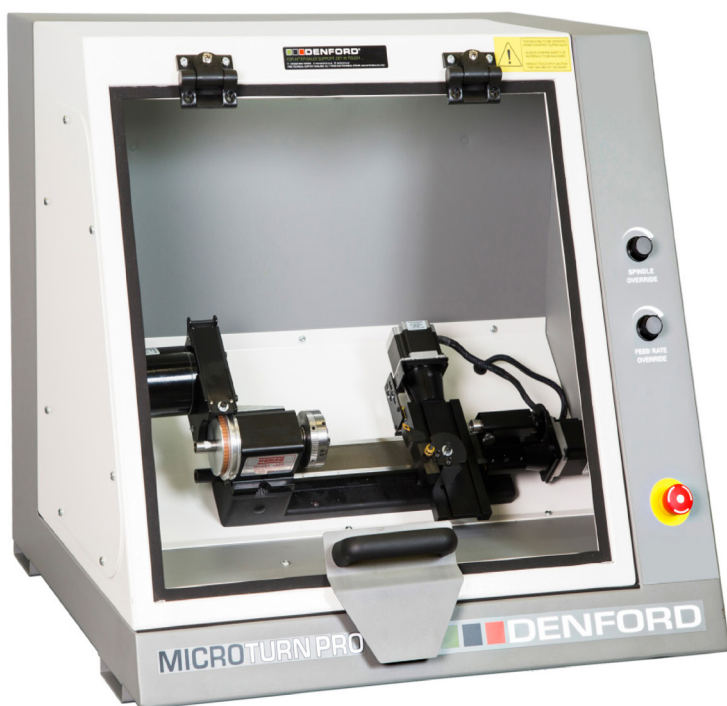




Microturn Pro
CNC Machine
User's Manual

UK
CA | CE
approved



Telephone: General Enquiries +44 (0) 1484 728000
E-mail: For sales enquiries contact, sales@denford.co.uk
For machine servicing enquiries contact, service@denford.co.uk
For customer services, contact customerservices@denford.co.uk

Monday to Thursday 8.30am - 4.30pm GMT
Friday 8.30am - 1.00pm GMT

[illegible]

1 : Notes



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1: Warning Notices

Warranty Disclaimer.

The Warranty on your Lathe will be invalidated if any modifications are made to the machine or any additional ancillary equipment fitted, or any adjustments are made to the controlling devices without prior notification from Denford Limited. Please refer to the information held in your separate Warranty pack, for specific details.

Any portable appliance testing (PAT) carried out on this equipment must comply fully with the instructions outlined later in this chapter.

Maintenance Disclaimer.

Always obtain permission from the person responsible for machinery in your establishment, before accessing the electrical control panel or Lathe machine casings to carry out any maintenance work. All work must be carried out by personnel suitably qualified for each maintenance task, to avoid damage to the machine systems and injury to the maintenance personnel. Denford Limited cannot accept responsibility for any damage, injury and/or loss that may occur through incorrect maintenance of your Lathe.

Use of Machine.

Your Lathe is designed for machining a range of resistant materials such as wax, plastic, free cutting alloys, aluminium and steel. In each case, the appropriate tooling, speeds and feeds should be used as recommended by the material supplier. Information should also be sought from suppliers regarding the safety specification of the materials to be cut.

Your Lathe is not intended for use with MDF or hard woods which may react with the machine lubricants causing oxidation of the machine surfaces, or with any materials which may contain known carcinogens.

Do not machine any toxic, radio-active or volatile materials.

Use of the machine for any purpose other than those for which it is designed may result in injury, and may also invalidate the warranty.

The machine should only be used under constant supervision, to help guard against, and respond to, any unforeseen hazard such as fire or explosion. First aid and firefighting equipment (CO₂ Extinguisher) should be located nearby in a clearly signed and prominent position.

1: Warning Notices



Sound Level Disclaimer.

The Noise Level test published in this manual is for the machine and any essential equipment such as dust extraction equipment, and complies with the relevant standards. It cannot make provision for noise resulting from the cutting process, since this is a variable, depending on such factors as material, cutting data and tooling.

Any ancillary equipment supplied by Denford will also comply with the relevant standards. However, when used jointly with the machine in a machining environment, the combined sound levels emitted may require that Personal Protection Equipment, such as ear defenders, be used. Other factors, such as high ambient noise levels and nearby machinery and equipment can also increase the sound levels.

It may be possible to reduce the sound levels by changing the machining process and/or repositioning the machine and/or its ancillary equipment.

If, under these circumstances, it is felt that the sound level is still unacceptably high, then independent advice should be sought and complied with.

If you have any doubts and/or questions regarding the use, specification, servicing, or features of your machine, please contact Denford Customer Services.

Denford Limited reserves the right to change the specification and/or operating features regarding this CNC machine without notice or documentation.



Portable Appliance Testing.

In-Service Testing

This is the testing carried out as a routine to determine whether the equipment is in a satisfactory condition.

In-Service testing will involve the following:

- Preliminary inspection
- Earth continuity tests (for Class 1 equipment)
- Insulation testing (for Class 1 equipment)

Electrical testing should be performed by a person who is competent in the safe use of the test equipment and who knows how to interpret the test results obtained. This person must be capable of inspecting the equipment and, where necessary, dismantling it to check the cable connections.

1: Warning Notices

Portable Appliance Testing (continued).

If equipment is permanently connected to the fixed installation, e.g. by a flex outlet or other accessory, the accessory will need to be detached from its box or enclosure so that the connections can be inspected. Such work should only be carried out by a competent person.

Preliminary inspection

Formal visual inspections should only be carried out by persons competent to do so.

- Cables located so as to avoid damage
- Means of disconnection/isolation readily accessible
- Equipment positioned to avoid strain on cord
- Equipment is being operated with the covers in place
- Indiscriminate use of multi-way adaptors and trailing sockets is avoided
- Identify signs of overheating
- Identify signs of damage to insulation
- Check the correct size fuse is fitted (13A)
- Check the flexible cable connections and anchorage.

Before carrying out the following tests ensure the machine is disconnected from any external equipment or supplies.

Ensure Ethernet (RJ45) and USB (if applicable) connections are removed prior to testing.

Earth continuity Test (Class 1 equipment)

The test should be carried out at 25A for a period of 5 – 10 Seconds

The reading should be less than $0.1 + R$ (where R is the resistance of the lead)

Insulation Resistance Test (Class 1 equipment)

The applied test voltage connected between Live/Neutral and Earth should be 500VDC

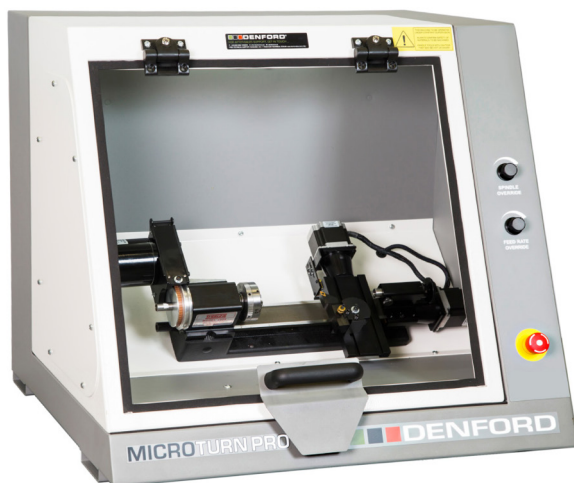
The insulation Resistance should be greater than 1M Ohms

1: About this Manual

Using this manual	<p>This manual provides information describing how to transport, site, setup and operate the basic functions of your Denford Lathe CNC machine, including any operational features of hardware specific to the Denford Lathe series.</p> <p>This manual does not provide any information regarding the software packages used. Please refer to the help section within the appropriate software.</p> <p>Please note that the Electrical Diagrams for your Lathe are not included in this manual - they are delivered separately in the standard equipment box supplied with your CNC machine.</p> <p>If you have any doubts and/or questions regarding the specification, servicing, or features of your Lathe, please contact Denford Customer Services. Denford Limited reserves the right to change the specification and/or operating features regarding this CNC machine without notice or documentation.</p>
Disclaimer	<p>Please note that due to the nature of hardware and software developments, the specifications and features of this product can change without notice. The information contained in this manual is correct at the date of printing only - February 2023. No liability can be accepted by Denford Limited for loss, damage or injury caused by any errors in, or omissions from, the information supplied in this manual.</p>
Screenshots	<p>Please note that any screenshots are used for explanation purposes only. Any numbers, wording, window or button positions may be different for the configuration of the CNC machine control software being used to control your Lathe.</p>
Language	<p>This manual is written using European English.</p>
Contact	<p>Any comments regarding this manual should be marked for the attention of our technical authoring team and referred to the following e-mail address: customerservices@denford.co.uk</p>

1: Introducing your Microturn Pro

Congratulations on your purchase of a Microturn Pro CNC machine. In this manual you will learn how to setup and use your Machine correctly and safely.



Your Lathe is a full two axes CNC Lathe. Suitable for all levels of education and training, it is manufactured to meet industrial standards. With rapid traverse rates of up to 600 mm/min. Your Microturn Pro is designed with you in mind - making the processes involved both safe and easy to use.

Main Features:

- Designed specifically for Education and Training.
- Manufactured to industrial standards.
- Programming via International Standards Organisation format (ISO).
- CE & UKCA approved for safety.
- Capable of cutting common resistant and prototyping materials Aluminium, Brass, Wax, Plastics and Acrylics.
- Links to various CAD/CAM software packages.
- Totally enclosed high visibility interlocked guard.
- Feedrate and Spindle Speed override controls.

1: Before Beginning to Setup

Before beginning to set up your Microturn Pro, please check your separate order documentation, making sure that all items have been delivered to your establishment. Any missing or damaged items should be reported to Denford Customer Services as soon as possible.

The following equipment is supplied as standard with your Lathe CNC machine:

- Microturn Pro CNC machine. Note that the precise specification of your CNC machine will depend on any options selected at the time of ordering (see below).
- 1 x Metric Allen (hex) keys pack.
- 1 x Imperial Allen (hex) keys pack.
- 1 x Microturn Pro warranty pack (UK Machines only).
- 1 x CD-ROM containing Denford VR CNC Machine Control Software and manuals, and Machine user's manual.
- 1 x CD-ROM containing VR CNC Machine Control Software Security Key.
- 1 x RJ45 Ethernet cable.
- 1 x USB to RJ45 adaptor.
- 1 x Spare fuse pack.
- 1 x Mains Cable.
- 1 x R.H. Turning Tool & Tip.
- 1 x L.H. Turning Tool & Tip.
- 1 x Parting off Tool & Tip.
- 1 x Torx Driver.
- 1 x Toolpost Hexagon Socket Key.
- 1 x Set of tommy bars.
- 1 x Manual tailstock.

The following optional equipment may also be supplied with, or ordered for, your machine:

- Additional Software: CAD/CAM, Offline CNC Machine Control.
- CNC Machine Control software security keys.
- 8 Station Auto Indexing Turret
- Comprehensive Tooling Packages for Auto Turret and Manual Toolpost.
- Thread cutting package.

2: Safety Features and Precautions

Safety Features Overview.

The following safety features are standard on your Machine:-

- Emergency stop button.
- Manually operated, totally enclosed guard door with interlock switch.
- Option to check CNC programs using toolpath graphics, prior to machining.
- Automatic tool retraction and spindle stop for tool changing.

Safety Precautions.

Safety is very important when working with all forms of machinery but particularly when working with CNC equipment, due to the hazardous voltages, speeds and forces that exist in the hardware. Follow the rules below at all times, when using your machine.

General Safety Precautions :

- Wear clothing suitable for machine operation and follow the safe working procedures in place at your establishment. When cleaning down the machine, wear suitable respiratory protective equipment. Other personal protective equipment, such as eye protection, overalls and gloves should also be considered.
- 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.
- Ensure the mains power is switched off (and unplugged) before starting any maintenance work on the machine. Depending on ancillary equipment supplied with machine there may be more than one power supply to the machine. When isolating the machine always ensure that all power sources have been disconnected. Post a notice informing others not to use the machine whilst undergoing maintenance.
- Hazardous voltages can still exist immediately after switching the machine off. Always wait at least 10 minutes before accessing the CNC machine electronics.
- If power fails turn off the mains power switch immediately and unplug the machine from the mains power socket.
- Correct maintenance is an essential part of the safe use of this machine (see the Maintenance section for further details).
- Observe caution when handling machine tooling, particularly with regard to hot and/or sharp cutters. Consider wearing protective gloves.
- When an emergency stop is required, press the circular red emergency stop button, located on the right side of the CNC machine front panel.
- Visually check door and window for signs of cracks or chips. Any damage should be reported immediately to Denford and a suitable replacement obtained without delay.

2: Safety Features - Emergency Stop



A circular, red emergency stop button is located on the right front panel of your Lathe, as shown above. When pressed, it has the effect of stopping all axes movements and bringing the spindle to a controlled stop. The guard interlock switch will also close. When the safety guard door is in its closed position, this will prevent access to the working area of the CNC machine.

To activate an emergency stop, press the button in until it clicks. The emergency stop button will continue to cut all power to the machine drives and keep the interlock switch closed, until the release sequence is performed.

To release a closed emergency stop button, turn the button clockwise until it springs back out.

After releasing an emergency stop, you will need to reset any CNC control software messages and home the CNC machines axes.

Check the emergency stop button is released before attempting to power up the Lathe.

2: Safety Features - Interlock Guard

Note

A closed safety guard door cannot be opened when:

- The machine is switched off (ie, not in use). To release the interlock guard switch, supply power to the machine.
- The emergency stop button is fully pressed in. To release the lock, push in and turn the emergency stop button counter-clockwise until it springs back out to its ready position.
- Machining is taking place. The interlock guard switch will release when the machining operations have been completed.

Warning



Danger of serious injury!

Do not let unauthorised personnel use the machine when the guard lock feature is disabled. Ensure the guard lock feature is switched back on as soon as possible. Under no circumstances must the safety switch actuator be removed (or a spare or replacement actuator, or other device be used) to defeat the safety interlocking system.

Note

When the guard lock feature is disabled, the machine spindle will not operate. Ensure this is enabled before operation.

An interlock guard switch is fitted to the front machine door. The switch unit itself is attached behind the lower machine panel, accessible from beneath the front of the machine. The lock must be manually released to enter the working area when the 24 volt circuit has failed and the door is clamped electrically. An override facility is provided on the interlock guard switch, allowing temporary removal of the guard lock feature. For manual interlock release, the power supply must be switched off.



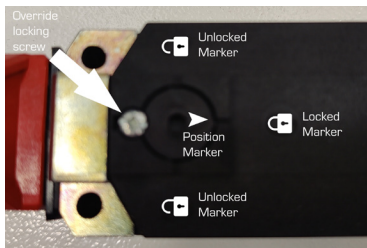
Left: The interlock guard switch unit (circled) is located behind the lower front machine panel.

1) Working beneath the front edge of the machine, locate the interlock guard switch unit.

2) Using a small flat or crosshead screwdriver, loosen the manual override locking screw until the circular black plastic lock screw can be turned (refer to photograph below).

3) Using a 3mm allen key, turn the circular black plastic lock screw one quarter turn to switch off the guard lock feature. If in doubt refer to the lock/unlock symbols embossed on the casing surface.

4) If necessary, tighten the manual override locking screw slightly. If you need to leave the machine, post a warning note informing users that the safety guard door lock is not operating.



Above: Looking directly at the face of the interlock guard switch

2: General Swarf Precautions



General Swarf Safety Precautions.

Obtain "material safety data sheets" from your material suppliers and enforce the recommended precautions. Be aware that certain materials could contain known carcinogens. Please consult your materials supplier for further details.

Swarf particles that remain inside the working area of the Mill after a part has been machined, should be removed using a dust pan and brush or a specifically designed swarf and lubricants vacuum.

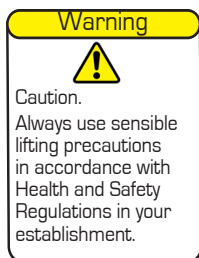
Never used a compressed airline for this purpose.

When cleaning down the machine, wear suitable personal protective equipment, such as respiratory protection, eye protection, overalls and gloves should also be considered.

swarf particles on the floor can cause slipping. This should be monitored by the operator and removed before becoming a hazard.



3: Unpacking and Lifting your CNC Machine



If your CNC machine has been supplied inside a delivery box, cut the top of the box open and remove any packaging carefully. To obtain better access to the machine, remove all the sides from the delivery box. Your Microturn Pro weighs 80kg.

With the bench mounting unit a suitable method of transportation must be used as the unit is not fitted with wheels: for example secure machine on a pallet and transport using a pallet truck.

If lifting by crane, suitable certified slings must be used as shown in following the illustration.



Denford do **not** advise manual lifting of this machine, however if no other suitable alternatives are available, the machine only could be lifted by at least 2 people, one at each end. Account should be taken of the non-uniform distribution of the weight of the machine. It is generally heavier at the right hand end than the left hand end. The use of suitably rated lifting bars through the hollow sections under the machine may assist in lifting the machine.

Always use sensible lifting precautions in accordance with Health and Safety Regulations in your establishment. Particularly in the case of manual lifting be aware of the danger of trapping.

Ensure that your CNC machine is both secure and balanced before lifting. Do not tip the machine whilst lifting.

All lifting equipment must be certified as being suitable for the loads involved.

3: Choosing a Site for your CNC Machine

Site your machine in a well ventilated room.

Ideally, the user will operate the machine when standing at its front, with a clear view of both the machine working area (through the transparent guard window) and the personal computer being used as the controller unit (which should be angled towards the user), as shown in the diagram below.

Sufficient room should also be provided for effective maintenance to be carried out around the machine itself. In particular, leave enough space for removal of the large plate covering the electronics at the right hand side of the cabinet. Positioning the PC on a movable workstation may allow easier access to the various vents, connectors and switches on the machine cabinet, when required.

Position any air compressors used at the rear, or under, the machine table.

Do not place the machine in a position which allows any of the cabinet vents to be covered. Ensure all cables, pipes and flexes are routed to avoid the possibility of users tripping over them.

Dimensional Data.

Machine Width (left to right) 685mm (27").

Machine height (top to bottom) 688mm (27").

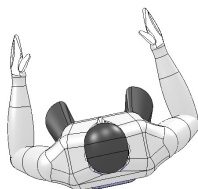
Machine depth (front to back) 654mm (25.7").

Ensure that any inlet/exhaust vents are not covered or blocked.

Allow space to remove the electrical panel cover plate at the side of the cabinet.



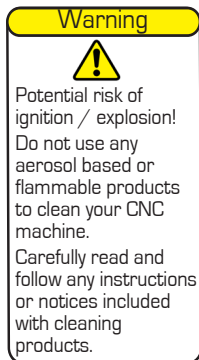
Computer angled towards Operator.



Machine Operator.

Plan View showing Ideal Machine Layout and Operating Positions.

3: Removing Protective Coatings and Packaging

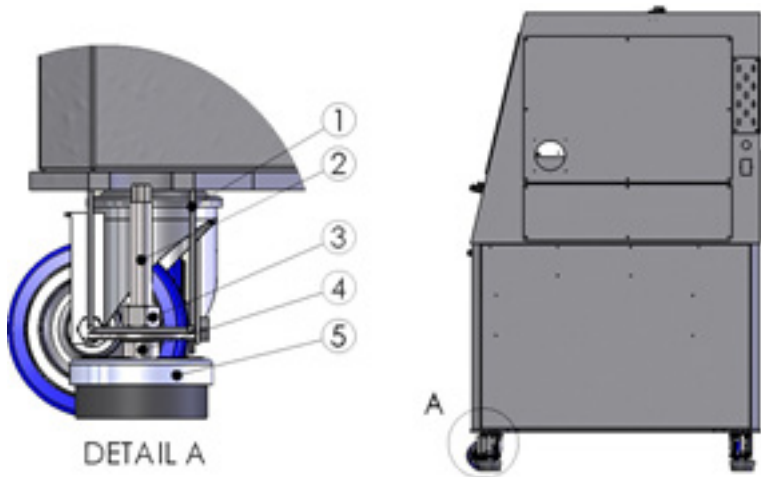


Once your Lathe has been sited and connected electrically, the protective coatings and transit packaging must be removed to prepare the machine for running:

- 1) The protective plastic sheeting on the guard door and window must be removed prior to cleaning them with an antistatic cleaner.
- 2) Tie-wraps may be used in the working area of the machine, to prevent movement of components during transit. Additional items from your order may also be supplied packaged inside the working area.
- 3) To gain entry to the working area of the machine, power must be supplied to the machine, in order to release the switch unit that locks the safety guard door. Note that the switch unit will also remain locked when the emergency stop button is fully pressed in.

Warning - Aerosol based or flammable products must not be used to clean your CNC machine. To avoid the potential risk of ignition / explosion, ensure that any trapped solvent vapours can exit fully from any enclosed areas on the CNC machine. Wait at least 1 hour before attempting to operate the CNC machine.

3: Adjusting anti-vibration feet



This is only relevant if the machine has been ordered as part of the Denford Duo package.

Note: the anti-vibration feet are intended to be used as steadies and not for jacking the machine/base off its wheels. The wheels must always remain in contact with the floor.

These instructions are for siting the machine and also for when the machine is in transit.

1. Remove the hexagon bolt [2] and lock nut [3] from foot assembly
2. Compress support platform [4] into foot [5] sufficiently to allow the foot assembly to be positioned under the base bracket [1]
3. Re-fit hexagon bolt and locknut to foot assembly.
4. While preventing the foot assembly from rotating, turn the hexagon bolt clockwise with a 9mm a/f spanner until the support platform contacts the underside of the base bracket and the foot contacts the floor. Turn the hexagon bolt another 2 full turns.
5. Using a 9mm a/f spanner to prevent the hexagon bolt from rotating, turn the locknut clockwise with a 19mm a/f spanner to lock the bolt.

4: Switching the Lathe On

Note

The safety guard cannot be opened until the Lathe is powered up to release the interlock guard switch.

Warning



Do not connect cables between any electrical hardware with the mains power switched on, since this could seriously damage components inside your CNC machine.

Warning



Never attempt to access the electronic hardware systems of the machine with the mains power switched ON.

Note that hazardous voltages can still exist immediately after switching off the power.

If the machine has previously been switched on, wait at least 10 minutes before attempting to open the electrical panel cover plate.

Many electronic components are sensitive to electrostatic damage - ensure components and/or personnel are suitably earthed to minimise this risk.

Follow these instructions to switch on your Lathe:

- 1) Check the Ethernet cable is fitted securely between the Lathe cabinet (located above or near the power cord) and either the RJ45 socket on your computer or into the supplied RJ45 to USB adaptor which is then fitted to your laptop or computer.
- 2) Check that all access panels are in position and securely fastened.
- 3) Check that all inlet/exhaust vents are clear from obstructions.
- 4) Check that the guard door is fully closed.
- 5) Plug the Lathe mains supply cable into an available power socket. Switch the power socket on.
- 6) The on/off power switch is located on the right-hand panel of the Lathe cabinet. To switch machine on depress the left-hand side of switch. The switch will illuminate when power is being supplied to the machine. If the Lathe does not begin its power-up routine, switch off the mains power and check all connections and fuses.
- 7) Switch on the machine controller PC and start the CNC machine control software.

Establish a communication link between your machine controller and PC - for help please contact technical support +44 (0) 1484 728000.

4: Switching the Lathe Off

Warning



Never attempt to access the electronic hardware systems of the machine with the mains power switched ON.

Note that hazardous voltages can still exist immediately after switching off the power.

If the machine has previously been switched on, wait at least 5 minutes before attempting to open the electrical panel cover plate.

Many electronic components are sensitive to electrostatic damage - ensure components and/or personnel are suitably earthed to minimise this risk.

Warning



Depending on ancillary equipment supplied with machine there may be more than one power supply to the machine.

When isolating machine always ensure that all power sources have been disconnected.

Follow these instructions to switch off your Denford Lathe off:

- 1) Wait for the Lathe to fully complete any machining or processing of any operational instructions.
- 2) Open the safety guard door and remove any finished parts from the working area.
- 3) Close the safety guard door.
- 4) Close down the communication link between the CNC control software and the Lathe, then exit the CNC control software, as described in your separate CNC Control Software User's Manual.
- 5) Power down the Lathe by depressing the right-hand side of the red on/off mains power switch. The on/off switch is mounted on the right-hand cabinet panel, Note that cutting the machine power will trigger the closing of the interlock guard switch. This will lock a closed safety guard door in position, preventing access to the machine working area. The interlock guard switch will automatically reopen when power is next supplied to your Lathe.
- 6) Switch off the mains power socket.

4: Homing the Machine Axes (Home Mode)

Note

The sequence of events required to home the Lathe will depend on the type of CNC machine control software being used - please refer to your separate CNC Machine Control Software User's Manual for specific details.

Immediately after establishing a communication link between the CNC control software and the Lathe, both axes and the tool post (if fitted) of the CNC machine must be homed. The process is commonly referred to as homing the machine, or datuming each of the machine axes.

When a communication link is first established between the Lathe and the CNC machine control software, or when the CNC machine "loses" position, the software will not know the true position of the machine axes in relation to the machine spindle.

Note

The CNC machine control software Jog and Auto Modes will not become available until the machine has been configured by homing all machine axes.

Homing the CNC machine defines:

- The machine datum, by physically driving the machine head to a fixed zero reference point.
- The constraints of the dimensional co-ordinate grid system used for plotting any programmed movements, effectively the working envelope of the CNC machine.

Note

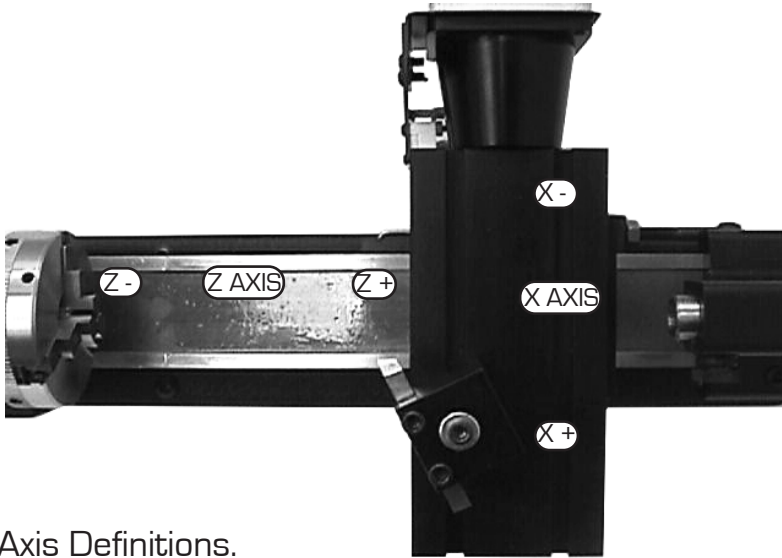
The machine datum position is set by Denford and can never be moved, since it defines the physical movement capability of the CNC.

After homing the machine, the zero position of the dimensional co-ordinate grid system is referred to as the machine datum. You can find the position of the machine datum by switching the co-ordinate display in your CNC control software to read Machine Co-ordinates. The position of the machine datum is achieved when the X and Z panels of the co-ordinate display all read zero.

In addition to homing the CNC machine after it has first been switched on, we also recommend homing the CNC machine after loading or configuring any offsets.

4: Manual Control - Axis Definitions (Jog Mode)

Jog mode is used for manually controlling the CNC machine, moving the machine axes, changing tools, operating optional equipment and configuring any offsets.



Axis Definitions.

X Axis - The X axis slides run at 90 degrees to the Z axes, vertically up and down, when viewed from the front of the machine.

Minus [-] X movements run towards the top end of the machine [towards the centre of rotation] and positive [+] X movements run towards the bottom end of the machine [away from the centre of rotation].

Jog Keys to move axis - arrow keys up and down.

Z Axis - The Z axis slides runs along a line between the spindle and the tailstock, or in other words, the centreline of rotation of the spindle, parallel with the longest edges of the machine bed, horizontally left and right, when viewed from the front of the machine.

Minus [-] Z movements run left, towards the spindle and positive [+] Z movements run right, away from the spindle.

Jog Keys to move axis - arrow keys left and right.

4: Machine Operators Panels

Note

Feedrate override changes will only be registered when an actual spindle speed or feedrate is being applied by the CNC control software.

Spindle Speed and Feedrate Override Controls.

The spindle speed and feedrate of the Microturn Pro can be manually overridden during a machining operation, using the potentiometer controls fitted to the operators panel. The spindle speed can be overridden between 50% and 120%.

The feedrate can be overridden between 0% and 150%.

To increase the spindle speed or feedrate, rotate the appropriate control clockwise.

To decrease the spindle speed or feedrate, rotate the appropriate control counterclockwise.

The degree of adjustment applied to each value is displayed in the CNC control software.

Warning



Depending on ancillary equipment supplied with machine there may be more than one power supply to the machine.

When isolating machine always ensure that all power sources have been disconnected.

Mains Power Switch.

To supply power to the CNC machine, depress left-hand side of the switch immediately above the power inlet socket. To cut power to the CNC machine, depress right-hand side of switch.

Do not cut the mains power when machining or processing of any operational instructions is taking place. Note that cutting the machine power will trigger the closing of the interlock guard switch. This will lock a closed safety guard door in position, preventing access to the machine working area. The interlock guard switch will automatically reopen when power is next supplied to your Lathe.

Note

Activating an emergency stop will also trigger the interlock guard switch. This will prevent a closed safety guard door from being opened.

Emergency Stop Button.

The emergency stop button is a circular red push button. Pressing the emergency stop button has the effect of stopping all axes and spindle movements immediately. To activate an emergency stop, press the button in fully until it clicks. The emergency stop button will remain closed (continuing to cut all power to the machine drives) until the release sequence is performed. To release a closed emergency stop button, push and turn the button clockwise until it springs back out, then wait 10 seconds for the machine systems to reset, unlocking the safety guard door.

5: Performing a Tool Change

Warning



Never open the safety guard door and enter the working area when the spindle or machine axes are moving.

Note

When two or more tools are used in the same CNC file:

Your new tool **MUST** be refitted to the toolpost in exactly the same position used when originally configuring its X tool offset value.

Performing a Manually Requested Tool Change.

To ensure that the machine is always aware of which tool is fitted to the spindle at any one time, it is recommended that if you wish to change tool it is carried out via the machine control software. When a tool change is requested the machine will automatically move to the tool change position as it would do in the Automatic tool change detailed in the next chapter.

Performing an Automatically Requested Tool Change during the running of a CNC program.

On reading a tool change operation line in your CNC program, the machine axes will move to their tool change positions, via an intermediate point, if programmed.

At this point, the software will pause the CNC program.

As this is a manual tool change system a message window will be displayed, prompting you to manually change tools.

Always wait for the spindle and machine axes to stop moving, before attempting to open the safety guard door.

Replace the current tool number with the tool number specified in the software message window (the tool profiles allocated to each tool number may be listed at the beginning of your CNC program).

Close the safety guard door and ok the software message window to resume your machining.

5: Quickchange Manual Tooling System

The tool change system, supplied as standard with your Microturn Pro, comprises of the following elements:

- i) The quickchange toolpost body, which is mounted to the cross slide and allows fitment of the quickchange tool holder.



The Quickchange
Lathe Toolpost
Body.



The Quickchange
Lathe Toolholder.



The Quickchange
Lathe Tool.

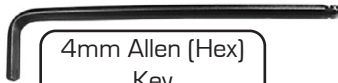
- ii) The tool holder, which is fitted to one of the two location slots on the sides of the toolpost body. Tool holders are held in position using a dovetail joint, to allow easy manual removal and replacement of tools, when necessary. Height adjustment is achieved using the knurled nut and locked in position using the hex bolt.
- iv) Special Tooling - M10 Spanner, Toolpost hex socket key and 4mm allen key, supplied with the machine.



M10 Spanner



Toolpost Hex
Socket Key

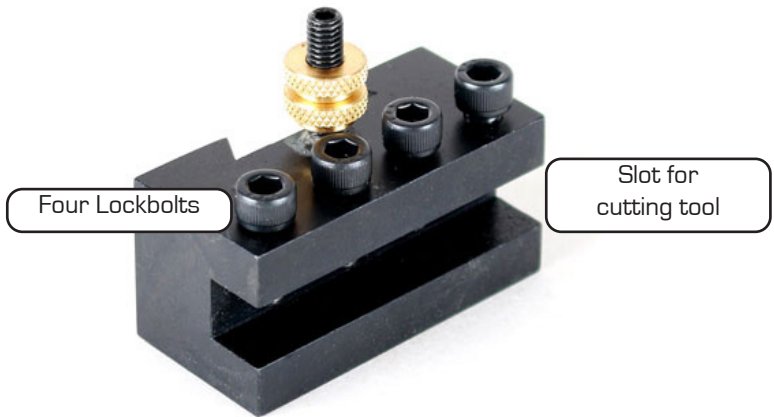


4mm Allen (Hex)
Key

5: Quickchange Manual Tooling System

Fitting a Tool to the Toolholder.

- 1) Using a 5/32" allen (hex) key, unscrew the four lockbolts on the toolholder. When directly viewing the top of the bolt heads, turn counter-clockwise to loosen or clockwise to tighten them.
- 2) Place the cutting tool into the toolholder, in the correct orientation. Diameter turning / external tools must be fitted with the cutting edge facing up.
- 3) Tighten the lockbolts until they just begin to grip the upper surface of the cutting tool body. Tighten each bolt used by one quarter turn. Continue this procedure until all bolts are fully tightened and the cutting tool is held securely.



Bear in mind the following recommendations when choosing tools:

- a) Only use fully sharpened tools, and make sure that they are securely locked in the tool holder.
- b) Never use bent, damaged tools or chipped tools.
- c) Always make sure that the mating surfaces of tools are perfectly clean and dent free before fitting the tool in the tool holder.
- d) Always ensure that the tool is a precision instrument, and inserts must be held in to a high degree of security.

5: Quickchange Manual Tooling System

Toolpost Body Angle Adjustment.

To adjust the angle of the toolpost body, use an M10 spanner to release the locknut. The locknut is located on the central toolpost mounting stud, shown circled right. When directly viewing the top of the nut, turn counter-clockwise to loosen or clockwise to tighten.



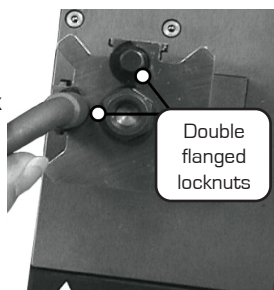
Warning



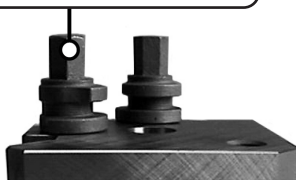
Never open the safety guard door and enter the working area when the spindle or machine axes are moving.

Fitting the Toolholder to the Toolpost Body.

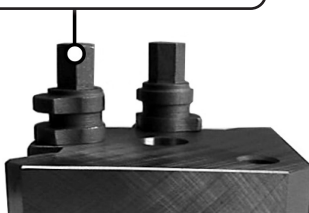
1) Using the supplied toolpost hex socket key, turn the appropriate locknut so the double flanges are pointing towards the centre of the toolpost, as shown right and below.



Double flanged locknut open



Double flanged locknut closed



5: Quickchange Manual Tooling System

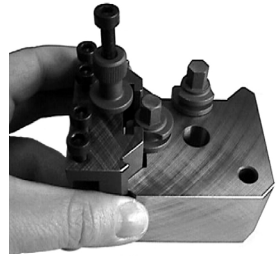
Warning



Never open the safety guard door and enter the working area when the spindle or machine axes are moving.

Fitting the Toolholder to the Toolpost Body.

2) Aligning the guides on the toolholder with the guides and spring loaded bracket on the toolpost body, slide the toolholder down into the toolpost bracket (shown right).

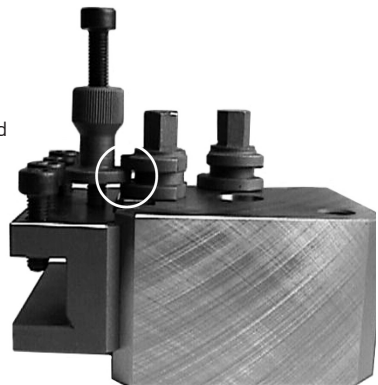


Lower the toolholder until the single flange on the toolholder height adjustment screw is level with the space between the two flanges on the toolpost locknut (shown right).



3) Turn the toolpost locknut, so the single flange on the toolholder height adjustment screw is loosely held between the two flanges on the toolpost locknut. At this stage, do not fully tighten the locknut, since this will prevent any toolholder adjustment from being carried out.

Turn the locknut to its closed position, holding the toolholder in position.



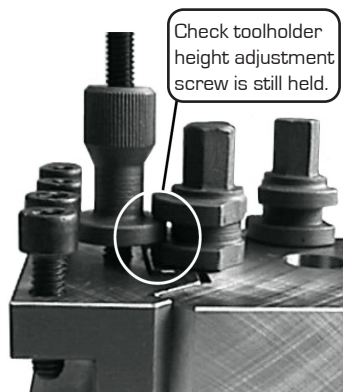
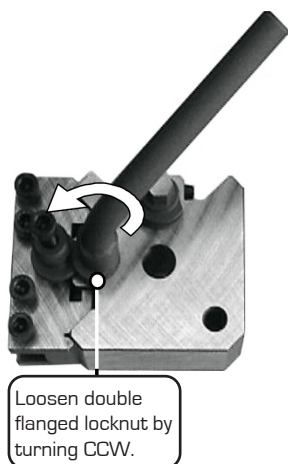
5: Quickchange Manual Tooling System

Toolholder Height Adjustment.

1) Using a 4mm allen (hex) key, release the lockbolt on the toolholder height adjustment screw (shown right). When directly viewing the top of the bolt head, turn counter-clockwise to loosen. If you intend to raise the height of the toolholder, you must unscrew the bolt further, to allow Toolholder movement.

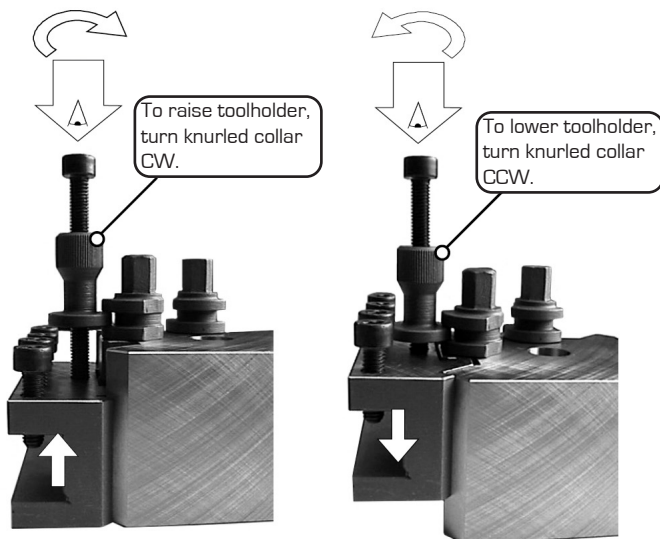


2) Loosen the double flanged locknut on the toolpost body, if tight. When directly viewing the top of the locknut, turn counterclockwise to loosen (shown below left). Check that the single flange on the toolholder height adjustment screw is still held between the two flanges on the toolpost locknut (shown below right).



5: Quickchange Manual Tooling System

3) Holding the knurled collar, turn the height adjustment screw to raise or lower the toolholder. When directly viewing the top of the screw, turn counter-clockwise to lower or clockwise to raise the toolholder.



4) Tighten the double flanged locknut on the toolpost body, then screw in and tighten the lockbolt on the toolholder height adjustment screw.

7: Manual Chuck Operation

Introduction.

The manual 3 jaw self-centring chuck is supplied as standard with the Microturn Pro CNC lathe. The system comprises two basic elements:

- i) The chuck body, which is secured against the spindle nose.
- ii) Chuck jaws. One set of external chuck jaws (fitted to the chuck shown below),

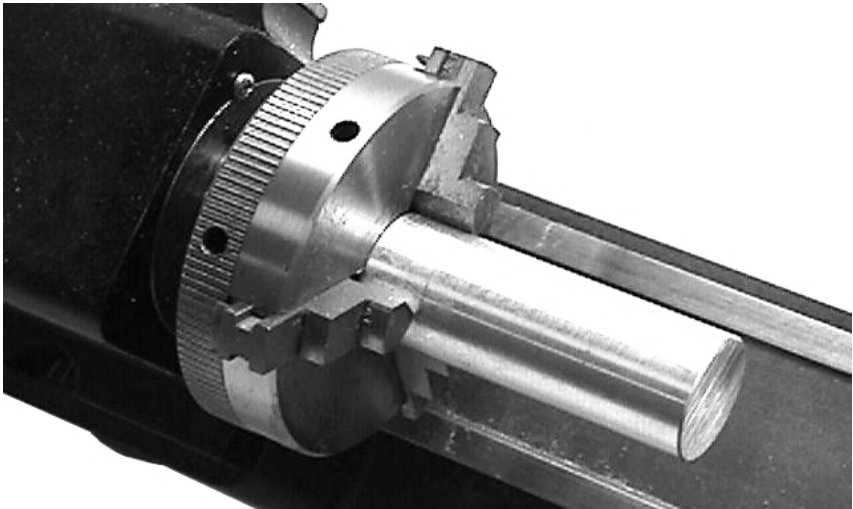
Headstock

Spindle nose

Back section of
chuck body

Front section of
chuck body

Chuck Jaw



Back section
of spindle bar
locating hole

Front section
of spindle bar
locating hole

Billet

Fitting the Billet in a Manual 3 Jaw Chuck.

- 1) The chuck jaws are adjusted using chuck spindle bars, these are $\frac{1}{8}$ " diameter by 3" long, shown below. These are fitted into 1 of 3 holes spaced equally around both the back section of the chuck body and the front section.



7: Manual Chuck Operation

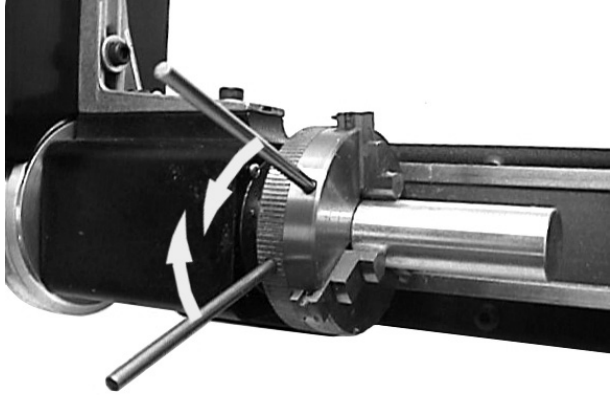
Fitting the Billet in a Manual 3 Jaw Chuck Cont.

Warning



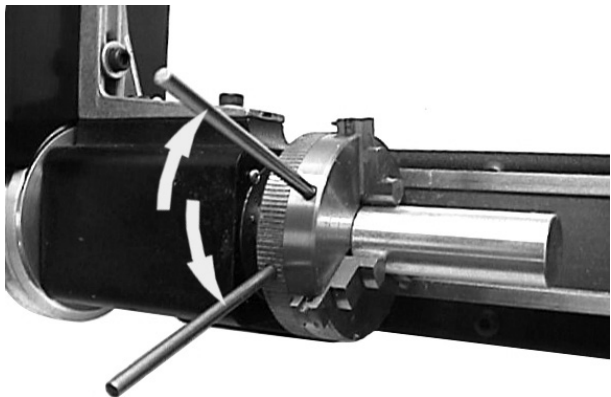
Never leave the chuck spindle bars fitted in one of the locating holes. If the spindle is switched on it could hit the operator or machine and cause serious injury or damage.

2) Open the chuck jaws by moving the two chuck bars together, until there is sufficient space to fit the billet, as shown below.



3) Place the billet between the chuck jaws. Ensure that the billet is placed sufficiently far into the chuck body to be in full engagement with the jaws.

4) Whilst supporting the billet inside chuck body, close the chuck jaws by pulling the two chuck bars apart.



8: Removing Chuck Body from Spindle Nose

Warning

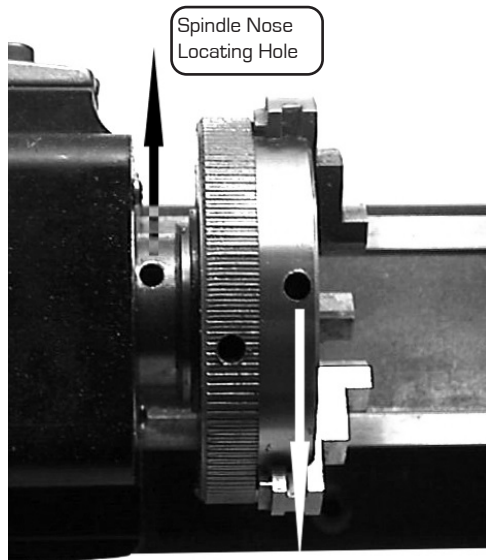


Never leave the chuck spindle bars fitted in one of the locating holes. If the spindle is switched on it could hit the operator or machine and cause serious injury or damage.

1) The chuck body is removed from the spindle nose using the two chuck spindle bars

2) Fit the first chuck spindle bar in one of the locating holes equally spaced around the perimeter of the front section of the chuck body. Fit the second chuck spindle bar in the single locating hole on the spindle nose shaft (just behind the back section of the chuck body).

3) To loosen the chuck body on the spindle nose, move the front chuck section spindle bar in an counterclockwise direction, whilst moving the spindle nose bar in a clockwise direction, shown below.



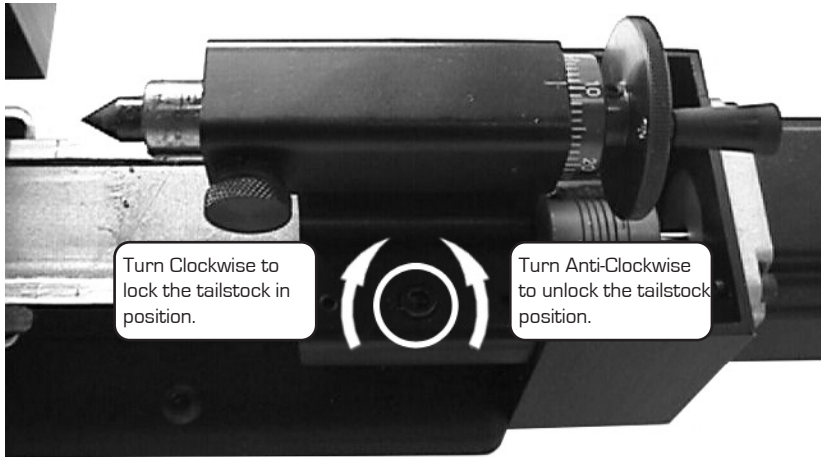
4) Once the chuck has been loosened, the bars can be removed and chuck can be turned by hand for the rest of the way.

5) To refit the chuck follow the above instructions in reverse.

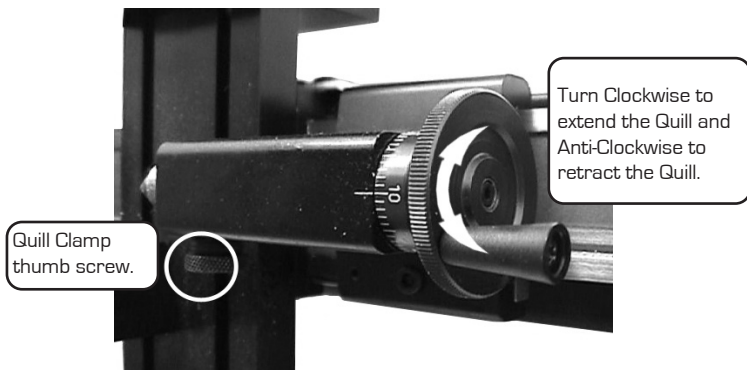
9: Moving the Tailstock

Tailstock Operation Cont.

To position the Tailstock slacken the Tailstock Body Clamp Screw (5/32" Allen Key) and slide Tailstock along the Tailstock Slideway stopping when the Tailstock Center is say 10mm short of the workpiece. Clamp the Tailstock in this position.

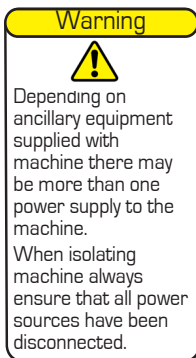
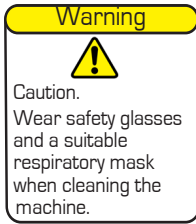


In order to clamp the material in place, wind the Tailstock Quill Positioning Handle until the Centre engages with the workpiece. Clamp the Quill in this position with the Quill Clamping thumb screw.



It must be noted that having a Tailstock fitted to a machine does limit the machine axis movements both when not in use and more over during use. Bearing this in mind care must be taken when programing work for the machine so as not to cause a collision between the machine slides and the tailstock.

10: Planning Procedure for Maintenance Work



When carrying out any maintenance, pay special attention to the following items, ensuring safe and correct working procedures in accordance with Health and Safety Regulations in your establishment:

- Before starting any maintenance work, define the task and obtain the information relevant to carry out the maintenance. Also, define the time period needed to complete the task, to obtain the correct tools and order any spare parts, if required.
- During the maintenance work period, display a suitable notice stating that the machine is under maintenance and should not be used until the notice is removed.
- Safety must be a priority when carrying out any maintenance work. Covers and safety guards that are removed during the maintenance work must be replaced after the task is completed.
- All work must be carried out by suitably qualified personnel.
- Never attempt to access the electronic hardware systems of the machine with the mains power switched ON.
- Hazardous voltages can still exist immediately after switching off the power. If the machine has previously been switched on, wait at least 10 minutes before attempting to open the electrical panel access plate.
- When replacing electrical components, ensure the new parts are of suitable replacement specification.
- All work completed on the machine, whether progressive, or preventative, should be logged to ensure a complete service record is available for future referral. We recommend the maintenance logs at the end of the maintenance section are used to log any maintenance tasks undertaken.
- When maintenance work has been completed, check that the replaced or serviced parts work correctly, before allowing general operation of the machine.

10: Maintenance Schedule

Every Day (and, if necessary between components)

- Clear dust or swarf from working area of machine and ensure that the surfaces of the spindle, tool housing and tool are clean - do not use compressed air.
- Lubricate the slideways and leadscrews - see p41.

Every Week

- Clean the machine thoroughly.
- Check all exposed screws and nuts for tightness.
- Check oil level if auto lubrication option fitted. Replenish if necessary.
- Visually check door for signs of cracks or chips. Any damage should be reported immediately to Denford and a suitable replacement obtained without delay.

Door Part Number MT2/0620

Every Two Months

- Check the condition of any electrical connections.
- Check and thoroughly clean all components of the tooling system.
- Check all cables for kinks and breaks.
- Check door hinges for correct tension and adjust if necessary.

If, after fully hand tightening the centre screw of all hinges with an appropriate tool, the door falls when released from a position 15 degrees forward of vertical, new hinges should be obtained and fitted without delay.

Denford Part Number BI01229

Every Three Months

- Clean microswitches - see p39.
- Check security of Spindle motor mounting bolts.
- Check and adjust spindle drive belt.
- Check the slides for wear.
- Check and adjust gib strips.

11: Lubrication Areas on the Microturn

Warning



Caution.

Wear safety glasses and a suitable respiratory mask when cleaning the machine.

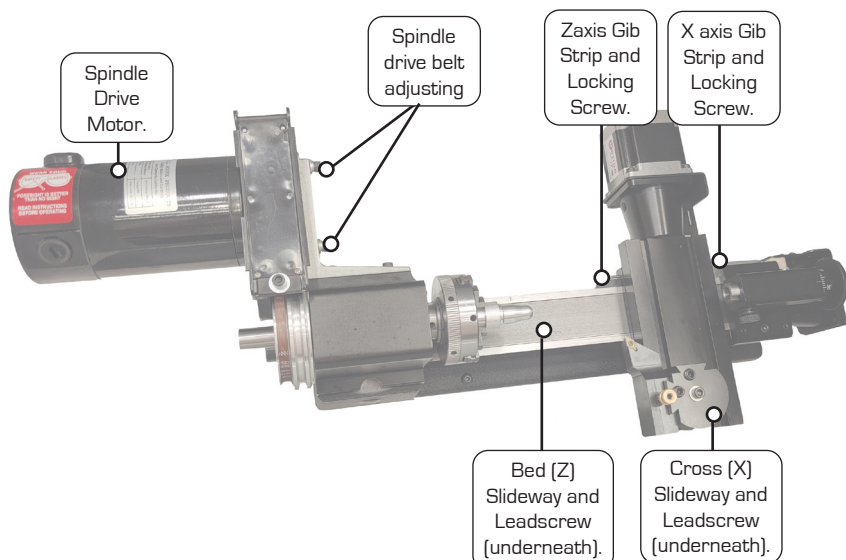
The following items on the machine should be oiled daily, using a light machine oil, sewing machine oil or 3 in 1 oil:

A) Slideways.

B) Leadscrews.

The photo below labels each area which requires daily lubrication.

Your lathe is encased in a cabinet. For illustration purposes, this photo shows a view of the machine without the cabinet.



Warning



Risk of Ignition or Explosion!
Denford recommends that aerosol based cleaning and lubrication products should NOT be used on parts of the CNC machine, since these products may cause potentially explosive vapours to build-up in enclosed areas of the working area.

Warning



Never open the safety guard door and enter the working area when the spindle or machine axes are moving.

Warning



Caution.
If the cutting tool has been recently used, it may still be HOT.

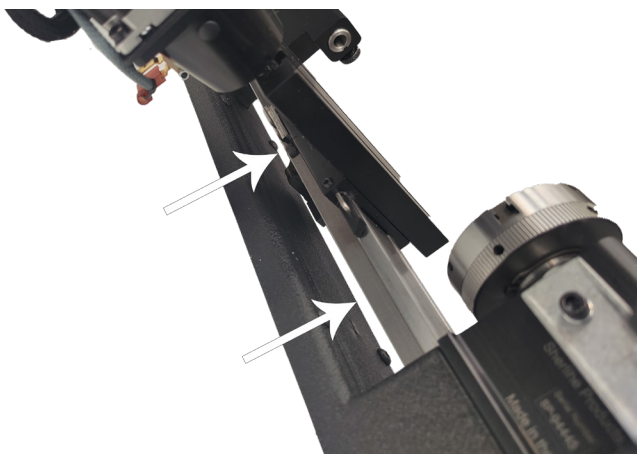
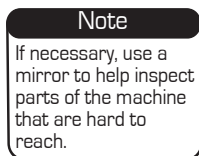
1 1: Lubrication of Leadscrews and Slideways

Bedway (Z Axis) Leadscrew and Slideway Lubrication.

Run the machine saddle fully to the right, to gain access to the bedway leadscrew and slideway. The leadscrew is located under the machine table. The slideway is visible from the front of the machine. Using a pump action oilgun, pump oil directly onto the exposed surface of the leadscrew and the two slideways.

Run the saddle fully to the left, to gain access to the opposite end of the leadscrew and slideways. Pump oil directly onto the remaining surface of the leadscrew and slideways.

Finally, run the saddle left and right along the Z axis, to distribute the oil along the full length of the leadscrew and slideways.



1 1: Lubrication of Leadscrews and Slideways

Cross slide (X Axis) Leadscrew and Slideway Lubrication.

Run the machine cross slide fully up, to gain access to the cross slide leadscrew and slideway. The leadscrew and slideway is located under the machine cross slide. Using a pump action oilgun, pump oil directly onto the exposed surface of the leadscrew and the two slideways.

Run the saddle fully to the left, to gain access to the opposite end of the leadscrew and slideways. Pump oil directly onto the remaining surface of the leadscrew and slideways.

Finally, run the table left and right along the X axis, to distribute the oil along the full length of the leadscrew and slideways.

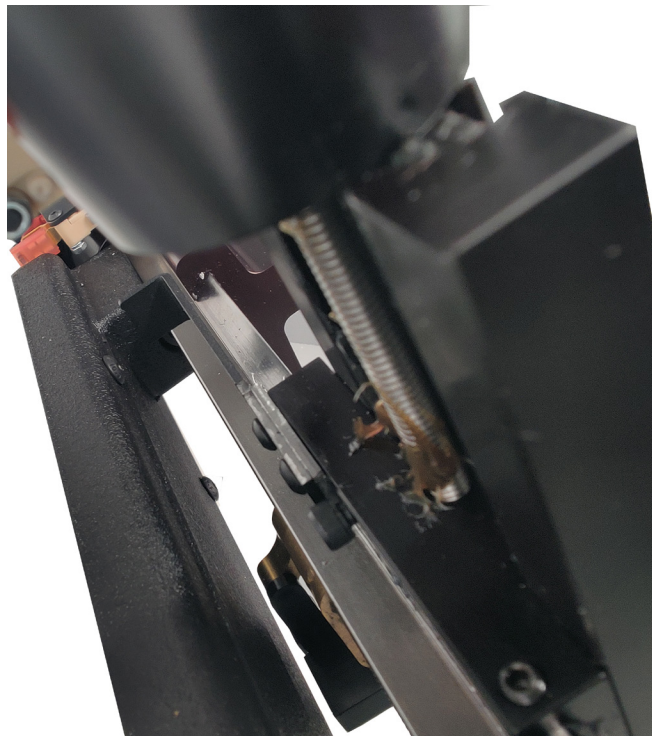
Location

Look behind bed slideway.



Note

If necessary, use a mirror to help inspect parts of the machine that are hard to reach.

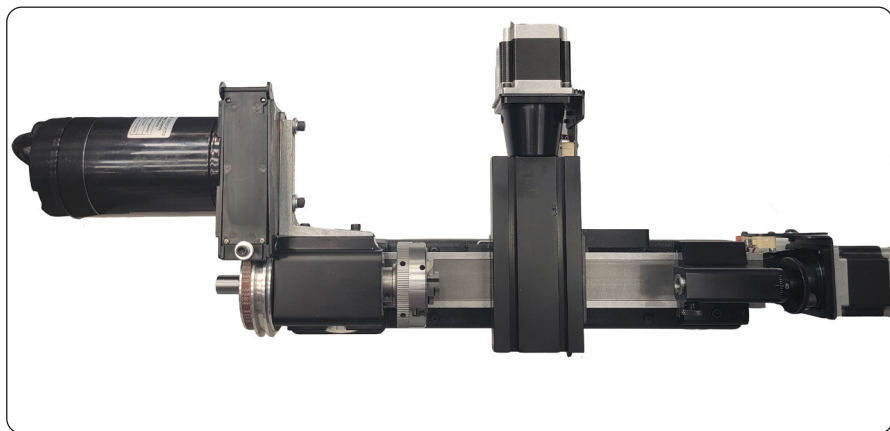


12: Cleaning the Microswitches

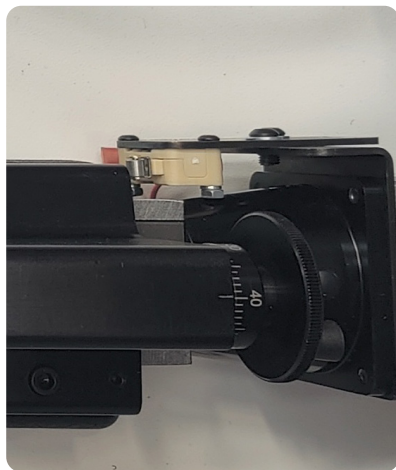
The X and Z axis both have microswitches

Using a soft bristled brush, carefully clean dust and debris away from the microswitch, to an area where it can be removed using a vacuum cleaner.

To access the Z-Axis Microswitch jog the Z-Axis towards the spindle, take care to ensure tools do not make contact with the chuck jaws, with the Z-Axis all the way to the spindle the microswitch should be easier to access.



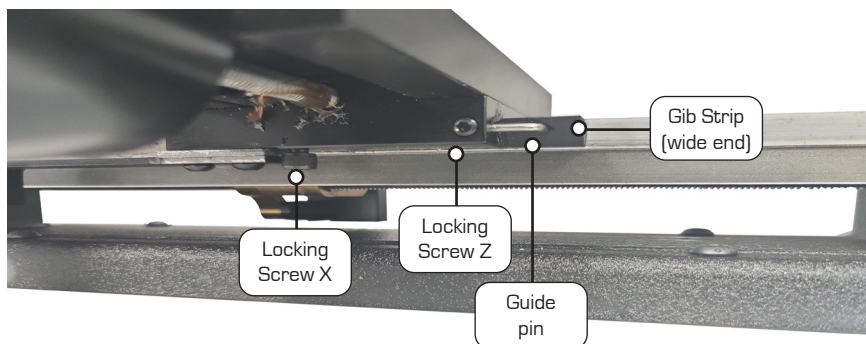
To access the X-Axis Microswitch jog the X-Axis up, take care to ensure tools do not make contact with the chuck jaws, when the X-Axis all the way up the microswitch should be easier to access.



13: Gib Strip Adjustment

A gib strip is an angled section of metal or plastic, tapered along its length, which is fitted to one side of a machine slide. One gib strip is fitted to each of the two machine slides on your Microturn.

Essentially, driving one of these wedges further along a slide will gradually decrease the amount of free play in the axis. The photo below shows a gib strip fitted to the Z axis of a Micromill machine.



During the day-to-day use of your Microturn, wear will occur in each of the gib strips. This wear is normal and if checked regularly will not affect the performance of your machine.

Denford recommends that the gib strips be checked annually. Any slack present in the slides should be rectified, by adjusting the gib strips, as described on the following pages.

Checking the Condition of the Gib Strips.

As the gib strips wear down, varying degrees of free play will become noticeable in each of the three machine axes.

You can quickly judge the slack available in each slide, by holding the cross slide and bed slide at their extreme ends. Try to move, or wobble them from side to side, across the width of the slide. Any excessive movement will indicate that the slide in question requires adjustment.

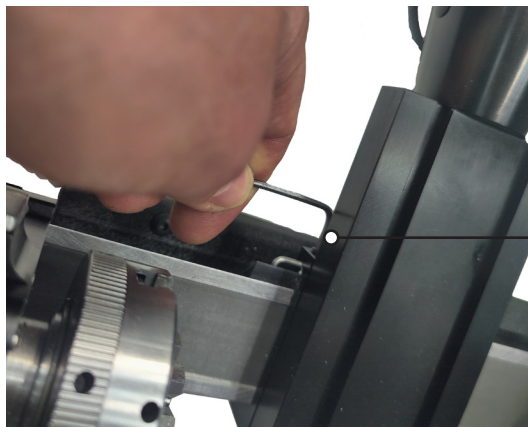
To accurately assess the condition of each slide, Denford recommends the use of a dial gauge.

Note that a slight degree of movement will always be present in every slide. If there is no free movement whatsoever, then the slides would be too tight to move.

13: Gib Strip Adjustment

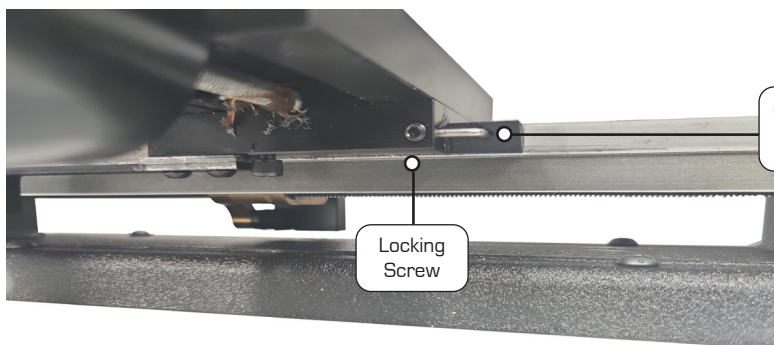
Z Axis Gib Strip Adjustment Method:

1) Release the gib strip locking screw, positioned on the back of the machine saddle (shown below).



Turn anticlockwise to release or clockwise to tighten locking screw (when viewing the face of the locking screw).

2) Push the wider end of the gib strip further into its channel to eliminate the free play in the slideway. The gib strip is accessed by reaching under the machine cross slide (see below). Remember that a slight degree of movement must be left in the slide to allow the slide to move.



Gib strip and guide pin

Locking Screw

3) Tighten the gib strip locking screw.

4) Move the machine cross slide left and right across the bedway, to ensure that the movement is smooth.

5) If the movement is not smooth, adjust the gib strip by repeating steps 1) to 3). Run the machine cross slide again to assess the smoothness of movement.

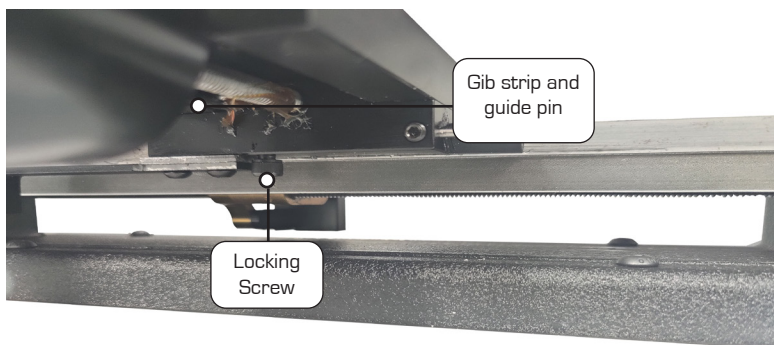
13: Gib Strip Adjustment

X Axis Gib Strip Adjustment Method:

1) Release the gib strip locking screw, positioned on the back of the machine saddle (shown below).



2) Push the wider end of the gib strip further into its channel to eliminate the free play in the slideway. The gib strip is accessed by reaching under the machine cross slide (see below). Remember that a slight degree of movement must be left in the slide to allow the slide to move.

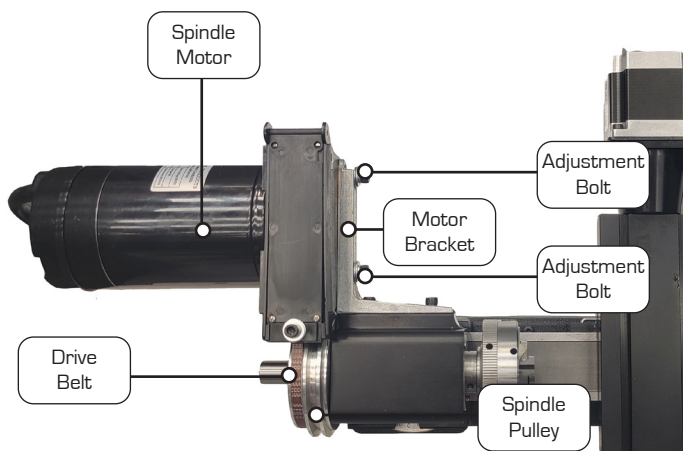
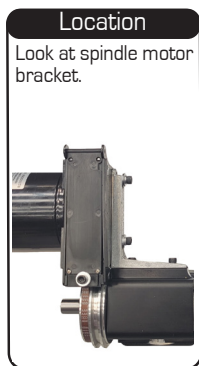


3) Tighten the gib strip locking screw.

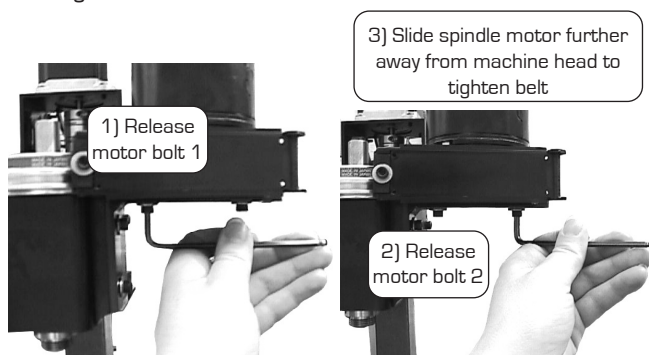
4) Move the machine cross slide up and down, to ensure that the movement is smooth.

5) If the movement is not smooth, adjust the gib strip by repeating steps 1) to 3). Run the machine cross slide again to assess the smoothness of movement.

14: Spindle Belt Drive Adjustment



The drive belt from the motor to the machine spindle may become slack from time to time, due to constant use. To adjust the tension, release the two bolts holding the motor. Slide the motor further away from the spindle until slack in the drive belt has been eliminated, then tighten the two bolts holding the motor.



Turn anticlockwise to release or clockwise to tighten the bolts holding the spindle drive motor in position (when directly viewing the face of the bolt from beneath the bracket).

15: Maintenance Log

Date of maintenance work.	Name of personnel carrying out the maintenance.	Details of maintenance work completed.



15: Maintenance Log

Date of maintenance work.	Name of personnel carrying out the maintenance.	Details of maintenance work completed.



16: Technical Support

Denford Limited provides unlimited telephone and e-mail Technical Support on this CNC machine to registered users. On-site visits by our engineers may be chargeable. Please refer to the information held in your separate Warranty pack, for specific details.

Before contacting Denford for support, please read your hardware and software manuals and check the Denford websites for support.

Internet (access technical support and FAQ sections):

www.denfordata.com/bb

When you request support, please be at your CNC machine, with your hardware and software documentation to hand. To minimise delay, please be prepared to provide the following information:

- CNC Machine Serial Number (from the machine ID panel).
- Registered user's name / establishment name.
- The CNC machine control software name and version number (from the "Help/About" menu option).
- The wording of any error messages that appear on your computer screen, if applicable.
- A list of the steps that were taken to lead up to the problem.
- A list of any maintenance work that has been carried out on the CNC machine.

Address: Denford Limited,
Armytage Road,
Brighouse,
West Yorkshire,
HD6 1QF,
UK.

Telephone: +44 (0) 1484 728000

E-mail: technical@denford.co.uk

Times: Monday to Thursday 8.30am - 4.30pm GMT
Friday 8.30am - 2.00pm GMT

16: Specification of the Microturn Pro

Safety Features:

- Manual operation, totally enclosed, interlocked, safety guard door.
- Emergency stop button.
- Toolpath graphics to verify part programs prior to machining.

Mechanical Details:

- Travel X axis - 57mm (2.25")
- Travel Z axis - 108mm (4.25")
- Swing Over Bed - 90mm (3.5")

Dimensions:

- Machine width - 1330mm (52.4")
- Machine width with PC extension - 1965mm (77.4")
- Machine height - 1445mm (56.9")
- Machine height with door open - 1830mm (72.0")
- Machine depth - 750mm (29.5")

Weights:

- Machine weight - up to 467kg (1027 lbs) depending on options fitted

Electrical Details:

- Mains supply required:
220/240Volts, 50Hz, 16 Amps - MCB Protected Socket.
- Spindle motor: 75 W
- Spindle Speeds: 0 - 2500RPM.
- Axis stepper motors

Performance:

- Rapid traverse rate up to 600 mm/min (23.6 in./min)
- Max Feed traverse rate up to 600 mm/min (23.6 in./min)



Declaration of Conformity

The responsible person and person
authorised to compile the Technical File

Mr Stephen Oddy

Business Name:

Denford Ltd

Address:

Armytage Road
Brighouse
W Yorkshire
HD6 1QF
United Kingdom

Declares that the Machinery Described:

Make:

Denford Ltd

Models:

Micromill Pro & Microturn Pro
Manufactured from January 1st 2023

We hereby declare that the product
described above, to which this declaration of
conformity refers to, is in conformity with
the essential requirements of the following
standards:

Supply of Machinery (Safety) Regulations 2008
BS EN 19085-1 :2021
BS EN 19085-3 :2021
The Electromagnetic Compatibility Regulations 2016
RoHS Directive:2011/65/EU
ISO 13849-1:2015(EN)

Signature of responsible person

A handwritten signature in black ink, appearing to read "S. Oddy".

Position:

Managing Director

Date:

7th December 2022



Declaration of Conformity

The responsible person and person
authorised to compile the Technical File

Mr Stephen Oddy

Business Name:

Denford Ltd

Address:

Armytage Road
Brighouse
W Yorkshire
HD6 1QF
United Kingdom

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described above, to which this declaration of
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the essential requirements of the following
standards:

Machinery Directive: 2006/42/EC
EN 19085-1 :2021
EN 19085-3 :2021
EMC Directive:2014/30/EU
RoHS Directive:2011/65/EU
ISO 13849-1:2015(EN)

Signature of responsible person

Position:

Managing Director

Date:

7th December 2022

16: Microturn Pro Noise Level Test Results

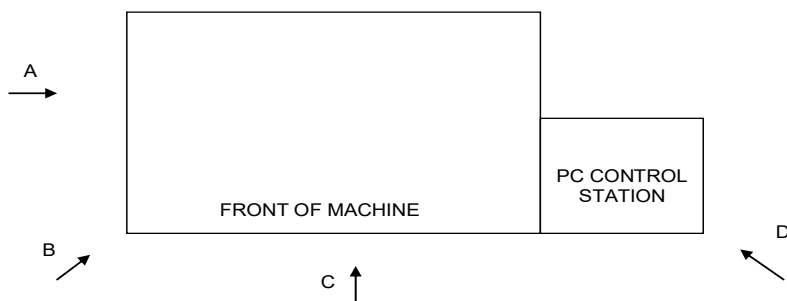
Noise Level test

Test Report No: NL-TRN-04
Machinery Manufacturer: Denford Limited.
Machinery Type/Model: TURN 370 Pro CNC Lathe

Equipment:
Meter Ref. Standard ST-805
Denford TURN 370

Test Conditions:

Spindle speed: 0 - 3700 RPM.
Axis speed: 0 - 3000 mm/min
Ambient background noise: <50 dB(A).



A, B, C, & D are measurement positions 1 metre from the machine and at a height of 1.6 metres above floor level.

Results;

All values are measured in dB(A)






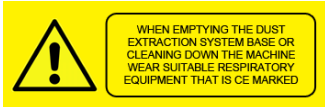



Condition	A	B	C	D
Test Program	68	66	64	64

Test Program

Spindle speed varying between 0 and 3700 RPM
Machine axes in combination 0 to 3000mm/min.
Flood Coolant and Auto Turret running.

The entire test cycle was run at each of the positions shown and the maximum figures registered at each position were recorded in the above table.

16: Labels used in Manual or on Machine

Label	Description & Location
	Description - Earth Label Location - Electrical Cabinet
	Description - Protected Earth label Location - Electrical Cabinet
	Description RJ45 / Ethernet Connection label Location - Right hand side of machine
	Description - Refers to an immediately impending danger. If the danger is not avoided, it could result in death or severe (crippling) injury. Please consult the manual where this symbol is displayed. Location - Machine
	Description Refers to a possibly dangerous situation. If it is not avoided, it could result severe injury. Location - Machine Manual and machine
	Description - PPE warning label Location - Right hand side of machine
	Description - Safety warning Location - Right hand side of machine
	Description - PAT Testing Label Location - Right hand side of machine
	Description - Hazardous Voltage Warning Location - Machine

DEFOR®



17: Glossary

JOG CONTROL	Manual movement mode for the machine axes, using very small pre-defined movements, called jog steps. One stepped movement is applied per movement using the machine offset facility. key/button press.
M CODE	A miscellaneous code function in a CNC program used to indicate an auxiliary function (ie, coolant on, tool change etc.).
MACHINE DATUM	A fixed zero reference point set by the machine manufacturer. The machine datum is used to define the co-ordinate based grid system of the CNC machine. All machining co-ordinates originate from this point. However, this point can be temporarily moved
MACHINE OFFSET	The workpiece offset file used with VR and real CNC machines.
MDI	Manual Data Input - A method used for manually inserting data into the control system (ie, Desktop Tutor, qwerty keyboard etc.).
MODAL	Modal codes entered into the controller by a CNC program are retained until changed by a code from the same modal group or cancelled.
NC	Numerical control.
OFFSET	Combination of two types of file, the workpiece offset and the tool offset. Used to describe the workpiece datum, a zero reference used on the CNC machine to ensure machining occurs in the correct place on the billet. Offsets are used to shift parts of the three dimensional co-ordinate based grid system, used by the CNC machine.
PART DATUM	Used as a zero reference point in a CNC file. All machining co-ordinates originate from this point.
PART PROGRAM	A list of coded instructions which describes how the designed part, or component, will be manufactured. The part program is also referred to as the CNC file, program, or G and M code program.
PC	Personal computer.
POST PROCESSOR	A file or setting that contains instructions for a CAM system, detailing how to create CNC code that can be understood by a particular CNC system (e.g. VR CNC Milling).
PROGRAM	A systematic arrangements of instructions or information to suit a piece of equipment.
RAPID TRAVERSE	Fast movement of the cutting tool through the machine axes between cutting settings.
REFERENCE POINTS	The machine has reference points used in setting the limits of movement for its slides [axes].
REMOVEABLE MEDIA	A computerised storage medium that is not permanently attached to the system, e.g. Floppy Disk, Flash Memory Card, USB Memory Key, CD/DVD disc.
SPINDLE MOTOR	The removable cutting head [motor]. Also referred to as the machine head.
RPM	Revolutions per minute [rev/min] - a measure of spindle speed.
SLIDES	The machine axes - see axis.
SPINDLE SPEED	The rate of rotation (velocity) of the machine head / cutting tool, measured in RPM.

17: Glossary

SOFTWARE	Programs, tool lists, sequence of instructions etc...
TOOL OFFSET	When machining, allowances must be made for the size of tools being used, since they all differ in length. The tool offset is the amount the Z value must be moved (or offset), so that all the different cutting tool tips used line up with each other, so they can all be used by one CNC file. See OFFSET.
TRAVERSE	Movement of the cutting tool through the machine axes between cutting settings.
TXT	Standard Windows text only file, extension ".txt".
WORK (WORKPIECE)	The actual material being machined. The work is sometimes referred to as the billet or stock.
WORKPIECE DATUM	Used as a zero reference point on the real billet. All machining co-ordinates originate from this point, when offset files are used.
WORKPIECE OFFSET	A file containing X and Z values that can shift the entire three dimensional co-ordinate based grid system, used by the CNC machine. See OFFSET.
WORD	A combination of a letter address and digits, used in a CNC program (ie, G42, M04 etc.).
VIRTUAL REALITY.....	A fully interactive, three dimensional, computer based simulation of a real world object or event.
Z TOOL OFFSET	See Tool Offset

18: Notes

Use this page to make a note of any parts of the software you have changed or configured, for example, common tooling set-ups, machine parameters, changes to installation paths or passwords etc.

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.