

Local Rules for Mechanical Workshops

Introduction

in mechanical workshops, of any size, anywhere in the University. They are not a substitute for the University Health & Safety Code of Practice which also applies to all workshop areas.

Mechanical workshops can be very dangerous places especially for the untrained and inexperienced. If you know that you are likely to need to use These Local Rules have been written especially for those who need to work workshop facilities talk to the workshop supervisor well in advance. Some machine tools can be operated after only a small amount of training, but others need a lot of training and experience to be operated safely.

Permission to enter a workshop and use the facilities must be obtained from the person in charge. This person is responsible for ensuring that the required safety equipment is available, and that anyone granted permission to use the facilities is conversant with the safe operation of the equipment and machinery. The user must be warned of any special hazards.

20 Workshop Safety

20.1 Risk Assessment

A risk assessment must be undertaken on all operations or processes which may be hazardous to the operator. Generic risk assessments for common workshop processes are acceptable, and copies of these should be available in each workshop. Those using such processes must familiarise themselves with the risk assessment before starting work.

1.2 Eye Protection

Each permanent member of the workshop staff must be supplied with a personal issue of safety spectacles or goggles. They must be worn whenever flying chips, swarf, turnings, and coolant splashes etc might endanger the eyes. Most workshops should be regarded as "eye protection" areas. Eye protection should be made available to (and worn by) visitors where necessary. All eye injuries should receive qualified medical attention.

1.3 Housekeeping

Good housekeeping is essential if workshops are to be safe places to work. Workshop users should replace tools and equipment immediately after use and remove swarf, filings and other debris from machine beds, workbenches and the floor as soon as possible. Tools should not be left in machine beds while the machine is running. The floor should be kept clear of obstructions, and spillages must be cleaned up immediately. Metal waste bins should be provided and used. Faulty wiring, worn or defective equipment, unsatisfactory storage arrangements and other circumstances likely to lead to an accident should be reported.

1.4 Personal Protection

Everyday clothes should normally be covered while working in mechanical workshops. Smocks are generally acceptable for use, provided that they are in good condition, close-fitting at the wrists and are kept fastened at the front. Boiler suits are a safer form of clothing for use in workshops.

Prolonged contact of the skin with oil, grease, cutting fluids etc. can cause skin problems. Barrier and cleansing creams should be available in all workshops and it is recommended that they be used. Clothing, smocks, boiler suits etc. should not be allowed to become heavily contaminated with oils, etc. They should be laundered regularly.

Solvents can cause dermatitis and should not be used to remove oil, etc. from the skin.

Long hair can easily be caught in moving machinery and must be secured.

The wearing of rings, dangling jewellery (neckchains and earrings etc.) is very dangerous. All jewellery should be removed before work commences.

Suitable gloves should be worn when handling rough, sharp or dirty objects. However, it should be noted that the wearing of gloves near rotating machinery could be very dangerous.

Protective shoes or boots should be supplied and used by those engaged in regular heavy lifting. Danger can also strike upwards, so boots or shoes should have strong soles. Sandals and similar

lightweight footwear should never be worn in workshops. (See also 1.11 Manual Handling)

Suitable hearing protection, such as ear defenders or disposable earplugs should be worn near a source of loud/prolonged noise, particularly if it is over 85dBA.

All workshops should have available clear safety glasses and ear defenders/disposable earplugs for visitors and casual users.

Every workshop should maintain a first aid box, which should be checked on a regular basis.

1.5 Storage of Materials

Proper racking facilities should be provided for the storage of sheet materials, rod bars, etc. Vertical racking requires a safety chain or bar. Where appropriate, the protruding ends of rods and the sharp corners of sheet materials should be sheathed to prevent injury.

1.6 Fumes and Dust

Areas where fumes or dust are created as part of a workshop process are subject to strict regulation, and appropriate equipment suitable for the safe removal of such fumes or dust must be used, particularly when using the following processes

- a. welding soldering, burning/cutting etc.
- b. Using a shot/bead blasting machine
- c. Using woodworking machinery (including portable equipment)
- d. Machining of ceramics, carbon or other materials which may cause a fine dust.

Reference should also be made to 1.12 C.o.S.H.H.

1.7 Electrical Equipment

Electrical equipment must be kept in good condition. Only qualified staff must rectify defects in the equipment. Loose cables should be kept off the floor as far as possible and where this is not possible cable protectors should be used. The use of cotton-covered electrical cable is not recommended in workshops or laboratories since it easily becomes contaminated with oil, grease, solvents, swarf, etc. which leads to rapid deterioration of the insulation. Machinery and appliances must be electrically isolated when not in use and when changing tools/accessories.

1.8 PAT Testing

All portable electrical equipment used in a workshop environment is now subject to the Portable Appliance Testing regulations (more commonly referred to as PAT testing). All portable electrical equipment should be clearly marked with a sticker showing the date that it was last tested, and the date that the next test is due. This sticker is usually located on the plug. If the date shown is overdue, or if no sticker is visible, or if there is any visible damage to the cable etc. **DO NOT USE THE EQUIPMENT.** Remove it from service, and inform the workshop supervisor who will arrange for testing to take place.

1.9 Gangways

Gangways, through and around the workshop, should be clearly marked and kept clear of obstructions at all times.

1.10 Emergency Isolation Buttons

Most machines are fitted with an emergency stop button. However in certain workshops throughout the University, provision has been made to cut the power to all machinery at once in an emergency by means of emergency isolation buttons.

Before commencing work in a machine shop, the location of any such emergency isolation button should be established.

In some cases specific machines may not be connected to the universal isolation button, these machines should have a separate emergency stop of their own. The location of such emergency stop buttons should also be established before work begins.

1.11 Manual Handling

All operations where lifting is required are covered by the Manual Handling Regulations. All workshop staff should attend basic manual handling training, and some should also attend the assessor's course. Manual Handling assessment forms should be completed for all lifting operations. It is however acceptable for generic forms covering lifting operations of a similar nature to be used. All workshop staff should be familiar with the contents of the manual handling booklet.

20.1 Lifting Aids

The correct lifting aid must be used for each lifting operation. Shackles, slings, "D" rings, eyebolts hooks etc. should all be marked with the Safe Working Load and be inspected and certified annually by a qualified University approved engineer. Unmarked uncertified or

improvised lifting aids should not be used.

1.13 C.o.S.H.H

The Control of Substances Hazardous to Health (C.O.S.H.H.) regulates all materials which might be hazardous to the user or persons in close proximity to the user. All substances are potentially hazardous, and details of the nature of the substance should be obtained prior to its use. If a substance to be used is thought to be hazardous a C.o.S.H.H. form should be completed, and detailed information about the nature of the materials attached. This information is usually available from the manufacturer in the form of a data sheet, and is often supplied when the goods are purchased.

All C.o.S.H.H. forms should be kept on file in a place accessible to potential users of the material.

Anyone using a hazardous or potentially hazardous substance should read the C.o.S.H.H. form before commencing work.

It is also important to dispose of hazardous substances correctly.

1.14 Storage and Disposal of Waste Solvents

Solvents used as part of workshop processes should be disposed of in properly labelled containers as specified in the guidelines from Safety Services. The Workshop Supervisor will have a copy. Care should be taken not to mix solvents from different groups in the same tin.

Waste coolant/cutting fluid must also be disposed of in the same manner. It should never be poured into a drain.

Solvents, oils, cutting fluids cleaners etc. should always be kept in marked containers, and never in jars, tins, bottles or other containers.

2. Machinery Guarding

2.1 Most workshop machinery is fitted with guards or other safety devices designed to prevent access to dangerous parts of the machine. While the Department has a responsibility to ensure that guards are in place, it must be emphasized that any person who causes an accident by willfully tampering with, removing or not replacing a guard is liable to prosecution under the Health & Safety at Work etc Act 1974 (sections 7 and 8).

2.2 Guards or other safety devices must not be removed or over-ridden for any reason without the written permission of the workshop supervisor. When it is essential that guards are removed for routine maintenance work to be carried out, it is important that they are replaced

- immediately afterwards. Before any guard is removed the person concerned in the removal must ensure that the machine is electrically isolated and made safe, such that it cannot be inadvertently started up again by anyone else.
- 2.3 The person about to use the machinery is responsible for ensuring that all safety equipment is in position. If it fails to function correctly or loses its effectiveness, operation should cease immediately and the person in charge of the workshop must be informed.
 - 2.4 Where it is necessary to move or remove a guard to make routine adjustments or measurements, the guard must be replaced before the machine is restarted.
 - 2.5 Stock guards must be used for parts of the material which project beyond the machinery.

3. Compressed Air

A compressed air supply must be treated with respect. It must never be used for cleaning purposes (blowing dust or swarf from clothing, skin, glassware or machinery) or for ventilation purposes. A jet of compressed air directed onto the body may introduce air into the bloodstream, produce blindness or other eye injuries or cause a burst eardrum. All compressed air lines should be fitted with safety nozzles of a type approved by the Health & Safety Executive and then may be used only under the following conditions:

- (a) The operator and anyone else in the immediate vicinity must wear eye protection.
- (b) They must be used only with the lowest air pressure possible.
- (c) They must only be used for the removal of swarf from blind holes where no other means are available for the removal of such swarf.
- (d) A compressed air supply must never be connected to a sealed container or be used to pressurise a sealed vessel, other than certified air receivers.
- (e) All compressed air receivers are subject to annual inspection and certification by a qualified University approved engineer.

Any deviation from the above conditions or misuse of these devices may result in the prohibition of their use throughout the University.

4. **Handtools**

4.1 General

Sharp edges or points of tools to be carried or stored, should be protected.

4.2 Files

Files must never be used without a handle.

Wooden handles should be renewed if they show signs of splitting.

4.3 Screwdrivers

Screwdriver blades should be kept in good condition. The correct type and size of screwdriver should be used for the job.

Both hands should be kept behind the blade when applying pressure.

Screwdrivers should not be used as levers or chisels.

4.4 Hammers

Hammerheads must be kept tightly wedged in place.

4.5 Punches and Chisels

Punches or chisels that have mushroomed heads must not be used.

They must be reground.

4.6 Spanners

The correct size spanner to fit the nut or bolt head should always be used.

5.0 **Welding - Electric Arc**

5.1 Exposure of the naked skin to the heat and light radiation from an electric arc should be avoided. The radiation from the arc includes infrared and ultra-violet light.

5.2 Screens or welding curtains must be used to protect bystanders from electric arc flashes.

5.3 Goggles do not give adequate protection from the arc. A hand-held

shield that covers the head, face, neck, wrist and hands should be used. Where both hands are needed a head shield should be used, together with gauntlets to protect the hands and wrists.

- 5.4 Both head shields and hand-held shields must be fitted with a filter of the correct density for the power rating in use.
- 5.5 Protective clothing should give cover from the throat to the knees.
- 5.6 Goggles or a face shield must be used when using a chipping hammer to remove slag and spatter.
- 5.7 Hoses and leads must be kept clear of hazards - sharp edges, hot metal, etc. Wheeled traffic must not be allowed to pass over them.
- 5.8 Welding return leads must be securely connected by bolting or clamping to prevent contact resistance.
- 5.9 Appropriate extracts for the removal of welding and other fumes must be used at all times.
- 5.10 Special care with fume extraction must be taken when using shielding gases in a confined space. Argon and nitrogen tend to puddle and displace the oxygen.
- 5.11 Power tools must not be left on an electric-arc-welding bench. Damage may be caused if the welding earth return should become open-circuit.
- 5.12 Work in progress or newly finished work, left unattended, should be clearly marked "HOT" with the date and time of writing added.

6. Welding /Cutting - Oxy-acetylene

- 6.1 Cylinders must be handled with care. Acetylene is liable to form shock-sensitive explosive acetylides with copper and silver salts (as well as with the metals) and certain other metals. The pressure in any piped acetylene system must not exceed 9 p.s.i. (0.621 bar, 62 kPa) above atmospheric pressure. A heavy blow on an acetylene cylinder can ignite the contents as a result of adiabatic compression, and the cylinder may subsequently explode unless action is taken **immediately**. Those responsible for the use of acetylene should be

- acquainted with the emergency routine to be followed should a cylinder start to warm up.
- 6.2 Cylinders must be used in an upright position and secured to prevent them falling or being knocked over.
 - 6.3 When turning on a cylinder, the valve should be opened very slowly. Whilst doing this, no one should stand in front of the gauges.
 - 6.4 Care must be taken to ensure that there are no gas leaks.
 - 6.5 Heat sources must never be allowed near the cylinders.
 - 6.6 Oil or grease must not be allowed to come into contact with the cylinder valves or fittings, especially on oxygen cylinders.
 - 6.7 Hoses must be kept in good condition. Wheeled traffic must not be allowed to pass over them. They should be kept away from sharp edges and hot metal.
 - 6.8 Flashback arrestors should be fitted both at the blowpipe end and the gauge end of both hoses.
 - 20.1 Cylinder valves must be closed when not in use, and hoses drained of any remaining gas.
 - 20.2 Appropriate goggles, fitted with the correct filter glass, must be worn.
 - 6.11 Suitable clothing and gloves or gauntlets should be worn where practicable.
 - 6.12 Goggles should be worn when removing flux residue or scale.
 - 6.13 Where toxic fumes may be present, an approved respirator of a type appropriate to the risk must be worn. Fume extractors should always be used when welding, cutting etc.
 - 6.14 Vessels or drums, which may in the past, have contained flammable or toxic materials must not be cut or welded until they have been thoroughly cleaned and made safe.
 - 20.1 Dross from cutting operations should be caught in a metal receptacle.
 - 20.2 Materials being cut should be adequately supported.

- 20.3 Care should be taken to ensure that off-cut pieces cannot fall and cause injury or damage.
- 20.4 When Plasma cutting equipment is being used similar safety precautions e.g. Clothing etc. should be taken as for Oxy- Acetylene burning.
- 20.5 When heating objects in furnaces do not enclose in sealed containers i.e. when deep case hardening components etc. unless the container has been specifically designed for this purpose. Some furnaces contain unprotected glass elements; care should be taken when loading such furnaces.

7. **Woodworking Machinery**

7.1 The Woodworking Machines Regulations 1974 are recognised as offering good practical standards of safety and should be followed. Reference should be made to the Health & Safety Series booklet HS(R)9 "A Guide to the Woodworking Machines Regulations 1974" before any work on such machines is undertaken. Some revision of these regulations specifically relating to the use of circular saws, appears in the Provision and Use of Work Equipment Regulations 1998. Copies of WIS16: "Circular Saw Benches: Safe Working Practices" are available free from HSE books PO Box 1999, Sudbury, Suffolk CO10 2WA

20.1 Persons under the age of 18 may not operate certain machines, viz. Circular-sawing machines, surface-planing machines (not mechanically fed) unless they have successfully completed a course of training approved by the Health & Safety Executive.

7.3 Reference should be made to 1.6 for details of dust extraction for woodworking equipment

8. **Computer Numerical Control (CNC) Machines**

20.1 Many workshops now have CNC machines of various types. As these machines are usually fairly new the standards of safety equipment fitted is high. Great care should be taken however when using such machines, particularly by personnel who are more used to conventional machine tools. CNC machines are by definition

computer controlled, and when the program is running the moving parts of the machine i.e. the table quill etc will move as dictated by the program, independent of the operator. On dedicated CNC machining centres this causes only minor problems, as the whole of the machining operation is usually confined within a guard. However conventional machine tools with retro fitted CNC controls do not usually have such guarding, and anyone not used to the operation of such machines should be made familiar with their method of operation.

- 8.2 There are some CNC machines around the University such as wire EDM and diesinkers which are of a highly specialized nature, and have their own particular hazards. When using such machines reference should be made to the individual handbook for the machine. As with all machinery and workshop processes the risk assessment for the machine should also be read before use.

- 20.1 CNC machines usually involve the use of computers for the writing of programs either on the machine or more commonly on a remote PC using a CAD system. Operators using PCs are subject to the Display Screen Regulations, and the departmental assessor for Display Screens should check both the operator and the workstation being used. It might also be necessary for regular users to undergo training. Courses are run periodically by Safety Services.

21 Health and Safety Legislation

- 9.1 Health and Safety Legislation is constantly changing. At the time of writing all current Health and Safety regulations pertaining to workshops have been included. However new legislation covering a wide variety of relevant areas may only be a few months away. The Departmental Safety Officer and the Workshop Supervisor should both be familiar with any changes in legislation which postdate this publication. Their advice should be sought.
Remember the most important piece of advice relating to workshop safety

IF IN DOUBT ASK!

**BEFORE OPERATING ANY MACHINE READ
THE GENERAL SAFETY CHECKLIST AND THE
SECTION SPECIFICALLY RELATING TO
THE MACHINE(S) TO BE USED**

10. General Safety Checklist

- 10.1 Do not attempt to operate any machinery until you are sure you know how to use it.
- 10.2 Ensure that you know how to stop the machine before starting it.
- 10.3 Ensure that all appropriate guards are in position before starting the machine.
- 10.4 Check, where appropriate that the direction of rotation of the workpiece or cutter is correct.
- 10.5 Ensure that any feed mechanisms are in neutral before starting the machine.
- 10.6 Ensure that all tools, workpieces, etc. are secure before starting the machine.
- 10.7 Do not walk away and leave the machine running
- 10.8 Wear appropriate personal protection - safety glasses, shoes, etc.
- 10.9 Do not remove swarf with bare hands - wear gloves and use a rake or brush.
- 10.10 Do not wear gloves near rotating machinery.

IF IN DOUBT ASK !!!

11. Lathes

- 11.1 Always remove the chuck key from the lathe chuck.
- 11.2 Do not use cracked or damaged tools.
- 11.3 Keep all tools sharp.
- 11.4 Do not touch revolving chucks or workpieces.
- 11.5 Keep the lathe-bed clear: Do not allow a build-up of swarf.
- 11.6 Always use the correct tools for the job.

12. Milling Machines

- 12.1 Ensure that the feed mechanism is disengaged before starting the machine.
- 20.1 Position guards to deflect chips to a safe area.
- 20.2 Do not use cracked or damaged cutters.
- 12.4 Do not attempt climb milling unless the machine is designed for that purpose.
- 12.5 Do not touch revolving cutters.
- 12.6 Do not attempt to clear swarf from the cutter area while it is rotating.

13. Bandsaws

- 13.1 Use the correct tooth-pitch and bandspeed for the material being sawn.
- 13.2 Adjust the top guard to just clear the workpiece.
- 13.3 Do not over-tension the blade.
- 13.4 Use a "Push Stick" when cutting completely through a narrow item of

work.

14. Pedestal/Radial Arm Drills

20.1 Ensure that long hair is restrained

20.2 Rotating drive shafts must be guarded.

20.3 Lock adjustable tables and arms before drilling commences.

14.4 Clamp the material to be drilled in a vice or to the machine table.

20.1 Use the correct speed range for the size of the drill in use.

15. Shapers/Planers

15.1 Check the speed and stroke length before starting.

15.2 Check that the clutch is disengaged before starting the drive motor.

15.3 Check that the workpiece is securely fastened and if using a vice that this is also secure before starting.

15.4 Do not use excessive stroke length.

15.5 Use guards, where possible, to stop or deflect chips into a collecting tray.

15.6 Check that the space occupied by the ram on its return stroke is clear.

15.7 Keep the hands away from the workpiece even when using a very low ram speed.

20.1 Always stop the ram before gauging the workpiece.

16. Surface Grinding

16.1 Only authorised personnel who have attended an appropriate Abrasive Wheels course may mount or dress grinding wheels (Abrasive Wheels

Regulations 1970).

This applies to **ALL** grinding machines.

16.2 Do not use a cracked wheel. Report it.

16.3 Turn off coolant when wheel is stationary.

16.4 Ensure that the work is held securely on the magnetic chuck, or is securely clamped by other means.

20.1 Always wear eye protection during grinding operations.

17. Off Hand Grinding

17.1 Only authorised personnel who have attended an appropriate Abrasive Wheels course may mount or dress grinding wheels (Abrasive Wheels Regulations 1970).
This applies to **ALL** grinding machines.

17.2 Do not use a cracked wheel. Report it.

17.3 Check the wheel rotation before grinding.

20.1 Turn off the coolant when the wheel is stationary.

17.5 Transparent face guards/eye shields must be fitted to the machine. They must be clean and properly adjusted.

17.6 The work-rest must be as close to the wheel face as possible.

17.7 The side of straight-sided wheels should never be used for grinding.

17.8 Always wear eye protection during grinding operations.

17.9 Take care not to leave loose rags etc. near grinding wheels, if a rag is caught in a rotating wheel it can cause the wheel to burst.

18. Cylindrical Grinding

18.1 Only authorised personnel who have attended an appropriate

Abrasive Wheels course may mount or dress grinding wheels (Abrasive Wheels Regulations 1970).

- 18.2 Do not use a cracked wheel. Report it.
- 18.3 Turn off coolant when the wheel is stationary.
- 18.4 Remove the chuck-key before starting rotation of the chuck.
- 18.5 Lock tailstock centre when grinding between centres.
- 18.6 Always wear eye protection during grinding operations.

19. Internal Grinding

- 19.1 Only authorised personnel may mount or dress grinding wheels (Abrasive Wheels Regulations 1970).
- 19.2 Do not use a cracked wheel. Report it.
- 19.3 Check the wheel rotation before grinding.
- 19.4 Turn off the coolant when the wheel is stationary.
- 19.5 Remove the chuck-key before the chuck rotates.
- 19.6 Ensure that the chuck has stopped before measuring the work.
- 19.7 Wind the work well clear of the wheel before checking the bore.
- 19.8 Check that the wheel will not foul the sides of the bore before entry.
- 20.1 Set stops correctly when grinding a blind bore or up to a shoulder.

20. Sheet Metalworking Equipment

- 20.1 Guillotines both power and treadle, should be fitted with appropriate guarding to ensure that the fingers etc. of the operator cannot come into contact with the shearing blades.

- 20.2 When using Rolls and Bending machines, care should be taken to prevent fingers etc. being caught in the mechanism. Bending machines should always be left in the closed position when not in use.

- 20.3 Lever shears should always be fitted with a locking arm to prevent the lever from being accidentally operated when not in use.

- 20.4 When using Fly Presses and Hydraulic Presses take care to align the punches, dies or components before the press is used, as misalignment may cause the dies to fracture, and injure the operator or those in close proximity.

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