



## Supervision and control of mechanical workshops

Accidents when working with mechanical equipment, particularly workshop machinery used to machine wood, metal and plastic, may have consequences which range from a minor cut to the loss of a finger, hand or eye. Great care is therefore required on the part of all machine operators to avoid either personal injury or injury to colleagues nearby. The immediate responsibility for the health and safety of all users of all mechanical workshop facilities rests with the person in charge of the workshop area, normally the laboratory supervisor, chief technician or workshop manager. However, every person who works in a workshop area has a duty to ensure that work is carried out in a safe manner and without foreseeable risk to the health of either themselves or other persons.

School rules for safe workshop practice must be formulated and must be strictly adhered to. Copies of all relevant Regulations, Codes of Practice and Health and Safety Executive Guidance Notes relating to individual activities within a particular workshop should be readily available, and these can usually be downloaded from the publishers website, for example Health and Safety Executive.

### **Smoking, eating and drinking are prohibited in mechanical workshops.**

Workshop machinery should be classified into two categories:

- Machinery which needs no specialised training to operate and requires the operator only to receive basic instruction from qualified and competent workshop personnel before commencing unsupervised use.
- Machinery which requires specialised knowledge and experience for its safe operation, and for which clearance must be obtained on each occasion, before unsupervised work can proceed, or on which unsupervised work is not permitted, except by highly skilled workshop staff.

Before using any piece of machinery or other workshop equipment, the prospective user must have received adequate instruction in its method of operation, and on the health and safety precautions which are necessary, and must fulfil the requirements of any Permit to Work system which may be in operation within the workshop. Restricted access to certain workshop areas or machines may have to be implemented, and such areas and machines should be clearly designated by warning notices, or machines locked off, where necessary.

Training and supervision must be provided by skilled and competent persons, who can ensure, by teaching and example, that only safe methods are learnt and subsequently used. Trainee workshop technicians must be fully supervised until judged by the workshop manager to be competent to work on their own on a particular item of machinery. The importance of using the correct tool for the job and not taking short cuts must be impressed on all



workshop personnel. It is advisable that a training matrix is developed and that a written record is kept of this training, in particular for any high hazard machinery.

## **Physical precautions**

The workshop manager must ensure that all items of equipment, including machinery, hand-held power tools and hand tools, are properly and regularly maintained and serviced, and that records of all such maintenance and servicing are kept. Tools must be kept sound and in good condition, edges of cutting tools must be sharp and kept covered when not in use, and any defects in tools and machinery should be reported immediately to the workshop manager. Hand tools which have the potential to cause injury should not be carried in pockets, and all tools must be returned to their proper storage areas after use. When maintenance and repairs to machinery are in progress, warning notices must be posted, particularly on electrical isolators. Whenever possible, as an additional safeguard, fuses should be removed, or switches physically locked off.

In all mechanical workshops, the working area must be kept clean and tidy and the floor must be kept clear of all obstructions and be free from oil and swarf. Waste oily rags or cotton waste should always be put in an enclosed metal container, separate from other waste materials, to avoid the possibility of spontaneous combustion.

Overcrowding leads to accidents and must be avoided. Non-slip mats should be used in front of machines where necessary, and machines should be sensibly placed to avoid overcrowding and suitably anchored to ensure stability and to prevent vibration. Lighting and ventilation should always be suitable for the work in hand. Warning notices must be fixed near to or on machines to indicate any special hazards, any precautions to be taken, and the type of protective clothing or equipment to be used.

In some circumstances, it may be necessary to paint mechanical equipment in such a way as to highlight dangerous points. Exposed moving parts are often painted in characteristic colours, a common standard being alternate bands of yellow and black.

## **Protective clothing and equipment**

Necessary protective clothing and equipment must be kept available at all times and returned to its proper place of storage after use. The workshop manager must ensure that appropriate protective clothing and/or equipment is worn or used wherever it is assessed as necessary. Long hair, ties, jewellery and clothing must never be allowed to hang loose, since any of these items can easily become entangled in the moving parts of machinery, and hence cause serious injury.



## Occupational health concerns

Wherever substances which are potentially hazardous to health are employed, the requirements of the Control of Substances Hazardous to Health Regulations must be complied with, and suitable risk assessments formulated. Workshop staff have been known to develop industrial dermatitis unless sensible and adequate protective measures are taken, to avoid excessive and prolonged contact with some substances, such as mineral oils, solvents, degreasing agents, synthetic resins and other chemical substances. The possibility of using commercial cutting oils from which potentially carcinogenic components have been removed should be investigated.

The simplest way to avoid any skin disorder is to pay close attention to personal hygiene by washing hands, forearms, face and any other exposed areas regularly with a good quality proprietary skin cleanser. Never use abrasives. Any skin problems should be reported as soon as possible to a medical practitioner, and to your workshop manager. Wherever practicable, the use of suitable gloves should be considered, to prevent a problem occurring in the first place. Please note latex gloves must not be used in any workshop at the University.

Machining of toxic metals (e.g. lead, manganese, nickel, chromium, beryllium, cadmium and vanadium), alloys containing these metals, and some plastics such as PTFE (Teflon) must only be carried out in strict accordance with the procedures laid down in the school rules for safe workshop practice, which will specify the ventilation and respiratory protection requirements.

Acute respiratory sensitisation has been associated with two-pack polyurethane paints and lacquers in which the hardener contains small amounts of isocyanates. When such two-pack systems are in use, work must be carried out under suitable local exhaust ventilation, which is subject to regular maintenance and performance testing. Written records should be maintained of all such tests.

## Paint Spraying Operations

Paint spraying presents both a toxic and a fire hazard, and must only be carried out in a suitable well ventilated enclosure, away from all sources of ignition, including static electricity. Filters on ventilation plant must be checked regularly. Efficient personal respiratory protection, as well as skin and eye protection, must be worn wherever necessary.

## Noise

In any area where the noise level is thought to be excessive or uncomfortable, the Occupational Hygiene Unit of the Health and Safety Department should be contacted, so that a noise monitoring exercise, as required by the Noise at Work Regulations, may be carried out. A good rule of thumb to indicate a



potential noise problem is the need to raise one's voice substantially, to communicate with another person standing 2 metres away, whilst the noise is present.

Depending upon the results of such a survey, decisions can then be taken on the requirement to provide appropriate ear defenders, display warning notices, or, where practicable, to control the noise at source.

## **Electrical safety in general workshops**

In general workshops where electrical equipment is being repaired, rather than developed, it should not usually be necessary to carry out work on live equipment. However, if there is no reasonably practicable alternative, work on live equipment can be carried out, by competent persons only. Continuity tests on simple equipment such as thermostats and pressure switches at mains voltage are not only unnecessary and unsafe procedures but are illegal under the Electricity at Work Regulations. Further guidance on electrical safety is available online at <https://www.ed.ac.uk/health-safety/guidance/electrical-hazards>.

## **Electronic and electrical test workshops**

It is the responsibility of the workshop manager to identify and assess all hazardous operations in the workshop. In workshops where electronic and electrical apparatus is being developed and tested, work on live equipment may only be carried out where there is no reasonably practicable alternative. It is appreciated that there will be many circumstances where work with live equipment cannot be avoided, and in such cases the following basic conditions should apply:

- The entrance to such locations must display a notice warning visitors that the workshop is a hazardous area.
- The floor of the workshop should be covered with an insulating material. Benches should be of non-conducting material and where personnel are working back-to-back between benches, the space should not be less than 1.5 metres.
- All socket outlets must be supplied with a Residual Current Device and the whole laboratory must be provided with an easily identifiable mains isolation switch.

As far as is practicable, equipment should fail to safety. Access to live parts should not be possible without removing a screwed-down cover. Mains leads should be of the correct current carrying capacity, and be mechanically secured with a clamping grommet. Where an instrument or piece of apparatus has been supplied with a mains lead of non-standard colour code, this should be removed and replaced with standard cable.

Where 3-cored mains lead is used, the earth lead should be either soldered or crimped to an earth tag and firmly screwed to an earth terminal on the



chassis. The earth terminal should not be used for securing other components. All accessible metal parts should be constructed so that they are provided with a permanent and reliable earth continuity path to the main earth terminal.

Internal wiring and other live conductors should be secured and the inner surfaces of exposed metal parts should be insulated to prevent any possibility of live conductors coming into contact with them in the event of an accidental disconnection. Leads used to carry the power to portable apparatus or from one chassis to another must be arranged so that connecting plugs or sockets do not leave bare live pins when disconnected.

Care should be taken in selecting the correct value of fuse for protection against insulation failure or overload. When connecting mains plugs to commercial equipment, reference should always be made to the manufacturer's handbook before fitting the recommended value and type of fuse.

Portable tools and hand inspection lamps should be operated from isolating transformers. A double wound transformer, centre tapped to earth, 50V (or less) for lighting and 110V for portable tools, should be used. As an alternative, connection via a suitable RCD, or use of battery operated tools, would be acceptable. Soldering irons should not be used without an earth connection and should preferably be of a low voltage type, with an on/off indicator light.

## **Safeguarding of Machinery**

The basic principle to bear in mind when considering safeguarding of machinery, is that all machinery with exposed moving parts which could be a source of danger, must have these parts effectively guarded, to eliminate, or satisfactorily reduce, danger, unless the machine's moving parts are "safe by position". This phrase means that, though potentially dangerous moving parts have not been physically guarded, they are not accessible to personnel, and so cannot cause injury. All machines must be maintained in a clean and efficient working condition. All machines must be fitted with guards and/or other safety devices to an appropriate standard during the time that the machines are in use. Guards must be of suitably sound design and adequate strength. Wherever practicable, a movable guard, cover etc., when used as a safeguard, must be electrically interlocked with the drive mechanism of the dangerous parts, and should be of a fail-safe design.

All safety devices, interlocks and emergency stop buttons, etc. must be regularly checked/tested to ensure their continued effective operation and it is recommended that a record is maintained of all such checks.



Employees who deliberately circumvent guarding systems are breaking the law. If for any reason whatsoever, conventional guarding is impracticable, some other means of equally effective temporary guarding must be employed.

Machine beds, tables and slideways must be clear of tools and materials, and chuck keys which are not spring-loaded must be removed, before the machine is started up. Suitable protective clothing and equipment must be worn, not only by machine operators, but also by any other persons in the vicinity who could foreseeably be at risk.

## **Lathes, Milling and Drilling Machines**

The stationary and moving parts of each machine must be properly secure, and rotating parts should be balanced, if necessary. Operating speeds must never exceed those recommended by the machine tool manufacturer. Each machine must be provided with a set of keys and clamping tools, and spring-loaded chuck keys are recommended for use with lathes and drills.

The machine operator should ensure that the work piece is always securely clamped without excessive unsupported overhang. Any part of a stock bar which projects beyond the head stock of a lathe must be guarded, unless it is in such a position as to be safe to every person in the workshop. Hand holding thin metal workpieces on drilling machines is extremely dangerous, and suitable clamps should always be used. Light tubular workpieces should be plugged to prevent "spring out" when tool pressure is applied.

The safety stops on each machine must be clearly indicated and easily accessible, and their location should be known to the operator. Large vertical milling machines should be fitted with suitable DC injection brakes to rapidly stop the motor in an emergency. Machines must be stopped when performing servicing functions or taking measurements.

Accumulated swarf should be removed from the machine by means of a brush and not with the hands. Rags and dusters must be kept well away from rotating work pieces and tools. Extract ventilation hoods on machines used for dry machining, and other operations where dust is produced, should be connected to an efficient filtered exhaust system, which should be regularly tested and maintained, by a competent person, at least on an annual basis.

## **Woodworking Machinery**

Every year in industry, woodworking machinery causes a number of serious injuries. Only mechanical workshop based staff, who have a thorough knowledge and the necessary experience of the operation of woodworking machines, are permitted to operate such machinery. Untrained employees must not operate woodworking machines.



The 'Safe use of woodworking machinery. Provision and Use of Work Equipment Regulations 1998 (as applied to woodworking machinery)'. Approved Code of Practice and guidance document produced by Health and Safety Executive (HSE) should be consulted prior to any work being carried out. The HSE also have extensive guidance on their dedicated woodworking industry webpages at <http://www.hse.gov.uk/woodworking/index.htm>.

It is fundamental to the safe operation of all woodworking machines that each machine is fitted with approved guards, and that each guard is adjusted by the operator, so that the machine cutters and any other moving parts are enclosed to the greatest extent practicable. Guards must not be adjusted whilst the machine is in motion, and an emergency stop button must be conveniently sited and clearly indicated adjacent to the machine, particularly at circular saw benches.

Machine operators must always use push sticks, jigs, holders and back stops in accordance with the Regulations, and must wear suitable personal protection, which will normally include suitable eye protection, hearing protection and respiratory protection; the latter is particularly important when machining hard woods.

## **Abrasive Wheels**

Abrasive wheels must be mounted and dressed only by a competent person, who has received specific training and information on the correct handling and mounting of abrasive wheels (including pre-mounting and storing procedures).

To minimise the risk of bursting, abrasive wheels should always be run within the specified maximum rotation speed, if wheels are large enough this will be marked on the wheel (in accordance with Regulation 23 of Provision and Use of Work Equipment Regulations (PUWER)). Where small wheels are used there should be a notice fixed in the workroom, giving the individual, or class maximum speed. The power driven spindle should be governed so that its rotation speed cannot exceed this.

Guarding must be provided to contain fragments of the wheel if it did burst, so as to prevent them injuring anyone in the workplace. The guarding has an additional role in aiding to fulfil the requirements of Regulation 11 of PUWER (Dangerous Parts of Machinery); it should be designed, constructed and maintained to fulfil both functions.

PPE in the form of high impact resistant eye protection (BS EN 166 with 'A' impact rating lens) must be worn at all times during grinding operations.

## **Printing and bookbinding machinery**

All potentially dangerous moving parts of printing machinery, guillotines and trimmers, shredders, stitching, sewing and bookbinding machines, must be



adequately guarded either by means of a physical or a photo-electric guarding system. Machinery must never be used without these guards in place and in working order, unless an alternative equally effective means of ensuring that the machine operators are protected from the moving parts can be employed. No attempts should be made to adjust or clean such machinery whilst it is in motion. All printing and bookbinding machinery must be regularly serviced by a competent engineer.

An adequate means of local exhaust ventilation should be provided in all printing and reprographic areas, where vapours from the solvents used to clean the machines may build up. This is particularly important where large numbers of such machines are housed together.

## **Centrifuges**

All new centrifuges must conform to the safety requirements set out in British Standard BS EN 12547:2014 "Centrifuges. Common Safety Requirements", (or an equivalent standard for imported models) and older models should be brought as close to this standard as is practicable. Advice in this regard may require to be sought from the suppliers of foreign-made equipment. Thereafter, the maker's instructions and the recommendations for use given in BSEN12547 should be carefully observed, and routine servicing by a competent engineer must be arranged.

Care must always be taken to ensure that centrifuge tubes are not cracked or flawed, and that all heads, trunnion rings and buckets, as well as other working parts, are regularly inspected for defects by a competent person. Centrifuge tubes should not be filled more than three-quarters full, especially if an angled head is used, and loads must be correctly balanced.

The lid of a centrifuge must not be opened whilst the rotor is still in motion, and flammable liquids should never be centrifuged unless it is known that the centrifuge motor and control gear are sparkproof. Arrangements should always be made to deal with tube breakages and mechanical failures before either event occurs.

## **Materials testing machines**

All materials which are under a test must be suitably guarded, in order to prevent the scatter of material, should fracture of the specimen occur.

## **Hand-Held Power Tools**

The essentially portable nature of these tools renders their effective guarding very difficult, and though many are in common DIY use, it is vital that their associated hazards must not be underestimated. Care must be taken to fit and properly adjust safety guards where these are practicable. A system of





control of use of hand-held power tools when these move outside the workshop environment must be in place and adhered to.

Regular examination for mechanical and electrical defects is essential, and a tool which is defective in any way should be withdrawn immediately from service, preferably disabled, and should be suitably labelled until repairs have been effected. All hand-held power tools should bear an electrical test label to indicate that they have been inspected and tested for electrical safety within the previous six months, and passed safe for use, see <https://www.ed.ac.uk/health-safety/guidance/electrical-hazards> for more guidance.

Some portable tools such as grinders and circular saws are extremely hazardous, and must only be operated by highly trained workshop staff, who are fully aware of the dangers and the necessary safety precautions. Trailing leads from portable power tools must be properly secured, and regularly checked for damage, and soundness of electrical connections. Wherever practicable, low voltage power tools must be used.

## Lifting equipment

All items of lifting equipment (such as lifts, cranes, beams, pulley blocks, chains, ropes and slings), must be notified to the University's Engineering Insurers, who will inspect each item of equipment at the statutorily required interval. Notification of the addition or deletion of such items should be made to the Insurance Office, Finance Department, ([insurance@ed.ac.uk](mailto:insurance@ed.ac.uk)), noting details of the equipment (serial number, model, location, etc.) and the contact name and telephone number of a person responsible for the equipment (e.g. Workshop Manager, etc.). Notification of newly installed equipment is required before it is brought into use. Fork lift trucks must be operated only by fully trained staff.

The safe working load (SWL), indicated on the insurance certificate, must be clearly marked on each item of lifting equipment, and these limits must never be exceeded under any circumstances. No lifting equipment with any visible defect should be used at any time. When lifting large weights, the load should be lifted initially only a few inches from the floor, to check the safe condition of the lifting apparatus and the security of slings, etc., before the full lifting operation is commenced.

Consideration as to the necessity of providing suitable foot protection must be assessed, bearing in mind the hazards of each individual task.

**If you require this document in an alternative format please contact The Health and Safety Department on [health.safety@ed.ac.uk](mailto:health.safety@ed.ac.uk) or call (0131) 651 4255**



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