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Health and safety for design and technology in educational and similar establishments – Code of practice

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Contents

Summary of pages

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 August 2014. It was prepared by Technical Committee GME/27, *Safety in school workshops*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 4163:2007, which is withdrawn.

Information about this document

The Health and Safety at Work etc. Act 1974 places a general duty on employers to ensure, as far as reasonably practicable, the health and safety of employees and other persons affected by their activities.

The Management of Health and Safety at Work Regulations 1999 require employers to carry out risk assessments for the purpose of identifying what is required to comply with this general duty and any relevant Regulations made under this Act. This code of practice is primarily for protection of learners, employees, trainee teachers, and other adults across the full range of design and technology teaching areas. This code applies to schools of all types, including those maintained by local authorities, academies, free schools, independent schools and any type of school for learners with special educational needs. It will also be helpful to further education colleges, universities, teacher training establishments, adult education workshops, and workshops in hospitals and prisons.

Implementation of this code of practice is not a legal requirement but it does provide one means of demonstrating that reasonably practicable steps have been taken to minimize risks from the machinery, equipment, processes and materials used. The recommendations in this code of practice cannot ensure the health and safety of learners and employees without proper training and supervision by the teacher in charge. It is essential that anyone in charge of a teaching space covered by this code of practice has recognized accredited training in health and safety.

This code of practice has been written also for persons responsible for providing services, equipment and machinery in educational establishments, and for persons employed to work in these establishments. If similar resources are used in other school departments and colleges of further education, the recommendations of this standard can be applied to these departments. They can also be applied where learners are undergoing initial teacher training.

Risk assessment is an important part of health and safety and teachers should be aware of the five step approach (information is available via the HSE toolbox [1)]). In design and technology teaching areas, risk assessments are likely to be applied to the working environment, equipment, processes, techniques, and activities.

[1)] The HSE toolbox is available at: http://www.hse.gov.uk/toolbox/ <last accessed 25 June 2014>.

Practical experience provides opportunities to introduce learners to concepts of risk assessment and safe working methods and with encouragement, they can develop their understanding of risk assessment processes. Through application of this process, learners can be trained to use appropriate control measures to minimize risks to themselves and others. It is essential that teachers are fully conversant with hazards in the area that they supervise, and that they plan, organize, control and monitor the work so that risks can be controlled.

Whilst this standard is meant to be comprehensive, it does not preclude the development and introduction of new technologies so long as appropriate risk assessments are made and the employer accepts their introduction.

This code of practice is intended to be a useful guide to those who teach and manage in design and technology areas in educational establishments, and it aims to contribute to the prevention of accidents and dangerous occurrences. Employers and employees can incorporate the recommendations of this code of practice into their working environment.

Hazard warnings

WARNING. Learners may only use the following machines when they have been assessed and the assessment has shown that they are competent, and they are under appropriate supervision of specifically trained employees:

- portable grinding machine (e.g. angle grinding machines) (see **12.3**);
- rotating (circular) portable saws (see **12.4**);
- portable biscuit jointer/tenon jointers (see **12.5**);
- reciprocating portable saws (e.g. jig saws) (see **12.6**);
- multi-tool (saws, carvers, scrapers etc.) (see **12.8**);
- portable planing machines (see **12.11**);
- portable routers (see **12.12**);
- band sawing machines (see **13.6.1**);
- chop and radial arm sawing machines (see **13.6.4**);
- sawing machines with cutting discs or abrasive discs, power hacksaws and metal cutting bandsaws (see **14.6**).

Use of this document

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

Presentational conventions

The provisions in this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

In particular, attention is drawn to the statutory legislation listed in the bibliography.

Section 1: General

1 Scope

This British Standard code of practice provides recommendations and guidance for persons responsible for planning services, equipment and machinery and for persons who might use these in design and technology facilities in all types of educational establishments.

Design and technology facilities include all teaching areas and preparation areas where materials are manipulated and processed, equipment is used and design and/or manufacturing takes place (e.g. food, catering, textiles, graphics, electronics, technology, craft, engineering, manufacturing, woodworking of all types, vocational workshops, motor vehicle workshops and computer areas).

NOTE The recommendations cover the supply and safe use of equipment, machine tools and materials and chemicals, personal protection and safety management, with particular reference to the hazards involved.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 546, *Two-pole and earthing-pin plugs, socket-outlets and socket-outlet adapters*

BS 1363-1, *13 A plugs, socket-outlets and adaptors – Part 1: Specification for rewirable and non-rewirable 13 A fused plugs*

BS 1363-2, *13 A plugs, socket-outlets and adaptors – Part 2: Specification for 13 A switched and unswitched socket outlets*

BS 1363-4, *13 A plugs, socket-outlets and adaptors – Part 4: Specification for 13 A fused connector units switched and unswitched*

BS 1710, *Specification for identification of pipelines and services*

BS 2769-1, *Hand-held electric motor-operated tools – Part 1: Specification for general requirements*

BS 4411, *Specification for woodcutting bandsaw blades*

BS 5169, *Specification for fusion welded steel air receivers*

BS 5499-4, *Safety signs – Part 4: Code of practice for escape route signing*

BS 7288, *Specification for socket outlets incorporating residual current devices (S.R.C.D.s)*

BS 7671, *Requirements for electrical installations – IET Wiring Regulations – Seventeenth edition*

BS EN 149:2001+A1:2009, *Respiratory protective devices – Filtering half masks to protect against particles – Requirements, testing, marking*

BS EN 166:2002, *Personal eye protection – Specifications*

BS EN 352-1, *Hearing protectors – General requirements – Part 1: Ear-Muffs*

BS EN 847-1, *Tools for woodworking – Safety requirements – Part 1: Milling tools, circular saw blades*

BS EN ISO 7010, *Graphical symbols – Safety colours and safety signs – Registered safety signs (ISO 7010:2011)*

BS 5733, *General requirements for electrical accessories – Specification*

BS EN 60204-1, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

BS EN 60309-2, *Plugs, socket-outlets and couplers for industrial purposes – Part 2: Dimensional interchangeability requirements for pin and contact-tube accessories*

BS EN 60335, *Specification for safety of household and similar electrical appliances*

BS EN 60529:1992+A2:2013, *Specification for degrees of protection provided by enclosures (IP code)*

BS EN 60669-2-4, *Switches for household and similar fixed electrical installations – Part 2-4: Particular requirements – Isolating switches*

BS EN 60898-1, *Electrical accessories – Circuit breakers for overcurrent protection for household and similar installations – Part 1: Circuit-breakers for a.c. operation*

BS EN 60947-3:1999, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*

BS EN 61008-1, *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs) – Part 1: General rules*

BS EN 61009-1, *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) – Part 1: General rules*

Other publications

[N1] The D&T Association. *Health and Safety Training Standards in Design and Technology.* 2013.

[N2] HSE. HSG258, *Controlling airborne contaminants at work*.

[N3] UKLPG. Code of Practice No. 7, *Storage of Full and Empty LPG Cylinders and Cartridges*. 2004.

[N4] CIBSE. *Lighting Guide 05: Lighting for Education (Society of Light and Lighting SLL LG5*).

[N5] Institution of Engineering and Technology. *Guidance Note 3: Inspection and Testing, 6th Edition.*

[N6] HSE. HSG261, *Health and safety in motor vehicle repair and associated industries*.

[N7] HSE. HSG17, *Safety in the Use of Abrasive Wheels.*

[N8] HSE. EM9, *Asbestos essentials – Disposal of asbestos waste.*

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

3.1 competent person
person, suitably trained and qualified by knowledge and practical experience, and provided with the necessary instructions, to enable the required task(s) to be carried out correctly alongside the user and giving their full attention to the user

3.2 extra-low voltage
voltage normally not exceeding 50 V a.c. or 120 V ripple free d.c., whether between conductors or to earth

[SOURCE: BS 7671:2008+A2:2013]

3.3 separated extra-low voltage (SELV)
extra-low voltage system which is electrically separated from earth and from other systems in such a way that a single fault cannot give rise to the risk of electric shock

[SOURCE: BS 7671:2008+A2:2013]

3.4 low voltage
voltage normally exceeding extra-low voltage but not exceeding 1 000 V a.c. or 1 500 V d.c. between conductors, or 600 V a.c. or 900 V d.c. between conductor and earth

[SOURCE: BS 7671:2008+A2:2013]

3.5 isolating switch
switch which, in the open position, satisfies the isolating requirements specified for a disconnector

3.6 fused isolating switch
isolating switch in which one or more poles have a fuse in series in a composite unit

NOTE 1 Fused switch-disconnectors are also called switched or fused isolators.

3.7 residual current device
mechanical switching device or association of devices intended to cause the opening of the contacts when the residual current attains a given value under specified conditions

[SOURCE: BS 7671:2008+A2:2013]

3.8 ingress protection (IP) rating
indication of degree of protection against liquids and solids ingress into electrical equipment

*NOTE See BS EN 60529:1992+A2:2013, **3.4**, definition of "IP code".*

Section 2: Health and safety management

4 Health and safety management

4.1 Risk assessment

NOTE 1 The Management of Health and Safety at Work Regulations (MHSWR) 1999 require that employers carry out an assessment of the risks to health and safety of employees and other persons.

Measures should be taken to comply with the requirements and prohibitions imposed by, or under, the relevant statutory provisions. The relevant statutory provisions are:

a) the general duties of the Health and Safety at Work etc. Act 1974, that require employers to ensure, as far as reasonably practicable, the health, safety and welfare at work of employees and the health and safety of other persons;

b) the duties imposed by any health and safety regulations relevant to the employer's activities.

The Management of Health and Safety at Work Regulations 1999 require that young persons (persons under 18 years of age) are not exposed to increased health and safety risks as a consequence of lack of experience, maturity and awareness of risks. Strictly, the regulations only apply where young persons are employed or are taking part in a work experience scheme, but the principle is the same for learners. Employers should assess the risks to which young persons are exposed, and to implement measures to protect their health and safety, taking into account lack of experience and maturity.

Specific consideration should be given to situations where people work alone and/or remote from assistance. Lone workers should not be at more risk than other employees and additional risk control measures might be required. There might be some high risk activities where another person should be present.

NOTE 2 The appropriate government department for education provides further guidance for local authorities, school leaders, school staff and governing bodies.

4.2 Hazards, risks and risk control measures

4.2.1 Hazards

NOTE Hazards are anything with the potential to cause harm.

Hazards should be identified as the first step in carrying out a risk assessment. When all hazards have been identified, it should be established first whether they can be eliminated. If the hazard can be eliminated, then it should be eliminated so that there is no risk and the risk assessment process is complete (e.g. use of a battery powered drill eliminates the hazard of mains electricity).

4.2.2 Risk

If a hazard cannot be eliminated, then the risk should be assessed. The risk is the likelihood of injury or damage occurring and the severity of the consequences. The risk depends on the prevailing circumstances and the risk control measures in place. The risk is affected by the number, experience and level of responsibility of the learners in the teaching environment.

4.2.3 Risk control measures

Risk control measures can be engineering control measures (e.g. guarding) or procedural measures such as systems of work in conjunction with instruction and supervision and personal protective equipment (PPE). Risk control measures should be taken in the following order.

a) If possible, eliminate the hazard.

b) If not possible, substitute with a safer alternative.

c) If not possible to eliminate the hazard, reduce risks at source, using engineering controls if practicable.

d) Institute procedures and systems of work in conjunction with instruction and supervision.

e) Use PPE.

4.3 Carrying out a risk assessment

Although it is essential that the risk assessment process is robust, a proportionate approach to safety should be taken and risk management within educational establishments should enable learners to undertake activities safely and not prevent activities from taking place.

NOTE 1 The objective of risk assessment is not to create an environment of absolute safety or zero risk but to take action as appropriate to ensure that significant risks are effectively managed.

Where good practice is not specified or obvious, the seriousness of the risk should be weighed against both the difficulty and cost in terms of time, effort and money, of reducing the risk and the benefits of the activity. In these cases, reasonable risk reducing measures should be pursued, up to the point where any further measures would be disproportionate to the benefits expected. If there are five or more employees involved, the significant findings of the assessments should be recorded.

NOTE 2 The Management of Health and Safety at Work Regulations 1999 specify that risk assessment includes identifying hazards and applying appropriate risk controls; satisfying legal requirements; and structuring risk control decision making.

In design and technology teaching, risk assessment should be applied to the activities taking into account the working environment, equipment, processes, techniques and the experience of the users.

Risk assessments should be undertaken for activities that are carried out by teachers and technicians, as well as for those carried out by learners.

Model risk assessments should be adopted and adapted to suit the nature of the activity.

NOTE 3 The HSE toolbox, including the leaflet Five Steps to Risk Assessment (INDG 163rev3), provides guidance on carrying out risk assessments.

NOTE 4 CLEAPSS has produced Model Risk Assessments for Design and Technology in Secondary Schools and Colleges. For Scotland, refer to the equivalent document published by SSERC.

NOTE 5 The Design and Technology Association (D&T Association) has produced Risk Assessment in Secondary School Design and Technology Teaching Environments.

4.4 Health and safety arrangements

NOTE 1 Employers are legally required to make appropriate arrangements (with regard to the nature of the activities and the size of the undertaking) for effective planning, organization, control, monitoring and review of preventative and protective health and safety measures.

All employees should be informed of their general health and safety responsibilities and any specific tasks delegated to them.

The employer should have an up to date written statement of health and safety describing the roles and responsibilities of key personnel when there are five or more employees.

NOTE 2 This policy may be further supplemented by local policy statements detailing specific responsibilities and arrangements within design and technology departments.

The employer should ensure proportionate monitoring arrangements are in place to demonstrate the successful implementation of the health and safety policy and the effectiveness of the preventative and protective measures implemented.

NOTE 3 Within design and technology departments, this might be delegated to the head of department/subject lead.

NOTE 4 An annual audit by the head of department/relevant subject lead can help maintain expected standards. For further information, see the CLEAPSS document G 79 Auditing health and safety in a secondary school design and technology department and the D&T Association document Risk Assessment in Secondary Schools & Colleges Design & Technology Teaching Environments.

If five or more persons are employed, the arrangements should be recorded.

A competent employee should carry out a formal review at least once each term to ensure that the measures remain effective. It is important that any monitoring that is carried out should be recorded in writing since this would demonstrate that monitoring has been done. The frequency of monitoring should be decided by the frequency of use of the equipment being monitored.

NOTE 5 Occasional inspections by specialist health and safety advisers can help maintain standards and keep employees informed of developments in health and safety legislation and good practice.

NOTE 6 See CLEAPSS guide, L 254 Health and Safety of D&T Workshop Equipment, for further advice on the monitoring of equipment. For Scotland, refer to the equivalent document published by SSERC.

Governors and other responsible bodies have an important monitoring role which should include an annual review of policy, roles and responsibilities and practical arrangements for health and safety in the establishment, which includes the design and technology department.

4.5 Provision of competent health and safety advice

Employers should appoint one or more competent person(s) to assist in carrying out measures to comply with health and safety legislation. The person(s) should be regarded as competent if they have sufficient training and experience or knowledge and other qualities to enable them to assist the employer to properly carry out the measures identified by the risk assessments. If possible, persons who provide assistance should be employees.

NOTE An Occupational Safety and Health Consultants Register (OSHCR) [2)] *is maintained by the HSE. A Directory of Registered Design and Technology Health and Safety Consultants (RDTHSCs) is maintained by the D&T Association* [3)].

2) See: http://www.oshcr.org <last accessed 25 June 2014>.
3) See: http://www.data.org.uk <last accessed 25 June 2014>.

4.6 Health and safety training

NOTE 1 All employers are required under the Health and Safety at Work etc. Act 1974 to provide, as far as reasonably practicable, all information, instruction, training and supervision necessary to ensure the health and safety at work of their employees.

NOTE 2 Employers are required, under the Management of Health and Safety at Work Regulations 1999, to take into account all employees' capabilities with regard to health and safety.

NOTE 3 The Provision and Use of Work Equipment Regulations (PUWER) 1998 (Regulation 9) require that all persons who use work equipment have received adequate training.

Employees should be competent to undertake the tasks expected of them. The competence of relevant employees should be part of the risk assessment process. Proper health and safety training should be provided to employees on induction and when exposed to any new or increased risks.

NOTE 4 The Design and Technology Association (D&T Association) has published training standards which provide a framework that employers can use to cover all elements of health and safety training for D&T. The PUWER regulations require refresher training to be provided when necessary.

Refresher training should be undertaken at least every five years.

NOTE 5 Accreditation provides a record of the training undertaken.

All employees and supporting adults should be trained in safe use of equipment, machinery and processes during initial training, or by in-service training. All those involved in any aspects of food handling should have at least a recognized food safety certificate.

NOTE 6 This is included in the D&T Association publication Health and Safety Training Standards in Design and Technology [N1].

4.7 Reporting accidents and dangerous occurrences

All significant accidents, work related ill health and dangerous occurrences should be reported and recorded either by completion of an employer's report form or by entering details in an accident book. In each case, the circumstances of the accident should be recorded and what action should be taken to prevent reoccurrence.

NOTE The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 2013 require certain types of incidents to be reported to the HSE; see the HSE INDG 453, A Brief Guide to the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR).

4.8 First aid

Sufficient first aid provisions should be available for employees and learners.

NOTE 1 The Health and Safety (First Aid) Regulations 1981 require employers to ensure that there is sufficient first aid provision for employees.

A first aid kit should be readily available.

NOTE 2 See HSE publication L74 The Health and Safety (First-Aid) Regulations 1981. Guidance on Regulation, 2013.

Eye wash facilities should be available where required (e.g. by using a suitable mains cold water tap or, where this is not available, by proprietary eye wash bottles). First aid materials conforming to HSE publication L74 should be provided and there should be a number of persons competent to provide first aid appropriate to the risks. At least one person holding a current first aid certificate or who has been trained in emergency first aid should always be available to attend and to provide first aid when design and technology rooms are in use.

NOTE 3 The appropriate government department for education provides further guidance for local authorities, school leaders, school staff and governing bodies.

4.9 Hazardous noise

High levels of noise can cause permanent hearing loss. This can take years to become serious and is irreversible. In general, if persons about two metres apart are required to raise their voices to carry out a normal conversation it might be necessary to implement controls under the Control of Noise at Work Regulations 2005, depending on how long they are exposed. The Regulations require the risks from noise to be assessed such that control of those risks can be implemented.

NOTE 1 The risk of hearing damage depends on the sound level and the length of exposure. Some impact type sounds can cause hearing damage instantaneously (e.g. gun shots, heavy hammer blows on resonant objects). The Management of Health and Safety at Work Regulations (MHSWR) 1999, Regulation 19 (Protection of young persons) and the Control of Noise at Work Regulations 2005 specify duties of employers and employees if the employee's daily noise exposure reaches specific daily or weekly "action values" and "limit values" as follows.

a) Lower exposure action values:

- *daily or weekly exposure of 80 dB(A);*
- *peak sound pressure of 135 dB(C);*

b) Upper exposure action values:

- *daily or weekly exposure of 85 dB(A);*
- *peak sound pressure of 137 dB(C);*

c) Exposure limit values:

- *daily or weekly exposure of 87 dB(A);*
- *peak sound pressure of 140 dB(C).*

Specific actions are required at each of the action values. The limit value is the level which are not to be exceeded (exposure limit values take account of any reduction in exposure provided by hearing protection).

NOTE 2 Weekly personal noise exposure may be used in place of daily personal noise exposure where exposure varies markedly from day to day.

Where local exhaust ventilation (LEV) is used, the employer should specify systems that have acceptable noise levels in accordance with HSG258 *Controlling airborne contaminants at work* [N2] and the designer should meet this specification.

NOTE 3 Noise generated by LEV can cause problems, especially where ambient noise is low. The noise originates from:

a) fans – the type of fan, blade design, drive, bearings, mounting, casing, sound;

b) insulation and duct connection;

c) turbulence in ducts, particularly flexible ducts, bends, changes in cross-section;

d) high velocities and large particles;

e) around small, high-velocity capturing hoods;

f) noise created elsewhere, propagated by hoods.

Employers have a duty under the Control of Noise at Work Regulations 2005 to ensure risk from the exposure of their employees to noise is either eliminated at source or, where this is not reasonably practicable, it should be reduced to as low a level as is reasonably practicable. Where persons are likely to be exposed to noise at or above the upper action value, employers should reduce exposure as far as reasonably practicable using organizational and technical measures other than personal hearing protectors. Where it is not reasonably practicable to reduce the level below the upper action value, personal hearing protectors should be provided and worn. Personal hearing protectors should be provided and worn by others in the vicinity of noisy operations, including learners. Suitable health surveillance including hearing tests should also be provided to employees who are regularly exposed to levels at or above the upper action value or otherwise at risk.

Where the daily noise exposure exceeds the lower exposure action value, employers should make hearing protectors available on request and provide adequate information, instruction and training about risks to hearing, action to minimize noise risk, and how to obtain ear protectors. At the lower exposure action value, individuals should be encouraged to use personal hearing protectors, but use is not mandatory.

Employers should ensure individuals are not exposed to noise above an exposure limit value, or if it is exceeded they should immediately reduce exposure to noise to below the exposure limit value, identify why it was exceeded, and modify the control measures to stop it being exceeded again.

In any area where the exposure limit value is likely to be exceeded, employers should mark hearing protection zones with suitable notices and restrict access, where this is practicable, and where the risk from exposure justifies it.

NOTE 4 Several pieces of equipment/processes used in design and technology generate noise levels above 85dB(A), e.g. planer/thicknessing machine and portable router. However, exposure times are likely to be fairly short and therefore action values are normally unlikely to be exceeded.

NOTE 5 Risk control measures could include alternative work methods, equipment selection, workstation design, work schedules, and clothing.

Exposure times can be exceeded where a technician uses equipment when preparing work for learners but this should be controlled by limiting the period of exposure.

The ambient noise levels in the work environment should not adversely affect the ability of the teacher to communicate with the learners.

NOTE 6 The HSE have published noise calculators and ready reckoners on their website which can help calculate daily noise and weekly noise exposures.

4.10 Vibration

*COMMENTARY ON **4.10**.*

Prolonged and regular exposure to hand/arm vibration (HAV) can affect the operator's health. HAV is vibration transmitted from work processes into workers' hands and arms. For example, it can be caused by operating hand held power tools, hand guided equipment or by holding materials being processed, e.g. on pedestal grinding machines. Prolonged and regular exposure can lead to a range of conditions collectively known as hand and arm vibration syndrome (HAVS). This is most likely when contact with a vibrating tool or work process is a regular part of the person's job.

The Control of Vibration at Work Regulations 2005 requires employers to assess the vibration risk to employees and, where necessary, they should implement appropriate control measures. Employers should also provide suitable and sufficient information, instruction and training about the risks from vibration, action to reduce the risks, why and how to detect and report sign or injury and the entitlement to health surveillance (regular health checks).

NOTE 1 The risk of damage from hand/arm vibration depends on the level of vibration and the period of exposure. The Control of Vibration at Work Regulations specify an "action value" and a "limit value" as follows.

a) Daily exposure action value: 2.5 m/s^2 A(8);

b) Daily exposure limit value: 5 m/s^2 A(8).

In the assessment of vibration risk, employees should be assessed to see if they are exposed above the daily exposure action value and, if they are, employers should introduce a programme of controls to eliminate risks, or reduce exposure to as low a level as is reasonably practicable. Employers should provide health surveillance to employees who continue to be regularly exposed above the action value or otherwise continue to be at risk.

If the assessment shows employees are likely to be exposed above the daily exposure limit value, the employer should take immediate action to reduce exposure below the limit value.

NOTE 2 Risk control measures could include alternative work methods, equipment selection, workstation design, work schedules, and clothing.

NOTE 3 Several pieces of equipment/processes used in design and technology can lead to hand/arm vibration, e.g. portable power tools. Rotary action power tools or machines used for more than about an hour per day or hammer action tools used for more than about 15 minutes per day, might lead to the action value being exceeded in a much shorter period of time.

Exposure times can be exceeded where a technician uses equipment when preparing work for learners but this should be controlled by limiting the period of exposure.

NOTE 4 The HSE have published a HAV exposure calculator on their website to assist in calculating exposures for hand-arm vibration.

4.11 Fire hazards

The following fire hazards in design and technology areas should be noted.

a) Sources of ignition:
   - hot surfaces;
   - electrically generated sparks;
   - mechanically generated sparks (e.g. from abrasive wheels);
   - naked flames (e.g. in welding);
   - hot materials (e.g. in heat processes).

b) Sources of fuel:
   - flammable liquids (e.g. cooking oils, solvents, petrol);
   - flammable gases (e.g. acetylene, propane);
   - combustible materials (e.g. wood shavings and dust, plastics dust textiles, soft furnishings, paper and card);

c) Sources of oxygen:
   - natural air flow and forced air flow [e.g. local exhaust ventilation (LEV)];

- oxidizing chemicals (e.g. catalysts for glass reinforced plastics work);
- oxygen cylinders (e.g. for welding).

4.12 Fire risk control measures

NOTE 1 Many of the risk control measures given in this standard for the management of services and specific activities are concerned with controlling the risk of fire.

Fire risk control measures include storage and use of flammable substances, the management of heat processes and the control of dust; all of these should be assessed in the fire risk assessment.

Fine particles of some dusts are combustible (e.g. wood, plastics and some metals) and can, in the right concentrations, ignite explosively and start a fire. Local Exhaust Ventilation (LEV) systems for combustible dusts should be separate, incorporate explosion relief (ATEX 95 compliant), and should not be used for processes where sparks are generated.

NOTE 2 Sparks from grinding machines, etc., could ignite combustible dust causing an explosion in the ducting or collector.

Dust should not be allowed to accumulate on electrical or other equipment as this can lead to overheating.

NOTE 3 See HSE guidance document HSG103, Safe handling of combustible dusts: Precautions against explosions and HSG258, Controlling airborne contaminants at work [N2].

Section 3: Planning and services

5 Planning and design

5.1 General

*COMMENTARY ON **5.1**.*

The education departments in England, Scotland and Wales provide guidance on the detailed design or work areas, for example DfES Building Bulletins, or the corresponding recommendations for Scotland and Northern Ireland, as applicable. These include dimensions for safe working areas around individual machines, furniture and equipment for new or refurbished facilities, and floor area ranges for varying group sizes.

Figure 1 should be used for guidance on the size of rooms required for different design and technology activities related to the size of the group for a single teacher.

H + (F x G) = recommended minimum room size [Equation (1)]

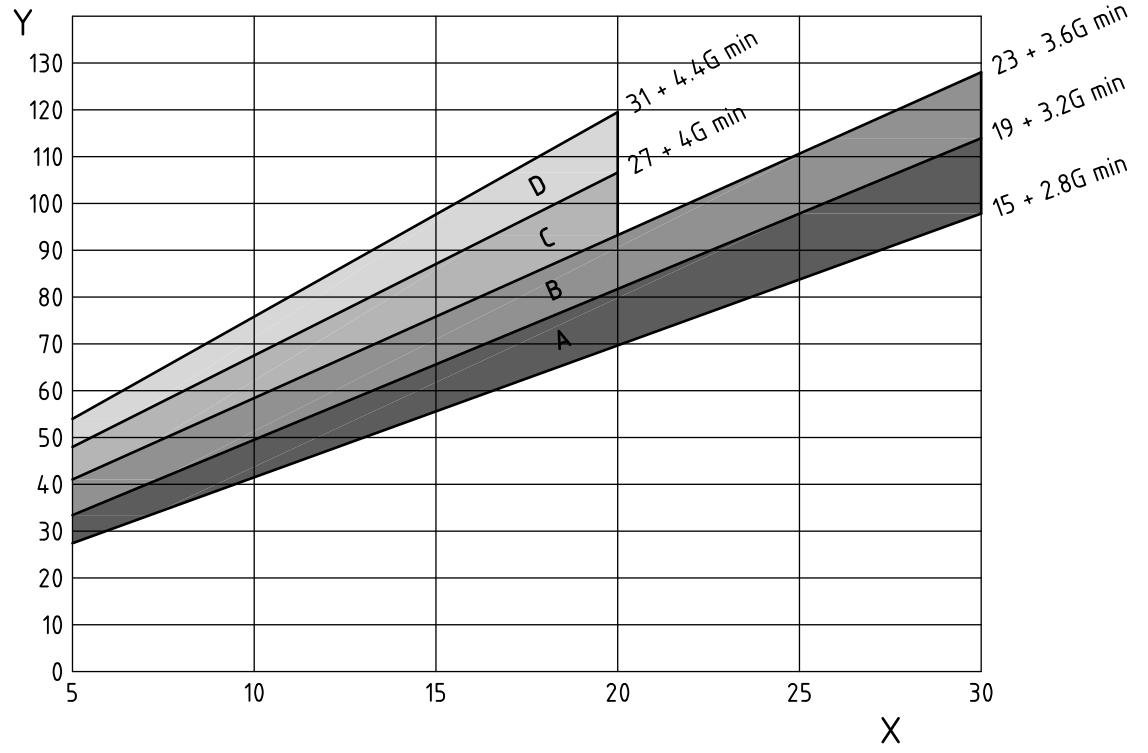
Where

F is the area per learner (m^2)

G is the number of learners

H is the space for fixed equipment (m^2)

Figure 1 **Recommended area ranges for design and technology teaching spaces**



Key

Y Area of room (m^2)

X Group size (G): Number of learners

Equation (1) should be used to calculate the recommended number of learners in a particular teaching space within each of the area ranges suitable for different design and technology activities as shown in Figure 1.

Example

In Zone D: for 20 learners the area range would be:

Minimum: 27 + (4 x 20) = **107 m²**

Maximum: 31 + (4.4 x 20) = **119 m²**

Typical zones for various activities

General teaching area	Zone A
Electronics and control systems	Zone B
Graphic activities	Zone B
Textiles activities	Zone B
Food activities	Zone C
Resistant material activities	Zone D
Engineering	Zone D

Table 1 shows the area ranges for typical group sizes.

Table 1 **Area ranges for typical group sizes (in m²)**

Zone	Group size				
	18	20	21	25	30
A	65–67	71–83	74–86	85–99	99–115
B	77–88	83–91	86–95	99–106	115–131
C	88–99	91–103	95–107	—	—
D	99–110	103–115	107–119	—	—

NOTE 2 If the number of learners in a teaching area exceeds the number for which the room was planned or creates unsafe working conditions the employer might be held liable under the Health and Safety at Work Act 1974 for failing to provide safe working conditions.

NOTE 3 Attention is drawn to the requirements of the Equality Act 2010.

NOTE 4 For more information, refer to Building Bulletin 81 [4)]*, Food Rooms Design Guide and Baseline design for 1,200 place 11 to 16 secondary school finger block with a practical subject.*

5.2 Storage

5.2.1 General

Safe storage should be provided for bulk supplies of materials and learner's projects.

Suitable access equipment should be provided for items that are safely stored at high level.

[4)] *Building Bulletin 81* has been archived and an update to this document is planned by DfE but the date is unknown at the time of publication of this British Standard.

All storage in design and technology areas should conform to the appropriate storage requirements.

5.2.2 Materials

Storage of bulk materials such as textile materials, timber, metal and plastics should be in an area separately designated and supplementary to the teaching area. The store should be adjacent to the work area with ready access both to it and to the outside to facilitate deliveries. Adequate racking for the storage of metal rods and tubes, timber, sheet materials and textile materials should be provided. Ends should not protrude from the rack. Retaining bars or chains should be provided if vertical stacking is employed.

To preserve materials in good condition and to facilitate safe handling at all times, timber and plastics should be stored in unheated areas and metals in warm and dry areas. However, a comfortable working environment should be provided in these areas.

5.2.3 Food

Food components and products should be separated and stored correctly. Provision should be made for storage of four categories of foods: dry and shelf stable foods, fresh fruit and vegetables, frozen foods and perishable foods. Inventories and labelling should be checked regularly at intervals depending on the type of food/product stored.

5.2.4 Hazardous substances

Suitable storage areas should be provided for chemicals, flammable liquids, liquefied petroleum gas (LPG), acetylene and oxygen. Hazardous substances should be stored systematically, e.g. highly flammable (liquid or gaseous), toxic, corrosive, etc., and should be kept apart from substances presenting a different type of hazard.

The local health and safety adviser or fire prevention officer should be consulted.

NOTE 1 Attention is drawn to the Health and Safety (Safety Signs and Signals) Regulations 1996, regarding the display of safety notices.

NOTE 2 If only very small quantities of some hazardous chemicals are required for occasional use, it might be appropriate to obtain supplies from other stores in the school or similar establishment.

The amount of any stored substance should be as low as possible in accordance with purchasing and curriculum requirements. Inventories should be reviewed at least once each term, and redundant stocks disposed of safely in accordance with the manufacturer's instructions.

NOTE 3 Attention is drawn to the Environmental Protection Act 1990.

NOTE 4 Substances hazardous to health are classified and labelled under the Registration, Evaluation, Authorisation & restriction of CHemicals (REACH).

If possible, schools should avoid using hazardous substances. Non-hazardous substances should be chosen in preference to hazardous substances.

Hazardous substances should be stored and used in accordance with the manufacturer's instructions.

NOTE 5 Guidance on storage of hazardous substances in technology can be found in the CLEAPSS publication Model Risk Assessments for Design and Technology in Secondary Schools and Colleges. For Scotland, refer to the equivalent document published by SSERC.

NOTE 6 If use of a hazardous substance is unavoidable, attention is drawn to the Control of Substances Hazardous to Health (COSHH) Regulations 2002 (as amended) which require an assessment of the risks associated with the use and storage of the substance.

Risk control measures should be implemented including the following.

a) Storage should be secure to prevent unauthorized access.

b) Adequate local exhaust and general ventilation should be provided and maintained.

c) Safe systems of work incorporating instruction, training, PPE and record keeping should be in use.

d) Emergency procedures should be provided in case of spillage or accident.

e) Emergency eye irrigation and body washing facilities should be available.

f) Pre-prepared spill kits should be used, if possible.

Main stocks of hazardous substances should be kept in a lockable store provided with ventilation at high and low levels on an outside wall. Provision should be made for spill containment within the store. Bottles of hazardous substances of 1 litre capacity or higher should be stored at low level, in a position where they cannot be knocked.

Only sufficient supplies of hazardous substances for immediate use should be kept in the work area. Supplies should be stored in strong, locked containers in which any spillage can be retained. Containers should be unbreakable. Glass containers, if used, should be carried in an unbreakable container or plastic bucket. Acids should be stored and used close to a water supply.

NOTE 7 The COSHH Regulations 2002 (as amended) require local exhaust ventilation (LEV) systems to be regularly maintained, and inspected by a competent person at least every 14 months.

5.2.5 Flammable liquids and highly flammable liquids

*COMMENTARY ON **CLAUSE 5.2.5**.*

The Dangerous Substances and Explosive Atmospheres Regulations 2002 are concerned with protection against risks from fire, explosion and similar events arising from dangerous substances used, or present, in the workplace. Dangerous substances are substances or preparations which are explosive, oxidizing, extremely flammable, highly flammable or flammable. They include petrol, liquefied petroleum gas, solvent based paints and varnishes, and dusts which when mixed with air could cause an explosive atmosphere.

5.2.5.1 Flammable liquids

NOTE Substances described as "flammable" burn but do not give off sufficient vapours at normal room temperatures to form an explosive concentration. Flammable liquids include paraffin, white spirit, turpentine substitute and oil.

Flammable liquids should be stored in a secure area away from heaters, lights and combustible materials (e.g. paper, cardboard, fabric, wood). Flammable liquids should be kept away from naked lights and smoking should be prohibited in the vicinity.

The risks from spillage should be minimized by using small quantities of flammable liquids and by replacing lids on containers quickly after use. Contact with the skin should be avoided by wearing suitable gloves. Any spillage should be cleared up immediately.

5.2.5.2 Highly flammable liquids

NOTE 1 Substances described as "highly flammable" are easily ignited at room temperature and might be explosive. Fire and inhalation hazards are much higher than with flammable liquids, and highly flammable liquids are to be avoided if possible. Highly flammable liquids include cellulose paints/thinners, methylated spirits and petroleum-based adhesives.

NOTE 2 Vapours from highly flammable liquids are heavier than air and accumulate low down, and can form explosive concentrations.

Quantities of highly flammable liquids in storage should be kept to a minimum.

Highly flammable liquids should be stored in closed containers in a secure, purpose built highly flammable liquids store, or, if there are no more than 50 litres, in a fire resisting, spill resistant cabinet marked with a "highly flammable" warning symbol. All containers should be suitable and properly marked with the "highly flammable" warning symbol. Containers should be returned to the store or storage cabinet immediately after use. Storage cabinets should be kept locked or should be in a locked storeroom.

If highly flammable liquids are to be used, this should be outdoors if possible. Petrol tanks should always be filled, and liquids transferred between containers, outdoors, well away from buildings and sources of ignition. Adequate ventilation should be ensured by only using highly flammable liquids in open workshops, by opening windows, and by operating any extractor fans. Care should be taken to ensure that any electrical extractor fans are not a source of ignition.

Highly flammable liquids should not be used in basements, pits or any other areas below ground.

Highly flammable liquids should not be used close to any source of ignition, naked lights, welding areas or electrical equipment, and smoking should be prohibited. Combustible materials (e.g. paper, cardboard, fabric, wood) should not be allowed to become soaked with highly flammable liquids.

Risks from spillage should be minimized by using small quantities and by replacing lids on containers. Purpose designed dispensing containers with spring closed caps should be used if possible. Contact with the skin should be avoided by wearing suitable gloves. Spills should be cleared up immediately and all contaminated rags, paper towels, etc., should be disposed of in an appropriate waste container outside the building.

5.2.6 Liquefied petroleum gas (LPG)

NOTE 1 Liquefied petroleum gas [propane and butane, and MAPP (methyl-acetylene-propadiene) gas] can be used for heating purposes and as an aerosol propellant. Propane is supplied in red cylinders, and at normal temperatures is stored at about 7 bar. Butane is supplied in blue cylinders, and is stored at about 2 bar. MAPP gas is supplied in yellow cylinders. The test pressures for propane and MAPP gas are 25 bar and 22 bar respectively.

The following should be taken into account when handling liquefied petroleum gas.

a) Leaks and/or spills of LPG from cylinders or pipework and fittings could create an explosive mixture in the building.

b) Cylinders of LPG involved in a fire can explode violently.

c) Cylinders of LPG are heavy and present moving/handling and toppling hazards.

d) Escaping vapour from cylinders and aerosols can ignite violently.

e) Skin and eyes can receive cold burns from rapidly evaporating LPG.

f) LPG is an asphyxiant.

g) Burning LPG can produce hazardous fumes.

h) LPG is heavier than air and sinks to low levels. It can accumulate in cellars, pits, drains or other depressions.

Suitable measures should be taken to prevent tampering with and vandalism of LPG cylinders at the design/installation stage. The measures should take into account the general security of the storage area.

A warning sign "highly flammable LPG" should be displayed on LPG cylinder storage. LPG cylinders should not impede or endanger any means of escape from buildings or adjoining areas. Portable fire fighting equipment should be readily available in the LPG storage area.

NOTE 2 Advice on provision and use of fire fighting equipment can be obtained from the local fire authority.

On fixed LPG installations, housings should be fire resistant and well ventilated, and should conform to the requirements of the local fire authority. A schematic drawing of the pipework installation should be provided in accordance with the Pressure Systems and Transportable Gas Containers Regulations (1989).

LPG should be stored and used in a well-ventilated position so that any small leaks can disperse and be diluted to well below the flammable concentration. Signs prohibiting smoking should be displayed in the storage area. LPG should preferably be stored outdoors and away from combustible materials, corrosive materials and oxygen cylinders, and in accordance with UKLPG Code of Practice No. 7, 2004 [N3]. Other materials (especially combustible materials) should not be stored close to LPG cylinders and should not obstruct or restrict natural ventilation of the storage area.

LPG vapour is denser than air and cylinders should not be stored below ground level or close to drains, cellars or basements.

LPG cylinders should not be subjected to mechanical damage or high temperatures, or dropped. Cylinders should be kept in trolleys and/or secured upright so that they cannot be knocked over. The valves of empty cylinders should be closed to prevent ingress of air, which could form an explosive mixture.

Numbers of stored LPG cylinders should be kept to a minimum. Not more than one spare cylinder should be kept for each application.

NOTE 3 The Dangerous Substances and Explosive Atmospheres Regulations 2002 cover the use and storage of LPG. Although not specifically required by the Regulations, it is recommended that no more than eight disposable canisters are stored together.

NOTE 4 See BS 5482-1 for more information.

5.2.7 Oxygen and acetylene cylinders

The following should be taken into account when handling oxygen and acetylene cylinders.

a) Compressed oxygen cylinders can explode violently if damaged or if involved in a fire, or could become a missile if the valve is damaged.

b) Oxygen leakage makes fires burn more quickly and more violently.

c) Acetylene cylinders can explode violently if involved in a fire.

d) Acetylene leaks can form an explosive mixture in buildings.

e) Cylinders are heavy and present moving/handling and toppling hazards.

Numbers of oxygen and acetylene cylinders should be kept to a minimum. Cylinders should be stored in well-ventilated areas away from combustible materials.

"Compressed gas" and "flammable gas" warning signs should be displayed at cylinder stores.

Cylinders (even if empty) should be kept in a safe, secure, well-ventilated place, preferably outside. Cylinders should not be stored below ground level, or next to drains, basements or other low-lying places.

If oxygen and acetylene is supplied through a fixed pipe work installation from cylinders outside the building, they should be in a secure store and a schematic drawing of the pipework installation should be provided in accordance with the Pressure Systems and Transportable Gas Containers Regulations (1989).

Cylinders should not be subjected to mechanical damage or high temperatures, or dropped. Cylinders should be kept in trolleys or secured upright so that they cannot be knocked over.

Acetylene in cylinders is dissolved in a liquid and cylinders should be kept with valves uppermost at all times.

*NOTE See **5.2.5**.*

5.2.8 Glass reinforced plastics materials

The following should be taken into account when handling glass reinforced plastics materials.

a) Resins and catalysts can be classified as hazardous substances.

b) Some plastics can give off toxic fumes if overheated or involved in a fire.

c) Inhalation of fumes and vapours can be hazardous. Individuals can suffer respiratory sensitization and in some cases the effects can be irreversible.

d) Adhesives containers can split and leak.

e) Chemicals for glass reinforced plastics work can constitute a fire hazard.

f) Splinters of material can issue from plastics sheets if they are snapped.

Glass reinforced plastics materials should be stored in cool, dry conditions away from direct heat sources.

Catalysts (organic peroxides) and accelerators (cobalt naphthenate) used for glass reinforced plastics work should be stored in separate (preferably metal) cupboards where any spillage can be retained.

Peroxides should be stored only in vented containers away from any flammable materials and should not be placed in sunlight or near to any source of heat. Large quantities of catalysts, resins and solvents are a fire hazard and storage of these should be avoided.

5.2.9 Casting and forging materials

A sufficient storage area should be provided for forge fuel and moulding sand. Areas around casting and forging equipment should be kept clear.

5.2.10 Portable equipment

Appropriate storage should be provided for portable equipment (e.g. hand tools, power tools and machine accessories). Specially designed rack systems should be devised to check returned items.

Power hand tools and their cutters should be securely stored to prevent unauthorized use.

5.2.11 Storage of personal clothing and Personal Protective Equipment (PPE)

Suitable and sufficient storage for clothing, school bags and PPE should be available close to the entrance to the teaching space. All persons working in specialist areas should use appropriate PPE.

5.3 Fire

5.3.1 General

NOTE 1 The management of risks from fire is covered by the following legislation:

a) in England and Wales: the Regulatory Reform (Fire Safety) Order 2005;

b) in Scotland: the Fire (Scotland) Act 2005;

c) in Northern Ireland: the Fire and Rescue Services (Northern Ireland) Order 2006.

A fire risk assessment should be undertaken in order to identify the means of fire prevention and the necessary fire precautions. While a fire risk assessment would normally be undertaken for the whole school, the risk assessment should take account of the specific fire risks in design and technology areas.

NOTE 2 Guidance on carrying out fire risk assessments in educational establishments are available from the appropriate government department.

5.3.2 Fire systems and procedures

The following fire systems and procedures should be present in design and technology areas.

a) Appropriate fire detectors and fire alarms.

b) Fire escape routes with the correct signs.

NOTE See BS EN ISO 7010 and BS 5499-4 for guidance on escape route signing.

c) Fire fighting equipment and suitable arrangements for:

1) preparing, communicating and testing procedures in case of fire;

2) maintaining and testing fire equipment.

6 Working area environment

6.1 Lighting

6.1.1 General

Sufficient lighting in work areas should be provided. Escape lighting should be provided in high risk areas and in escape routes from high risk areas.

The following levels of lighting should be provided at least in accordance with CIBSE LG5 [N4] Table 5.1 and Table 5.3.

a) High intensity of natural light (500 lx) should be provided in food preparation areas. Fluorescent lighting with a minimum colour rendering index (Ra) of 80 should be provided to avoid distortion of food colours.

b) At least 500 lx should be provided for normal bench and machine work (taking into consideration the stroboscopic effect of fluorescent lighting units).

c) At least 500 lx should be provided in fabric work areas.

d) 1 000 lx should be provided for fine bench and machine work.

NOTE 1 Use suitable task lights to provide lighting at 1 000 lx.

Subdued lighting should be provided in forging, brazing and welding areas to enable colour changes in heated metals to be easily observed. These areas should not be close to windows, especially windows that face south.

Sudden changes in intensity of illumination within work areas or at entrances and exits should be avoided. If possible, the recommended levels of illumination should be provided by natural light, supplemented by artificial lighting if required. Glare should be avoided.

Lighting units installed in storage areas should be mechanically protected.

Computer visual display units should be positioned away from glare and reflection from lights and windows and spaced at least 1 m apart. Window blinds should be provided where required. If it is probable that the computer room will be put into prolonged use, provision of anti-glare category 2 light fittings should be considered.

NOTE 2 The Health and Safety (Display Screen Equipment) Regulations 1992 (as amended) provide guidance (see HSE document L26).

6.1.2 Supplementary lighting

Supplementary lighting should be provided for machine tools and equipment if the main room lighting is not sufficient. Supplementary lighting should conform to BS EN 60204-1. Lamps should not operate at more than 50 V a.c. If the switch for the supplementary light is not easily accessible to the machine tool operator, another switch should be provided adjacent to the light source. Lighting should be provided with a deep shade to prevent glare from polished surfaces.

6.2 Heating and ventilation (including LEV)

Work areas should be maintained at a temperature comfortable to work in when appropriate protective clothing is worn. Heating should be available in rooms used for the preparation of materials as well as teaching areas.

NOTE 1 Attention is drawn to the Workplace (Health, Safety and Welfare) Regulations 1992, and the HSE Approved Code of Practice and Guidance (L24), and also to The School Premises (England) Regulations 2012. Equivalent guidance documents are also available in Scotland and Wales.

Food preparation should not be carried out in close proximity to fan assisted heating units because there is the potential for food contamination from airborne dust.

Fan assisted heating should be avoided where dust-producing activities are carried out.

Underfloor heating should be avoided in rooms where equipment has to be bolted to the floor.

LEV should be provided if a risk assessment shows that this is required in order to comply with the COSHH Regulations 2002 (as amended) or to ensure the safety and comfort of the operators for the following equipment and processes.

a) Cooking appliances that give off steam, oil, grease, odour and heat (the ventilation system for food technology should include a fan of sufficient capacity to ensure the fume load is removed from the equipment).

b) Equipment for heat treatment, including equipment for brazing, forging, welding, cutting, soldering and casting.

c) Woodworking machines, including machines for sawing, sanding, routing, planing and thicknessing.

d) Chemical processes and procedures, including acid pickling, processes involving plastics, paint spraying, and procedures producing engine exhaust emissions.

e) Metalworking machines (used for grinding and polishing).

f) Laser and other cutters.

The local exhaust inlet should be sited as close as possible to the source of contaminant. If venting to the outside, care should be taken not to harm persons outside or in another part of the building. Air should be admitted to the room to compensate for air exhausted to the outside.

NOTE 2 For information on airborne contaminants that could present health risks, and on the levels of these permitted in industrial environments, see HSE Guidance Note EH40, Workplace Exposure Limits.

NOTE 3 For information on LEV see HSE Guidance Book HSG258, Controlling airborne contaminants at work [N2].

NOTE 4 For information on LEV see the CLEAPPS document L 225 Local exhaust ventilation in design and technology.

NOTE 5 The COSHH Regulations 2002 (as amended) require ventilation systems to be thoroughly examined at least every 14 months to ensure efficient operation to their original specifications.

The system of examination used should comply with the requirements of HSG258, *Controlling airborne contaminants at work* [N2]. Records of maintenance should be kept for at least five years, and any health surveillance records for individuals for 40 years.

NOTE 6 Additional ventilation or air conditioning might be required where computers are used.

6.3 Surfaces

6.3.1 Floors

Floors in areas where design and technology activities occur should be on one level. Floors should be provided with a non-slip surface and this should be maintained in good condition. Floors in heat treatment areas should be of fire-resistant material. Floors in food handling areas should be washable and should be washed at the end of every day on which food preparation has taken place.

Due to the risk of injury from needles or pins caught in the pile of a carpet, floors in textile areas should not be carpeted.

NOTE Further information is available on the HSE website.

6.3.2 Ceilings, walls and work surfaces

Ceilings, walls and work surfaces of work areas should be smooth, clean and able to provide a good level of reflected light, except for areas used for heat treatment processes, which should be provided with non-reflective surfaces. Walls adjacent to heat treatment areas should be free of flammable materials. Work surfaces in food handling areas should be smooth and easy to clean. Work surfaces should not be edged with wood or plastics lipping. Ceilings and walls should be suitable for regular cleaning. Separate, clearly coded cutting boards should be provided for working with different foods.

7 Services

7.1 General

Services (electricity, gas, water and compressed air, provided within the work area by pipes and ducts) should be colour coded as specified in BS 1710. Where risks cannot be controlled in other ways (e.g. verbal instructions, suitable guards), safety signs should be provided.

NOTE Attention is drawn to the Health and Safety (Safety Signs and Signals) Regulations 1996.

Fire exit and emergency escape route signs should be in accordance with BS 5499-4.

7.2 Electrical installations

7.2.1 General

New fixed installations and alterations should conform to BS 7671.

NOTE 1 Attention is drawn to the Electricity at Work Regulations 1989.

Sufficient socket outlets should be installed. Drop down ceiling mounted socket outlets should be considered to avoid the hazards caused by trailing leads. The power to socket outlets should be supplied through a non-time delayed residual current device with a rated residual operating current not exceeding 30 mA and an operating time not exceeding 40 ms at a residual current of five times the operating current as specified in BS 7288, BS EN 61008-1 or BS EN 61009-1.

NOTE 2 Attention is drawn to the Electricity at Work Regulations 1989 with regard to the maintenance of electrical systems and equipment.

Inspections and tests on fixed electrical installations and equipment should be carried out at least once every five years by a competent person in accordance with *Guidance Note 3: Inspection and Testing, 6th Edition* [N5], published by the Institution of Engineering and Technology.

NOTE 3 The frequency of inspections and tests of portable equipment depends on the design and use of the equipment (see HSE publication HSG107).

Electrical equipment should only be used in the intended environment.

Protective conductor current from the power supply circuits of computers should be taken into consideration when selecting residual current devices, to prevent unwanted tripping to circuits supplying computers. Where necessary, local residual current devices should be provided to reduce the risk of problems associated with information technology equipment in the event of loss of supply.

Special precautions should be taken in areas where equipment with high protective conductor current (e.g. information technology equipment, electronic office equipment, process control equipment) is used.

NOTE 4 For further information, see BS 7671.

If there is a risk of water and/or solids ingress (including use of equipment outdoors), the equipment should have an appropriate ingress protection (IP) rating.

NOTE 5 For details of specifications, and of tests to verify degrees of protection, refer to BS EN 60529.

All portable electrical equipment should be correctly fused.

7.2.2 Food areas

Electrical installations in food areas should conform to BS 7671. Socket outlets should be supplied via a non-time delayed residual current device with a maximum tripping current of 30 mA.

Where a risk assessment indicates the need, an overall main switch for food rooms should be installed. If there is an overall main switch, refrigerators, freezers and appliances with clocks and timers and computers should be supplied by separate circuits which are not under the control of the overall main switch. Electric cookers should have individual circuits at the correct rating to match the appliance. There should be a suitable electrical supply for gas cookers to supply ignition, clocks and timers.

All electrical equipment should be positioned away from sinks. Working areas and electrical sockets should be positioned so that electric cables do not cross cookers or other hot surfaces.

Warning signs should be displayed adjacent to types of hotplates that show no visible heat source when in operation.

Fixed appliances (e.g. cookers, washing machines and dryers) should be installed by a competent person. To reduce noise levels, washing machines and driers should not be installed in teaching areas.

The length of flexible cords of portable equipment should be as short as is reasonably practicable and they should be frequently inspected to ensure they are in good condition. All portable equipment should be unplugged if not in use, and before making adjustments or cleaning. Portable electrical equipment should be inspected regularly and tested periodically (usually every 12 months).

Electrical equipment should not be used with damp or wet hands.

Food technology equipment includes cookers, washing machines, dishwashers, etc., that have been installed via a permanent cable and these appliances should be fitted with an isolating switch that is clearly labelled and visible to identify the appliance supplied, so that the appliance can be isolated.

Appliances supplied via a plug and socket should have the plug clearly labelled to identify the appliance supplied, so that the appliance can be isolated.

7.2.3 Computer areas

The electrical supply to computer rooms should conform to BS 7671. Any servers should be supplied through an individual dedicated supply that cannot be switched off unintentionally. Sufficient socket outlets should be provided in the room to avoid use of adapters or extension leads to computers and peripheral equipment (printers, scanners, control boxes, monitors, etc.).

7.2.4 Main work area switchgear

The electrical supply to work areas should conform to BS 7671. In each workshop area it should be possible to disconnect and isolate all electrical circuits that supply fixed equipment and socket-outlets by a single switch conforming to BS EN 60669-2-4 or BS EN 60947-3. Switchgear should be clearly labelled to show the circuit or function controlled. The isolating switch should be readily accessible, clearly labelled "main switch", and lockable in the "off" position. The switching device should not control lighting, space heating equipment provided for health and safety such as extraction fans and specific socket outlet circuits for computers, refrigerators and freezers and cleaning purposes. Workshop areas without electrically operated fixed equipment and only a 230 V a.c. supply should be fitted with an isolating switch and an emergency switch-off system (see **7.2.5**) if there is rotating or other machinery (but not portable machinery) present.

7.2.5 Work area emergency switching systems

NOTE 1 Attention is drawn to the Provision and Use of Work Equipment Regulations 1998.

Emergency switching systems should be provided in each separate student work area and should only control one work area. Preparation areas for employees use only need not have any emergency switching system and should not be affected by the emergency system of any other area. The systems should switch off all circuits supplied via the isolating switch in an emergency. Critical circuits specifically installed to remove hazards (e.g. fume extractor fans, lighting, alarm circuits) should not be controlled by the emergency system.

The emergency switching device should be a remotely operated contactor or circuit breaker that opens when the coil is de-energized. The switching device should be controlled by a series of readily accessible non-latching push buttons evenly distributed around the work area, at an approximate height of 1.5 m, and clear of benches and machines. It should only be possible to reset the remotely operated contactor or circuit breaker by a single key-operated spring return switch sited within view of the work area it controls. A responsible person should retain the key.

NOTE 2 See also BS EN 60204-1, BS 7671 and BS EN ISO 13850.

Push buttons should be conspicuous and coloured red on a yellow mounting surface (see BS EN ISO 13850) and a safe condition sign conforming to BS EN ISO 7010 should be in place adjacent to each switch.

The emergency stop system installed in a workshop should not negate any other safety systems fitted to machines, e.g. braking systems on hand fed wood cutting machines.

The electrical supply should be turned off at the end of the working day.

7.2.6 Electrical equipment for fixed machine tools

NOTE 1 The Provision and Use of Work Equipment Regulations 1998 (PUWER) require that, where appropriate, stop, emergency stop and emergency isolation systems are to be installed for each item of work equipment.

Electrical equipment for fixed machine tools should conform to BS EN 60204-1.

Motor starters, switches and controls for fixed machine tools should conform to and be fitted in accordance with BS EN 60204-1 and BS 7671. They should be readily accessible to the operator from the normal operating position and should not require the operator to reach over any moving parts of the machine. Emergency stop switches (which could be the normal "off" switch) should be provided at all fixed machines, where a risk assessment shows that it is required, and easily actuated by the user. An emergency stop switch should only control the power to the machine to which it is fixed, and not to other machines in the work area.

Any fixed machine or item of electrical equipment should be supplied via a fused isolating switch conforming to BS EN 60947-3, or a connection unit conforming to BS 1363-4, or a circuit breaker conforming to BS EN 60898-1, or a residual current operated circuit-breaker (RCBO) conforming to BS EN 61009-1. The supply cables should be enclosed within suitable robust conduit or trunking or armoured cable.

Any controls or means of isolation not incorporated in the equipment should be not more than 2 m away from the equipment and positioned so that they can be operated safely while the equipment is in use. Each switching device should be clearly marked with its function and its associated machine/equipment.

Electric motors with a rating exceeding 0.37 kW should be provided with control equipment incorporating a means of protection against overcurrent in the motor.

NOTE 2 This recommendation does not apply to motors incorporated in current-using equipment conforming to a British Standard.

Means to prevent automatic restarting of an electric motor after certain types of stoppage (e.g. no-volt release starter) should be provided.

NOTE 3 This recommendation does not apply to automatic control devices that are set to start motors at some interval, and where other safety precautions are taken against unexpected restarting.

NOTE 4 The use of plastic conduit or trunking in workshop areas is not advised since it can be easily damaged.

7.2.7 Electrical supplies for motor vehicle workshops

Electrical installations within motor vehicle workshops should be installed and maintained by competent persons and should conform to BS 7671.

NOTE 1 Attention is drawn to the requirements of the Dangerous Substances and Explosive Atmospheres Regulations 2002 concerning installations within potentially explosive atmospheres and HSG261, Health and safety in motor vehicle repair and associated industries [N6].

Socket outlets should be supplied via non time delayed RCD with a residual current not exceeding 30 mA.

Where supplies are provided for portable power tools and equipment they should be supplied via CE marked industrial type sockets to BS EN 60309-2 at the appropriate voltage.

Extension leads should not be used.

Socket outlets should not be sited below 1 000 mm from floor level to reduce the risk of igniting spilt petrol or flammable liquids.

Where possible, hand lamps should be battery operated, rechargeable types. Alternatively, these should be supplied at reduced voltage such as 110 V centre tapped to earth or a separated extra low voltage (SELV) supply not exceeding 50 V a.c.

NOTE 2 See HSE publication PM38 for guidance on the selection and use of handlamps.

Fixed items of electrical equipment should be supplied via a fused electrical isolator.

Electrical installations within motor vehicle workshops should be tested and inspected at three year intervals in accordance with HSG261, *Health and safety in motor vehicle repair and associated industries* [N6], to ensure safety, and a written record kept of the inspection, reports and any repairs completed.

7.2.8 Electrical supplies for portable equipment

Cordless, battery-operated portable tools should be used wherever possible.

Mains-powered portable equipment (indoors or outdoors) should be supplied via a socket-outlet protected by a residual current device (see **7.2.1**). The effectiveness of these devices should be verified frequently, using the test button, in accordance with the manufacturer's instructions.

For construction related vocational courses, SELV supplies incorporating a 110 V centre tapped transformer should be used to minimize the risk of serious electric shock. Socket-outlets should conform to BS EN 60309-2 and should be colour coded yellow.

Socket-outlets of supplies with different voltages should not be compatible with outlets of other voltage systems.

For a standard nominal 230 V a.c. supply with neutral at, or approximately at, earth potential, the socket-outlets should conform to BS 1363-2. Equipment that requires installation in a particular location or that requires an industrial type plug, should be supplied by socket-outlets conforming to BS EN 60309-2, colour coded blue.

Sufficient socket outlets should be provided to avoid use of adapters or extension leads.

Equipment that requires an electrical supply greater than 16 A and/or 250 V should be directly connected to fixed wiring.

Socket-outlets for use by cleaning employees only should conform to BS 1363-2. These socket-outlets should be protected by a residual current device and should be sited adjacent to an entrance door if possible. If it is essential to locate socket-outlets for caretaking employees in work areas, they should be supplied from an independent circuit (also protected by a residual current device) labelled "Cleaning use only".

In new installations, surface mounted boxes for electrical accessories should not have multiple conduit knockouts. For socket-outlets or plugs, consideration should be given to fitting security screws that require a special tool for insertion and removal.

Socket-outlets with neon indicators should only be used to supply equipment for which an indication of an "on" condition is required (e.g. a refrigerator). Neon indicators should not be used to indicate that a socket-outlet is "off". Socket-outlets that supply voltages greater than extra-low voltage and up to 250 V (a.c. or d.c.) and that do not conform to BS 1363-2, BS 7288, BS EN 60309-2 or BS 546 (shuttered) should conform to BS 5733.

Socket-outlets that are intended to, or are likely to, supply power for outdoor use should be supplied via a residual current device not exceeding 30 mA.

7.3 Mains gas installations

All work on gas fittings should be carried out by someone on the Gas Safe Register who is qualified to work on the specific type of gas appliances.

NOTE IGEM/UP/11 covers gas installations for educational establishments. Gas Safety (Installation and Use) Regulations 1998 (as amended) apply to gas installations.

7.3.1 Main isolator

Emergency control valves should be situated:

a) as near as practicable to the point where the gas supply enters the building, either internally or externally;

b) in a readily accessible position;

c) so that the key or lever (handle) is parallel to the pipe when the valve is open and pulled down to close; and

d) with a test point fitted downstream of each valve.

The emergency control valve key or lever should be securely attached to the valve and should be clearly labelled.

7.3.2 Room isolation

Design and technology work areas with gas equipment should have a means of isolating the gas supply to the room. The means of isolation should be in a readily accessible position and should be clearly marked, but should not be readily accessible to learners. The means of isolation should be either a manual valve, or a fail-safe electrically operated solenoid valve that might form part of an emergency stop system within the room.

The gas supply should be turned off at the end of the working day.

7.3.3 Ventilation systems

NOTE 1 Guidance on ventilation systems and on the use of gas installations in educational establishments can be found in IGEM/UP/11 Gas Installations in Educational Establishments published by the Institution of Gas Engineers and Managers.

Purpose provided permanent ventilation should be fitted to provide sufficient fresh air for the purposes of combustion and climate control for all gas appliances used in educational establishments. There should be sufficient ventilation to prevent a build-up of carbon dioxide and carbon monoxide.

NOTE 2 For information on ventilation in conjunction with gas appliances that could present health risks, and on the levels permitted in workplace environments, see HSE Guidance Note EH40, Workplace Exposure Limits.

For all new installations, and for existing installations that are being refurbished or systems where any new gas fired appliances are installed, a means of monitoring the correct provision of air supplies should be provided if a mechanical system is used to provide air for combustion, or to extract the products of combustion. Such systems should be interlocked to the gas supply to ensure that the gas fired appliance is unable to be operated without the fans being operational.

For existing installations where such safety interlocks are not installed, a written robust safe system of work should be produced, which could include the use of suitable signage, to ensure that the gas fired appliances are not used until the supply air (where required) and extraction fans are operational.

NOTE 3 The air supply needed could be supplied by opening a window or door.

Gas safety interlocks should be provided to all existing installations. Gas fired appliances should not be operated without adequate supply air and extraction systems.

NOTE 4 Attention is drawn to the Gas Safety (Installation and use) Regulations 1998 (as amended) regarding interlocked ventilation systems.

NOTE 5 An existing system which is installed without the benefit of a gas safety interlock would only be classified as "Not to current standards" by someone on the Gas Safe Register if it can be shown that measures have been taken to prevent the use of the gas fired equipment without the extraction operational. Such measure could include the provision of suitable notices indicating that extraction systems are to be used. However, if evidence was found that the gas fired equipment was being used without the supply air or extraction systems operational, the engineer would classify the installation as "immediately dangerous" and would request permission to disconnect and make safe the installation.

7.4 Fixed installations using liquefied petroleum gas

All work on fixed installations using liquefied petroleum gas (LPG) should be carried out by someone registered on the Gas Safe Register.

LPG should be supplied by hard pipe from cylinders located outside the building in the open air. Cylinders should be securely fixed in an upright position with the valve uppermost. Manifold systems should incorporate a main shut-off valve and a regulator downstream (appropriately set), and a non-return valve downstream of these.

LPG fired appliances should be fitted with appropriate safeguards (e.g. flame failure devices, shut-off valves, pilot burners).

7.5 Water installations

Hot and cold water should be provided to each work area and sinks should be fitted with bottle traps. Soap and hand drying facilities should be provided in each work area.

Waste pipes should be able to withstand corrosion from weak acid solutions.

In food technology areas, sinks should be provided with hot and cold water and the cold water should be of drinking water quality. A safe drinking water sign conforming to BS EN ISO 7010 should be placed adjacent to the relevant tap.

7.6 Compressed air systems

NOTE 1 The Pressure Systems Safety Regulations 2000 apply to mobile and fixed compressed air systems.

Under the Pressure Systems Safety Regulations 2000, compressed air systems where the maximum operating pressure (in Bars) multiplied by the internal volume of the pressure vessel (in Litres) exceeds 250 litres should have a "written scheme of examination" drawn up by a competent person and the system should be thoroughly examined by a competent person in accordance with the scheme.

NOTE 2 Preparation of a written scheme of examination and performance of the examinations are normally contracted to insurance companies with specialist engineers.

Air receivers should conform to BS 5169. They should be tested hydraulically and a certificate obtained from the manufacturer or a competent authority (e.g. an insurance company) stating the safe working pressure (SWP) of the receiver and details of the hydraulic tests. The SWP should be clearly marked on the receiver. Air receivers should be fitted with a suitable pressure gauge and safety valve and an appliance for draining any condensate from the receiver. Air receivers should have an opening sufficiently sized to allow cleaning and thorough examination. If the receiver is designed so that the internal surface cannot be thoroughly examined, a suitable hydraulic test should be carried out instead. Water in the receiver should be drained at least once per week. Air receivers should be installed outside the work area if possible. If installed inside the work area, consideration should be given to the level of noise produced, and action taken as appropriate.

7.7 Machine installations

NOTE 1 The Provision and Use of Work Equipment Regulations 1998, Regulation 5, require that work equipment is suitable for the intended purpose and that it is located where risks to health and safety are minimized.

The location of work equipment should be chosen taking into consideration the location of other equipment, the purpose of the equipment, and the operating position.

NOTE 2 See also DfES Building Bulletin 81 (archived publication).

Machinery should be secured so that it cannot creep or be toppled. Floors should be level to prevent distortion of machines and should be checked for hidden services prior to drilling for fixings. Fixings for floors with surface finishes (wood block, tiles, vinyl sheeting, asphalt, etc.) should be long enough to penetrate the building structure or, where this is not possible, fixings appropriate to the particular surface finish should be used. Spring washers (or preferably lock nuts) should be used if the machine is liable to vibrate. Machines with a high centre of gravity should not be mounted on flexible mounts or glued felts. Glued felts and rubber composition pads should not be glued to a surface that is glued to the floor.

Benches that support machinery should be level, secure, sufficiently strong, and at an appropriate height for safe operation of the equipment. Machines should be fixed securely to the bench if required. Equipment that does not require fixing (e.g. food processors, sewing machines) should be fitted with rubber feet to prevent slipping on the work surface.

If provision is to be made for machines to be moveable to suit curriculum demands, they should be stable in use and correctly connected to the electrical supply. A risk assessment should be carried out before machines are moved and this should include manual handling hazards.

NOTE 3 New machinery and equipment supplied since 1995 requires a CE mark. This indicates that the machine has been designed and built in accordance with the essential safety requirements of the Supply of Machinery (Safety) Regulations 2008 (as amended) and the Supply of Machinery (Safety) (Amendment) Regulations 2011. These regulations are designed to provide a consistent and appropriate level of safety on new machinery. The regulations apply to the suppliers of equipment and are in addition to the duties of care that PUWER and MHSWR impose on users of equipment. CE regulations do not, in general, apply to used machinery, although PUWER does. However, purchasers need to be aware that a CE mark does not necessarily indicate that the equipment is suitable for the robust use typical of educational environments and it is recommended that they conduct their own risk assessment of proposed systems of work and hazards arising from the machine in the teaching environment.

7.8 Lifting equipment

NOTE 1 The Lifting Operations and Lifting Equipment Regulations (LOLER) 1998 applies to equipment and accessories used for lifting and lowering loads (e.g. vehicle hoists, lifting beams, pulley blocks, engine cranes, jacks, chains, slings, eyebolts).

The Lifting Operations and Lifting Equipment Regulations (LOLER) 1998 require the following.

a) That all lifting operations are planned, supervised and carried out safely by competent persons;

b) That lifting equipment is sufficiently strong, stable and suitable for purpose, and positioned or installed correctly to prevent risk of injury;

c) That the safe working load and other appropriate information be taken into account for its safe use is visibly marked on the equipment and accessories;

d) That a test certificate is provided by the equipment supplier;

e) That thorough examinations are carried out by a competent person at appropriate intervals (these are normally every 12 months for lifting machines such as hoists or cranes, and every six months for loose lifting equipment such as chains, slings, eyebolts, etc. Examinations are normally contracted to insurance companies with specialist engineers.)

In addition to thorough examinations, lifting equipment may be inspected at suitable intervals between thorough examinations.

Manufacturers of lifting equipment usually provide a guide on how often inspections should take place. Inspections should be regular (weekly, monthly or quarterly). Inspections, where required, should include visual and functional checks and they are normally carried out on machinery (e.g. hoists).

NOTE 2 Lifting accessories such as chains or slings will not normally require an inspection as long as they receive a thorough examination at the appropriate interval and a proper pre-use check.

Reports of examinations should be kept so that appropriate action can be taken as required.

Section 4: Teaching areas, equipment, tools and processes

8 General health and safety

Areas where tools and equipment are used have varying degrees of risk for all users and where design and technology activities are carried out, there should be clear health and safety guidance for using all teaching resources and for all environments.

NOTE In addition to BS 4163, Model Risk Assessments and an example model safety policy are available from CLEAPSS. For Scotland, refer to the equivalent document published by SSERC.

The guidance should include advice to teachers, technicians and learners on safe use of specific equipment and safe organization of the teaching environment. Employees should have at least a good understanding of equipment and processes, they should be confident in their use, and they should be fully aware of the risks involved and safety measures required to ensure safe working. Employees should be trained to the standards specified in the *Health and Safety Training Standards in Design and Technology* [N1], which recommends that refresher accreditation/training be undertaken at least every five years. All health and safety training should be recorded and updated as part of professional good practice.

Learners should be fully instructed in the use of equipment and processes before commencing the activity. Learners should be fully instructed in hazards associated with equipment and the precautions provided to counter these. The teaching environment should be appropriate for the task, it should be well maintained and the level of supervision should be appropriate for the level of risk. Close supervision should be provided with high-risk operations. The use of hand held power tools should be closely monitored, especially if powered by mains electricity. Tools and equipment should be well maintained, including regular sharpening of tools as appropriate.

A record of learners' competencies should be kept.

9 Management of the teaching environment

9.1 General

The number of learners in any one work area should be carefully considered to ensure safe working and effective supervision.

In England and Wales, there should be a maximum of 20 learners with one competent, qualified teacher in any one work area.

In Scotland and Northern Ireland, there should be a maximum of 20 pupils for all classes in practical subjects.

NOTE 1 In Scotland, The Schedule of Salaries and Conditions of Service for Teachers in School Education states that classes in practical subjects have no more than 20 pupils. This is based on the Schools (Scotland) Code 1956 Regulation 15(2).

NOTE 2 In Northern Ireland, the Department of Education – Northern Ireland provides guidance on class sizes in practical subjects for post-primary schools in Circular 2004/05 Class sizes in practical subjects in post-primary schools, which can be summarized as follows.

Under Regulation 15 of the Secondary School (Grant Conditions) Regulations (Northern Ireland) 1973:

a) a practical subject includes science, technology and design, home economics, art and design, physical education and music;

b) the maximum number of pupils under instruction by one teacher for a class in a practical subject is 20, except where approved by the Department.

The Department is prepared to approve class sizes in excess of 20 where:

a) a class of pupils is under instruction in a practical subject and are not involved in practical activities;

b) the activities are unlikely to present a risk to the health and safety of the pupils in the class; and

c) classrooms meet the required standards as set out in paragraph 6 of Circular 2004/05.

Risk assessments should be carried out to determine the appropriate number of learners in the work area. Any adaptations required should be clearly documented.

NOTE 3 Attention is drawn to the D&T Association publication Risk Assessment in Secondary School Design and Technology Teaching Environments.

The risk assessment should take the following factors into account.

a) The size and layout of the work area.

b) The size and number of items of furniture and equipment in the work area.

c) The type of activities carried out in the work area.

d) The age and ability of the learners.

e) The competence and experience of the teacher.

f) The extent of technician or other appropriate support.

g) Whether learners with special needs are present.

h) Whether there are learners whose first language is not English.

i) The behaviour of the learners.

NOTE 4 If the number of learners in a teaching area exceeds the number for which the room was planned, or creates unsafe working conditions, the employer may be held liable under the Health and Safety at Work etc. Act 1974 for failing to provide safe working conditions.

Teachers should ensure that, following a thorough risk assessment:

1) the teaching environment is suitable for the class size;

2) the class is orderly and properly managed;

3) basic rules of care and maintenance are followed;

4) safety checks and control measures are taught conscientiously and that learners benefit from a good example.

Learners should only work in a high-risk area when it is fully under the control of a person competent to work in the area (i.e. a person with demonstrated competency through the D&T Association training scheme) and, where appropriate, risk assessments have been carried out taking into account the learners' capabilities. For specific higher risk activities, training and assessment of individual learners is necessary and training records should be kept. Risk assessments should be carried out on the requirements of learners, in particular those with special needs, learning or behavioural difficulties, or those who do not have English as their first language.

NOTE 5 The risk assessment might indicate that closer supervision, use of physical aids, provision of instructions in a second language, modified group sizes and/or special teaching programmes are needed.

*NOTE 6 See **4.3** for details on how to carry out a risk assessment.*

If use of PPE is deemed necessary by a risk assessment, and under the Personal Protective Equipment at Work Regulations 1992, this should be advised by clear signs in the area.

NOTE 7 Attention is drawn to the Health and Safety (Safety Signs and Signals) Regulations 1996.

Spilt oil, water, food debris or chemicals should be cleaned away immediately. Accumulations of waste materials should be removed from floors each day. Floors should be kept free of obstacles and tripping hazards.

Duckboards should not be used.

9.2 Health and safety monitoring

Health and safety monitoring should be carried out regularly to ensure that:

a) emergency stop systems operate effectively;

b) room isolating gas taps or controls are clearly marked, accessible, and in working order;

c) only authorized competent persons use specialized equipment;

d) the power isolator is locked in the "off" position when the room is unsupervised;

e) equipment guards and protective interlocks are in place and properly adjusted;

f) health and safety notices are clearly displayed;

g) learners receive appropriate health and safety instruction (and a record of their training is kept) before equipment is operated or before heavy items are lifted or handled;

h) suitable protective clothing is worn and PPE provided, where risk of injury cannot be controlled by other means;

i) first aid kits are provided;

NOTE 1 Attention is drawn to the Health and Safety (First Aid) Regulations 1981 (see HSE Approved Code of Practice and Guidance L74).

j) floors, doors and gangways are kept clear and free from obstructions;

k) floor surfaces are not slippery;

l) fire doors are operational and clearly marked, can be easily opened, and are free from obstructions;

m) fire fighting equipment is readily available;

n) materials, tools and ancillary equipment are stored safely;

o) flammable materials are stored safely in a suitable lockable cupboard;

p) food products are stored at the correct temperature;

q) socket outlets, plugs and flexible cords are maintained in a safe condition, and are safely anchored by the cord grip;

r) fume and dust extraction systems are maintained in good working order;

NOTE 2 Attention is drawn to the COSHH Regulations 2002 (as amended) which require such systems to be thoroughly examined by a competent person at least once every 14 months and require records of test results to be kept.

s) gas hoses are maintained in a safe condition;

t) residual current devices are checked using the test button in accordance with the manufacturer's recommendations;

u) maintenance is carried out regularly and written records kept.

NOTE 3 The CLEAPSS document G 79 Auditing health and safety in a secondary school design and technology department and the D&T Association document Risk Assessment in Secondary Schools & Colleges Design & Technology Teaching Environments can be used as guides. For Scotland, refer to the equivalent document published by SSERC.

9.3 Electrical equipment

Inspections and tests on fixed electrical installations and equipment should be carried out at least once every five years by a competent person in accordance with *Guidance Note 3: Inspection and Testing, 6th Edition* [N5], published by the Institution of Engineering and Technology.

NOTE The frequency of inspections and tests of portable equipment depends on the design and use of the equipment (see HSE Guidance Book HSG107).

Electrical equipment should only be used in the intended environment.

Electrical equipment should not be used with damp or wet hands.

Only persons with sufficient technical knowledge and practical skills should fit plugs to ensure that the manufacturer's instructions are carried out.

Power operated equipment and tools should be isolated from the power source and locked in the "off" position in the following situations.

a) When left unattended for any period of time or at the end of the working day.

b) When the competent qualified person is not in the work area.

c) Before clearing out any blockage.

d) Before cleaning is carried out.

A responsible person should retain the key.

Power operated equipment and tools should be switched off in the following situations.

1) Before guards are adjusted or re-adjusted.

2) Before measuring or gauging is carried out.

3) Before tools are adjusted or changed.

4) Before coolant pipes are adjusted or re-adjusted.

5) Before removing chips or swarf.

Multi-purpose machines should not be used unless they are in accordance with the recommendations for the individual machines that they replace. Powered equipment and tools should only be used within the design working capacity and accessories outside the recommended range of sizes should not be used.

9.4 Plugs for portable equipment

Plugs for portable equipment should either conform to BS 1363-1 (i.e. should have sleeved pins) and should be fused either in accordance with the equipment manufacturer's instructions or in accordance with BS EN 60309-2, BS 546 (fused) or BS 5733.

Plugs and sockets used outdoors should be supplied via a residual current device in accordance with BS EN 60529 or BS EN 60309-2.

NOTE In hose/wash-down areas, a higher degree of protection might be required and the manufacturer's advice might be necessary.

Only persons with sufficient technical knowledge and practical skills should fit plugs and carry out portable appliance testing (PAT) to ensure that the manufacturer's instructions are carried out.

9.5 ICT workstations

Workstations used solely by learners should comply with the minimum standards laid down in the Health and Safety (Display Screen Equipment) Regulations 1992.

NOTE Information technology suites used by learners are not covered by the Health and Safety (Display Screen Equipment) Regulations 1992. However, general duties under the Health and Safety at Work etc. Act 1974 in relation to persons who are not employed do apply. Any workstation used by an employee is required to meet the "minimum requirements" of the Health and Safety (Display Screen Equipment) Regulations 1992. These are laid down in a schedule to the regulations. Where an employee is a "user", a full risk assessment is required.

Workstations should be capable of being adjusted to accommodate learners of various sizes.

9.6 Maintenance

NOTE 1 The Health and Safety at Work etc. Act 1974, Section 2, requires that employers ensure equipment is safe and that risks to health and safety are minimized. The Provision and Use of Work Equipment Regulations 1998 (Regulation 9) require that work equipment is maintained in efficient working order.

A competent person should carry out regular formal inspections and tests (if appropriate) to identify any faults that require repairs. All portable electrical equipment should be visually examined before use to ensure that cables are not damaged or plugs loose and wires should not be exposed.

A competent person should carry out repairs and maintenance of machines. All repairs to gas equipment should be carried out by someone registered on the Gas Safe Register.

A regular maintenance programme should be put into operation and a maintenance log should be kept.

The frequency of formal inspections and tests should be chosen depending on the design, use and location of the equipment.

NOTE 2 A formal annual inspection by a suitably competent or qualified person, who may be an outside contractor, is advisable but more frequent in-house monitoring of the safety of machines and equipment is required. The frequency of such in-house checking will depend on the frequency of use of the machines and equipment.

Hand tools should be regularly visually inspected to check the condition and, if appropriate, the sharpness.

10 Food

10.1 General

Floors in food handling areas should be washable and should be washed at the end of every day on which food preparation has taken place.

Separate, clearly coded cutting boards should be provided for working with different foods.

10.1.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electrical appliances and equipment, which can present a hazard of electric shock.

b) Hot surfaces and liquids, which can cause burns and scalds.

c) Trailing cables and obstructions, which can present a tripping hazard.

d) Spillage, which can cause slips and falls.

e) Gas, which can cause an explosion.

f) Insufficient ventilation.

g) Contact with cutters or blades, which can cause cuts.

h) Broken cutters and blades from cutting operations, which can be violently ejected if incorrectly fitted.

i) Inadvertent operation of appliances and equipment.

j) Appliances and equipment which can present a noise hazard (see **4.9**).

k) Batteries.

10.1.2 Risk control measures

Appliances and equipment should be robust and single-purpose. Appliances and equipment should only be used for the design purpose in accordance with the manufacturer's recommendations. Equipment should conform to the appropriate standard.

Learners should be made aware of hazards associated with appliances and equipment and precautions that should be taken during use. Learners should be assessed as competent before using the equipment, a record of their training should be kept and they should be supervised at all times by a trained, competent person. PPE should be provided where appropriate.

Long hair and loose clothing should be secured and jewellery should be removed.

Ear and/or eye protection should be provided if required by the risk assessment.

Portable appliances and equipment should be kept in suitably locked storage when not in use. Detachable tools and cutters should be removed and stored separately.

NOTE The frequency of inspections and tests of portable equipment depends on the design and use of the equipment (see HSE publication HSG107).

Gas appliances should be turned off after use. The main gas valve covering the room should be turned off at the end of the working day.

Warning signs should be displayed adjacent to types of hotplates that show no visible heat source when in operation.

The length of flexible cords of portable equipment should be as short as is reasonably practicable and they should be frequently inspected to ensure they are in good condition. All portable equipment should be unplugged if not in use, and before making adjustments or cleaning. Portable electrical equipment should be inspected regularly and tested periodically (usually every 12 months).

Electrical equipment should not be used with damp or wet hands.

Portable appliances, equipment and supply leads should be visually examined before use.

A competent person should carry out inspections and tests (as appropriate) at least every 12 months, and records should be kept.

PPE should be provided where appropriate.

10.1.3 Portable electrical appliances and equipment

Battery powered portable electrical appliances should be used if possible. Batteries should be charged, fitted and disposed of in accordance with the manufacturer's instructions.

Portable electrical appliances should be single-purpose and robust. Portable electrical appliances should conform to the relevant part of BS EN 60335. A residual current device should protect mains sockets (see **7.2.1**).

Portable electrical appliances and equipment should be fitted with the correct plug to match the socket outlet and correctly fused. Adapters should not be used. The length of supply leads should be kept to a minimum to avoid tripping or accidental disconnection.

Portable electrical appliances should be included in a maintenance programme in accordance with the manufacturer's recommendations.

NOTE The frequency of inspections and tests of portable equipment depends on the design and use of the equipment (see HSE publication HSG107).

10.1.4 Fixed electrical appliances

Refrigerators, freezers, washing machines, tumble dryers, and dishwashing machines should be installed by a competent person. Plugs and leads should be regularly inspected.

Socket outlets supplying appliances pushed under a work surface (e.g. dishwashers, tumble dryers and fridges) should be accessible when the appliance is pulled out and should preferably be controlled by an accessible switch.

Appliances built into furniture (integrated appliances) should be connected to a socket outlet or fused connection unit that is readily accessible when the appliance is in place and in normal use, or supplied from a socket outlet or other connecting device controlled by a readily accessible double pole switch or switched fused connection unit.

Fixed electrical appliances such as these should be included in a maintenance programme in accordance with the manufacturer's recommendations and subject to portable appliance testing.

NOTE The frequency of inspections and tests of portable equipment depends on the design and use of the equipment (see HSE publication HSG107).

Fixed electrical appliances such as cookers should be used in accordance with the manufacturer's instructions. A risk assessment should be carried out taking into account the users of the equipment. All fixed electrical appliances should be permanently wired into the electrical installation of the room by a competent person.

10.2 Food – appliances and equipment

10.2.1 Domestic oven and hob: gas, electric, dual fuel

10.2.1.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Hot surfaces, which can cause burns.

c) Steam from food being cooked, which can cause scalding.

d) Gas leaks.

10.2.1.2 Risk control measures

Electric ovens and hobs should be correctly installed with an appropriately fused isolating switch.

An appropriate risk assessment should be carried out prior to using the oven and hob. Suitable PPE should be provided (e.g. oven gloves).

The equipment installed should be of a type where the external casing temperatures do not cause burns if touched.

To prevent scalding, care should be taken when opening the oven.

The oven and hob should be kept clean and free from a build-up of debris that could cause contamination or a fire.

Learners should be warned that hob surfaces, particularly those on ceramic hobs, remain hot for long periods after being switched off.

The installation and maintenance of fixed gas appliances should be carried out by someone registered on the Gas Safe Register.

A chain should be fitted so that cookers cannot be pulled out of position to a point where the flexible gas connection is strained. Appliances should be regularly inspected and records kept.

Fixed gas appliances should be used in accordance with the manufacturer's instructions. A risk assessment should be undertaken covering the use of the appliance if it is considered that a significant risk is possible in its use in relation to those likely to use the equipment.

The oven and hob should be included in a planned maintenance programme that should include formal visual inspections and, where appropriate, tests should be carried out by a competent person at suitable frequencies to identify any faults that require rectification to reduce risk.

NOTE The frequency of these inspections and tests will depend on the design of the equipment and the type of use.

One inspection every 12 months is recommended but experience might indicate this should be done more frequently or, in some cases, less frequently. Records of inspection should be kept.

10.2.2 Commercial cooker

10.2.2.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Hot surfaces, which can cause burns.

c) Cooking and combustion fumes.

d) Steam and radiated heat, which can scald and burn.

10.2.2.2 Risk control measures

Instruction should be given on correct use of the commercial cooker.

Commercial cookers should be correctly installed, with an appropriately fused isolating switch if the appliance's rating requires one, and an appropriately fitted gas connection, which might require an interlock with a ventilation extraction system, if fitted.

An appropriate risk assessment should be carried out prior to using the commercial cooker and suitable PPE should be provided (e.g. oven gloves).

The cooker should be kept clean and free from a build-up of debris that could cause a fire.

The cooker should be included in a planned maintenance programme that should include formal visual inspections and, where appropriate, tests should be carried out by a competent person at suitable frequencies to identify any faults that require rectification to reduce risks.

NOTE The frequency of these inspections and tests will depend on the design of the equipment and the type of use.

One inspection every 12 months is recommended but experience might indicate this should be done more frequently or, in some cases, less frequently.

10.2.3 Tunnel ovens

10.2.3.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Hot surfaces, which can cause burns.

c) Exposed moving parts, in which hair, hands or clothing can become entangled.

10.2.3.2 Risk control measures

Instruction should be given on correct use of the tunnel oven. Tunnel ovens should be correctly installed with an appropriately fused isolating switch.

An appropriate risk assessment should be carried out prior to using the oven and suitable PPE should be provided (e.g. oven gloves).

The oven and conveyor should be kept clean and free from a build-up of debris that could cause a fire.

Long hair and loose clothing should be secured so as not to come into contact with moving parts. Jewellery should be removed.

The tunnel oven should be included in a planned maintenance programme that should include formal visual inspections and, where appropriate, tests should be carried out by a competent person at suitable frequencies to identify any faults that require rectification to reduce risk.

NOTE The frequency of these inspections and tests will depend on the design of the equipment and the type of use.

One inspection every 12 months is recommended but experience might indicate this should be done more frequently or, in some cases, less frequently. Records of inspection should be kept.

10.2.4 Microwave and microwave combination ovens

10.2.4.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Leads, which could be tripped over.

c) Hot substances and hot surfaces, which can cause scalding and burns.

d) Overheating of the oven mechanism, which can be caused by incorrect use of materials.

e) Microwave radiation.

10.2.4.2 Risk control measures

Instruction should be given on correct use of the microwave or microwave combination oven.

Microwave ovens should be sited on a stable surface at a safe height to allow ease of access.

Trailing leads should be kept clear of work surfaces and persons using the oven.

Oven gloves should be used when handling hot food and containers.

Ingredients and materials should be suitable for heating in the oven.

Door seals and the oven casing should be regularly inspected.

10.2.5 Commercial blast chiller

10.2.5.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Bacterial growth.

c) Cold burns.

10.2.5.2 Risk control measures

Instruction should be given on correct use of the blast chiller.

Blast chillers should be correctly installed with an appropriately fused isolating switch if hard wired or using an isolating plug and, if the appliance's rating requires one, with a ventilation extraction system.

The blast chiller should have a cleaning schedule in order to ensure that the chiller is kept clean internally.

There should be a monitoring procedure in place to check the operating temperature. An appropriate risk assessment should be carried out prior to using the blast chiller and suitable PPE provided to prevent cold burns (e.g. gloves).

The blast chiller should be included in a planned maintenance programme that should include formal visual inspections and, where appropriate, tests that should be carried out by a competent person at suitable frequencies to identify any faults that require maintenance to reduce the risk of incorrect operation.

NOTE The frequency of these inspections and tests will depend on the design of the equipment and the type of use.

One inspection every 12 months is recommended but experience might indicate this should be done more frequently or, in some cases, less frequently.

10.2.6 Portable food processing machines and liquidizers

10.2.6.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Leads, which could be tripped over.

c) Rotating parts.

d) Sharp cutters.

e) Hot ingredients, which can cause scalding or burns.

10.2.6.2 Risk control measures

Learners should be assessed as competent before using portable food processing machines or liquidizers. Instruction should be given on correct use of the food processing machine or liquidizer.

Portable food processing machines and liquidizers should be situated where distractions to the user can be minimized and positioned away from hot surfaces.

Trailing leads should not become entangled with the operator or others in the vicinity of the food processing machine or liquidizer.

The machine should be checked to ensure that safety interlocks function correctly. The plug should be removed from the power socket before the machine is taken apart for any reason.

Long hair and loose clothing should be tied or secured well away from rotating parts. The food processing machine or liquidizer should be checked to ensure it is correctly assembled before use.

10.2.7 Portable food mixing machines

10.2.7.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Leads, which could be tripped over.

c) Rotating parts.

d) Sharp blades.

10.2.7.2 Risk control measures

Learners should be assessed as competent before using portable food mixing machines or liquidizers. Instruction should be given on correct use of the food mixing machine.

Portable food mixing machines should be situated where distractions to the user can be minimized and positioned away from hot surfaces.

Trailing leads should not become entangled with the operator or others in the vicinity of the food mixing machine.

The machine should be checked to ensure that any safety interlocks function correctly. The plug should be removed from the power socket before the machine is taken apart for any reason.

Long hair and loose clothing should be tied or secured well away from rotating parts. The food mixing machine should be checked to make sure it is correctly assembled before use. Food mixing machines should be used as fixed units if practicable.

Additional instruction should be given on use of "hand-held" mixing machines (e.g. electric whisks).

10.2.8 Portable hand blending machines

10.2.8.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Leads, which could be tripped over.

c) Rotating parts.

d) Sharp blades.

10.2.8.2 Risk control measures

Instruction should be given on correct use of the hand blending machine.

The blender should be kept within a bowl or container whilst it is running or slowing down. The machine should not be turned on while the blender is outside of a container. Learners should be assessed as competent before using hand blending machines.

Hand blending machines should be used only where distractions to the user can be minimized.

Trailing leads should not become entangled with the operator or others in the vicinity of the machine itself.

The machine should be checked to ensure that any safety interlocks function correctly. The plug should be removed from the power socket before the machine is washed or taken apart for any reason.

The hand blending machine should be checked to make sure that it is correctly assembled before use.

Long hair and loose clothing should be tied or secured well away from rotating parts.

10.2.9 Deep fat fryers and other table top cooking appliances

10.2.9.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Leads, which could be tripped over.

c) Hot substances, surfaces and equipment, which can cause scalding or burns.

d) A fire hazard from the hot fat or oil in deep fat fryers.

e) Overheating, which can be caused by other table top cooking appliances.

f) Environmental hazards, which can be caused by incorrect disposal of fat or oil.

10.2.9.2 Risk control measures

Instruction should be given on correct use of the deep fat fryer or other table top cooking appliances.

Trailing leads should be kept clear of work surfaces and persons using the fryer or cooker.

Ingredients and materials should be suitable for heating in the deep fat fryer or other table top cooking appliances.

Hot surfaces should be kept clear and turned off when not required.

Excess moisture should be removed from ingredients before deep frying.

Oven gloves or cloths should be used when handling hot food.

Fats and oils should be changed regularly.

NOTE Attention is drawn to local authority procedures for disposal.

10.2.10 Pressure cookers

10.2.10.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Hot substances and surfaces, which can cause scalding or burns.

b) The high temperatures at which pressure cookers operate.

c) High pressures, which can cause a pressure cooker to explode.

10.2.10.2 Risk control measures

Instruction should be given on correct use of pressure cookers.

Ingredients and materials should be suitable for heating in the type of pressure cooker used. There should be sufficient water in the pressure cooker.

Oven gloves should be used when handling hot food.

NOTE 1 Pressure cookers are covered by the Pressure Systems Safety Regulations 2000.

A scheme of examination should be prepared and carried out for pressure cookers.

NOTE 2 CLEAPSS has produced a model scheme of examination for pressure cookers that conforms to the Pressure Systems Safety Regulations 2000. Under the scheme, examinations can be carried out by a competent employee at the school or similar establishment. For Scotland, refer to the equivalent document published by SSERC.

10.2.11 LPG fuelled portable blowtorches

NOTE Gas safety in catering and hospitality. Catering information sheet number 23 (revision 2).

Blowtorches are powered by butane gas and should be refillable.

10.2.11.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Hot substances and surfaces, which can cause burns.

b) High temperatures at which blowtorches operate.

c) Risk of explosion if placed on hot surface.

d) Fuel contamination of food.

10.2.11.2 Risk control measures

An approved proprietary design should be used.

Instruction should be given on the correct use of the blowtorch. Loose hair and clothing should be secured before use. Appropriate protective equipment should be worn by the operator.

The blowtorch should be inspected to make sure there are no leaks.

NOTE Listen for and smell to check for leaking propane gas.

The flame should not be touched. The gas should be switched off before leaving the blowtorch.

Flammable material should not be near the area of use. Food should be placed on a metal tray before blowtorching. The blowtorch should not be placed on hot surfaces.

Stored gas canisters should be stored correctly or fuel should be refilled correctly.

The blowtorch should be started facing away from the food and the blowtorch should be lit before putting it near the food otherwise raw fuel might be deposited on the food during lighting.

11 Textiles

11.1 General

11.1.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electrical appliances and equipment, which can present a hazard of electric shock.

b) Hot surfaces, liquids and steam, which can cause burns and scalds.

c) Trailing cables and obstructions, which can present a tripping hazard.

d) Spillage, which can cause slips and falls.

e) Contact with cutters or blades, which can cause cuts.

f) Broken cutters and blades from cutting operations, which can be violently ejected if incorrectly fitted.

g) Sharps, e.g. machine needles or pins, which can cause puncture injuries.

h) Inadvertent operation of appliances and equipment, which can present a hazard.

i) Appliances and equipment, which can present a noise hazard (see **4.9**).

j) Batteries.

k) Chemicals, e.g. dyes and mordants, which can cause irritation and/or allergic reaction.

11.1.2 Risk control measures

Appliances and equipment should be robust and single purpose. Appliances and equipment should only be used for the design purpose in accordance with the manufacturer's recommendations. Equipment should conform to the appropriate standard.

Learners should be made aware of hazards associated with appliances and equipment and precautions that should be taken during use. Learners should be assessed as competent before using the equipment, a record of their training should be kept and they should be supervised at all times by a trained, competent person.

PPE should be provided where appropriate and ear and/or eye protection should be provided if required by the risk assessment.

Long hair and loose clothing should be secured and jewellery should be removed.

Portable appliances and equipment should be kept in suitably locked storage when not in use. Detachable tools and cutters should be removed and stored separately.

Portable appliances, equipment and supply leads should be visually examined before use.

A competent person should carry out inspections and tests (as appropriate) at least every 12 months, and records should be kept.

11.1.3 Portable electrical appliances and equipment

Battery powered portable electrical appliances should be used if possible. Batteries should be charged, fitted and disposed of in accordance with the manufacturer's instructions.

Portable electrical appliances should be single purpose and robust. Portable electrical appliances should conform to the relevant part of BS EN 60335. A residual current device should protect mains sockets (see **7.2.1**).

Portable electrical appliances and equipment should be fitted with the correct plug to match the socket outlet and correctly fused. Adapters should not be used. The length of supply leads should be kept to a minimum to avoid tripping or accidental disconnection.

Portable electrical appliances should be included in a maintenance programme in accordance with the manufacturer's recommendations.

NOTE The frequency of inspections and tests of portable equipment depends on the design and use of the equipment (see HSE publication HSG107).

11.1.4 Fixed electrical appliances

Washing machines and dryers should be installed by a competent person. Plugs and leads should be regularly inspected.

Socket outlets supplying appliances pushed under a work surface, e.g. washing machines and dryers, should be accessible when the appliance is pulled out and should preferably be controlled by an accessible switch.

Appliances built into furniture (integrated appliances) should be connected to a socket outlet or fused connection unit that is readily accessible when the appliance is in place and in normal use, or supplied from a socket outlet or other connecting device controlled by a readily accessible double pole switch or switched fused connection unit.

Fixed electrical appliances such as these should be included in a maintenance programme in accordance with the manufacturer's recommendations and subject to portable appliance testing.

11.2 Textiles – appliances and equipment

11.2.1 Batik wax pots

11.2.1.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Leads, which can be tripped over.

c) Hot liquids and surfaces, which can cause scalding or burns.

d) Overheating of the wax pot, which can be caused by incorrect use.

e) Fumes from wax pots.

11.2.1.2 Risk control measures

Batik work should be carried out only where distractions to the user can be minimized.

Trailing leads should not become entangled with the operator, others in the vicinity or the wax pot. Supply leads for wax pots should be heat resisting.

Materials should be suitable for heating in the type of heater used.

Gloves should be worn when handling hot wax.

Instruction should be given on correct use of wax pots.

Adequate and appropriate ventilation should be provided where required.

11.2.2 Portable electric irons (including heat presses and steamers)

11.2.2.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Leads, which can be tripped over.

c) The hot surface of the iron, and steam.

d) Crush or trapping hazards.

e) Falling equipment.

11.2.2.2 Risk control measures

Ironing should be carried out only where distractions to the user can be minimized.

Trailing leads should not become entangled with the operator, others in the vicinity or the hot iron. Supply leads for irons should be heat resisting.

Irons, ironing boards and heat presses should be stored and used where they are not likely to fall.

Instruction should be given on correct use of irons and heat presses.

11.2.3 Portable sewing/overlocking/embroidery/embellisher machines

11.2.3.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Leads, which could be tripped over.

c) Rotating and reciprocating parts.

d) Exposed sharp edges and needles.

e) Unexpected starting, in the case of computer numerically controlled (CNC) machines.

f) Moving/lifting machines.

11.2.3.2 Risk control measures

Sewing/overlocking/embroidery/embellisher machines should be situated only where distractions to the user can be minimized.

Trailing leads should not become entangled with the operator, others in the vicinity or the sewing machine.

Sewing machines should be connected to a switched socket outlet. The use of extension leads and multi-way distributions boards should not be permitted.

Learners should be assessed as competent before using portable sewing/overlocking/embroidery/embellisher machines.

Long hair and loose clothing should be tied or secured well away from rotating parts.

Sewing machines should be located on tables or fixed benching that is of an appropriate height for the age of the users, and where the foot control can be used safety.

NOTE Special arrangements might be required for users with physical disabilities, or those who use wheelchairs.

Instruction should be given on correct use of sewing/overlocking/embroidery/embellisher machines.

A risk assessment should be undertaken governing the manual handling of the equipment.

Machines should be included in a planned maintenance programme that should include electrical safety tests.

11.2.4 Electric rotary cutters

WARNING. Learners should only use electric rotary cutters when they have been assessed and the assessment has shown that they are competent, and they are under the direct supervision of specifically trained employees.

11.2.4.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock and trailing leads.

b) Rotating parts.

c) Exposed sharp edges.

d) Replacing used blades.

e) Generation of fabric particles/loose threads.

11.2.4.2 Risk control measures

Instructions should be given to ensure that users do not touch the rotating parts of the cutter. The cutter should have the correct guards fitted.

Rotary cutters should be used where distractions can be minimized.

Trailing leads should not become entangled with the operator, others in the vicinity or the rotary cutter.

Rotary cutters should be connected to a switched socket outlet.

Long hair and loose clothing should be tied or secured well away from rotating parts.

The rotary cutter safety catch should be used and the blade retracted after each use.

Blades should be replaced according to manufacturer's instructions and disposed of safely.

Eye protection should be worn.

12 Portable tools and equipment used in workshops

12.1 General

12.1.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Cutters, blades, abrasive wheels and sanding discs, contact with which can cause injuries.

c) Broken cutters, blades and abrasive wheels, and particles from cutting operations, which can be violently ejected.

d) Trailing cables and compressed air lines, which could be tripped over.

e) Contact with the open end of a compressed air line, which can force air through the skin into the bloodstream.

f) Unrestrained compressed air lines, which can lash about with force.

g) Inadvertent operation of portable tools.

h) Dust, which can be inhaled.

i) Noise and vibration.

j) Batteries, which can spontaneously combust or explode if incorrectly used.

k) Start-up torque.

12.1.2 Risk control measures

Portable tools should be single-purpose and robust.

Portable tools should only be used for the design purpose in accordance with the manufacturer's recommendations. Tools should conform to the appropriate standard.

Learners should be made aware of hazards associated with portable tools and precautions that should be taken during use. Before using the equipment, learners should be trained and assessed as competent, and a record of their competence should be kept. Learners should be physically capable of using portable tools, and supervised at all times by a trained, competent person. Care should be taken when removing or changing blades or cutters.

Portable tools should be immobilized when changing cutters, blades, etc.

If the machine has moving parts or is likely to produce hazardous material, long hair and loose clothing should be secured. Jewellery should be removed. Gloves should not be worn unless they are suitable for the task. PPE should be used including suitable eye protection, conforming to BS EN 166:2002 1B.

A risk assessment should be carried out to evaluate the likely risks to health from inhalation of wood dust. Where an effective LEV system is not in place, a dust mask conforming to BS EN 149:2001+A1:2009 class FFP3 should be used.

NOTE 1 For further information on RPE, see HSG53 RPE at Work and Wood dust: Selecting suitable respiratory protective equipment, Woodworking Sheet No 14 (Revision 2).

A risk assessment on noise levels should be carried out. Ear protectors conforming to BS EN 352-1 should be provided if required.

A risk assessment on vibration levels should be carried out and appropriate control measures should be put in place (see **4.10**).

Portable tools should be securely and appropriately stored when not in use. Portable tools and supply leads or hoses should be visually examined before use. A competent person should carry out inspections and tests (as appropriate) at least every 12 months and records of inspections and test results should be kept.

12.1.3 Risk control measures specific to portable compressed air tools and equipment

WARNING. Care should be taken when using compressed air guns, as air accidentally forced into the bloodstream can be life threatening. Care should be taken to avoid projecting debris into the eyes. Suitable eye protection should be used. Non-users of compressed air guns should not be allowed near the equipment.

Compressed air powered tools should be operated at the manufacturer's recommended pressure. A regulator and pressure gauge should be fitted between the equipment and the permanent supply.

The length of the air hose should be kept to a minimum. The air hose should be able to withstand the safe working pressure. Compressed air hose fittings should automatically cut off the air supply when disconnected. Fittings should be regularly checked to ensure they are securely attached to the hose.

Tools and equipment with an air piston should have a lubricator on the tool side of the regulator.

Compressed air lines with guns (jets) fitted should have a non-ferrous venturi-type nozzle.

Connections on flexible compressed air lines should be checked regularly. Compressed air equipment should not be used for cleaning down purposes or for removal of dust from brakes or machines unless specifically designed for this purpose.

12.1.4 Risk control measures specific to portable electric tools and equipment

Portable electric tools should be single-purpose and robust. Portable electric tools should conform to BS 2769-1. Attachments should not be used. Only double insulated mains fed portable electric tools should be used. A residual current device should protect mains sockets (see **7.2.1**).

Portable electric tools should be fitted with the correct plug to match the socket outlet and it should be correctly fused. Adapters should not be used. The length of supply leads should be kept to a minimum to avoid tripping or accidental disconnection.

Battery powered portable electric tools should be used in preference to mains powered tools. Batteries should be charged, fitted and disposed of in accordance with the manufacturer's instructions.

A written record should be kept of learners' training.

12.2 Portable drills

12.2.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Long hair, loose clothing, etc., which can become entangled in moving parts of the drill.

b) Chuck keys, broken drill bits, swarf, work pieces, etc., which can be violently ejected.

c) Sharp edges on drill bits, work pieces and swarf, which can cause cuts.

d) Leads and hoses, which could be tripped over.

e) Electric shock.

f) Batteries.

g) Drill jamming, which can produce a torque reaction.

h) Dust, which can be inhaled.

i) Ejected particles which might enter the eyes.

j) HAVS.

k) Insecure workpiece.

12.2.2 Risk control measures

Long hair and loose clothing should be tied up or otherwise secured away from rotating drill parts.

Instruction should be given to ensure that users do not touch rotating parts of the drill. Drill bits should be fixed securely into the chuck. Where provided, chuck keys should only be used to tighten and loosen the chuck, and otherwise kept safely away from the drill.

Training should be given on deburring sharp edges on drilled materials.

Trailing leads and hoses should not become entangled with the operator or others in the vicinity or the drill.

NOTE 1 The risk of electric shock is reduced by good maintenance, the use of double insulated machines or battery powered machines.

Batteries should be charged, fitted and disposed of in accordance with the manufacturer's instructions.

It should be ascertained whether the operator has sufficient strength to withstand the turning moment of the drill if the drill bit becomes jammed.

NOTE 2 HAVS will normally only occur if the hammer action of a portable drill is used.

Eye protection should be worn and a face mask should be worn where a risk assessment shows that it is required.

A risk assessment of the likelihood of harm should be carried out and appropriate control measures used.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

Any workpiece should be securely held.

12.3 Portable grinding machines (e.g. angle grinding machines)

WARNING. Learners should only use portable grinding machines when they have been assessed and the assessment has shown that they are competent, and they are under the appropriate supervision of specifically trained employees.

12.3.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Overspeeding, damaged or incorrectly mounted abrasive wheels or cutting discs, which can disintegrate while rotating and can be violently ejected from the grinding machine.

b) Contact with the wheel or disc, or with sharp edges, which can cause cuts.

c) Leads and hoses, which could be tripped over.

d) Electric shock.

e) Batteries.

f) Long hair, loose clothing, etc., which can become entangled with the spindle or wheel.

g) Ejection of work pieces or sparks from the machine.

h) Hot work pieces, which can cause burns.

i) Sharp edges, which can cause cuts.

j) Inadvertent starting of the machine.

k) Dust, which can be inhaled.

l) Incorrect disc.

12.3.2 Risk control measures

The grinding or cutting disc should be inspected for damage prior to each use and changed accordingly. The disc should be securely fitted to the machine.

Instruction should be given to ensure that users do not touch rotating parts of the grinding machine. A suitable guard should be fitted which will enclose the disc or wheel as far as is practicable.

Users should be warned of the risk of harm from sharp edges.

Trailing leads and hoses should not become entangled with the operator or others in the vicinity or the machine.

Batteries should be charged, fitted and disposed of in accordance with the manufacturer's instructions.

Long hair and loose clothing should be tied or secured away from rotating parts.

Suitable eye protection should be used. Non-users of the grinding machine and objects that could be damaged by ejected material or sparks should be kept well away from the grinding machine.

Work that has been ground should be handled with care. Users should be warned that the work piece might become hot.

A risk assessment on dust inhalation should be carried out and LEV provided if required. RPE should also be worn if appropriate.

The composition of the disc should suit the material of the work piece being ground. The grinding or cutting disc should have a safe working speed that exceeds the machine speed.

*NOTE 1 For recommendations on the use of abrasive wheels see **14.5**.*

Grinding machines should be used in accordance with the recommendations of HSG17, *Safety in the Use of Abrasive Wheels* [N7], and in accordance with the manufacturer's instructions.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

NOTE 2 The risk of electric shock is reduced by good maintenance, the use of double insulated machines or battery powered machines.

12.4 Rotating (circular) portable saws

WARNING. Learners should only use rotating (circular) portable saws when they have been assessed and the assessment has shown that they are competent, and they are under the direct supervision of specifically trained employees.

12.4.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Rotating parts, which can cause cuts and with which long hair, loose clothing, etc., can become entangled.

b) Leads and hoses, which could be tripped over.

c) Electric shock.

d) Batteries.

e) Dust, which can be inhaled.

f) Ejected particles.

g) Jamming or "kick back" of the saw.

12.4.2 Risk control measures

Instruction should be given to ensure that users do not touch the rotating parts of the saw. The saw should have the correct guard fitted. Rotating portable saws should not be used if the operator could be distracted. Non-users of the saw, and objects that could be damaged by ejected material, should be kept well away from the saw. Long hair and loose clothing should be tied or otherwise secured away from rotating parts.

Trailing leads and hoses should not become entangled with the operator or others in the vicinity or the machine.

NOTE The risk of electric shock is reduced by good maintenance, the use of double insulated machines or battery powered machines.

Batteries should be charged, fitted and disposed of in accordance with the manufacturer's instructions.

A risk assessment on dust inhalation should be carried out and LEV provided if practicable. RPE should also be worn if appropriate.

The peripheral speed of the saw blade should match the speed of the machine. The blade should be securely fitted to the machine. The blade should be inspected for damage prior to each use. Damaged blades should not be used.

Learners should be assessed as competent before using rotating portable saws. Rotating portable saws should only be used under the direct supervision of a competent person specifically trained in the use of the saw. Rotating portable saws should not be used if the operator could be distracted. Non-users of the saw, and objects that could be damaged by ejected material, should be kept well away from the saw. The user should be strong enough to withstand any "kick back" that could occur.

A portable circular saw should not be turned over and used as a circular saw bench.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

12.5 Portable biscuit jointer/tenon jointers

WARNING. Learners should only use these machines when they have been assessed and the assessment has shown that they are competent, and they are under the appropriate supervision of specifically trained employees.

12.5.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Leads and hoses, which could be tripped over.

c) Rotating parts which can cause cuts and with which long hair, loose clothing, etc., can become entangled.

d) Dust, which can be inhaled.

e) Ejected particles.

f) Jamming or "kick back" of the biscuit jointer/tenon jointer.

g) Insecure workpiece.

12.5.2 Risk control measures

A risk assessment on dust inhalation should be carried out and LEV provided if practicable. RPE should also be worn if appropriate.

Trailing leads and hoses should not become entangled with the operator, others in the vicinity or the portable biscuit jointer/tenon jointer.

The peripheral speed of the biscuit jointer saw blade should match the speed of the machine. Mortising bits used with tenon jointers should be rated for at least the speed recommended on the tool.

The saw blade/mortising bit should be securely fitted to the biscuit jointer/tenon jointer. The saw blade/mortising bit should be inspected for damage prior to each use. Damaged saw blades and bits should not be used.

Learners should be assessed as competent before using portable biscuit jointers/tenon jointers, which should only be used under supervision from a competent person specifically trained in the use of the equipment.

Long hair and loose clothing should be tied or otherwise secured away from rotating parts. Suitable eye protection should be worn.

Instruction should be given to ensure that users do not touch the rotating parts of the biscuit jointer/tenon jointer.

The tools should have the correct guards and fences fitted.

Portable biscuit jointers/tenon jointers should not be used if the operator could be distracted.

Non-users of the tools, and objects that could be damaged by ejected material, should be kept well away.

The user should be sufficiently strong to withstand any "kick back" that could occur.

Any workpiece should be securely held.

12.6 Reciprocating portable saws for wood, metal or plastics

WARNING. Learners should only use reciprocating portable saws when they have been assessed and the assessment has shown that they are competent, and they are under the appropriate supervision of specifically trained employees.

12.6.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Reciprocating and other moving parts, including sharp blades, which can cause cuts and with which long hair, loose clothing, etc., can become entangled.

b) Leads and hoses, which could be tripped over.

c) Electric shock.

d) Batteries.

e) Dust, which can be inhaled.

f) Ejected particles.

g) Jamming or "kick back" of the saw.

h) HAVS.

12.6.2 Risk control measures

Instruction should be given to ensure that users do not touch the moving parts of the saw. The saw should have the correct guard fitted. Long hair and loose clothing should be tied or otherwise secured away from moving parts. The blade should be removed from the machine when it is not in use.

Trailing leads and hoses should not become entangled with the operator or others in the vicinity or the machine.

NOTE The risk of electric shock is reduced by good maintenance, the use of double insulated machines or battery powered machines.

Batteries should be charged, fitted and disposed of in accordance with the manufacturer's instructions.

A risk assessment on dust inhalation should be carried out and LEV provided if practicable. RPE should also be worn if appropriate.

The blade should be securely fitted to the machine and should only be used on materials specified by the manufacturer. The blade should be inspected for damage prior to each use. Damaged blades should not be used.

Reciprocating portable saws should not be used if the operator could be distracted. Non-users of the saw, and objects that could be damaged by ejected material should be kept well away from the saw. The user should be sufficiently strong to withstand any "kick back" that could occur.

A risk assessment of the likelihood of harm should be carried out and appropriate control measures used.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

12.7 Multi-tool (saws, carvers, scrapers, etc.)

WARNING. Learners should only use the multi-tool when they have been assessed and the assessment has shown that they are competent, and they are under the appropriate supervision of specifically trained employees.

12.7.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Leads and hoses, which could be tripped over.

c) Oscillating parts.

d) Dust, which can be inhaled.

e) Ejected particles.

i) Jamming or "kick back" of the tools.

j) HAVS.

12.7.2 Risk control measures

The lead should be visually checked before use.

Trailing leads and hoses should not become entangled with the operator, or others in the vicinity or the multi-tool.

The blade or other tool should be securely fitted to the machine and should only be used on materials specified by the manufacturer. The blade or other tool should be inspected for damage prior to each use. Damaged blades or tools should not be used. Hands should be kept clear of the oscillating tools.

A risk assessment on dust inhalation should be carried out and LEV provided if practicable. RPE should also be worn if appropriate.

Suitable eye protection should be worn.

Instruction should be given to ensure that users do not touch the moving parts of the multi-tool. Oscillating portable multi-tools should not be used if the operator could be distracted. Non-users of the multi-tool should be kept well away. The user should be sufficiently strong to withstand any "kick back" that could occur.

A safe workplace exposure time limit should be established by risk assessment.

Learners should be assessed as competent before using portable multi-tools. Multi-tools should only be used under supervision from a competent person specifically trained in its use.

Long hair and loose clothing should be tied or otherwise secured away from moving parts.

12.8 Portable sanding machines (orbital)

12.8.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Moving parts, into which long hair, loose clothing, etc., can become entangled.

b) Leads and hoses, which could be tripped over.

c) Electric shock.

d) Batteries.

e) Dust, which can be inhaled.

f) Noise, which can be excessive with this type of machine.

g) HAVS.

12.8.2 Risk control measures

Long hair and loose clothing should be tied or otherwise secured away from moving parts. Instruction should be given to ensure that users do not touch moving parts of the portable sanding machine and that the abrasive medium is firmly attached to the machine.

Trailing leads and hoses should not become entangled with the operator, others in the vicinity or the sanding machine.

NOTE 1 The risk of electric shock is reduced by good maintenance, the use of double insulated machines or battery powered machines.

Batteries should be charged, fitted and disposed of in accordance with the manufacturer's instructions.

A risk assessment on dust inhalation should be carried out and LEV provided if required. RPE should also also be worn if appropriate.

NOTE 2 Other workers nearby might also need to wear respiratory equipment

An assessment of the noise produced by the machine should be carried out. Ear protectors, conforming to BS EN 352-1 should be worn if the level of noise exceeds the specified action value.

NOTE 3 Other workers nearby might also need to wear ear protectors.

A risk assessment of the likelihood of harm from HAVS should be carried out and appropriate control measures used.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

12.9 Portable sanding machines (disc)

12.9.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Moving parts, into which long hair, loose clothing, etc., can become entangled.

b) Leads and hoses, which could be tripped over.

c) Electric shock.

d) Batteries.

e) Jamming of the sanding disc.

f) Dust, which can be inhaled.

12.9.2 Risk control measures

Long hair and loose clothing should be tied or otherwise secured away from moving parts. Instruction should be given to ensure that users do not touch moving parts of the portable sanding machine and that the abrasive medium is firmly attached to the machine.

Trailing leads and hoses should not become entangled with the operator, others in the vicinity or the sanding machine.

NOTE The risk of electric shock is reduced by good maintenance, the use of double insulated machines or battery powered machines.

Batteries should be charged, fitted and disposed of in accordance with the manufacturer's instructions.

The operator should have sufficient strength to withstand the turning moment of the sanding disc if the disc becomes jammed.

A risk assessment on dust inhalation should be carried out and LEV provided if required. RPE should also be worn if appropriate.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

12.10 Portable sanding machines (belt)/power file

12.10.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Moving parts, into which long hair, loose clothing, etc., can become entangled.

b) Leads and hoses, which could be tripped over.

c) Electric shock.

d) Batteries.

e) The pulling force that can be exerted by the belt of the machine.

f) Jamming of the sanding belt.

g) Dust, which can be inhaled.

12.10.2 Risk control measures

Long hair and loose clothing should be tied or otherwise secured away from moving parts.

Instruction should be given to ensure that users do not touch moving parts of the portable sanding machine and that the abrasive medium is firmly attached to the machine. The belt should be fitted so that the arrow on the back matches the direction of rotation of the machine. The tracking of the belt should be adjusted correctly.

Trailing leads and hoses should not become entangled with the operator, others in the vicinity or the sanding machine.

NOTE The risk of electric shock is reduced by good maintenance, the use of double insulated machines or battery powered machines.

Batteries should be charged, fitted and disposed of in accordance with the manufacturer's instructions.

The operator should have sufficient strength to withstand the pulling motion of the sanding belt if the belt becomes jammed.

A risk assessment on dust inhalation should be carried out and LEV provided if required. RPE should also be worn if appropriate.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

12.11 Portable planing machines

WARNING. Learners should only use portable planing machines when they have been assessed and the assessment has shown that they are competent, and they are under the appropriate supervision of specifically trained employees.

12.11.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Moving parts, into which long hair, loose clothing, etc., can become entangled.

b) Leads and hoses, which can be tripped over.

c) Electric shock.

d) Batteries.

e) Dust, which can be inhaled.

f) Jamming or "kick back" of the machine.

g) Distraction of the user.

12.11.2 Risk control measures

Learners should be assessed as competent before using portable planing machines. Portable planing machines should only be used under supervision from a competent person specifically trained in the use of the machine.

Long hair and loose clothing should be tied or secured well away from rotating parts.

Instruction should be given to ensure that users do not touch rotating parts of the portable planing machine. The machine should have the correct guard fitted.

Trailing leads and hoses should not become entangled with the operator, others in the vicinity or the planer.

NOTE The risk of electric shock is reduced by good maintenance, the use of double insulated machines or battery powered machines.

Batteries should be charged, fitted and disposed of in accordance with the manufacturer's instructions.

A risk assessment on dust inhalation should be carried out and LEV provided if required. RPE should also be worn if appropriate.

The planer blades should be inspected for damage. Damaged blades should not be used. The blades should be securely fitted to the machine in accordance with the manufacturer's instructions.

Suitable eye protection should be worn.

Portable planing machines should not be used if the operator could be distracted. Non-users of the machine, and objects that could be damaged by ejected material, should be kept well away from the machine. The user should be sufficiently strong to withstand any "kick back" that could occur.

On no account should a portable planing machine be turned over and fitted to a bench for use as an overhand planer.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

12.12 Portable routers

WARNING. Learners should only use portable routers when they have been assessed and the assessment has shown that they are competent, and they are under the appropriate supervision of specifically trained employees.

12.12.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Moving parts, including sharp cutters, into which long hair, loose clothing, etc., can become entangled.

b) Leads and hoses, which could be tripped over.

c) Electric shock.

d) Dust, which could be inhaled.

e) Ejected particles.

f) Jamming, "kicking back" or biting in of the router cutter.

g) Distraction of the user.

h) Noise.

12.12.2 Risk control measures

Long hair and loose clothing should be tied or secured well away from rotating parts.

Instruction should be given to ensure that users do not touch the rotating parts of the tool. The tool should have the correct guard and/or fence fitted.

The peripheral speed of the router cutter should match the speed of the machine. The router cutter should be inspected for damage. A damaged cutter should not be used. The cutter should be securely fitted to the machine in accordance with the manufacturer's instructions and should be removed when the machine is not in use.

Trailing leads and hoses should not become entangled with the operator or the cutter.

NOTE 1 The risk of electric shock is reduced by good maintenance and the use of double insulated machines.

A risk assessment on dust inhalation should be carried out and LEV provided if required. RPE should also be worn if appropriate.

Instruction should be given to ensure that routing operations are undertaken well away from persons and objects that could be affected by material being ejected from the operation. The person using the machine should be sufficiently strong to withstand any kicking back or biting in that might take place when the router is in use.

Suitable eye protection should be worn when using a portable router.

A LEV unit should be used to control the dust hazard where the risk assessment of the operation indicates a significant risk. Those persons particularly susceptible to dust irritation, and all users if sustained routing is undertaken, should use an appropriate dust mask.

A portable routing machine may be turned over and fitted to a proprietary purpose-made table and designed for intensive use to act as a small spindle-moulding machine using one-piece cutters. In this mode of working, the portable router should only be used by an employee, who should be a competent person specifically trained in its use, or by learners assessed as competent under the direct supervision of a competent person specifically trained in the use of the machine. The cutter should be guarded at all times when in use.

A push button no-volt and overload starting switch should be in place. In this mode, the machine should be controlled by a starter incorporating overload protection and no volt release and a conveniently positioned, emergency stop switches (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency.

A push stick or push blocks, and anti-kickback devices should be used where the risk assessment shows that they are required.

Homemade router tables should not be used in any educational establishment.

A portable router should not be used when there is a likelihood of the operator being distracted when using the tool.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

When using the tool for longer than 15 mins, hearing protection should be used.

12.13 Soldering irons

12.13.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Leads, which can be tripped over.

c) Fumes from rosin based fluxes, which can cause respiratory sensitization.

d) Hot soldering iron tips, which can cause burns.

e) Splashes of flux and solder.

12.13.2 Risk control measures

Soldering irons (below 50 V a.c.) should be used where indicated necessary by the risk assessment.

Non-rosin based fluxes should be used where practicable. Where rosin based fluxes have to be used, a risk assessment on fume inhalation should be carried out and LEV provided as required. For most soldering operations, opening a window should be sufficient to control fumes.

Supply leads for soldering irons should be heat resisting. Trailing leads should not become entangled with the operator, others in the vicinity or the hot soldering iron.

Instruction should be given on correct use of the soldering iron.

Soldering should be carried out where distractions to the user can be minimized.

Suitable eye protection should be worn.

12.14 Hot melt glue guns

12.14.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Leads, which could be tripped over.

c) Hot glue nozzle tips, which can cause burns.

d) Splashes of glue, which can cause burns.

12.14.2 Risk control measures

Supply leads for glue guns should be heat resisting. Trailing leads should not become entangled with the operator, others in the vicinity or the hot glue nozzle.

Instruction should be given on correct use of the glue gun including warning learners of the hot surfaces of the gun and the risk of burns from the residual heat of any molten glue that comes into contact with the skin.

Suitable eye protection should be worn.

Where possible, low melting point glue guns should be used.

NOTE In certain situations where a higher temperature is required for satisfactory gluing, standard hot melt glue guns may be used.

Glue guns should be provided with an appropriate stand to ensure that hot glue that dribbles from the nozzle when the glue gun is switched on but not in use does not result in a glue build up on a surface under the gun that could easily be touched by learners.

12.15 Hand tools: storage and use

12.15.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Sharp tools.

b) Falling tools.

c) Tools breaking or coming apart in use.

d) Slipping of tools, which can occur when pressure is applied to them.

12.15.2 Risk control measures

Hand tools should be stored at a suitable height for access. Hand tools should not be left projecting from a bench.

Sharp edged tools, including craft knives, should be stored so that the sharp edges are protected.

NOTE It might be necessary to lock away such tools when not in use.

The faces of hammer heads and hammer shafts should be frequently inspected. Damaged heads and shafts should be discarded. The correct handle should be securely fixed on the tool. Wedges in hammer shafts should be kept tight.

"Mushrooming" on the struck ends of metalworking chisels should be removed regularly.

Edged tools should be kept sharp and in good condition.

Sawing boards (bench hooks) should be maintained in good condition.

Instruction should be given on correct use of hand tools.

Sharp or pointed tools should be handled with care (with cutting edges protected or pointing downwards).

Tools should not be carried in pockets or under belts.

The correct size of spanner should be used to fit nuts and bolts. Packing pieces should not be used.

13 Woodworking machinery

13.1 General

NOTE 1 The COSHH Regulations 2002 (as amended) require employers to prevent, or to adequately control, exposure by inhalation to wood dust. Dust from all types of wood, hardwood, softwood and composite materials such as medium density fibreboard (MDF) has been assigned a workplace exposure limit (WEL) of 5 mg·m^{-3}. This is a time weighted average over an eight hour period. For both hardwood and softwood dusts the COSHH Regulations require employers to ensure that exposure by inhalation is reduced as far as reasonably practicable and in any case to below the WEL.

As a general rule, woodworking machines in educational establishments should be single purpose machines rather than ones intended to perform more than one function. If a multi-purpose machine is used, then unused blades or cutters should be guarded at all times, even when not in use, and that only the cutter, blade or tool that is in use is rotating.

NOTE 2 A special risk assessment might be needed if such machines are used.

A risk assessment should be carried out on woodworking machinery to evaluate risks to health and any action required to prevent or control risks. This should involve consideration of the dust concentrations inhaled and the length of time exposed.

NOTE 3 This is particularly important where machining operations produce fine dust that remains airborne and is easily inhaled.

NOTE 4 Higher dust concentrations are produced from MDF than from hardwoods or softwoods.

Wood dust should be controlled by an effective local exhaust ventilation (LEV) system that captures and removes the dust at source before it can spread. The LEV should be properly designed, maintained and used correctly. LEV systems should be thoroughly examined at least every 14 months by a competent person and the results recorded and kept for a minimum of five years.

NOTE 5 Examinations are normally contracted to insurance companies or to LEV suppliers who employ specialist engineers.

In addition to thorough examinations, a weekly check should be done to verify that the basic operational features are functioning correctly.

NOTE 6 Most suppliers of LEV equipment supply a log book to enable daily or weekly checks to be recorded. The presence of dust or chips on or around a machine is an indication that the LEV system might not be functioning correctly. For further information on controlling wood dust, see Wood dust: Controlling the risks, Woodworking Sheet No 23 (Revision 1) and the COSHH Essentials information sheets.

Where an effective LEV system is not in place, a dust mask conforming to BS EN 149:2001+A1:2009 class FFP3 should be used. Class FFP3 should be used when emptying or cleaning LEV systems and maintaining machines.

NOTE 7 For further information on RPE, see HSG53 RPE at Work.

Training should be provided on correct use of respirators. Disposable filtering respirators should be replaced as appropriate in accordance with the manufacturer's instructions.

NOTE 8 Wood responds unevenly to internal stresses. This can result in unpredictable bending and breaking when working with the material.

NOTE 9 The Management of Health and Safety at Work Regulations 1999 and the Provision and Use of Work Equipment Regulations 1998 require employers to provide sufficient training so that persons are able to control risks. Training is required before new or increased risks are encountered. Training is to be repeated if required to maintain competence. The Approved Code of Practice and Guidance on Safe Use of Woodworking Machinery (L114) issued by the HSE under the PUWER 1998 provides more detailed information on training.

The school or similar establishment should decide which machinery is suitable for use by each group of learners. The decision should be based on student maturity and competence, the level of supervision, and local authority/employer and national guidelines. In general:

a) learners should be trained and instructed in safe operating methods by a competent person, who has attended a recognized training course;

b) learners should be assessed as mature and competent before operating the machinery, and should be continuously supervised.

Where young persons (persons under 18 years of age) are employed or participating in a work experience scheme, employers should assess the risks to which young persons are exposed and implement measures to protect their health and safety (see **4.1**). Young persons should not use high-risk woodworking machinery unless they have been assessed as mature and competent and have received sufficient training, and a record of their training has been kept. Training in the use of high-risk woodworking machinery should only be provided under proper supervision.

NOTE 10 "High-risk woodworking machinery" includes any hand-fed woodworking machinery, any sawing machine fitted with a circular blade or saw band, and planing machines when used for surfacing.

Electrical hazards from woodworking machinery should be minimized by ensuring that electrical equipment conforms to BS EN 60204-1 unless otherwise stated (see **7.2.6**).

Employees should be competent and properly trained to the standards specified in the D&T Association publication *Health and Safety Training Standards in Design and Technology* [N1] or hold other recognized qualifications to industry standards.

The following general safety measures should be applied when working with woodworking machinery.

1) Guards and fences should be securely fitted and correctly set. They should be appropriate for the machine and the activity.
2) Tooling should be of the correct type, size, sharpness, and direction of cut, and securely fastened. Only limited cutter projection tooling should be fitted to hand-fed machines.

   NOTE 11 For further information, see PUWER 98: Selection of tooling for use with hand-fed woodworking machines, Woodworking Sheet No 37.
3) Woodwork machinery should be used at the correct speed.
4) Precautions should be taken to prevent loose clothing becoming entangled in moving parts of machines. Jewellery should be removed.
5) Suitable PPE, including eye protection, should be worn where the risk assessment shows it is required.
6) Ventilation/extraction equipment should be properly adjusted and checked that it is working.

*NOTE 12 For CNC machining centres see **19.4**.*

13.2 Mortising machines (hollow chisel type)

NOTE Chain mortisers are not suitable for school use.

13.2.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Work pieces in the mortising machine, which can become loose and can be ejected.
b) Hands or clothing, which can become entangled with the cutting tool.
c) Inadvertent starting of the machine.
d) Wood dust, which can be inhaled.

13.2.2 Risk control measures

Mortising machines should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) fixed guards (removable only with the use of a tool), or alternatively interlocked guards that enclose the drive mechanisms.

A risk assessment should be carried out to evaluate the risks to health from inhalation of wood dust and any action required to prevent or control the risks.

The timber work piece should be securely clamped.

The key for locking the bit in the chuck should be removed before starting the machine and after the work is completed.

The machine should be included in a planned maintenance programme that should include electrical safety tests.

13.3 Moulding machines (spindle moulders)

Moulding machines should not be used in schools and sixth form colleges.

*NOTE The nature of the built-up cutter and the difficulty of guarding the machine adequately for short non-production runs is too high a risk for schools, except as in **12.12**. Colleges of further education might wish to undertake their own risk assessments to enable these machines to be used.*

13.4 Planing and thicknessing machines

*NOTE 1 Planing and thicknessing machines are "high-risk woodworking machinery" (see **13.1**).*

NOTE 2 The HSE Approved Code of Practice and Guidance on the Safe Use of Woodworking Machinery (L114) issued under the PUWER 1998, requires that existing planing and thicknessing machines have a braking device providing a run down time of less than 10 s. For further information see Safe use of hand-fed planing machines, Woodworking Information Sheet No 17.

WARNING. Learners in schools and sixth form colleges should not use planing and thicknessing machines.

13.4.1 Hazards

Operators should be aware of the following hazards.

a) The work piece in planing and thicknessing machines, which can be "kicked back" towards the operator.

b) Hands or clothing, which can become entangled with the cutter block.

c) Inadvertent starting of the machine.

d) The blade running on after the machine is switched off.

e) Noise, which can cause permanent hearing damage.

f) Wood dust, which can be inhaled.

13.4.2 Risk control measures

Planing and thicknessing machines should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) fixed guards (removable only with the use of a tool), or alternatively interlocked guards that enclose the drive mechanisms.

The upper part of the machine, including the infeed and outfeed rollers, should be guarded to prevent accidental access to the cutter block and feed rollers. An anti-kickback device should be fitted over the whole working width of the machine. The width of the anti-kickback fingers should be between 3 mm and 8 mm for machines with a useful working width less than 260 mm and between 8 mm and 15 mm for machines with a useful working width 260 mm and above.

NOTE 1 The risk of ejection of thin work pieces when they come into contact with the cutters can be reduced by using sectional feed rollers. Feed roller sections are not to exceed 50 mm in width.

It should be possible to lock the machine "off" when not in use.

Planing and thicknessing machines together with their LEV system can produce noise levels of about 100 db(A) so a competent person should carry out an assessment of the daily personal exposures. Ear protectors should be used if the machines are used for more than a few minutes.

*NOTE 2 Any person exposed to this level of noise for more than a few minutes each day needs to be protected by actions at the first or the second action value specified in the Control of Noise at Work Regulations 2005 (see **4.9**).*

A risk assessment should be carried out to evaluate the likely risks to health from inhalation of wood dust and any action required to prevent or control the risks (see **13.1**).

Only competent and trained persons should use planing and thicknessing machines. Users should be trained in accordance with the *Health and Safety Training Standards in Design and Technology* [N1], or hold other recognized qualifications to industry standards.

Planing and thicknessing machines should not be used if the user could be distracted.

The blade of the machines should come to rest within 10s of the machine being turned off.

The radial cutting edge of the knife/knives should not project from the block more than the minimum stipulated by the manufacturer or supplier. For machines purchased since 1995 the maximum cutter projection should be no more than 1.1 mm.

Knives should be the correct length, secure and set using the manufacturer's settings and setting jig where possible.

NOTE 3 Some recent machines are fitted with double-sided disposable planer blades which have a fixed setting position.

A "push stick" should be used to push short work pieces into the machine.

For surface planing, an adjustable bridge guard with the following characteristics should be provided.

1) The bridge guard should be lockable in any position without using a tool.

2) The height of the bridge guard should be adjustable from 0 mm to 75 mm above the outfeed table (height adjustment should be continuous, not in steps).

3) The width of the bridge guard should be 100 mm for cutter blocks up to and including 350 mm, and 120 mm for cutter blocks over 350 mm.

4) The edge of the bridge guard should be set as close as possible from the upper surface of the work piece on the infeed table side, and no more than 3 mm away on the outfeed side.

For thicknessing, a guard that does not impede discharge of the waste should be fitted to prevent access to the cutter block.

The planing and thicknessing machine should be included in a planned maintenance programme that should include electrical safety tests.

13.5 Sanding machines (belt, bobbin and disc types)

*NOTE Sanding machines are "high-risk woodworking machinery" (see **13.1**).*

13.5.1 Belt sander/band facer and bobbin sanding machines

13.5.1.1 Hazards

Employees and learners should be made aware of the following hazards.

a) The work piece, which can become jammed in the sanding machine.

b) Hands or clothing, which can become entangled with moving parts.

c) Wood dust, which can be inhaled.

d) Inadvertent starting of the machine.

e) The belt, which can break up and lash out.

f) Hands and fingers, which can come into contact with the abrasive surface.

13.5.1.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) fixed guards (removable only with the use of a tool) or, alternatively, interlocked guards that enclose the drive mechanisms.

The belt should be narrower than the belt support plate and pulleys, to protect the user from the belt edges. Belts should be set in the correct direction of rotation.

The sanding table should be of rigid metal construction. The gap between the table and the belt should be as small as is practicable but sufficient to clear the debris. For angled sanding, it should only be possible to tilt the table downwards away from the belt, to avoid jamming timber between the table and the belt.

On horizontal sanding machines, the fence should be correctly set close to the abrasive surface. The tracking should be checked by rotating first by hand.

On bobbin sanding machines, there should be as small a gap as possible between the table insert and the bobbin.

Consideration should be given to marking a "no finger zone" on the table of the machine.

A risk assessment should be carried out to evaluate the likely risks to health from inhalation of wood dust and any action required to prevent or control the risks (see **13.1**). Where an effective LEV system is not in place, a dust mask conforming to BS EN 149:2001+A1:2009 class FFP3 should be used.

Suitable eye protection should be used if deemed appropriate by the risk assessment. Long hair and loose clothing should be secured so as not to come into contact with moving parts. Jewellery should be removed. Gloves should not be worn.

Abrasive belts and bobbins should be examined before use. Torn belts and bobbins should be discarded.

Adjustable guarding should be provided for the abrasive belt so that only the minimum required for the sanding operation is exposed.

The machine should be included in a planned maintenance programme that should include electrical safety tests.

13.5.2 Disc sanding machines

13.5.2.1 Hazards

Employees and learners should be made aware of the following hazards.

a) The work piece, which can become jammed in the sanding machine.

b) Hands or clothing, which can become entangled with the sanding disc, or caught between the disc and work piece support.

c) Wood dust, which can be inhaled.

d) Inadvertent starting of the machine.

e) The sanding disc, which can break up during use.

f) Inadvertent contact with the disc while slowing down.

13.5.2.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) fixed guards (removable only with the use of a tool) or, alternatively, interlocked guards that enclose the drive mechanisms;

d) a fixed guard should be provided which only allows the down-running quadrant of the sanding disc to be exposed;

e) where the risk assessment shows that it is required, the down-running quadrant could have additional guarding fitted to reduce the risk of harm.

The sanding table should be of rigid metal construction.

The gap between the table and the disc should be as small as is practicable but sufficient to clear the debris. Small pieces of timber should not be disc sanded. The teacher or responsible person should check the setting of the machine before use.

Consideration should be given to marking a "no finger zone" on the table of the machine.

A risk assessment should be carried out to evaluate the likely risks to health from inhalation of wood dust and any action required to prevent or control the risks (see **13.1**). Where an effective LEV system is not in place, a dust mask conforming to BS EN 149:2001+A1:2009 class FFP3 should be used.

Suitable eye protection should be used if deemed appropriate by the risk assessment. Long hair should be protected from entanglement.

A risk assessment should be undertaken to ensure that a user cannot inadvertently touch the moving disc whilst it is slowing down.

The machine should be included in a planned maintenance programme that should include electrical safety tests.

13.6 Sawing machines (band, circular and reciprocating saws)

NOTE 1 All sawing machines are now required to have a number of enhanced safety features such as a braked motor.

NOTE 2 The HSE Approved Code of Practice and Guidance on the Safe Use of Woodworking Machinery (L114) issued under the PUWER 1998, requires that existing sawing machines include a braking device providing a run down time of less than 10 s.

13.6.1 Band sawing machines

*NOTE Band sawing machines are "high-risk woodworking machinery" (see **13.1**).*

WARNING. Learners should only use band saws when they have been assessed and the assessment has shown that they are competent, and they are under the direct supervision of specifically trained employees.

13.6.1.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Work pieces, which can become jammed in band sawing machines.

b) Bench mounted band saws, which can become detached from the bench.

c) Hands or fingers, which can come into contact with the blade.

d) Clothing, which can become entangled with the blade.

e) Wood dust, which can be inhaled.

f) Noise, which can cause permanent hearing damage.

g) Inadvertent starting of the machine.

h) The blade running on after the machine is switched off.

i) Withdrawing the work piece with the machine running.

j) Blunt or damaged blades.

13.6.1.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency.

It should be possible to lock to "off" whenever the machine is not in use, if a key actuated locking device is not incorporated in the machine itself.

Band saws should be checked to ensure they are secure. Bench mounted models should be effectively fixed to the bench.

The pulley wheels and blade (except for the down-running part through the machine table) should be completely enclosed by the frame of the machine and/or fixed guards (removable only with the use of a tool), or alternatively interlocked guards. A guard that can be adjusted to suit the height of the work piece should protect the part of the blade not used for cutting. The guard should be connected to, and moved with, the upper blade guide.

Learners should only be trained to use band sawing machines by a competent and trained person. A record of their training should be kept.

NOTE 1 The trained person is defined as someone who has been trained in accordance with the Health and Safety Training Standards in Design and Technology [N1], or who holds other recognized qualifications to industry standards.

A risk assessment should be carried out to evaluate the likely risks to health from inhalation of wood dust, and any action required to prevent or control the risks (see **13.1**). Where an effective LEV system is not in place, a dust mask conforming to BS EN 149:2001+A1:2009 class FFP3 should be used.

Suitable eye protection should be used if deemed appropriate by the risk assessment. Long hair should be protected from entanglement.

Saw blades should be of the correct pattern, sharp and distortion-free.

NOTE 2 Blunt or distorted blades can break if used.

Saw blades should conform to BS 4411. Saw blades should have the full number of teeth, as missing teeth can cause timber to "kick back". The saw blade should be checked for correct tension and tracking before use. If a machine is fitted with a brake, it should be used with care.

The top and bottom guides, if not aligned properly, can cause damage to the blade so the top guide should be adjusted to the lowest possible position and the part of the blade above it properly guarded. The top guide/guard should not be more than 12 mm above the top surface of the material being cut.

NOTE 3 The use of a lower sub fence might be appropriate.

The guide blocks and table should be maintained in good condition.

Users should be informed to keep their fingers clear of the saw line and they should not make adjustments to the machine set-up until it stops.

NOTE 4 A suitable push stick, workpiece support and/or jig would be required. For further information on machine operation see Narrow band saws: Safe working practices, Woodworking Sheet No 31 (Revision 1).

The blade of the machines should come to rest within 10s of the machine being turned off.

Care should be taken when withdrawing the work piece while the machine is in operation (e.g. after making a long curving cut, when friction between the blade and the work piece can pull the blade off the guides and pulley). Care should be taken not to make a curving cut with too small a radius in relation to the blade width and tooth size.

Bench mounted band sawing machines should be checked to ensure they are securely fixed to the bench before use.

The machine should be included in a planned maintenance programme that should include electrical safety tests.

13.6.2 Table circular sawing machines

*NOTE Circular sawing machines are "high-risk woodworking machinery" (see **13.1**).*

WARNING. Learners in schools and sixth form colleges should not use circular sawing machines. Learner use should be restricted to those in further education who are following a recognized training course in wood machining, and learners in teacher training establishments who are being trained in the safe use of workshop machines.

13.6.2.1 Hazards

Operators should be aware of the following hazards.

a) The work piece, which can become jammed in the circular sawing machine or can "kick back".

b) Hands or fingers, which can come into contact with the blade.

c) Wood dust, which can be inhaled.

d) Noise, which can cause permanent hearing damage.

e) Inadvertent starting of the machine, which can present a hazard.

f) The blade running on after the machine is switched off.

g) Blunt or damaged blades, which can present a hazard.

13.6.2.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) fixed guards (removable only with the use of a tool), or alternatively interlocked guards that enclose the drive mechanisms.

It should be possible to lock the machine to "off" when not in use, if a key actuated locking device is not incorporated in the machine.

There should be sufficient space around the saw bench so that the timber can be handled safely.

The floor of the work area should be level and the floor surface should be kept free from loose material and should be non-slippery.

Projecting ends of saw spindles should be guarded. The part of the blade below the machine table should be guarded by the main frame of the machine or, for open frame machines, by a fixed guard that requires a tool for removal.

The riving knife should be securely fixed below the surface of the table and should be set so that the gap between the knife and the saw blade at table level is the minimum practicable, and at any rate not exceeding 8 mm and not less than 3 mm. The riving knife should be thicker than the plate of the saw, but thinner than the saw kerf. The riving knife should extend upwards from the table surface to a point not more than 25 mm below the top of the saw blade, or to a minimum height of 225 mm if the diameter of the saw blade is 600 mm or greater.

The crown guard for the exposed part of the saw blade should be rigid and easily adjustable, but not easily deflected. The crown guard should extend from the top of the riving knife to a point above, and as close as practicable to, the work piece normally within 12 mm. The crown guard should extend down each side of the saw blade, and the adjustment should ensure that the roots of the teeth are covered at all times. The ripping fence, if used, should be accurately adjusted to not extend more than 50 mm beyond the tips of the saw teeth, in the direction of feed.

NOTE 1 When cutting narrow strips, the use of a sub fence (false fence) might be appropriate.

Circular saws should not be used for cutting a rebate or groove unless the blade is effectively guarded. If rebates or grooves are required, consideration should be given to an alternative method for undertaking these tasks.

For machines with a single working spindle speed, saw blades with a diameter below 60% of the largest diameter the machine is designed to use should not be used. For machines with more than one working spindle speed, saw blades with a diameter below 60% of the largest diameter the machine is designed to use at the fastest working speed should not be used. A notice specifying the smallest diameter saw blade that can be used on the machine should be clearly displayed on the machine.

Only a competent trained employee should use circular sawing machines.

NOTE 2 The trained person is to be trained in accordance with the Health and Safety Training Standards in Design and Technology [N1], or hold other recognized qualifications to industry standards.

A risk assessment should be carried out to evaluate the likely risks to health from inhalation of wood dust and any action required to prevent or control the risks (see **13.1**). Where an effective LEV system is not in place, a dust mask conforming to BS EN 149:2001+A1:2009 class FFP3 should be used.

Some table sawing machines are fitted with a cowling below the saw table that encloses the saw blade, and to which the dust extraction collection point is connected; this can become blocked and should be checked regularly to ensure that it is clear.

Circular sawing machines can produce noise levels about 100 dB(A) so a competent person should carry out an assessment of daily personal exposures.

*NOTE 3 Any person exposed to this level of noise for more than a few minutes each day has to be protected at the first or the second action value specified in the Control of Noise at Work Regulations 2005 (see **4.9**).*

Ear protectors conforming to BS EN 352-1 should be used if a noise risk assessment indicates that this is required.

Suitable eye protection should be used if deemed appropriate by the risk assessment. Long hair should be protected from entanglement.

Circular sawing machines should not be used if the user could be distracted.

A push stick (or correctly designed push block, if required) should be used for making any cut of less than 300 mm and for feeding the last 300 mm of longer cuts. The push strip should be long enough so that the hands are no closer than 300 mm to the saw blade.

Long lengths of timber should be properly supported during cutting. If an assistant helps in drawing off, a suitable extension table should be provided to a minimum distance of 1 200 mm between the up-running part of the saw blade and the further edge of the extension table.

Saw blades should be kept sharp and should be of the correct profile and properly set. Saw blades should conform to BS EN 847-1. Saw blades that have been subjected to overheating should be discarded. Saw blades should have the correct number of teeth, as an insufficient number can cause timber to "kick back". Tungsten carbide tipped saw blades should be inspected regularly for chipped teeth and small cracks between the tips and the body of the blade, and discarded or repaired as appropriate.

The machine should be included in a planned maintenance programme that should include electrical safety tests.

13.6.3 Powered fret sawing machines

13.6.3.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Hands or fingers, which can come into contact with the saw blade.

b) The powered fret sawing machine, which can become detached from the bench.

c) Wood dust, which can be inhaled.

d) Inadvertent starting of the machine.

13.6.3.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release; and

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency.

The saw should be securely fixed to the bench. Alternatively, if on a floor mounted stand, the stand should be securely fixed. The height of the machine should be set for comfortable working as appropriate.

A risk assessment should be carried out to evaluate the likely risks to health from inhalation of wood dust, and any action required to prevent or control the risks (see **13.1**). Where an effective LEV system is not in place, a dust mask conforming to BS EN 149:2001+A1:2009 class FFP3 should be used.

Suitable eye protection should be used if deemed appropriate by the risk assessment. Long hair should be protected from entanglement.

Blades should be sharp, and should be of the correct pattern and distortion-free.

NOTE Blunt or distorted blades can break in use.

Blades should be guarded at all times. The hold-down foot should be used at all times.

The machine should be included in a planned maintenance programme that should include electrical safety tests.

13.6.4 Chop and radial arm sawing machines

WARNING. Learners should only use chop and radial arm saws when they have been assessed and the assessment has shown that they are competent, and they are under the direct supervision of specifically trained employees. There should be sufficient space around the machine so that the timber can be handled safely. The floor of the work area should be level. The floor surface should be kept free from loose material and should be non-slippery.

13.6.4.1 Hazards

Employees should be made aware of the following hazards.

a) Hands or fingers, which can come into contact with the saw blade.

b) The saw blade, which can become loose.

c) The blade, which can move forward inadvertently.

d) Wood dust, which can be inhaled.

e) Inadvertent starting of the machine.

f) The blade of the machines should come to rest within 10s of the machine being turned off.

g) Blunt or damaged saw blades.

13.6.4.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) fixed guards (removable only with the use of a tool) that enclose the drive mechanisms.

It should be possible to lock the machine to "off" when not in use, if a locking device is not incorporated in the machine.

An appropriate means of stopping the machine in the event of an emergency should be provided, in a position readily accessible to the operator during use.

The saw should be securely fixed to the bench or the floor, as appropriate. The height of the machine should be set for comfortable working, as appropriate.

NOTE 1 Additional supports might be necessary when cutting long lengths of timber.

The machine should be fitted with a fixed guard to enclose the non-cutting part of the saw blade. There should be no access to the saw blade when the machine is in the rest position.

NOTE 2 Self-closing guards that rise and open on contact with the work piece can achieve this.

The machine should be equipped with an adjustable nose guard that should be adjustable within 12 mm of the table.

Machines should be fitted with a spring assisted return mechanism so that the saw unit returns to its safe rest position when it is released.

Care should be taken when removing short lengths of cut timber.

NOTE 3 A push stick might be required.

Ripping operation should not be carried out on a radial arm saw; a circular saw should be used for this.

A risk assessment should be carried out to evaluate the likely risks to health from inhalation of wood dust, and any action required to prevent or control the risks (see **13.1**). Where an effective LEV system is not in place, a dust mask conforming to BS EN 149:2001+A1:2009 class FFP3 should be used.

Suitable eye protection should be worn. Long hair should be protected from entanglement.

The machine should not be used if the user could be distracted. The blade of the machines should come to rest within 10s of the machine being turned off.

Blades should be sharp, and should be of the correct pattern and distortion-free.

NOTE 4 Blunt or distorted blades can break in use.

The machine should be included in a planned maintenance programme that should include electrical safety tests.

13.6.5 Vertical panel circular sawing machines

*NOTE All circular sawing machines are "high-risk woodworking machinery" (see **13.1**).*

WARNING. Learners in schools and sixth form colleges should not use vertical panel circular sawing machines. Student use should be restricted to learners in further education who are following a recognized training course in wood machining, and learners in teacher training establishments who are being trained in the safe use of workshop machines.
There should be sufficient space around the machine so that sheet materials can be handled safely. The floor of the work area should be level. The floor surface should be kept free from loose material and should be non-slippery.

13.6.5.1 Hazards

Operators should be aware of the following hazards.

a) Hands or fingers, which can come into contact with the blade.

b) Wood dust, which can be inhaled.

c) Noise, which can cause permanent hearing damage.

d) Inadvertent starting of the machine.

e) The blade running on after the machine is switched off.

f) Damaged power leads, which present the risk of electric shock.

13.6.5.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) fixed guards (removable only with the use of a tool), or alternatively interlocked guards that enclose the motor/drive mechanisms.

It should be possible to lock the machine to "off" when not in use, if a locking device is not incorporated in the machine.

There should be sufficient space around the panel saw so that the boards can be handled safely. The floor of the work area should be level. The floor surface should be kept free from loose material and should be non-slippery.

Boards should be located in the correct mounts provided with the machine. Horizontal cuts should only be undertaken with the board located against an appropriate stop.

The part of the blade extending from the main guard of the machine should be protected by a spring loaded guard that retracts when the machine is brought into contact with the material.

For machines with a single working spindle speed, saw blades with a diameter below 60% of the largest diameter the machine is designed to use should not be used. For machines with more than one working spindle speed, saw blades with a diameter below 60% of the largest diameter the machine is designed to use at the fastest working speed should not be used. A notice specifying the smallest diameter saw blade that can be used on the machine should be clearly displayed on the machine.

Only a competent trained operator should use circular sawing machines. The trained person is to be trained in accordance with the *Health and Safety Training Standards in Design and Technology* [N1], or hold other recognized qualifications to industry standards.

A risk assessment should be carried out to evaluate the likely risks to health from inhalation of wood dust and any action required to prevent or control the risks (see **13.1**). Where an effective LEV system is not in place, a dust mask conforming to BS EN 149:2001+A1:2009 class FFP3 should be used.

Vertical panel sawing machines can produce noise levels above 100 dB(A) so a competent person should carry out an assessment of daily personal exposures.

*NOTE Any person exposed to this level of noise for more than 30 min each day has to be protected at the first or the second action value specified in the Control of Noise at Work Regulations 2005 (see **4.9**).*

Ear protectors conforming to BS EN 352-1 should be used if a noise risk assessment indicates that this is required.

Suitable PPE equipment, including eye protection, should be used. Long hair should be protected from entanglement.

The machine should not be used if the user could be distracted.

The blade of the machines should come to rest within 10s of the machine being turned off.

Saw blades should be kept sharp, and should be of the correct profile and properly set. Saw blades should conform to BS EN 847-1. Saw blades that have been subjected to overheating should be discarded. Saw blades should have the correct number of teeth, as an insufficient number can cause the cutting head to "kick back". Tungsten carbide tipped saw blades should be inspected regularly for chipped teeth and small cracks between the tips and the body of the blade, and discarded or repaired as appropriate.

The machine should be included in a planned maintenance programme that should include electrical safety tests.

13.7 Wood turning lathes

13.7.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Long hair, loose clothing, etc., can become entangled in moving parts of the lathe.

b) Hand held wood turning tools can become trapped between the rest and the work piece.

c) Work pieces can fly off if not correctly mounted to a face plate, chuck or between centres.

d) Timber particles can fly off poorly selected or prepared wood.

e) Inadvertent starting of the machine can present a hazard.

f) Lack of space around the machine can lead to the operator being pushed by passers-by.

g) Slippery floor surfaces or loose items around the machine can cause slips that result in contact with moving parts.

h) Wood dust can be inhaled.

13.7.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) fixed guards (removable only with the use of a tool), or alternatively interlocked guards that enclose the drive mechanisms.

There should be sufficient space around the machine to prevent the operator from being accidentally pushed by passers-by.

The floor surface should not be slippery and should be kept free of loose items and wood shavings.

Only one person at a time should operate the machine.

Suitable eye protection should be used while operating the machine. Substantial footwear should be worn.

Long hair and loose clothing should be secured so as not to come into contact with moving parts. Jewellery should be removed.

Gloves should not be worn.

Timber should be inspected carefully to ensure it is free from any defect and it should be prepared in a roughly circular or octagonal shape before commencing machining operations. Segmented material should not be turned. If jointed material is used (e.g. in pattern making), it should be turned under close supervision.

Work mounted to a faceplate, a chuck or between centres should be properly secured and balanced to prevent excessive vibration. The rotational clearance should be checked by hand before starting the machine.

Only one side of the headstock should be set up for work and the unused end of the headstock mandrel protected.

The machine should be electrically isolated before the speed is changed. A safe peripheral turning speed is important and this speed should be adjusted as appropriate for:

1) the material;

2) the diameter of the material;

3) the condition of the turned surface.

The tool rest should be set at the correct height and fixed close to the work piece. Wood turning tools should be held securely and at the correct cutting angle. Tools, stored safely, should be kept sharp and should make a secure fit in their handles. Improvised tools, such as tools made from files, should not be used.

The machine should be stopped before measuring, gauging or adjusting the tool rest.

A risk assessment should be carried out to evaluate the likely risks to health from inhalation of wood dust, and any action required to prevent or control the risks (see **13.1**). Where an effective LEV system is not in place, a dust mask conforming to BS EN 149:2001+A1:2009 class FFP3 should be used.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

13.8 Mitre trimmers

13.8.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Contact with the blade can result in serious injury.

b) Inadvertent starting of the mitre trimmer can present a hazard.

c) Insufficient fixing to the bench can present a hazard.

13.8.2 Risk control measures

The mitre trimmer should be securely fixed and the blade immobilized when not in use. The mitre trimmer should not be left in an operational mode. If possible, the operating handle should be removed or otherwise secured with a locking device.

Only competent persons should use mitre trimmers.

NOTE The mitre trimmer blade can cause serious injury and cannot be effectively guarded.

Blades should be kept sharp. Sliding mechanisms and guides should be kept clean.

14 Metalworking machinery

14.1 General

Metalworking machines are often used to machine materials other than metals in schools and similar establishments; risk assessments should be made if materials other than metals are used.

NOTE 1 Metalworking machines are covered by the Supply of Machinery (Safety) (Amendment) Regulations 2011, the Provision and Use of Work Equipment Regulations 1998 and BS EN 60204-1.

Persons who supervise, teach or work in machine areas should be adequately trained as required in the *Health and Safety Training Standards in Design and Technology* [N1], or hold other recognized qualifications to industry standards.

The school or similar establishment should decide which machinery is suitable for use by each group of learners. The decision should be based on student maturity and competence, the level of supervision, and local authority/employer and national guidelines. In general the following recommendations should apply.

a) Learners should be trained and instructed in safe operating methods by a competent employee, who has attended a recognized training course. A record of their training should be kept.

b) Learners should be assessed as mature and competent before operating the machinery, and should be continuously supervised.

*NOTE 2 For recommendations regarding CNC machining centres see **19.4**.*

14.2 Centre lathes

14.2.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Long hair, loose clothing, etc., can become entangled in moving parts of the lathe.

b) Work pieces, chuck keys, broken cutting tools, swarf, etc., can be violently ejected from the lathe.

c) Centre lathes can present a hazard of electrical shock.

d) Closing movements between parts under power feed can be a trapping hazard.

e) Sharp edges on tools, work pieces and swarf can cause cuts.

f) Contact with cutting fluids, oil and grease can irritate the skin.

g) Swarf can jam or be ejected if allowed to build up.

h) Inadvertent starting of the machine can present a hazard.

i) Lack of space around the machine can lead to the operator being pushed by passers-by.

j) Slippery floor surfaces or loose items around the machine can cause slips that result in contact with moving parts.

k) Manual handling (lifting) of heavy equipment (e.g. chucks, faceplates) can present a hazard.

14.2.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) fixed guards (removable only with the use of a tool), or alternatively interlocked guards that enclose the drive mechanisms including the headstock spindle end.

The machine should be fitted with a suitable chuck guard. The spindle mandrel should be guarded. If feed shafts and lead screws are not sufficiently protected by the overhang of the bedways and/or saddle and swarf trays, an appropriate guard should be provided.

NOTE 1 As an alternative to guarding of the lead screw and feed shaft, the drive to these items can be disconnected by removal of a gear from the change wheel drive. If the drive shaft or lead screw is required, a special risk assessment showing how the additional hazards presented by the unguarded shaft will be removed or reduced might be appropriate.

There should be sufficient space around the machine to prevent the operator from being accidentally pushed by passers-by. The floor surface should not be slippery and should be kept free of loose items and swarf.

Only one person at a time should operate the machine.

Suitable eye protection should be used while operating the machine. Substantial footwear should be worn.

Long hair and loose clothing should be secured so as not to come into contact with moving parts. Jewellery should be removed.

Heavy grade gloves should not be worn.

An assessment should be carried out and measures implemented to minimize risks associated with lifting heavy items (e.g. use of lifting aids, team lifts, correct lifting techniques).

NOTE 2 Manual handling tasks associated with changing heavy chucks and faceplates, etc., can be beyond the physical ability of some persons.

The machine should be electrically isolated before any internal mechanisms are adjusted. The drive to feed shafts and lead screws should be disconnected until required. The chuck key, preferably spring-loaded, should be removed immediately after use and before starting the machine.

Work mounted to a faceplate, a chuck or between centres should be properly secured and balanced to prevent excessive vibration. The rotational clearance should be checked by hand before starting the machine. The cutting tool should also be carefully checked for security before starting the machine.

Stock bar should not project beyond the headstock. If this is unavoidable, the portion of stock bar projecting beyond the headstock should be guarded to prevent entanglement. The hole that allows a long stock bar to project should be covered by a metal plate secured with suitable screws or bolts when not in use.

Coolant nozzles should not be adjusted while the machine is in operation.

The machine should be stopped before measuring or gauging and the cutting tool positioned to minimize possible contact.

Files and abrasive tape should not be used on centre lathes if possible.

Tool-post grinding machines should only be used on lathes for which they have been specifically designed.

*NOTE 3 For recommendations regarding the use of abrasive wheels see **14.5**.*

Swarf should not be allowed to accumulate as it can become entangled or ejected by the chuck or work piece. Swarf should not be removed while the machine is operating. A suitable implement should be used to avoid hand contact with swarf.

Metalworking fluids, if used, should be mixed and changed in accordance with the supplier's instructions. Where a coolant tank and pump is fitted the tank and system should be drained every 12 months, the system flushed through with clean water and the tank refilled with fresh coolant.

Contact with the skin should be kept to a minimum.

NOTE 4 Barrier creams or appropriate protective close fitting gloves may be used.

Hands should be washed thoroughly after using the machine.

Only a competent trained person should supervise the use of centre lathes. The trained person should be trained in accordance with the *Health and Safety Training Standards in Design and Technology* [N1], or hold other recognized qualifications to industry standards.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

14.3 Milling machines (horizontal and vertical)

14.3.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Contact with revolving cutters can present a hazard.

b) Long hair, loose clothing, etc., can become entangled with rotating cutters or arbors.

c) Broken cutters, swarf, work pieces, etc., can be violently ejected.

d) Closing movement between parts, under power feed, can result in finger trapping.

e) Closing movement between the table and fixed structures can result in body crushing.

f) Heavy objects such as vices and index fixtures can fall from the table.

g) Milling machines can present a hazard of electric shock.

h) Sharp edges on cutters, work pieces and swarf can cause cuts.

i) Contact with cutting fluids, oils and greases can irritate the skin.

j) Inadvertent starting of the machine can present a hazard.

k) Lack of space around the machine can lead to the operator being pushed by passers-by.

l) Slippery floor surfaces or loose items around the machine can cause slips that result in contact with moving parts.

m) Manual handling of heavy equipment such as vices and index fixtures can present a hazard.

14.3.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) fixed guards (removable only with the use of a tool), or alternatively interlocked guards, that enclose the drive pulleys, belts and gears.

Guards should prevent access to dangerous in-running nips on the pulleys or gearwheels.

Cutters should be guarded while in motion to prevent access. Ends of rotating arbors should be fitted with guards to prevent entanglement. Such covers should be fixed with suitable screws or bolts.

Milling machines should be fitted with a space of at least 500 mm between the machine table at the extreme ends of its travel and any fixed object.

Handles or hand wheels to operate the table mechanism should be set up so that they do not rotate when the power drive is engaged.

There should be sufficient space around the machine to prevent the operator from being accidentally pushed by passers-by. The floor surface should not be slippery and should be kept free of loose items.

PPE, including suitable eye protection, should be used while operating the machine. Substantial footwear should be worn.

Long hair and loose clothing should be secured so as not to come into contact with moving parts. Jewellery should be removed.

Heavy grade gloves should not be worn.

An assessment should be carried out and measures implemented to minimize risks associated with lifting heavy items (e.g. use of lifting aids, team lifts, correct lifting techniques).

NOTE 1 Manual handling tasks associated with moving heavy work, vices and indexing heads can be beyond the physical capability of some persons.

The machine should be electrically isolated before any internal mechanisms are adjusted. Cutters should be stopped when positioning the work piece, clearing swarf, adjusting coolant hoses, measuring or gauging.

Hands should be kept away from the table while it is traversing under power to minimize the risk of trapping fingers.

Suitable implements should be used to remove swarf to avoid hand contact.

If metalworking fluids are used, they should be mixed and changed in accordance with the supplier's instructions. Where a coolant tank and pump is fitted the tank and system should be drained every 12 months, the system flushed through with clean water and the tank refilled with fresh coolant.

Contact with the skin should be kept to a minimum. Hands should be washed thoroughly after use.

NOTE 2 Barrier creams or appropriate protective close fitting gloves may be used.

Only a competent trained person should supervise the use of milling machines. The trained person should be trained in accordance with the *Health and Safety Training Standards in Design and Technology* [N1], or hold other recognized qualifications to industry standards.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

14.4 Drilling machines

14.4.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Long hair, loose clothing, etc., can become entangled in moving parts of the drilling machine.

b) Chuck keys, broken drills, swarf, work pieces, etc., can be violently ejected.

c) Unexpected spinning of hand held work pieces could cause injuries to hands.

d) The drill table can slip down or heavy objects fall from the table.

e) Drilling machines present an electric shock hazard.

f) Closing movements between parts can lead to trapping.

g) Sharp edges on drills, work pieces and swarf can cause cuts.

h) Contact with metalworking fluids, oil and grease can irritate the skin.

i) Inadvertent starting of the machine can present a hazard.

j) Lack of space around the machine can lead to the operator being pushed by passers-by.

k) Slippery floor surfaces or loose items around the machine can cause slips that result in contact with moving parts.

14.4.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a foot operated emergency stop device so that the machine can be quickly stopped in an emergency, without requiring the operator to let go of the spindle feed or work piece;

c) a guard that encloses the drill chuck and which extends to the bottom of the drill bit;

d) fixed guards (removable only with the use of a tool), or alternatively interlocked guards that enclose the drive pulleys and belts (guards should prevent access to dangerous in-running nips on the pulleys).

There should be sufficient clear space around the machine to prevent the operator from being accidentally pushed by passers-by. The floor surface should not be slippery and should be kept free of loose items.

PPE, including suitable eye protectors conforming to BS EN 166:2002 1B (medium energy impact), should be used while operating the machine. Substantial footwear should be worn.

Long hair and loose clothing should be secured so as not to come into contact with moving parts. Jewellery should be removed.

Gloves or bandages should not be worn while operating the machine.

An assessment should be carried out and measures implemented to minimize risks associated with lifting heavy items (e.g. use of lifting aids, team lifts, correct lifting techniques).

NOTE 1 Manual handling tasks associated with changing/moving heavy drill tables and vices, etc., can be beyond the physical capability of some persons.

The machine should be electrically isolated before the position of the drive belt is changed. The chuck key, preferably spring-loaded, should be removed immediately after use and before starting the machine.

NOTE 2 A high proportion of accidents at drilling machines occur when the work piece is being put into position, with the drill bit at its uppermost point.

The drilling machine should be fitted with a suitable guard that extends to the bottom of the drill bit when it is in the uppermost position. The table should be adjusted so that, as the drill bit leaves the guard, it enters the work piece.

When using a specialist printed circuit board drilling machine, the need for a guard should be ascertained by a specific risk assessment.

Where appropriate, the work piece should be prevented from spinning around by use of a vice or hand grips, or by clamping it to the table.

NOTE 3 A vice or clamp might not be required if a small diameter drill is used. In this case it might be sufficient to hold the work piece by hand but carry out a risk assessment first.

If no rack and pinion rise and fall mechanism is provided for table adjustment, the safety collar stop under the table should be used. If the head is adjustable, the safety collar stop underneath it should be secure.

Suitable implements should be used to remove swarf, so that hand contact is avoided.

If metalworking fluids are used, they should be mixed and changed in accordance with the supplier's instructions. Where a coolant tank and pump is fitted the tank and system should be drained every 12 months, the system flushed through with clean water and the tank refilled with fresh coolant. Contact with the skin should be kept to a minimum and hands should be washed thoroughly after use.

Coolant nozzles should not be adjusted while the machine is in operation.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

14.5 Grinding machines

NOTE Although the Abrasive Wheels Regulations 1970 have been superseded by the Provision and Use of Work Equipment Regulations 1998, the sections covering training of persons to mount abrasive wheels, on guarding of wheels, and on measures to prevent wheels overspeeding, are still recognized as good practice guidelines. These are also detailed in the Health and Safety Executive publication HSG17, Safety in the Use of Abrasive Wheels [N7].

14.5.1 Bench and pedestal grinding machines

14.5.1.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Overspeeding, damaged or incorrectly mounted abrasive wheels can break while rotating and be violently ejected from the grinding machine.

b) Contact with the wheel can cause cuts.

c) Long hair, loose clothing, etc., can become entangled with the spindle or wheel.

d) Work pieces can be ejected from the machine.

e) Fingers or work pieces can become jammed between the wheel and rest.

f) Hot work pieces can cause burns.

g) Grinding machines can present a hazard of electric shock.

h) Sharp edges can cause cuts.

i) Inadvertent starting of the machine can present a hazard.

j) Dust can be inhaled.

k) Lack of space around the machine can lead to the operator being pushed by passers-by.

l) Slippery floor surfaces or loose items around the machine can cause slips that result in contact with moving parts.

14.5.1.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) a suitable guard to enclose the wheels and spindles. The guard should be able to contain debris from a wheel breaking in motion and should prevent entanglement with the threaded spindle ends (the only gap in the guard should be at the front to allow access for the work piece).

There should be sufficient space around the machine to prevent the operator from being accidentally pushed by passers-by. The floor surface should not be slippery and should be kept free of loose items.

A risk assessment should be carried out on dust inhalation at the machine.

NOTE Normal room ventilation is likely to be sufficient for dust from grinding machines but, depending on the materials and scale of use, additional measures might be required (e.g. LEV or RPE).

Suitable eye protectors conforming to BS EN 166:2002 1B (medium energy impact) should be used while operating the machine.

Long hair and loose clothing should be secured so as not to come into contact with moving parts. Jewellery should be removed.

Gloves should not be worn.

Wheels should be suitable for the material of the work piece and should be mounted correctly by a competent person in accordance with the manufacturer's instructions. The maximum operating speed marked on the wheel should not be exceeded. The spindle speed should be marked on the machine. Any wheel that has a chip should not be used. If a wheel becomes glazed it should be "dressed" with a grinding wheel dresser to restore the surface.

Most grinding machines in schools have wheels fitted that are intended for the sharpening of metalworking tools made from hardened steel and the correct grinding wheel should be fitted for the material to be ground.

Grinding should not be undertaken on the sides of a grinding wheel. The competent person should be trained in accordance with the *Health and Safety Training Standards in Design and Technology* [N1], or hold other recognized qualifications to industry standards.

The work rest should be adjusted as close as possible to the wheel to prevent fingers and work pieces from becoming jammed. The gap between the work rest and wheel should not exceed 3 mm. Spark arrester(s), where fitted, should be adjusted to the manufacturer's specification.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

14.5.2 Surface grinding machines

14.5.2.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Overspeeding, damaged or incorrectly mounted abrasive wheels can break while rotating and be violently ejected from the grinding machine.

b) Contact with the wheel can cause cuts.

c) Long hair, loose clothing, etc., can become entangled with the spindle or wheel.

d) Work pieces can be ejected from the machine.

e) Fingers or work pieces can become jammed between the wheel and rest.

f) Hot work pieces can cause burns.

g) Grinding machines can present a hazard of electric shock.

h) Sharp edges can cause cuts.

i) Inadvertent starting of the machine can present a hazard.

j) Dust can be inhaled.

k) Lack of space around the machine can lead to the operator being pushed by passers-by.

l) Slippery floor surfaces or loose items around the machine can cause slips that result in contact with moving parts.

m) Closing movement between parts under power feed can result in finger trapping.

n) Closing movement between the table and fixed structures can result in body crushing.

o) Unsecured work pieces can be ejected off the table.

p) Contact with metalworking fluids can irritate the skin.

14.5.2.2 Risk control measures

*NOTE The recommendations given in **14.5.1.2** apply to surface grinding machines, together with the following recommendations.*

Surface grinding machines should have a space of at least 500 mm between the machine table at the extreme ends of its travel and any fixed object.

The end of the table from which an unsecured work piece could be projected from the wheel should be fitted with a substantial guard, or should face towards a wall.

Drive mechanisms should be provided with fixed guards that require use of a tool for removal, or alternatively should be interlocked to prevent access while in motion.

PPE, including suitable eye protectors conforming to BS EN 166:2002 1B (medium energy impact), should be used while operating the machine. Substantial protective footwear should be worn.

The machine should be electrically isolated before any internal mechanisms are adjusted.

The wheel should be balanced to minimize vibration if required. Coolant nozzles should not be adjusted while the machine is in operation.

The work piece should be properly secured before starting the machine (special care should be taken if magnetic tables are used). The wheel should be stopped prior to positioning the work piece, measuring or gauging. Hands should be kept away from the table while it is traversing under power, to minimize risk of trapping of fingers.

If metalworking fluids are used, they should be mixed and changed in accordance with the supplier's instructions. Contact with the skin should be kept to a minimum. Hands should be washed thoroughly after use.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

14.5.3 Polishing (buffing) machines

14.5.3.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Long hair, loose clothing, etc., can become entangled with the spindle, mop or brush.

b) Work pieces, wires from brushes and particles from the polishing process can be ejected from the machine.

c) Hot work pieces can cause burns.

d) Polishing machines can present a hazard of electric shock.

e) Sharp edges can cause cuts.

f) Inadvertent starting of the machine can present a hazard.

g) Dust can accumulate and can be inhaled.

h) Lack of space around the machine can lead to the operator being pushed by passers-by.

i) Slippery floor surfaces or loose items around the machine can cause slips that result in contact with moving parts.

14.5.3.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) fixed guards (removable only with the use of a tool), or alternatively interlocked guards that enclose the drive mechanisms;

d) a suitable guard to protect the brush or mops. (The only gap in the guarding should be at the front to allow access for the work piece. The guard should be able to prevent entanglement with the spindle ends and threaded mandrel.)

There should be sufficient clear space around the machine to prevent the operator from being accidentally pushed by passers-by. The floor surface should not be slippery and should be kept free of loose items.

A risk assessment should be carried out on dust inhalation at the machine.

NOTE 1 Normal room ventilation might be sufficient for dust from grinding machines but, depending on the materials and scale of use, additional measures might be required (e.g. LEV or RPE).

PPE, including suitable eye protectors conforming to BS EN 166:2002 1F (low energy impact), should be used while operating the machine.

Long hair and loose clothing should be secured so as not to come into contact with moving parts. Jewellery should be removed.

Gloves should not be worn.

As a general rule, items such as bracelets, bangles, chains and other items with linked parts should either be polished by hand or by means of a small mop mounted on a flexible drive shaft.

NOTE 2 The polishing of these items presents particular hazards due to the possibility of entanglement of the item being polished with the mop.

Wire brushes and mops should be suitable for the work and should be mounted so as not to come loose while in motion.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

14.5.4 Abrasive belt machines (linishing machines)

14.5.4.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Long hair, loose clothing, etc., can become entangled with the belt or drive pulleys.

b) Fingers or the work piece can become trapped in pulley/belt in-running nips.

c) Contact with the edge of the belt can cause cuts.

d) Hot work pieces can cause burns.

e) Abrasive belt machines can present a hazard of electric shock.

f) Sharp edges can cause cuts.

g) Inadvertent starting of the machine can present a hazard.

h) Dust can be inhaled.

i) Lack of space around the machine can lead to the operator being pushed by passers-by.

j) Slippery floor surfaces or loose items around the machine can cause slips that result in contact with moving parts.

14.5.4.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) fixed guards (removable only with the use of a tool), or alternatively interlocked guards that enclose the drive mechanisms;

d) a guard over the in-running nips created by the belt and pulleys to prevent traps. (The in-running fence should be kept as close as possible to the belt surface to prevent traps.)

There should be sufficient space around the machine to prevent the operator from being accidentally pushed by passers-by. The floor surface should not be slippery and should be kept free of loose items.

A risk assessment should be carried out on dust inhalation at the machine.

NOTE Normal room ventilation might be sufficient for dust from grinding machines, but depending on the materials and scale of use, additional measures might be required (e.g. LEV or RPE).

Suitable eye protectors conforming to BS EN 166:2002 1B (medium energy impact) should be used while operating the machine.

Long hair and loose clothing should be secured so as not to come into contact with moving parts. Jewellery should be removed.

Gloves should not be worn.

The machine should be electrically isolated before any internal mechanisms are adjusted. Abrasive belts should be examined before use. Torn or badly worn belts should not be used.

Abrasive belts should be narrower than the belt support plate and pulleys (to protect the belt edges and eliminate the risk of cuts). Abrasive belts should be suitable for the material of the work piece. They should be fitted to run in the correct direction and adjusted so as not to break or come loose while in motion.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

14.6 Sawing machines with cutting discs or abrasive discs, power hacksaws and metal cutting bandsaws

WARNING. Learners should only use metal sawing machines when they have been assessed and the assessment has shown that they are competent, and they are under the direct supervision of specifically trained employees.

14.6.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Long hair, loose clothing, etc., can become entangled in moving parts.

b) Closing movements between parts can result in trapping.

c) Forward motion of the saw arm (on a power hacksaw) can result in trapping or cuts.

d) The bar stock projecting from the vice can present a tripping hazard.

e) The bar being cut can become loose in the vice.

f) Sawing machines can present a hazard of electric shock.

g) Sharp edges on tools and work pieces can cause cuts.

h) Blunt or damaged blades can present a hazard.

i) Contact with cutting fluids, oil and grease can irritate the skin.

j) Inadvertent starting of the machine can present a hazard.

k) Lack of space around the machine can lead to the operator being pushed by passers-by.

l) Slippery floor surfaces or loose items around the machine can cause slips that result in contact with moving parts.

m) Manual handling of bar stock can present a hazard.

14.6.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) fixed guards (removable only with the use of a tool) or alternatively interlocked guards, that enclose the drive pulleys, belts and gears. (Guards should prevent access to dangerous in-running nips on the pulleys or gearwheels.)

Long hair and loose clothing should be secured so as not to come into contact with moving parts. Jewellery should be removed.

On reciprocating power hacksaws, the user should be made aware of the dangers of moving parts. The saw should not be manually assisted to increase the rate of cutting.

NOTE Reciprocating power hacksaw machines require a space of at least 500 mm between the saw arm at the extreme ends of its travel and any fixed object.

There should be sufficient space around the machine to prevent the operator from being accidentally pushed by passers-by. The floor surface should not be slippery and should be kept free of loose items.

Work pieces should be securely held in the vice and properly supported (on both sides of the cut if required). If short pieces of bar cannot be held securely then they should not be cut by these types of machine. Long, heavy bars should be properly supported to prevent sawn parts from falling or tipping when the vice is unclamped.

Blade guides on bandsaws should be correctly adjusted for the size of the material being cut and for the size of the blade itself. Badly worn or damaged blades should not be used.

Suitable eye protectors conforming to BS EN 166:2002 1F (low energy impact) should be used where the risk assessment shows that it is required. Substantial footwear should be worn where the risk assessment shows that it is required.

Measures should be taken to prevent persons tripping over long bars being sawn. Manual handling tasks associated with moving bar stock should be assessed and measures implemented, as appropriate, to minimize risks (e.g. team lifts, correct lifting techniques, care of passers-by).

The machine should be electrically isolated before any internal mechanisms are adjusted. Coolant nozzles should remain in position during machining. Care should be taken not to spill coolant.

If metalworking fluids are used, they should be mixed and changed in accordance with the supplier's instructions. Where a coolant tank and pump is fitted the tank and system should be drained every 12 months, the system flushed through with clean water and the tank refilled with fresh coolant.

Contact with skin should be kept to a minimum. Hands should be washed thoroughly after use.

Reciprocating power hacksaws should be fitted with an auto finished cut knock-off switch. The switch should be utilized at all times and regularly checked to ensure that it is in good order.

Where fitted, the hydraulic dashpot or damping device should be maintained in good working order.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

14.7 Guillotines, shears (hand or treadle operated), folding and rolling machines

14.7.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Closing movement between surfaces and other parts can result in trapping and serious injury.

b) Sharp edges on cut materials can cause cuts.

c) Lack of space around the machine can lead to the operator being pushed by passers-by.

d) Slippery floor surfaces or loose items around the machine can cause slips that result in contact with moving parts.

e) Manual handling of sheet materials and operating levers or treadles can present a hazard.

f) Entanglement of long hair, loose clothing, etc., in moving parts can present a hazard.

14.7.2 Risk control measures

Sheet cutters should preferably be of the "nibbler" or "notching" type. Where bench shears and guillotines are used, a specific risk assessment should be undertaken.

These machines should be secured to a bench or stand specifically designed for the purpose.

Machines with a worktable should be provided with a guard that prevents access to shearing points from all positions.

NOTE See also HSE publication HSG42, Safety in the Use of Metal Cutting Guillotines and Shears.

There should be sufficient space around the machine to prevent the operator from being accidentally pushed by passers-by. The floor surface should not be slippery and should be kept free of loose items.

Long hair and loose clothing should be secured so as not to come into contact with moving parts. Jewellery should be removed.

When the machine is not in use, it should be made safe by locking the action and, if possible, removing the operating handle.

Only one person should operate the machine at any time and industrial type gloves should be worn to handle materials. Only material within the capacity of the machine should be cut, to minimize physical effort and to prevent damage to the machine. Sheet material should be properly supported during cutting.

Manual handling tasks associated with moving sheet materials should be assessed and measures implemented as appropriate to minimize risks (e.g. team lifts, correct lifting techniques, care of passers-by).

Shearing edges should be maintained in good condition, and should be distortion-free and correctly adjusted.

These machines should be included in a planned maintenance programme that should include electrical safety inspections and tests.

14.8 Lapidary equipment

14.8.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Grinding and polishing stones produces a very fine dust that can cause serious respiratory irritation.

b) Pieces of stone can be ejected from the machine.

c) The work area can become wet and slippery.

14.8.2 Risk control measures

14.8.2.1 Grinding units

Abrasive wheels on the grinding unit should be run in water at all times to ensure that dust particles are carried away safely.

Care should be taken when disposing of slurry from grinding as slurry can block drainage systems. Waste should be allowed to settle, the water drained off, and solids removed.

Water should be drained from the trough when the unit is not in use.

A risk assessment should be carried out and suitable PPE provided. Suitable eye protectors conforming to BS EN 166:2002 1F (low energy impact) should be worn.

Stone should be mounted on a dop stick for grinding. Stone should not be held by hand.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

14.8.2.2 Cutting units

The diamond saw blade on the cutting unit should be true.

A risk assessment should be carried out and suitable PPE provided. Suitable eye protectors conforming to BS EN 166:2002 1F (low energy impact) should be worn.

Cutting oil or water should be used to cool the saw blade. Stone dust should be carried away safely. Cutting oil spilt on the bench top or floor should be cleaned away immediately.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

15 Motor vehicle work, machinery and equipment

15.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Moving vehicles can crush or run over persons.

b) Vehicles or components falling from supports, lifting equipment or vehicle hoists can trap or crush.

c) Moving parts can trap or entangle.

d) Inadvertent moving of vehicles and starting of engines/display machinery can present a hazard.

e) Petrol vapours can cause fires or explode.

f) Exhaust fumes can be inhaled.

g) Inspection pits can accumulate flammable vapours/exhaust fumes.

h) Inspection pits can present a falling hazard.

i) High-tension ignition equipment can present an electric shock hazard.

j) Batteries give off an explosive hydrogen and oxygen mixture during and after charging.

k) Arcing caused by making and breaking a circuit at battery terminals can cause batteries to explode.

l) Short circuiting battery terminals or other connections can cause burns or ignition of flammable gases and vapours.

m) Spilt oils/fluids and untidy work areas can cause slips and falls.

n) Dust from brake and clutch linings (which can contain asbestos) can be inhaled.

o) Hot exhaust system surfaces and brake discs/drums can cause burns.

p) Hot cooling systems, engine oil and automatic transmission and power steering fluids can cause scalding and burns.

q) Used engine/transmission oils and hydraulic fluids can irritate the skin.

r) Hydrofluoric acid from burnt or overheated synthetic rubber oil seals, O-rings and fuel pipes can cause burns.

s) Unintentional operation of air bags can present a hazard.

t) Fuel from high-pressure diesel/petrol injection systems can spray into eyes and onto the skin and can penetrate the skin.

u) Manual handling (lifting) of heavy components, materials and tools can present a hazard.

v) Inspection lamps powered at 230 V present a hazard from electric shock.

15.2 Risk control measures

15.2.1 General

Vehicle ignition keys should be kept by a competent person. Persons should be assessed as being competent and properly qualified before moving or road testing vehicles. Care should be taken when reversing vehicles in restricted areas.

Work areas should be kept tidy to minimize risks of falls. Equipment should be stored away after use. Trailing cables should not be used if possible. Work systems should be organized to minimize the likelihood of oils and fluids spilling onto floors. Spills should be cleaned up using absorbent granules or sawdust.

Engines should not be run indoors unless the vehicle exhaust is clear of the building or is vented via an extraction pipe to the outside. All couplings and flexible connections should be maintained and in good condition.

Long hair and loose clothing should be secured so as not to come into contact with moving parts. Jewellery should be removed.

Suitable close fitting overalls should be worn. Protective headgear should be worn when working under vehicles on hoists.

Contact with used engine/transmission oils and hydraulic fluids should be minimized by the work systems used and by the use of suitable protective gloves (e.g. disposable gloves). Hands should be washed thoroughly after work with suitable hand cleansers. Nail brushes and barrier cream should be provided.

Care should be taken while engines are running for setting/fault diagnosis, etc., to ensure that hands/fingers/clothing/hair/rags are kept away from trapping and entanglement points on pulleys and belts.

An assessment should be carried out and measures implemented to minimize risks (e.g. lifting aids, team lifts, correct lifting techniques).

NOTE 1 Manual handling tasks associated with moving heavy equipment and components, including tyre changing, can be beyond the capability of some persons.

Work should not be carried out on or near to ignition systems while the engine is running.

NOTE 2 High-tension ignition voltages present a significant risk, especially to persons with heart problems or a pacemaker.

Care should be taken when working on fuel injectors and pipes to ensure that persons are not exposed to fuel sprays.

Care should be taken with burnt or overheated synthetic rubber components (seals, O-rings, fuel pipes).

NOTE 3 These appear as charred and sticky and contain hydrofluoric acid which is highly corrosive and difficult to remove from the skin.

If there is any doubt, any charred rubber component should be assumed to be synthetic. Protective gloves should be worn. If contact is made with the skin, the area should be washed immediately and medical attention obtained.

Radiator or expansion tank caps should not be removed while the engine is hot. Care should be taken to prevent contact with hot engine oil, exhausts or brake discs or drums.

The manufacturer's instructions should be complied with when working near to, or removing, the steering wheel and/or facia.

Portable electrical equipment should be powered by a mains socket outlet protected by a residual current device (see **7.2.1**). The operational effectiveness of the RCD should be verified and recorded on a frequent basis, by pressing the test button in accordance with the manufacturer's instructions.

Where possible hand lamps should be battery operated rechargeable types, alternatively these should be supplied at reduced voltage such as 110 V centre tapped to earth or a SELV supply not exceeding 50 V a.c.

A decision should be made about which machinery or equipment is suitable for use by each learner. The decision should be based on a risk assessment which considers learners' maturity and competence, the level of supervision, and local authority/employer and national guidelines.

Learners should be made aware of hazards associated with processes, equipment and precautions that should be taken during use. Learners should be assessed as competent before using the equipment, a record of their training should be kept and they should be supervised at all times by a trained, competent person.

PPE should be used, where required, as indicated by a risk assessment.

NOTE 4 For general advice on electrical equipment for work with motor vehicles, etc., see HSE booklet HSG261 Health and safety in motor vehicle repair and associated industries [N6].

15.2.2 Batteries and chargers

Areas used for battery charging should be properly ventilated to prevent accumulation of a hydrogen and oxygen gas mixture.

Arcing near to battery terminals should be avoided as follows.

a) Jump leads should be connected in the sequence recommended by the vehicle manufacturer. The last connection (where the circuit is made and where arcing might occur) should be made on the earthed bodywork at least 500 mm from the battery.

b) Battery chargers should be switched off before connecting to terminals.

c) Metal objects should be prevented from falling across battery terminals.

d) The battery earth terminal should be disconnected in accordance with the vehicle manufacturer's instructions to prevent tools arcing on live connections.

e) Rings and metal wrist jewellery should be removed before carrying out work.

15.2.3 Demonstration engines and ancillary equipment

Static displays should be securely supported to prevent falling and any moving parts that could trap hands/fingers should be guarded or locked to prevent unauthorized movement.

Keys to locking devices and engine ignition keys should be kept by a competent person.

15.2.4 Fuel tanks

Repairs to fuel tanks should only be carried out by specialists. Hot work should not be attempted on or near to a petrol tank.

All work on fuel systems should be carried out in a properly ventilated area (preferably outdoors).

Fuel siphoning should be carried out using a siphon pump (not by mouth suction on a tube) or fuel retriever. Fuel should be drained into suitable containers. Tanks should be completely drained before components, such as fuel gauge sender units, are removed.

Vehicle chassis and containers should be grounded by earthing straps.

Sources of ignition should be excluded from areas in which fuel vapours can be present.

Only inspection lamps that are suitable for use in explosive atmospheres should be used.

NOTE 1 Inspection lamps can ignite fuel vapours if the lamp breaks. Guidance is given in HSE Guidance Note PM 38 Selection and Use of Electric Handlamps.

Fuel should be stored in a locked, external, fireproof store that is well ventilated. The store should be labelled to show that it contains fuel and also should have affixed to it a hazard sign indicating "Beware flammable material" conforming to BS EN ISO 7010. The amount of fuel stored should not exceed 20 litres. If stored in quantities of 10 litres, storage should be in metal containers. If plastics containers are used, only 10 litres should be stored. Fuel should be stored in containers that are marked as being suitable for the storage of fuel.

Spill kits should be available and fuel spills should be soaked up immediately with absorbent granules or similar material.

*NOTE 2 See **5.2.5** for further information on the management of flammable and highly flammable liquids.*

15.2.5 Brake and clutch linings

Old vehicles might have brake and clutch linings fitted with asbestos materials so components containing asbestos should be disposed of in accordance with HSE guidance, EM9, *Asbestos essentials – Disposal of asbestos waste* [N8]. Advice on disposal of asbestos containing materials should be obtained from the local waste regulation authority.

The following precautions should be taken when removing brake and clutch linings and disc pads.

a) Care should be taken to avoid inhaling dust from brake assemblies and clutch housings.

b) Compressed air should not be used to remove dust from brakes or clutch housings.

c) Proprietary brake cleaners should be used that prevent dust from becoming airborne.

15.2.6 Vehicle lifts and hoists

NOTE 1 The Lifting Operations and Lifting Equipment Regulations 1998 cover vehicle lifting devices.

The manufacturer's instructions and recommendations should be complied with. The weight distribution of the vehicle and the effects on the weight distribution of removal of components should be continuously assessed.

All lifting devices should be marked with the safe working load in a conspicuous place. The safe working load should not be exceeded.

Only competent employees should operate lifting equipment.

To prevent falls, persons should not ride on hoist platforms, and raised platforms should not be used as working areas.

The operating switch for raising and lowering should be sprung so that movement stops when the switch is released. The switch should be positioned to allow the operator a clear view all around the hoist. On four post hoists, automatic chocking should be provided to prevent vehicles rolling off.

NOTE 2 On some hoists the lifting platform can be lowered even if the power is switched off. It might be necessary to fit a lockable cover to the operating lever so that only authorised people can operate the hoist.

Hoists and their slings should be included in a planned inspection and maintenance programme carried out by a competent person at periods of at least six months.

15.2.7 Vehicle lifts and lifting accessories (e.g. chains and slings)

Hoists and their slings should be visually examined for wear before each use and included in a planned inspection and maintenance programme. Engine hoists and lifting accessories should be thoroughly examined by a competent person every six months and a record kept.

The safe working load should be marked on any sling or other lifting accessory and this should not be exceeded.

15.2.8 Jacks and axle stands

NOTE 1 The Lifting Operations and Lifting Equipment Regulations 1998 cover trolley, bottle and screw jacks.

Axle stands should be inspected by a competent person every 12 months and a record kept. All jacks and axle stands should be marked with the safe working load and this should not be exceeded.

Before any person carries out work on a raised vehicle, axle stands or other suitable supports should be positioned correctly to support and steady the vehicle. Suitable jacks should only be used to raise and lower the vehicle. Jacks and axle stands should be used only on suitable level, undamaged surfaces. Where necessary, vehicle movement should be prevented during jacking by using chocks. Care should be taken to avoid jacks and axle stands slipping.

NOTE 2 Vehicle jacking points are usually identified by a symbol on the vehicle sill but if in doubt, consult the manufacturer's handbook.

The correct pins should be used for axle stands.

Jacks and axle stands should be maintained in good condition and checked before use.

15.2.8.1 Inspection pits

As they are not appropriate in schools and similar establishments, inspection pits should not be used.

15.3 Equipment

15.3.1 Wheel balancing

15.3.1.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Inadvertent starting of the machine can present a hazard.

b) Contact with rotating wheels can cause friction burns.

c) Long hair, loose clothing and jewellery etc. can become entangled in moving parts.

d) Loose stones, weights etc. can be violently ejected from rotating wheels.

e) Lack of space around the machine can lead to the operator being pushed by passers-by.

f) Slippery floor surfaces or loose items around the machine can cause slips that result in contact with moving parts.

g) Manual handling (lifting) of tyres onto the machine.

15.3.1.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) fixed guards (removable only with the use of a tool), or alternatively interlocked guards that enclose the drive mechanisms;

d) a fully interlocked cover fitted to protect the wheel whilst in motion. Operation of the guard should be checked at regular intervals.

The machine should be included in a planned maintenance programme that should include electrical safety tests.

Before the wheel is balanced, a check for embedded objects such as loose stones or weights should be performed.

Suitable eye protection and substantial protective footwear should be worn.

Long hair and loose clothing should be secured so as not to come into contact with moving parts. Jewellery should be removed.

Suitable close fitting overalls should be worn.

Learners should be assessed as competent before using wheel balancing machines and machines should only be used under the direct supervision of a competent person.

There should be sufficient space around the machine to prevent the operator from being pushed by passers-by. The floor surface should not be slippery and should be kept free of loose items.

To reduce the risk of injury, a manual handling risk assessment should be carried out.

15.3.2 Tyre changing machine

15.3.2.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Entrapment of fingers, long hair and loose clothing.

b) Inadvertent starting of the machine.

c) Crush injury.

d) Lack of space around the machine.

e) Slippery floor surfaces or loose items.

f) Manual handling (lifting) of tyres onto the machine.

g) Explosion due to over inflated tyres or tyres mounted on wrong sized rims.

15.3.2.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency.

The machine should be included in a planned maintenance programme that should include electrical safety tests.

Hands should be kept clear of all pinch points when mounting and demounting.

A proprietary tyre lubricant should be used to prevent tyre binding.

Long hair and loose clothing should be secured. Jewellery should be removed.

Suitable close fitting overalls should be worn.

Users should stand away from the bead breaker arm when in operation. The wheel should be properly secured and checked prior to operating.

Suitable PPE should be worn.

Learners should be assessed as competent before using tyre changing machines and machines should only be used under the direct supervision of a competent person.

There should be sufficient space around the machine to prevent the operator from being pushed by passers-by. The floor surface should not be slippery and should be kept free of loose items.

To reduce the risk of injury, a manual handling risk assessment should be carried out.

The valve core should be removed before bead breaker is used.

The tyre and rim should be visually checked for damage and they should be of the same diameter.

Tyres should be inflated to the correct pressure as indicated on the tyre itself.

15.3.3 Rolling roads

WARNING. Learner use should be restricted to those in further education who are following a recognized training course in motor vehicle repair and learners in teacher training establishments who are being trained in the safe use of workshop machines.

15.3.3.1 Hazards

Employees should be made aware of the following hazards.

a) Loss of vehicle control.

b) Vehicle slipping from rollers.

c) Inadvertent starting of the machine.

d) Lack of space around the machine can lead to the operator being pushed by passers-by.

e) Uncovered rollers causing slips and trips.

15.3.3.2 Risk control measures

The machine should be:

a) provided with a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) fitted with a hold-to-run/dead man's control system and that this is functioning.

The machine should be included in a planned maintenance programme that should include electrical safety tests.

The machine should be isolated from mains when not in use and cover plates fitted over rollers when not in use to prevent tripping hazards.

Testing or adjustments should not be made to a vehicle while the rolling road is in operation.

Access should be restricted during use and guards should be fitted to the sides of exposed rollers where this cannot be prevented.

15.3.4 Compressed air

WARNING. Care should be taken when using compressed air guns, as air accidentally forced into the bloodstream can be life threatening. Care should be taken to avoid projecting debris into the eyes. It is essential that suitable eye protection is used. Non-users of compressed air guns should not be allowed near the equipment.

*NOTE For more information on compressed air, see **12.1.3** and **7.6**.*

15.3.4.1 Hazards

A risk assessment should be completed to cover the use of compressed air. Employees should be made aware of the following hazards.

a) Trailing cables and compressed air lines which could be tripped over.

b) Contact with the open end of a compressed air line, which can force air through the skin into the bloodstream.

c) Unrestrained compressed air lines, which can lash about with force.

d) Inadvertent operation of portable tools.

15.3.4.2 Risk control measures specific to portable compressed air tools and equipment

Compressed air powered tools should be operated at the manufacturer's recommended pressure.

A regulator and pressure gauge should be fitted between the equipment and the permanent supply.

The length of the air hose should be kept to a minimum. The air hose should be able to withstand the safe working pressure. Compressed air hose fittings should automatically cut off the air supply when disconnected. Fittings should be regularly checked to ensure they are securely attached to the hose.

Tools and equipment with an air piston should have a lubricator on the tool side of the regulator.

Compressed air lines with guns (jets) fitted should have a non-ferrous venturi-type nozzle.

Connections on flexible compressed air lines should be checked regularly. Compressed air equipment should not be used for cleaning down purposes or for removal of dust from brakes or machines unless specifically designed for this purpose.

15.4 Processes

15.4.1 Vehicle valeting

15.4.1.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Vapours which can be flammable.

b) Cleaning substances.

c) Inhalation of solvents, fumes and vapours.

15.4.1.2 Risk control measures

All chemicals should be handled in accordance with the manufacturer's instructions.

Suitable PPE should be used and barrier creams may be required. Cleaning substances which are flammable should not be used near to a source of ignition. Cleaning substances that produce fumes should only be used in well ventilated areas.

The manufacturer's hazard data sheets should be followed and appropriate risk assessments produced based on this information.

15.4.2 Steam/water pressure cleaners

15.4.2.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Steam.

c) High pressure water jets.

d) Impact injuries from material loosened during cleaning.

e) Leads and hoses which could be tripped over.

f) Irritant materials.

15.4.2.2 Risk control measures

The equipment should be visually examined before use and should not be used if any damage is present.

Trailing leads and hoses should not become entangled with the operator or others in the vicinity of the machine.

Appropriate PPE should be used including waterproof clothing, waterproof, slip-resistant boots, gloves, eye protection and barrier cream.

Portable electrical appliances should be included in a maintenance programme in accordance with the manufacturer's recommendations.

NOTE See HSE guidance INDG68 Do you use a steam/water pressure cleaner?

16 Moulding processes and equipment for plastics

WARNING. Absorbed moisture in plastics materials can form steam that can cause hot material to eject from the injection moulding machine.

16.1 Injection and extrusion moulding machines

16.1.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Hot or molten plastics discharges from injection moulding machines can cause burns.

b) Fumes can be inhaled.

c) The machine can become unstable and cause injuries.

d) Absorption of moisture by hygroscopic material (e.g. nylon) can present a risk of explosive discharges.

16.1.2 Risk control measures

The machine should be provided with a means of electrical isolation using a fused isolating switch on, or adjacent to, the machine.

The machine should be fitted with safety guards around the nozzle area to provide protection in all directions from possible ejection of hot material. Split moulds should be clamped prior to injection of plastics. Interlocking guards should be provided if the moulds are closed by any power driven system.

Certain plastic materials (especially nylon) absorb moisture and these materials should be stored in airtight drums, and dried in accordance with the manufacturer's instructions immediately before use.

Appropriate PPE (e.g. heat-resistant gloves or gauntlets) should be worn, based on a risk assessment. Suitable eye protection should be worn.

The machine should be included in a planned maintenance programme that should include any appropriate electrical safety tests.

16.2 Moulding trimming machines

16.2.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Cutting blades or discs and the drive mechanism can cause injuries.

b) Unstable equipment or work pieces can cause injuries.

c) Trimmed material can cause injuries.

16.2.2 Risk control measures

The machine should be provided with:

a) a means of electrical isolation using a fused isolating switch on or adjacent to the machine, and that it is controlled by a starter incorporating overload protection and no-volt release;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency.

Drive mechanisms should be provided with fixed guarding that requires a tool for removal. Interlocked guards and cutter guards should be provided where practicable. Adjustable fences or guides should be provided if there is a risk of "snatching".

Hands should be kept well away from the blade when holding and moving the material.

Suitable eye protection should be worn.

Moulding trimming machines should be included in a planned maintenance programme that should include any appropriate electrical safety tests.

16.3 Vacuum forming machines

16.3.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Fumes can be inhaled.

b) Overheated plastics can cause burns or a fire.

c) The pressure tank can fail and cause injury.

16.3.2 Risk control measures

Appropriate materials should be chosen (see **20.4**).

Fixed vacuum forming machines should be provided with a means of isolation (preferably a fused isolating switch on or adjacent to the equipment).

Portable vacuum forming machines should be powered by a mains socket outlet protected by a residual current device (see **7.2.1**). The operational effectiveness of the unit should be verified and recorded on a frequent basis, by pressing the test button in accordance with the manufacturer's instructions. Plugs should conform to BS 1363-1 and should be fused in accordance with the equipment manufacturer's instructions. Plugs should be removed from the mains socket when the equipment is not in use.

The heater system should be shielded or guarded against accidental contact. The moving heater system should be mechanically attached to the machine.

It should be possible to regulate the output from the heater system.

NOTE 1 On larger vacuum forming machines the heating element might be zoned.

If ceramic heaters are used, a mechanical interlock with the platen mechanism should be provided to prevent accidental elevation of a mould into the heaters.

Where harmful fumes are released, a risk assessment should be carried out to determine if LEV should be provided.

NOTE 2 Most common materials are unlikely to produce significant fumes during vacuum forming and normal room ventilation is usually sufficient.

Vacuum forming machines should not be left unattended when plastics are being heated.

If fumes are produced by heated material, the machine should be switched off, and the room evacuated if required, and ventilated. A timer with an audible warning device should be provided to prevent overheating.

The machine should be included in a planned maintenance programme that should include any appropriate electrical safety tests.

16.4 Hot wire cutters

16.4.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Fumes and smoke can be inhaled.

b) Contact of the hot wire cutter with the skin can cause burns.

16.4.2 Risk control measures

Hot wire cutters should only be used to cut expanded polystyrene material.

Portable hot wire cutters should be powered via a socket outlet protected by a residual current device (see **7.2.1**). The operational effectiveness of the RCD should be verified and recorded on a frequent basis, by pressing the test button in accordance with the manufacturer's instructions. Mains plugs should conform to BS 1363-1 and should be fused in accordance with the equipment manufacturer's instructions. Mains plugs should be removed from the socket when the cutters are not in use.

The electrical supply to the cutting wire or wires should not exceed 25 V and should be supplied from a SELV source. The voltage should be adjustable to a level that does not produce fumes at typical cutting speeds.

If possible, a "push-to-make" foot or pressure operated switch should be provided to control the power supply to the cutting wire.

Where harmful fumes are released, a risk assessment should be carried out to determine if local ventilation should be provided.

The machine should be included in a planned maintenance programme that should include electrical safety tests.

16.5 Strip heaters and line bending heaters

16.5.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Fumes can be inhaled.

b) Hot plastics and hot surfaces can cause burns.

c) Unstable equipment or work pieces can cause injury.

d) Strip heaters present an electric shock hazard.

16.5.2 Risk control measures

Appropriate materials should be chosen (see **20.4**).

Fixed strip heaters should be provided with a means of isolation (preferably a fused isolating switch on or adjacent to the equipment).

Portable strip heaters should be powered via a socket outlet protected by a residual current device (see **7.2.1**). The operational effectiveness of the unit should be verified and recorded on a frequent basis, by pressing the test button in accordance with the manufacturer's instructions. Mains plugs should conform to BS 1363-1 and should be fused in accordance with the equipment manufacturer's instructions. Mains plugs should be removed from the socket when the equipment is not in use.

Line bending heaters with heated tensioned resistance wire should be of SELV type and should have a transformer designed to protect against mains voltage breakdown to the secondary windings.

Simple heat output controls should be provided as well as an adjustable work support to control the distance between the heat source and the material.

Guarding should be provided if practicable or if the risk of causing burns is high.

Where harmful fumes are released, a risk assessment should be carried out to determine if local ventilation should be provided.

The equipment should be included in a planned maintenance programme that should include any appropriate electrical safety tests.

16.6 Ovens

16.6.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Fumes can be inhaled.

b) Hot surfaces can cause burns.

16.6.2 Risk control measures

The equipment should be provided with a means of isolation (preferably a fused isolating switch on or adjacent to the equipment).

Only thermostatically controlled electric ovens should be used to heat plastics materials (see **20.4**). A standard domestic oven should not be used if also used for food. The temperature controller should include a maximum heat limit facility set to 250 °C to 300 °C. The temperature controller should prevent excessive overheating when starting from cold.

Fan circulated ovens should be used if practicable.

External casing temperatures should not be excessive.

The oven chamber should be kept clean at all times.

A risk assessment should be carried out, and suitable PPE provided. Heat-resistant gauntlets should be used.

The equipment should be included in a planned maintenance programme that should include any appropriate electrical safety tests.

16.7 Blow moulders

*NOTE This piece of equipment is used in conjunction with a plastics oven so the hazards and risk control measures in this section can be read in conjunction with **16.6**.*

16.7.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Fumes can be inhaled.

b) Hot plastics and hot surfaces can cause burns.

c) Unstable equipment or work pieces can cause injury.

d) Dome blowers present an electric shock hazard.

e) Compressed air presents a hazard (see **12.1.3**).

16.7.2 Risk control measures

Suitable eye protection should be worn. Other appropriate PPE (e.g. heat-resistant gloves or gauntlets) should be worn, based on a risk assessment.

A risk assessment should be completed to cover the use of compressed air.

The appropriate material should be used at all times in accordance with the manufacturer's instructions and material data sheets (see **20.4**).

Suitable and sufficient training should be carried out before using the equipment.

The equipment should be included in a planned maintenance programme that should include any appropriate electrical safety tests.

16.8 Hot air plastics welding

16.8.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Fumes can be inhaled.

b) Hot plastics, air and surfaces can cause burns or overheating.

c) Unstable equipment or work pieces can cause injury.

d) Hot air guns can cause burns either through contact with the air or the gun.

e) The equipment presents an electric shock hazard.

f) Leads and hoses could be tripped over.

16.8.2 Risk control measures

Suitable eye protection should be worn. Other appropriate PPE (e.g. heat-resistant gloves or gauntlets) should be worn, based on a risk assessment.

The appropriate material should be used at all times in accordance with the manufacturer's instructions and material data sheets (see **20.4**).

Trailing leads and hoses should not become entangled with the operator, others in the vicinity or the machine.

Suitable and sufficient training should be carried out before using the equipment.

The equipment should be included in a planned maintenance programme that should include any appropriate electrical safety tests.

17 Heat processes, plant and equipment for metals

17.1 Forging

17.1.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Care should be taken when carrying hot metals (particularly metals at black heat that might not appear hot).

b) Clay and concrete bricks should not be heated as they can disintegrate violently.

c) Ceramic chips remain hot for a considerable time after the heat source has been removed.

d) Foreign materials present in a forge can cause fumes and stones can explode.

e) Quenching of hot metals, particularly tubular components, can present a risk of scalding.

f) Fuel combustion can produce dangerous gases.

17.1.2 Risk control measures

Firebrick or other refractory materials should be used for the brazing base. Anvils should be mounted on a stable base at an appropriate height for the user. Anvils and quenching tanks should be sited as close as possible to the hearth or forge.

LEV should be provided to remove fumes.

Appropriate PPE should be used. Strong, fire resistant aprons, gloves, face protection and sturdy protective footwear should be used. A face shield conforming to BS EN 166:2002, 1 9B should be worn.

A warning notice should be displayed where hot metal is left to cool.

Hot metal should be held using appropriately shaped tongs.

Tools should be appropriate and of the correct size for the work. They should be quenched and stored safely after use.

Floors should be kept clear of any loose materials and tools.

17.2 Brazing and silver soldering

17.2.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Care should be taken when carrying hot metals (particularly metals at black heat that might not appear hot).

b) Clay and concrete bricks should not be heated as they can disintegrate violently.

c) Brazing and silver soldering might produce fumes.

d) Quenching of hot metals, particularly tubular components, can present a risk of scalding.

17.2.2 Risk control measures

Firebrick or other refractory materials should be used around items being soldered.

LEV should be provided to remove fumes.

Appropriate PPE should be used. Strong, fire resistant aprons, gloves, and sturdy protective footwear should be used.

NOTE A face shield might be required.

A warning notice should be displayed where hot metal is left to cool.

Hot metal should be held using appropriately shaped tongs.

Floors should be kept clear of any loose materials and tools.

17.3 Welding and welding installations

17.3.1 General hazards

Employees and learners should be made aware of the following hazards.

a) Sparks or UV radiation can cause burns to skin, eyes and clothes.

b) Hot metal components can cause burns.

c) Chipping or cleaning welds can lead to eye injuries.

d) Welding can present a fire hazard.

e) Explosive vapours can form inside containers that have contained flammable liquids.

f) Hazardous fumes can be produced.

g) The penetration of the weld metal into a joint can be tested by filing a cross section of a joint smooth and then etching the surface using Nital, a mixture of concentrated nitric acid and ethanol.

NOTE The mixing of Nital is very hazardous.

17.3.2 General risk control measures

Persons supervising work in welding areas should be trained to a standard as specified in *the Health and Safety Training Standards in Design and Technology* [N1], or should have equivalent recognized qualifications to industry standards.

Appropriate protective clothing, including gloves where required, and eye protection, conforming to the appropriate BS EN standard, should be worn when welding. Nylon overalls, and overalls that are contaminated with oil or grease, should not be worn.

Tongs or pliers should be used to handle hot metal. Tongs should be able to hold the metal firmly. Metal that has been welded should be left in a safe place to cool.

Suitable eye protection, conforming to the appropriate BS EN standard, should be worn when welded joints are being cleaned or when slag is being chipped off a joint.

Suitable eye protection, conforming to the appropriate BS EN standard, should always be worn by anyone involved in any form of welding, and by any other persons nearby who are watching the process. Where screens are used, or if a separate welding bay is used, there should be adequate supervision of those doing the welding and other learners who might be present in the room.

Welding areas should be kept free of combustible materials and flammable liquids. Particular care should be taken if welding is done in mixed materials workshops where plastics and timber might be present. All welding should cease 30 minutes prior to the end of the working day. A fire extinguisher and fire blanket should be readily available. Welding should not take place directly onto a dense concrete or non-refractory cement base, as these materials can disintegrate explosively when heated.

A good level of general ventilation should be provided. Concentrations of welding fumes should be avoided. A risk assessment should be carried out, and suitable control measures and LEV provided if required.

In any educational environment, the welding, cutting or any other heat processes on tanks should not be undertaken.

If testing of welded joints using Nital is to be done, the mixture should be made on each occasion that it is required for use and not stored. A maximum of a 2% solution should be made. The solution should be made up by a suitably qualified science technician wearing appropriate protective clothing, eye protection and using a fume cupboard. After use, the solution should always be disposed of using a safe method.

All welding equipment should be included in a planned annual maintenance programme that should include any appropriate electrical safety tests.

17.4 Metal-arc welding (including spot welding)

17.4.1 Hazards

The mains supply circuit and connections to metal-arc welding equipment [manual metal arc (MMA), metal active gas (MAG), metal inert gas (MIG), tungsten inert gas (TIG)] should be able to supply the required input current. Only equipment with open circuit output voltages of less than 50 V a.c. or 120 V d.c. should be used.

The work piece earthing conductor should be robust enough to withstand possible mechanical damage, and should be connected to the work piece and a suitable earth terminal by bolted lugs or secure screw clamps.

NOTE 1 Older types of welding equipment require the work piece to be earthed as well as the welding return lead. This is to provide protection against internal insulation failure of the welding transformer, by keeping the work piece at or near to earth potential until the protective device (e.g. a fuse) operates to cut off the mains supply. Newer equipment does not require the work piece to be earthed because the internal insulation is reinforced.

Newer equipment should have an identification symbol (two circles within a shield) or should be marked with the appropriate standard number.

NOTE 2 Ultraviolet and infra-red radiation can cause "arc eye", a painful (but usually temporary) eye condition. The glare from the electric arc has the potential to cause damage to the eyes.

Welding equipment can present an electric shock hazard and suitable storage should be provided as damp conditions will increase the risk of electric shock.

NOTE 3 The electric currents used in arc welding can induce currents in jewellery high enough to cause partial melting.

NOTE 4 Electromagnetic fields can affect the operation of pacemakers and other electronic medical devices.

Care should be taken when putting down the electrode holder, which might be live, to prevent contact with other earthed objects (especially earthed electrical equipment).

NOTE 5 The coating of electrodes will give rise to fumes, as will any paint or surface contaminants on the metal being welded. There is a particular risk of fumes if galvanised steel is welded.

17.4.2 Risk control measures

A suitably qualified electrician should be consulted to ensure that the electrical supply will be able to cope with the current demands of the equipment.

Welding should be carried out in dry surroundings with dry equipment.

Appropriate eye protection should be worn by users.

The welding areas used for any form of arc welding should be separated from other work areas by fixed or portable screens, or suitable curtains that protect persons nearby who are not wearing suitable eye protection from the arc glare.

NOTE 1 Regular maintenance will reduce the risk of electric shock.

Users should remove all personal jewellery (especially rings, bracelets and metallic watchstraps) before carrying out any welding.

A risk assessment should be carried out to assess the risk from fumes and suitable extraction equipment provided where the risk assessment shows that it is required.

An insulated container or an insulated hook should be provided to support the electrode holder. When welding is finished, the power supply should be switched off and the electrode removed from the holder.

Metal-arc welding should be carried out in areas that are non-reflective and are curtained or screened-off.

Wearers of vital electronic medical equipment (e.g. pacemakers) should consult their physician before beginning any arc welding, cutting, gouging or spot welding operations.

All welding equipment should be included in a planned annual maintenance programme that should include any appropriate electrical safety tests.

NOTE 2 Further information can be found on the HSE website [5)]*.*

17.5 Plasma arc cutting

17.5.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Ultra-violet radiation can cause eye damage.

b) Hot sparks can cause fires or burns to nearby articles, etc.

c) Sparks and splatter produced from cutting.

d) Articles being cut can release explosive vapours.

e) The equipment can present an electric shock hazard.

f) Leads and hoses could be tripped over.

g) Jewellery can conduct electricity that could induce heating and cause burns.

h) Toxic fumes could be generated by the cutting process.

17.5.2 Risk control measures

Users and observers of plasma arc cutting should be protected against glare and sparks by the use of appropriate eye protection or shields, conforming to the appropriate BS EN standard. Surrounding surfaces should be non-reflective so that glare is not transmitted out of the immediate area of the cutter.

Users of plasma arc cutting equipment should ensure that they are wearing appropriate protective clothing covering all parts of the body. Overalls should be self-extinguishing to BS EN 531 and BS EN 470-1. Users should ensure that any flammable articles are kept well away from any cutting operations.

Plasma cutting should be done over a sand filled container.

The cutting up of tanks or any other closed containers should not be undertaken.

Trailing leads and hoses should not become entangled with the operator, the cutting equipment or others in the vicinity.

Jewellery should not be worn when plasma arc cutting.

[5)] See: http://www.hse.gov.uk/welding/electrocution.htm <last accessed 25 June 2014>.

LEV should be provided to remove fumes.

Plasma arc cutting equipment should be included in a planned annual maintenance programme that should include any appropriate electrical safety tests.

17.6 Oxy-acetylene welding and cutting

17.6.1 Hazards

NOTE 1 Under the Pressure Systems and Transportable Gas Containers Regulations 1989, a competent person is required to install gas pipes.

a) Compressed oxygen cylinders if damaged or involved in a fire can explode violently.

b) Oxygen leaks make fires burn quicker and more violently.

c) Cylinders of acetylene gas can explode violently if involved in a fire.

d) Acetylene gas leaks can form an explosive mixture inside buildings.

e) Sparks and glare.

f) Cylinders can be knocked over unless correctly stored and secured. Cylinders can become damaged by rough handling or abnormal heat.

g) Acetylene cylinders contain liquid and can leak.

h) Acetylene gas is heavier than air and can collect in low lying places, including drains and basements.

i) The welding flame can cause "flash back" into hoses and cylinders.

j) Regulators and blowpipes can be damaged by rough handling and incorrect use.

k) Oil or grease on oxygen valves or fittings can spontaneously combust.

l) Gases can leak from faulty joints, damages hoses, regulators or other fittings.

m) Sparks and splatter produced from cutting.

17.6.2 Risk control measures

Suitable warning signs indicating the presence of flammable gasses under pressure, conforming to BS EN ISO 7010, should be displayed at entrances to workshops. Educational establishments should inform the local fire service of the presence of such gases on the premises.

NOTE 1 Good maintenance and general good workshop practice will reduce the risk of gas leaks and fire.

Only those oxygen and acetylene cylinders in current use should be kept in the workshop. These should be secured on a trolley in an upright position in a well-ventilated area away from combustible materials and having direct access to the outside of the building.

NOTE 2 It is important to have the correct trolley to ensure that it cannot be knocked over.

Cylinders should be treated with care. Cylinders should not be subjected to mechanical damage, falls or abnormal heat levels. Particular care should be taken when cylinders are delivered to the establishment. Cylinders should not be left unattended in roadways or paths around buildings.

Acetylene cylinders contain liquid and should be kept with the valves uppermost. Spare cylinders (full or empty) should be kept upright, apart, in a safe, secure, well-ventilated place outside the building. Cylinders should not be kept below ground level or next to drains, basements or other low-lying places.

If oxygen and acetylene is supplied through a fixed pipe work installation from cylinders outside the building, they should be in a secure store and a schematic drawing of the pipework installation should be provided in accordance with the Pressure Systems and Transportable Gas Containers Regulations (1989).

Appropriate eye protection should be worn.

Risk of a welding flame "flash-back" into hoses or cylinders should be minimized by training users in the correct lighting up and working procedures and by fitting effective non-return valves and flame arresters.

Appropriate regulators, hoses, non-return valves, flame arresters, torches and welding nozzles should be used with care and should be maintained in good condition. Particular care should be taken to ensure that the seating of nozzles is in good condition and when changing nozzles. Nozzles with a damaged seating or tip should not be used. Advice on these items should be obtained from a welding equipment supplier.

Oil or grease should not be allowed to come into contact with oxygen regulator valves or fittings.

Cylinder valves should be turned off after use, and the pressure on the diaphragm of the regulators taken off. Gases should then be purged from the regulators. Cylinders should be changed in a well-ventilated place away from sources of ignition. Proprietary leak detecting fluids should be used to test for leaks from connections.

All regulators, blowpipes and other equipment used for oxy-acetylene or oxy-propane welding should be checked every 12 months by a competent person, and replaced where necessary every five years.

Appropriate PPE should be provided and worn. Cutting should be carried out over a sand-filled container.

17.7 Casting

17.7.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Hot molten metal can present a hazard.

b) Molten metal in contact with moisture on moulds and equipment can cause an explosion.

c) A violent reaction can occur between molten aluminium and various metallic oxides [e.g. iron oxide (rust)].

d) Degassing tablets cause fumes that can be harmful if inhaled.

e) Some molten metals can give off harmful fumes.

f) Expanded polystyrene patterns can produce large quantities of harmful fumes when in contact with molten metal.

g) Manual handling of heavy, hot crucibles can present a hazard.

h) Damaged crucible.

17.7.2 Risk control measures

Only equipment specifically intended for metal casting should be used. Safety tilt crucible furnaces should be used. Casting should only be carried out in a dry area.

LEV should be used.

Casting equipment should only be used under supervision of a competent teacher with training at least to the standard specified in the *Health and Safety Training Standards in Design and Technology* [N1], or who has equivalent recognized qualifications to industry standards.

All persons involved in pouring molten metal should wear PPE (substantial footwear, suitable eye protection, heat resistant gloves, spats and gaiters, leather apron).

Any persons not directly taking part in pouring hot metal should be kept at a safe distance.

Large-scale casting work should only be carried out on aluminium or zinc based alloys.

Aluminium alloys should not be melted in a plain iron pot.

Oil-bonded sand should be used if possible. If green sand is used, the moisture content should be kept to the minimum required to bond the sand.

Crucibles should be inspected prior to being preheated to avoid cracking and to remove moisture. Equipment to be brought into contact with metal should be wire brushed, and preferably coated in a limestone refractory wash and thoroughly dried.

Casting equipment should be included in a planned annual maintenance programme that should include any appropriate electrical and gas safety tests.

Molding boxes used for casting should be of steel.

17.8 Low temperature casting

17.8.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Molten metal in contact with moisture on moulds and equipment can cause an explosion.

b) Some molten metals can give off harmful fumes.

c) Expanded polystyrene patterns can produce large quantities of harmful fumes when in contact with molten metal.

d) Hot metal can cause burns.

e) Unstable equipment or work pieces can cause injury.

f) The equipment can present an electric shock hazard.

17.8.2 Risk control measures

Only equipment specifically intended for metal casting should be used.

Casting should only be carried out in a dry area. Casting equipment should only be used under supervision of a competent teacher with training at least to the standard specified in the *Health and Safety Training Standards in Design and Technology* [N1], or who has equivalent recognized qualifications to industry standards.

All persons involved in pouring molten metal should wear PPE (e.g. suitable eye protection, heat resistant gloves, leather apron, substantial footwear).

Any persons not directly taking part in pouring hot metal should be kept at a safe distance.

Crucibles and any other equipment that will be in contact with the molten material should be preheated before use to avoid cracking and to remove moisture.

Trailing leads should be inspected regularly.

Casting equipment should be included in a planned annual maintenance programme that should include any appropriate electrical safety tests.

17.9 Centrifugal casting equipment

17.9.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Centrifugal casting requires considerable expertise to carry out and to supervise effectively.

b) Spillage or spray of molten metal can occur if the crucible or casting flask is poorly affixed, or if the crucible is cracked.

c) Molten metal in contact with moisture on moulds and equipment can cause an explosion.

d) Some molten metals can give off harmful fumes.

e) Expanded polystyrene patterns can produce large quantities of harmful fumes when in contact with molten metal.

f) Hot metal can cause burns.

g) Unstable equipment or work pieces can cause injury.

h) The equipment can present an electric shock hazard.

17.9.2 Risk control measures

Centrifugal casting equipment should be of sufficient strength to withstand rigorous service. The equipment should be confined to a robust fire-resistant container to minimize risk of spillage or spray of molten metal. Particular attention should be given to secure fixing of the crucible, the adjacent flask, and any connection between them.

Only specifically intended centrifugal casting equipment should be used.

Only a competent person trained to use the equipment, and who has a secure knowledge of the process and the associated hazards, should carry out centrifugal casting. Centrifugal casting should only be carried out in a specially designed heat treatment area.

Before use, crucibles should be closely examined for cracks, splits or broken coatings. Crucibles should be preheated before use. If the "lost-wax" process is used, all traces of wax should be burnt out.

All persons involved in pouring molten metal should wear PPE (e.g. suitable eye protection, heat resistant gloves, leather apron, substantial footwear).

Any persons not directly taking part in pouring hot metal should be kept at a safe distance.

The equipment should not be moved while the material is still molten.

Casting equipment should be included in a planned annual maintenance programme.

17.10 Vacuum and pressure casting equipment

Only a competent person trained to use the equipment should carry out vacuum and pressure casting of metals.

Equipment should be specifically for the purpose and operated in accordance with the manufacturer's instructions.

NOTE Attention is drawn to the Pressure Systems Safety Regulations 2000.

17.11 Heat-treatment ovens

17.11.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Hot surfaces.

b) Electric shock.

c) Gas leaks from furnaces or pipework, which can produce an explosive mixture with air.

d) Fumes.

17.11.2 Risk control measures

Electric heat-treatment ovens should have a means of isolation (preferably a fused switch-disconnecter) on or adjacent to the equipment, controlled by a starter incorporating overload protection and a no-volt release.

Gas heat-treatment ovens should include a non-return valve in the gas supply line.

Heat-treatment ovens should only be used by a competent person trained to use the equipment.

Heat-treatment oven temperatures should be checked by a pyrometer or digital readout temperature sensor.

Boxes used for heat treatment should be of steel.

LEV should be used where fumes are produced.

Appropriate PPE should be used.

Provision should be made to remove items from the heat-treatment oven with suitable lifting and transfer devices and for placing them in a safe position.

The heat-treatment oven should be included in a planned maintenance programme that includes safety inspections and gas and electrical tests as appropriate.

18 Chemical processes for metals and fabrics

18.1 General

All chemicals should be handled with care.

NOTE Chemical substances and mixtures are classified, labelled and packaged in accordance with CLP Regulation (classification, labelling and packaging of substances and mixtures).

Up-to-date information on hazards associated with chemicals should be used. Employees and learners should be made aware of hazards associated with chemicals. Warning labels on bottles, supplier's hazard data sheets and model risk assessments from CLEAPSS should be consulted, and a risk assessment undertaken.

Proper control measures should be applied to the use of chemicals in schools and similar establishments to minimize hazards.

Appropriate PPE should be provided and used by employees and learners.

Only chemicals required for immediate use should be kept in the work area (see **5.2** for recommendations for storage).

18.2 Electronic circuit board etching (including PCB processing equipment)

18.2.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Ferric chloride [iron(III) chloride] is irritant and harmful.

b) Sodium persulfate is an oxidizing agent and an irritant.

WARNING. Mixing ferric chloride with sodium persulfate should be avoided as chlorine gas will be released. CLEAPSS recommends that the two chemicals should not be available together in a design and technology department.

18.2.2 Risk control measures for ferric chloride

Suitable eye protection, conforming to BS EN 166:2002 3, and protective gloves should be used when preparing ferric chloride [iron(III) chloride] solutions and emptying tanks. Skin contact should be avoided. If skin contact occurs, the solution should be washed off with plenty of water.

If etching is carried out in bubble tanks, the lids should be fitted to contain any mist.

NOTE Guidance on disposal of used solutions is available from CLEAPSS. For Scotland, refer to the equivalent document published by SSERC.

18.2.3 Risk control measures for sodium persulfate

Suitable eye protection and protective gloves should be used when preparing and disposing of sodium persulfate solutions.

Crystals should be kept away from combustible materials and sources of heat. Solutions should not be stored in airtight containers as oxygen is released.

When emptying tanks, suitable eye protection and protective gloves should be used. Skin contact should be avoided. If skin contact occurs, the solution should be washed off with plenty of water.

If etching is carried out in bubble tanks, the lids should be fitted to contain any mist.

NOTE Guidance on disposal of used solutions is available from CLEAPSS. For Scotland, refer to the equivalent document published by SSERC.

18.3 Soft soldering

18.3.1 Hazards

Employees and learners should be made aware that fumes from rosin based fluxes are harmful, irritant and can cause respiratory sensitization.

NOTE 1 Rosin based solder flux fumes have a workplace exposure limit (WEL) of 0.15 mg·m^{-3} (15 min reference period) and 0.05 mg·m^{-3} (eight hour reference period). For rosin fumes (as an asthmagen) the COSHH Regulations 2002 (as amended) require employers to ensure that exposure by inhalation is reduced as far as reasonably practicable and in any case to below the WEL.

NOTE 2 Use of lead based solders with a blowtorch can result in the release of lead fumes if temperatures exceeding 500 °C are reached. This is not a significant hazard as lead based solders do not release lead vapour at temperatures below 500 °C. However, lead based solders are currently being phased out of products because of the environmental hazards they pose when the products are recycled.

18.3.2 Risk control measures

NOTE 1 Under the COSHH Regulations 2002 (as amended), there is a duty to prevent exposure to hazardous substances or, where that is not reasonably practicable, to control exposure.

Non-rosin based fluxes should be used wherever possible. Where rosin based fluxes have to be used, a risk assessment on fume inhalation should be carried out and LEV provided as required.

NOTE 2 When soldering is undertaken using a blowtorch LEV will normally be required.

Instruction should be given on correct soldering procedures.

Suitable PPE, including eye protection conforming to BS EN 166:2002 9, should be worn.

18.4 Vitreous enamelling

18.4.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Finely ground borosilicate glass (coloured by trace metallic compounds) is toxic and an irritant to the skin and eyes.

b) If an enamelled surface is reheated too quickly it can shatter and eject particles.

18.4.2 Risk control measures

Enamels should be lead free. Suitable eye protection should be used during heating and when surfaces are allowed to cool. Hands should be washed thoroughly after handling enamels.

18.5 Pickling (acid deoxidizing) and acid etching of metals

18.5.1 General

The use of acids for deoxidizing and etching should be carried out in a purpose made acid bath, bench or container.

18.5.2 Hazards

Employees and learners should be made aware that concentrated acids are corrosive and some are oxidizing agents. Employees and learners should be made aware of the following hazards.

a) Corrosion from acids.

b) Incorrect preparation of acids/etches.

c) Incorrect storage.

d) Splashes from acids.

e) Fumes from acids.

f) Spillages from acids.

18.5.3 Risk control measures

Only a competent teacher or technician should prepare acid solutions.

Suitable eye protection, substantial footwear and protective clothing should be worn during preparation and use of pickling and etching solutions.

Fume control measures should be provided where required by risk assessment.

Splashes of solutions on the skin should be washed off immediately with plenty of water.

Acids should not be stored in open pickling baths. Acids should be securely stored such that they cannot be accessed by unauthorized persons when not in use. Hot metals should not be quenched in acids. A kit containing materials to absorb and neutralize spilt acid should be readily available.

If pickling or etching is only an occasional activity, or if it is carried out on a small scale, consideration should be given to conducting this activity in a science laboratory, where appropriate risk control measures are already to be in place.

18.6 Dyes

18.6.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Some dyes might be carcinogenic.

b) Some dyes are classified as harmful or irritant to the skin and eyes.

c) Some reactive dyes can produce sensitization and allergic reactions.

18.6.2 Risk control measures

All dyes should be handled with care (although many do not present any significant risk to most users).

Extra care should be taken when handling harmful and/or irritant dyes, to prevent ingestion and to protect the skin and eyes.

NOTE 1 Dyes classified as carcinogenic are so classified on the basis of data obtained from studies on laboratory animals using high doses of the dye. If these dyes are used with the normal safety precautions that are taken when handling chemicals in the laboratory, there are unlikely to be long-term effects on the health of persons.

NOTE 2 Persons can become sensitized to dyes so that subsequent exposure even to small doses can provoke an allergenic reaction. Contact can be through inhalation, ingestion or skin absorption. Very reactive dyes are most likely to trigger an allergic response.

The procion MX range of dyes should not be used (procion HE dyes are safer).

NOTE 3 Solutions of dyes are safer to handle than solid dyes.

When preparing solutions of solid dyes, care should be taken to avoid raising any dust that could be inhaled and to ensure that there is no skin or eye contact, gloves and suitable eye protection should be used. If very reactive dyes are used, solutions should be prepared in a fume cupboard.

Learners should handle dyes in solution rather than as solids. Powdered dyes should not be used by learners below year 9. Learners below year 12 should only handle powdered dyes under close supervision.

WARNING. Learners should not handle powder of very reactive dyes.

18.7 Mordants

18.7.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Iron(II) (ferrous) sulfate, potassium dichromate(VI) and tin(II) (stannous) chloride are classified as harmful.

b) Some dye fixatives (e.g. containing sodium silicate), and mordant solutions containing more than 0.5% potassium dichromate(VI), are classified as toxic and irritant to the eyes and skin. Potassium dichromate(VI) is classified as oxidizing, very toxic and dangerous for the environment.

18.7.2 Risk control measures

Care should be taken to prevent ingestion and to protect the skin and eyes from mordants classified as harmful and/or irritant (especially when preparing solutions).

Gloves and suitable eye and body protection should be worn at all times when using mordants and dye fixatives.

18.8 Testing fibres and fabrics

18.8.1 Hazards

Employees and learners should be made aware of the following hazards.

a) The following solutions are classified as corrosive:

- hydrochloric acid (> 25%);
- nitric acid (> 5%);
- sodium chlorate(I) (> 10%);
- sodium hydroxide (> 2%);
- sulfuric acid (> 15%);
- zinc chloride.

b) The following solutions are classified as harmful:

- ammonia solution;
- iodine;
- lead(II) ethanoate;
- propanone;
- nail varnish remover.

c) The following solutions are classified as irritant to skin and eyes:

- ammonia solution;
- iodine solution;
- soda lime;
- sodium chlorate(I) (5% to 10%).

18.8.2 Risk control measures

Many tests on fibres and fabrics present a high level of risk and these tests should not be carried out unless proper facilities are available for working with chemicals. All persons carrying out tests on fibres and fabrics should be fully aware of the risks, the safety precautions required, and the action to be taken in case of accidents.

NOTE 1 Attention is drawn to the appropriate CLEAPSS risk assessments. For Scotland, refer to the equivalent document published by SSERC.

Special care should be taken when preparing solutions for tests. Only a competent teacher or technician should prepare chemical solutions. Suitable eye protection (face shield or goggles) conforming to BS EN 166:2002 9 should be worn.

When investigating samples of fibres or fabrics, only very small quantities of materials and chemicals should be used. If fabrics are to be burned, the tests should be performed in a well-ventilated room using only minute amounts of material. Different chemicals should not be used together, unless required by the test method.

PPE should be worn when corrosive or irritant solutions are handled or dispensed, unless only very small quantities are used when treating fabrics on a test-tube scale.

Tests on fibres and fabrics should not be carried out by learners below year 9. Learners below year 12 should not carry out tests with corrosive chemicals.

WARNING. Trichloromethane (chloroform) is very dangerous by skin absorption, the vapour irritates the eyes, and short-term exposure to high concentrations can cause serious or even fatal poisoning.

Trichloromethane should not be used for tests on fibres and fabrics.

NOTE 2 Further advice on fabric testing is contained in the Model Risk Assessments published by CLEAPSS, particularly 2.012. CLEAPSS advises such work be carried out in a laboratory with the assistance of a suitably qualified science teacher or technician. For Scotland, refer to the equivalent document published by SSERC.

The necessary chemical should always be prepared by a science technician.

18.9 Cleaning fibres and fabrics

18.9.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Tetrachloromethane (carbon tetrachloride) and trichloromethane are toxic and should not be used as cleaning agents.

b) Ammonia solution, methylated spirit, propanone, turpentine and 1,1,1-trichloroethane are harmful.

c) Ammonia solution and sodium chlorate(I) (5% to 10% solutions) (bleach) are irritant to the eyes and skin.

d) Ethanol, methylated spirit and propanone are highly flammable.

e) Enzymes in clothes-washing powders or liquids can cause sensitization and/or allergic reactions. Washing powders and soaking agents can cause skin irritation.

18.9.2 Risk control measures

Highly flammable solvents should not be used near naked flames or other sources of ignition such as hot plates.

White spirit is harmful if swallowed and ethanol vapour should not be inhaled. Methanol and methylated spirit [especially mineralized (blue) methylated spirit] are poisonous and should not be ingested.

NOTE Sodium chlorate(I) (bleach) can be irritant or corrosive depending on the concentration.

Suitable eye protection should be worn and hands should be protected from contact with the solution.

19 Computer-operated equipment

19.1 Laser cutters

19.1.1 Hazards

Employees and learners should be made aware of the following hazards.

a) The equipment can present an electric shock hazard.

b) Leads could be tripped over.

c) Fumes from materials being cut might be harmful.

d) Looking into the light source when working on reflective materials might be harmful.

e) Moving parts might present a tripping hazard.

f) Fire hazard.

19.1.2 Risk control measures

The manufacturer's specific instructions for the particular machine being used should be followed. Leads should be in good condition and should be positioned to prevent tripping or snagging.

A risk assessment should be made when cutting materials that might give off toxic fumes. Appropriate LEV should be provided.

On recirculatory extraction systems the condition of any filters provided to control the fumes should be checked at regular intervals and they should be replaced when necessary.

If there is any chance of the laser beam being reflected into the view of any person in the vicinity of the machine, a cover should be placed over the viewing area of the cutter. The correct power of laser should be used for the material being etched or cut.

The cutter should have all covers or guards in place.

The cutter should be supervised when there is an ignition risk.

19.2 Rapid prototyping including 3D printers, stereolithography (SLA), laser sintering, laminated object manufacture (LOM)

19.2.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Closing movements between parts under power feed, which can present a trapping hazard.

b) Heat, which can be involved in some processes.

c) Lasers.

d) The nature of the material used to form the prototype.

e) Post-build curing processes.

19.2.2 Risk control measures

The manufacturer's specific instructions for the particular machine being used should be followed.

The machine should be guarded by interlocked guards that prevent access whilst the process is ongoing.

Models should be allowed to cool sufficiently to allow safe handling.

NOTE 1 Heat resistant gloves might be needed to remove the model from the machine.

Shields and guarding should be appropriate to the class of laser.

Some polymer models might be toxic and should not be sucked or chewed.

NOTE 2 In the case of powders, attention is drawn to the COSHH Regulations 2002 (as amended) for rules for handling the particular product.

Post-build curing processes should be risk assessed.

19.3 Rapid prototyping (printing) machines

19.3.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Electric shock.

b) Leads, which could be tripped over.

c) Fumes.

d) Toxic materials.

e) The ultraviolet light source.

19.3.2 Risk control measures

Leads should be in good condition and should be positioned to prevent tripping or snagging.

A risk assessment should be undertaken if the machine being used produces toxic fumes. If found to be necessary, LEV should be provided.

A risk assessment should be undertaken if the material that the printer lays down is toxic. Appropriate measures should be undertaken when handling products produced by the printer, if the risk assessment indicates a significant risk.

The printer should be used in accordance with the manufacturer's instructions and all covers should be in place when it is in operation.

19.4 Computer numerically controlled (CNC) machines

19.4.1 General

NOTE CNC machines generally have the same risks associated with them as their manual equivalents. However, they are generally safer in operation because most CNC machines used in education are fully enclosed, with opening doors that are interlocked in such a way that the machine stops if the door is opened whilst the machine is operating under computer control.

Covers of CNC machines should not be removed to allow larger work pieces to be accommodated.

In setting up the machines, there are times when it might be possible for the machine to be operated manually, in which case similar care should be taken to that needed for manually operated machines.

CNC machines should not be left running without supervision.

Where the software allows for emulation of the tool path, this should always be carried out before the material is cut in order to ensure that cutting tools or tools holders will not come too close to the work piece, and that the depth of cut is suitable for the material being machined.

19.4.2 CNC controlled routers

19.4.2.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Contact with revolving cutters can present a hazard.

b) Long hair, loose clothing, etc., can become entangled with rotating cutters or arbors.

c) Broken cutters, waste, work pieces, etc., can be violently ejected.

d) Wood dust can be inhaled.

e) Closing movement between parts, under power feed, can result in finger trapping.

f) Closing movement between the table and fixed structures can result in body crushing.

g) Heavy objects such as vices and jigs or fixtures can fall from the table.

h) CNC routing machines can present an electric shock hazard.

i) Sharp edges on cutters, work pieces and swarf can cause cuts.

j) Inadvertent starting of the machine can present a hazard.

k) Lack of space around the machine can lead to the operator being pushed by passers-by.

l) Slippery floor surfaces or loose items around the machine can cause slips that result in contact with moving parts.

m) Manual handling of heavy equipment such as vices and index fixtures can present a hazard.

19.4.2.2 Risk control measures

The manufacturer's specific instructions for the particular machine being used should be followed.

The machine should be provided with:

a) a means of electrical isolation adjacent to the machine;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) fixed guards (removable only with the use of a tool), or alternatively interlocked guards, that enclose the drive pulleys, belts and gears.

The work piece should be properly secured.

Guards should be used to prevent access to dangerous in-running nips on the pulleys or gearwheels. Cutters should be guarded while in motion to prevent access. Ends of rotating arbors should be fitted with guards to prevent entanglement.

Where not enclosed, CNC routing machines should be fitted with a space of at least 500 mm between the machine table at the extreme ends of its travel and any fixed object.

There should be sufficient space around the machine to prevent the operator from being accidentally pushed by passers-by. The floor surface should not be slippery and should be kept free of loose items.

Suitable eye protection should be used while operating the machine, if the machine is not totally enclosed, and also when cleaning the machine.

Substantial footwear should be worn.

Long hair and loose clothing should be secured so as not to come into contact with moving parts. Jewellery should be removed.

Gloves should not be worn.

A risk assessment should be carried out to evaluate the likely risks to health from inhalation of wood dust and any action required to prevent or control the risks. Normally LEV should be used (see **13.1**).

An assessment should be carried out and measures implemented to minimize risks associated with lifting heavy items (e.g. use of lifting aids, team lifts, correct lifting techniques).

NOTE Manual handling tasks associated with moving heavy work pieces, vices and jigs and fixtures can be beyond the physical capability of some persons.

The machine should be electrically isolated or the computer programme should be stopped before any internal mechanisms are adjusted. The cutters should be stopped when positioning the work piece, clearing waste, measuring or gauging.

Hands should be kept away from the table while it is traversing under power in manual mode to minimize the risk of trapping fingers.

Suitable implements should be used to remove waste, to avoid hand contact.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

19.4.3 CNC controlled centre lathes

19.4.3.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Long hair, loose clothing, etc., can become entangled in moving parts of the lathe.

b) Work pieces, chuck keys, broken cutting tools, swarf, etc., can be violently ejected from the lathe.

c) CNC centre lathes can present an electric shock hazard.

d) Closing movements between parts under power feed can present a trapping hazard.

e) Sharp edges on tools, work pieces and swarf can cause cuts.

f) Contact with cutting fluids, oil and grease can irritate the skin.

g) Swarf can jam or be ejected if allowed to build up.

h) Inadvertent starting of the machine can present a hazard.

i) Lack of space around the machine can lead to the operator being pushed by passers-by.

j) Slippery floor surfaces or loose items around the machine can cause slips that result in contact with moving parts.

k) Manual handling (lifting) of heavy equipment (e.g. chucks, faceplates) can present a hazard.

19.4.3.2 Risk control measures

The manufacturer's specific instructions for the particular machine being used should be followed. The machine should be provided with:

a) a means of electrical isolation adjacent to the machine;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) fixed guards (removable only with the use of a tool), or alternatively interlocked guards that enclose the drive mechanisms.

The machine should be fitted with suitable guarding. If feed shafts or lead screws are outside of the guarded areas and are not sufficiently protected by the overhang of the bedways and/or saddle and swarf trays, a telescopic helical metal guard should be provided.

There should be sufficient space around the machine to prevent the operator from being accidentally pushed by passers-by. The floor surface should not be slippery and should be kept free of loose items and swarf.

Only one person at a time should operate the machine.

Suitable eye protection should be used while operating the machine, if the machine is not totally enclosed, and also when cleaning the machine.

Substantial footwear should be worn.

Long hair and loose clothing should be secured so as not to come into contact with moving parts. Jewellery should be removed.

Gloves should not be worn.

An assessment should be carried out and measures implemented to minimize risks associated with lifting heavy items (e.g. use of lifting aids, team lifts, correct lifting techniques).

NOTE Manual handling tasks associated with changing heavy chucks and faceplates, etc., can be beyond the physical ability of some persons.

The machine should be electrically isolated or the computer programme should be stopped before any internal mechanisms are adjusted. The power to drive feed shafts or lead screws should be disconnected until required. The chuck key, preferably spring-loaded, should be removed immediately after use and before starting the machine.

Work mounted to a faceplate, a chuck or between centres should be properly secured and balanced to prevent excessive vibration. The rotational clearance should be checked by hand before starting the machine. The cutting tool should also be carefully checked for security before starting the machine.

Stock bar should not project beyond the headstock. If this is unavoidable, the portion of stock bar projecting beyond the headstock should be guarded to prevent entanglement.

Coolant nozzles should not be adjusted while the machine is in operation.

The machine should be stopped when measuring or gauging, and the cutting tool positioned to minimize possible contact.

Swarf should not be allowed to accumulate as it can become entangled or ejected by the chuck or work piece. Swarf should not be removed while the machine is operating. A suitable implement should be used to avoid hand contact with swarf.

Metalworking fluids, if used, should be mixed and changed in accordance with the supplier's instructions. Contact with the skin should be kept to a minimum. Hands should be washed thoroughly after use.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

19.4.4 CNC controlled milling machines or machining centres, and engraving machines

19.4.4.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Contact with revolving cutters can present a hazard.

b) Long hair, loose clothing, etc., can become entangled with rotating cutters or arbors.

c) Broken cutters, swarf, work pieces, etc., can be violently ejected.

d) Closing movement between parts, under power feed, can result in finger trapping.

e) Closing movement between the table and fixed structures can result in body crushing.

f) Heavy objects such as vices and jigs and fixtures can fall from the table.

g) CNC milling machines can present an electric shock hazard.

h) Sharp edges on cutters, work pieces and swarf can cause cuts.

i) Contact with cutting fluids, oils and greases can irritate the skin.

j) Inadvertent starting of the machine can present a hazard.

k) Lack of space around the machine can lead to the operator being pushed by passers-by.

l) Slippery floor surfaces or loose items around the machine can cause slips that result in contact with moving parts.

m) Manual handling of heavy equipment such as vices and index fixtures can present a hazard.

19.4.4.2 Risk control measures

The manufacturer's specific instructions for the particular machine being used should be followed. The machine should be provided with:

a) a means of electrical isolation immediately adjacent to the machine;

b) a conveniently positioned and accessible, emergency stop switch (which could be the normal "off" switch) or other suitable control device that can quickly stop the machine in an emergency;

c) fixed guards (removable only with the use of a tool), or alternatively interlocked guards, that enclose the drive pulleys, belts and gears.

The work piece should be properly secured.

Guards should be used to prevent access to dangerous in-running nips on the pulleys or gearwheels. Cutters should be guarded while in motion to prevent access. Ends of rotating arbors should be fitted with guards to prevent entanglement.

Where not enclosed, CNC milling machines or machining centres should be fitted with a space of at least 500 mm between the machine table at the extreme ends of its travel and any fixed object.

There should be sufficient space around the machine to prevent the operator from being accidentally pushed by passers-by. The floor surface should not be slippery and should be kept free of loose items.

Suitable eye protection should be used while operating the machine, if the machine is not totally enclosed, and also when cleaning the machine.

Substantial footwear should be worn.

Long hair and loose clothing should be secured so as not to come into contact with moving parts. Jewellery should be removed.

Gloves should not be worn.

An assessment should be carried out and measures implemented to minimize risks associated with lifting heavy items (e.g. use of lifting aids, team lifts, correct lifting techniques).

NOTE Manual handling tasks associated with moving heavy work pieces, vices and indexing heads can be beyond the physical capability of some persons.

The machine should be electrically isolated or the computer programme should be stopped before any internal mechanisms are adjusted. The machine and cutters should be stopped when positioning the work piece, clearing swarf, adjusting coolant hoses, measuring or gauging.

Hands should be kept away from the table while it is traversing under power to minimize the risk of trapping fingers.

Suitable implements should be used to remove swarf to avoid hand contact.

If metalworking fluids are used, they should be mixed and changed in accordance with the supplier's instructions. Contact with the skin should be kept to a minimum. Hands should be washed thoroughly after use.

The machine should be included in a planned maintenance programme that should include electrical safety inspections and tests.

Section 5: Materials

20 Materials

NOTE The COSHH Regulations 2002 (as amended) and the Dangerous Substances and Explosive Atmospheres Regulations 2002 require that a full assessment of risks to health and any steps required to eliminate or control these risks is carried out. Control measures have to be put into effect before any hazardous substances are used.

20.1 Material safety data sheets

NOTE It is a legal requirement under the REACH Regulations 2007 to provide a safety data sheet and the COSHH Regulations 2002 (as amended) advise suppliers on the use of data sheets.

Employees should ensure, for materials for which this is relevant, that current material safety data sheets are available and that the control measures given are followed.

20.2 Asbestos and products containing asbestos

20.2.1 Hazards

Employees and learners should be made aware that asbestos dust and fibres can be inhaled.

20.2.2 Risk control measures

Asbestos containing materials should not be used. All fire blankets, mats, gloves, ropes, wools, fillers, cement and brake/clutch linings should be asbestos free.

NOTE 1 The Control of Asbestos Regulations 2012 require employers to assess the likely exposures to asbestos and to ensure that concentrations of airborne asbestos fibres do not exceed strict exposure limits. Advice from specialists might be required. In some cases it is required that the HSE are notified before work with asbestos containing materials can be carried out.

NOTE 2 If any asbestos is present in the department it is a requirement under the Control of Asbestos Regulations 2012 for this to be included in the establishment's asbestos management plan.

20.3 Adhesives

20.3.1 General

20.3.1.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Adhesives in contact with the eyes can cause permanent injuries.

b) Adhesives in contact with the skin can cause irritation. Some adhesives are toxic by absorption through the skin. Hot adhesives can cause burns.

c) Inhalation of solvents, fumes and vapours can present a hazard and can cause respiratory sensitization.

d) Adhesives containers can spill or leak.

e) Adhesives vapours can be highly flammable.

20.3.1.2 Risk control measures

Adhesives should be used in accordance with the manufacturer's instructions.

Sufficient ventilation should be provided, in accordance with the manufacturer's recommendations.

NOTE Under the COSHH Regulations 2002 (as amended), a risk assessment needs to be carried out.

LEV should be provided if required.

Non-hazardous or reduced-hazard alternatives should be used in preference to adhesives that carry the risk of respiratory sensitization.

20.3.2 Formaldehyde resins

20.3.2.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Formaldehyde resins release toxic fumes, but at very low concentration.

b) Inhalation of unmixed powder can present a hazard.

c) Formaldehyde resins can irritate the eyes and skin.

d) Some formaldehyde resins are highly flammable.

e) Formaldehyde resins are a skin sensitizer.

f) Liquid hardener can be corrosive.

20.3.2.2 Risk control measures

A safer substitute should be used if available.

Formaldehyde resins should be used in accordance with the manufacturer's instructions. Sufficient ventilation should be provided.

Protective gloves or a barrier cream should be used.

Dust release should be kept to a minimum when mixing powder.

Formaldehyde resins should be stored in appropriate containers.

Containers should be closed when not in use.

20.3.3 Epoxy and polyester resins

20.3.3.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Epoxy and polyester resins are hazardous if ingested or absorbed through the skin.

b) Vapour and dust can irritate the eyes and skin. Resins can be a cause of dermatitis.

c) Dust from machining fully cured resin can irritate the eyes, nose, throat and lungs.

d) Epoxy resins can produce highly flammable vapours.

20.3.3.2 Risk control measures

Epoxy and polyester resins should be stored in securely closed containers. Care should be taken to prevent leakage.

Sufficient ventilation should be provided. All sources of ignition should be removed.

Epoxy and polyester resins should not be allowed to come into contact with the eyes or skin. Protective gloves should be worn.

Suitable eye protection and RPE should be worn during machining and shaping of cured resins.

20.3.4 Cyanoacrylate adhesives ("superglues")

20.3.4.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Cyanoacrylate adhesive vapours can irritate the skin and nasal passages.

b) Cyanoacrylate adhesives can rapidly bond skin.

20.3.4.2 Risk control measures

A safer substitute should be used if available.

Proper instruction should be given on use of cyanoacrylate adhesives.

Sufficient ventilation should be provided.

Suitable eye protection should be worn. A barrier cream should be used on hands.

20.3.5 Solvent-based rubber solutions and polymer cements

20.3.5.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Solvent-based rubber solutions and polymer cements produce highly flammable vapours.

b) Inhalation of vapours can be harmful.

c) Solutions can irritate the skin and eyes.

20.3.5.2 Risk control measures

A safer substitute should be used if available.

Sufficient ventilation should be provided.

All sources of ignition should be removed.

Suitable eye protection should be worn.

20.3.6 Rubber-based and water-based adhesives

20.3.6.1 Hazards

Employees and learners should be made aware that rubber-based and water-based adhesives can cause allergic reactions.

20.3.6.2 Risk control measures

Rubber-based and water-based adhesives should not come into contact with eyes and skin.

20.3.7 Acrylic cement

20.3.7.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Inhalation of acrylic cement vapour can present a hazard. Vapours can irritate the eyes, skin and respiratory tract.

b) Methyl methacrylate is a respiratory sensitizer.

c) Acrylic cement vapour is flammable and potentially explosive in air.

20.3.7.2 Risk control measures

A safer substitute should be used if available.

Acrylic cement should be refrigerated prior to use.

Sufficient ventilation should be provided.

Suitable eye protection should be worn. Learners with sensitive skin should wear gloves.

Acrylic cement should only be used for a short time, depending on the level of ventilation. Only an appropriate amount of acrylic cement should be used for each application. Work should be carried out well away from any source of ignition.

20.3.8 Hot melt glue using glue guns

*NOTE Guidance on the use of glue guns is given in **12.14**.*

20.4 Plastics

20.4.1 General

NOTE 1 The COSHH Regulations 2002 (as amended) require a suitable risk assessment to be carried out before plastics materials are used.

Manufacturer's instructions and warnings associated with plastics, materials and items of equipment should be complied with. Unidentified plastics materials should not be used.

Care should be taken if working on brittle plastics sheet material. Taping and safe handling techniques should be used to avoid shattering.

NOTE 2 Many plastics materials produce dust and other fine particles when machined or abraded. Persons suffering from asthmatic conditions are at increased risk from the health hazards arising from abrading of plastics materials.

Hand methods of abrading should be preferred over machining, and water should be used as a lubricant where practicable.

Sufficient ventilation should be provided. Concentrations of vapours from solvents and cement should be kept to a minimum. A risk assessment should be carried out and LEV provided if required.

NOTE 3 In many cases there can be a delayed reaction to inhalation of toxic vapours in the work area.

Ventilation should be provided at a rate of six to eight air changes per hour.

Plastics materials should be stored in cool, dry conditions. Stocks of plastics materials should not exceed the quantities required for three months.

20.4.2 Acrylic and other thermoplastics materials

20.4.2.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Dust from hand and machine cutting and shaping of acrylic and other thermoplastics materials can irritate the eyes, nose and throat. Inhalation of dust can present a hazard.

b) Heat softened plastics can stick to skin.

c) Work pieces can shatter during machining.

20.4.2.2 Risk control measures

Sufficient ventilation should be provided.

If possible, water should be used as a lubricant to minimize dust.

Suitable eye protection and RPE should be worn during machining. Gloves should be used if work pieces are heat softened.

Work pieces should be securely clamped during machining.

20.4.3 Expanded polystyrene

20.4.3.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Overheated expanded polystyrene can produce fumes.

b) Dust or solid pieces can irritate the eyes.

c) Inhalation of dust can irritate the upper respiratory tract.

20.4.3.2 Risk control measures

A safer substitute should be used if available.

Hot wire cutters should be used at the lowest temperature practicable, and a risk assessment made to determine the level of ventilation required.

Sufficient ventilation should be provided.

20.4.4 Rigid polyurethane foam

20.4.4.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Heated rigid polyurethane foam produces hazardous fumes.

b) Dust from abrading can present a hazard.

20.4.4.2 Risk control measures

Hot wire cutters should not be used to cut rigid polyurethane foam.

Sufficient ventilation should be provided.

Suitable eye protection should be used during abrading or cutting rigid polyurethane foam.

20.4.5 Glass reinforced polyester (GRP) resin

20.4.5.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Polyester resin and glass reinforced polyester resin can produce fumes until fully cured. Fumes are flammable and can irritate the eyes and respiratory system.

b) Very high concentrations of vapour can build up in confined spaces (e.g. inside a canoe).

c) Resins degrease the skin and prolonged contact can cause dermatitis.

d) Catalysts in resins are very irritating to the eyes, throat and upper respiratory system. Prolonged contact with the eyes causes permanent damage.

e) Catalysts and accelerators can react violently or explode if mixed.

20.4.5.2 Risk control measures

Sufficient ventilation should be provided. LEV should be used if required. Work should not be carried out near to sources of ignition.

Not more than 1 m^2 of laid up material should be in the work area at any time. Not more than 0.25 kg of casting resin should be used at any time.

Laying up should not be carried out at floor level.

Resins should be of the pre-accelerated type. Catalysts and accelerators should not be mixed together directly. Calibrated dispensers should be used. Only a competent teacher or technician should dispense these materials.

Suitable eye protection and protective gloves should be worn.

20.5 Timber

NOTE Information on specific woods and possible adverse health effects are given in Toxic woods, Woodworking Sheet No 30 (Revision 1).

20.5.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Wood dust irritates the eyes and respiratory tract.

b) High exposure to wood dust can cause or exacerbate skin, lung and nasal disorders, including asthma, and, rarely, cancer.

c) High concentrations of fine wood dust in the air can form an explosive mixture.

d) Wood dust accumulated on surfaces is a fire hazard.

e) Wood dust on the floor of the work area can be slippery.

f) Brushing can create airborne dust.

g) Handling heavy samples can be hazardous.

20.5.2 Risk control measures

NOTE 1 The COSHH Regulations 2002 (as amended) require a risk assessment to be carried out on wood dust to determine the control measures required. A combination of control measures might be required.

NOTE 2 Regular users of timber materials (especially if sanding is regularly carried out) are at increased risk of cumulative hazards to their nasal and upper respiratory passages. The degree of risk depends on the dust concentration, the length of exposure and the type of material.

All timber-based dusts are assigned with an HSE maximum workplace exposure limit (WEL) of 5 $mg \cdot m^{-3}$, and control measures should be put in place to reduce exposure to the lowest reasonably practicable level.

Sufficient general ventilation should be provided. A risk assessment should be carried out, and LEV provided if required. Where an effective LEV system is not in place, a dust mask conforming to BS EN 149:2001+A1:2009 class FFP3 should be used.

Removal of large amounts of material using machine sanding should be kept to a minimum.

RPE should be worn during any prolonged hand or machine sanding.

Work areas (including floors) should be kept clean using a vacuum cleaner with high efficiency particle arrestance (HEPA) air filters.

20.6 Metals

*NOTE The recommendations given in **20.6.1** and **20.6.2** apply to commonly used metals in design and technology work areas.*

20.6.1 Hazards

Employees and learners should be made aware of the following hazards.

a) Waste materials from processing metals can damage the eyes and skin.

b) Coolants and cutting oils can irritate the eyes and can cause dermatitis.

c) Falling materials can present a hazard.

20.6.2 Risk control measures

Proper instruction should be given on safe handling of metals and metal waste.

Suitable eye protection should be worn when machining metals.

Hands should be washed thoroughly after contact with metals and coolants.

20.7 Food and food components

20.7.1 General

Teachers, technicians and supervisors using food or food components should be competent in food hygiene. As a minimum qualification, a nationally recognized food safety certificate should be held and, preferably, the relevant qualification from the *Health and Safety Training Standards in Design and Technology* [N1]. All teachers and supervisors handling food should be aware of the requirements of the Food Safety Act 1990, the Food Safety (Temperature Control) Regulations 1995 and the Food Safety (General Food Hygiene) Regulations 1995.

NOTE These regulations might not apply to food technology departments in schools unless the food is for sale. Advice can be sought from the local environmental health department.

20.7.2 Hazards

Employees and learners should be made aware of the following hazards.

a) Fungi, bacteria and viruses, which can cause food poisoning.

b) Potential allergic reactions.

c) Poor personal hygiene.

d) Inappropriate storage areas or temperatures.

e) Inappropriate food preparation areas.

f) Inappropriate clothing.

g) Cross contamination.

h) Inadequate cleaning.

i) Waste food.

20.7.3 Risk control measures

Hands should always be washed thoroughly before handling food.

Any employees or learners displaying symptoms or recovering from illness or food poisoning or who have suffered in the previous 48 hours should not handle food.

Learner records should be checked for potential allergies.

Appropriate, clean and hygienic clothing should be worn. Cuts and sores should be covered with appropriate waterproof dressings.

Cooked and raw foods should be kept separate.

Food should be kept clean, covered and stored correctly. Food should always be stored at the appropriate temperature.

Food handling areas should be kept clean at all times and all tools and equipment should be clean before use.

Waste food should be stored and disposed of appropriately.

Hazard analysis and critical control points (HACCP) should be applied as appropriate.

20.7.4 Food storage management

Dry and shelf stable foods (e.g. bread, bottled foods, canned foods) should be stored in dry, well ventilated rooms with a temperature range of 10 °C to 15 °C. These foods should not be stored on the floor and storage should facilitate rotation. The manufacturer's storage instructions should be followed. Open packets of dry food should be stored in re-sealable plastic containers

Raw and unprepared fruit and vegetables should be stored away from other foods in a cool, dry and well-ventilated area, not exposed to full sunlight and with a temperature range of 10 °C to 15 °C.

Frozen foods should be stored at a temperature between packs of at least minus 18 °C.

Perishable foods (e.g. fish, meat and poultry, dairy products, prepared fruits and vegetables, opened canned and bottled foods, uncooked or partly cooked pastries and dough products) should be stored with a core temperature of between 1 °C and 4 °C. Cook-chilled food should be stored between 0 °C and 3 °C.

All freezers, refrigerators and chillers should be regularly checked and recorded to ensure that the correct temperature is maintained.

Food stored in a refrigerator or freezer should be wrapped or placed in suitable containers and dated.

Raw and cooked foods should be kept apart at all times and separate handling equipment should be used for each. If only one refrigerator is available, raw foods should be stored on shelves below cooked foods.

Hot foods should not be placed in refrigerators or freezers.

Hot food should be covered, and cooled as quickly as possible, using a rapid cooler if available.

Sufficient refrigerator or chiller unit space should be available to store perishable ingredients and/or finished food products belonging to learners, during the school day.

Reheated food should be brought to at least 70 °C for at least two minutes. Hot food should be kept at a minimum of 63 °C.

20.8 Fabric and fibres

20.8.1 General

Teachers, technicians and supervisors using textiles or textile components should be competent.

As a minimum qualification, a nationally recognized safety certificate should be held and, preferably, the relevant qualification from the *Health and Safety Training Standards in Design and Technology* [N1].

20.8.2 Hazards

Employees and learners should be made aware of the following hazards.

a) Inappropriate storage of fabrics and fibres.

b) Needles, pins and other sharp implements.

c) Testing of fabrics, which can produce harmful fumes.

d) Dyes, mordants, paints, and inks.

e) Materials which can cause irritation.

f) Processes, such as those where heat is used to "distress" fabrics, might cause hazards.

20.8.3 Risk control measures

All fabrics and fibres should be stored appropriately and away from any sources of ignition and all waste bins should be regularly emptied.

An appropriate risk assessment should be made prior to using dyes, mordants, paints, and inks.

Care should be taken when using needles, pins, unpickers, and any other sharp implements.

Where distressing of fabrics is done, a risk assessment should be made of the hazards that might be caused by heat, including fumes from burning fabrics.

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