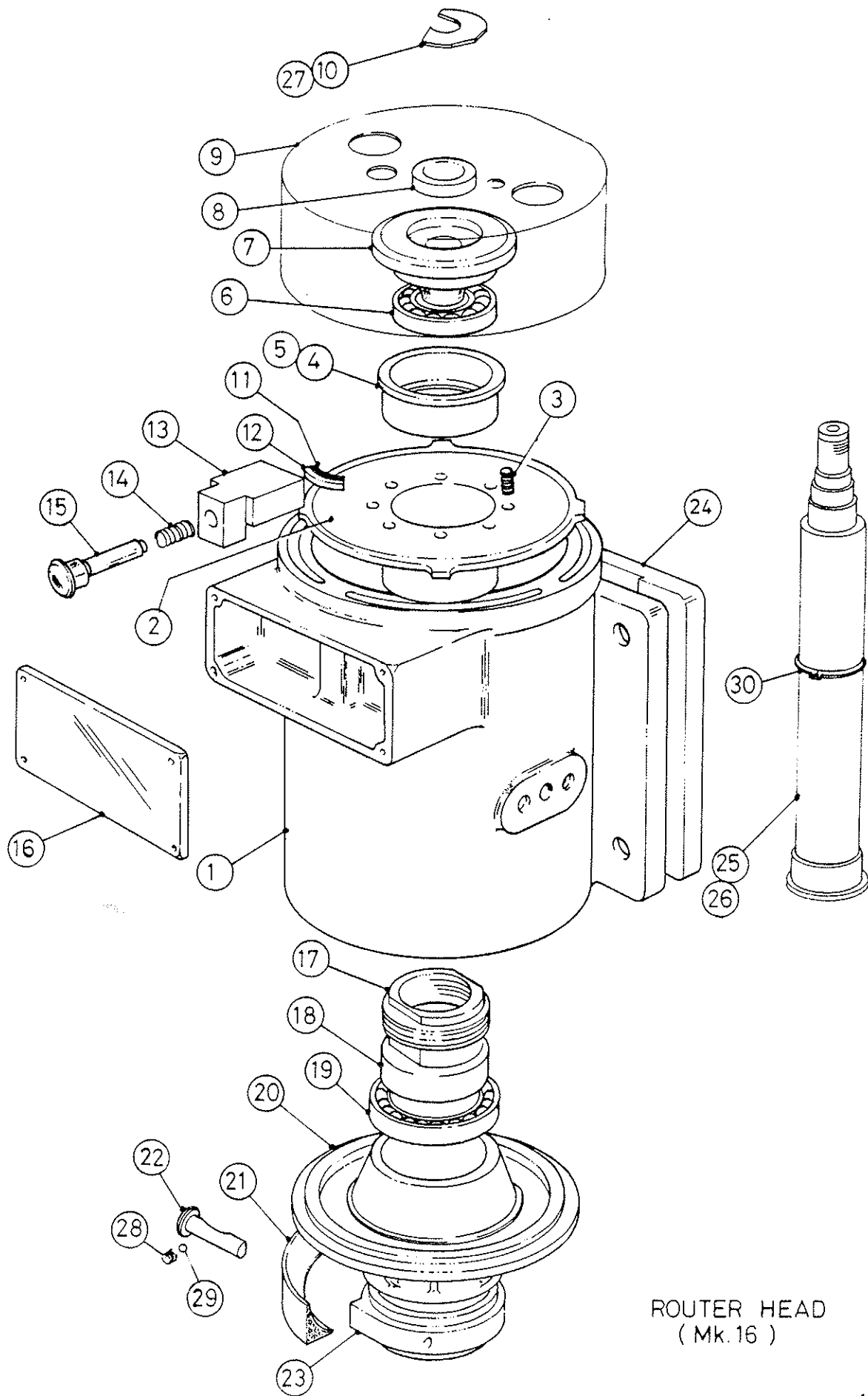
TABLE BASE



## ROUTER HEAD (MK.16)

### Key to Illustration

Item	Description	Part No.
1.	Stator frame	LS 1499/A
2.	Top end shield	LS 1667
3.	Spring	LS 1098
4.	Top bearing sleeve	LS 1648
5.	'O' ring	K30-69-163
6.	Bearing	K06-18-141
7.	Upper bearing grease retainer	LS 1631
8.	Locknut	K05-19-162
9.	Cowl for router	LS 1681
10.	Cover for drawbolt	LS 1671
11.	Brake lining	LS 1092
12.	Brake shoe	LS 1033
13.	Brake plunger housing	LS 1665
14.	Brake spring	LS 1094
15.	Brake plunger	LS 1093
16.	Cover plate (blank)	LS 1483
17.	Bottom bearing locknut	LS 1460
18.	Inner bearing spacer	LS 1673
19.	Bearing	K06-18-144
20.	Bottom bearing housing	LS 1668
21.	Air deflector	LS 1684
22.	Spindle locking pin	LS 1031/A
23.	Bottom bearing cap	LS 1647
24.	Motor backplate	UX 1384
25.	Rotor spindle	LS 1455/A
26.	Drawbolt	LS 1466
27.	Stud for drawbolt cover	LS 1526
28.	Spring for spindle	LS 1038
29.	Steel ball	K30-05-501
30.	Circlip	K30-09-189

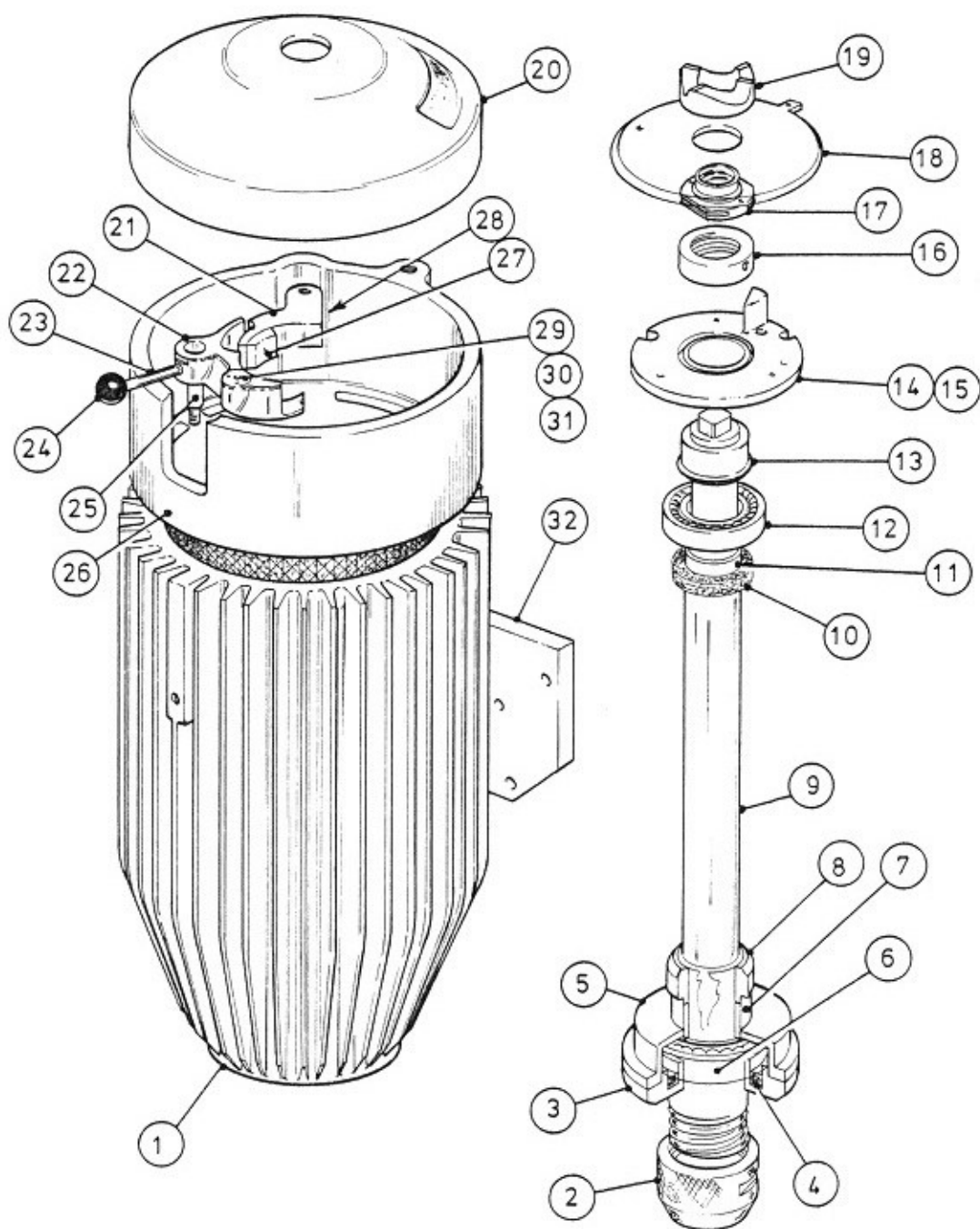


ROUTER HEAD  
( Mk.16 )

## FREQUENCY HEAD

### Key to Illustration

Item	Description	Part No.
1.	Stator frame	UR 401
2.	Chuck nut assembly	LS 6893
3.	Bearing retaining plate	UR 213
4.	Felt ring	LS 881
5.	Bearing housing	UR 212
6.	Bearing	K06-01-299
7.	Spacing sleeve	UR 215
8.	Locknut	LS 399
9.	Rotor shaft	LS 948
10.	Felt ring	LS 880
11.	Bearing oil seal	LS 872
12.	Bearing	K06-01-293
13.	Bearing spacing sleeve	UR 209
14.	Felt ring housing labyrinth	UR 118
15.	Felt	K30-21-101
16.	Brake drum	UR 206
17.	Bearing locknut	UR 221
18.	Baffle	UR 224
19.	Fan	UR 119
20.	Cover	UR 116
21.	Brake shoe	UR 114
22.	Arm carrying locking pin	UR 117A
23.	Brake operating lever	UR 219
24.	Knob	K05-21-464
25.	Brake shoe pivot pin	UR 218
26.	Top bearing housing	UR 121
27.	Brake lining	UR 232
28.	Spring	LS 863
29.	Plunger	EQ 181
30.	Spring	LS 1038
31.	Retaining cap	UR 220/A
32.	Head fastening plate	UX 1714



FREQUENCY HEAD

UX/CNC

SECTION 8

RECOMMENDED SPARES LISTS

Nov. '83



## RECOMMENDED MECHANICAL SPARES

Quantity	Description	Part No.
2	X-axis bellows	UX 3116
2	Y-axis bellows	UX 3117
1	X-axis timing belt (Kenyon)	330H100
1	Y-axis timing belt	*
1	Ballscrew drive end bearing (Nadella)	ARN B2572
1	Ballscrew tail end bearing (SKF)	6304
4	Linear bearings (Barden)	LO-20-MM
1	Solenoid valve	M/1742/152
1	Glass filter jar	AA401
1 set	Pneumatic cylinder 'O' rings and seals	*
1	Vacuum pump service kit (Comprises 4 vanes 1 main body gasket 1 deflector 2 bearings 2 filters)	K 350

\* Quote the machine number when ordering these items.

## RECOMMENDED ELECTRICAL SPARES

Quantity	Description	Part No.
6	35 Amp fuses	3615.0
3	20 Amp fuses	3613.0
2	2 Amp fuses	412.273
6	Indicator lamps	CM 334
1	Contactor	K19
1	8-pin relay 110V ac	103-104
1	8-pin relay 24V dc	
1 set	Frequency changer brushes	*
1 set	Servo motor brushes	*

\* Quote the machine number when ordering these items.



UX/CNC

SECTION 9

CUSTOMER'S SPECIAL FEATURES

Nov. '83



## SECTION 9

### CUSTOMER OPTIONS

The following lists the optional equipment supplied with the machine for which this manual is issued.

CUSTOMER

MACHINE NUMBER

MAINS SUPPLY

OPTIONAL EQUIPMENT SUPPLIED

## CUSTOMER SPECIFIC PARAMETERS

Company: \_\_\_\_\_ Date: \_\_\_\_\_

Machine: \_\_\_\_\_ Rapid = 7.5V

BAUD	_____
FMAN	_____
RATIO	_____
0.01MM	_____
60HZ	_____
LAG	_____
ACT.POS	_____
INCH	_____
VCRT	_____
MFO & GO	_____
T CODE OUT	_____

	X	Y	Z
GA			
BAK			
DIV			
COM			
SEN			
REF			
SD			
FGO			
FMA			
LI+			
LI-			
PRE			

DECODED OUTPUTS	Return	E.Block	Decod.	Ext/Port	Excl.M
M					
M					
M					
M					
M					
M					
M					
M					
M					
M					
M					
M					
M					
M					
M					



MANUFACTURING CORPORATION

P. O. BOX 97, BENTON HARBOR, MICHIGAN 49022  
PHONE 616-926-6171

70-230  
(10-80)

**PARTS LIST and OPERATING  
and MAINTENANCE INSTRUCTIONS  
FOR 1067, 2067, and 2567**

**OIL LESS  
VACUUM PUMPS  
and  
COMPRESSORS**

PRINTED IN U.S.A.

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REF. NO.	DESCRIPTION	PART QNTY.	1067-V103	1067-P102	2067-V103	2067-P102	2567-V103	2567-P102
1	Body	1	AH345	AH345	AH191	AH191	AH355	AH355
2	Rotor Assembly	1	AH428	AH428	AH192	AH192	AH192	AH192
3	Vane	4	AH430	AH430	AH195	AH195	AH195	AH195
4	Body Gasket	1	D330	D330	D330	D330	D330	D330
5	Foot Bracket	1	AH208	AH208	AH208	AH208	AH208	AH208
6	Deflector	2	AH193	AH193	AH193	AH193	AH193	AH193
7	Bail Bearing (Drive & Dead)	2	AC894	AC894	AC894	AC894	AC894	AC894
8	End Cap, Drive	1	AB339A	AB339A	AB339A	AB339A	AB339A	AB339A
9	Fan Coupling Assembly	1	AH198	AH198	AH198	AH198	AH198	AH198
10	Fan Guard	1	AH194	AH194	AH194	AH194	AH194	AH194
11	End Plate Dead	1	AH205	AH205	AH205	AH205	AH205	AH205
12	Belleville Springs	2	AB337	AB337	AB337	AB337	AB337	AB337
13	Washer	1	AB338	AB338	AB338	AB338	AB338	AB338
14	Snap Ring	1	AB335	AB335	AB335	AB335	AB335	AB335
15	Fan	1	AC3268	AC3268	AC3268	AC3268	AC3268	AC3268
16	Fan Guard	1	AC1028	AC1028	AC1028	AC1028	AC1028	AC1028
17	Intake Filter Assembly	1	AA800C	AA905F	AA900D	AA905G	AA900D	AA905G
18	Cover	1	AV801		AV901	AV901	AV901	
19	Gasket	2	AA405		AA405	AA405	AA405	
20	Jar	2	AA401		AA401	AA401	AA401	
21	Filter Assembly	1	AC433-1		AC435-1	AC435-1	AC435-1	
22	Cartridge	2	AC393	AC393	AC393	AC393	AC393	
23	Filter-Felt	1		D344B		D344B		D344B
24	Muffler	1	AA800D		AA900F		AA900F	
25	Cover	1	AV803		AV903		AV903	
26	Muffler Assembly	1	AC434-1		AC436-1		AC436-1	

To rebuild, order service kit:

K356

K356

K350

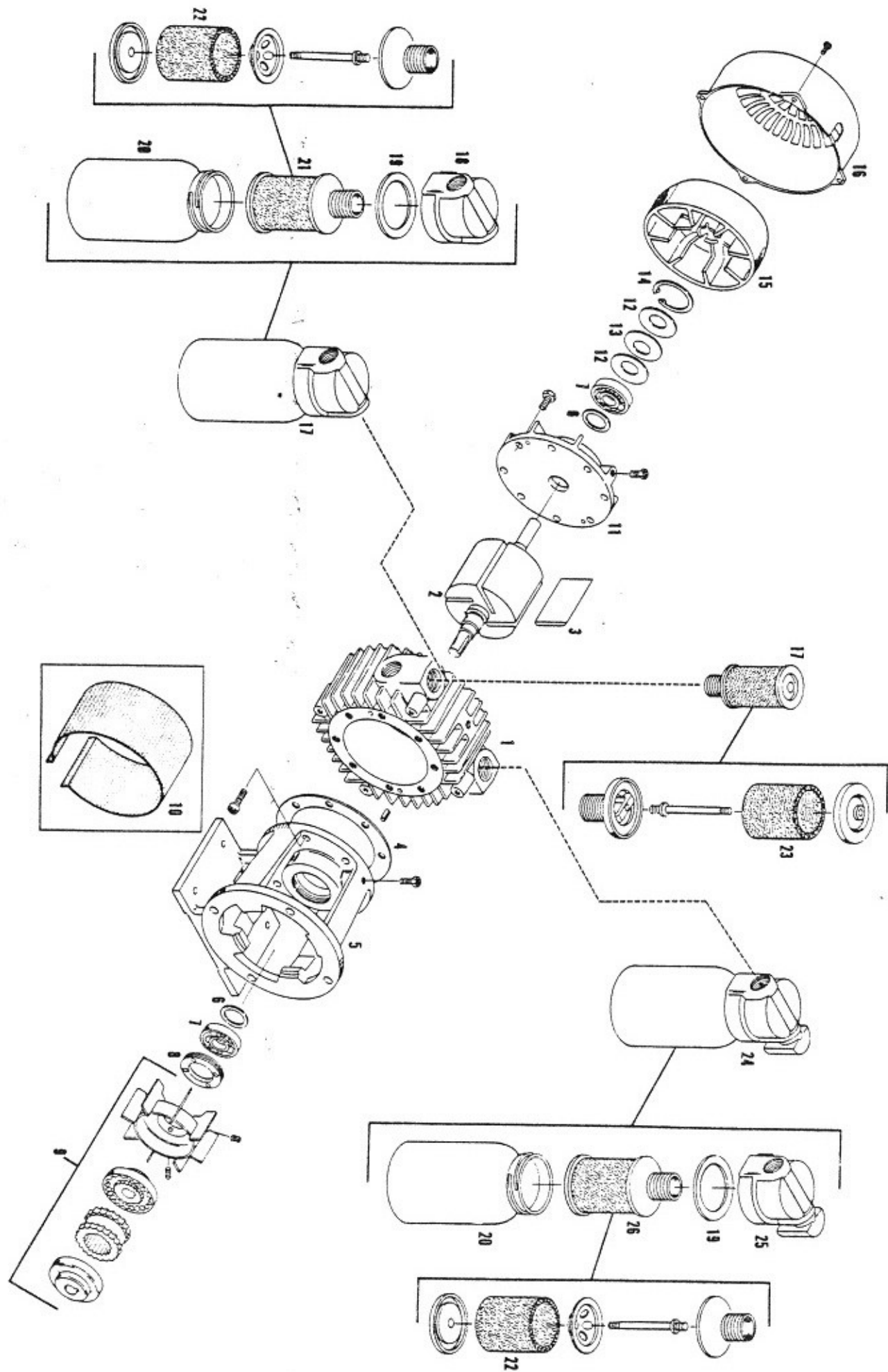
K357

K350

K357

• Denotes parts in service kit.

When corresponding or ordering spare parts, please give complete model and serial numbers.



**CAUTION:** Running this pump in the wrong rotation will cause severe internal damage. Check rotation arrow on pump. NEVER LUBRICATE THIS DRY "OIL-LESS" AIR PUMP. The carbon vanes and grease packed bearings require no oil. This unit may be equipped with an automatic thermal protector. The unit may restart automatically. Disconnect power source before performing any maintenance operations on the unit.

**CONSTRUCTION:** Your Rotary pump is a precision product. There is only .0015" top clearance and .0025" total end clearance between the rotor and the body. (This will vary on special models). The vanes take up their own wear. This unit is built of steel and cast iron and is designed to pump only clean air. With proper care and preventative maintenance you will receive years of trouble free service.

**INSTALLATION:** LOCATION should be on a solid plate, preferably of metal, which in turn should be anchored to a shelf, the floor, a foundation, or to other machinery. To save time and inconvenience place the pump where easy access can be both the oil reservoir (item #16) and exhaust muffler (item #43).

**CONNECTIONS** are standard pipe thread, and be sure to use lines the same size or larger if the distance is great. Avoid extra elbows. Give the line a uniform slope away from unit and place a drain cock at the low point. For ease of servicing use a union or hose with clamps near the pump. A hose helps eliminate noise and vibration. If a vacuum/pressure supply tank is used, slope the line to it, provide a drain at the bottom and place a check valve between the tank and pump so the pump will not run backward when shut off.

**EXTRAS** such as gauges and relief valves can be very useful. A gauge shows any loss in efficiency and helps test for leaks. Where moderate vacuum/pressure is required, a relief valve will unload the pump so that it will run cooler.

**CLEANING:** If foreign particles are present in pump chamber, an experienced mechanic may remove the end plate opposite to the drive shaft end. This will permit the removal of the 4 sliding vanes for a thorough cleaning in a solvent\* and also provide accessibility to any particles which must be removed. The original body gaskets are only .001"-.005" thick therefore replace accordingly. If thicker gaskets are used, the pump efficiency will be greatly reduced.

**FLUSHING:** With the pump stopped, remove the felts from the intake and exhaust filters and wash them in a solvent. When clean and dry, replace them. Flushing of the pump is accomplished by removing the filter assemblies and while pump is running, add several teaspoons of solvent. Recommended solvents are: Loctite Safety Solvent, Inhibisol Safety Solvent, and Dow Chemical Chloroethane. Do not use Kerosene. After the solvent has passed thru the pump, replace the filter assemblies. Frequent flushing is recommended.

**WARNING:** The motor may be thermally protected and can automatically restart when the protector resets. Always disconnect power source before servicing.

**INSPECTION:** Regular inspection may prevent expensive repairs. Do not be alarmed if pump temperature reaches 150°-200°F when running continuously. If pump shows evidence of overheating or excessive noise, stop immediately for repairs. It is quickest and cheapest to remove pump from base and return it for guaranteed rebuilding.

**DANGER:** To prevent explosive hazard Do NOT pump combustible liquids or vapors with these units.

It is usually quickest and least expensive to send the motor in for repair. Authorized service facilities are located at:

Gast Manufacturing Co., Ltd.  
Halifax Road, Cressex Estate  
High Wycombe, Bucks HP12 3SN  
England  
High Wycombe 23571

Brenner-Fiedler & Assoc.  
16210 Gundry Ave.  
Paramount, CA 90723  
213/636-3206

Gast Manufacturing Corp.  
2550 Meadowbrook Road  
Benton Harbor MI 49022  
616/926-6171  
Wainbee, Ltd.  
121 City View Drive  
Rexdale, Ontario, Canada M9W 5A9  
416/243-1900

Gast Manufacturing Corp.  
505 Washington Ave.  
Carlstadt NJ 07072  
201/933-8484

Wainbee, LTD.  
215 Brunswick Blvd.  
Pointe Claire, Montreal,  
Canada H9R 4R7  
514/697-8810