

# Denford

# Cyclone P

# FANUC 21i

**DENFORD**

COMPUTERISED MACHINES AND SYSTEMS

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Operating Guide  
for the Cyclone  
TU-15Ø P Series  
CNC Lathe, with  
a FANUC 21i  
controller.

- Installation
  - Specific Features
  - Routine Maintenance
- 

This manual applies only to the machine having the serial number shown below.

Please note that this number will be required should Denford Limited be contacted regarding this machine.

Machine Serial Number : \_\_\_\_\_

Year of Manufacture : \_\_\_\_\_



Manufactured by  
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# INTRODUCTION.

This guide will describe how to transport, site and setup your Denford Cyclone TU-15Ø P CNC Lathe.

Any operational features, specific to the Cyclone TU-15Ø P, are also covered in this guide. Use of the machine control software is covered in the separate FANUC 21i control software manual delivered with your machine.

A Routine Maintenance section is also included. Please note, the Electrical Diagrams for your machine are held in a folder fixed inside the electrical control cabinet.

**IF YOU HAVE ANY DOUBTS AND/OR QUESTIONS REGARDING THE SPECIFICATION, SERVICING, OR FEATURES OF YOUR MACHINE, PLEASE CONTACT CUSTOMER SERVICES AT DENFORD. DENFORD LIMITED RESERVES THE RIGHT TO CHANGE THE SPECIFICATION AND/OR OPERATING FEATURES REGARDING THIS CNC MACHINE WITHOUT NOTICE OR DOCUMENTATION.**

## WARNING.

*The Warranty on this machine will be invalidated if any modifications, additional ancillary equipment is fitted, or any adjustments made to the controlling devices without prior notification from Denford Limited.*

*Do not carry out any portable appliance testing (PAT) on any of the supplied equipment.*

## WARNING.

*Warning! Obtain permission from the person responsible for the machine in your establishment, before opening the electrical control box to carry out ANY maintenance work. All work must be carried out by personnel suitably qualified for each maintenance task, to avoid damage to both the machine systems and the maintenance personnel.*

## FORESEEN USE OF MACHINE.

This machine is designed for turning non-hardened Ferrous metals, Aluminium, hard woods and plastics. In each case the appropriate tooling, speeds and feeds should be used as recommended by the material supplier.

Only use water based soluble oil cutting fluids, do not use parafinic or potentially explosive cutting fluid.

Do not attempt to use the machine for manual operations.

# EC DECLARATION OF CONFORMITY.

The responsible person : Mr N J H Crowther

Business Name : Denford Limited.

Address : Birds Royd,  
Brighouse,  
West Yorkshire,  
HD6 1NB,  
England.

Declares that the machinery described :

Manufacturer : Denford Limited.

Model Name : Cyclone TU-15Ø P with FANUC 21i

Serial Number : \_\_\_\_\_

conforms to the following directives : EC Machinery directive 89/392/EEC as amended  
by directive 91/368 EEC and directive 93/  
44/EEC, CE marking directive 93/68/EEC and  
low voltage directive 73/23/EEC

and the following standards : BS EN 6Ø2Ø4 - 1 : 1993

and complies with the relevant health and safety requirements.

Signature : \_\_\_\_\_

Position within company : Director / General Manager

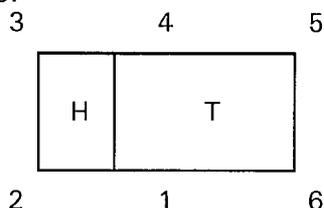
Signed at : Denford Limited,  
Birds Royd,  
Brighouse,  
West Yorkshire,  
HD6 1NB,  
England.

# NOISE LEVEL TEST.

Test Report No: NL - AC7 - Ø1.  
 Machinery Manufacturer: Denford Limited.  
 Machinery Type/Model: Cyclone TU-15Ø P  
 Test Specification in accordance with BS4813 : 1972.

Instrumentation used: Cirrus CRL 2.35A  
 Test Site: Denford Limited, Inspection Dept.

General Machine Test Conditions:  
 Chuck on size: Std.  
 Splash guard on: N/A.  
 Machine mounting: Floor.  
 Additional equipment: None.  
 Test positions:



Background Noise : 61 dB (A)  
 Maximum Spindle Speed : 5000 revs/min  
 Spindle Direction : Counter-clockwise

| Spindle<br>RPM | Speed<br>Range | Feed<br>INS/REV | Sound Levels dB (A) |    |    |    |    |    | Mean |
|----------------|----------------|-----------------|---------------------|----|----|----|----|----|------|
|                |                |                 | Position            |    |    |    |    |    |      |
|                |                |                 | 1                   | 2  | 3  | 4  | 5  | 6  |      |
| 1000           | N/A            | N/A             | 61                  | 62 | 61 | 61 | 61 | 62 | 61   |
| 1000           | N/A            | N/A             | 62                  | 62 | 62 | 61 | 62 | 62 | 62   |
| 2500           | N/A            | N/A             | 63                  | 62 | 62 | 61 | 62 | 63 | 62   |
| 3000           | N/A            | N/A             | 62                  | 62 | 62 | 62 | 63 | 63 | 62   |
| 4000           | N/A            | N/A             | 63                  | 62 | 62 | 62 | 64 | 63 | 62   |

Background Noise : 61 dB (A)  
 Maximum Spindle Speed : 5000 revs/min  
 Spindle Direction : Clockwise

| Spindle<br>RPM | Speed<br>Range | Feed<br>INS/REV | Sound Levels dB (A) |    |    |    |    |    | Mean |
|----------------|----------------|-----------------|---------------------|----|----|----|----|----|------|
|                |                |                 | Position            |    |    |    |    |    |      |
|                |                |                 | 1                   | 2  | 3  | 4  | 5  | 6  |      |
| 1000           | N/A            | N/A             | 61                  | 61 | 61 | 61 | 62 | 62 | 61   |
| 1000           | N/A            | N/A             | 62                  | 62 | 62 | 61 | 62 | 62 | 62   |
| 2500           | N/A            | N/A             | 61                  | 63 | 62 | 62 | 61 | 61 | 62   |
| 3000           | N/A            | N/A             | 62                  | 62 | 62 | 62 | 63 | 61 | 62   |
| 4000           | N/A            | N/A             | 63                  | 63 | 63 | 63 | 64 | 62 | 63   |

# UNPACKING & LIFTING THE MACHINE.

Carefully remove any main packaging from around the machine and table.

During the movement and installation period, the protective coatings and coverings applied prior to despatch should not be removed.

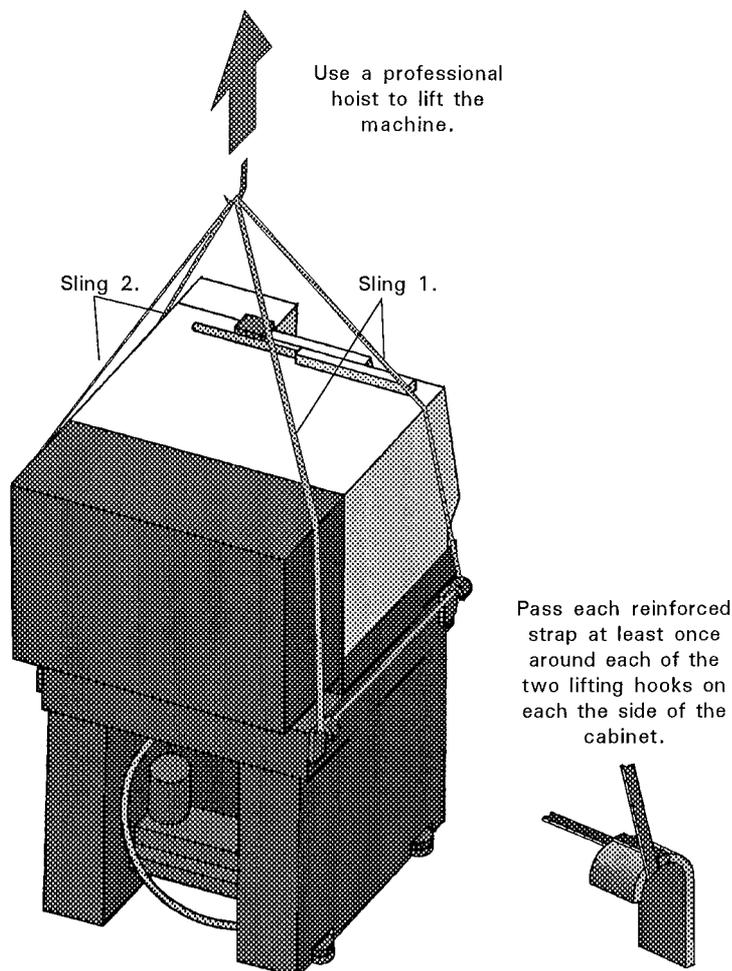
The Cyclone TU-15Ø P is a floor mounted machine, hence it is important to ensure that a level site is prepared before movement and installation.

To lift the machine, Denford recommends using a professional hoist and 2 five metre x 1000 kilo nylon slings. The slings must be fitted to the four lifting hooks on the machine, as shown in the diagram below. Each lifting hook should be wrapped around at least once by the sling.

NOTE - The Cyclone TU-15Ø P is back heavy - Ensure that the machine is secure and balanced before lifting. Ensure that the machine is secure before lifting. Always use sensible lifting precautions in accordance with Health and Safety Regulations in your establishment.

Machine dimensions:

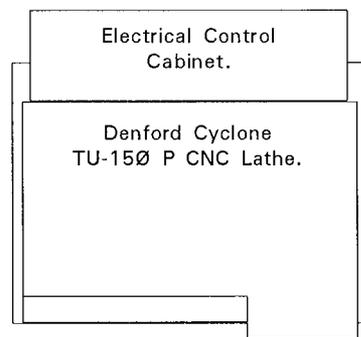
|                            |                        |
|----------------------------|------------------------|
| Machine Length .....       | 1145mm (45")           |
| Machine Width .....        | 1100mm (43.5")         |
| Machine Height .....       | 1550mm (61")           |
| Machine Weight (net) ..... | 750 Kilos (1653.5 lbs) |



# POSITIONING THE MACHINE.

Remember when positioning the machine in the room, space will be required for opening of the electrical control cabinet door, at the rear of the machine (leave a gap of at least 1000mm). Sufficient room should also be provided for effective maintenance to be carried out around the machine.

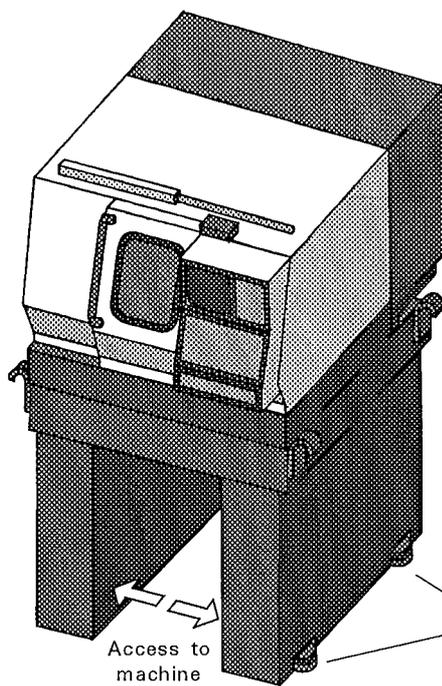
The Cyclone TU-150 P cabinet is mounted on a machine table incorporating the flood coolant tank, with the electrical control cabinet attached to the back of the machine cabinet. It is designed for a height which enables comfortable operating and programming to take place. Ideally, the user will operate the machine when standing at its front, with a clear view of both the machine table (through the front viewing window) and the controller unit, as shown in the diagram below.



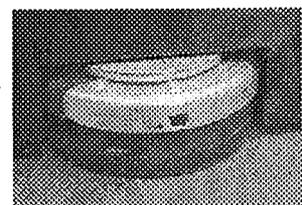
PLAN VIEW SHOWING IDEAL MACHINE OPERATING POSITIONS.



# LEVELLING THE MACHINE.



Machine table levelling pads (2 per table side)



# LEVELLING THE MACHINE.

The Cyclone TU-15Ø P stands on four anti-vibration feet. The machine bed is levelled to the cabinet during manufacture, hence it is only necessary to ensure that the cabinet is levelled during installation.

All four feet are situated at the corners of the machine table, incorporating the flood coolant tank. Access for adjustment is gained by completely removing the front wheeled coolant tank unit and adjusting each anti-vibration foot from the inside of the table.

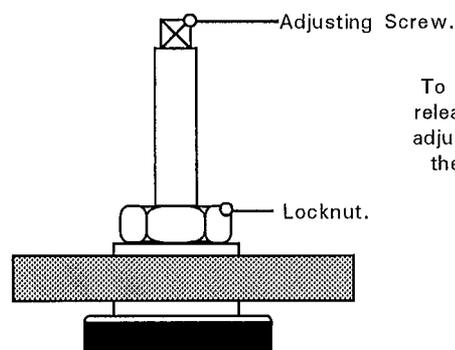
**Note** - The coolant pump cable beneath the machine is attached to the Cyclone TU-15Ø P cabinet by a spring and hook, to prevent entrapment when the coolant tank is pulled forward from the machine table.

Tools required: 1Ømm and 24mm A/F spanners.

Adjustment of anti-vibration feet:

Release the locknut on the levelling screw whilst holding the screw stationary with the 1Ømm spanner. By turning the screw CW the machine can be raised, whilst turning CCW lowers the machine. Once the machine is level, tighten all the locknuts, taking care to hold the adjusting screw stationary.

**Note:** On delivery the electrical cabinet should be sealed with a yellow tamperproof seal. If this is broken inform the suppliers immediately.



To increase the machine height, release the locknut, then turn the adjusting screw clockwise (when the adjusting screw is viewed from above).

# ELECTRICAL DIAGRAMS, CONTROL CABINET CONNECTION AND SEAL.

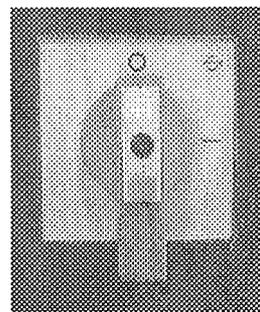
The electrical control cabinet is attached to the back of the machine cabinet.

The Electrical Diagrams and Inspection Sheets for your machine are held in a folder fixed inside the electrical control cabinet.

Access to the electrical control cabinet is obtained through the pair of doors located at the rear of the machine. Ensure that the isolator switch is in the "OFF" position and the power supply to the machine is unplugged, before opening the electrical control cabinet doors.

**Note:** Depending on the specification of the machine, some electrical cabinet doors may additionally be fitted with locks.

Isolator switch must be in "OFF" position before unlocking and opening the electrical cabinet doors.



**Warning!** Do not connect cables between any electrical hardware with the mains power switched on, since this could damage the hardware.

The electrical control cabinet is inspected then sealed with a yellow seal; if this seal is broken on delivery, inform the suppliers immediately. The seal should only be broken for the initial mains power connection.

All electrical connections must be carried out by a suitably qualified electrical engineer.

**Warning!** Obtain permission from the person responsible for the machine in your establishment, before opening the electrical control cabinet to carry out ANY maintenance work. All work must be carried out by personnel suitably qualified for each maintenance task, to avoid damage to both the machine systems and the maintenance personnel.

# CONNECTING THE MAINS SUPPLY.

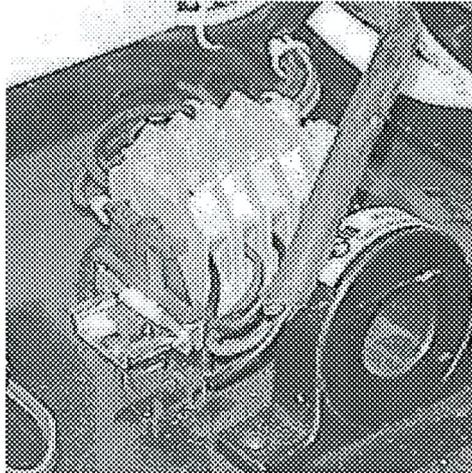
The electrical power supply is fed to the electrical control cabinet, attached to the back of the machine cabinet, which in turn is connected to the lathe.

Connection procedure:

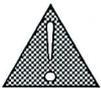
- 1) Switch the isolator to "OFF", then unlock and open the the electrical control cabinet (breaking the delivery seal).
- 2) The isolator is located in the top centre position, the mains connection block is located in the bottom right corner, viewed from the back of the machine.
- 3) Put crimp connectors on all five/six mains cable wires (three live, one neutral, one or two earth).
- 4) Connect these mains wires into the contact block, as shown in the diagram below.

Tool required:

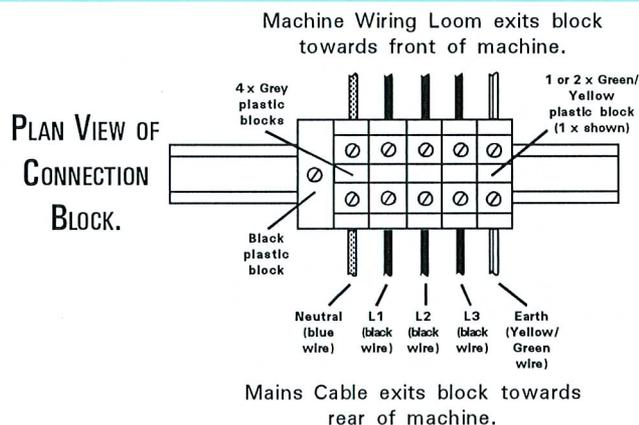
Flathead screwdriver and crimping pliers.



Mains Connection Block.

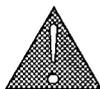


*The electrical diagrams are shown for illustrative purposes only. The location and arrangement of wiring for your machine may differ according to its specification. Note the clear labelling of terminals on your machine before following the connection procedures listed here.*



# CONNECTING THE MAINS SUPPLY.

The supply is 380/415 Volts 3 Phase 50/60 Hz.  
Cable required:- 3 Core + Neutral + Earth, 2.5mm<sup>2</sup>  
per core.  
Current Taken 12 Amps.



*All electrical connections must be carried out by a suitably qualified electrical engineer.*

*Warning! If the neutral conductor is isolated from earth potential, then the machine(s) must be protected by a Residual Current Device (RCD).*

At this stage, it is required to check that the phases on the mains power are connected correctly. The simplest method to check the phases is to switch on the coolant by pressing the [COOLANT ON] button, then the [COOLANT OFF] button, located on the FANUC controller.

The coolant pump is located at the back of the removable flood coolant tank unit, the middle unit of the machine table, when viewed from the front. If the pump spindle is rotating in a clockwise direction (when viewed directly from above) then the phases are wired correctly. If the spindle is rotating in an anticlockwise direction, the phases must be switched over. When adjusting phases, only switch between two selected wires from the three available.

# REMOVAL OF PROTECTIVE COATINGS.

Once the machine has been sited and connected electrically, the protective coatings must be removed to prepare the machine for running.

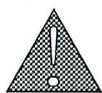
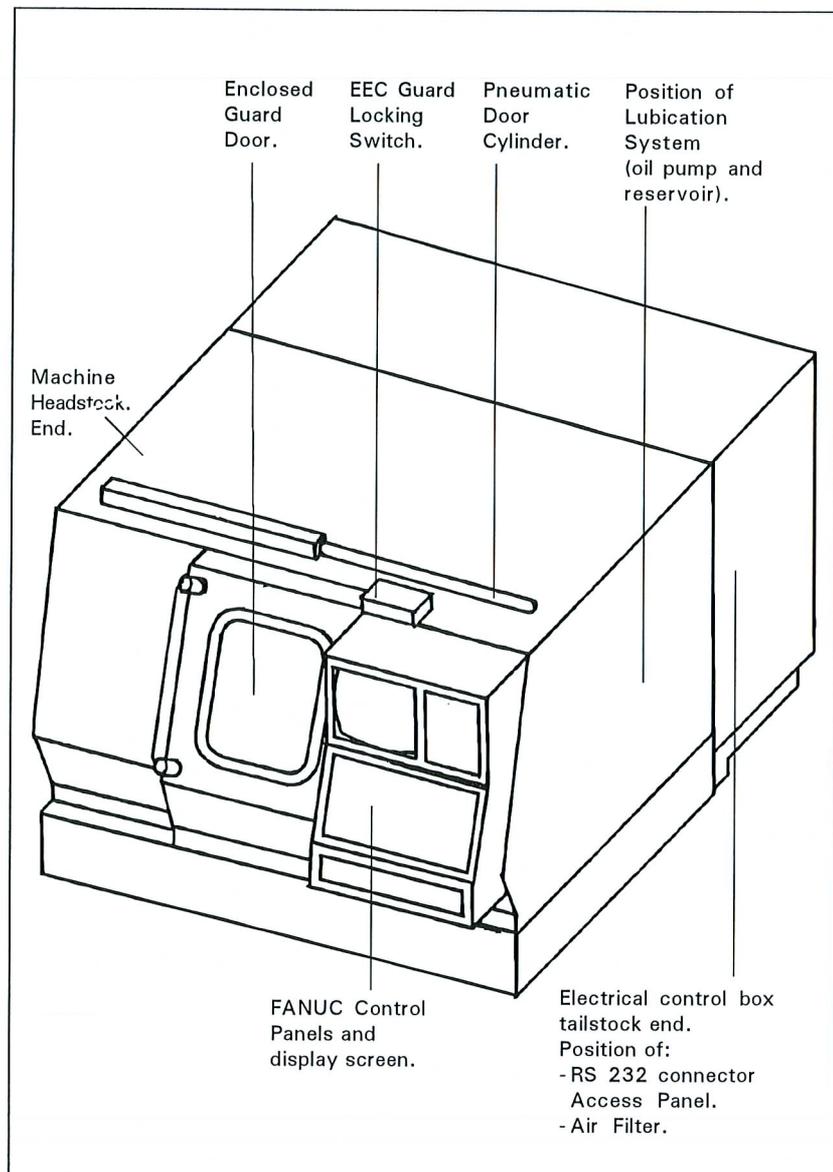
The protective coatings applied to the slideways and bright surfaces can be removed using a kerosene based solvent. The coatings must be removed from the slideways before any attempt to move them is made. Once these protective coatings have been removed, all untreated surfaces should be coated with a light covering of machine oil (eg BP: CS 68).



*Warning! Only use kerosene based solvents in accordance with the solvent manufacturers instructions and safety recommendations. Ensure that no naked flames are present.*

The protective plastic sheeting on the guard windows should be removed and the glass and perspex cleaned with an anti-static cleaner.

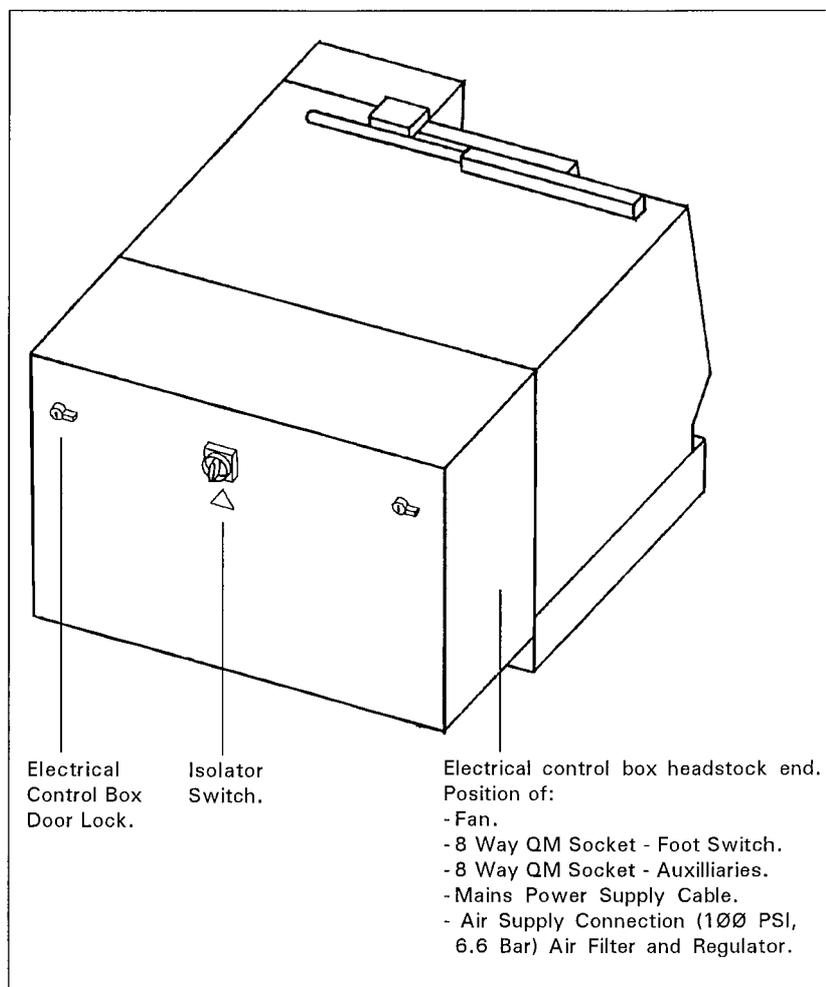
# CYCLONE TU-150-P - GENERAL LAYOUT - FRONT VIEW.



## PLEASE NOTE.

*Please Note - The positions of any ancillary components shown in these diagrams may differ on your machine due to specification and/or engineering component updates.*

# CYCLONE TU-150-P - GENERAL LAYOUT - BACK VIEW.



## AIR PIPE CONNECTION.

### AIR PIPE CONNECTION.

Air Connection 100 PSI, 6.6 Bar.

The pneumatic chuck and pneumatic machine door, require an air compressor fitted with a SCHRADER quick release connector.

The connection fitted onto the machine air filter regulator is SCHRADER part number SC 8051-11 1/8 BSP MALE (or Denford part number BI 01451S).

The female connector required on the 1/4" pipe leading to the air compressor is SCHRADER part number 9793C-12 1/4" BSP FEMALE (or Denford part number BI 01128S).

## PNEUMATIC GUARD DOOR OPERATION.

### PNEUMATIC GUARD DOOR OPERATION.

The opening and closing of the machine guard door is controlled using the following M codes:

To open guard, program code M38.

To close guard, program code M39.

M codes can be entered using MDI mode (see page 26 for an example of running in MDI mode).

The system defaults to guard close (M39). Pressing the Emergency Stop button has no effect on the operation of the guard. When the pneumatic power is off or disconnected, the guard can be operated manually (unless an EEC locking switch is fitted).

Note - on machines fitted with an EEC guard locking switch, the EEC guard locking switch will not allow the door to be opened if the power is not switched on.

# GENERAL SAFETY PRECAUTIONS.

## General Safety Precautions :

- Wear clothing suitable for operating the machine and follow the safe working procedures in place at your establishment.
- Do not place any objects so that they interfere with the guards or the operation of the machine.
- Never try to clean the machine if any part of it is rotating, or in motion.
- Ensure that the correct cable for the power source is used.
- If power fails turn off the yellow isolator (found on the electrical control cabinet) immediately.
- Ensure the power is switched off before starting any maintenance work on the machine or opening/working on the electrical control cabinet.
- Check the state of the slideway lubrication daily, to prevent the axes from becoming jammed.
- Further operational safety precautions are outlined in the separate FANUC control manuals delivered with your machine.

Note - Training courses are available on request.

# EMERGENCY STOP BUTTON.

## EMERGENCY STOP BUTTON.

The red emergency stop button is fitted on the FANUC control panel, mounted on the righthand side of the machine. When depressed it has the effect of stopping all axis and spindle movement. To reset, push the button in and turn clockwise. After pressing the emergency stop button, home both machines axes.

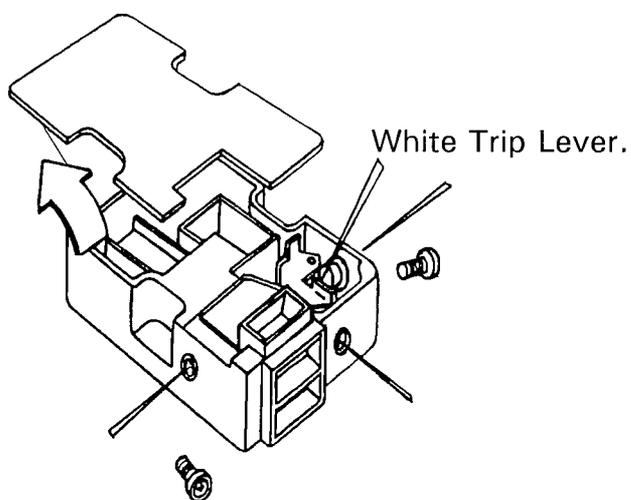
# GUARD DOOR SAFETY SWITCH.

## GUARD DOOR SAFETY SWITCH.

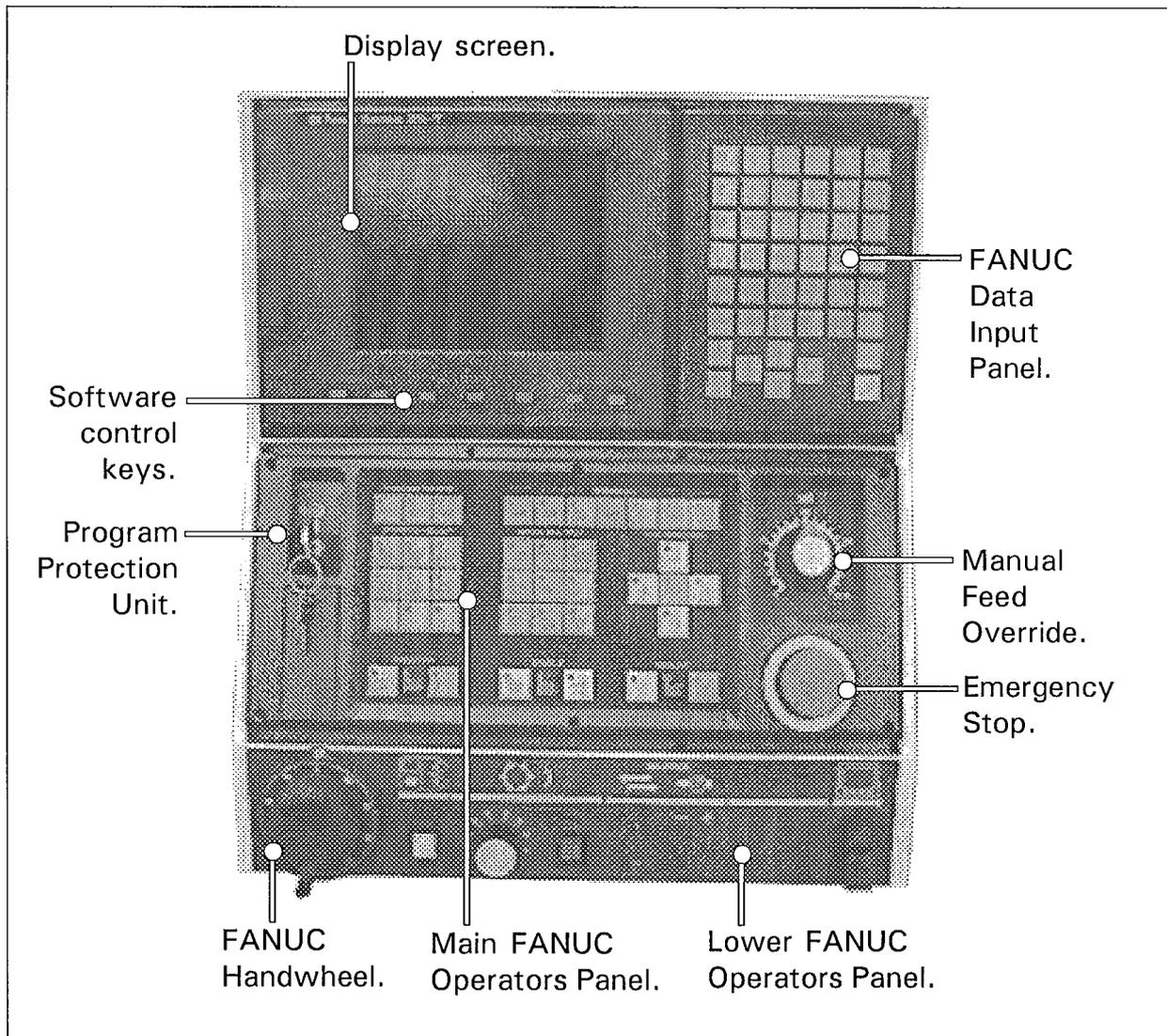
To enter the working area when the 24 volt circuit has failed and the door is clamped electrically. As indicated in the diagram below:

1) The cover of the safety switch can be removed using the special tool (supplied in the toolkit) to remove the special tamper proof screws (6); the internal workings of the switch are now exposed. Alternatively, by removing any of the three screws indicated, the white trip lever may be moved using a 2mm dia. rod through the screw hole.

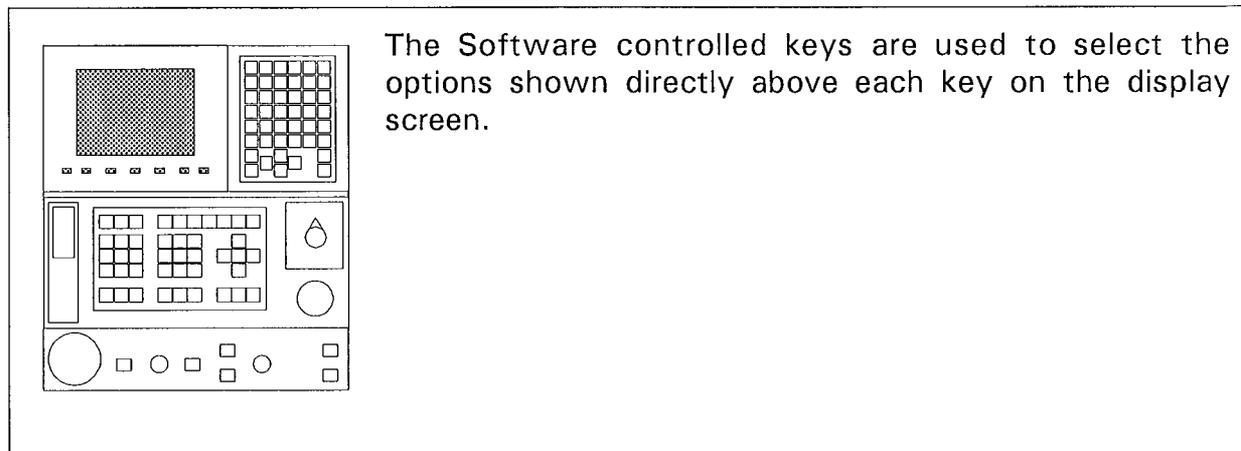
2) Using a screwdriver, or similar tool, move the white trip lever to the right to operate the switch, keeping this depressed the door can now be opened.



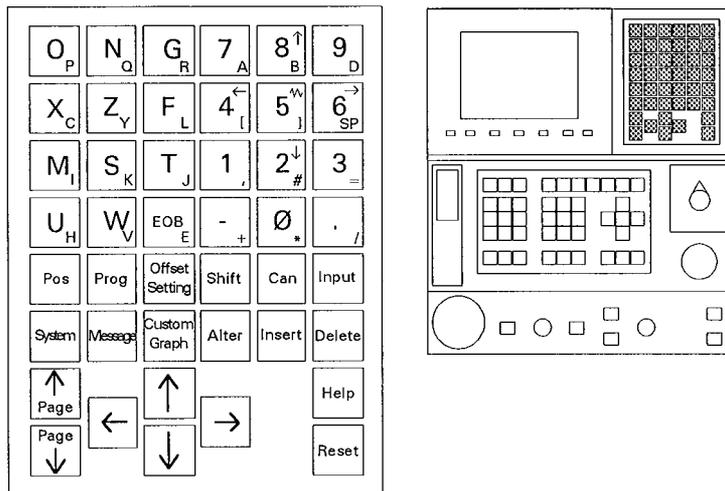
# GENERAL LAYOUT OF MACHINE CONTROL PANEL.



## DISPLAY AREA LAYOUT.



# FANUC DATA INPUT PANEL.



[RESET] - Resets any alarm messages.

[HELP] - Obtain help when using MDI keys.

[ADDRESS/NUMERIC] - Used to enter letters and numbers.

[SHIFT] - Pressing [SHIFT] followed by an address key will input the lower-right character on the address key. The character ^ is displayed to indicate that the lower-right character will be displayed.

[INPUT] - Used when data from the key input buffer needs writing to the offset register.

[CAN] - Deletes characters from the key input buffer.

[ALTER] - Edit program - alter character.

[INSERT] - Edit program - insert character.

[DELETE] - Edit program - delete character.

[POS] [PROG] ... - Used to switch screens for each function.

[POS] - Displays current position.

[PROG] - Displays and edits a program stored in memory.

[OFFSET SETTING] - Displays offset values and data.

[SYSTEM] - Displays and sets a parameter and pitch error compensation value and displays self diagnostic data.

[MESSAGE] - Displays an alarm messages and data.

[CUSTOM GRAPH] - Displays graphical data.

[CURSOR RIGHT] - Moves cursor right, or forwards, in small units.

[CURSOR LEFT] - Moves cursor left, or backwards, in small units.

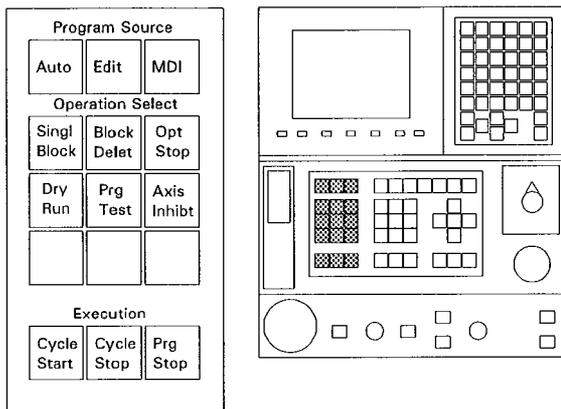
[CURSOR DOWN] - Moves cursor down, or forwards, in large units.

[CURSOR UP] - Moves cursor up, or backwards, in large units.

[PAGE UP] - Display the previous page.

[PAGE DOWN] - Display the next page.

# MAIN FANUC OPERATORS PANEL.



## AUTOMATIC OPERATION PANEL KEYS.

### *Program Source:*

[AUTO] -  - Select to run program (Auto mode).

[EDIT] -  - Select to edit program (Edit mode).

[MDI] -  - Select to manually key in G & M Codes out of program mode.

### *Operation Select:*

[SINGL BLOCK] -  - Allows single step execution of program.

[BLOCK DELETE] -  - Select in edit mode to ignore block when running program (Activates \ in front of block)

[OPT STOP] -  - Used in conjunction with MO1 to optionally stop program.

[DRY RUN] -  - Runs program through at jog feed rate.

[PRG TEST] -  - Runs program through ignoring all M codes.

[AXIS INHIBIT] -  - Runs program through with axes locked.

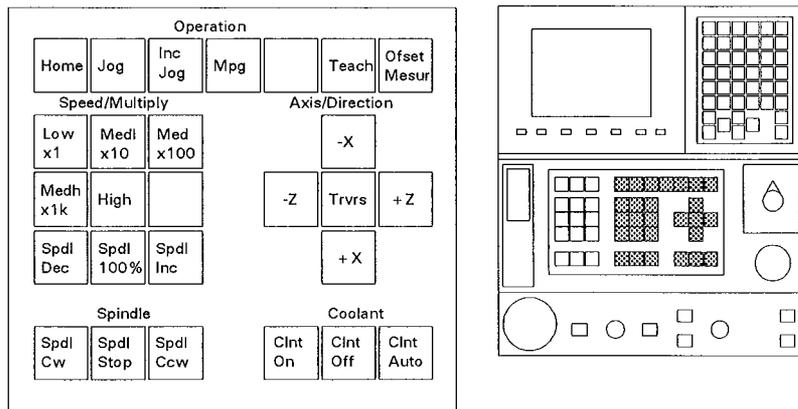
### *Execution:*

[CYCLE START] -  - Starts program.

[CYCLE STOP] -  - Stops program.

[PRG STOP] -  - Stops program at end of current block.

# MAIN FANUC OPERATORS PANEL.



## FANUC MANUAL OPERATION PANEL KEYS.

### *Operation:*

- [HOME] -  - Zeros machine around its own reference points.
- [JOG] -  - Moves axes around at feeds as set on override.
- [INC JOG] -  - Moves axes at 0.001, 0.01, 0.1, 1 Increments.
- [MPG] -  - Manual Pulse Generator (Electronic Handwheel Control).
- [TEACH] -  - Inputs actual machine position into program.
- [OFSET MESUR] -  - Registers actual slide positions for inputting of tool offsets.

### *Speed/Multiply:*

- [X 1] -  - Multiplier selection for handwheel control MPG or INC JOG mode - x1.
- [X 10] -  - Multiplier selection for handwheel control MPG or INC JOG mode - x10.
- [X 100] -  - Multiplier selection for handwheel control MPG or INC JOG mode - x100.
- [X 1K] -  - Multiplier selection for handwheel control MPG or INC JOG mode - x1k.
- [HIGH] -  - Multiplier selection for handwheel control MPG or INC JOG mode - High.
- [SPDL DEC] -  - Spindle Decrease (Override of SPDL 100%), -10 %.
- [SPDL 100%] -  - Reverts spindle speed back to programmed value.
- [SPDL INC] -  - Spindle increase (Override of SPDL 100%), +10 %.

continued on next page....

# MAIN FANUC OPERATORS PANEL.

....continued from previous page.

*Axis/Direction - Press either [JOG] or [MPG] to operate:*

[-X] - Movement in -X direction.

[+ X] - Movement in + X direction.

[-Z] - Movement in -Z direction.

[+ Z] - Movement in + Z direction.

[TRVRS] -  - Rapid Traverse (toggle switch).

*Spindle:*

[CW] -  - Spindle movement clockwise.

[STOP] -  - Spindle Stop.

[CCW] -  - Spindle movement counter clockwise.

*Coolant:*

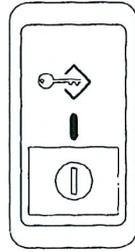
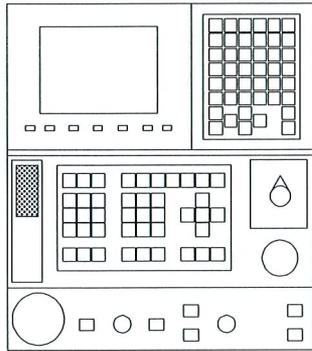
[CLNT ON] -  - Coolant on.

[CLNT OFF] -  - Coolant off.

[CLNT AUTO] -  - Coolant operated by program.

# PROGRAM

## PROTECTION UNIT.

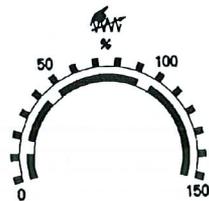
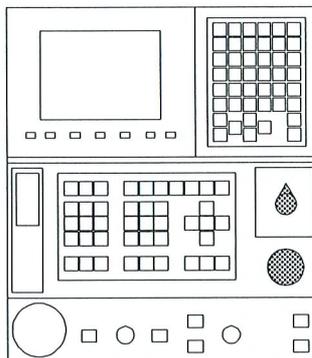


Key operated protection switch.

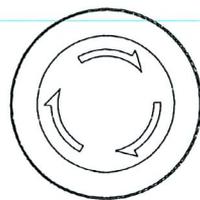
[SWITCHED ON] - Protects programs from tampering or accidental erasure.

[SWITCHED OFF] - Allows full program editing.

## EMERGENCY STOP & MANUAL FEED OVERRIDE.

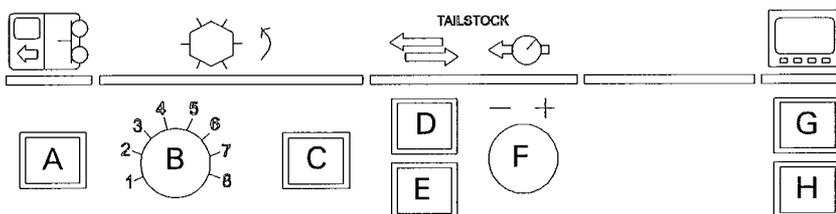
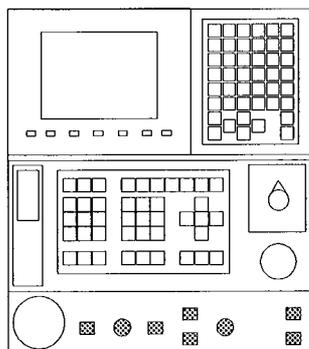


The manual feed override dial provides manual override of the program feed and rapid traverse rates and override of axis direction feed rates.



When pressed, the emergency stop button will cut all power to the drives.

# LOWER FANUC OPERATORS PANEL.



## *Override:*

A) [GUARD OVERRIDE] - Manual guard switch override. Opening the machine guard will activate a fail safe microswitch and stop the machine. To override this system during setting, etc, hold the button depressed while opening the door, then release the button. Once the door has been closed again, the system will return to its original condition.

## *Automatic Tool Changer:*

B) [TOOL INDEX NO. SELECTOR DIAL] - Select the number of the tool required, then press the [TOOL INDEX START] button. This cannot be operated in Auto Mode.

C) [TOOL INDEX START] - Begins movement of the automatic toolpost to the requested position.

## *Tailstock (optional):*

D) [TOP TAILSTOCK DIRECTION] - Manual control of the tailstock direction (in)

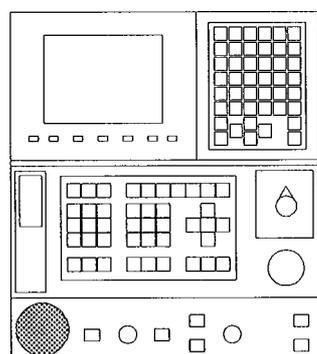
E) [LOWER TAILSTOCK DIRECTION] - Manual control of the tailstock direction (out).

F) [TAILSTOCK QUILL PRESSURE] - Regulator adjusting the tailstock quill pressure.

## *Control:*

G) [START CONTROL] - Green button to start the control system.

H) [CLOSE CONTROL] - Red button to close down the control system.

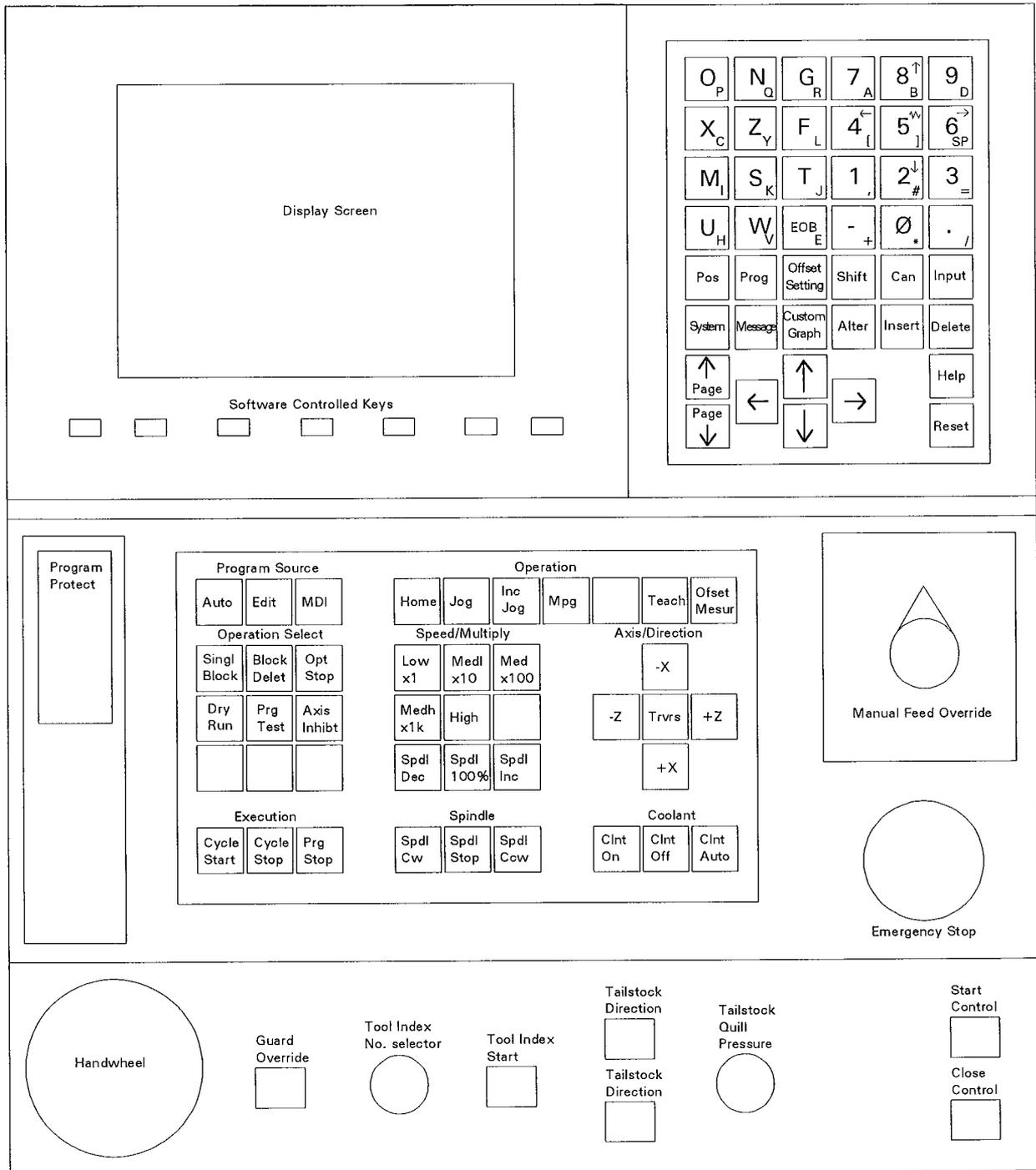


The FANUC Handwheel, MPG (Manual Pulse Generator). Manual movements of Z, Y and Z axes when operating in handwheel mode.

Clockwise = Positive direction.

Counter clockwise = Negative direction.

# CONTROL PANEL - QUICK REFERENCE DIAGRAM.



# SWITCHING THE MACHINE ON/OFF.

## SWITCHING THE MACHINE 'ON'.

Power up the machine by turning the yellow rotary isolator switch on the electrical control cabinet door to the 'on' position.

Press the green 'control on' button once (on the righthand side of the lower FANUC control panel) to initialise power to the FANUC controller.

When the first display screens have loaded, press the flashing green 'control on' button again to fully power up the controller.

## SWITCHING THE MACHINE 'OFF'.

Press the red 'control off' button (on the righthand side of the lower FANUC control panel) to power down the FANUC controller.

Power down the machine by turning the yellow rotary isolator switch on the electrical control cabinet door to the 'off' position.

The machine must not be turned off if a turning program is running, or the machine is cutting work....

# DATUMING THE MACHINE AXES.

Use the following procedure to datum (home) the machine axes:

- 1) Press the [PROG] key on the FANUC data panel until the screen is running in MDI mode - the [PROG] key toggles between MDI and Program modes. Note - check that the [MDI] key on the main FANUC operators panel is also illuminated.
- 2) Press the [EOB] key (to access the ; character) followed by the [INSERT] key, both found on the FANUC data panel. The first program line should read **O 0000 ;**  
Type the second program line **G91 G28 X0 Z0 ;** and press the [INSERT] key on the FANUC data panel.
- 3) Cursor to the beginning of the program and press [CYCLE START] on the main FANUC operators panel to start the program.

# RUN IN PROCEDURES (STARTING THE SPINDLE).

Before working on the Cyclone TU-15Ø P for the first time, it is important that the spindle is "run in" for a set period:

| Speed.   | Time.  |
|----------|--------|
| 5ØØ rpm  | 15 min |
| 1ØØØ rpm | 1Ø min |
| 2ØØØ rpm | 1Ø min |
| 3ØØØ rpm | 1Ø min |

Use the following procedure to "run in " the spindle:

1) Press the [PROG] key on the FANUC data panel until the screen is running in MDI mode - the [PROG] key toggles between MDI and Program modes. Note - check that the [MDI] key on the main FANUC operators panel is also illuminated.

2) Press the [EOB] key (to access the ; character) followed by the [INSERT] key, both found on the FANUC data panel. The first program line should read **O ØØØØ ;**

Type the second program line **M Ø3 S 5ØØ ;** and press the [INSERT] key on the FANUC data panel.

3) Cursor to the beginning of the program and press [CYCLE START] on the main FANUC operators panel to start the program.

Note - Ensure that SPDL 1ØØ% is activated on the main FANUC operators panel.

4) After the correct time period for this spindle speed stated in the table above, press the [SPDL STOP] key on the main FANUC operators panel, to stop the spindle.

5) To change the spindle speed, re-enter the program but change the **S** value in the second program line to read the next spindle speed stated in the running-in table above.

6) Cursor to the beginning of the program and press [CYCLE START] on the main FANUC operators panel to start the program.

7) After the correct time period for this spindle speed stated in the table above, press the [SPDL STOP] key on the main FANUC operators panel, to stop the spindle.

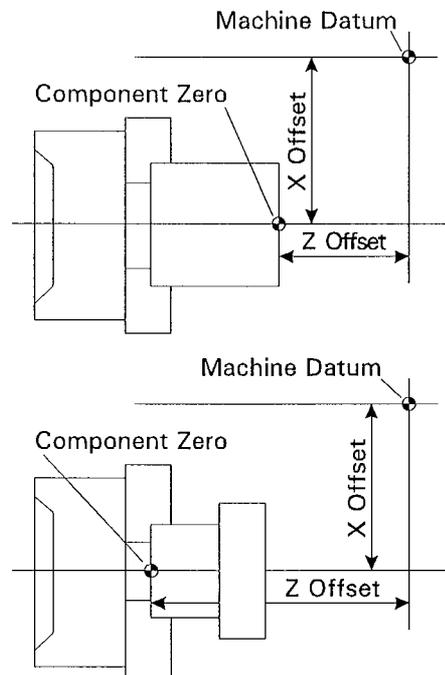
8) Run through this procedure until all spindle speeds have been run for their stated time periods.

# COMPONENT ZERO (WORK SHIFT).

Component zero is the datum from which all component co-ordinate values are referred. Component zero is also called the work zero or work datum point.

The programmer chooses component zero to lie on some position in the Z plane (the zero position for X will always lie on the spindle centre-line), at a point which is convenient to describe component lengths. To establish this work zero position relative to the machine datum, Work Shift is available.

Note that the component zero position selected for the first operation in a program may not be the required position for the second operation in a program.



The statements for Work Shift are as follows:

Z = Set up value Z .ie. The incremental distance (with sign) from the component zero to the machine datum.

Example: This will move the zero position from the machine datum to a position towards the component being turned.

The value is entered into the control via the keyboard as part of the machine setting procedure (see your separate Fanuc Manual for further information and display).

After initial power up and when slide reference has taken place, the position registers will read Zero. Each tool is selected whereby its cutting edge becomes (X and Z) of the co-ordinate system. All the tools can be set in turn and their values stored in the tool offset register.

# TOOL SETTING PROCEDURE.

This section uses the following terminology:

softkey = Software option displayed at the base of screen controlled by the appropriate key below its title.

softkey: [LEFT ARROW] will view previous menus and commands.

softkey: [RIGHT ARROW] will view next menus and commands.

The Tool Setting procedure can be carried out using a number of different methods. One of these methods is listed below::

1) *Clear any registered offset values.*

To clear any values present in the offsets file, press the [OFFSET SETTING] key on the FANUC data panel. From the displayed menu at the base of the screen, press softkey: [OFFSETS], followed by softkey: [OPRT]. Use softkey: [RIGHT ARROW] to toggle through options and press softkey: [CLEAR], followed by softkey: [ALL]. This will zero all the values registered in the offsets table.

2) *Clear any registered work shift values.*

Press the [OFFSET SETTING] key on the FANUC data panel. Use softkey: [RIGHT ARROW] to toggle through options and press softkey: [W.SHFT]. Use the [CURSOR ARROW] keys on the FANUC data panel to highlight the values to be changed. Enter a value of 'zero' on the edit line and press softkey: [INPUT] to clear each value.

3) *Enter Work Shift values for your Reference Tool.*

Use the [Tool Index dial] and [Tool Select] button on the lower FANUC operators panel to change to the reference tool (this will be tool number 1). Press the [SPDL CW] key on the main FANUC operators panel. Using the [AXIS] keys in [JOG] mode, or the handwheel in [MPG] mode, touch on the end of the work and face off. Press [SPDL STOP] on the main FANUC operators panel to stop the spindle.

Press the [OFFSET SETTING] key on the FANUC data panel. Use softkey: [RIGHT ARROW] to toggle through options and press softkey: [W.SHFT]. Use the [CURSOR ARROW] keys on the FANUC data panel to highlight the Z 'measurement' value. Enter a value of 'zero' on the edit line and press softkey: [INPUT]. The Z work shift value is now set.

# TOOL SETTING PROCEDURE.

Press the [SPDL CW] key on the main FANUC operators panel. Using the [AXIS] keys in [JOG] mode, or the handwheel in [MPG] mode, turn an outside diameter, moving away in the Z axis only. Press [SPDL STOP] on the main FANUC operators panel to stop the spindle. Measure the outside diameter just turned.

Press the [OFFSET SETTING] key on the FANUC data panel. Use softkey: [RIGHT ARROW] to toggle through options and press softkey: [W.SHFT]. Use the [CURSOR ARROW] keys on the FANUC data panel to highlight the X 'measurement' value. Enter the value of 'the outside diameter just turned' on the edit line and press softkey: [INPUT]. The X work shift value is now set.

#### 4) *Enter Offset values for all remaining Tools.*

Use the [Tool Index dial] and [Tool Select] button on the lower FANUC operators panel to change to the next tool. Using the [AXIS] keys in [JOG] mode, or the handwheel in [MPG] mode, gently touch on the end of the work.

Press the [OFFSET SETTING] key on the FANUC data panel. Press softkey: [OFFSET] followed by softkey: [GEOM]. Use the [CURSOR ARROW] keys on the FANUC data panel to highlight the Z value for the required tool number. Press [Z] followed by the value required (usually zero) and press softkey: [OPRT] followed by softkey: [MEASUR].

Using the [AXIS] keys in [JOG] mode, or the handwheel in [MPG] mode, gently touch on the outside diameter of the work.

Press the [OFFSET SETTING] key on the FANUC data panel. Press softkey: [OFFSET] followed by softkey: [GEOM]. Use the [CURSOR ARROW] keys on the FANUC data panel to highlight the X value for the required tool number. Press [X] followed by the value required (usually the 'measured' diameter) and press softkey: [OPRT] followed by softkey: [MEASUR].

Use the [CURSOR ARROW] keys on the FANUC data panel to highlight any tool radius / orientation values for the required tool number. Enter the value required and press softkey: [INPUT].

Repeat procedure 4) for all remaining tools.

# FORMATTING PROCEDURE.

Formatting is used to provide the control with a standardised pattern of input data.

The procedure is also referred to as Initialisation, or Safe Start.

The control system will only perform the operations that it has been instructed to perform.

Typical formatting conditions are as follows:

- a) G20, G21 (Inch, Metric).
- b) G00, G01 (Rapid, Feed Movement).
- c) G40, G41, G42 (Tool Nose Radius Compensation).
- d) G98, G99 (Feed/min, Feed/rev).
- e) G96, G97 (CSS, Direct rpm).
- f) S.... M03, M04 (Spindle Speed and Direction).
- g) M06 T.... (Tool Number).
- h) G50 S.... (CSS rpm Limit).
- i) G96 S.... (CSS and Cutting Speed).

Example Program Start:

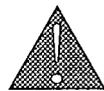
```
:O001  
N10 G21 G97 G99 G40  
N15 G96 S350  
N20 M06 T0101  
N30 M03 G0 X100 Z100  
N40 G50 S5000  
N60 G01 X.... Z.... F....
```

# CONNECTION DIAGRAM FOR AIR CHUCK CYLINDER.



## **IMPORTANT !!**

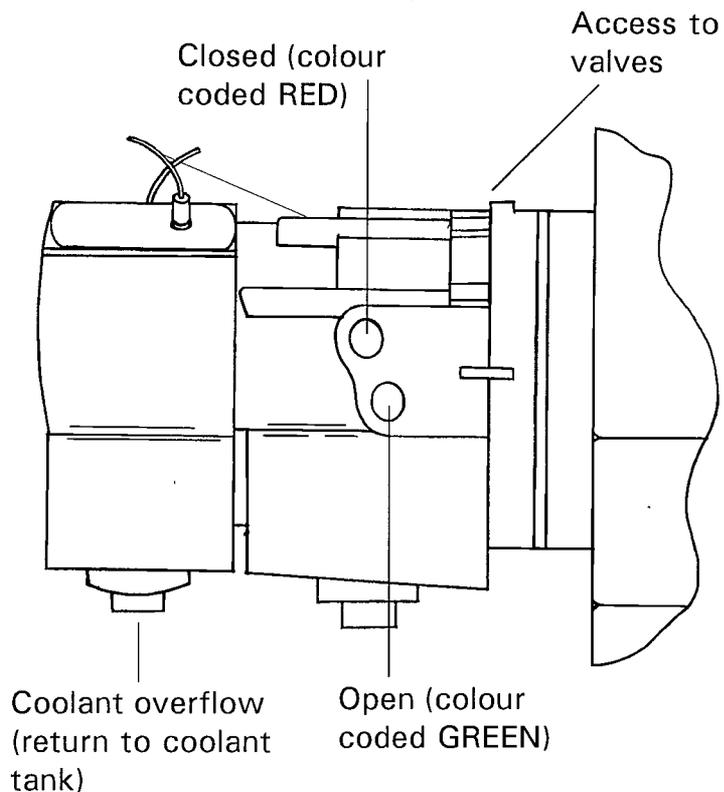
*Please note that auxiliary components may differ from those shown and described, according to the model specified and fitted. If you have any doubts concerning the connection and operating features for the auxiliary components fitted to your machine, please contact Denford Limited, or your local Denford agent, for further details.*



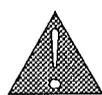
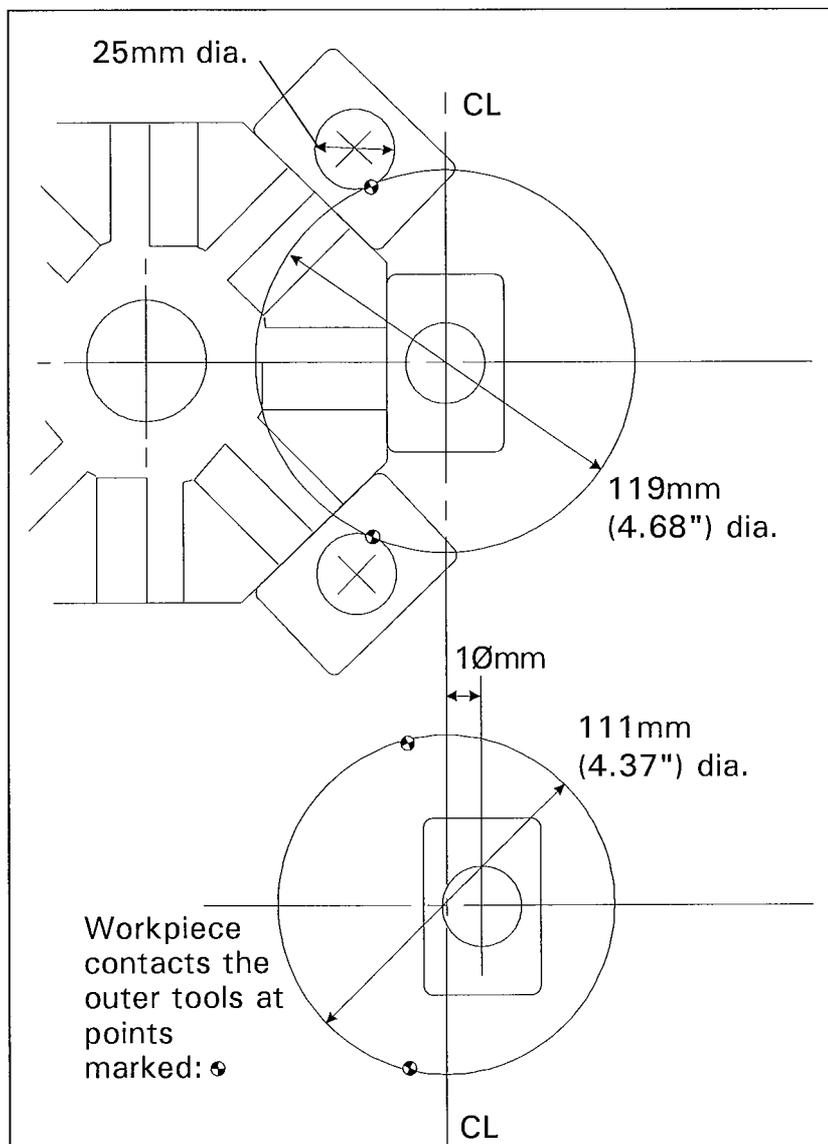
*Only workholding equipment approved by Denford Ltd should be used on the machine.*

*Only high speed chucks should be used and they must comply with BS 1983 and DIN 6350.*

The air chuck cylinder is mounted on the outside of the headstock end panel of the machine cabinet.  
Connect the tank and compressor to the air chuck cylinder as shown in the diagram below.

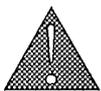
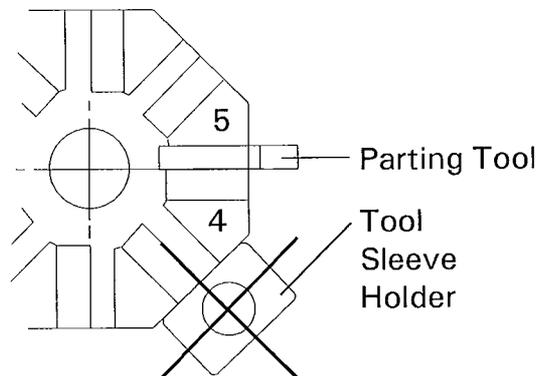


# TURRET SWING EXTENT.



**IF A PARTS CATCHER IS FITTED TO THE MACHINE THEN A TOOL SLEEVE HOLDER MUST NOT BE FITTED IN THE STATION PRIOR TO THE PARTING OFF TOOL.**

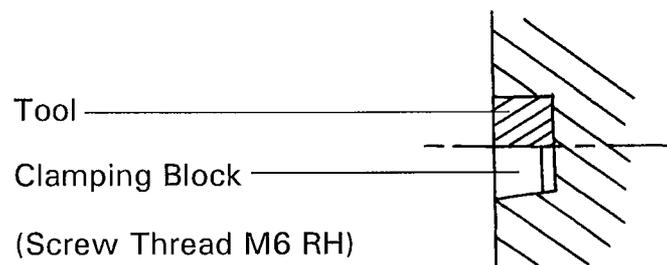
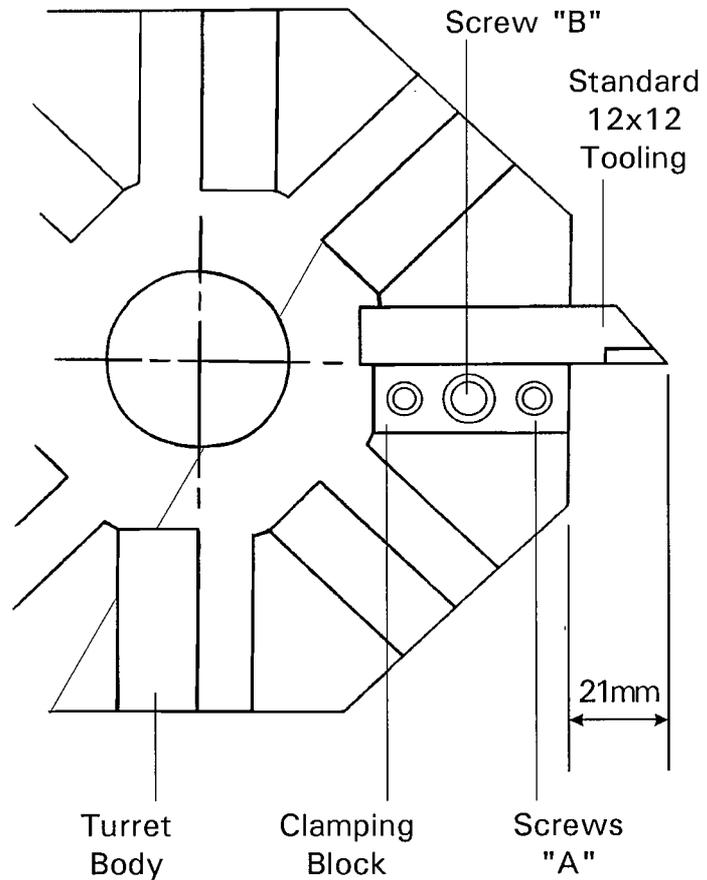
i.e. If the parting off tool is fitted in station 5 then an axial toolholder must not be fitted in station 4. During the turning operation the Parts Catcher should be in the **RETRACTED POSITION**. In the programming block prior to parting off, the parts catcher should be activated.



## **IMPORTANT !!**

*Please note that auxiliary components may differ from those shown and described, according to the model specified and fitted. If you have any doubts concerning the connection and operating features for the auxiliary components fitted to your machine, please contact Denford Limited, or your local Denford agent, for further details.*

# TURRET TOOL CLAMPING.



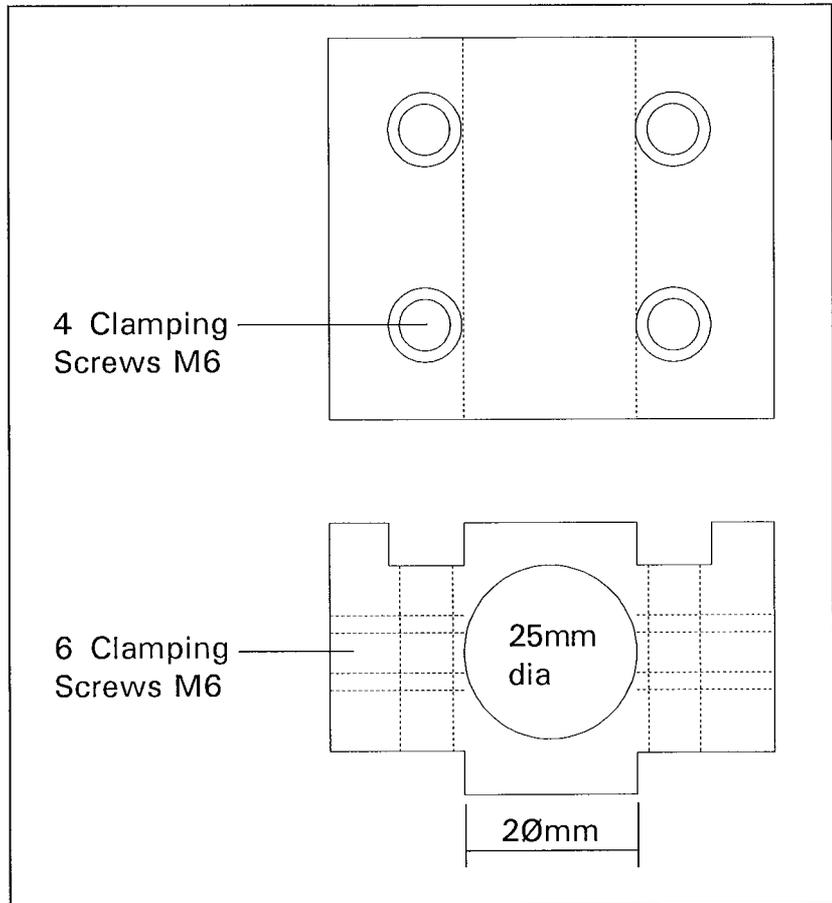
## Tool Mounting Procedure:

- 1) Before mounting tool ensure screw 'B' is tightened down fully - see diagram on previous page.
- 2) Tighten clamping block on turret head using screws "A". At this point tighten screws only 3 or 4 turns.
- 3) Place cutting tool between clamp and turret with approximately 21mm protruding from turret.
- 4) Ensure tool and clamping block are square with turret head before evenly tightening screws "A".

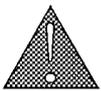
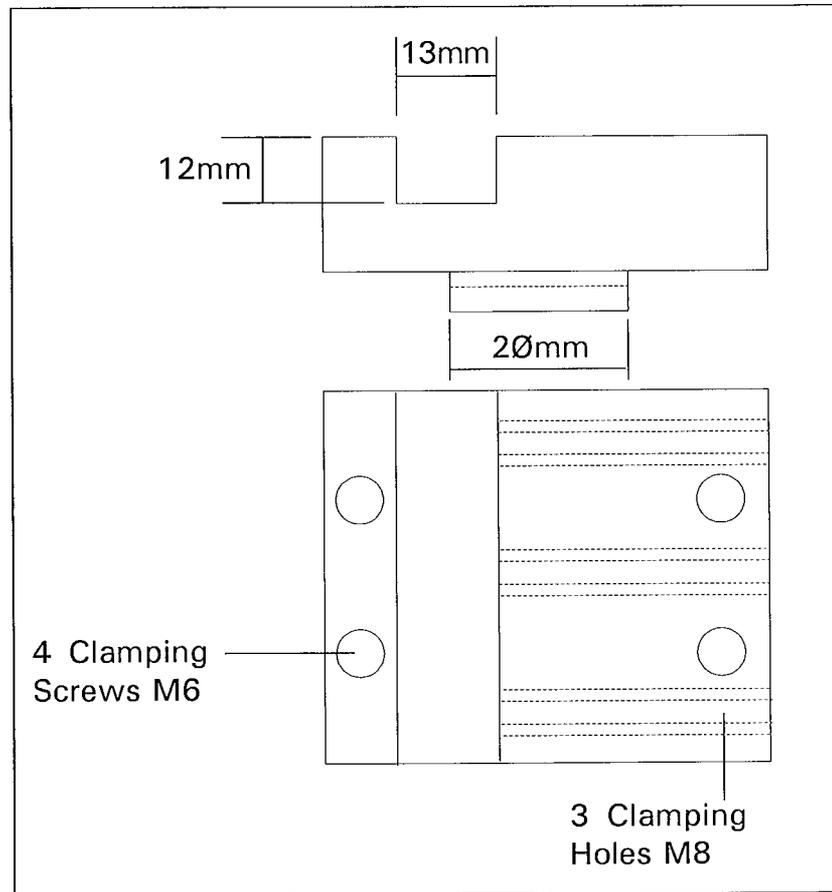
## To remove cutting tool:

- 1) Sufficiently loosen screws "A".
- 2) Unscrew "B" to eject Clamping Block.
- 3) Remove cutting tool.

# TURRET TOOL SLEEVE HOLDER (AC2 811A).



# AXIAL TOOL HOLDER (AC2 / 819A).

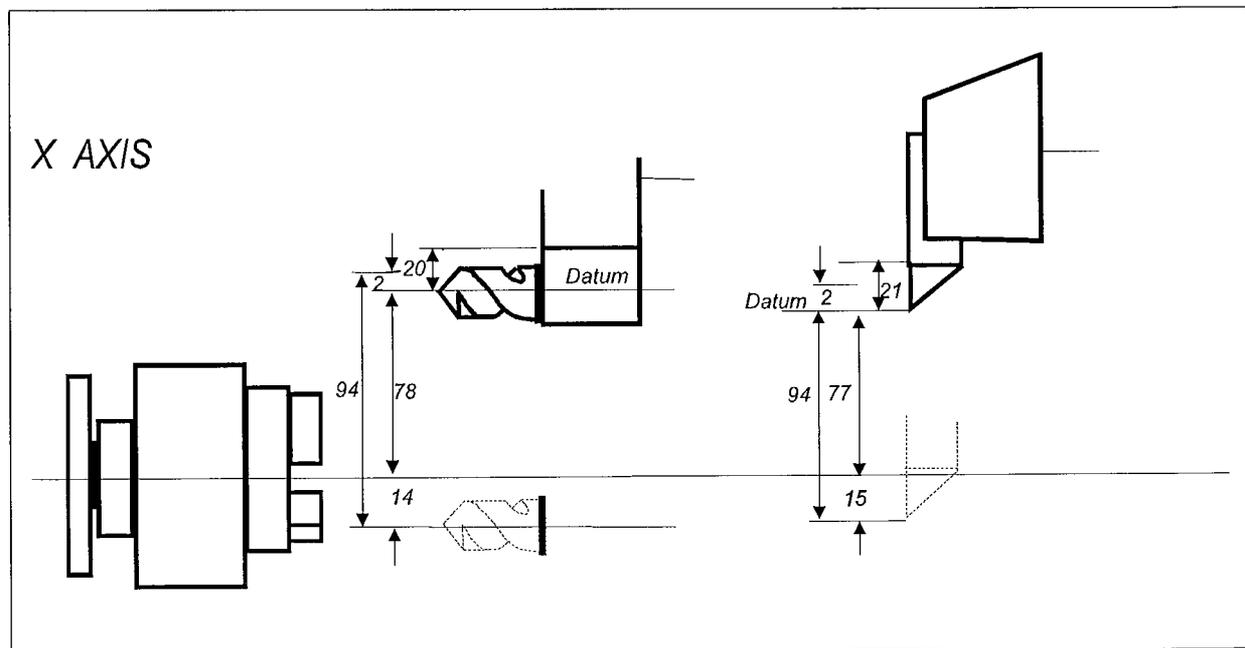
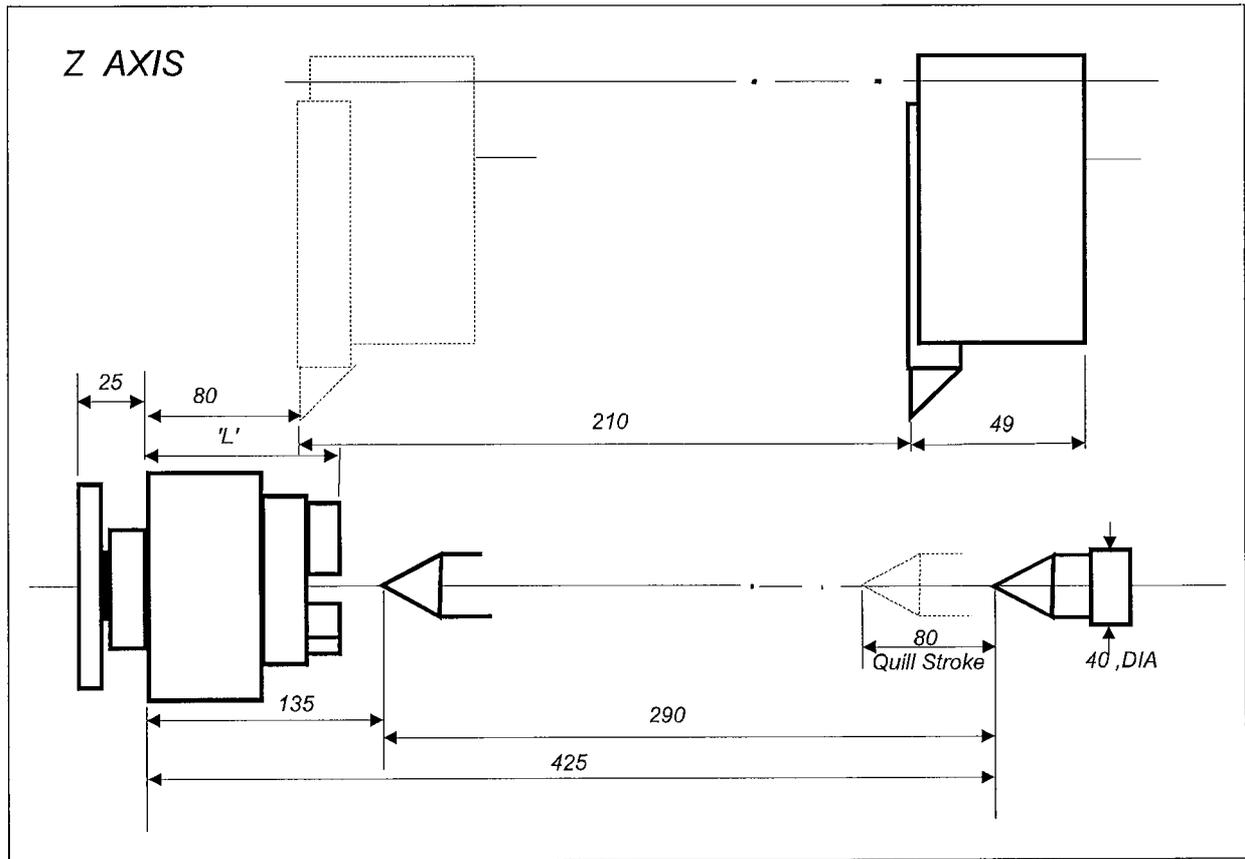


**IMPORTANT !!**

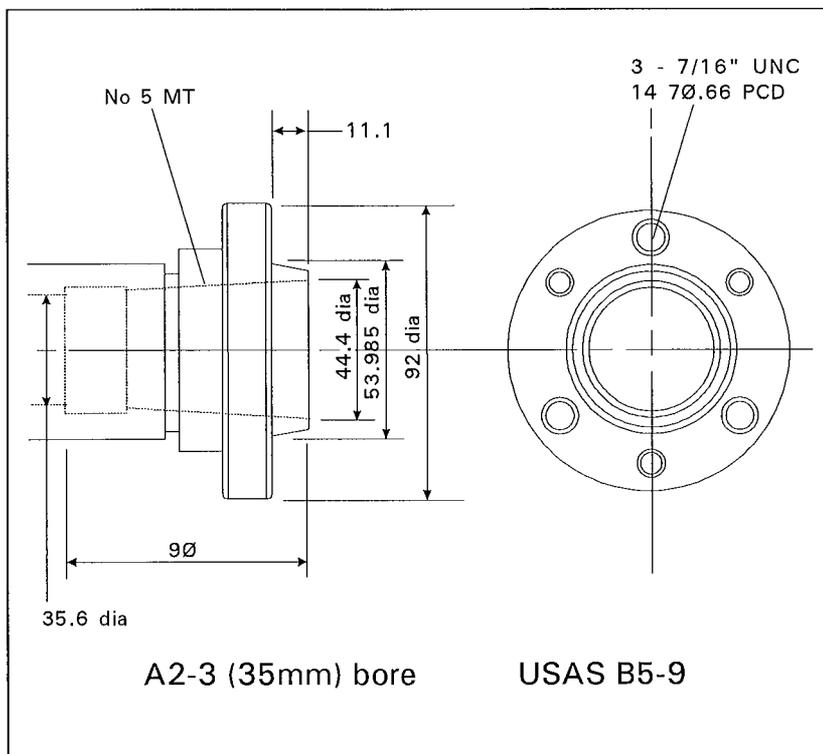
*Please note that auxiliary components may differ from those shown and described, according to the model specified and fitted. If you have any doubts concerning the connection and operating features for the auxiliary components fitted to your machine, please contact Denford Limited, or your local Denford agent, for further details.*

# CYCLONE TU-150 P

## CAPACITY DIAGRAMS.



# SPINDLE NOSE.



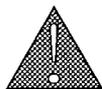
## INSTALLATION & MAINTAINANCE INSTRUCTIONS FOR 5-C & 16-C DEAD LENGTH PICK OFF CHUCKS.

### Description.

This chuck operates in conjunction with standard 5-C or 16-C collets. Unlike conventional drawback chucks in which the chuck body is static and the collet moves axially rearward to clamp, these chucks permit static fixing of the collet relative to the chuck body. The collet closing sleeve is pushed forward to engage the collets closing taper via bridging bolts and spacers driven by the threaded rear actuating plate. This gives several advantages:

- 1) In second operation work, shouldered components can be stopped against the collet face.
- 2) Both collet types are internally threaded in the rear end to house either a backstop or ejector if required.
- 3) Drawback spring collets achieve the highest possible concentric accuracy, however, they cannot be used in the conventional mode for second operations where a tight control on component lengths is required.
- 4) The axial movement of drawbar collets in conventional chucks imposes undue loads on machine ballscrews when used in pick-off applications. These problems are overcome by the new design.
- 5) When used for picking-off, extremely short components may be gripped.

# INSTALLATION & MAINTAINANCE INSTRUCTIONS FOR 5-C & 16-C DEAD LENGTH PICK OFF CHUCKS.



## **IMPORTANT !!**

*Please note that auxiliary components may differ from those shown and described, according to the model specified and fitted. If you have any doubts concerning the connection and operating features for the auxiliary components fitted to your machine, please contact Denford Limited, or your local Denford agent, for further details.*

## Collet Chuck Removal.

CAUTION - Read thoroughly prior to removal.

- 1) Turn off the air pressure and remove any collet from the collet chuck
- 2) Remove the three 7/16" UNC screws from the collet chuck body.
- 3) Insert tube holding /driver and turn CCW , this will remove the chuck body and the draw tube together out of the air cylinder, they can then be removed from the machine.
- 4) Remove the three 7/16 UNC screws from the A2/3 - A2/5 adaptor, this can then be removed from the spindle nose. Once the spindle nose has been revealed and cleaned an alternative holding device may be fitted.

## Loading Collets to the Dead Legth Pick Off Chuck.

With the chuck sleeve fully advanced, slacken the collet key actuating screw approximately one full turn. Mark the collet face with an ink marker in line with the keyway position.

Screw the collet fully into the chuck with the insertion tool provided and then back off only sufficiently to advance and tighten the collet key.

CAUTION - The maximum drawbar force and maximum speed indicated on the chuck must not be exceeded.

## Maintenance.

Remove the collet, clean and replace occasionally during long production runs.

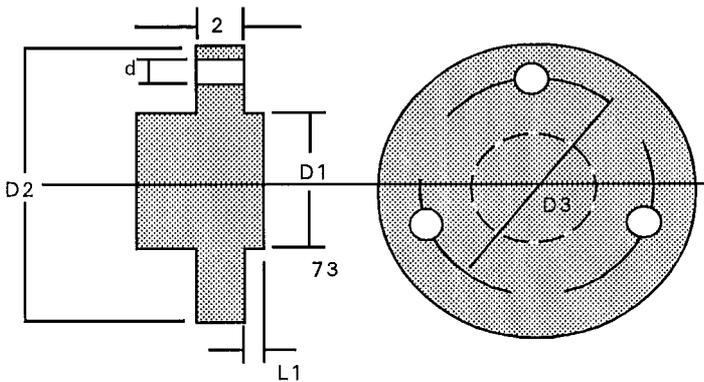
Lubricate sparingly every 50 (fifty) operating hours with MOLYCOTE TR42 or LITHIUM GREASE.

For further information contact Crawford Collets Ltd.

# MANUAL CHUCK INFORMATION.

Units mm

| Type       |            |                           |       | Internal Jaw Run Out |           | External Jaw Run Out |          | Face &                | Gripping Force   |                        | Max. Unbalance     |    |
|------------|------------|---------------------------|-------|----------------------|-----------|----------------------|----------|-----------------------|------------------|------------------------|--------------------|----|
| SC<br>(OD) | SK<br>(OD) | Dia. of Test<br>Round Bar |       | Accuracy             | Test Disc |                      | Accuracy | Peripheral<br>Run Out | Pinion<br>Torque | Gripping<br>Force of 3 | at Peripheral Dia. |    |
| inch       | mm         | inch                      | mm    |                      | OD        | Width                |          |                       | kg.m             | Jaws. Kg               | g                  |    |
| 3          | (85)       |                           |       | 8, 10, 15            | A         | 60                   | 20       | B                     | D                | 3                      | 900                |    |
| 4          | (110)      |                           |       | 8, 10, 20            |           | 80                   | 20       |                       |                  | 4.5                    | 1200               | 11 |
| 5          | (130)      |                           |       | 10, 15, 25           |           | 100                  | 20       |                       |                  | 6.5                    | 1500               |    |
| 6          | (165)      | 6                         | (165) | 10, 20, 30           |           | 125                  | 30       |                       |                  | 9.0                    | 2100               |    |
| 7          | (190)      | 7                         | (190) | 10, 20, 30           |           | 145                  | 30       |                       |                  | 11.0                   | 2400               | 21 |
| 9          | (232)      | 9                         | (232) | 20, 30, 50           |           | 170                  | 30       |                       |                  | 15.0                   | 3000               |    |
| 10         | (273)      | 10                        | (273) | 20, 40, 50           |           | 205                  | 40       |                       |                  | 18.0                   | 3600               |    |
| 12         | (310)      | 12                        | (310) | 30, 50, 70           |           | 235                  | 40       |                       |                  | 21.0                   | 3900               | 42 |



### KEY.

A - When the round test bar is clamped by the master pinion (arrow marked), the accuracy should be within the  $\pm 0.30\text{mm}$  T.I.R. at each position of  $100\text{mm}$  from the root ( $50\text{mm}$  in the case of the test bar being 8 dia. or 10 dia.). In the case that it is clamped by the other pinions, the accuracy should be  $\pm 0.50\text{mm}$  T.I.R.

B - Peripheral run out of test disc within  $\pm 0.050\text{mm}$ .  
Face run out of test disc within  $\pm 0.020\text{mm}$ .

C - Peripheral run out of test disc within  $\pm 0.050\text{mm}$ .  
Face run out of test disc within  $\pm 0.030\text{mm}$ .

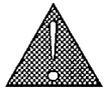
D - Peripheral run out of test disc within  $\pm 0.020\text{mm}$ .  
Face run out of test disc within  $\pm 0.020\text{mm}$ .

Units mm

| Type | D1 |       | D2              |     | D3        | L1  | L2  | Mounting Bolt |      | Max. Dia. gripped by external jaw |       |      |       | Allow<br>Max. RPM |      |
|------|----|-------|-----------------|-----|-----------|-----|-----|---------------|------|-----------------------------------|-------|------|-------|-------------------|------|
| SC   | SK | Pilot | Tolerance       | PCD |           |     |     | Tolerance     | d    | Thread                            | SC    |      | SK    |                   |      |
|      |    |       |                 |     |           |     |     |               |      | inch                              | mm    | inch | mm    |                   |      |
| 3    |    | 60    | $+0.021/+0.002$ |     | $\pm 0.2$ | 88  | 3   | 10            | 6.6  | 3-M6                              | 2.75  | 70   |       |                   | 3000 |
| 4    |    | 80    | $+0.021/+0.002$ | 95  | $\pm 0.2$ | 115 | 4   | 12            | 9.0  | 3-M8                              | 3.75  | 95   |       |                   | 2500 |
| 5    |    | 100   | $+0.025/+0.003$ | 115 | $\pm 0.2$ | 135 | 4   | 12            | 9.0  | 3-M8                              | 4.33  | 110  |       |                   | 2500 |
| 6    | 6  | 130   | $+0.028/+0.003$ | 147 | $\pm 0.2$ | 170 | 4.5 | 15            | 11.0 | 3-M10                             | 5.70  | 145  | 5.90  | 150               | 2000 |
| 7    | 7  | 155   | $+0.028/+0.003$ | 172 | $\pm 0.2$ | 172 | 4.5 | 18            | 11.0 | 3-M10                             | 6.5   | 165  | 6.89  | 175               | 2000 |
| 9    | 9  | 190   | $+0.033/+0.004$ | 210 | $\pm 0.2$ | 235 | 5.5 | 20            | 13.0 | 3-M12                             | 7.87  | 200  | 8.67  | 220               | 2000 |
| 10   | 10 | 230   | $+0.033/+0.004$ | 250 | $\pm 0.2$ | 275 | 5.5 | 20            | 13.0 | 3-M12                             | 9.45  | 240  | 9.66  | 245               | 1800 |
| 12   | 12 | 260   | $+0.036/+0.004$ | 283 | $\pm 0.3$ | 310 | 6.5 | 22            | 13.0 | 3-M12                             | 10.83 | 275  | 11.22 | 285               | 1800 |
| 14   |    | 300   | $+0.036/+0.004$ | 328 | $\pm 0.3$ | 355 | 6.5 | 26            | 13.0 | 6-M12                             | 12.41 | 315  |       |                   | 1500 |

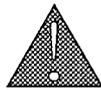
SC = Type with solid hard jaw, with plain back. SK = Type with 2 piece hard jaw, with plain back.

# CHUCK MOUNTING AND REMOVAL.



## IMPORTANT !!

*Please note that auxiliary components may differ from those shown and described, according to the model specified and fitted. If you have any doubts concerning the connection and operating features for the auxiliary components fitted to your machine, please contact Denford Limited, or your local Denford agent, for further details.*



**ENSURE THAT THE MACHINE IS ISOLATED BEFORE ENTERING THE WORKING AREA.**

## MOUNTING A MANUAL CHUCK.

The backplate should be an A2-3 type with a front fitting to match the chuck. Thoroughly clean the spindle nose, chuck mounting register and the backplate before assembly.

The backplate is mounted to the spindle and secured by three 7/16" UNC cap head screws (5/16" Allen Key) through the front of the chuck.

## REMOVAL OF A MANUAL CHUCK.

Clean all swarf from the work area.

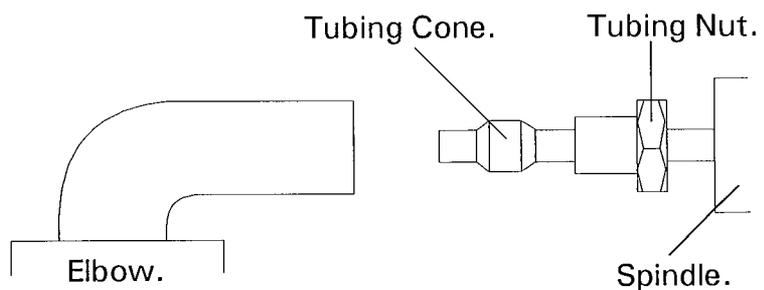
Remove the three cap head screws from the front of the chuck. Take care to hold the chuck securely whilst removing the screws. Remove the chuck from the backplate. Unscrew the three 7/16 UNC cap head screws from the backplate and remove the backplate.

Thoroughly clean and dry all parts.

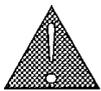
## MOUNTING A PNEUMATIC CHUCK.

Ensure that the backplate is an A 2-3 type with a front fitting to suit the chuck.

Thoroughly clean the spindle nose, chuck mounting register and backplate before assembly.



# CHUCK MOUNTING AND REMOVAL.



## **IMPORTANT !!**

*Please note that auxiliary components may differ from those shown and described, according to the model specified and fitted. If you have any doubts concerning the connection and operating features for the auxiliary components fitted to your machine, please contact Denford Limited, or your local Denford agent, for further details.*

The backplate is mounted to the spindle and secured by three 7/16 UNC cap head screws.

Before mounting the chuck to the backplate, ensure that the air pipe supplied is fitted to the rear of the chuck. This pipe is passed down the spindle as the chuck is mounted.

The chuck is secured by six cap head screws. Screw in through the front of the chuck.

To fit the air pipe, first remove the headstock end cover, found at the lefthand side of the machine. This is secured by eight button head screws.

Once removed, the pipe will be seen at the end of the spindle.

Remove the tubing nut from the elbow and also remove the tubing cone from within the elbow. Slide the tubing nut onto the pipe followed by the tubing cone, as shown in the diagram. Screw this assembly into the elbow. Do not overtighten this assembly.

Replace the headstock end cover.

## **REMOVAL OF A PNEUMATIC CHUCK.**

Clean all swarf from the working area.

Remove the headstock end cover, found at the lefthand side of the machine. This is secured by eight button head screws. Unscrew the tubing nut and pull the tube out of the elbow.

Remove the tubing cone and nut from the pipe and replace them in the elbow.

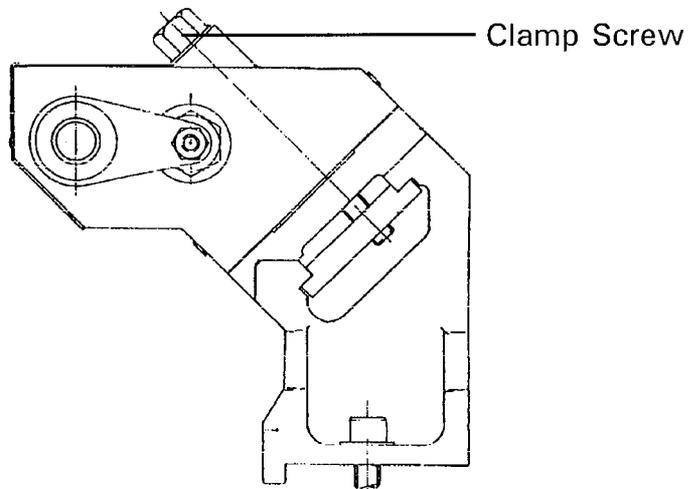
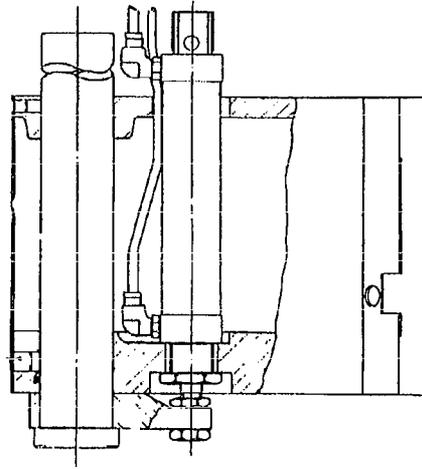
Replace the headstock end cover.

Unscrew the six cap head screws from the front of the chuck. Take care to hold the chuck securely whilst removing the screws.

Remove the chuck from the backplate. Unscrew the three UNC cap head screws from the backplate and remove the backplate from the spindle.

Thoroughly clean and dry all parts.

# TAILSTOCK.



## DESCRIPTION.

The barrel bore taper is No. 3 Morse, the stroke is 80mm and the maximum operating pressure is 100psi.

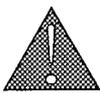
## TAILSTOCK OPERATION.

The operation of the tailstock is controlled by two buttons and a knob on the FANUC control panel.

The knob controls the air pressure applied to the barrel of the tailstock when moving forwards. The pressure is controllable so that when long slender items are being machined, the pressure can be reduced so as not to distort the item being turned when using the tailstock centre as a support. Turning the knob clockwise will increase the pressure and counterclockwise will decrease the pressure.

The two buttons control the direction of the barrel stroke, press the top button for extend and the bottom for retract.

Manual positioning of the tailstock is achieved by releasing the clamp screw (19mm A/F) and moving the tailstock to the required position, then tightening the clamp screw - see above diagram.



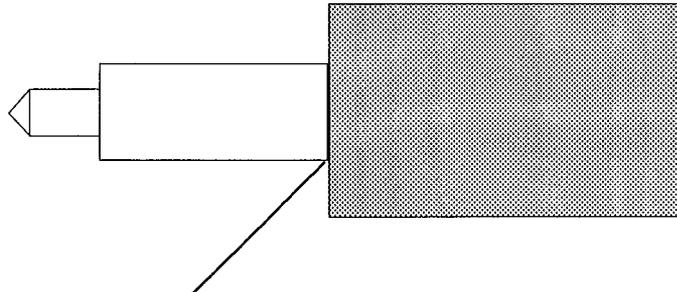
### **IMPORTANT !!**

*Please note that auxiliary components may differ from those shown and described, according to the model specified and fitted. If you have any doubts concerning the connection and operating features for the auxiliary components fitted to your machine, please contact Denford Limited, or your local Denford agent, for further details.*

# TAILSTOCK.

## PRESSURE INDICATION LINE.

The tailstock barrel has an indication mark which when visible indicates that the pressure is at a minimum. When this line appears then manual positioning of the tailstock is required in the direction of the headstock to increase the pressure.



Pressure Indication Line

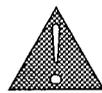
# COOLANT FILLING.

Capacity: 25 Litres

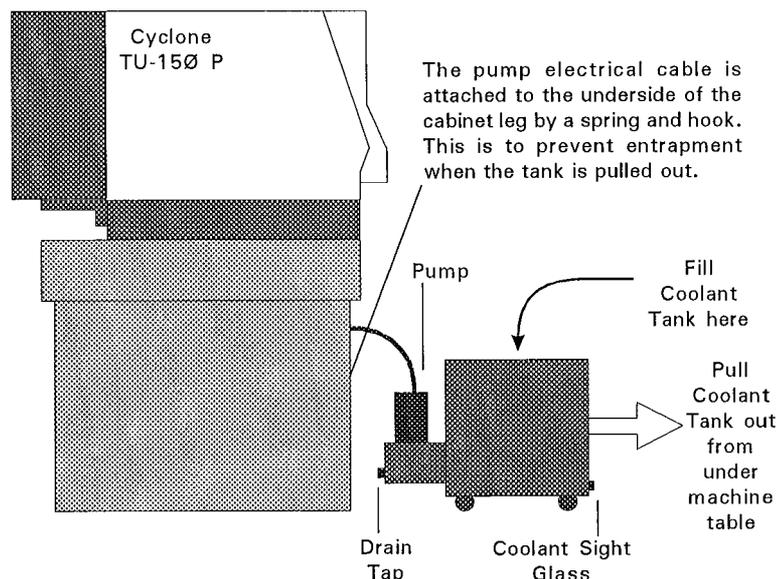
Recommended Type: Cincinnati Millacron Simcool C6Ø

Filling:

- 1) Mix the coolant as prescribed by the manufacturer.
- 2) Pull out the tank from beneath the machine and clean out swarf.
- 3) Pour in the coolant from the top of the tank (see diagram below).
- 4) Watch the sight level on the lower front of the tank assembly.
- 5) Stop filling when the coolant level is reached.



*The % mix for Simcool 6Ø is 2 - 5% , if the mixture exceeds this percentage it may have a detrimental effect on the paintwork and seals.*

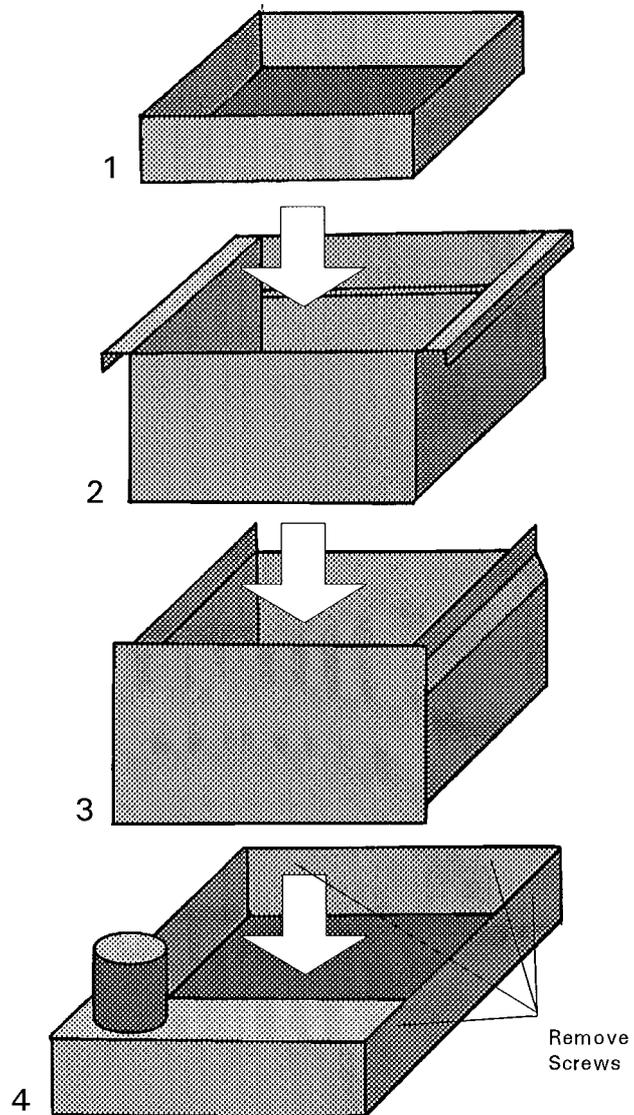


# COOLANT TANK.

The coolant tank breaks down into four component parts:

- 1) The Ferrous filter tray
- 2) The Non - Ferrous filter tray
- 3) The Main Body tank
- 4) The Pump Filter Tank Base.

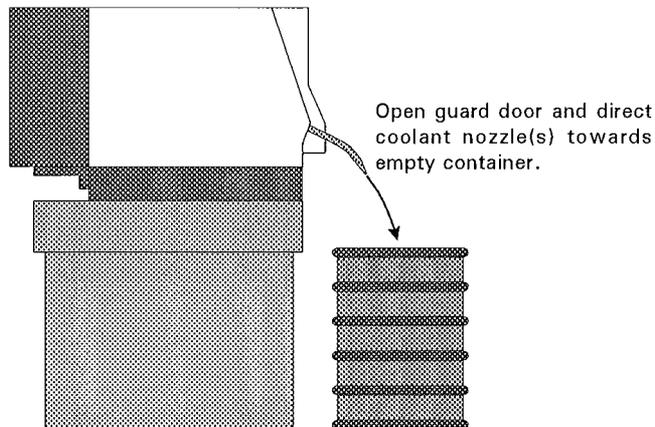
Trays 1 and 2 lift clear (separately) of the main body tank, the main body tank can then be separated from the base by removing the six screws.



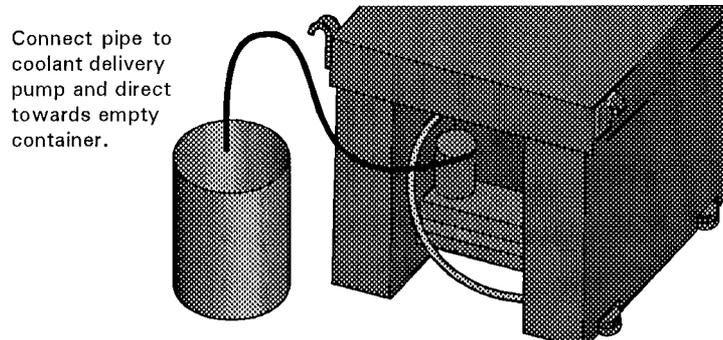
# COOLANT DRAINING.

There are basically two methods of draining the coolant tank:

1) With the coolant tank still in place beneath the cabinet base, place the drum or container which is to hold the drained off coolant as near to the machine cabinet as possible. Angle the coolant nozzle(s) into the drum and switch on the coolant flow (see diagram below). When the coolant ceases to flow, switch off the coolant and pull out the tank from beneath the cabinet (front or rear depending on the cabinet model). The tank can then be separated as in the diagram on the previous page and the remainder of the coolant removed from the base.



2) With the coolant tank still in place beneath the cabinet and with the coolant switched off, remove the coolant delivery pipe from the pump by removing the clip. Place a pipe of the same size over the pump nozzle which you have just removed the delivery pipe from, clamp with the same clip and place the other end in a drum or container, then switch on the coolant pump to drain the coolant into the drum. When the coolant ceases to flow, switch off the coolant pump, pull out the coolant tank from beneath the cabinet. The tank can then be separated as in (1) above. Ensure delivery pipe is reconnected to pump after the draining operation is completed.



# SLIDE LUBRICATION SYSTEM.

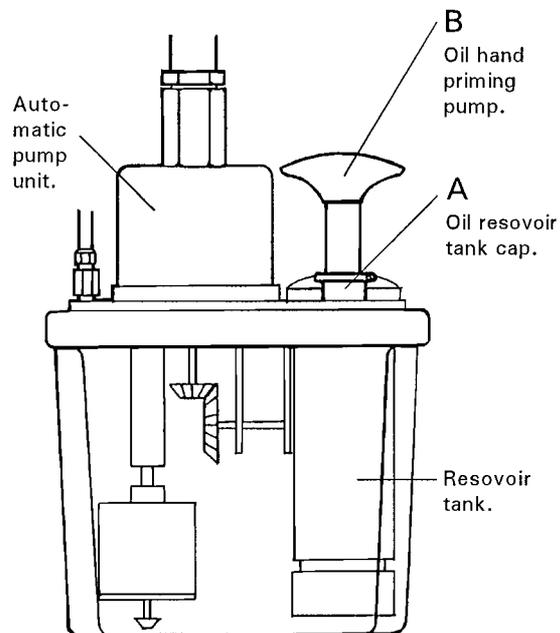
## SLIDE LUBRICATION SYSTEM.

The slide lubrication system comprises of an oil reservoir tank and an automatic pump unit. Oil is automatically pumped to the required areas of the machine.

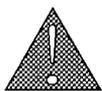
The slide lubrication system is located on the right-hand side of the machine cabinet, when viewed from the front.

The oil level can be topped-up by adding the required grade of lubrication oil into the reservoir through cap A.

The hand priming pump, B, should only be used if there is no oil in the reservoir, ie, the pump has run dry or the oil is being renewed (shown below).



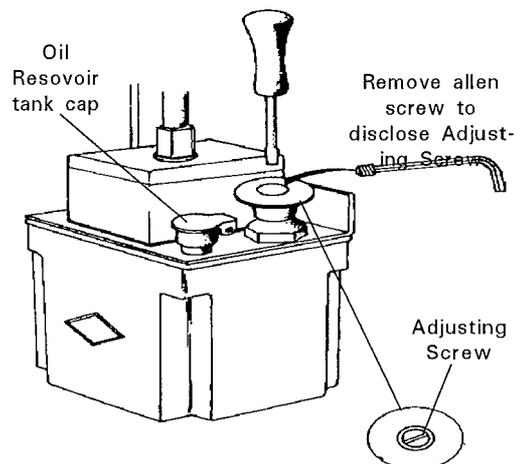
FRONT ELEVATION OF SLIDE LUBRICATION SYSTEM.



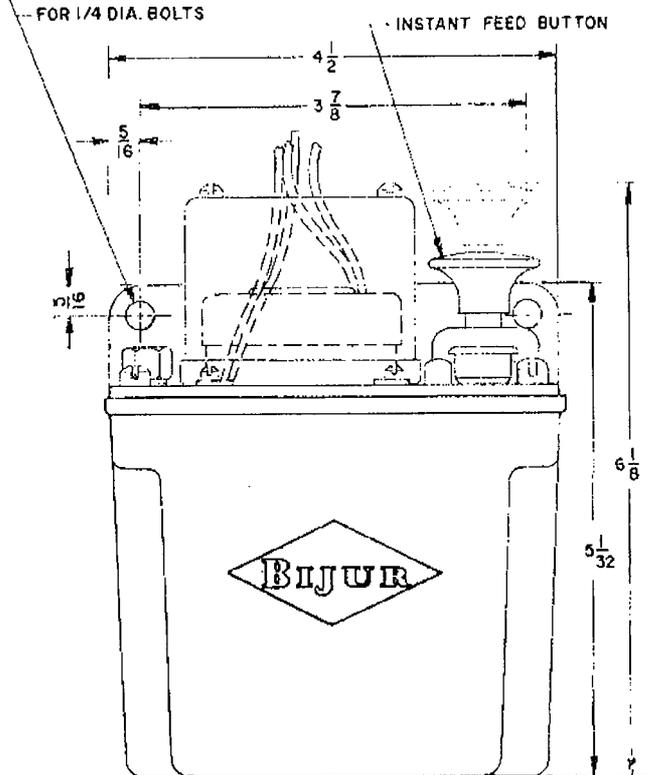
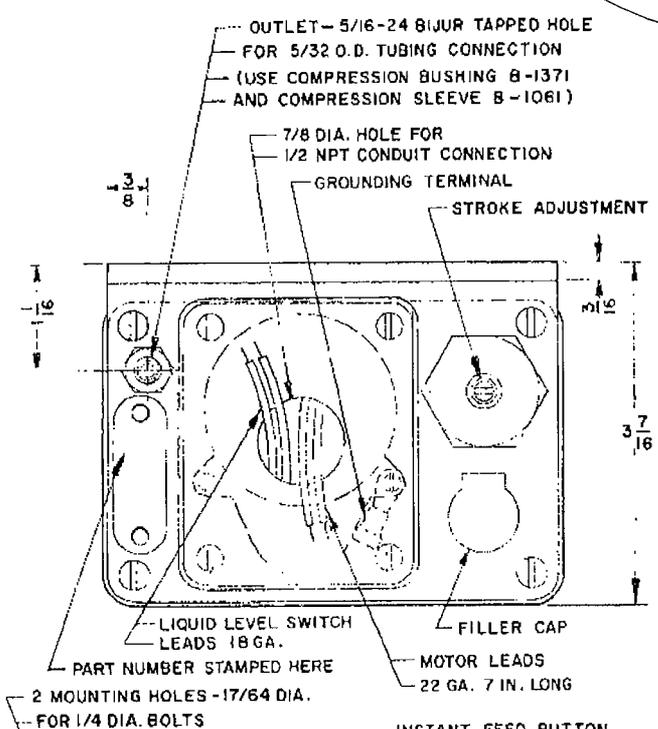
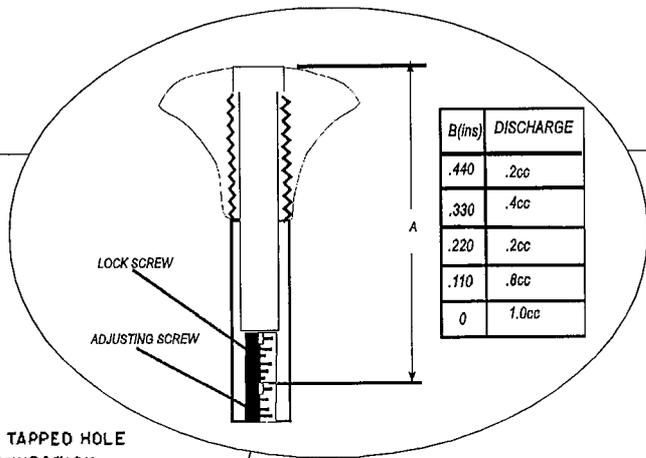
### IMPORTANT !!

*Please note that auxiliary components may differ from those shown and described, according to the model specified and fitted. If you have any doubts concerning the connection and operating features for the auxiliary components fitted to your machine, please contact Denford Limited, or your local Denford agent, for further details.*

The lubrication flow is set for correct flow at the manufacturers, to lessen the flow - remove the allen screw and turn the cross-head screw clockwise. Replace the allen screw after adjustment (shown below).



# SLIDE LUBRICATION SYSTEM.



### Operation.

Lubricator type TM1 is a motor driven piston pump of the spring discharge type. The motor incorporates a gear reduction which determines the operating cycle of the pump piston. The cycle times available are shown in the table above.

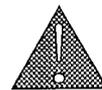
### Discharge Volume per Stroke

Adjustable - 0.2 cu. cm. minimum  
1.0 cu. cm. maximum

The flow is set at the factory for medium flow - to lessen the flow, remove the lock screw (1/8" allen key), then measure A, turn the adjusting screw clockwise increasing A by B dimension.

### Capacity.

The reservoir capacity is 1 pint (475 cu. cm.)

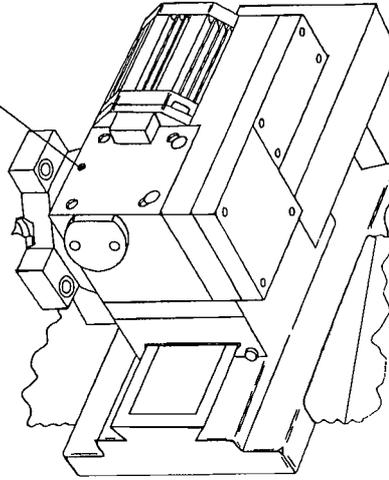


### IMPORTANT !!

*Please note that auxiliary components may differ from those shown and described, according to the model specified and fitted. If you have any doubts concerning the connection and operating features for the auxiliary components fitted to your machine, please contact Denford Limited, or your local Denford agent, for further details.*

# DENFORD MODEL TOOLPOST LUBRICATION.

Auto  
Toolpost  
turret oil  
here.



AUTO TOOLPOST  
LUBRICATION  
POINT FOR A  
DENFORD  
TOOLPOST.

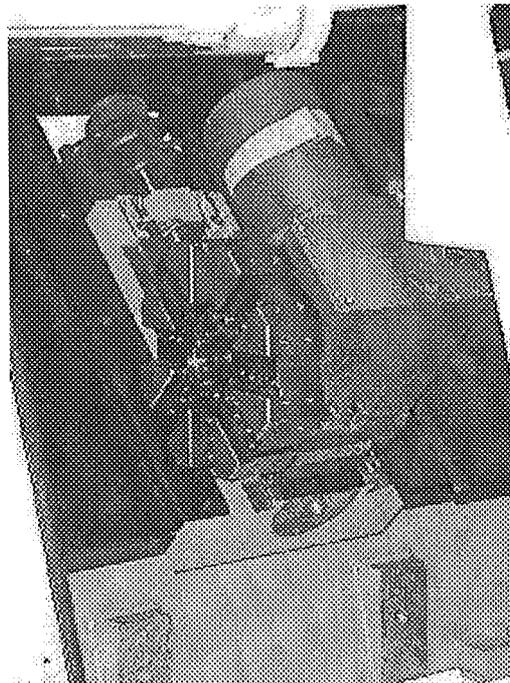
The turret mechanism of the **Denford model** auto toolpost should be oiled at weekly intervals, using a pump-action oil can. The lubrication point for the turret is shown in the diagram above.

The specification of oil used on the turret should be the same as the slide lubrication system.

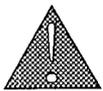
# BARUFFALDI TOE 80 MODEL TOOLPOST LUBRICATION.

The turret mechanism of the **Baruffaldi TOE 80 model** toolpost is self lubricating and sealed for life.

Oil lubrication is only required if the unit is removed and stripped down. On reassembly of the unit, use 80SW90 grade oil, quantity 0.06kg.



SELF-  
LUBRICATING  
BARUFFALDI  
TOE 80  
TOOLPOST.



**IMPORTANT !!**

*Please note that auxiliary components may differ from those shown and described, according to the model specified and fitted. If you have any doubts concerning the connection and operating features for the auxiliary components fitted to your machine, please contact Denford Limited, or your local Denford agent, for further details.*

# AIR FILTER ISOLATOR AND REGULATOR.

## AIR FILTER REGULATOR AND LUBRICATOR (SEE DIAGRAM BELOW).

The automatic toolpost, chuck and machine door are supplied with compressed air, passing through an air filter regulator and lubricator, situated on the tailstock end panel of the electrical control box.

## AIR SUPPLY ISOLATOR.

Turn anticlockwise to allow air to flow (as shown in the diagram below).

Turn clockwise to cut air supply and drain air pressure from the system.

## AIR FILTER REGULATOR.

Normal operating pressure (as supplied, preset on the machine) is 100 PSI (6.6 Bar).

Maximum pressure for the air regulator is 150 PSI (9.9 Bar).

Always check the main supply pressure before adjusting pressure at the regulator. To adjust the pressure, pull up the rotary control to unlock it from its current position. Turn the control clockwise to increase pressure, or anticlockwise to decrease pressure (when viewed from above). Push the rotary control down to relock it in its new position.

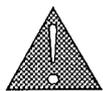
Regularly drain any water collected in the filter bottle using the cap in the base of the bottle. The interval at which this operation is required will depend on the type and condition of the air compressor being used.

## AIR LUBRICATOR.

The air lubricator uses oil - ISOVG32.

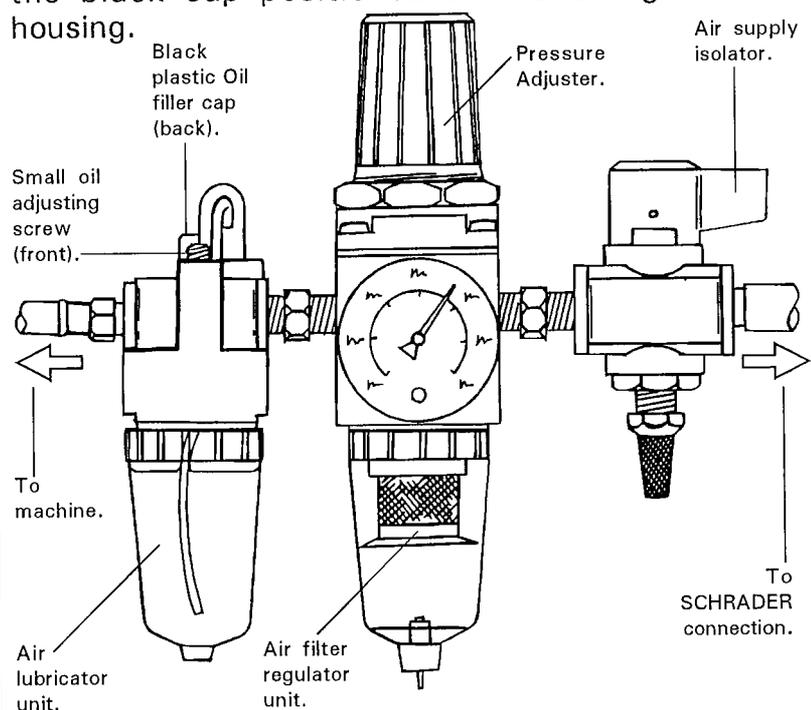
Turn the front small adjusting screw clockwise to decrease the oil flow, or anticlockwise to increase the oil flow.

Oil can be added to the reservoir bottle by removing the black cap positioned behind the glass bell housing.



### IMPORTANT !!

*Please note that auxiliary components may differ from those shown and described, according to the model specified and fitted. If you have any doubts concerning the connection and operating features for the auxiliary components fitted to your machine, please contact Denford Limited, or your local Denford agent, for further details.*



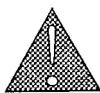
# PLANNING PROCEDURE FOR MAINTENANCE WORK.

When carrying out maintenance work, pay special attention to the following items to ensure safe and correct procedures.

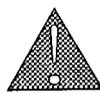
- 1) Before starting any maintenance work, define the task and obtain the information relevant to carry out the maintenance to a successful conclusion.
- 2) Prior to commencing any maintenance task, define the work period to do the necessary work, obtain the correct tools, order the spare parts needed to complete the task.
- 3) During the maintenance work period put up a notice in a place easily seen, to the effect that the machine is under maintenance and should not be used until the notice is removed.
- 4) Safety should be a priority when carrying out any maintenance, covers and safety guards that are removed during the maintenance period should be replaced after the work is completed and all interlocks and micro-switches reset.
- 5) All maintenance work should be carried out by suitably qualified personnel.
- 6) When replacing electrical components ensure that they are the ones specified.
- 7) All maintenance work done on the machine whether progressive or preventative should be logged so that a complete service record can be kept for future referral.
- 8) When the maintenance is completed, check that the replaced and serviced parts are working correctly, and that the machine runs efficiently.

# MAINTENANCE SCHEDULE.

|                    |   |
|--------------------|---|
| <i>Daily</i>       | <ul style="list-style-type: none"> <li>- Clean and remove swarf.</li> <li>- Check/top-up slide lubrication oil level in reservoir.</li> </ul>   |
| <i>Weekly</i>      | <ul style="list-style-type: none"> <li>- Clean machine thoroughly.</li> <li>- Check exposed screws and nuts for tightness.</li> <li>- Check/top-up Cutting Coolant level.</li> </ul>  |
| <i>Bi-annually</i> | <ul style="list-style-type: none"> <li>- Pneumatic Chuck / Door models - Check condition of filter and drain any build-up of water in the filter bottle.</li> <li>- Check condition of electrical connections.</li> <li>- Check all cables for kinks and breaks.</li> <li>- Remove chuck jaws, clean chuck.</li> <li>- Check adjustment of saddle strips.</li> <li>- Check adjustment of crossslide strip.</li> </ul> |
| <i>Annually</i>    | <ul style="list-style-type: none"> <li>- Check slides for wear.</li> <li>- Check machine alignments and accuracy.</li> <li>- Check axis drive belt and spindle drive belt for wear.</li> <li>- Grease axis bearings.</li> <li>- Change Air Filters.</li> <li>- Check headstock bearing adjustment.<br/>(Note, locknut is LH).</li> <li>- * Change FANUC controller memory batteries.</li> </ul>                       |



*\* When changing the batteries in the memory of the FANUC controller, ensure that the FANUC controller is switched ON before and during the battery changing operation.*



*If in doubt about any of the above procedures, contact Denford Limited for assistance.*

# LUBRICATION CHART.

| Lubrication Point         | Lubricating System | Frequency                   | Recommended Oil/Grease                                   | Quantity     |
|---------------------------|--------------------|-----------------------------|--|--------------|
| Slide ways and Ballscrews | Auto pump unit     | As required                 | BP : CS 68<br>Shell : Vitrea 68<br>Castrol : Perfecto NN | Ø.5 litre    |
| Headstock                 | Grease Seal        | On Maintenance of Headstock | Kluber Isoflex NBU 15                                    | 4 cc/Bearing |
| Axis Bearings             | Grease Seal        | Once a year                 | BP : LS 3<br>Shell : Alvania No. 3                       | 2 cc/Bearing |
| Coolant                   | Electric pump      | As required                 | Cincinnati Millacron<br>Simcool C6Ø                      | 25 litres    |

## MECHANICAL TROUBLE SHOOTING.

**PROBLEM :** Poor surface finish.

**Corrective Action:**

- 1) Ensure that the tool tip is in good condition and that the grade is suitable for the material being cut.
- 2) Check feeds and speeds, are they compatible with the material being cut and the grade of carbide being used for cutting?
- 3) Ensure that the tool tip, tool body, tool turret or toolpost are rigid and secure. Do not overhang the tool too far from the turret or toolpost body.
- 4) Ensure that the axis gib strips are correctly adjusted.
- 5) Ensure the spindle drive belt is not worn and is correctly adjusted for tension.

**PROBLEM :** Coolant not flowing.

**Corrective Action :**

- 1) Has the coolant ON been programmed - MØ8 - COOLANT ON, or M13 COOLANT ON and SPINDLE FORWARD.
- 2) Check the level of the coolant in the tank and top up if necessary.
- 3) Check that the pump is working - observe flow in pipe connected to the pump.
- 4) Check all pipes for leakages and replace if necessary. If accumulated swarf is causing an obstruction remove the pipe and clear the obstruction and replace the pipe ensuring a good seal without leaks.

# MECHANICAL TROUBLE SHOOTING.

ISOLATE MACHINE BEFORE MAINTENANCE COMMENCES.

MECHANICAL CORRECTIVE PROCEDURES:

## 1) PROCEDURE FOR ADJUSTMENT OF SPINDLE DRIVE BELT TENSION.

Tools required: Tension rod - 8mm dia, 8mm A\F Allen Key, 4mm A\F Allenkey.

- a) Remove eight M6 button head screws from headstock end cover and remove the cover.
- b) Release the three M1Ø Allen cap head screws holding the motor plate to the lathe bed.
- c) Place the tension rod through the top RH slot and lever plate towards the back of the machine to tension the spindle drive belt.
- d) Whilst still under tension tighten the bottom RH screw then release and remove the tension rod, tighten the remaining M1Ø screws.
- e) Run the spindle and observe the belt to ensure there is no excessive slack, fluctuation or bulging away from the drive pulley.
- f) Replace the headstock end cover and secure with the eight M6 button head screws.

# MECHANICAL TROUBLE SHOOTING.

## 2) PROCEDURE FOR ADJUSTING THE THE GIB STRIPS.

### Z AXIS

Tools required: Long reach screw driver.

- a) Remove eight M6 button head screws from the headstock end cover and remove the cover.
- b) Remove M6 knurled headed screw from lubrication pump door at the tailstock end of the machine and open the door to full extent.
- c) Release the gib strip lock screw at the headstock side of the saddle. This is accessible through the headstock housing and under the bed guards.
- d) Adjust the gib strip by turning the lock screw which is accessible through the lubrication pump door.
- e) Turn the screw clockwise to tighten the strip. Do not overtighten.
- f) Lock the strip with the lock screw at the headstock side of the saddle.
- g) Move the saddle up and down the bed to ensure smooth and continuous movement.
- h) When correctly adjusted replace headstock end cover and close lubrication pump door and secure with appropriate screws.

### X AXIS

- a) Remove the crossslide cover by releasing the two M8 grub screws at the rear of the indexing turret base.
- b) Release with a screwdriver the gib strip lock screw at the rear of the crossslide.
- c) Using the same screwdriver turn the screw at the front of the crossslide clockwise to tighten the gib strip. Do not overtighten.
- d) Lock the strip in position by tightening the lock screw at the rear of the crossslide.
- e) Move the crossslide up and down the saddle to ensure a smooth and continuous movement.
- f) When correctly adjusted replace the crossslide cover.

# AIR FILTERS.

The air filters on the side panel(s) of the machine electrical control box should be changed either annually, or when visibly dirty, blocked or damaged.

When ordering new filters quote reference:

Air Inlet Filter - 120mm Ref: RS 507-876

# FAULT FINDING TABLE.

| PROBLEM  | CORRECTIVE ACTION.                                   |
|--|--|
| 1) Control will not come on  | Check fuse F1  |
| 2) Control is on<br>Cabinet fan not running<br>Workilight not on   | Check control transformer<br>circuit breaker CT C/B  |
| 3) Axis motors will not run<br>Various axis alarms on screen   | Check axis drive circuit<br>breakers ADT C/B, AD C/B |
| 4) Spindle motor will not run<br>Alarm on screen:<br>Spindle drive fault   | Check spindle drive motor<br>starter MMS SD          |
| 5) Coolant pump does not run   | Check coolant pump motor<br>starter MMS CP           |
| 6) Toolpost does not rotate  | Check fuse F3  |
| <p>If the problem still persists after corrective action has been taken, contact Denford Limited for further assistance.</p> |  |

# ELECTRICAL

## TROUBLESHOOTING.

Where to find fuses and circuit breakers etc....

The following items are fitted inside the electrical control cabinet:

- The electrical diagrams for the Cyclone TU-15Ø P are held in a folder inside the electrical control cabinet.

- F1 3.15 Amp semi delay fuse

- F2 3.15 Amp semi delay fuse

- F3 6.3 Amp semi delay fuse

- ADT C/B 1Ø Amp 3 pole circuit-breaker for axis drive transformer

- AD C/B 1Ø Amp 3 pole circuit-breaker for axis drives

- CT C/B 1Ø Amp 2 pole circuit breaker for control transformer

- MMS CP Ø.6 - 1 Amp motor starter for coolant pump

- MMS SD 1Ø - 16 Amp motor starter for spindle drive

# CYCLONE TU-150P

## SPECIFICATION.

### MECHANICAL.

|                                  |                          |
|----------------------------------|--------------------------|
| Swing over Bed .....             | 250mm (10")              |
| Maximum Turning Diameter .....   | 160mm (6.25")            |
| Maximum Turned Length .....      | 210mm (8.25")            |
| Spindle Bore .....               | 35mm (1.25")             |
| Spindle Nose .....               | A 2-3"                   |
| Spindle Bore Taper .....         | No.5MT                   |
| Distance between centres .....   | 300mm (12")              |
| Tailstock Taper (optional) ..... | 3MT                      |
| Spindle Speeds .....             | 100-5000 RPM             |
| Feedrates .....                  | 0-5000 mm/min            |
| X Axis Travel .....              | 94mm (3.75")             |
| Z Axis Travel .....              | 210mm (8.5")             |
| Bed .....                        | Hardened and Ground Ways |
| Coolant Capacity .....           | 12 litres (2.6 gals)     |
| System Resolution .....          | 0.001mm (0.00004")       |
| Mechanical Resolution .....      | 0.01mm (0.0004")         |

### Optional Automatic Toolpost:

|                          |                           |
|--------------------------|---------------------------|
| External Tool size ..... | 12mm x 12mm (0.5" x 0.5") |
| Internal Tool size ..... | 25mm (1")                 |
| Index Time .....         | 0.65 seconds              |

|                            |                        |
|----------------------------|------------------------|
| Machine Length .....       | 1145mm (45")           |
| Machine Width .....        | 1100mm (43.5")         |
| Machine Height .....       | 1550mm (61")           |
| Machine Weight (net) ..... | 750 Kilos (1653.5 lbs) |

### ELECTRICAL.

|                |   |
|----------------|---|
| Mains Supply   | 50/60 Hz - 3 phase - 380/415 Volts - 12 Amp |
| Spindle Motor: | 2.2 Kw / 3 H.P. AC                          |
| Axes Motor:    | DC Servo - 1.2 Nm                           |

# LIST OF G CODES.

| G Code. | Group. | Function.                                      |
|---------|--------|--|
| G00     | 1      | Positioning (Rapid Traverse)                   |
| G01     | 1      | Linear Interpolation (Feed)                    |
| G02     | 1      | Circular Interpolation CW                      |
| G03     | 1      | Circular Interpolation CCW                     |
| G04     | 0      | Dwell  |
| G10     | 0      | Offset Value Setting By Program                |
| G20     | 6      | Inch Data Input                                |
| G21     | 6      | Metric Data Input                              |
| G22     | 9      | Stored Stroke Check On                         |
| G23     | 9      | Stored Stroke Check Off                        |
| G27     | 0      | Reference Point Return Check                   |
| G28     | 0      | Reference Point Return                         |
| G29     | 0      | Return From Reference Point                    |
| G30     | 0      | Return To 2nd Reference Point                  |
| G31     | 0      | Skip Function                                  |
| G32     | 1      | Thread Cutting                                 |
| G34     | 1      | Variable Lead Thread Cutting                   |
| G36     | 0      | Automatic Tool Compensation X                  |
| G37     | 0      | Automatic Tool Compensation Z                  |
| G40     | 7      | Tool Nose Radius Compensation Cancel           |
| G41     | 7      | Tool Nose Radius Compensation Left             |
| G42     | 7      | Tool Nose Radius Compensation Right            |
| G50     | 0      | Work Co-ord. Change/Max. Spindle Speed setting |

# LIST OF G CODES.

| G Code. | Group. | Function.                             |
|---------|--------|---------------------------------------|
| G65     | 0      | Macro Call                            |
| G66     | 12     | Macro Modal Call                      |
| G67     | 12     | Macro Modal Call Cancel               |
| G70     | 4      | Finishing Cycle                       |
| G71     | 4      | Stock Removal in Turning              |
| G72     | 0      | Stock Removal in Facing               |
| G73     | 0      | Pattern Repeating                     |
| G74     | 0      | Peck Drilling in Z Axis               |
| G75     | 0      | Grooving in X Axis                    |
| G76     | 0      | Thread Cutting Cycle                  |
| G90     | 1      | Cutting Cycle A                       |
| G92     | 1      | Thread Cutting Cycle                  |
| G94     | 1      | Cutting Cycle B                       |
| G96     | 2      | Constant Surface Speed Control        |
| G97     | 2      | Constant Surface Speed Control Cancel |
| G98     | 11     | Feed Per Minute                       |
| G99     | 11     | Feed Per Revolution                   |

Code listing full and correct at the time of printing.

G codes of 00 group represent those non modular and are effective to the designated block.

G codes of different groups can be commanded to the same block indefinitely. If more than one G code from the same group are commanded, the latter becomes effective.

# LIST OF M CODES.

| M code. | Function.                                    |
|---------|--|
| M00*    | Program Stop                                 |
| M01*    | Optional Stop                                |
| M02*    | Program Reset                                |
| M03     | Spindle Forward (clockwise)                  |
| M04     | Spindle Reverse (counter clockwise)          |
| M05*    | Spindle Stop                                 |
| M06     | Automatic Tool Change                        |
| M07     | Coolant "B" On                               |
| M08     | Coolant "A" On                               |
| M09*    | Coolant Off                                  |
| M10     | Chuck Open                                   |
| M11     | Chuck Close                                  |
| M13     | Spindle Forward and Coolant On               |
| M14     | Spindle Reverse and Coolant On               |
| M15     | Program Input using MIN P (special function) |
| M16     | Special Tool Call (tool call ignores turret) |
| M19     | Spindle Orientation                          |
| M20     | Spindle Index A                              |
| M21     | Spindle Index 2A                             |
| M22     | Spindle Index 3A                             |
| M23     | Spindle Index 4A                             |
| M25     | Quill Extend                                 |
| M26     | Quill Retract                                |
| M29     | Select DNC mode                              |
| M30     | Program Reset and Rewind                     |
| M31     | Increment parts counter                      |
| M37     | Door open to stop                            |
| M38     | Door Open                                    |
| M39     | Door Close                                   |
| M40     | Parts catcher extend                         |
| M41     | Parts catcher retract                        |
| M43     | Swarf conveyor forward                       |
| M44     | Swarf conveyor reverse                       |

# LIST OF M CODES.

| M code. | Function.   |
|---------|---|
| M45 *   | Swarf conveyor stop   |
| M48     | Lock % feed and % speed at 100%                               |
| M49     | Cancel M48 (default)  |
| M50     | Wait for axis in position signal<br>(cancels continuous path) |
| M51     | Cancel M50 (default)  |
| M52     | Pull-out in threading = 90 degrees<br>(default)               |
| M53     | Cancel M52  |
| M54     | Disable spindle fluctuation testing (default)                 |
| M56     | Select internal chucking<br>(from PLC edition "F")            |
| M57     | Select external chucking<br>(from PLC edition "F")            |
| M62     | Auxiliary Output 1 On   |
| M63     | Auxiliary Output 2 On   |
| M64     | Auxiliary Output 1 Off  |
| M65     | Auxiliary Output 2 Off  |
| M66 *   | Wait for Auxiliary Output 1 On Input                          |
| M67 *   | Wait for Auxiliary Output 2 On Input                          |
| M68     | Only index with all axes at home position                     |
| M69     | Index turret anywhere   |
| M70     | Mirror in X On  |
| M76     | Wait for Auxiliary Output 1 Off<br>(from revision C)          |
| M77     | Wait for Auxiliary Output 2 Off<br>(from revision C)          |
| M80     | Mirror in X Off   |
| M98     | Sub Program Call  |
| M99     | Sub Program End   |

Code listing full and correct at the time of printing.

M codes marked with an \* are executed at the end of a block, ie, after axis movement.

# DENFORD CONTACTS, PRODUCTS AND SERVICES.

If you require specific help regarding the specification, operation or maintenance of this machine, contact Denford on the phone/fax number below. Please have the machine serial number and year of manufacture (printed on the front of this guide) to hand, when you call.

Telephone: +44 (0)1484 712264.

Fax: +44 (0) 1484 722160.

Denford Limited,

Birds Royd, Brighouse, West Yorkshire, HD6 1NB, England.

Email: [service@denford.co.uk](mailto:service@denford.co.uk)

### *Stuck for projects and ideas?*

Denford LatheCAM Designer is an easy to use CAD package specifically designed for use with Denford CNC lathes.

Components can be designed directly on-screen, or imported from other popular drawing packages. The G-code programs are then automatically generated by LatheCAM's post processor.

What simpler way is there of creating your own library of CNC files? !!

### *Need further training?*

The Denford PTDC (Professional Training and Development Centre) is a purpose built centre specialising in project guidance, CNC machine training and software development skills for Denford customers. Training packages can be tailored to suit your needs, with the help of our experienced Education Support team. The centre can cater for training sessions from the very basics of CNC machine operation, upto the complexities of G-code programming, then further into 'new' Technology areas such as video conferencing.

Denford Limited is committed to the development of its training guides and manuals. If you have found certain sections in this setup guide useful, or feel that particular sections could be further developed, or new sections added in future, we would welcome your suggestions and comments.

# SLIDE LUBRICATION SYSTEM - MLZ AUTOMATIC PISTON PUMP.

## MLZ AUTOMATIC PISTON PUMP (SEE PHOTO BELOW).

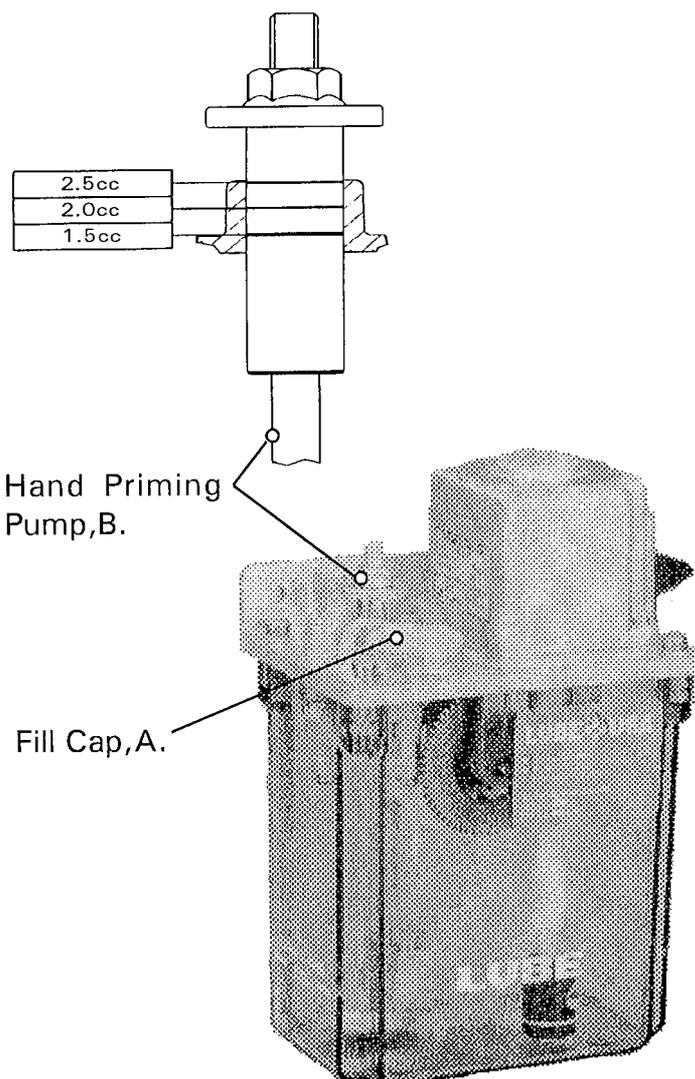
The MLZ slide lubrication system comprises of an oil reservoir tank and an automatic pump unit. Oil is automatically pumped to the required areas of the machine.

The oil level can be topped-up by adding the required grade of lubrication oil into the reservoir through the Fill Cap, A.

The hand priming pump, B, should only be used if there is no oil in the reservoir, ie, the pump has run dry or the oil is being renewed.

To adjust the discharge of oil, loosen the locknut. Turn the hand priming pump counterclockwise to decrease the discharge, or clockwise to increase the discharge. Tighten the locknut.

Only adjust the oil discharge when the piston is fully relaxed.



# SLIDE LUBRICATION SYSTEM - MLZ AUTOMATIC PISTON PUMP.



781 Congaree Rd., Greenville, SC 29607  
1-800-326-3765 • TEL 864-297-3950 • FAX 864-242-1652

Interval: 15 min  
Motor: Synchronous Motor  
Motor Voltage: 110V (50/60Hz)  
Motor RPM: 4 RPM  
Oil Level Switch (Without): Part No. 162802  
Oil Level Switch (With): Part No. 162807  
Discharge Pressure: 43 PSI (3 kg/cm<sup>2</sup>)  
Discharge Volume: 1.5cc-2.5cc/shot (0.09 in<sup>3</sup>-0.15in<sup>3</sup>/shot)  
Working Oil Viscosity: 150-6000 SSU (32-1300 Cst)

Reservoir Capacity 0.8 liters (27 oz.)  
\*\*Note - Check label for motor voltage before wiring, interval depends on motor (see label on motor cover)

Optional Oil Level Switch  
Max. Volt 200 VAC/DC  
Contact Point Rating  
30W (Resistance Load)  
aux. Relay required

