MODEL RISK ASSESSMENTS
FOR DESIGN AND TECHNOLOGY
IN SECONDARY SCHOOLS AND COLLEGES

CLEAPSS®, The Gardiner Building, Brunel Science Park, Kingston Lane, Uxbridge UB8 3PQ
Tel: 01895 251496 *Fax/Answerphone:* 01895 814372 *E-mail:* science@cleapss.org.uk *Web site:* www.cleapss.org.uk

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Model Risk Assessments for Design & Technology: General Introduction

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CLEAPSS, The Gardiner Building, Brunel Science Park, Uxbridge UB8 3PQ. Tel: 01895 251496,
fax / answerphone: 01895 814372, email: dt@cleapss.org.uk, web site:
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Foreword

This edition (2016) is the sixth full version; it takes into account the reclassification of some substances and changes in nomenclature and values of exposure limits. These changes have not had much effect on the risk assessments because, in those cases where the revision was an increased hazard, the substance was already handled with maximum precautions. It is hoped that this edition will also prove useful to university departments and others involved in training teachers of design and technology, whether on an initial course or an in-service one.

We would like to thank everyone who has been involved for the contributions that have been made over the years in developing this resource.

This edition incorporates some changes arising from comments sent in by users for which CLEAPSS is very grateful. Since every risk assessment must be subject to review in the light of changes of circumstances and new information, this publication will be further revised when necessary. Any further comments will continue to be gratefully received. This edition also takes into account changes in the most recent edition of the British Standard Code of Practice, *Health and Safety for Design and Technology in Schools and Similar Establishments*, BS 4163:2014 and other related legislation and guidance.

This document is available only to local authority members of this Consortium (and so to their schools) and to those foundation, voluntary aided and independent schools, academies, incorporated colleges and other institutes that are members of CLEAPSS.

If more information is required on any of the topics in this booklet, then readers should contact CLEAPSS.

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INTRODUCTION

Work in design and technology is bound to include the teaching of safe practices, in school, domestically and to some extent industrially. The information included in this part stresses the importance of helping teachers and students to become aware of the various hazards involved in the use of equipment, materials and their storage during activities with textiles and other compliant materials. The emphasis is placed on the acquisition and development of appropriate knowledge and skills so that safe procedures are implemented. What is learned and practised at school will clearly also be relevant for future lives.

Unlike work in the home, however, activities in school are covered by health and safety legislation. Not only must health and safety be considered, there must also be evidence that safe and healthy systems of working have been set up and are in action. The protection of staff health and safety is just as important as protecting children or students and is more likely to be overlooked.

The general requirement in the National Curriculum and GCSE and A Level specifications is to teach about health and safety as well as to work in a safe and healthy manner. Pupils will, where appropriate, be taught to understand hazards and risks and how they should be managed. However this resource is designed to support the planning and work of teachers, technicians and others in working safely in a hazardous environment.

The model risk assessments should help teachers to understand the basis of the rules but are not intended as teaching materials. It would be inappropriate in many cases to copy them and issue them to students, however the content can be shared with students to help them to understand the importance of planning safety into an activity.

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How to use model (or general) risk assessments – Summary

The model risk assessments are not an end in themselves; merely possessing them does not meet the various regulations which call for risk assessments.

Model risk assessments are starting points which Design and Technology departments must adapt to their local circumstances and use in preparing activities for their pupils or students. Teachers should make reference to the CLEAPSS guide L235, *Managing Risk Assessment in Design and Technology* for advice and guidance on how to carry out risk assessments.

One way of adapting model risk assessments is to consider the following questions:

- *What is the proposed activity?*
  - Is it to be done by teachers, technicians or pupils / students?
  - Do all staff have the necessary skills and experience to do and supervise this activity? If not, the activity must be restricted to those with the skills until training has taken place.
  - Does it use equipment listed in these Model Risk Assessments? If so, locate the associated MRAT(s).
  - Does it use chemicals, eg, adhesives, finishes or cleaning materials? If so, find the sheet(s).

If no sheets are available and you consider the activity could be hazardous, telephone the CLEAPSS *Helpline* (01895 251496) for advice.

- *Do any rooms have layout / space / equipment problems?*
- *Do the MRATs list Control Measures which your facilities cannot provide?*
  (For example, is local exhaust ventilation essential but yours is inadequate or broken?)
- *Can you avoid the problem perhaps by restricting the work to small groups or by working outside?*

Record the MRAT numbers and your conclusions in a place where all staff will be aware of them.
(See below under *Management Regulations* for suggestions of suitable locations.)

Answer for each lesson:

- *Is this an activity I can supervise? If not, see the department arrangements.*
- *Does this activity require preparation which the technician can do or must I do it?*
- *Is my class ready for this activity?*
- *Are the class members mature enough to follow my instructions or should I defer it until later in the year or later in the course?*
- *Is the class too large for all to do this activity at once? If so, how large a group should it be?*
- *Are there pupils in this class whose presence would make this activity unsafe for all?*

Note your conclusions in your lesson plans.

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HEALTH & SAFETY LAW

Common law duty of care

It has been established for centuries that all adults have a duty to do what they can to look after the safety of others, particularly the young or others that may have problems in caring for themselves. It applies to those met casually as well as those met in the course of everyday activities including work.

The Health and Safety at Work (etc) Act and its Regulations

The *HSW Act* of 1974 extended the common law duty of care and gave certain bodies and persons specific duties to preserve health and safety. In particular, it laid duties on employers to care for the health and safety of their employees and all others who are affected by the activities of the employers. This **duty** cannot be delegated so it is essential for all those at work to know the particular person or body with whom their contract of employment is made.

In the case of schools the employer is likely to be the local authority (for community and voluntary controlled schools), for academies, free schools, UTCs and studio schools, the employer will be the Trust, the education and library board (in Northern Ireland), the governing body (for foundation and voluntary aided schools, some academies and for some independent schools). For incorporated colleges, the employer is usually the body corporate; for some independent schools it is a charity or the proprietor.

Although the duty cannot be delegated, the employers can delegate particular **tasks** to employees to enable employers to meet their duties. If an employer does this, he retains the responsibility for seeing that the task is done properly.

This fundamental principle does not, however, remove all responsibility for health and safety from employees. The Act specifically lays on employees the **duties** to take reasonable care for their own and others' health and safety, to cooperate with their employers and not to misuse equipment provided for health and safety.

One of the most significant features of the *HSW Act* is the power that it gives to the government of the day to make regulations on health and safety matters. Current regulations include:

- the *Health and Safety (First-Aid) Regulations* 1981 (re-interpreted in 1997);
- the *Management of Health and Safety at Work Regulations* 1999 (the Management Regs);
- the *Provision and Use of Work Equipment Regulations* 1998 (PUWER);
- the *Personal Protective Equipment Regulations* 2002 (PPE Regs)
- the *Control of Substances Hazardous to Health Regulations* 2002 (COSHH Regs).

Each of these Regulations has an associated Approved Code of Practice (ACoP) or a guidance booklet that explains how the regulations are to be interpreted. While it is a criminal offence to fail to comply with both the *HSW Act* and the regulations made under it, in those court cases involving education, the charge has usually been failure to comply with the Act itself. Evidence that the advice in an ACoP has been followed forms an effective defence against a charge of negligence under the Act. The size of fines

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levied by courts in recent years has increased dramatically and this trend is likely to continue.

Duties of employers

Since the **employer** has the ultimate duty to ensure health and safety in a place of work, the employer must give instructions on how this is to be achieved. This is done through the Health and Safety Policy which often provides the overall instructions and the policy may be extended by more detailed guidance in one or more codes of practice. In many cases, it is useful for the practical departments of a school to have subsidiary health and safety policy documents that are endorsed by the employer (or his representative). Indeed, these departmental policies are often required by the employer and their value is stressed by OFSTED.

The Management Regulations

The *Management Regulations* include a requirement for employers to assess the risks to health and safety that arise from their activities.

The first step is to identify the hazards, where a **hazard** is anything with the potential to cause harm. The risk expresses both the likelihood of that harm being realised and the severity of that harm (ie, the number of people who could be harmed and the extent of the injury or resulting health problems).

The employer is also required to see that staff are appropriately **trained and retrained** (the Health and Safety Training Standards in Design and Technology published by DATA[1] can be used to satisfy this requirement). The DATA standards list the competencies staff should achieve to give instruction in particular activities.

Where the training budget has been delegated to individual schools, the employer does not have to provide 'free' training: the school may be required to fund it. Training does not have to be provided all at once but it is **essential** that a programme of training is planned and executed.

The *Management Regulations* 1999 incorporate the *Health and Safety (Young Persons) Regulations* 1997. These define a **child** as one below statutory school-leaving age and a young person as one older than this but below the age of 18. The Regulations require employers to ensure that **young persons** in their employment are protected at work from any risks to their health and safety that are a consequence of their lack of experience or maturity. However, a young person may be exposed to risk where necessary for training, when supervised by a competent person and where the risk is reduced to the lowest level that is reasonably practicable.

The employer also has a duty to **monitor** that the arrangements for health and safety are working. The mechanism by which this requirement is met may be delegated to senior staff in individual schools or departments with regular reports to the employer.

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[1] ISBN 1898788472 available from www.data.org.uk, Although it is not mandatory to follow this scheme, it is a recognised method for employers to show that their D & T staff are adequately trained.

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Use of model risk assessments
The requirement for employers to assess the risks to health and safety is relatively simple in manufacturing industry where the same few operations are repeated many times a day and for day after day. In education, the activities may be less hazardous than in the manufacturing industry, but there is an enormous variety of activities going on, potentially requiring many thousands of risk assessments.

The ACoP for the *Management Regulations* contains a suggested method for reducing the magnitude of this problem:
"Employers who control a number of similar workplaces containing similar activities may produce a basic 'model' risk assessment reflecting the core hazards and risks associated with these activities. 'Model' assessments may also be developed by trade associations, employers' bodies or other organisations concerned with a particular activity. Such **model assessments** may be applied by employers or managers at each workplace, but **only if** they:

a) satisfy themselves that the model assessment is broadly appropriate to their type of work; and
b) adapt the model to the detail of their own actual work situations, including any extension necessary to cover hazards and risks not referred to in the model."

If employers choose this route, they must tell their staff which sources to use as models and ensure that any necessary adaptation is done and recorded.

This publication, *Model Risk Assessments for Design and Technology in Secondary Schools and Colleges*, is an example of a source produced by an employers' body. Adaptation is needed for two reasons:

1. To cope with problems arising from the premises or equipment and,
2. to cope with different pupil groups.

Problems with premises may arise, for example, if the model assessment states that 'good general ventilation will be sufficient' to deal with a substance in the air but the staff need to consider whether the ventilation in the room used for this operation is 'good'. A ventilation engineer will usually specify this as '2.5 air changes per hour'. This means that enough fresh air is entering (and leaving) the room in each hour to completely replace the air in the room two and a half times. This rate is sufficient to remove body odour from a class of 30 pupils that are sitting still. If they are active or have just returned from a PE lesson then the rate should be higher and, if the activity involves smelly chemicals or cooking, a rate of 5 air changes per hour is considered advisable. If it is necessary to open windows when the class has just been to PE then the risk assessment needs adaptation by the addition of the words 'with open windows'.

It is **essential** for any ventilation system in a teaching space to be sufficiently quiet for the teacher's voice to be heard without the need to shout. If this is not achieved then the ventilation system will become a nuisance and over time the system will not be used, therefore not fulfilling its requirements.

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Quiet systems nearly always involve remote fans and properly-designed ducts. It is, of course, essential to allow fresh air into a room if stale air is being extracted.

The other sort of adaptation is one which good teachers have always done; they have asked themselves the question ‘is this class sufficiently mature or experienced to follow my instructions and complete this activity safely?’ If the answer is ‘No’, then the teacher should defer this activity until the class is older and/or more experienced or the teacher modifies the activity so that the pupils can do it safely.

Similarly, an activity may be safe if ‘well-supervised’ but the number or nature of the pupils may make this impossible. If a planned activity has to be modified or cancelled due to the behaviour of pupils this should be reported to the school management.

The guidance from HSE officials is that adaptations and other notes related to risk assessment should be recorded in ‘point of use’ documents, these may be; the **scheme of work** or **lesson plan**. Other risk assessment materials such as COSHH data sheets or information about particular issues such as heating or lighting, which have a general effect across a department, could usefully be in the **departmental health and safety policy** document.

For example, reminders to use extract fans could be in the scheme of work but policy decisions would best be put in the policy document such as:

- a particular machine or appliance will not be used by classes below a certain age or key stage;
- a particular activity should not be done if the class size exceeds 20;
- a specific skill is needed to change the grinding wheel.

If users come across substances or activities for which no model risk assessment can be found, then they should contact CLEAPSS for advice.

Particular Management Regulations

The regulations that refer to assessment of risks and their control may be summarised as follows.

Regulation 3	Requires employers to make suitable and sufficient assessments of the risks to health and safety resulting from the activities being carried out, to review and record them. (The hazards and model risk assessments for each activity are contained on the sheets in this CLEAPSS publication.)
Regulation 4	Lists the principles to be applied when dealing with risks. These principles have been used to draw up these model risk assessments.
Regulation 6	Requires the provision of appropriate health surveillance and this probably includes watching out for the symptoms of stress in oneself and colleagues.
Regulation 8	Identifies danger areas as those where the level of risk is unacceptable unless special precautions are taken. This is interpreted as including those rooms used for instruction in design and technology where

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	employees require particular skills and extra health and safety instruction.
Regulation 10	Requires employers to provide their employees with comprehensible information on the risks that have been identified. (This information is given on individual sheets in this publication.)
Regulation 13	Requires employers to assess the capabilities of their employees and provide them with information, instruction and training (some of which could be done 'in house'). Although these sheets can provide information, it is unlikely that merely the issue of this set to all schools will be regarded as an adequate discharge of this duty.
Regulation 14	Requires each employee to follow the instructions of the employer and to report to their employer any defects in the equipment or instruction provided.

The COSHH Regulations
Substances, both natural and manufactured, can be hazardous to health. These hazards are discussed in some detail in Section 7 of the CLEAPSS Laboratory Handbook, which should be available in the Science Department or from the CLEAPSS web site. The *COSHH Regulations* require employers to assess the risks to health from substances used at work and to comply with workplace exposure limits that are discussed in detail below.

General risks in handling chemicals
Apart from the hazards to long-term health from handling chemicals, they can also present hazards that may give rise to injuries. Some substances used in Design and Technology present a significant fire risk while others may react explosively with common materials.

Clearly, it is important that access to chemicals, whatever the hazard, must be controlled so that no persons, either adults or children, may put themselves or others at risk. Unattended stores or cupboards which contain solvents, glues, paints, acids, dyes, cleaning materials, etc must therefore be locked.

Each hazardous substance (eg, highly flammable, highly combustible, toxic, corrosive) should be kept apart from substances presenting different types of hazard.

Substances (such as sawdust) which are 'highly combustible' will not have a hazard warning label but still need to be stored carefully pending disposal. In addition, materials that are labelled 'highly flammable' should be stored in locked metal cupboards. Such cupboards should have close fitting doors to restrict air flow, are normally yellow in colour and carry the highly flammable symbol. Only materials that are labelled 'highly flammable' should be stored in such cupboards, however, if only one such cupboard is available, containers labelled 'flammable' may be kept there. Further advice on storage is contained in BS 4163:2014 and on individual model risk assessments where necessary.

Particular COSHH Regulations

Those Regulations that refer to assessment of risks from substances and their control are as follows.

Regulation 6	Requires employers to assess the risks to health of the processes being carried out using hazardous substances and identify the steps necessary to meet Regulations 7 to 12. (The hazards and model risk assessments for each process are contained on the sheets in this publication.)
Regulation 7	Requires the prevention of exposure to be considered and the control measures to be specified so that the identified hazards are eliminated or the concentrations reduced to a level below the standards published in the guidance note EH/40 2005 (with amendments). (The sheets in this publication specify the control measures for typical school situations.)
Regulation 8	Requires employers to take all reasonable steps to see that the control measures are used. (The employer's health & safety policy document should specify how compliance is to be confirmed by inspection or otherwise. HoDs should expect to have a monitoring role.)
Regulation 9	Specifies the inspection, examination or tests required to ensure that control measures remain effective. (Details are given on individual sheets.)
Regulations 10 and 11	Deal with environmental monitoring and formal health surveillance, neither of which should be necessary for employees working in schools where no process continues for even the whole of one working week and where the health record of staff has been good in the past.
Regulation 12	Requires employers to provide their employees with information, instruction and training. (Although these sheets can provide information, it is unlikely that the issue of this set to all schools will be regarded as an adequate discharge of this duty.)

Risk Phrases

R1 Explosive when dry.
R2 Risk of explosion by shock, friction, fire or other sources of ignition.
R3 Extreme risk of explosion by shock, friction, fire or other sources of ignition.
R4 Forms very sensitive explosive metallic compounds.
R5 Heating may cause an explosion.
R6 Explosive with or without contact with air.
R7 May cause fire.
R8 Contact with combustible material may cause fire.
R9 Explosive when mixed with combustible material.
R10 Flammable.
R11 Highly flammable.
R12 Extremely flammable.
R14 Reacts violently with water.
R15 Contact with water liberates extremely flammable gases.
R16 Explosive when mixed with oxidising substances.
R17 Spontaneously flammable in air.
R18 In use, may form flammable / explosive vapour-air mixture.
R19 May form explosive peroxides.
R20 Harmful by inhalation.

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R21 Harmful in contact with skin.
R22 Harmful if swallowed.
R23 Toxic by inhalation.
R24 Toxic in contact with skin.
R25 Toxic if swallowed.
R26 Very toxic by inhalation.
R27 Very toxic in contact with skin.
R28 Very toxic if swallowed.
R29 Contact with water liberates toxic gas.
R30 Can become highly flammable in use.
R31 Contact with acids liberates toxic gas.
R32 Contact with acids liberates very toxic gas.
R33 Danger of cumulative effects.
R34 Causes burns.
R35 Causes severe burns.
R36 Irritating to eyes.
R37 Irritating to respiratory system.
R38 Irritating to skin.
R39 Danger of very serious irreversible effects.
R40 Limited evidence of a carcinogenic effect.
R41 Risk of serious damage to eyes.
R42 May cause sensitisation by inhalation.
R43 May cause sensitisation by skin contact.
R44 Risk of explosion if heated under confinement.
R45 May cause cancer.
R46 May cause heritable genetic damage.
R48 Danger of serious damage to health by prolonged exposure.
R49 May cause cancer by inhalation.
R50 Very toxic to aquatic organisms.
R51 Toxic to aquatic organisms.
R52 Harmful to aquatic organisms.
R53 May cause long-term adverse effects in the aquatic environment.
R54 Toxic to flora.
R55 Toxic to fauna.
R56 Toxic to soil organisms.
R57 Toxic to bees.
R58 May cause long-term adverse effects in the environment.
R59 Dangerous for the ozone layer.
R60 May impair fertility.
R61 May cause harm to the unborn child.
R62 Possible risk of impaired fertility.
R63 Possible risk of harm to the unborn child.
R64 May cause harm to breast-fed babies.
R65 Harmful: may cause lung damage if swallowed.
R66 Repeated exposure may cause skin dryness or cracking.
R67 Vapours may cause drowsiness and dizziness.
R68 Possible risk of irreversible effects.

Risk phrases 13 and 47 are not currently used.

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Combination of risks

R14/15 Reacts violently with water, liberating extremely flammable gases.
R15/29 Contact with water liberates toxic, extremely flammable gases.
R20/21 Harmful by inhalation and in contact with skin.
R20/21/22 Harmful by inhalation, in contact with skin and if swallowed.
R20/22 Harmful by inhalation and if swallowed.
R21/22 Harmful in contact with skin and if swallowed.
R23/24 Toxic by inhalation and in contact with skin.
R23/24/25 Toxic by inhalation, in contact with skin and if swallowed.
R23/25 Toxic by inhalation and if swallowed.
R24/25 Toxic in contact with skin and if swallowed.
R26/27 Very toxic by inhalation and in contact with skin.
R26/27/28 Very toxic by inhalation, in contact with skin and if swallowed.
R26/28 Very toxic by inhalation and if swallowed.
R27/28 Very toxic in contact with skin and if swallowed.
R36/37 Irritating to eyes and respiratory system.
R36/37/38 Irritating to eyes, respiratory system and skin.
R36/38 Irritating to eyes and skin.
R37/38 Irritating to respiratory system and skin.
R39/23 Toxic: danger of very serious irreversible effects through inhalation.
R39/23/24 Toxic: danger of very serious irreversible effects through inhalation and in contact with skin.
R39/23/24/25 Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.
R39/23/25 Toxic: danger of very serious irreversible effects through inhalation and if swallowed.
R39/24 Toxic: danger of very serious irreversible effects in contact with skin.
R39/24/25 Toxic: danger of very serious irreversible effects in contact with skin and if swallowed.
R39/25 Toxic: danger of very serious irreversible effects if swallowed.
R39/26 Very Toxic: danger of very serious irreversible effects through inhalation.
R39/26/27 Very Toxic: danger of very serious irreversible effects through inhalation and in contact with skin.
R39/26/27/28 Very Toxic: danger of very serious irreversible effects through inhalation,
in contact with skin and if swallowed.
R39/26/28 Very Toxic: danger of very serious irreversible effects through inhalation and if swallowed.
R39/27 Very Toxic: danger of very serious irreversible effects in contact with skin.
R39/27/28 Very Toxic: danger of very serious irreversible effects in contact with skin and if swallowed.
R39/28 Very Toxic: danger of very serious irreversible effects if swallowed.
R42/43 May cause sensitisation by inhalation and skin contact.
R48/20 Harmful: danger of serious damage to health by prolonged exposure through inhalation.

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R48/20/21 Harmful: danger of serious damage to health by prolonged exposure through inhalation
and in contact with skin.

R48/20/21/22 Harmful: danger of serious damage to health by prolonged exposure through inhalation,
in contact with skin and if swallowed.

R48/20/22 Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.

R48/21 Harmful: danger of serious damage to health by prolonged exposure in contact with skin.

R48/21/22 Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed.

R48/22 Harmful: danger of serious damage to health by prolonged exposure if swallowed.

R48/23 Toxic: danger of serious damage to health by prolonged exposure through inhalation.

R48/23/24 Toxic: danger of serious damage to health by prolonged exposure through inhalation
and in contact with skin.

R48/23/24/25 Toxic: danger of serious damage to health by prolonged exposure through inhalation,
in contact with skin and if swallowed.

R48/23/25 Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.

R48/24 Toxic: danger of serious damage to health by prolonged exposure in contact with skin.

R48/24/25 Toxic: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed.

R48/25 Toxic: danger of serious damage to health by prolonged exposure if swallowed.

R50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

R51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

R52/53 Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

R68/20 Harmful: possible risk of irreversible effects through inhalation.

R68/20/21 Harmful: possible risk of irreversible effects through inhalation and in contact with skin.

R68/20/21/22 Harmful: possible risk of irreversible effects through inhalation, in contact with skin and if swallowed.

R68/20/22 Harmful: possible risk of irreversible effects through inhalation and if swallowed.

R68/21 Harmful: possible risk of irreversible effects in contact with skin.

R68/21/22 Harmful: possible risk of irreversible effects in contact with skin and if swallowed.

R68/22 Harmful: possible risk of irreversible effects if swallowed.

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Levels in air

The *COSHH Regulations* require that levels of hazardous substances must be kept below certain limiting values originally called Occupational Exposure Limits but called Workplace Exposure Limits since 2005 (WELs).

In many cases, a substance in the air becomes hazardous only when the body's natural defences are inadequate. The concentration of the substance in the air at which problems begin was referred to as the 'threshold level'.

Some substances (such as sulfur dioxide and nitrogen dioxide) are so hazardous that a safe threshold level cannot be found. WELs are still given 'reference periods' which means that the level may be the average over 8 hours (the 8 h time-weighted average or TWA) or over a shorter time, usually 15 minutes or both values may be quoted. Tables of WEL values are published as the HSE Guidance Note EH 40/2005 with later amendments. A 'derived WEL' is a calculated value for a mixture and it clearly depends on the proportion of the constituents that are hazardous. Where a substance is assigned one of the risk phrases R42, R42/43, R45, R46 or R49, is listed as a 'carcinogen' in the *COSHH Regulations* or is listed as a cause of occupational asthma, exposure must be reduced to a level as low as reasonably practicable. The use of some substances in specific processes is also banned under the *COSHH Regulations*.

The third type of concentration level is the Action Level that is used for specific substances such as lead, asbestos and dusts other than those that have WEL values. It is simply that concentration of the substance in the air above which the employer must take action to control exposure of employees.

In all of the assessments used to decide whether control measures are required in school technology areas, it has been assumed that the normal ventilation system (usually windows) can achieve at least three changes of air in one hour. In some workshops, where the windows are inadequate, ventilation fans are provided but are not in use all of the time because the background noise level would then be too high for instruction to be given to the class. In this unfortunate situation, the fans must be started before any dusty or fume-producing operations are begun.

Workplace Exposure Limits are defined for adults in typical occupations and the relevance to children has been questioned. It has been suggested that the values for children should be reduced compared with those for adults because:

1. children have a lower body mass and therefore a given exposure is more concentrated in a child;
2. children are developing faster than an adult and are therefore more susceptible to any substance that affects growth or development.

On the other hand, children in schools are exposed for much shorter times than the staff who may receive repeat doses several times each day. There is no history of cases of children's health being affected by activities in Design and Technology covered by COSHH but there are a few cases on record of teachers and technicians whose health has been affected.

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The values quoted in these model risk assessments are usually the short-term limit values (15 minute ones) since exposures of children are usually much shorter than this and each staff exposure is rarely much longer.

Skin absorption
Although for most substances, the main route of entry into the body is by inhalation, certain substances have the ability to penetrate the intact skin. These substances are given an additional hazard indicator: 'Sk'. It is necessary to take special precautions to prevent skin contact when handling these substances.

Sensitisation
Many people are allergic to chemicals (eg, nickel in cheap jewellery), pollen or fine particulates emanating from animals, car exhausts or just in ordinary dusts. In some cases this may include fine dust from timber. The allergy may result in a rash on the skin, the eyes may stream or there may be an increase in catarrh (as in 'hay fever'). Some people that have asthma may suffer an asthma attack that is triggered by these substances.

In some cases people can become 'sensitised'. This term is used to describe that situation in which the allergic reaction is produced by a very low concentration of the substance. It is believed that previous exposure to the substance, which has often been over a long period but may be a single incident, has conditioned the body's defence mechanism to react to even a very small amount of that substance. In the most serious cases, a minute trace of the allergen triggers an extreme immunological response named 'anaphylaxis', as in some reactions to peanuts or bee venom.

If there is evidence that a substance or preparation causes sensitisation in humans at a significant frequency then it is labelled either HARMFUL (by inhalation) or IRRITANT (skin contact) on the bottle with risk phrases R42 ('May cause sensitisation by inhalation') and R43 ('May cause sensitisation by skin contact') in the suppliers' catalogues. (NB. There are other effects that may also cause substances to be given the ratings HARMFUL or IRRITANT.)
Many nickel salts and chromates carry these warnings because there are many cases of sensitisation in industry, yet there is no case known to CLEAPSS of any of these salts sensitising a person working in a school although nickel jewellery is freely available. On the other hand, sensitisation to enzymes is widely recognised. It has been reported that a Procion dye has affected one school technician and this, too, is a recognised problem in industry.

Local exhaust ventilation
This is now the subject of a separate CLEAPSS publication (L225, *Local Exhaust Ventilation in D&T*) that discusses the legal requirements, regular examination methods, different types of LEV and test methods. A database of suppliers and testers can also be accessed via CLEAPSS.

The Personal Protective Equipment Regulations
The *Personal Protective Equipment Regulations* 2002 require the employer to provide whatever personal protective equipment is required by the risk assessment but only for staff and trainees over school leaving age. (Trainees on work experience are to be

treated as ‘employees’ whatever their age.) It is only the general provisions of the *HSW Act* that might require PPE for children. However, if PPE is provided only for staff while children are exposed to the same risks for a similar length of time, it might be difficult to justify this situation in any court. Reference is made to BS EN 166, *Personal eye-protection*, on individual risk assessment sheets.

Teachers of Design and Technology have sometimes asked whether or not all persons in a resistant-materials workshop should be wearing eye protection while practical work is in progress and, if so, which type is required. The short answer is that eye protection is needed whenever the risk assessment requires it.

In these model risk assessments, eye protection is listed (and specified) when it is required by the person carrying out the activity but only rarely do they mention its use by others nearby. It really depends on the activities involved and the proximity of others. In most cases, eye protection is not required for other persons working near to machines (for example) nor for pupils working at opposite sides of a typical educational workbench when doing hand work. However it should be noted that there have been instances where pupils have had dust enter the eyes when doing hand work and therefore the risk assessment should consider carefully the possibility of this.

It should be noted that the wearing of ordinary spectacles does not provide sufficient protection against particles entering the eyes. Teachers and technicians who need to wear spectacles will need to equip themselves with prescription safety spectacles that should include side protection and plastic or shatterproof lenses. It should be noted that it is the responsibility of the employer to meet the cost of providing prescription safety spectacles. The wearing of safety spectacles or goggles over ordinary spectacles will probably be sufficient short-term protection for pupils but is unlikely to be practicable for teachers and technicians.

The Noise at Work Regulations

The *Noise at Work Regulations* 1989 require steps to be taken to protect the hearing of those who work in noisy environments[2]. It is unlikely that students or pupils will be subjected to loud noise levels for any significant time but **staff** in Design and Technology departments have suffered from hearing loss as a result of the noise. If you have ever had to shout to be heard by someone two metres away (eg, when near the circular saw) or your ears are ringing when you finish some activity then you should request an assessment of the noise levels by your employer. It may be that ear protectors should be worn for certain jobs or machines might be modified to reduce the noise they produce. If noise is likely to be a problem then this is indicated on the model risk assessment. Reference should be made to BS 4163:2014 for further information.

The Manual Handling Regulations

The *Manual Handling Operations Regulations* 1992 require the employer to assess the risks to health from lifting, carrying, pushing or any other manual-handling task. While many employers provide model assessments for manual handling, their application is necessarily delegated to staff on the spot because the tasks vary so much and often

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[2] Guidance is available from the HSE on the *Noise at Work Regulations* 1989. It is called *Reducing Noise at Work*, HSE reference L108, ISBN 0717615111 available from HSE Books

occur at short notice. Every school should have a procedure for meeting this requirement (and not only in Design and Technology).

There is a particular need for care to be taken when handing heavy materials and equipment in workshops. Unloading of thick sheet materials such as MDF require care and will often need at least two adults to be involved. Similarly the fitting of heavy chucks to metal turning lathes needs care.

Particular Manual Handling Operations Regulations
The Regulations that are relevant here may be summarised as follows.

Regulation 4(1)(a)	Requires employers to avoid the need for their employees to undertake any manual handling operation that involves a risk of being injured.
Regulation 4(1)(b)	Requires employers to assess the risk of injury and reduce it so far as is reasonably practicable.
Regulation 4(2)	Requires employers to review the assessment if circumstances change.
Regulation 5	Requires employees to make full and proper use of any system of work provided by the employer.

The Provision and Use of Work Equipment Regulations
The *Provision and Use of Work Equipment Regulations* 1998 (PUWER 98) revise and replace the 1992 regulations of the same name. The primary object of PUWER 98 is to ensure that equipment used at work should be suitable for the task and not result in unacceptable health and safety risks, regardless of its age, condition or origin.

It applies to the provision and use of all work equipment, including tools provided by employees, mobile equipment and lifting equipment which is also subject to the requirements of the *Lifting Operations and Lifting Equipment Regulations* 1998 (LOLER 98). It should be noted that the PUWER Regulations revoke the *Abrasive Wheels Regulations* 1970 and the *Woodworking Machine Regulations* 1974 and it is not necessary for either of these two regulations to continue to be displayed in schools or colleges.

Although employers have the duty to see that items of work equipment used by their employees are safe and suitable for the intended purpose, in a school or department with a delegated budget, **those spending that budget must see that the items selected meet those criteria** (so far as can be ascertained). One way of doing that is to select items which carry the CE mark and are from a supplier specialising in educational equipment. It might be much cheaper to pop round to the local discount store for a new sewing machine, food mixer or hammer but the **purchaser** would then have to find **evidence** to suggest that the item purchased was **safe enough** for use at a place of work and **suitable** for educational purposes.

Small lightweight machines intended for home or hobby use are unlikely to be suitable for use in a school. Guarding may be inadequate and arrangements for the power supply for electrically powered equipment may not meet the standards suggested by BS 4163:2014.

Again, employers have the duty to see that the equipment is properly maintained but the maintenance task may well be delegated to the head of the department. Whether the task is delegated or not, the employer must take advice from persons competent to give it, on the nature and frequency of inspections necessary to ensure that equipment is properly maintained.

This means that the employer then has to decide who does the inspection and how the results are to be reported.

Although these tasks are given to employers, staff are expected to report faults or defects (eg, the lack of brakes on certain woodworking machines) and some staff may be considered competent to carry out inspection and maintenance tasks.

Reference should be made to the CLEAPSS guide L254, *Health and Safety Maintenance of D&T Workshop Equipment* for guidance on the checking and maintenance of workshop machines. It is good practice to keep a record of the checking and maintenance that is carried out and L254 contains a suggested pro-forma that can be used for this purpose.

PUWER also requires employers to ensure that employees are **adequately trained** and retrained but this does not mean that the training has to be paid for by a local authority that has delegated the training budget to individual schools. Individuals are not expected to pay for their own training and failure to train staff is regarded as a serious offence attracting fines far in excess of the costs of the training.

The regulations also require dangerous machines of all types to have adequate guards and controls but there are special provisions for **woodworking machinery** which are spelt out a separate HSE publication: *Safe Use of Woodworking Machinery*, Ref No L114, ISBN 0717616304 from HSE Books.

Free information sheets are also available covering woodworking procedures. These are the WIS series and details are available from HSE Books.

LOLER applies to all lifting equipment from simple pulley blocks to passenger lifts. In Design and Technology, this mainly affects motor vehicle maintenance where heavy components and complete vehicles must be raised for access.

Pneumatic tools

Where compressed air is available in a workshop, it provides a safer alternative to mains powered electrical hand tools. However, there are safety precautions that must be observed:

A regulator and pressure gauge should be fitted between the compressor and the lines feeding the tools and set to the required pressure. Hoses must be capable of standing the working pressure and kept to a minimum length. The fittings should be of a type that automatically cuts off the supply when disconnected.

Users must be instructed in the hazards of compressed air at high working pressures.

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- Compressed air guns must not be aimed at the skin or body orifices since air can be injected into the bloodstream which can be life threatening.
- Ordinary working clothes do not provide protection against injection.
- Hoses can thrash about violently if the self-sealing fitting is removed from the end.
- Horseplay with compressed air equipment must be strictly forbidden.

It is necessary to check that the pressure of the line is set so that no tool is supplied at a pressure above its safe maximum.

Particular items from PUWER

The Regulations that are relevant here may be summarised as follows.

Regulation 4	Requires employers to ensure that all equipment is suitable for its intended purpose and does not constitute a significant risk to health and safety. (This requirement is effectively delegated when the equipment budget is delegated.)
Regulation 5	Requires employers to ensure that work equipment is maintained in an efficient state, in working order and in good repair. (If the task of maintenance is delegated to staff, the employer must still ensure that it is done properly.)
Regulation 6	Requires employers to arrange for competent persons to decide the nature and frequency of inspections required to ensure that Regulation 5 is met (unlikely to be staff) and to ensure that the inspections are carried out and recorded.
Regulation 7	Requires employers to identify equipment with specific risks and restrict the use to those persons who have received specific training to minimise those risks. (The *Health and Safety Training Standards in Design and Technology* published by DATA will identify the training required.)
Regulation 8	Requires employers to ensure that all persons who use work equipment have available to them adequate health and safety information and where appropriate, written instructions pertaining to the use of the work equipment.
Regulation 9	Requires employers to ensure that all persons who use work equipment are adequately trained.
Regulations 11 to 19	Require employers to ensure that danger areas are properly guarded and that controls ensure safe starting, stopping and isolation during maintenance. (BS 4163 interprets the details for education.)

The Electricity at Work Regulations

Again, the *Electricity at Work Regulations* 1989 require employers to ensure that electrical installations and equipment are installed in a safe condition and maintained in a satisfactory manner. Guidance from the HSE suggests that fixed installations should be inspected and tested at intervals of five years. This work would be done by a qualified electrical contractor who would provide a written report on the condition of the installation.

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After such checks, an adhesive label is normally fixed to fuse boxes and distribution boards to show that the test has been done and the date when the next test is due.

The regulations require that portable equipment (with 13 amp plugs) should be maintained in good order. Most schools choose to meet this requirement by having all portable equipment tested each year (PAT testing). It is important that PAT testing is carried out regularly and that a record is maintained of all the electrical equipment in a school so that a check can be made to see if any equipment has been missed. Where equipment is not moved, it is suggested that the interval between formal tests can be extended. It is good practice to fix a label to each piece of equipment after a test since there is then an immediate visual indication of the test having been done.

It should be noted that electrical equipment that is the personal property of staff should be checked before it is used in a school. Items that pupils make, such as table lamps and electronic products that are designed to work on a 240 volt supply, are subject to a portable appliance test before use.

Although a formal check of electrical safety every 12 months is good practice, it is important that equipment that is subject to arduous use is subject to a quick visual check before use, and where appropriate, to formal checks at more frequent intervals.

Examples of equipment that needs such a quick visual check are portable power tools and soldering irons that work on a 240 volt supply, the cables of sewing machines and any type of extension cable.

Electrical safety and electrical connections of fixed equipment

The checking required under the *Electricity at Work Regulations* is to reduce the risk of electric shock. To ensure safety during maintenance it must be possible to isolate each machine from the supply. There must also be an emergency stop button on machines at risk so that they can be stopped quickly should entanglement (for example) occur.

It should be noted that the guidance on PUWER now requires the fitting of emergency stop controls unless it is not necessary by reason of the nature of the hazard. Although the phrase ‘latching stop button’ is not used, this is the simplest way of ensuring that ‘the stop function has priority following the release of the control’. The controls for all fixed machines should incorporate a no-volt and overload push button starter to prevent unexpected starting after the power has been interrupted.

BS 4163:2014 states that all fixed machines should be permanently connected to the electrical supply through a suitable fused switch disconnector. It should be noted that all supply cables, including those of fixed machines that work on a single phase 240 volt supply, should be enclosed within suitable fixed or flexible conduit. Metal conduit is preferred rather than plastic conduit since metal will be more robust and cannot be damaged so easily.

The isolating switch will normally be lever operated with fuses within the isolator itself but a fused spur switch may be used for light machines. The use of a fused switch disconnector is intended to provide additional safety protection when maintenance is

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being carried out since the fuses can be removed and stored in a safe place, thus preventing the machine from being started inadvertently.

In many schools, lever operated isolating switches are installed that do not contain fuses. These isolators will be sufficient to isolate the machine for normal tasks such as changing work holding devices. An additional key switch or padlock passed through the operating lever of the isolator gives good additional protection for maintenance. Standard 13 amp plugs and sockets should not be used for fixed machines. Where machines have to be moved or are portable the use of industrial plugs and sockets conforming to BS EN 60309-2 and colour coded blue should be used.

In an educational workshop it should be possible to disconnect and isolate all electrical circuits that supply fixed equipment and socket outlets from a single switch conforming to BS EN 60669-2-4 or BS EN 60947-3. This switch disconnector should be easily accessible and should be capable of being locked on the 'OFF' position.

It is good practice to turn off the power at the end of each school day or after the last lesson of the day.

An educational workshop should be provided with an emergency power control system so that the teacher can press any one of a number of strategically-placed stop buttons to interrupt power to all machines. Normally one emergency stop button should be placed on each wall and they should be fitted about 1.4 metres above the floor. Where these stop buttons are fitted they should control the power in one room only and should not affect the actions of equipment installed for safety, such as extraction fans.

Emergency stop buttons should be conspicuous and coloured red on a yellow background. (See BS EN ISO 13850.) A safe condition sign conforming to BS 5499-5 should be in place adjacent to each stop button.

There is no requirement for educational workshops to run any machines from 110 V ac supplies, although some employers may choose to specify this. However, if the object of the instruction is to show how electrical tools are used safely on building sites, or any other places that are very wet, then a local transformer could be used (with an output of 110 V and the secondary winding centre-tapped to earth so that the maximum voltage to earth becomes 55 V).

This is one way of providing a 'SELV' (Safety Extra-Low Voltage) supply. Since even this supply is not totally safe, some experts prefer Separated Extra-Low Voltage as there is no electrical connection between the ordinary mains input and the safer output. Another 'SELV' supply is provided by the re-chargeable battery packs often used with portable power tools. However, these could be misused when removed from the tool.

In electronics projects, it may be possible to provide power using inexpensive battery eliminators that plug into the mains. These should be examined before use to ensure that they are of adequate quality. Most of them are built to the double-insulated standard shown by the square-in-a-square symbol. Others may carry a CE mark, British Standard Kitemark or other symbol of quality. If the electrical output is not adequately

smooth or held at the required voltage, a simple smoothing or regulator circuit may be built into the design.

Portable and hand-held electrical equipment powered by the mains
Portable or hand-held electrical equipment should, where possible, be powered by low-voltage, rechargeable-battery packs. Where mains electrical power is used, extra care must be taken over the quality and use of the equipment. There is no requirement to use 110 V supplies unless the work is equivalent to, or intended to simulate, conditions on a construction site. It is recommended that the equipment should be constructed to the standards for 'double-insulation'.

Powered hand tools often require electrical extension leads that trail across the workshop floor. Such leads are at considerable risk of damage and present a tripping hazard to those moving around the workshop, particularly to teachers. Clearly these leads should be avoided if at all possible and the use of retractable cable drums fitted just below the ceiling is preferable. If extension cables must be used, care must be taken to position them along the safest available route; they must be subject to frequent quick checks (whenever brought into use) and formal inspections every half term. If they have to cross a walkway at floor level, it is useful to cover them with a rubber cable protector. The use of extension cables should only be for very short-term use, such as whilst a power tool is in use. They should not be used as a semi-permanent installation.

Where long extension leads are used, the system should be protected by an earth-leakage circuit breaker of the residual current type (an RCD). It is a mistake to imagine that using an RCD with an item of mains-powered electrical equipment automatically makes it safe or even safer; the RCD is necessary with extension leads because of the electrical resistance of the long cable: a fuse would not give adequate protection.

Electrical equipment such as laundry equipment used in food technology should be permanently connected to the electrical supply using a fused spur switch. If appliances have to be supplied via a plug and socket then the plug should be clearly labelled to identify the appliance. There should be easy access to such fused spur switches or to socket outlets - they should not be hidden behind the appliance.

Immediate Remedial Measures & First Aid
The *Health and Safety (First-Aid) Regulations* 1981 define 'first aid' as that which is provided by a qualified first-aider. Unqualified persons are advised not to administer first aid because the treatment given may make the casualty worse.

Some employers have issued instructions that prohibit the use of first-aid equipment by unqualified persons. However, in schools, it may take a few minutes to locate and summon the first-aider and the problem may need immediate treatment. The procedures that are appropriate for the technician- or teacher-on-the-spot to provide are called **Immediate Remedial Measures** (Basic First Aid) and, where necessary, they are detailed on the back of each model risk assessment sheet. Further information for the qualified first-aider or other medical personnel is also included occasionally. In addition reference should be made to CLEAPSS guidance leaflet PS 65, *Immediate Remedial Measures in Design and Technology*.

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Many sheets include the statement ‘DO NOT INDUCE VOMITING’ as the main hazard is of aspiration into the lungs following vomiting. Many sheets also advise eye irrigation; it is expected that this will be done by trickling water over the eye from a rubber tube fixed to a cold-water tap. If this method is to be used, the rubber tube should be kept clean in a plastic bag, secured to the wall near the tap. Although a special tap may have to be provided for this purpose, a special eye-wash station is not considered necessary. Local water by-laws will probably prohibit the connection of this tap to the cold water main. The use of water from a tank in the roof for eye-washing is better than inadequate irrigation using eye-wash bottles or not washing at all. In some cases, eye-wash bottles may be the only practicable source of water. It is acceptable to refill these bottles from a cold-water tap to maintain the eye washing for the recommended time but tap water will not stay fresh for more than a few days so regular (eg, daily) refilling is necessary.

It is strongly recommended that staff that have not attended a full first-aid training course (with an end-of-course examination) should receive instruction in Immediate Remedial Measures. This training can be provided in many ways, as a one-day session, as several short sessions after the end of the teaching day, on a staff training day, etc. Courses are also available from many different training organisations but it is sensible to select one that understands the education sector. Persons that have received this training are often nominated by the employer as ‘appointed persons’ to take over if the qualified first-aider is not available. However, a teacher who has not received such training should not hesitate to follow the measures detailed on these model risk assessments; these measures are for everyone.

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Model Risk Assessments in Design and Technology

These model risk assessments are divided into five parts:

Part 1: *Work with Resistant Materials.* Covers both the hazards from substances used in a workshop (as required to meet the *COSHH Regulations*) and hazards from activities and equipment used with resistant materials (to meet the *Management and other Regulations*).

Part 2: *Work with Compliant Materials.* Covers the hazards from substances used in textile technology and similar studies (as required to meet the *COSHH Regulations*) and hazards from activities and equipment (to meet the *Management and other Regulations*).

Part 3: *Work with Food.* Covers the hazards from substances used in food technology (as required to meet the *COSHH Regulations*) and the hazards from activities and equipment (to meet *the Management and other Regulations*).

Part 4: *Art and Design.* Covers the hazards from substances used in Art and Design (as required to meet the *COSHH Regulations*) and the hazards from activities and equipment (to meet *the Management and other Regulations*).

Part 3: *Construction.* Covers the hazards from substances used in building and construction (as required to meet the *COSHH Regulations*) and the hazards from activities and equipment (to meet *the Management and other Regulations*).

Within each part, a sheet is provided for each group of either **substances hazardous to health** or **hazardous activities** to include: identification of the hazards; assessments of the risks; and the measures needed to control them.

Additional information on disposal, storage, first aid and other comments are included where necessary. It is expected that in many schools the sheets will be held in a ring-binder to allow the sheets or parts to be handled separately and photocopied for use within the institution. If a presentation ring-binder is used then the front cover can be inserted in the transparent wallet on the front to aid recognition.

Although these sheets are designed to help education employers to meet their obligations under the *COSHH Regulations* (1999), the *Management Regulations* (1999) and other regulations, so far as Design and Technology departments are concerned, the mere possession of these sheets will not satisfy the requirements of the regulations. Employers, ie, governing bodies, educational trusts and Local Authorities will need to **adopt** them formally and **add** their local arrangements for:

(a) adapting them as described above;
(b) inspecting and maintaining equipment;
(c) regular testing and examination of control measures (eg, local exhaust ventilation);
(d) monitoring that the control measures are used or applied; and
(e) informing, instructing or training employees accordingly.

In the context of the *COSHH Regulations*, **health** refers to the longer-term well-being of the workforce. The hazards are concerned with inhalation of gases, fumes and dust through the nose and mouth, the ingestion of substances through the mouth and the

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effects of substances both directly on the skin and elsewhere in the body, having used the skin as the route of entry. However, incidents that give rise to short-term exposures are also covered.
The *COSHH Regulations* make considerable use of the HSE Guidance Workplace Exposure Limits: Containing the list of workplace exposure limits for use with *the Control of Substances Hazardous to Health Regulations* 2002 (as amended). Limiting values from this HSE publication (see individual MRATs on substances hazardous to health) are quoted in this CLEAPSS publication.

Readers are also referred to the newly revised *Health and safety for design and technology in schools and similar establishments - Code of Practice* (BS 4163 2014). This Code of Practice complements this CLEAPSS publication particularly as regards the design of technology workspaces.

It must always be remembered that rules made by an employer, whether an education authority, Trust, a governing body or the proprietor, override the recommendations in any guidance (although they cannot be more lax than the law requires!).

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Contents:

This document contains the complete set of MRATs

Part 1: Work with Resistant Materials Introduction to Part 1
1.001 Adhesives: acrylic cement
1.002 Adhesives: cyanoacrylate
1.003 Adhesives: hot-melt glue guns
1.004 Adhesives: hot-melt glue sticks
1.005 Adhesives: reactive resins, epoxy, polyester
1.006 Adhesives: reactive resins, formaldehyde
1.007 Adhesives: solvent-based, cellulosics, polymer cements, rubber solution
1.008 Adhesives: solvent-based, repositionable
1.009 Adhesives: water-based, PVA, rubber latex
1.010 CNC machines
1.011 Craft knives, scalpels and scissors
1.012 Cutting and shaping metal by hand
1.013 Electrical and electronics work
1.014 Electronics: chemicals for Printed Circuit Board etching
1.015 Electronics: chemicals for Printed Circuit Board preparation
1.016 Heat processes: brazing, silver soldering
1.017 Heat processes: brazing, silver soldering, fumes and fluxes
1.018 Heat processes: butane blowtorch
1.019 Heat processes: casting
1.020 Heat processes: casting, fumes and sand
1.021 Heat processes: forging
1.022 Heat processes: forging, fumes
1.023 Heat processes: oxygen and oxygen cylinders
1.024 Heat processes: plasma cutting
1.025 Heat processes: soft-soldering, fumes and fluxes
1.026 Heat processes: soldering irons
1.027 Heat processes: welding - electric arc
1.028 Heat processes: welding - electric arc fumes
1.029 Heat processes: welding - oxy-acetylene
1.030 Heat processes: welding - oxy-acetylene fumes
1.031 Lapidary equipment: cutters and grinders
1.032 Laser cutters
1.033 Metal working: cutting oils
1.034 Metal working: dust from grinding
1.035 Metal working: grinding, surface and tool
1.036 Metal working: guillotines, folding and rolling equipment
1.037 Metal working: lathes - metal turning
1.038 Metal working: milling machines
1.039 Metal working: pillar and bench drilling machines
1.040 Metal working: polishing and linishing
1.041 Metal working: polishing dust and polishing materials
1.042 Metal working: portable power tools - angle grinders
1.043 Metal working: portable power tools – drills
1.044 Metal working: portable power tools - sheet metal shears
1.045 Metal working: power saws
1.046 Motor vehicle engineering: asbestos
1.047 Motor vehicle engineering: batteries, electrolyte and fumes
1.048 Motor vehicle engineering: demonstration engines
1.049 Motor vehicle engineering: engine fuels, engine oils
1.050 Motor vehicle engineering: exhaust fumes
1.051 Motor vehicle engineering: lifting and holding equipment
1.052 Plastics: abrading and trimming equipment
1.053 Plastics: abrading, dust and fumes

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1.054 Plastics: glass-reinforced plastic, resin casting, chemicals and fumes
1.055 Plastics: hazards of materials
1.056 Plastics: hot-air welding
1.057 Plastics: hot-wire cutting, fumes
1.058 Plastics: injection-moulding equipment
1.059 Plastics: polishers
1.060 Plastics: polishing dusts
1.061 Plastics: sheet benders
1.062 Plastics: vacuum- and pressure-forming equipment
1.063 Pneumatics equipment and compressed air
1.064 Surface finishes: acid treatments (pickling & sample etching)
1.065 Surface finishes: air brushes and paint sprays
1.066 Surface finishes: enamelling kilns
1.067 Surface finishes: enamelling materials
1.068 Surface finishes: solvent-based paints (aerosol)
1.069 Surface finishes: solvent-based paints (liquid)
1.070 Surface finishes: varnishes and wood polishes
1.071 Wood working: dust
1.072 Wood working: hand tools - chisels and gouges
1.073 Wood working: hand tools – saws
1.074 Wood working: portable power tools - biscuit cutters
1.075 Wood working: portable power tools – drills
1.076 Wood working: portable power tools – planers
1.077 Wood working: portable power tools – routers
1.078 Wood working: portable power tools – sanders
1.079 Wood working: portable power tools – saws
1.080 Wood-working machines: lathes - wood turning
1.081 Wood-working machines: mortising
1.082 Wood-working machines: planing and thicknessing
1.083 Wood-working machines: sanders - belt, bobbin, disc
1.084 Wood-working machines: saws – band
1.085 Wood-working machines: saws - bench-mounted, fret, jig, scroll
1.086 Wood-working machines: saws - chop, cross-cut, mitre, radial arm
1.087 Wood-working machines: saws - circular and vertical panel
1.088 Additive Manufacturing: 3D printing
1.089 Plastics dip coating

Introduction to Part2
2.001 Adhesives used with compliant materials
2:002 Batik pots / Wax kettles
2.003 Cleaning agents: bleaches
2.004 Cleaning agents: detergents
2.005 Cleaning agents: solvents
2.006 Cleaning fabrics
2.007 Cutting with scissors, scalpels and craft knives
2:008 Distressing fabrics
2.009 Dyes & mordants
2.010 Fabric identification: activities
2.011 Fabric identification: chemicals
2.012 Flammable substances: liquids
2.013 Flammable substances: non-liquids
2:014 Heat presses
2.015 Inks & paints used with textiles
2.016 Ironing
2.017 Knitting machines
2.018 Sewing equipment: general-purpose machines
2.019 Sewing equipment: overlockers
2.020 Sewing equipment: small items
2.021 Wear tests on textiles

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Appendix 1: Burning tests on fabrics
Appendix 2: Chemical tests on fabrics

Part 3: Work in food technology
3.001 Blast chillers
3.002 Chemical testing of food
3.003 Cleaning activities: general
3.004 Cleaning agents for food handling areas: bleaches
3.005 Cleaning agents for food handling areas: descalers
3.006 Cleaning agents for food handling areas: detergents
3.007 Cleaning agents for food handling areas: disinfectants
3.008 Cleaning agents for food handling areas: drain & sink cleaners
3.009 Cleaning agents for food handling areas: oven cleaners
3.010 Conventional ovens
3.011 Cooking and reheating, food poisoning
3.012 Deep fat fryers
3.013 Defrosting foods
3.014 Eating and tasting
3.015 Enzymes
3.016 Food processors
3.017 Food storage: dry foods
3.018 Food storage: high temperatures
3.019 Food storage: low temperatures
3.020 Freezing food: freezer, refrigerator
3.021 Frying and grilling food
3.022 Handling food
3.023 Hob, kettle, urn
3.024 Knives
3.025 Liquidising, mincing, mixing
3.026 Microorganisms used in food production
3.027 Microwaves
3.028 Pest control
3.029 Portable food processors, mixers & powered tools
3.030 Pressure cookers
3.031 Purchase and selection of food
3.032 Toasting food
3.033 Tunnel ovens
3.034 Waste disposal
Appendix 3: Food poisoning: the major causes of food poisoning
Appendix 4: Food tests: details of suggested tests

Part 4 art and design contents
4.001 ceramics: clay & dust
4.002 ceramics: glazes & colours
4.003 ceramics: electric kilns
4.004 ceramics: gas-fired kilns
4.005 ceramics: outdoor kilns
4.006 ceramics: machinery
4.007 3-dimensional work: carving, cutting & abrading
4.008 3-dimensional work: embedding
4.009 3-dimensional work: plaster of paris
4.010 3-dimensional work: working with scrap materials
4.011 using bench-mounted cutting tools
4.012 painting & drawing
4.013 paper-making
4.014 print-making: printing
4.015 print-making: chemical etching
4.016 print-making : engraving with small hand tools

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4.017 print-making: use of ultra-violet (uv) light & photo-sensitive resists
4.018 solvents
4.019 adhesives: general
4.020 adhesives: spray type
4.021 adhesives: glue guns & glue sticks
4.022 textiles: dyes, mordants, bleaches, etc
4.023 textiles: batik & other wax processes
4.024 textiles: using electric heat sources
4.025 textiles: sewing machines
4.026 textiles: small sharp items
4.027 enamelling: kilns
4.028 enamelling: materials
4.029 working with glass
4.030 jewellery (lapidary): stone cutting & grinding
4.031 jewellery: metal casting
4.032 jewellery: soldering
4.033 photography: chemicals
4.034 photography: darkrooms
4.035 use of ict & audiovisual equipment
4.036 artists in residence & other visitors
4.037 off-site visits
4.038 projects, testing, experimental & novel activities & materials

Part 5 construction introduction
5.001 adhesives: acrylic cement and pipe sealants
5.002 adhesives: reactive resins, epoxy, polyester
5.003 adhesives: reactive resins, formaldehyde
5.004 adhesives: solvent-based
5.005 adhesives: water-based, pva, rubber latex, wallpaper adhesive
5.006 building crafts: brick and block work
5.007 building crafts: use of cement and lime mortar and concrete
5.008 building crafts: using lintels
5.009 building crafts: concrete (cement) mixers
5.010 building crafts: plaster and plasterboard
5.011 building crafts: glazing
5.012 building crafts: wall and floor tiling
5.013 building crafts: cutting compliant materials
5.014 building crafts: using hand tools
5.015 building crafts: using laser spirit levels
5.016 heat processes: blowtorches (butane &/or propane)
5.017 heat processes: soft soldering, fumes and fluxes
5.018 metal working: cutting and shaping metal using hand tools
5.019 metal working: using lead
5.020 painting and decorating: painting
5.021 painting and decorating: brush cleaning
5.022 painting and decorating: surface preparation by sanding
5.023 painting and decorating: surface preparation using chemical strippers
5.024 painting and decorating: surface preparation using heat processes
5.025 painting and decorating: paper-hanging
5.026 plastics: hazards of materials
5.027 plastics: abrading, trimming, drilling & shaping equipment
5.028 plastics: machine abrading - fumes and dust
5.029 portable power tools: angle grinders and abrasive wheel cutters
5.030 portable power tools: biscuit cutters
5.031 portable power tools: drills
5.032 portable power tools: planing machines
5.033 portable power tools: routers
5.034 portable power tools: sanders
5.035 portable power tools: circular saws, jig saws

5.036 wood working: using sharp edged hand tools
5.037 wood working: wood cutting using hand saws
5.038 wood-working: mortising machines
5.039 wood-working: planing and thicknessing machines
5.040 wood-working: disc, belt and bobbin sanders
5.041 wood-working: band saws
5.042 wood-working: circular saws, vertical panel saws
5.043 wood working: bench-mounted jig saws, scroll saws and fret saws
5.044 wood-working: cross cut, mitre, radial arm and chop saws
5.045 wood-working: wood turning lathe
5.046 working practices: control of dust
5.047 working practices: manual handling
5.048 working practices: working at height
5.049 working practices: electrical work
5.050 working practices: minor demolition
5.051 working practices: work experience on, or visits to construction sites

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MODEL RISK ASSESSMENTS
FOR DESIGN AND TECHNOLOGY
IN SECONDARY SCHOOLS AND COLLEGES

Part 1
Work with resistant materials

CLEAPSS®, The Gardiner Building, Brunel Science Park, Kingston Lane, Uxbridge UB8 3PQ
Tel: 01895 251496 *Fax/Answerphone:* 01895 814372 *E-mail:* science@cleapss.org.uk *Web site:* www.cleapss.org.uk

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Part 1: Contents

Part 1: Work with Resistant Materials
Introduction to Part 1
1.001 Adhesives: acrylic cement
1.002 Adhesives: cyanoacrylate
1.003 Adhesives: hot-melt glue guns
1.004 Adhesives: hot-melt glue sticks
1.005 Adhesives: reactive resins, epoxy, polyester
1.006 Adhesives: reactive resins, formaldehyde
1.007 Adhesives: solvent-based, cellulosics, polymer cements, rubber solution
1.008 Adhesives: solvent-based, repositionable
1.009 Adhesives: water-based, PVA, rubber latex
1.010 CNC machines
1.011 Craft knives, scalpels and scissors
1.012 Cutting and shaping metal by hand
1.013 Electrical and electronics work
1.014 Electronics: chemicals for Printed Circuit Board etching
1.015 Electronics: chemicals for Printed Circuit Board preparation
1.016 Heat processes: brazing, silver soldering
1.017 Heat processes: brazing, silver soldering, fumes and fluxes
1.018 Heat processes: butane blowtorch
1.019 Heat processes: casting
1.020 Heat processes: casting, fumes and sand
1.021 Heat processes: forging
1.022 Heat processes: forging, fumes
1.023 Heat processes: oxygen and oxygen cylinders
1.024 Heat processes: plasma cutting
1.025 Heat processes: soft-soldering, fumes and fluxes
1.026 Heat processes: soldering irons
1.027 Heat processes: welding - electric arc
1.028 Heat processes: welding - electric arc fumes
1.029 Heat processes: welding - oxy-acetylene
1.030 Heat processes: welding - oxy-acetylene fumes
1.031 Lapidary equipment: cutters and grinders
1.032 Laser cutters
1.033 Metal working: cutting oils
1.034 Metal working: dust from grinding
1.035 Metal working: grinding, surface and tool
1.036 Metal working: guillotines, folding and rolling equipment
1.037 Metal working: lathes - metal turning
1.038 Metal working: milling machines
1.039 Metal working: pillar and bench drilling machines
1.040 Metal working: polishing and linishing
1.041 Metal working: polishing dust and polishing materials
1.042 Metal working: portable power tools - angle grinders
1.043 Metal working: portable power tools - drills
1.044 Metal working: portable power tools - sheet metal shears
1.045 Metal working: power saws
1.046 Motor vehicle engineering: asbestos

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1.047 Motor vehicle engineering: batteries, electrolyte and fumes
1.048 Motor vehicle engineering: demonstration engines
1.049 Motor vehicle engineering: engine fuels, engine oils
1.050 Motor vehicle engineering: exhaust fumes
1.051 Motor vehicle engineering: lifting and holding equipment
1.052 Plastics: abrading and trimming equipment
1.053 Plastics: abrading, dust and fumes
1.054 Plastics: glass-reinforced plastic, resin casting, chemicals and fumes
1.055 Plastics: hazards of materials
1.056 Plastics: hot-air welding
1.057 Plastics: hot-wire cutting, fumes
1.058 Plastics: injection-moulding equipment
1.059 Plastics: polishers
1.060 Plastics: polishing dusts
1.061 Plastics: sheet benders
1.062 Plastics: vacuum- and pressure-forming equipment
1.063 Pneumatics equipment and compressed air
1.064 Surface finishes: acid treatments (pickling & sample etching)
1.065 Surface finishes: air brushes and paint sprays
1.066 Surface finishes: enamelling kilns
1.067 Surface finishes: enamelling materials
1.068 Surface finishes: solvent-based paints (aerosol)
1.069 Surface finishes: solvent-based paints (liquid)
1.070 Surface finishes: varnishes and wood polishes
1.071 Wood working: dust
1.072 Wood working: hand tools - chisels and gouges
1.073 Wood working: hand tools - saws
1.074 Wood working: portable power tools - biscuit cutters
1.075 Wood working: portable power tools - drills
1.076 Wood working: portable power tools - planers
1.077 Wood working: portable power tools - routers
1.078 Wood working: portable power tools - sanders
1.079 Wood working: portable power tools - saws
1.080 Wood-working machines: lathes - wood turning
1.081 Wood-working machines: mortising
1.082 Wood-working machines: planing and thicknessing
1.083 Wood-working machines: sanders - belt, bobbin, disc
1.084 Wood-working machines: saws - band
1.085 Wood-working machines: saws - bench-mounted, fret, jig, scroll
1.086 Wood-working machines: saws - chop, cross-cut, mitre, radial arm
1.087 Wood-working machines: saws - circular and vertical panel
1.088 Additive Manufacturing: 3D printing
1.089 Plastics: Dip Coating

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1.001 COSHH Regs	Adhesives: Acrylic cement	Applicable to: acrylic cements, eg, Tensol 12 or Tensol 70	See also: 1.055

Process(es) covered: Spreading cement on joint surfaces; pouring from a large stock container to smaller ones.
Tensol 12 cement contains methyl methacrylate in a solvent, usually methylene chloride or trichloroethylene (both non-flammable) but other cements could use highly flammable solvents.
Tensol 70 is a two-pack adhesive: pack A is methyl methacrylate polymer dissolved in the unpolymerised substance; pack B is di-benzoyl peroxide in dimethyl phthalate

Hazards

Harmful — Hazardous by inhalation (may cause drowsiness), through the skin and by swallowing. Both methylene chloride (R40 Sk) and trichloroethylene (R45, 67 Carc Sk) can have irreversible effects.

Irritant — Methyl methacrylate (R37/38) and trichloroethylene (R36/38 Sk) are irritating to the skin, eyes and respiratory tract.

Highly flammable — If a highly flammable solvent (R11) is used, flammable or explosive vapour-air mixtures may form. Thermal decomposition will evolve toxic and flammable vapours.

Sensitiser — Methyl methacrylate monomer (R43) is recognized as a skin sensitiser but not as a respiratory one.

Risk Assessment

Harmful — Methylene chloride (dichloromethane): WEL is 100 ppm (8 h TWA)[3] or 300 ppm (15 min ref period) Trichloroethylene (trichloroethene): WEL is 100 ppm (8 h TWA) or 150 ppm (15 min ref period).
In school workshop activities, the 8 h hazard levels will be reached only in the event of a major spill or use in a small, unventilated room.
The 15 minute hazard levels will not be exceeded if the total area of exposed adhesive is less than 500 cm^2.

Irritant — Cement splashes must be kept out of eyes and off sensitive skin.

Highly flammable — Vapour from some solvents could be ignited by flames or red-hot metal.

Sensitiser — Methyl methacrylate monomer is an irritant liquid which has a WEL of 50 ppm (8 h TWA) or 100 ppm (15 min ref period)[1]. It may act as a sensitiser at much lower concentrations and the level should be kept as low as possible. Splashes on the skin have produced sensitisation.

Control measures

If containers are opened and used only in well-ventilated areas, local exhaust ventilation will not be required for normal use. If ventilation is poor, Tensol 70 is available as an 'application kit' which minimises the release of fumes.
If the total area of exposed adhesive might exceed 500 cm^2, local exhaust ventilation must be provided. Use by an open window may be required.
Eye protection must be worn. Gloves are advisable for sensitive skin.

The work must be at least 1 m from sources of ignition. This includes pilot flames on heat treatment equipment.

[3] EH 40/2007.

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Disposal	Small amounts of cement that have become solid (or too viscous to be used) may be left in the tin and added to the solid waste. Large tins should be taken to a domestic recycling or disposal site. Cement that is still liquid is hazardous to the environment (R52/53) and must be collected by an authorised Waste Disposal Contractor[4].
Storage	Keep containers tightly closed in a cool, well-ventilated place where there should be no smoking.

IMMEDIATE REMEDIAL MEASURES

Cement is swallowed	The swallowing of small splashes is unlikely to cause any adverse effects. Large doses may produce internal irritation, nausea, vomiting or diarrhoea and may lead to drowsiness and unconsciousness. DO NOT INDUCE VOMITING. Provided the casualty is conscious, wash out mouth with water. Obtain medical attention.
Fumes are inhaled	Remove from exposure. Keep warm and at rest. Obtain medical attention.
Cement is splashed into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
In case of fire	If the cement is ignited, evacuation of the area should take place as thermal decomposition will evolve phosgene. The fire service should be summoned.
Effects on the skin	Repeated and prolonged contact with the skin may cause removal of natural greases, resulting in dryness, cracking and possible dermatitis. Wash with mild antiseptic and apply moisturising cream.
Cement is spilt in workshop	Ensure suitable personal protection during removal of the spill. Contain the spill with sand, earth or any suitable absorbent. Transfer to a container for disposal.

[4] CLEAPSS guidance leaflet PS 05 lists contractors known to work with schools.

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1.002 COSHH Regs	Adhesives: Cyanoacrylate	Applicable to: Permabond; Superglue; Wonderbond; etc	See also:

Process(es) covered: These adhesives are used in very small amounts and set by virtue of a moisture-catalysed polymerisation process. They form very strong instant bonds between non-absorbent surfaces, eg, metal, glass, plastics, rubber and hardwoods.

Hazards

Irritant — The vapour is irritating to the skin and nasal passages (R36/37/38) particularly when heated.

Skin adhesion — These adhesives can stick skin and eyelids in seconds.

Risk Assessment

Irritant — Methyl 2-cyanoacrylate has no long-term limit and a WEL of 0.3 ppm (15 min ref period)[5] When used in very small amounts by staff only, the risk is trivial in areas with normal ventilation.

Skin adhesion — Even using dispensers that release the adhesive in drops, it is still possible to glue fingers together. Rubbing the eyes with contaminated fingers can lead to eyelids stuck together.

Control measures

Staff only use.
Only use in a well-ventilated work area. Do not apply heat to anything that has been joined with cyanoacrylate.
Wear eye protection at all times. The use of polyethylene or polypropylene gloves is recommended when handling large volumes. Other protective equipment is not required under the conditions of use reasonably to be expected.
Skin adhesion can be dealt with by suitable remedial measures provided the casualty does not panic.

[5] EH 40/2007.

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RESTRICTIONS	Because there is a considerable danger of skin bonding occurring when these adhesives are used, under no circumstances should cyanoacrylate adhesives be used in schools by children[6].
Disposal	Tubes should be emptied on to damp paper and left to cure. Then dispose of as normal refuse.
Storage	Cyanoacrylates should be stored in sealed containers in a cool, dry place with a temperature range of 5 to 30 °C.

IMMEDIATE REMEDIAL MEASURES

Vapour is inhaled	Remove casualty to fresh air and seek medical advice.
Adhesive is in the eyes	If the eyelids are stuck, DO NOT ATTEMPT TO PRISE OPEN. Wash with warm water for at least ten minutes. Apply a gauze patch to discourage any attempt to force the eye open. The eye will open without further action in one to four days. If in doubt, seek medical advice.
Adhesive is on the skin	Wash with soap and warm water and apply a fatty hand cream. In cases of skin bonding, DO NOT PANIC. Soak in warm water but do not attempt to pull the skin apart. Ease the skin apart with a gentle peeling action, using a blunt edge, eg, a spatula or spoon handle. Do not use a general solvent but the manufacturer's 'release agent' may help. If in doubt, seek medical advice.
Cement is spilt in workshop	Clean up excess material using absorbent material or, when cured, remove mechanically.
In the mouth	Seek medical attention and warn ambulance or accident staff that: it is almost impossible to swallow cyanoacrylate as the adhesive solidifies and adheres in the mouth; saliva will lift the adhesive in 12 to 48 hours; if a lump has formed in the mouth, the casualty should be positioned to prevent ingestion (or inhalation) of the lump when it detaches.

6 A 'child' is defined as one below statutory-school-leaving age. A 'young person' is one over school-leaving age but below the age of 18.

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1.003 Man Regs	Adhesives: Hot-Melt Glue Guns	Applicable to:	See also: 1.004

Process(es) covered: Hot-melt adhesives are supplied as sticks of copolymers of ethene and vinyl acetate. Heat is used to melt the adhesive in the 'glue gun' so that drops can be applied to the materials to be joined. Bonding results when the glue solidifies on cooling. Many different types of gun are available with electric or butane cartridge heating and supplying glue at different rates.

Hazards

Electricity	Some low-cost guns have not been made to satisfactory standards.
Tripping	Trailing cables present a tripping hazard.
Fire	Cordless types present a fire hazard from the butane cartridge.
Burns	Although the handle and trigger of the gun should remain sufficiently cool not to be a hazard, every design will have at least a small component at a temperature high enough to cause skin burns.

Risk Assessment

Electricity	Glue guns purchased from an established educational supplier will meet satisfactory standards. Double-insulated models are most appropriate and present minimal risks.
Tripping	Trailing cables should be avoided by working close to a power socket.
Fire	Small butane cartridges present a high risk in the hands of students but could be used safely by staff after a further assessment.
Burns	The risk of burns from a properly-used glue gun is minimal.

Control measures

Regular inspection[7] of the integrity of the body and mains cables with a portable appliance test when necessary and at least every 12 months will control the electric shock risk.

Ideally, the work bench should be provided with a suitable power socket to avoid any need for trailing cables.

If cordless types are stocked, it may be necessary to control access.

Instruction and training in safe use will normally be sufficient to control the risk of burns but, with some classes, it could be advisable to restrict use to the low-temperature types (see sheet 1.004).

[7] Where glue guns are used throughout the year and they are used responsibly, a monthly inspection checking for damage should be sufficient. If they are used intensively for a few weeks then it might be necessary to check them every time they are removed from the store.

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Storage	Only the butane-heated types present a problem. Spare gas cartridges should be kept in a highly-flammable liquids cupboard. Care should be taken over the cable to ensure it is not 'kinked' or damaged in storage.

FURTHER INFORMATION

Glue guns are available in a range of powers that deliver glue at different rates. Low-powered models can be left on indefinitely, higher-powered types produce glue so quickly that they are soon surrounded by a pool of it. A power greater than 50 W is likely to be too high for school work. Should a high rate of glue delivery be required, this risk assessment should be reconsidered.
Alternative nozzles are available for some models. There is no evidence for particular risks associated with any of them.
Most glue guns are supplied with a metal stand that allows them to be stood upright. These stands should be used where provided since laying the glue gun on its side will cause glue to adhere to the body of the glue gun. The use of a simple stand made from wood is a good alternative to a metal stand.

IMMEDIATE REMEDIAL MEASURES

Hot adhesive is on the skin	As soon as possible, plunge the skin into cold water or hold it under a running cold tap. Keep the burn in cold water for at least 5 minutes (10 minutes if the casualty continues to experience discomfort). If extensive, seek first-aid treatment as for any other burn. DO NOT APPLY CREAMS OR OINTMENTS OF ANY TYPE.

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1.004 COSHH Regs	Adhesives: Hot-Melt Glue Sticks	Applicable to: glue sticks	See also: 1.003

Process(es) covered:

These adhesives are supplied as sticks of copolymers of ethene and vinyl acetate. Polyamide is used in some specialist applications. Heat is used to melt the adhesive in the 'glue gun' so that drops can be applied to the materials to be joined. Bonding results when the glue solidifies on cooling. They form fairly strong bonds between many surfaces, eg, cardboard, wood and plastics. Metals present a problem because they conduct the heat away from the joint too quickly unless the metal is pre-heated.

Hazards

Burns

There are two basic classes of hot-melt glue:
the original (hot-melt) material, melting at 160 to 190 °C and
the 'low-temperature' (cool-melt) one, melting at 90 to 110 °C.
The guns are designed for one class of glue only (although there are variants within each class). The cool-melt glue sets more quickly and may be difficult to use for complex assemblies.

Irritant

If the glues are overheated (by using a soldering iron or flame to melt them), they can release irritant fumes and vapours.

Risk Assessment

Burns

Both classes of glue are capable of blistering the skin when dripped directly onto it but the cool-melt glue is safer.

Irritant

If the glues are heated only with the appropriate glue gun the risk is trivial.

Control measures

No specific control measures are required but the cool-melt glue should be chosen provided it is adequate for the task.
Adequate supervision should be provided[8].
Heating structures assembled with hot-melt glue should be avoided

[8] Advice on the use of glue guns with younger children (eg, visitors from primary schools) is given in the CLEAPSS guide L18, *Glues and Adhesives*.

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RESTRICTIONS	Low-melt glue sticks must never be used in a hot-melt glue gun: the slightest pressure will cause the glue to squirt out.
Disposal	Unwanted glue can be disposed of as normal refuse.
Storage	In a cool, dry place to avoid distortion of the sticks, which might prevent them from moving freely through the glue gun.

FURTHER INFORMATION

Polyamide glues require a more sophisticated glue gun to ensure the correct temperature and this is considered too expensive for schools.

IMMEDIATE REMEDIAL MEASURES

Hot adhesive is on the skin	As soon as possible, plunge the skin into cold water or hold it under a running cold tap. Keep the burn in cold water for at least 5 minutes (10 minutes if the casualty continues to experience discomfort). If extensive, seek first-aid treatment as for any other burn. DO NOT APPLY CREAMS OR OINTMENTS OF ANY TYPE.

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1.005 COSHH Regs	Adhesives: Reactive resins, Epoxy, Polyester	Applicable to: Araldite; Bondaglass; Bostik Epoxy; Permabond; Plastic Padding; UHU Plus; etc	See also: 1.055

Process(es) covered: This wide range of epoxy adhesives and polyester resins is produced mostly as two-component systems. Curing is effected by the reactions of a resin and a hardener. Epoxy resins are used for the bonding of metals, ceramics, glass, rubber, plastics, wood, etc. Polyester resin has useful applications where glass fibre is involved and for bonding ceramics, some metals and rubbers.

Hazards

Irritant — Sensitisation of the skin and eyes may occur by contact with uncured material (liquid or solid) or exposure to its vapour or dust. May also cause contact dermatitis. Irritation to the eyes, nose, throat and lungs by dust from the machining or abrading of fully-cured material.

Highly flammable — Certain epoxy materials give off highly flammable vapours

Risk Assessment

Irritant — Because of the limited use and the small quantities involved in school workshop operations, these hazards do not represent a risk to health.

Highly flammable — In school workshops, where the total area of application at one time does not exceed 0.25 m^2, this risk is small.

Control measures

No special measures are required; ordinary ventilation is sufficient, the use of these adhesives should be carried out under general supervision.

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Disposal	For small quantities, mix the resin and hardener, allow to cure and place in a plastic bag in the waste. For large quantities, an authorised waste disposal contractor is required.
Storage	In a cool, dry place away from food and food containers.

FURTHER INFORMATION

The catalysts in the hardeners now used in these products are less hazardous than the dibenzoyl peroxide traditionally used.

IMMEDIATE REMEDIAL MEASURES

Swallowed	Immediately rinse the mouth with water. Drink plenty of water and seek medical attention promptly.
Vapour is inhaled	The casualty should be taken to fresh air and made to rest whilst medical attention is sought.
In the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
On the skin	Immediately remove by wiping with a disposable paper towel. Then cleanse the affected area with resin-removing cream[9], followed by washing with warm, soapy water. Do not use solvents.
Spilt in the workshop	Spilt resin should be taken up with sand, cotton waste, sawdust, paper towel or other absorbent material. This should then be placed in a plastic bag and sealed prior to disposal. The area should then be washed with hot water and detergent. Spills of hardener (catalyst) should **not** be absorbed on sawdust or other flammable material. Mineral-based cat litter is suitable.

[9] Various suppliers of resins can supply barrier cream and cleansing cream.

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1.006 COSHH Regs	Adhesives: Reactive resins, Formaldehyde	Applicable to: Cascamite; Aerodux 185; Aerolite 300/306; Cascophen; RS216M; etc	See also:

Process(es) covered: These adhesives are essentially a resin bonding agent (liquid or powder) which sets as a result of chemical action with a hardener. A catalyst may be added to accelerate setting at room temperature.

Hazards

Toxic	Fumes of methanal (formaldehyde) (R23/24/25) and other organic vapours are toxic.
Dust	Unmixed powder is hazardous by inhalation.
Irritant	All components are potentially irritant to skin and eyes
Highly flammable	Some liquid resin components are highly flammable
Sensitiser	Methanal (formaldehyde) (R43) is a recognized skin sensitiser.

Risk Assessment

Toxic	Methanal fumes are given off during curing. The WEL is 2 ppm (both 8 h TWA and 15 min ref period)[10]. This will not be reached with the small joints made in school workshops. Some resin components are a complex mixture of hydrocarbons having heavier-than-air vapours that are harmful by inhalation. On the scale of use in school workshops, both fumes and vapours will be adequately removed away by good natural ventilation.
Dust	Urea formaldehyde powder is subject to the general dust limit: a WEL of 10 mg/m^3 (8 h TWA)[1]. However, unless more than a litre of adhesive is prepared at once, this limit will not be reached.
Irritant	Prolonged contact with skin may cause dermatitis so, if these adhesives are used frequently, gloves should be worn.
Highly flammable	For example, Cascophen contains ethanol and methanol but the levels produced in the school workshop will not present a problem.

Control measures	
	Manufacturer's advice must be strictly followed. All work areas must have good natural ventilation. Care must be taken to avoid raising dust during mixing, which is best done by teachers or technicians. Gloves should be worn or a barrier cream should be applied. The skin should be thoroughly washed with soap and warm water after using the adhesive and before eating, drinking or using the toilet. All containers should be closed when not in use to minimise evaporation or spilling.

[10] EH 40/2007.

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Disposal	Small quantities can be added to solid refuse.
Storage	Store in a cool, dry place with the containers tightly closed. Resins classified as Highly Flammable, if held in large quantities, are subject to storage regulations. Contact CLEAPSS for detailed advice.

FURTHER INFORMATION

These adhesives are particularly valuable for bonding wood and produce an exceptionally strong, waterproof joint.
The vapours from some resins may cause nausea, headache and dizziness.

NB Methanal (formaldehyde) is **not** considered to be a human carcinogen, although it is listed as a 'carcinogen category 3', which means there is some evidence that it can cause a cancer in animals when administered at high concentration.

IMMEDIATE REMEDIAL MEASURES

Swallowed	DO NOT INDUCE VOMITING. Seek medical attention.
Vapour is inhaled	The casualty should be taken to fresh air and, if unconscious, turned on face. If breathing is irregular or has stopped, administer artificial resuscitation while medical attention is sought.
In the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
On the skin	Remove excess with hand cleaner, followed by washing with soap and water. Do not use solvents.
Spilt in the workshop	The powder should be collected with an industrial vacuum cleaner to keep the dust to a minimum. Liquid resin should be contained and soaked up by an absorbent, non-flammable material (dry earth or sand). Do not allow to enter drains. Exclude sources of ignition and ventilate the area.

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1.007 COSHH Regs	ADHESIVES: SOLVENT-BASED, CELLULOSICS, POLYMER CEMENTS, RUBBER SOLUTION	Applicable to: Bostik No 1; Thixofix; Evostik 528; Britfix PVC; Plastic Weld; Polystyrene & Balsa cements	See also: 1.001

Process(es) covered:	The adhesive is applied to both surfaces to be bonded, the solvent allowed to evaporate and the surfaces then joined. The solvents are usually highly flammable (hydrocarbons, esters or ketones) but are sometimes non-flammable chlorinated hydrocarbons. Cements used with polymers such as ABS and polystyrene are often just mixtures of solvents that are drawn into the joint by capillary action. This risk assessment also covers paint strippers that use similar solvents, eg, methylene chloride (dichloromethane).
Hazards	
Harmful	Some are hazardous by inhalation (may cause drowsiness), through the skin and by swallowing. Both methylene chloride (R40 Sk) and trichloroethylene (R45, 67 Carc Sk) can have irreversible effects. Toluene (R48/20, 63, 65) vapour can lead to nausea, headaches, dizziness and, eventually, to unconsciousness.
Irritant	Some, eg, toluene (R38) are irritant to skin and eyes eg propanone (R36).
Highly flammable	Some use highly flammable, volatile solvents (R11) such as toluene, propanone (acetone) and petroleum spirit.
Risk Assessment	
Harmful	In use, these adhesives give off a vapour that is heavier than air (eg, toluene, WEL 50 ppm, 8 h TWA[11]; 100 ppm, 15 min ref period). Methylene chloride has a WEL of 100 ppm, 8 h TWA, 300 ppm, 15 min ref period and trichloroethylene has a WEL of 100 ppm, 8 h TWA, 150 ppm, 15 min ref period. In a school workshop, good natural ventilation will be adequate, but these adhesives should not be used in confined spaces. Where total areas greater than 300 mm × 300 mm are being bonded, this work must be done under cover outside or with local exhaust ventilation.
Irritant	Avoid prolonged contact. The cements in tubes are quick drying and can block the tube nozzle; when pressure is applied to clear the blockage, spurting can occur.
Highly flammable	There is a considerable risk of ignition during the drying period, particularly with those classified as petroleum mixtures.

Control measures	
	Good ventilation is required during application and drying to prevent the inhalation of solvent vapours. It is essential that the top is replaced on any adhesive container as soon as possible. Eye protection is needed when using adhesives from tubes. The ventilation required will disperse potentially explosive concentrations of solvent vapour.

[11] EH 40/2007.

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RESTRICTIONS	Solvent abuse. Strict control over the use and storage of solvent-based adhesives should be enforced to ensure that the deliberate inhalation of vapour does not take place.
Disposal	Waste, including emptied containers, must be transported to a domestic recycling or disposal site. Large quantities require collection by an authorised waste disposal contractor.
Storage	In sealed containers in a dry place within the temperature range of 5 to 30 °C and well away from sources of ignition such as sparks, pilot lights and other naked flames, ideally in a highly flammable liquids cupboard. They should not be stored with oxidising agents (eg, the catalysts for hardening resins and sodium persulfate used for etching copper boards) and other highly combustible materials.

FURTHER INFORMATION

The adhesives come as a wide range of viscous liquids comprising dissolved resins and rubbers in solvents, whose vapours, if inhaled, can lead to nausea, headaches, dizziness and, eventually, to unconsciousness. Some of the adhesives effectively bond a wide range of materials including wood, rigid PVC, plastic laminates, fabrics etc, whilst others are specifically intended for use with a single material.

IMMEDIATE REMEDIAL MEASURES

Swallowed	DO NOT INDUCE VOMITING. Seek medical attention.
Vapour is inhaled	Remove casualty to fresh air and seek medical attention.
In the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
On the skin	Wipe off excess with a paper towel and clean with resin-removing cream[12] or hand cleanser. Do not use solvent. Finally, wash with soap and water.
Spilt in the workshop	Remove all sources of ignition and ventilate the area thoroughly. Cover the spill with sand or earth, pick up the resultant paste with spark-proof tools and place in a sealable, metal container. Store safely pending disposal.

[12] Various suppliers can supply barrier cream and cleansing cream.

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1.008 COSHH Regs	Adhesives: Solvent-based, Repositionable	Applicable to: Photomount; Scotch Mount; SprayMount	See also:

Process(es) covered: The adhesive is sprayed onto one of the surfaces to be bonded; the drying time is long so that repositioning is possible. The adhesive is supplied as a solution in organic solvents and delivered as an aerosol with propane / butane propellant.

Hazards

Harmful	A small fraction of the solvent mixture is hexane (R48/20, 65) which is harmful by inhalation or swallowing. This can lead to nausea, headaches, dizziness and, eventually, to unconsciousness.
Irritant	Hexane (R38) is irritating to the skin.
Highly flammable	Highly flammable, volatile solvents and propellants are used.

Risk Assessment

Harmful	Hexane has a WEL of 20 ppm (8-hour TWA[1]) and butane has a WEL of 600 ppm (8-hour TWA) 750 ppm (15 min ref period)[13]. Propane is asphyxiant at high concentration. There is a risk of solvent abuse.
Irritant	Repeated spraying of the adhesive onto the hand is likely to irritate it.
Highly flammable	There is a considerable risk of ignition during the spraying period since butane is listed as extremely flammable (R12).

Control measures

Good ventilation is required during application and drying to prevent the inhalation of solvent vapours and propellant gases.
If good ventilation is not available in the workplace, spraying and drying can be done outside.
Avoid holding the surface being sprayed with a bare hand. If pins cannot be used, the hand should be protected with a disposable nitrile glove.
The ventilation required would disperse explosive concentrations of solvent vapour but these adhesives should not be used in the same room as sources of ignition.

13 EH 40/2005.

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RESTRICTIONS	Solvent abuse. Strict control over the use and storage of solvent-based adhesives should be enforced to ensure that the deliberate inhalation of vapour does not take place. 'Spraymount' adhesives are particularly convenient for mounting artwork for preparing printed-circuit boards but should be used by staff only and then in well-ventilated areas.
Disposal	Emptied containers may be disposed of in ordinary dry waste. No attempt must be made to incinerate locally.
Storage	One container may be kept on a shelf ready for use but should be stored in a suitable metal cupboard at the end of the school day or when not in use. Spare containers should be kept at temperatures below 49 °C in a metal cupboard designated as suitable for the storage of highly flammable liquids.

IMMEDIATE REMEDIAL MEASURES

Swallowed	DO NOT INDUCE VOMITING. Seek medical attention
Vapour is inhaled	Remove casualty to fresh air and seek medical attention.
In the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
On the skin	Wipe off excess with a paper towel. Wash with soap and water.

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1.009 COSHH & Man Regs	Adhesives: Water-based, PVA, Rubber latex	Applicable to: Bostik 8; Britfix PVA; Unibond; Resin W; Copydex; etc	See also:

Process(es) covered: These adhesives are sold as emulsions and are ready to use.

Hazards

Sensitisation	People with a sensitive skin could have an allergic reaction. Latex allergy is especially common.
Highly flammable	Vinyl acetate monomer is highly flammable

Risk Assessment

Sensitisation	These adhesives are very safe but, although latex allergy has not yet been reported with latex adhesives, contact with skin and eyes should be avoided.
Highly flammable	Vinyl acetate monomer is highly flammable.

Control measures
No special measures are required, other than supervision of users

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Disposal	Moderate amounts may be placed in normal refuse.
Storage	Store in a dry place in the temperature range 5 to 25 °C. Protect from frost.

FURTHER INFORMATION

Polyvinyl acetate (PVA) bonds wood, paper, fabrics, card and leather. However, it will not stick PVC, rubbers or polythene. PVA adhesives contain different fillers for different applications so a product designed to bond leather is not necessarily ideal for fabrics or paper.

Although these adhesives are among the safest available, they should not be used by pupils who might put them in their noses or mouths. This action could lead to a dangerous obstruction to breathing if the solidifying products were inhaled; there is similarly a danger that they might be swallowed. This risk is reduced if the adhesive is supplied in a jar rather than in a tube.

If PVA comes into contact with clothing it should be immediately soaked with cold water. If is left to dry it may bond to the fibres of the clothing and will then not be removable.

IMMEDIATE REMEDIAL MEASURES

Swallowed	Drink plenty of water and seek medical attention.
In the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
On the skin	Wash off with water then with soap and water, before the material dries. If adhesives dry on the skin, wash with a skin cleanser. Do not use solvent for hand cleaning.
Large quantities are spilt	Absorb with earth or sand. Place in a metal or plastic container pending disposal. Do not allow to enter drains.

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1.010 Man Regs	CNC machines	Applicable to: card and vinyl cutters, milling machines and lathes controlled by a computer	See also: 1.032 1.033 1.037 1.038 1.053 1.071

Process(es) covered: The cutting and shaping of compliant and resistant materials using machines controlled by a computer ('CNC machines'). Cutting / soluble oil is often used when metals are being shaped.

Hazards

Trapping	Fingers can become trapped between moving and fixed parts of machines that are not fully enclosed.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with moving parts that are not fully enclosed.
Dust	Dust can be emitted when cutting materials if the machine is not fully enclosed.

Risk Assessment

Trapping	Machines that are not fully enclosed, and cutters used for thin sheet materials which do not normally have guards fitted, present a risk from trapping.
Entanglement	Entanglement could occur if the user is too close to a machine which is not fully enclosed or which starts unexpectedly when being set up.
Dust	Dust will be produced when machining MDF and high-density modelling foam. Where machines are not fully enclosed, this will present a risk.

Control measures

Some smaller CNC machines are fitted with guards which prevent access by the user under normal circumstances, but which do not fully enclose the machine. Additional guarding may be required, or the machine could be contained within a suitable enclosure to prevent access. CNC cutting machines used with sheet materials need sufficient working space to allow the material being cut to move freely. The cutting head can move quickly. Users should be instructed to keep well clear of the cutting head when the machine is in use. To reduce the risk of the machine starting to cut unexpectedly, the person loading the machine should also operate the computer that controls the cutter.

Where machines are not fully enclosed, long hair should be tied back, jewellery should be removed or covered and loose clothing should be secured. Users and observers should be instructed to take care when observing the cutting process.

The larger CNC machines are usually fully enclosed, with an electrical interlock fitted to the enclosure. There is no hazard from these machines since access is not possible when the machine is running and any dust that is produced will be contained within the enclosure. If the machine is not connected to a dust-extraction system, a vacuum cleaner will be required to remove the dust once cutting is complete. Machines that are used extensively to shape MDF or modelling foam should be connected to a dust-extraction system.

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Disposal	Dust should be disposed of as detailed in 1.071.

FURTHER INFORMATION

3D machining can produce considerable amounts of dust and other waste. A range of materials is available for use with CNC machines, particularly milling machines. Some of these, such as wax and modelling foams, allow for the rapid production of prototype 3D models. It is also possible to use these machines to make circuit boards using copper-clad, resin-based, glass-reinforced laminate. Teachers should consult the relevant *Model Risk Assessment* for the material being cut and this should be supplemented by health & safety information provided by the supplier of the material.

Some materials are abrasive and can cause rapid tool wear. Care should be taken to ensure that the correct type of cutting tool is used and that the tool is sharp. The use of incorrect or blunt tools may produce excessive amounts of dust and/or heat and therefore increase the level of risk. Cutting oils are normally used when shaping metals, with large quantities being delivered by a pump. Reference should be made to 1.033 for advice on cutting oils.

There have been instances where the tool holding collet has rubbed on the work piece and generated heat due to the friction. This is particularly the case where the software used does not allow the emulation of the tool part before cutting takes place and has happened when a machine has been running overnight. If the tool path cannot be emulated, it is recommended that machines are not left running unattended.

IMMEDIATE REMEDIAL MEASURES

Dust is in the eye	Irrigate immediately with water for several minutes, telling the casualty to hold eyelids apart.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.

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1.011 Man Regs	Craft knives, scalpels and scissors	Applicable to: craft knives; scalpels; scissors (hand & powered)	See also: 2.007

Note This sheet largely repeats information on 2.007 but is repeated here for the convenience of schools, for example, where work with textiles is quite separate from graphics work.

Process(es) covered: The use of scissors for cutting paper and boards.
The use of craft knives and scalpels, with and without cutting mats.

Hazards

Cuts to user — Craft knives and scissors (whether powered or not) can cut fingers.

Injury when carried — Knives and scissors can injure the user or others when being carried or as a result of misbehaviour in the workplace.

Risk Assessment

Cuts to user — Cuts are received from craft knives by slicing when cutting along a straight edge or template or when the knife slips out of the material. Cuts also result from changing blades in scalpels and craft knives, particularly the type with snap-off blades.

Injury when carried — There is a risk of injury if scissors or knives are carried with the blade exposed. This risk is increased where desks / tables are close together or where bags on the floor give a risk of tripping.

Control measures

The use of a cutting mat greatly reduces the risk of cuts from craft knives. The mat reduces the risk of the work slipping and of loss of control of the knife when the end of the cut is reached. The use of steel 'safety rules' reduces the risk of slicing fingers and the hand holding the material should always be behind the direction of cutting. It is necessary to teach the safe ways to change blades on knives and scalpels.
If craft knives are used for carving and shaping wood, the wood must be held or clamped so that hands cannot be cut.
Children must be taught how to carry scissors safely with the blades enclosed by the fist. Craft knives with retractable or rotary blades are safer to carry than those with open blades. Clear instructions must be given to ensure the circulation space is kept clear of obstructions.

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RESTRICTIONS	For younger pupils, blade changing should be carried out by adults. This is especially true of the 'snap-off' type of knife blade. With some classes, it may be necessary to restrict the use of craft knives to an inherently safe type.
Disposal	Used blades must be disposed of responsibly. An old coffee tin or a small 'sharps box' as used in first-aid rooms or science laboratories could be used.
Storage	Scissors and knives must be stored in a secure place to control access. It is important to ensure that scissors and knives are collected in after use since they could constitute a hazard if removed by children or if left on tables, chairs or on the floor.
FURTHER INFORMATION	
	Battery-powered scissors (eg, Pifco Speedcut) may be safer than ordinary scissors because the opening of the blades is small and the length of exposed blade is short.

IMMEDIATE REMEDIAL MEASURES

Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves then the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.

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1.012 Man Regs	Cutting AND SHAPING metal BY HAND	Applicable to: saws for metal; files; cold chisels	See also:

Process(es) covered: The use of hacksaws to cut metal.
The use of cold chisels to cut metal.
The use of files on metal.

Hazards

Cuts to user	Incorrect or careless use of a hacksaw can cause cuts. Poor holding of the work can cause saws to slip and cause cuts. Handles of files may work loose from the tang and cause injury. Wooden file handles may split allowing the tang to pierce the palm of the hand.
Eye injury	Prolonged use of a cold chisel can cause a burr to occur on its head. In extreme cases, the end of the cold chisel will 'mushroom' over. Striking this burr at an angle could cause chips of metal to fly off.
Impact injury	The hammer may cause impact injury if used inaccurately.

Risk Assessment

Cuts to user	The risk of cuts is greater if the saw blade is not fitted correctly and if the vice or clamp is inappropriate for the task. Old file handles present a greater risk than new.
Eye injury	The use of excessive force because the chisel is blunt increases the risk of chips of metal flying. Injury from burrs is rare.
Impact injury	Novices are quite likely to hit their fingers with a hammer while attempting to use a cold chisel, but the resulting injury is usually trivial.

Control measures

With all of the tools covered by this risk assessment, inexperienced users should be given appropriate instructions in their use.

When using a hacksaw or junior hacksaw to cut metal, or when using a cold chisel, the work should be held in a metal-work vice. The head of the chisel should be checked for burrs and these should be removed using a suitable grinding machine. Eye protection should be worn when using a cold chisel to cut metal.

When sawing work that is too large to fit into a suitable vice the work should be held as securely as possible, with the aid of several G-clamps. Care should be taken to ensure that at no time is the saw cutting towards any part of the body of the operator, or any assistant who may be holding the work.

Wooden file handles should be checked regularly for tightness or for splits and should be replaced when necessary. Plastic handles are usually more robust and are less likely to work loose. Students should be instructed to seek assistance from a teacher or technician should they find that a file handle is loose.

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RESTRICTIONS	Sharpening of cold chisels and removal of burrs should be done by a suitably-trained adult.
Storage	Hand tools should be stored at a height appropriate for safe collection by the students. The storage system should be such that it is easy to check that all tools have been returned. In some situations it might be considered necessary to lock the cupboard(s) containing hand tools.

IMMEDIATE REMEDIAL MEASURES

Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Impact injury	Rest the injured part; apply ice to reduce the bruising and pain; attention from a first aider may be required.
A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.

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1.013 Man Regs	Electrical and Electronics work	Applicable to:	See also: 1.014 1.015 1.025 1.026

Process(es) covered:

The design and construction of items which will be connected to the mains supply where the use of electricity is peripheral (eg, lamps) or fundamental (eg, low-voltage power supplies for electronics).
Instruction in the repair and maintenance of high-voltage equipment.
The construction of electronics circuits from prepared modules or components.

Hazards

Electric shock

Any equipment connected to the mains supply has the possibility of giving an electric shock to the user or constructor.
The repair of equipment using cathode-ray tubes will involve EHT power supplies with significant current output.

Explosion

Many electronic components can disintegrate violently if overheated.

Risk Assessment

Electric shock

Projects to design and make reading or standard lamps require mains wiring and present considerable risks unless the principles of safe construction are understood and followed.
Building a power unit for an electronics system may be part of the learning process and not avoidable. Again, it presents considerable risks unless the principles of safe construction are understood.
Repair and maintenance of high-voltage equipment also present considerable risks.

Explosion

Resistors, cells, electrolytic capacitors, thermistors and integrated circuits have all exploded in educational activities. The frequency is low and the risk of injury is not high although particles may enter the eye and give rise to alkaline contamination.

Control measures

In many cases, mains electricity can be avoided by using commercial low-voltage supplies (eg, battery eliminators) so that lamps and electronic equipment have a safe input of 6 or 12 V ac or dc. Where this is not appropriate, the design and construction must be carefully checked and tested using a commercial safety test set and the work carried out by a person trained to do portable appliance testing. (See CLEAPSS guide L242.)
Instruction in repair work should stress the importance of earth-free environments whenever tests on live equipment are to be made.
The risk of explosion is so low that even the wearing of eye protection seems difficult to justify. Most events are due to reversed connection or bad practice (eg, mixing cells of different types in one appliance or circuit). Electrolytic capacitors may also fail if the significance of the ‘ripple current rating’ is not understood or if they have been stored for too long.

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Disposal	Dry batteries originating in technology workshops can be disposed of in ordinary waste (although those from laboratories cannot!). If a local recycling scheme exists, it should be used.
Storage	Electrolytic capacitors deteriorate in storage because the dielectric (insulation) between the plates breaks down. These components, if they have been stored for more than twelve months, should be re-formed before use. See CLEAPSS *Laboratory Handbook* Section 12.

FURTHER INFORMATION

Even with modular electronics teaching kits it is possible for students to make connections which will destroy one or more components. So long as the rate of damage is low, this can be accepted as part of the learning process.

IMMEDIATE REMEDIAL MEASURES

A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Electrolyte is in the eyes (from a battery or capacitor)	Obtain medical attention. Irrigate immediately with water, holding eyelids apart and continue the irrigation until the casualty reaches hospital.

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1.014 COSHH Regs	Electronics: Chemicals for PRINTED CIRCUIT BOARD Etching	Applicable to: etchants; solvents	See also: 1.013 1.015

Process(es) covered: To produce, by etching away unwanted copper, an electronic circuit board designed to meet a specific requirement.
The prepared board is immersed in ferric chloride [iron(III) chloride] solution or sodium peroxodisulfate (persulfate) solution to etch away the copper. The board is sometimes cleaned with a solvent before or after soldering, formerly mainly 1,1,1-trichloroethane, now propan-2-ol (isopropanol) or other alcohols (eg, ethanol).

Hazards

Harmful Both ferric chloride (R22, 38, 41) and sodium peroxodisulfate[14] (R8, 22, 36/37/38, 42/43) are harmful if swallowed. Although the alcohols are not classified as harmful, they can cause headaches, dizziness and drowsiness.

Toxic If the two etchants are mixed, toxic chlorine gas is produced.

Irritant Solid etchants and the etching solution can be irritant to the skin or respiratory system.

Highly flammable When damp, sodium peroxodisulfate slowly releases oxygen, which promotes fire. Mixtures of alcohols (the cleaning solvent) are highly flammable.

Risk Assessment

Harmful Since solid sodium peroxodisulfate is harmful, steps should be taken to minimise the risk of ingestion. Propan-2-ol (R11, 36, 67) has a WEL of 500 ppm (15 min ref period). Ethanol (R11) has a WEL of 1000 ppm (8-hour TWA)[15]. If applied by brush (not a spray), these concentrations will not be approached, even locally, in a school electronics area.

Toxic If the two alternative etchants are both in use in the same work area, it is quite likely that they will be mixed deliberately or accidentally.

Irritant Iron salts have a WEL of 2 mg/m^3 (15 min ref period)[2]. If the solution is prepared with gentle agitation and used in a tank with a lid, the mist produced will be minimised. Sodium peroxodisulfate has an irritant mist that makes it less suitable for use in a bubble-etch tank. When used with a small manual developing tray, little mist will be produced.

Highly flammable The presence of sodium peroxodisulfate adds little to the fire risk presented by the solvent.

Control measures

When preparing solutions and emptying tanks, eye protection and protective gloves must be worn. If the processes are carried out in bubble tanks, the lids must be fitted to contain any mist.

Ferric chloride and sodium peroxodisulfate should not be available together in one workplace to eliminate the possibility of mixing. See over for changing etchants.

Users with cuts or sensitive skin must wear disposable gloves. The wet boards must always be handled with plastic tongs.

Sources of ignition should be removed from the area when using highly flammable solvents and natural ventilation is required to keep the level of vapour as low as practicable.

14 Since 1994, the recommended spelling of sulfur and sulfate etc has been with an ‘f’ not ‘ph’.

15 EH 40/2005.

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Disposal	Solid waste of both etchants should be placed in appropriate containers and consigned to an authorised waste disposal contractor. Used ferric chloride solution should be neutralised with sodium carbonate and flushed away. NB Emptying the tank requires care and a siphon pump is recommended. If changing from ferric chloride to sodium peroxodisulfate (or vice versa), the tank must be washed out thoroughly before filling with the new etchant. Solutions of sodium peroxodisulfate should not be stored in sealed containers but may be re-used until they are a deep copper-sulfate blue when they can be well-diluted and flushed away with plenty of water.
Storage	Both substances should be stored in a secure, well-ventilated area. Ferric chloride should not be stored in the vicinity of metals.

FURTHER INFORMATION

If a single bubble-etch tank is used, it is recommended that a base board is used to improve the stability. The tank can be held in an aluminium U-channel with sides at least 100 mm high and screwed to the board. Alternatively the tank could be fixed to a baseboard using aluminium strips. It is useful to fit a device to enable the lid of the tank to be locked shut when not in use.

IMMEDIATE REMEDIAL MEASURES

Swallowed	Wash out mouth thoroughly with water and give plenty of water to drink. Obtain medical attention.
Mist is inhaled	Remove from exposure. Keep warm and at rest. In severe cases, obtain medical attention.
In the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Spilt in workshop	Dilute with copious quantities of water and swill away.

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1.015 COSHH Regs	Electronics: Chemicals for PRINTED CIRCUIT BOARD Preparation	Applicable to: photoresist developer; photoresist stripper	See also: 1.013 1.014

Process(es) covered:

To produce the track layout on a copper-clad board so that an electronic circuit can be made by etching away unwanted copper.
This may be done by hand with an etch-resist ink pen or photographically using a transparent mask and a board coated with photoresist. The board may be precoated or sprayed when required. After exposure to ultra-violet radiation (UV), the photoresist coating is developed using a dilute solution of sodium hydroxide (0.4 M or 16 g/l) or sodium silicate (5%). After etching, a more concentrated solution of sodium hydroxide (2 M or 80 g/l) may be used to strip away the coating or it can be removed with a proprietary stripper (eg, ethanolamine in 2-butoxyethanol).

Hazards

Corrosive — Solid sodium hydroxide and concentrated solutions of it are rated corrosive (R35).

Harmful — The 5% sodium silicate (sometimes called metasilicate) solution (R34) is harmful by inhalation and if swallowed. The stripper is harmful by inhalation and in contact with skin (R20/21/22, 34).

Irritant — Sprays of all the solutions can be irritant to eyes, skin and respiratory systems.

Risk Assessment

Corrosive — Sodium hydroxide and its concentrated solution may cause burns to the skin and may blind eyes. The mist has a WEL of 2 mg/m^3 (15 min ref period)[16]. This will not be a risk to health in education as the mist from the process tank can be contained beneath the lid.

Harmful — The proprietary stripper contains ethanolamine (2-aminoethanol) (WEL 6 ppm for 15 min ref period[1]) and 2-butoxyethanol (WEL 25 ppm over 8 h TWA and 50 ppm for 15 min ref period) and must also be kept out of eyes (R36/38 Sk).

Irritant — The more dilute solutions used as a developer must also be kept out of eyes and should be kept off skin.

Control measures

When preparing solutions, emptying tanks and using manual developing trays, chemical goggles and protective gloves must be worn.
If the processes are carried out in bubble tanks, the lids must be fitted while operating to contain any mist.
The measures used to control the other risks will also limit the irritant issue.

16 EH 40/2007.

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Disposal	Solid waste should be placed in appropriate containers and consigned to an authorised waste disposal contractor. Used sodium hydroxide solutions should be neutralised with 1 M ethanoic (acetic) acid before pouring down the foul-water drain. NB Emptying a tank requires care and a siphon pump is recommended. Sodium silicate solutions are difficult to dispose of and the following technique is suggested. Put no more than 500 ml of solution in the bottom of a bucket and add a similar volume of 1 M ethanoic acid. This will convert the solution to a gel. Almost fill the bucket with warm water and stir. Leave for several hours, stirring occasionally, and then pour down the foul-water drain (a toilet) and flush away.
Storage	All substances should be stored in a secure, dry, well-ventilated area.

FURTHER INFORMATION

If the layout is transferred photographically to the copper-clad board, ultra-violet radiation is needed to expose the photoresist. Since the UV is hazardous to the eyes, the boards are placed in commercial exposure boxes that have interlocks so that the lamp can only be switched on when the lid is closed. Home-made boxes should not be used.

NB If the tanks form part of a plumbed in 'labstation', a non-return valve must be fitted in the water supply.

IMMEDIATE REMEDIAL MEASURES

Swallowed	Wash out mouth thoroughly with water and give plenty of water to drink. Obtain medical attention.
Mist is inhaled	Remove from exposure. Keep warm and at rest. In severe cases, obtain medical attention.
Sodium hydroxide or sodium silicate solutions are in the eyes	Obtain medical attention. Irrigate immediately with water, holding eyelids apart and continue irrigation until the casualty reaches hospital
The proprietary stripper or acetic acid is in the eyes	Irrigate immediately with water, holding eyelids apart, for at least 10 minutes.
The proprietary stripper or acetic acid is in the eyes	Irrigate immediately with water, holding eyelids apart, for at least 10 minutes.
Any of these solutions are spilt in the workshop	Dilute with copious quantities of water and swill away.

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1.016 Man Regs	HEAT PROCESSES: Brazing, Silver soldering	Applicable to: steel; brass; copper; gilding metal; silver	See also: 1.017 1.023 1.029

Process(es) covered: The bonding together of two pieces of metal, the joint being created by a layer of molten alloy, the flow of which is assisted by a flux. Brazing utilises a filler alloy having copper as the major constituent and is a higher-temperature process than silver soldering, where the filler alloy contains a high proportion of silver.

Hazards

Explosion	Incorrect handling of gas / air or gas / oxygen blowpipe (torch).
Radiant heat	Infra-red radiation from hot surfaces, flames etc, can damage the cornea of the eye.
Burns	Careless handling of hot metals or ceramic blocks after brazing.

Risk Assessment

Explosion	Valves on cylinders, controls on blowpipes etc must be operated correctly. Flashback arrestors and non-return valves should be fitted.
Radiant heat	Most school brazing jobs are too short for this to be a serious problem but if an oxy-acetylene blowpipe is used for heating then it will be.
Burns	Handling hot metals (particularly when at 'black heat' which may not appear hot) presents a real risk of burns. Rearranging ceramic blocks for a new job can cause burns if they are still hot from a previous use. Quenching hot metals in a bath of water can produce scalding amounts of steam

Control measures

Operators should be trained in the use of the equipment.

As there is a risk of spitting of flux or spatter of molten metal[17] eye protection giving protection against radiant heat and metal or flux should be worn.

The clothing worn must provide adequate protection from the heat and hot objects. This should include substantial footwear, a fire-resisting apron, gloves or gauntlets as well as eye protection.

When hot metal or blocks are left to cool, a warning notice should be displayed close to them.

Hot metals or ceramic blocks should be handled with suitable tongs.

The floor should be kept clear of any tripping or slipping hazard since anyone carrying a hot object will not be concentrating on the floor.

[17] Eye protection is marked with a number which describes the darkness of the filter, a manufacturer's mark and a robustness code which may be a number or a letter and number. Eye protection for brazing should have the following codes on each ocular (lens) where X is the manufacturer's mark: 4 or 5 X 1 or 2 F or S 9.

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Storage	Gas cylinders *ready for use* may be kept in the workshop and should be held securely, with the valves uppermost, either close to a wall or bench or in a cylinder trolley. When not in use, the equipment should be removed from the workplace to a suitably designated store, agreed with the local Fire Prevention Officer, away from any source of heat. While secure from unauthorised persons, easy access must be assured at all times in case of fire. Spare cylinders, whether full or empty, should be kept in a secure, well-ventilated place, ideally outside.

FURTHER INFORMATION

The brazing hearth should contain only ceramic chips and/or firebrick blocks designed to be heated. Ordinary bricks and stones can explode when heated.
Any propane (LPG) tanks or pipework should be installed and maintained to the standards of the *Pressure Systems Safety Regulations* 2000.

IMMEDIATE REMEDIAL MEASURES

Flux powder or paste is in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.
Flux is swallowed	The casualty must go to hospital

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1.017 COSHH Regs	HEAT Processes: Brazing, Silver soldering, Fumes and fluxes	Applicable to: brass; copper; gilding metal; steel; silver	See also: 1.016 1.023 1.029

Process(es) covered: The bonding together of two pieces of metal, the joint being created by a layer of molten alloy, the flow of which is assisted by a flux. Brazing utilises a filler alloy having copper as the major constituent and is a higher-temperature process than silver soldering, where the filler alloy contains a high proportion of silver.

Hazards

Toxic Flux fumes. Copper and zinc fumes from silver brazing alloys can induce 'metal fume fever' (see *Further Information* overleaf).

Irritant The blowpipe (torch) may produce nitrogen oxides that might cause irritation of the respiratory tract, while contact with the flux may irritate skin and eyes.

Risk Assessment

Toxic Flux fumes are dependent upon the flux composition, which varies according to the manufacturer. They could contain a small amount of hydrogen fluoride (R26/27/28, 35) (WEL 3 ppm 15 min ref period)[18] and possibly boron trifluoride (R14, 26, 35) (WEL 1 ppm 15 min ref period)[19].
The WEL for copper fume is 0.2 mg/m^3 (8 h TWA) and for zinc fume 10 mg/m^3 (8 h TWA). Metal fume fever will not occur below these limits.
None of these limits would be exceeded in a well-ventilated school workshop with the amount of silver soldering or brazing normally done.

Irritant Burnt gases from the torch, ie, carbon dioxide (WEL 5000 ppm, 8 h TWA) with traces of nitrogen oxides) are unlikely to cause any problem in a well-ventilated area.
Prolonged contact with the flux is necessary to give rise to irritation of the skin.
Immediate irritation is likely if the skin has abrasions or cuts.
Irritation of the eyes may be caused by flux in powder form.

Control measures

Brazing hearths in schools and colleges should be fitted with local exhaust ventilation, which will extract fumes at a low level – ie, not past the face of the user. Extraction hoods at high level are unlikely to be sufficient.
Heat-resistant eye protection must be worn[20] where the risk assessment shows that it is required, as would be the case if an oxy-acetylene blowpipe is used as a heat source.
The clothing worn must provide adequate protection from the heat and hot objects. This should include substantial footwear, a fire-resisting apron, gloves or gauntlets as well as eye protection.
If powder fluxes are used, they should be mixed in a special flux tray positioned to minimise dispersion of the powder into the air. Preference should be for ready-mixed paste.
Thoroughly wash hands after work or prior to visiting the toilet.

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18 EH 40/2005.

19 Boron trifluoride does not have an official WEL: this is based on that for the tribromide.

20 Eye protection is marked with a number which describes the darkness of the filter, a manufacturer's mark and a robustness code which may be a number or a letter and number. Eye protection for brazing should have the following codes on each ocular (lens) where X is the manufacturer's mark: 4 or 5 X 1 or 2 F or S 9.

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FURTHER INFORMATION

Should metal fume fever symptoms (similar to influenza) appear, this is usually after a latent period of ten hours. They tend to disappear after a 24-hour rest period. Irritation, caused by gases or fume particles, manifests itself through dryness of the throat, a ticklish cough, tightness of the chest and general breathing difficulties. These assessments assume that filler rods containing cadmium are not used for brazing in school workshops and there are therefore no references to control measures for dealing with its vapour. If such rods were used, the hearths would require local exhaust ventilation with an inspection and test every 14 months. Cadmium oxide fumes (R45, 26, 48/23/25, 62, 63, 68, 50/53 Carc) have a very low WEL of 0.025 mg/m^3 (8 h TWA)[21]. Consequently, products containing (or plated with) cadmium must **not** be welded in schools.

IMMEDIATE REMEDIAL MEASURES

Flux powder or paste is in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.
Flux is swallowed	The casualty must go to hospital.

[21] EH 40/2005.

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1.018 Man Regs	HEAT Processes: Butane Blowtorch	Applicable to: Ronson blowtorch Taymar blowtorch	See also: 1.019 1.025

Process(es) covered: Small soldering jobs requiring a flame or the annealing of small metal objects with a blowtorch attached to a small cartridge of butane.

Hazards

Explosion	Accumulations of butane (which is heavier than air) can explode. Cartridges, even when apparently empty, can explode if in a fire. Bricks other than firebricks can split explosively when hot enough.
Fire	The naked flame could ignite other flammable material.
Radiant heat	Infra-red radiation from hot surfaces, flames etc, can damage the cornea of the eye
Burns	Users have been burned by their own blowtorch or by heat from the metal on which they have been working.

Risk Assessment

Explosion	Cartridges that leak in storage present a significant risk, as does inappropriate disposal. The rate of heating is unlikely to be sufficient to cause bricks to explode
Fire	The risk is small if work is done on a brazing hearth or other non-flammable environment.
Radiant heat	This is unlikely to be a problem with the temperatures involved in these operations.
Burns	Trainees are likely to have inadequate control of the size or direction of the flame while even experienced users may underestimate heat conduction through the workpiece. The burner will be too hot to separate from the cartridge after only a short period of use.

Control measures

Cartridges must be checked for leakage after use and stored correctly.

Even small blowtorches must be used in a non-flammable area.

Heat-protective goggles are not likely to be necessary, but should be considered.

Heat-proof gloves should be available for handling the work and for dismantling the blowtorch.

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RESTRICTIONS	The use of these portable blowtorches should be restricted to responsible students of sufficient maturity to follow the instructions safely under adult supervision.
Disposal	Empty cartridges should be left outside (in a secure location) with the burner valve open to allow the last vapour to disperse; then the cartridge can be placed in the solid refuse.
Storage	Cartridges can be stored with the burner attached or removed, according to the maker's recommendations. They should not be stored in cupboards used for the storage of flammable substances. The location should be secure, well-ventilated, cool, away from flames, combustible materials and escape routes and, ideally, in a fire-resistant structure. Some local authorities may required cylinders to be stored in a well ventilated outside store room. For further details, see CLEAPSS guide L164, *Portable Laboratory Gas Burners*.

IMMEDIATE REMEDIAL MEASURES

Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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1.019 Man Regs	HEAT PROCESSES: Casting	Applicable to: aluminium; lead-free pewter; zinc alloys	See also: 1.018 1.020

Process(es) covered: The production of a one-piece component, often of complex shape, from molten metal poured into the cavity of a mould which may be of sand, steel, plaster or cuttlefish 'bone'. Composite moulds, eg, thin MDF forms between steel plates, are sometimes used for one-off exercises, especially when using low-melting point metals.

Hazards

Explosion	Water, on or in the mould material, can boil explosively when heated by the hot metal.
Burns	Contact with a hot crucible or molten metal splashed onto skin can cause severe burns.
Chemical reaction	Molten aluminium can react violently with metal oxides such as rust.

Risk Assessment

Explosion	The risk of explosion is high in the following cases: when a green sand mould contains excess moisture; when steel moulds are used straight from a cold store or are cooled in water before being re-used; when plaster moulds are not thoroughly dried before use.
Burns	Molten metal can be splashed around when moving hand-held crucibles and ladles or as a result of an explosion whilst pouring.
Chemical reaction	Although the reaction between molten aluminium and iron oxide is very violent, it is rare in school workshops.

Control measures

Water must not be added to oil-bonded sand to overcome apparent dryness.
Green sand is best avoided but large amounts of water must not be used with green sand to aid bonding and achieve even distribution. If green sand is used all parts of the mould that are likely to come in contact with molten metal should be dried out using a brazing torch set to a small soft flame. Staff must have received specific training in its use.
Steel moulds, and ingot moulds used to hold molten metal left after the casting has been poured **must** be pre-heated before pouring.
If a tilting crucible furnace is used to melt the metal, the use of a ladle can be minimised. Neither a ladle nor crucibles should be lifted above waist height.
Whenever molten metals are being handled, suitable personal protective equipment is essential, ie, eye protection, heat-resistant gloves, leather apron, spats, gaiters and appropriate footwear.
Aluminium (or an aluminium alloy) should not be melted in a plain iron pot or ladle. Pots and all iron implements should be wire brushed, coated with a limestone refractory wash and thoroughly dried before use.

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RESTRICTIONS	Casting should only be carried out in a dry area, with equipment designed for that purpose and under the supervision of certificated staff. (See *Duties of Employers* in the *General Introduction*.) Observers must also wear personal protective equipment and should be positioned at least two metres from the operation. There should be sufficient space to manoeuvre the crucible and the pouring area should be tidy and free of trip hazards. Centrifugal casting is a specialist process that requires equipment specifically designed for the purpose and staff with a secure knowledge of the process and its hazards.
FURTHER INFORMATION	Health and safety data supplied by manufacturers of products used should be studied and observed. Centrifugal casting is mainly used for making jewellery and it can be practised using lead-free pewter or white metal if silver is too expensive. Equipment and materials are supplied by specialists such as H S Walsh & Sons Ltd or Tiranti (Alec Tiranti Ltd). Several serious incidents occurred involving casting during the 1990s, resulting in serious injuries to staff and pupils. Some of these incidents became court cases, highlighting the need for staff training and the observance of the elementary precautions above. Low temperature casting using lead free pewter is much safer. Aluminium **must not** be melted in an open ladle, only in a proper crucible furnace. Lead-free pewter is sometimes used for making low-cost cast jewellery. It presents minimal risks. Where the pattern is created in wax, the mould should be heated to melt or burn out the wax before the metal is poured. Although low temperature casting using lead free pewter is much safer, there have been instances of molten metal exploding from a wooden mould that is damp. Care should be taken to see that all moulds are dry, especially on wet days or in locations near to the sea.

IMMEDIATE REMEDIAL MEASURES

Fumes are inhaled	In the event of dizziness occasioned by fume, remove the affected person to the fresh air until recovered.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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1.020 COSHH Regs	Heat PROCESSES: Casting, FUMES and sand	Applicable to: aluminium; lead-free pewter; zinc alloys	See also: 1.018 1.019 1.057

Process(es) covered: The production of a one-piece component, often of complex shape, from molten metal poured into the cavity of a sand mould (oil-bonded or green sand). The pattern is sometimes made of expanded polystyrene, which is left in place and is vaporised by the hot metal. Alternatively, a steel mould can be used where re-use is envisaged. Composite moulds, eg, thin MDF forms between steel plates, are sometimes used for one-off exercises, especially when using low-melting point metals.

Hazards

Toxic — Degassing tablets, smoke from oil-bonded sand or heated MDF can all produce toxic fumes.

Harmful — Fumes of styrene vapour (R10, 20, 36/38) are rated harmful.

Irritant — The sand can irritate sensitive skin.

Risk Assessment

Toxic — Degassing results in fumes from the constituents of the degassant tablets added to the melt. The most hazardous are fluorides (WEL 2.5 mg/m^3 8 h TWA)[22] and hexachloroethane (No WEL available). The latter is identifiable from the camphor-like smell. These fumes must be forcibly extracted to the outside air.
Smoke, primarily hydrocarbons with a small amount of carbon monoxide, is evolved from the metal/mould interface where oil-bonded moulding sand is used which, while not considered a serious hazard, can cause dizziness in the event of over-exposure. If moulds involve MDF and smoke is emitted during pouring, it would be wise to collect the smoke and vent it to the outside air.

Harmful — Styrene vapour (WEL 250 ppm, 15 min ref period[1]) is liberated where expanded polystyrene patterns have been used and must be extracted.

Irritant — Oil-bonded sand is generally considered as non-irritant although those having hypersensitive skin can be affected.

Control measures

Local exhaust ventilation to the outside air is required which, under COSHH Regulations, must be tested every 14 months.
Smoke release, occasioned by separating the casting and the oil-bonded sand mould can, if time allows, be effectively reduced by extending the cooling period to hours rather than minutes.
Those having hypersensitive skin should use an appropriate barrier cream or industrial gloves when creating a mould. Hands should be washed following completion of any part of the process and prior to using the toilets.

22 EH 40/2007.

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RESTRICTIONS

Avoid the use of excessive amounts of water when damping green sand to aid bonding and ensure even distribution (see *Further Information* below).
Water must not be used to overcome apparent dryness in oil-bonded sand.

Disposal

Spills of oil-bound sand can be cleaned up by sweeping or with an industrial vacuum cleaner.
Disposal of both types of sand is via the ordinary refuse collection service.

Storage

Store moulding sand in a cool, dry area.

FURTHER INFORMATION

An explosive discharge of molten metal, through the pouring hole or 'riser', can occur if a green sand mould contains excess moisture. If green sand is used all parts of the mould that are likely to come in contact with molten metal should be dried out using a brazing torch set to a small soft flame. It is for this reason that oil-bonded sand is considered the safer option.
Health and safety data supplied by manufacturers of the products used should be studied and observed.

NB Some proprietary parting powders (used to coat moulds to ease separation) have been found to contain asbestos.

Lead-free pewter is sometimes used for making low-cost cast jewellery. It presents minimal risks. Where the pattern is created in wax, the mould should be heated to melt or burn out the wax before the metal is poured. Although low temperature casting using lead free pewter is much safer, there have been instances of molten metal exploding from a wooden mould that is damp. Care should be taken to see that all moulds are dry, especially on wet days or in locations near to the sea.
Cuttle-fish 'bone' also presents minimal risks when used to form a mould.

IMMEDIATE REMEDIAL MEASURES

Fumes are inhaled	In the event of dizziness occasioned by fumes, remove the affected person to the fresh air until recovered.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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1.021 Man Regs	HEAT PROCESSES: Forging	Applicable to: copper; iron; steel	See also: 1.022

Process(es) covered: The forming of shapes, possibly incorporating irregular and variable cross-section, by the application of localised heat which allows relatively easy transformation by mechanically- or physically-applied effort.

Hazards

Burns	Careless handling of hot metals or ceramic chips after heating, and 'sparks' of metal or hot scale, can cause burns.
Radiant heat	Infra-red radiation from hot surfaces, flames etc, can damage the cornea of the eye.

Risk Assessment

Burns	Handling hot metals (particularly after forging when at 'black heat' which may not appear hot) presents a significant risk of burns. Rearranging ceramic chips for a new job can cause burns if they are still hot from a previous use. Quenching hot metals in a bath of water can produce scalding amounts of steam
Radiant heat	Staff supervising forging work in education could expose their eyes to undue radiant heat.

Control measures

Hot metals or ceramic chips should be handled with suitable tools.
The clothing worn must provide adequate protection from the heat and hot objects. This should include substantial footwear, a fire-resisting apron, gloves or gauntlets as well as eye protection.
The floor should be kept clear of any tripping or slipping hazard since anyone carrying a hot object will not be concentrating on the floor.
When hot metal or the forge is left to cool, a warning notice should be displayed close to either.
Eye protection that reduces the radiation[23] reaching the eyes, and prevents chips of scale entering the eyes, should be worn where the risk assessment shows that it is required. It will also protect against sparks and hot scale.

[23] Eye protection is marked with a number which describes the darkness of the filter, a manufacturer's mark and a robustness code which may be a number or a letter and number. For forge work, it should have the following codes on each ocular (lens) where X is the manufacturer's mark: 4 or 5 X 1 or 2 B or F 9.

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FURTHER INFORMATION

Where coke is used, keep it dry and free from stones in a bunker close to the forge but where it is not likely to be ignited accidentally.
Forging tools should be adequate in range and size for the work being done. After use they should be quenched and returned to a suitable storage rack.
Quenching tanks and anvils should be as close to the forge as possible.
Pupils should be warned of the dangers of:

(a) carrying hot metal;
(b) touching completed items which are cooling;
(c) quenching hot metal, particularly tubes;
(d) the anvil should be positioned so that the beak (pointed end) does not project across circulation space.

IMMEDIATE REMEDIAL MEASURES

Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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1.022 COSHH Regs	Heat PROCESSES: Forging, Fumes	Applicable to: copper; iron; steel	See also: 1.021

Process(es) covered: The forming of shapes, possibly incorporating irregular and variable cross-section, by the application of localised heat which allows relatively easy transformation by mechanically- or physically-applied effort.

Hazards

Harmful — Carbon dioxide is produced which is harmful.

Risk Assessment

Harmful — The major product of combustion from both coke-fired forges and natural gas-fired chip forges is carbon dioxide with a WEL of 5000 ppm (8 h TWA)[24] or 15000 ppm (15 min ref period). With either type, these limits could be exceeded.

Control measures

Extraction equipment exhausting to the outside air is required and must, under the *COSHH Regulations*, be tested every 14 months.

[24] EH 40/2005.

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FURTHER INFORMATION

The hazards of this process are mainly those of burns etc which are not covered by the *COSHH Regulations* but are covered on the *Heat processes: Forging* sheet number 1.021.

IMMEDIATE REMEDIAL MEASURES

Fumes are inhaled	In the event of dizziness occasioned by fume, remove the affected person to the fresh air until recovered.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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1.023 Man Regs	Heat Processes: Oxygen and Oxygen Cylinders	Applicable to: gas welding; silver brazing	See also: 1.016 1.017 1.029 1.030

Process(es) covered: The combustion of any fuel, eg, acetylene, propane or methane, with oxygen from a cylinder rather than air at normal or increased pressure, gives a hotter flame that is often easier to control.

Hazards

Spontaneous ignition — Oil, grease and even some textiles can catch fire spontaneously in the presence of high concentrations of oxygen.

Fire — Even small increases in the concentration of oxygen make it easier to start fires and cause fires to burn hotter and more fiercely than in air. A leaking hose or valve may make it impossible to extinguish a fire.

Risk Assessment

Spontaneous ignition — If the materials in contact with oxygen are chosen carefully, this risk becomes small. Care needs to be taken with O-rings and gaskets, metal (alloy) fittings, pressure regulators, hoses and lubricants.

Fire — An atmosphere enriched with oxygen cannot be detected by the senses. It is essential that hoses, valves, regulators and fittings carrying oxygen are properly maintained to prevent leaks. The users should be trained to ignite the fuel gas correctly and close the valves properly after use.

Control measures

All the equipment for handling oxygen must be properly maintained. It is recommended that the equipment be inspected by a suitably qualified person every 12 months and the regulators and hoses replaced every five years.
Good general ventilation must be maintained at all times. Care should be taken to see that excess oxygen is not used.

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Storage	When not in use, the cylinder should be removed from the workplace to a designated store, away from any source of heat, with the level of fire resistance and explosion relief agreed with the local Fire Prevention Officer. While secure from unauthorised persons, easy access should be assured at all times in case of fire. Spare cylinders, whether full or empty, should be stored outside the building in a secure compound, not adjacent to cylinders of fuel gases and protected from the weather. Suitable notices indicating the presence of flammable gases under pressure should be displayed on the building where cylinders are used. It should be noted that most fire brigades now need to know when cylinders of oxygen and acetylene are used on school premises.

FURTHER INFORMATION

Since oxygen cylinders will have to be moved after use, those ready for use should be held firmly in a trolley designed for the purpose. It is essential that the tasks of moving cylinders into and out of trolleys have been assessed under the *Manual Handling Regulations* to protect those doing so from strain injuries.

IMMEDIATE REMEDIAL MEASURES

An oxygen leak is suspected	Turn off the oxygen supply. Extinguish all flames in the room. Open doors and windows to promote ventilation. Identify the source of the leak and deal with it by replacing any defective part or remaking a defective joint. Sealing tape should not be used.
Clothing may be contaminated	Remove the clothing if practicable and take it outside for airing.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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1.024 COSHH & Man Regs	HEAT PROCESSES: plasma cutting	Applicable to: the cutting of a range of materials	See also:

Process(es) covered: The cutting of metals by means of a plasma arc that produces a high-temperature stream of ionised gas capable of cutting metal. Hand-held torches usually use compressed air as the gas but mixtures of argon and either hydrogen or nitrogen may occasionally be used. In some instances, a second stream of gas may also be employed to cool the torch, act as a shielding gas and combine with the plasma gas to assist in slag removal.

Hazards

Eye damage	The arc is a source of ultra-violet and visible radiation.
Fumes & gases	Toxic fumes can be generated by the cutting process; cutting stainless steel produces chromium and nickel (Carc) fume, copper and its alloys give copper fume, but the most hazardous product is nitrogen oxides. Inert gases may accumulate in confined spaces.
Electric shock	The equipment can present an electric shock hazard.
Noise	Dry plasma cutting can generate high levels of noise.
Burns	Burns can be caused if the current passes through jewellery or from hot metal or sparks.

Risk Assessment

Eye damage	Ultra-violet radiation can cause eye damage.
Fumes / gases	Chromium and nickel have a WEL of 0.5 mg/m^3 (8 h TWA). Copper fume has a WEL of 0.2 mg/m^3 (8 h TWA). Oxides of nitrogen (R26) are very toxic and can accumulate in areas of poor ventilation especially where air or nitrogen is used as the plasma gas. Ozone has a WEL of 0.2 ppm (15 min ref period) and is most likely to be formed during the cutting of aluminium or stainless steel. In poorly ventilated areas, flammable gases (eg, hydrogen) may also produce a risk of explosion. Gases, particularly oxides of nitrogen, are a significant hazard when hand-held cutting as the operator is in close proximity to the torch. Where inert gases (eg, argon) are used they may accumulate and cause an asphyxiation risk.
Electric shock	Electric shocks are possible since the open-circuit voltages (dc) are above 40 and may be over 100.
Noise	Dry plasma cutting can generate high levels of noise with a significant high frequency content. The limited power supplies used with hand-held torches together with the reduced duty cycle mean that noise is less likely to be a problem. The higher power levels employed with mechanised systems produce higher levels of noise. Noise in excess of 100 dB(A) may be produced at high power levels but these machines are unlikely to be used in schools.
Burns	Trainees are likely to have inadequate control of the torch and experienced users may underestimate the heat conduction through the workpiece. Sparks may also cause burns.

Control measures

A face shield[25] designed for plasma cutting should be worn. Observers must also wear suitable eye protection.

The electric shock risk is reduced by good maintenance of leads etc, and by avoiding metallic jewellery, rings or watchstraps.

If noise is considered a problem, a flame-proof booth may contain it. The operator may need ear protection.

[25] Eye protection is marked with a number which describes the darkness of the filter, a manufacturer's mark and a robustness code which may be a number or a letter and number. Face shields for plasma cutting should now have the following codes on the ocular (lens) where X is the manufacturer's mark: 10, 11 or 12 X 1 or 2 B or S EN169. Older ones should carry the code EW 10, 11 or 12 and the old BS number 679. The filters specified for gas welding are adequate for observers.

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	The hazards from fumes and gases should be controlled using local exhaust ventilation equipment as used for welding. Where hot metal is left to cool, a warning notice should be displayed. Care should be taken to ensure that slag and sparks cannot ignite flammable materials in the vicinity.

Heat Processes: Plasma Cutting (Continued)

RESTRICTIONS	Plasma cutting should only be carried out in a dry area, with equipment designed for that purpose. The equipment should only be used by suitably-trained staff. (See *Duties of Employers* in the *General Introduction*.) Suitable protective clothing should be worn. This should include substantial footwear, leather apron, gloves or gauntlets as well as the eye protection. Overalls worn under protective clothing should be self extinguishing. Observers must also wear personal protective equipment and should be positioned at least two metres from the cutting operation. Screening may be required to shield others in the vicinity from the glare. Plasma cutting is a specialist process that requires equipment specifically designed for the purpose and staff with a secure knowledge of the process and its hazards.
FURTHER INFORMATION	Health and safety data supplied by manufacturers of the equipment should be studied and observed. Reference should be made to the document *PLASMA CUTTING: CONTROL OF FUME, GASES AND NOISE* published by HSE (HSE 668/22 obtainable from HSE Books, PO Box 1999, Sudbury, Suffolk, CO10 6FS.)

IMMEDIATE REMEDIAL MEASURES

Fumes are inhaled	In the event of dizziness occasioned by fume, remove the affected person to the fresh air until recovered.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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1.025 COSHH Regs	Heat Processes: Soft soldering, Fumes and Fluxes	Applicable to: brass; copper; electronics work; tin plate	See also: 1.013 1.026

Process(es) covered:

The creation of a joint between either the faces of sheet metal components or between wires and terminals using molten solder with a flux. Soft solder is an alloy of tin and lead with traces of other metals. The flux may be in cores in the solder or supplied as a liquid or jelly. The most common materials are:

rosin (also called colophony) - a compound which decomposes at high temperatures;

halides, eg, ammonium chloride and zinc chloride ('active fluxes').

Newer fluxes (eg, Multicore Ecosol 105 or Omega) are based on organic acids. There is an increasing use of lead free solder and it is likely that solder containing lead will be phased out.

Hazards

Harmful	Lead fumes, especially to the unborn child (R61, 62, 20/22, 50/53), ammonium chloride (if swallowed) (R22, 36) and zinc chloride fumes (R22, 34, 50/53) are harmful.
Corrosive	Fluxes containing zinc chloride can cause burns.
Eye injury	Flux can spit when heated. Small lumps of solder can be flicked off the tip of the soldering iron.
Irritant	Flux fumes are irritant to eyes and respiratory system, possibly causing occupational asthma.
Sensitisation	Fumes from rosin fluxes (Sen) can give rise to sensitisation of the airways.

Risk Assessment

Harmful	Lead vapour is not generated significantly at temperatures below 500 °C. Soft solders melt below 300 °C so the risk from lead vapour is negligible. The fumes of ammonium chloride (WEL 20 mg/m^3)[26] and of zinc chloride (WEL 2 mg/m^3) will not reach these 15 min reference values in a school workshop.
Corrosive	Active fluxes must be kept off the skin and out of eyes.
Eye injury	Instances have been reported of flux 'spitting' and entering the eye. There have also been instances of small balls of solder being flicked off the tip of the soldering iron when it is replaced in the stand although the risk is not great.
Irritant	Fumes from heating any flux may irritate the eyes and respiratory system at high concentrations. The fumes from decomposition of rosin flux have WEL values of 0.05 mg/m^3 (8 h TWA) and 0.15 mg/m^3 (15 min ref period). The concentration of fumes must therefore be kept as low as reasonably practicable.
Sensitisation	Since sensitisation can occur at very low concentrations, rosin-based fluxes should be avoided altogether.

Control measures

Eye protection[27] and gloves are required when using active fluxes and eye protection should be worn when any soldering is done.

[26] EH 40/2007.

[27] Simple protective spectacles should be adequate.

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	Due to changes in the environment regulations, CLEAPSS now advises that schools stop using leaded solder and change to non-leaded solder only. Please note this is not due to concerns over any associated health issues, but due to changes in environmental regulations which do not allow Lead to enter the waste system When using rosin-free (colophony-free) fluxes, ventilation produced by opening windows near the working area will normally be sufficient to control the fumes. **If work with rosin flux continues, local exhaust ventilation will be required.** The only way of controlling the sensitisation risk is to stop using rosin-based fluxes.

Disposal	Contact an authorised waste disposal company if large quantities are involved.
Storage	Active flux should be stored in the container in which it is supplied, tightly closed, and in a cool, dry, well-ventilated area.

FURTHER INFORMATION

	It has been suggested that joints made in electronics work with rosin-based fluxes last much longer than the period claimed for rosin-free fluxes. This is no longer true and there is no need to use rosin-based fluxes and LEV even for repair work in education establishments. The cost of providing LEV for student work-stations is not usually justified since the extra cost of providing rosin-free solder is relatively small. Lead free solder melts at a higher temperature (217 °C) than solder containing lead and requires a soldering iron that will reach this temperature.
Sensitisation	Where a person has become sensitive to the fumes from rosin flux, the slightest exposure may give rise to an asthma attack.

IMMEDIATE REMEDIAL MEASURES

Active flux is swallowed	Seek medical aid.
Fumes are inhaled	Remove from exposure. Keep warm and at rest. Obtain medical attention.
Active flux spilt on the skin	Immediately wash the affected area with plenty of soap and water.
Active flux in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Active flux is spilt in workshop	Contain the spill with sand, earth or any suitable absorbent. Transfer to a container for disposal.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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1.026 Man Regs	HEAT PROCESSES: Soldering Irons	Applicable to: gas-heated irons; low-voltage irons; mains irons; pyrography tools	See also: 1.013 1.025

Process(es) covered:

The creation of a joint between either the faces of sheet metal components or between wires and terminals using molten solder with a flux. Soft solder is an alloy of tin and lead with traces of other metals. The flux may be in cores in the solder or supplied as a liquid or jelly. The most common materials are:

rosin (also called colophony) - a compound which decomposes at high temperatures;

halides, eg, ammonium chloride and zinc chloride ('active fluxes').

Newer fluxes (eg, Multicore Ecosol 105 or Omega) are based on organic acids.

Pyrography is the creation of patterns, using heat, mainly on wood and leather.

Hazards

Electricity

It is very difficult to provide electrical insulation between the bit and the element without also reducing the conduction of heat. There is a possible hazard of electric shock via the bit to the metal being soldered.

The mains connecting lead is vulnerable to damage from the hot bit.

Fire

Gas-heated types present a fire hazard from the butane fuel.

Burns

The bit and the stem of the iron will be hot enough to burn skin.

Risk Assessment

Electricity

Although many mains irons do not meet the modern standards of insulation resistance, circuit components are more likely to be damaged than users. Mechanical and heat damage to mains leads presents a higher risk.

Fire

Small butane cartridges present a high risk in the hands of students but could be used safely by staff after a further assessment.

Burns

Burns from soldering, although common among novices, are usually superficial.

Control measures

The use of low-voltage (24 V or below) irons will eliminate the risk of electric shock. If mains irons must be used, silicone rubber insulation on the lead will protect against heat damage.

If gas-heated types are used then it may be necessary to restrict access.

Soldering-iron stands reduce the risk of inadvertent contact as well as helping to prolong the life of the bit.

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FURTHER INFORMATION

Some soldering-iron stands are very light weight and should be screwed to a block of wood when in use.
As described in the introduction under *Electricity at Work Regulations* 1989, electrical equipment should be subject to regular inspection and test.
See sheet 1.025 for an assessment of the risks from flux fumes.
Pyrography tools are manufactured by Antex and Janik, among other companies, and are supplied, for example, by Craft Supplies Ltd. No hazards from fumes have been reported when the material is wood or leather. However, since the tools operate at temperatures high enough to decompose many plastics, the use of these materials should be avoided unless efficient fume extraction is employed. It is better to do pyrography using purpose made tools rather than improvising with a soldering iron.

IMMEDIATE REMEDIAL MEASURES

Electric shock	Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a trained first aider does not arrive quickly and the pulse is absent, consider carrying out cardio-pulmonary resuscitation.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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1.027 Man Regs	Heat processes: Welding - electric arc	Applicable to: aluminium; mild steel; stainless steels	See also: 1.028

Process(es) covered: The creation of a joint using a filler (welding rod) of similar composition to the metal being joined. The electric arc gives rise to fumes from the electrode coatings, metallic oxides, any paint or surface contaminant and possibly to ozone and nitrogen oxides.

Hazards	
Eye damage	The arc is an intense source of visible and ultra-violet radiation.
Burns	Careless handling of hot metals after heating and 'sparks' of metal or hot scale can cause burns.
Electric shock	If the operating voltage is sufficiently high, there is an electric shock hazard.
Fire	Fires can be caused if sparks from welding land on combustible material.
Risk Assessment	
Eye damage	The eyes and face must be protected from the intense radiation.
Burns	During welding operations, metal components remote from the weld will be hot enough to burn. After welding, metal structures will remain hot and present a significant risk of burns until cool. A welding electrode that is too short increases the risk of burns to the hand. Rearranging ceramic blocks for a new job can cause burns if they are still hot from a previous use. Inadvertent arcs, caused by putting the live electrode near earthed objects, are also possible causes of burns.
Electric shock	Although most welding equipment used in education works at voltages below that of the mains, electric shocks are still possible.
Fire	Welding in a mixed materials workshop or in an area where combustible materials are stored presents an increased risk of fire.

Control measures	
	A face shield[28] designed for use when arc welding must always be used. Self-adjusting variable shade visors are preferable. Observers must also wear suitable eye protection. If welding is done in a workshop used by others, then screening should be used to provide protection from glare. The clothing worn must provide adequate protection from the heat and hot objects. This should include substantial footwear, leather apron, gaiters, gloves or gauntlets as well as the eye protection. Short welding rods should not be used. When hot metal is left to cool, a warning notice should be displayed. Hot metals or refractory bricks should be handled with suitable tools. The open-circuit voltage should be limited to 50 V ac or 120 V dc and, in general, the workpiece should be earthed. Earthing is not necessary if the current supply has reinforced insulation as shown by the identification symbol consisting of two circles within a shield. Welding should be carried away from combustible materials, including timber.

[28] Eye protection is marked with a number which describes the darkness of the filter, a manufacturer's mark and a robustness code which may be a number or a letter and number. Face shields for arc welding should now have the following codes on the ocular (lens) where X is the manufacturer's mark: 10, 11 or 12 X 1 or 2 B or S EN169. Older ones should carry the code EW 10, 11 or 12 and the old BS number 679. The filters specified for gas welding are adequate for observers.

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RESTRICTIONS	Closed vessels or tanks must not be welded, unless purged of any explosive or flammable materials, and oxygen must **not** be used for this purpose. It is important in any welding operation to see that there are no adjacent flammable materials that could be ignited by sparks or the arc itself.
FURTHER INFORMATION	The availability of compact kits for metal inert gas (MIG) welding and other modern techniques has encouraged schools and colleges to introduce these systems to complement the simpler technique with coated electrodes. Further information is available from Woodhead Publishing Ltd[29] who supply materials formerly available from the Welding Institute. Teachers should consider the supervision issues when glare screens are used. SPECIAL NOTE Welded joints may be tested by filing a cross section of the joint smooth, polishing the surface and then etching the surface using Nital - a mixture of concentrated nitric acid and ethanol. There have been incidents of such a mixture exploding during the course of preparation. If Nital has to be used then it should be prepared on each occasion that it is needed 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 chemical-resistant gloves and goggles using a fume cupboard. After use the solution **MUST** be disposed of and by safe methods. See 1.064.

IMMEDIATE REMEDIAL MEASURES

Fumes are inhaled	In the event of dizziness occasioned by fume, remove the affected person to the fresh air until recovered.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

[29] Woodhead Publishing Ltd, Abington Hall, Abington, Cambridge CB1 6AH

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1.028 COSHH Regs	Heat Processes:Welding - electric arc Fumes	Applicable to: aluminium; mild steel; stainless steels	See also: 1.027

Process(es) covered: The creation of a joint using a filler (welding rod) of similar composition to the metal being joined. The electric arc gives rise to fumes from the electrode coatings, metallic oxides, any paint or surface contaminant and possibly to ozone and nitrogen oxides.

Hazards

Toxic — Ozone is likely to be present with traces of nitrogen oxides (R26) unless a totally inert shielding gas is used. Particles of freshly-formed metallic oxides may also be present to give the possibility of 'metal fume fever'. (See *Further Information* overleaf.)

Irritant — Irritation of the respiratory tract, caused by gases or fine particles.

Risk Assessment

Toxic — The WEL for ozone is 0.2 ppm (15 min ref period)[30], while that for nitrogen dioxide is too low to quote. Neither is likely to be exceeded if welding is very occasional but, even in MIG welding, the ozone concentration can reach the limit quite quickly.
Zinc oxide fumes, commonly emitted when galvanised steel is welded, have no published WEL value. This operation will not be routine in a school workshop but may be required for an occasional repair that can be done outside.
Welding through painted surfaces, particularly those containing lead compounds, also produces hazardous fumes.
Cases of 'metal fume fever' are rare.

Irritant — The oxide particles are mainly responsible for this risk.

Control measures

All steel welding must be carried out with adequate and suitable extraction or forced ventilation, which must be maintained at all times, will keep fume levels down as well as removing any ozone. Painted surfaces should be chemically stripped (see dichloromethane on sheet 1.007) before welding in case the paint contains lead.
The ventilation required to control the toxic hazard also eliminates the irritant one.
See sheet 1.027 for eye protection requirements.

[30] EH 40/2005.

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FURTHER INFORMATION

In schools, arc-welding usually involves the simplest technique with coated electrodes but flux-cored electrodes and inert gas shielding welding (MIG and TIG) are now increasingly used and are generally safer.
Other hazards of this process are mainly those of burns etc which are not covered by the *COSHH Regulations*. See *Heat processes, Welding: Electric arc* (sheet 1.027) for assessments of these risks.
These assessments assume that filler rods containing cadmium are not used in school workshops and there are therefore no references to control measures for dealing with its vapour. If such rods were used, the hearths would require local exhaust ventilation with an inspection and test every 14 months. Cadmium oxide fumes (Carc, R45, 26, 48/23/25, 62, 63, 68, 50/53) have a very low WEL of 0.025 mg/m^3 (8 h TWA)[31]. Consequently, products containing cadmium must not be welded in schools either.
Should metal fume fever symptoms (similar to influenza) appear, this is usually after a latent period of ten hours. They tend to disappear after a 24-hour rest period.

IMMEDIATE REMEDIAL MEASURES

Fumes are inhaled	In the event of dizziness occasioned by fume, remove the affected person to the fresh air until recovered.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

[31] EH 40/2005.

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1.029 Man Regs	Heat processes, Welding: Oxy-acetylene	Applicable to: brass; steel	See also: 1.023 1.030

Process(es) covered: The creation of a joint using a filler (welding rod) of similar composition to the metal being joined. The combustion of the fuel gives rise to hazardous fumes.

Hazards	
Explosion	Most explosions have been caused by gas leaks, backfires, flashbacks and welding on tanks or drums that have contained highly flammable materials.
Fire	Fires are caused by careless handling of a lighted blowpipe (torch) or the presence of combustible materials too close to the working area.
Radiant heat	Infra-red radiation from hot surfaces, flames etc, can damage the cornea of the eye.
Burns	Many users have been burned by their own blowpipes or by heat from the metal on which they have been working.

Risk Assessment	
Explosion	Gas leaks can result from damaged hoses, loose connections and faulty equipment. Non-return valves and flashback arrestors should prevent explosions in pipes etc. Working on tanks, drums or wheels with tyres fitted is a high-risk activity.
Fire	Experienced users can be distracted or hasty and trainees are likely to make mistakes with the blowpipe.
Radiant heat	Most school brazing jobs are too short for this to be a serious problem.
Burns	Trainees are likely to have inadequate control of the direction of the flame and experienced users may underestimate the heat conduction through the workpiece. The use of too short a welding rod is another possible cause.

Control measures	
	All connections, regulators, valves and hoses should be checked for leaks regularly[32]. Flashback arrestors ae a mandatory requirement and must always be fitted. All welding equipment should be kept free from oil and grease. Tyres must always be removed before welding wheels. Tanks or drums must be effectively cleaned of flammable residues before welding work is done. A burning blowpipe must never be put down on the floor or bench: the flame must be shut off first. Hoses should be kept away from the working area to prevent contact with flames, sparks or hot spatter. Combustible materials should be moved well away from welding. Goggles that reduce the radiation reaching the eyes should be worn as a matter of habit since they will also protect against spitting of flux or spatter of molten metal[33]. Protective clothing including apron, gauntlets and eye protection must be worn. Observers must be well away from the work, wearing heat-proof aprons and eye protection. Hot objects must be left to cool in a safe place with a warning notice if necessary.

[32] The frequency depends on the use. If the equipment is in daily use, a weekly check is required. If used infrequently, check before each use.

[33] Eye protection is marked with a number which describes the darkness of the filter, a manufacturer's mark and a robustness code which may be a number or a letter and number. Eye protection for welding should have the following codes on each ocular (lens) where X is the manufacturer's mark: 4 or 5 X 1 or 2 F or S 9.

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Storage

Gas cylinders *ready for use* may be kept in the workshop and should be held securely, with the valves uppermost, either close to a wall or bench or in a cylinder trolley.

When not in use, the equipment should be removed from the workplace to a suitably designated store, agreed with the local Fire Prevention Officer, away from any source of heat. While secure from unauthorised persons, easy access must be assured at all times in case of fire.

Spare cylinders, whether full or empty, should be kept in a secure, well-ventilated place, ideally outside.

Suitable notices indicating the presence of flammable gases under pressure should be displayed on the building where cylinders are used. It should be noted that most fire brigades now need to know when cylinders of oxygen and acetylene are used on school premises.

FURTHER INFORMATION

A fire extinguisher of suitable type and fire blanket should be to hand during welding operations. The type of extinguisher should be chosen according to the nature of the materials that could be set on fire.

Cleaning up welds by chipping off spattered metal can lead to eye injuries if suitable protection is not worn.

Irritation of the throat etc manifests itself via dryness of the throat, tickling, coughing, tightness of the chest and difficulty in breathing.

The *Pressure Systems Safety Regulations* 2000 do not apply to gas cylinders and simple welding sets. The *Carriage of Dangerous Goods (Classification, Packaging and Labelling) and Use of Transportable Pressure Receptacles Regulations* 1996 require owners of cylinders to ensure that they have been examined and tested to be safe. Companies refilling cylinders may do so only if they are sure that the cylinders are safe. There is no requirement for regular inspection of welding sets against a written schedule but the equipment should be included in the planned annual maintenance programme. It is recommended that the equipment (especially the regulators and the blowpipe) are inspected by a suitable qualified person every 12 months and that they are replaced every five years. (The British Compressed Gases Association[34] Code of Practice CP7 gives guidance on maintenance.)

Recent guidance from the Home Office to fire brigades has resulted in changed procedures for fighting fires in which acetylene cylinders may be involved. In most cases fire officers will now require an evacuation zone of 200 m or more, and enforce it for 24 hours or longer. This would obviously be highly disruptive not only to the school but also, in built-up areas, to the whole neighbourhood. Schools, therefore, may come under pressure to use alternatives such as MIG welding or LPG for brazing.

SPECIAL NOTE

Welded joints may be tested by filing a cross section of the joint smooth, polishing the surface and then etching the surface using Nital - a mixture of concentrated nitric acid and ethanol. There have been incidents of such a mixture exploding during the course of preparation. If Nital has to be used it should be prepared on each occasion that it is needed 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 chemical-resistant gloves and goggles using a fume cupboard. After use the solution **MUST** be disposed of and by safe methods. See 1.064.

IMMEDIATE REMEDIAL MEASURES

Fumes are inhaled

In the event of dizziness occasioned by fume, remove the affected person to the fresh air until recovered.

Burns to the skin

Cool the affected area under a running cold tap for ten minutes.

Serious burns to the skin

Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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[34] BCGA, 14 Tollgate, Eastleigh, Hampshire, SO53 3TG.

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1.030 COSHH Regs	Heat Processes: Welding - Oxy-acetylene Fumes	Applicable to: brass; steel	See also: 1.023 1.029

Process(es) covered: The creation of a joint using a filler (welding rod) of similar composition to the metal being joined. The combustion of the fuel, acetylene, gives rise to gases consisting mainly of carbon dioxide with the addition of oxides of nitrogen where an oxidising flame is used, and carbon monoxide if the flame is slightly reducing.

Hazards

Toxic — Carbon dioxide with traces of nitrogen oxides (R26) and carbon monoxide (R12, 23, 48/23, 61) present as combustion products. Particles of freshly-formed metallic oxides may also be present to give the possibility of 'metal fume fever'. (*See Further Information* overleaf.)

Irritant — Irritation of the respiratory tract, caused by gases or fine particles.

Risk Assessment

Toxic — If the combustion products are allowed to accumulate, the WEL for carbon monoxide, 30 ppm (8 h TWA) and 200 ppm (15 min ref period)[35], or that for carbon dioxide, 5000 ppm (8 h TWA) and 15000 ppm (15 min ref period), may be exceeded. Zinc oxide fume, commonly emitted when welding galvanised steel, no longer has a published exposure limit value, however, it must be treated with care. This operation will not be routine in a school workshop but may be required for an occasional repair which can be done outside.
Welding through painted surfaces, particularly those containing lead compounds, also produces hazardous fumes.
Cases of 'metal fume fever' are rare.

Irritant — The oxide particles are mainly responsible for this risk.

Control measures

All steel welding must be carried out with adequate and suitable extraction or forced ventilation, must be maintained at all times which will keep fume levels well below the value for general welding fumes which may produce problems. Painted surfaces should be stripped before welding in case the paint contains lead.
Local exhaust ventilation will be necessary only where the general ventilation cannot be described as 'good'.
The ventilation required to control the toxic hazard also eliminates the irritant one.

[35] EH 40/2005.

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Storage	Gas cylinders *ready for use* may be kept in the workshop and should be held securely, with the valves uppermost, either close to a wall or bench or in a cylinder trolley. When not in use, the equipment should be removed from the workplace to a suitably designated store, agreed with the local Fire Prevention Officer, away from any source of heat. While secure from unauthorised persons, easy access must be assured at all times in case of fire. Spare cylinders, whether full or empty, should be kept in a secure, well-ventilated place, ideally outside.

FURTHER INFORMATION

Other hazards of this process are mainly those of burns etc which are not covered by the *COSHH Regulations*. See *Heat processes, Welding: Oxy-acetylene* (sheet 1.029) for assessments of these risks.
Should metal fume fever symptoms (similar to influenza) appear, this is usually after a latent period of ten hours. They tend to disappear after a 24-hour rest period.
It is essential that the tasks of moving cylinders into and out of trolleys have been assessed under the *Manual Handling Operations Regulations* to protect those doing so from strain injuries.
When assessing the possible need for LEV, refer to the *Introduction*, *Use of model risk assessments* and *problems with premises*.

IMMEDIATE REMEDIAL MEASURES

Fumes are inhaled	In the event of dizziness occasioned by fume, remove the affected person to the fresh air until recovered.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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1.031 Man Regs	Lapidary Equipment: Cutters and Grinders	Applicable to: decorative minerals; semi-precious stones	See also: 1.033 1.034

Process(es) covered:

Stone cutting: A diamond-impregnated saw blade is used to cut semi-precious stones and minerals.
Stone grinding: The cut stone is ground and polished to a high surface finish.

Hazards

Flying particles	When cutting crystalline materials, the saw blade can flick particles towards the operator.
Flying workpiece	Pieces of stone can be ejected violently if not held correctly or if the machine starts unexpectedly.
User injury	Human contact with the rotating grinding wheel can cause cuts or abrasions. Fingers can be jammed between the wheel and the rest.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with the rotating parts, dragging the user onto them.

Risk Assessment

Flying particles	Water is usually used to cool the diamond saw blade and this reduces to a low level the risk of particles being ejected.
Flying workpiece	A hand-held workpiece may be released if it becomes too hot to hold or if excessive pressure causes it to be pulled from the user's hand.
User injury	An unguarded wheel presents considerable risks of injury.
Entanglement	Entanglement is most likely to occur if the spindle ends are exposed.

Control measures

Cutting oil or water should be used to cool the blade. Eye protection should be worn for cutting as well as for grinding.
The rest should be used to minimise the risk of losing control of the workpiece. Eye protection should be worn in addition to the use of any shields fitted to the machine.
Each grinding wheel should be surrounded by a guard that is only open at the front in order to allow access for the workpiece. A dop stick (see over) must be used to hold the stone for grinding.
The guard should also cover the spindle ends. Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.

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FURTHER INFORMATION

Small stones must be mounted onto a wooden stick (a 'dop stick') with a suitable adhesive during cutting and polishing operations to prevent injury to fingers.
There should be sufficient space around a grinding machine to ensure that the user is not pushed into the machine by a passer-by and the floor surface should not be slippery to avoid accidental slips while using the machine.
Grinding machines should be included in the planned annual maintenance programme.
Useful guidance is available from HSE Books in HSG 17, *Safety in the Use of Abrasive Wheels* but there is a charge for this publication.

IMMEDIATE REMEDIAL MEASURES

Dust is in the eye	Irrigate immediately with water for several minutes, telling the casualty to hold eyelids apart.
A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.

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1.032 Man Regs COSHH Regs	Laser Cutters	Applicable to: CO_2 laser cutters	See also: 1.010 1.055

Process(es) covered: Use of a high-power laser to cut plastics, rubber, wood, card and textiles under computer control as an example of CAD / CAM.

Hazards

Burns	Class 4 (high-power) lasers can cause severe burns to skin.
Blinding	Class 4 lasers can cause blinding if even a reflected beam enters the eye; the invisible infra-red radiation from a CO_2 laser renders the cornea of eye opaque in a fraction of a second.
High voltage	The gas-filled tubes used as the source of the radiation operate at hazardous-live potentials.
Toxic fumes	The use of the laser to cut PVC generates toxic vinyl chloride (Carc, R45, 12) WEL 3 ppm, 8h TWA and other decomposition products. Polyurethane foams may give hydrogen cyanide (Sk, R12, 26, 50/53) (WEL 10 ppm, 15 min ref period) and nitrogen oxides (R26) (WEL too low to quote) when heated by the beam.
Harmful particles	The cutting process releases fine particles and decomposition products from the materials being cut. Rubber will produce a mixture of pyrolysis products, including some harmful ones.
Fire	The material being cut may be ignited by the cutting process.

Risk Assessment

Burns	Provided the laser beams are totally enclosed (reducing the hazard class of the system to 1), this risk is minimal.
Blinding	Provided the laser beams are totally enclosed (reducing the hazard class of the system to 1), this risk is minimal.
High voltage	Provided the electrical supplies to the tube are totally enclosed, this risk is minimal.
Toxic fumes	PVC and polyurethane foams present a serious risk.
Harmful particles	Other plastics (see 1.055), rubber and MDF can give rise to harmful fumes.
Fire	If the instructions provided by the manufacturer are followed then the risk of ignition of the workpiece should be low.

Control measures

An interlock to prevent laser operation unless the system is enclosed is **essential and it must not be over-ridden**. (This is necessary to make the system into a Class 1 device, which may be used in schools.)
Because of the risk of fire, laser cutters must not be left to run unattended
Servicing should be restricted to authorised and trained personnel to control the high voltage risk as well as risks from the beam.
PVC and polyurethane foams should **not** be cut even with LEV in use.

Other materials require efficient dust and fume control. Suppliers may recommend special filters for certain tasks, eg, cutting rubber.
The power setting and speed of cut must be set correctly to minimise the risk of ignition of the workpiece.

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Disposal	The fume and dust-control systems must be properly maintained, tested annually and the filters changed according to the manufacturer's instructions. Used filters should be sealed into strong plastic bags before placing them in the waste.
Storage	Laser cutters, unless controlled by a key switch, should be stored in secure locations to prevent unauthorised use.

FURTHER INFORMATION

Class 4 lasers must never be used in schools but, when enclosed, the classification of the whole system is reduced to class 1, which is acceptable. Any model where the interlock can be over-ridden easily must be considered **unsuitable** for use in education.

The laser tubes used in these devices are claimed to have an operating lifetime of about 20,000 hours. However, this is measured by running them almost continuously. In education, laser cutters are unlikely to be operated even once every working day. It is possible that the life of the tube may then be very much lower and, at a replacement cost of up to £1000, it is worth discussing the cost of an extended warranty with the supplier.

In order to meet the requirements of the *COSHH Regulations* for LEV, the establishment must operate a strict regime of filter replacement and/or testing. Pre-filters, which collect the coarse particles, may need changing every few weeks. The main filter, which is probably active carbon together with a HEPA filter for fine particles, may last six months. If accurate records of times of use are difficult to keep, an elapsed running-time recorder can be connected to the mains supply.

Many models incorporate a low-power, visible (red) beam alongside the invisible, high-power cutting beam. Wherever the visible beam is, it must be assumed that the invisible one is also present.

IMMEDIATE REMEDIAL MEASURES

Burns	The beam may produce a deep cut in tissue with little bleeding because the wound is immediately cauterised. Obtain specialist treatment.
Blinding	There is no immediate remedial measure.
Electric shock	Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a trained first aider does not arrive quickly and the pulse is absent, consider carrying out cardio-pulmonary resuscitation.
Vapour is inhaled	Remove casualty to fresh air and seek medical attention.
Dust is in the eye	Irrigate immediately with water for several minutes, telling the casualty to hold eyelids apart.

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1.033 COSHH Regs	METAL WORKING: Cutting oils	Applicable to: mineral oils; synthetic oils; soluble oils; Tellus oil	See also: 1.010 1.037 to 1.039

Process(es) covered: Cutting oils are used in surface grinding, drilling, turning, milling and power-sawing metals.

Hazards

Irritant — Cutting oils are irritant to skin and eyes.

Harmful — There is a small risk of Legionella bacteria surviving and developing in machine oils.

Risk Assessment

Irritant — Some coolants or cutting oils can cause irritation to the eyes and/or dermatitis. The mist from products based on highly-refined mineral oils was given an OES of 10 mg/m^3 (15 min ref period)[36] but this value has not been converted to a WEL. Suppliers are required to provide warnings and if these are observed, there will be minimal risks to health.

Harmful — The likelihood of growth is not substantial since temperatures are rarely consistently above the 20 °C necessary for the Legionella bacteria to grow. Other microbes however, are known to proliferate at temperatures below 20 °C.

Control measures

The instructions stated by the suppliers of the coolants must be followed, particularly when diluting for use and pouring from one container to another.
Eye protection (against swarf and coolant spray) must be worn at all times.
Hands should be washed after work and prior to using the toilets.
The risk of harm from Legionella bacteria and other organisms can be reduced by regular draining and cleaning of cutting oil systems and replacement with fresh oil.

Disposal — Large volumes of used or generally unwanted coolant must be disposed of via an authorised waste disposal contractor. 500 ml or less can be diluted with water and flushed down the drain.

[36] EH 40/2005

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FURTHER INFORMATION

The use of a barrier cream may be advisable. While coolants are refined, mineral-based oil against which creams are not an effective protection, they do assist and encourage the cleaning of skin following contact. See the supplier's guidance.
In school workshops, cutting oils used on manually operated machines are usually applied by means of a brush or manually operated dispenser. This will reduce the risks from mists. Sometimes containers, such as those for washing up liquid or those with a trigger pump used for other cleaning products, are used as dispensers for cutting oils. Whilst these reduce the risks in applying cutting oil with a brush close to rotating work pieces or cutters, and also reduce spillage, there is the potential for pupils to use such containers to squirt each other with the cutting oil. This should not be allowed to happen. If CNC machines are used to cut metals that require the use of cutting oils applied by a pump, then there is an increased risk of mist.
There is no published evidence of cutting oils causing cancer either by contact or inhalation but, since used lubricating oils present a risk of cancer, there is a small risk from cutting oils that have become contaminated with other lubricants.
In order to reduce the risk of harm from Legionella bacteria and other organisms CLEAPSS advice is as follows:
At least once every six months:

- Drain down the machine coolant system.
- Flush through with clean water.

Then either

- Fill with a degreasing solution to remove any bacterial film. Washing up liquid in water will probably do but this will depend on the system and how contaminated it is.
- Flush through with clean water.
- Fill with 1% Virkon solution (probably available from the science department) and leave for a minimum of 20 minutes.

Or

- Fill with 1% Virkon solution to which a generous squirt of washing up liquid has been added and leave for a minimum of 20 minutes.

- Drain and flush a couple of times with clean water.
- Refill with the cooling machine oil mixture.

If cutting oils are kept in small containers of any sort and the oil is applied by hand, then the containers should be emptied and degreased every six months as outlined above and refilled with fresh oil.

IMMEDIATE REMEDIAL MEASURES

Coolant is in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Coolant is swallowed	Accidental ingestion is unlikely. If ingestion is suspected, wash out the mouth with water and send the casualty to hospital immediately, showing the manufacturer's safety data sheet to the doctor. DO NOT INDUCE VOMITING.
Effects on the skin	Repeated and prolonged contact with the skin may cause removal of natural greases, resulting in dryness, cracking and possible dermatitis. Wash with mild antiseptic and apply moisturising cream.

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1.034 COSHH Regs	METAL WORKING: Dust from grinding	Applicable to: cast, high speed or tool steels; mild steel - surface only	See also: 1.035 1.042

Process(es) covered:

Tool grinding: The profiling and sharpening of tool bits for metal turning and shaping operations and the sharpening of drills.
Surface grinding: The completion of a workpiece to a very high standard of surface finish and flatness to close tolerance.

Hazards

Dust

Abrasive material from wheels and fine particles of ground material are irritating to the eyes and to the respiratory system.

Risk Assessment

Dust

The eyes must be protected.
The dust created is an irritant to the respiratory system in the event of long periods of exposure. However, the dust is dense and settles relatively quickly. There is a WEL of 10 mg/m^3 (8 h TWA)[37] for respirable dust, which will not be exceeded during normal operations.
If large numbers of tools are to be prepared, so that the operation continues for more than an hour, the use of a dust mask should be considered.

Control measures

A dust mask to standard FFP3 (Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science) must be used when the risk assessment requires it.
Eye protection giving protection to at least BS EN 166 F[38] must be worn when grinding.
If the grinder is not fitted with a transparent guard, goggles to the higher standard BS EN 166 B 4 must be used.

37 EH 40/2007.

38 Eye protection originating outside the UK may not be marked 'BS' (British Standard) but should include 'EN' (European Norm). R135 Eye and face Protection has a table of equivalences

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RESTRICTIONS	The changing of abrasive wheels is a hazardous activity that should only be carried out by a competent person who has had the relevant specialist training.

FURTHER INFORMATION

Should grinding wheels contain abnormally hazardous materials, an appropriate warning will be shown on the wheel. This should be repeated on the grinder itself.

IMMEDIATE REMEDIAL MEASURES

Dust is in the eye	Irrigate immediately with water for several minutes, telling the casualty to hold eyelids apart.
A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.

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1.035 Man Regs	# METAL WORKING: Grinding, Surface and Tool	Applicable to: cast, high speed or tool steels; mild steel - surface only	See also: 1.034 1.042

Process(es) covered:

Surface grinding The completion of a workpiece to a very high standard of surface finish and flatness to close tolerance.
Tool grinding: The profiling and sharpening of tool bits for metal turning and shaping operations and the sharpening of twist drills.

Hazards

Wheel break up	Abrasive wheels can break and parts can be ejected violently if they are damaged, incorrectly mounted or run too fast.
Flying workpiece	Workpieces can be ejected violently if not held correctly or if the machine starts unexpectedly.
User injury	Human contact with the rotating wheel can cause cuts or abrasions. Fingers can be jammed between the wheel and the rest.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with the rotating wheel, dragging the user onto it.

Risk Assessment

Wheel break up	Most grinding machines used in education have a fixed speed so that a wheel suitable for that speed, properly mounted will only break if damaged.
Flying workpiece	A hand-held workpiece may be released if it becomes too hot to hold or if excessive pressure causes it to be pulled from the user's hand.
User injury	An unguarded wheel presents considerable risks of injury.
Entanglement	Entanglement is most likely to occur if the spindle ends are exposed.

Control measures

Wheels should be mounted only by those trained to do so and the guard should protect against flying debris.
The rest should be used to minimise the risk of losing control of the workpiece.
Small tools may need to be held in a suitable jig to avoid any temperature rise.
Eye protection should be worn in addition to any shields fitted to the machine.
Each grinding wheel should be surrounded by a guard that is only open at the front in order to allow access for the workpiece. The gap between the rest and the wheel should not exceed 3 mm.
The guard should also cover the spindle ends. Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.

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FURTHER INFORMATION

The low-speed grinders used to sharpen woodworking tools present minimal risks. High speed grinding machines should only be used to sharpen tools. Mild steel and other soft metals should not be ground on these machines.

There should be sufficient space around a grinding machine to ensure that the user is not pushed into the machine by a passer-by and the floor surface should not be slippery to avoid accidental slips while using the machine.

Grinding machines should be included in the planned annual maintenance programme.

Useful guidance is available from HSE Books in HSG 17, *Safety in the Use of Abrasive Wheels* but there is a charge for this publication.

IMMEDIATE REMEDIAL MEASURES

Dust is in the eye	Irrigate immediately with water for several minutes, telling the casualty to hold eyelids apart.
A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.

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1.036 Man Regs	METAL WORKING: Guillotines, FOLDING AND ROLLING EQUIPMENT	Applicable to: hand- and treadle-operated shears; hand-operated and hand-held power nibblers; universal sheet metal-working machines	See also: 1.044

Process(es) covered:	*Guillotines:* Both hand-operated and treadle-operated, scissor-action guillotines (shears) are used in education for cutting sheet metal. *Notchers or nibblers:* This type of guillotine works by removing a slice of material (kerf) allowing the cut to be achieved without distortion. Since the kerf is cropped off at each stroke, the machine can produce notches of rectangular and other shapes in both metals and plastics. Hand-held nibblers may consist of an accessory fitted to a portable drill. *Folding machines:* These machines are used to bend sheet metal. *Rolling machines*: When fitted with three rollers, these machines may be used to roll sheet metal into a cylindrical shape. Machines with two rollers are used to make sheet and wires thinner. *Universal machines:* Combine cutting, folding and rolling operations in one machine.
Hazards	
Trapping	Movement between cutting or closing surfaces can result in serious injury.
User injury	Contact with the operating handle or treadle can cause an impact injury.
Cuts from edges	Sharp edges on the workpiece or waste can cause cuts.
Manual handling	Possible injury from large sheets of material.
Electric shock	A power cable to a portable tool may be damaged on a sharp metal edge.
Risk Assessment	
Trapping	Unguarded guillotines and folding machines present serious risks to the user.
User injury	The user or an observer could stand in such a position that operation of the handle or treadle could hit a head, shoulder or foot. The foot can slip off the treadle with a consequent risk to the ankle.
Cuts from edges	The edges of cut metals are often very sharp and can cause deep cuts.
Manual handling	Large or heavy sheets of material have to be lifted onto the cutting table and manipulated into position for cutting.
Electric shock	The risk of damage to a power cable is high.
Control measures	Guillotines with a worktable should have guards that prevent access to the shearing points (front and rear). Bench shears are difficult to guard. Careful instruction should reduce the risk of trapping when folding or rolling machines are used. Only one person should operate the guillotine with any assistants positioned at the side. Users must be aware of potential hazards and safe ways of operating. All types of sheet metal cutting, folding and rolling machines should be locked in a safe condition when not in use. Industrial-type gloves should be used to handle large sheets of materials with sharp edges. Individual tasks involving large or heavy sheets must be assessed for manual handling risks and assistance obtained where necessary. Tools with integral re-chargeable batteries or powered by compressed air minimise the electric shock risk.

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FURTHER INFORMATION

There must be sufficient space around any of these machines to ensure that the user can operate it safely and not be pushed into it by a passer-by. The floor surface should not be slippery to avoid accidental slips while using the machine.
If bench shears are used, they must be secured to the bench or stand. Notchers are much safer and it is **strongly recommended** that bench shears are replaced at the earliest opportunity. All types of shears, notchers and guillotines should be locked when not in use or secured in such a way that they cannot be used.
Guillotines should be included in the planned annual maintenance programme.
Folding machines for bending sheet metal work on a similar principle to some guillotines and present similar trapping hazards. These machines should also be locked when not in use.

IMMEDIATE REMEDIAL MEASURES

Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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1.037 Man Regs	METAL WORKING: Lathes - metal turning	Applicable to: aluminium; brass; copper; steel; plastics	See also: 1.033

Process(es) covered: *Turning*: The production by turning, facing, boring, screw cutting, centre drilling and knurling of primarily cylindrical or spherical forms from both ferrous and non-ferrous raw material, or appropriate plastics possibly using oil-based coolants.

Hazards	
Trapping	Closing movements between parts under power feed can present a trapping hazard. A trapping hazard exists from the outer end of the hollow mandrel.
Flying workpiece	Workpieces (and chuck keys or tools) can be ejected violently if not held correctly or if the machine starts unexpectedly.
User injury	Human contact with rotating parts and swarf can cause cuts or abrasions.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them. Application of cutting oil using a brush presents an entanglement risk.
Manual handling	Heavy parts, eg, chucks, face plates and stock bars can present a manual-handling hazard.
Risk Assessment	
Trapping	Movements under power feed are usually slow, minimising this risk.
Flying workpiece	There is a high risk that trainees will not clamp these items securely.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts. Application of cutting oil by the use of a brush has a high risk of entanglement.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed or loose materials are introduced to the workpiece.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk.

Control measures
The provision of adequate space around machines should minimise the trapping risk, with telescopic guards over lead screws etc. See *Further Information* overleaf. Guards over the hazardous areas should prevent anything flying towards the user. Ideally an interlock should prevent the machine operating unless the guard(s) are in place. Eye protection is needed. Self-ejecting chuck keys are recommended. When a pupil has fitted work into the chuck then the position and tightness should be checked by a suitably qualified teacher or technician. The guards will also reduce the risk of hand or finger injury. Application of cutting oil by use of a coolant pump (if fitted) is safer, but where this is not possible then a long handled brush should be used. Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall. Loose cloths or emery cloth must not be used to polish rotating workpieces The risk of back injury is reduced greatly if two persons handle heavy items.

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FURTHER INFORMATION

There should be sufficient space around these machines to ensure that the user is not pushed into the machine by a passer-by and the floor surface should not be slippery to avoid accidental slips while using the machine.
The risks from entanglement from rotating lead screws and feed shafts can be reduced if these are disconnected by removing one or more of the change wheels. When a power feed or screwcutting is necessary, then a specific risk assessment of the hazards should be carried out and additional control measures introduced. A specific risk assessment should be carried out if a long bar that projects through the hollow mandrel is to be turned, and the bar should be guarded using a tubular guard.
If material is to be polished on the machine, guidance can be found on Engineering Information Sheet 2 (EIS2)[39], available from the HSE website. Loose cloths or emery cloth must not be used to polish rotating work pieces.
For requirements of controls for electrical machines, see the introduction to this part.
These machines should be included in the planned annual maintenance programme.
CNC lathes are usually among the safest machines in the educational workshop since they are enclosed to contain flying particles and prevent access to hazardous areas.

IMMEDIATE REMEDIAL MEASURES

A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Coolant is in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

[39] EIS2 Accidents at Metalworking Lathes using Emery Cloth

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1.038 Man Regs	METAL WORKING: Milling machines	Applicable to: vertical & horizontal milling of aluminium; brass; copper; mild steel & plastics.	See also: 1.033

Process(es) covered: *Milling*: The removal of material to provide a finished form of close tolerance and good surface finish. Milling may be used to form flat surfaces, grooves or recesses.

Hazards	
Trapping	Closing movements between parts under power feed can present a trapping hazard.
Flying workpiece	Workpieces (and cutting tools) can be ejected violently if not held correctly or if the machine starts unexpectedly.
User injury	Human contact with rotating parts, especially the cutting tool and swarf can cause cuts or abrasions. Swarf can enter the eyes. Application of cutting oil using a brush can lead to entanglement.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Manual handling	Heavy parts, eg, machine vices and angle plates or large work pieces can present a manual-handling hazard.
Risk Assessment	
Trapping	Movements under power feed are usually slow, minimising this risk.
Flying workpiece	There is a high risk that trainees will not clamp these items securely.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts. Application of cutting oil by the use of a brush has a high risk of entanglement.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk.

Control measures
The provision of adequate space around machines should minimise the trapping risk, with suitable guarding over drive shafts etc. The risk of trapping can be reduced by disconnecting or isolating the feed mechanism. Guards over the hazardous areas should prevent anything flying towards the user. Ideally an interlock should prevent the machine operating unless the guard(s) are in place. Eye protection should always be worn when using this machine. Horizontal mills require more extensive guarding than vertical ones. The level of training of staff and students required for milling is higher than for other operations. A qualified person should check the setting of the work before cutting is started. The guards will also reduce the risk of hand or finger injury. Application of cutting oil by use of a coolant pump (if fitted) is safer, but where this is not possible then a long handled brush should be used. Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall. The risk of back injury is reduced greatly if two persons handle heavy items.

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FURTHER INFORMATION

There should be sufficient space around these machines to ensure that the user is not pushed into the machine by a passer-by and the floor surface should not be slippery to avoid accidental slips while using the machine.
For requirements of controls for electrical machines, see the *General Introduction*.
Machines that are fitted with a power feed often have an exposed drive shaft that is virtually impossible to guard. Trapping and entanglement can be reduced by isolating the drive mechanism. If a power feed is required then a specific risk assessment of the hazards should be carried out and additional control measures introduced.
Where power feeds are by means of a separate electric motor then consideration should be given to isolating the motor.
These machines should be included in the planned annual maintenance programme.
CNC machines are usually among the safest machines in the educational workshop since they are enclosed to contain dust and prevent access to hazardous areas.

IMMEDIATE REMEDIAL MEASURES

A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Coolant is in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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1.039 Man Regs	METAL WORKING: Pillar AND BENCH Drilling MACHINES	Applicable to: most resistant materials including timber and plastics	See also: 1.033

Process(es) covered: The cutting of holes in sheet or block materials. Cutting oils or other lubricants may sometimes be required particularly when drilling mild steel.

Hazards	
Flying workpiece	Workpieces (and chuck keys or broken drill bits) can be ejected violently if not held correctly or if the machine starts unexpectedly.
User injury	Human contact with rotating parts and swarf can cause cuts or abrasions. Loss of control of the workpiece can result in spinning that can cause injury. Small particles of waste material can enter the eyes.
Trapping	Belts on drive pulleys present a trapping hazard.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Manual handling	Heavy parts, eg, the drill table and machine vices can present a manual-handling hazard.

Risk Assessment	
Flying workpiece	There is a high risk that trainees will not clamp items securely enough to prevent work being ejected from the machine or broken drills from flying.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts. The risk of small particles entering the eyes is high.
Trapping	Changing the drive belt from one pair of pulleys to another, especially when the machine may start, presents a real risk.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed. This includes the drill chuck.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk.

Control measures

It is impracticable to guard all the hazardous areas during this operation. Correct selection of the bit speed will reduce the risks from flying workpieces but machine vices or clamps should be used where required. Eye protection should always be worn when using this machine.

Guards around the chuck and bit will reduce the risk of hand or finger injury but training and experience are essential. The drill chuck guard should be adjusted to cover the whole of the drill bit when the machine is in use.

Guards preventing inadvertent contact with belt drives should require a tool to remove them or be interlocked with the power supply to prevent trapping when moving the drive belt. Interlocked guards on belt drives are recommended. The machine should be isolated when changing the speed.

Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.

The risk of back injury is reduced greatly if two persons handle heavy items. A pillar drill with a rack and pinion drive to the table is to be preferred to one without it.

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FURTHER INFORMATION

Chuck keys should not be secured with a chain near the working area as this increases the risk of entanglement. There should be sufficient space around these machines to ensure that the user is not pushed into the machine by a passer-by and the floor surface should not be slippery to avoid accidental slips while using the machine.

For general requirements of controls for electrical machines, see the introduction to this part. However, for drilling machines, a foot-operated or knee operated emergency stop switch is considered essential so that the user can stop the machine without letting go of the workpiece or spindle feed.

The drill chuck guard must always be used. If the drill bit is short so that the guard will foul the workpiece before the hole is drilled (as could happen when countersinking for example) then alternative methods should be used, or the drill bit could be fitted into an extension piece. On no account should any task be carried out on a drilling machine without the drill chuck guard being in place.

Pillar drills are also often used to make holes in timber and wood based materials. The specific risks of drilling different materials and the use of different types of drill bits, such as hole saws and machine Forstner bits, should be assessed before commencing work.

These machines should be included in the planned annual maintenance programme.

IMMEDIATE REMEDIAL MEASURES

A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Coolant is in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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1.040 Man Regs	METAL WORKING: Polishing and Linishing	Applicable to: all metals	See also: 1.041 1.059

Process(es) covered: Production of a high-quality surface finish using an abrasive belt (linisher), graded polishing wheels or polishing compounds and a power-driven mop. Final finishing could be done by hand using liquid polish and a cloth.

Hazards

Trapping	Fingers or material can become trapped between the belt and drive pulleys.
Flying workpiece	Workpieces can be thrown violently if not held correctly or if the machine starts unexpectedly.
User injury	Human contact with moving or rotating parts can cause cuts or abrasions and particles from the polishing process can enter the eye.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Burns	Objects heated by the polishing process may cause burns.
Dust	Hazardous by inhalation

Risk Assessment

Trapping	Inadequate guards cause an increased risk.
Flying workpiece	Workpieces are usually held in the hand for polishing, allowing the pressure on the mop or wheel to be released quickly. This risk is therefore small.
User injury	If guards are positioned to enclose those moving or rotating parts that are not being used, the risk is reduced but in some applications this is difficult. This risk must be reassessed for each application.
Entanglement	Entanglement is likely to occur if rotating spindles or spindle ends are exposed.
Burns	Polishing does not generate large amounts of heat but objects of small mass may become warm. This risk is trivial.
Dust	Dust may contain aluminium oxide (WEL of 10mg.m^3 8h TWA)[40], paraffin wax fume (WEL 6mg.m^3 15 minute reference period) and other materials, but it is unlikely to be a significant issue in normal school use.

Control measures

Drive mechanisms should be fitted with fixed or interlocked guards and any fence should be close to the belt to prevent trapping.
Instruction and practice should be sufficient to control the small risk from flying workpieces.
Eye protection should always be worn. Guards should be used to reduce the risk when the assessment shows them to be practicable.
The whole of the exposed spindle on both sides of the polishing mop should always be guarded, eg, by the use of adjustable telescopic guards. Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.
Polishing and abrasive compounds can be ejected from the machine and can be an irritant, LEV should be considered where there is a concern regarding the volume of dust emitted.

[40] EH40 2005

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RESTRICTIONS	Polishing wheels should be prepared with cold-adhesive cement only by a teacher or technician.

FURTHER INFORMATION

There should be sufficient space around these machines to ensure that the user is not pushed into the machine by a passer-by and the floor surface should not be slippery to avoid accidental slips while using the machine.
For requirements of controls for electrical machines, see the *General Introduction*.
The whole of the spindle should be guarded. Guards should be adjustable so that they can fit closely up to the polishing mop.
These machines should be included in the planned annual maintenance programme.

IMMEDIATE REMEDIAL MEASURES

A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Polish splashes into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.

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1.041 COSHH Regs	Metal working: polishing dust and Polishing materials	Applicable to: all metals; Coldax cement; Satenbond	See also: 1.040

Process(es) covered: Production of a high-quality surface finish using graded polishing wheels or polishing compounds and a power-driven mop. Final finishing by hand using liquid polish and a cloth.

Hazards

Dust	Hazardous by inhalation.
Irritant	Some adhesives are irritant to skin and eyes.
Flammable	Liquid metal polish used in hand-finishing operations is flammable.

Risk Assessment

Dust	Dust concentrations will not normally exceed the 10 mg/m^3 action limit[41] during polishing operations in education.
Irritant	Cold-adhesive cements, used to glue the abrasive disc onto the wheel (or some polishing compounds onto a mop) are very alkaline when liquid: it is necessary to prevent skin and, particularly, eye contact. When set solid, these products are harmless. Liquid metal polish: prolonged contact with the skin may cause dermatitis.
Flammable	Liquid metal polish is difficult to ignite and presents minimal risk so no control measure is necessary.

Control measures

LEV should be provided in cases of prolonged use or if excessive amounts of dust or lint are being shed from a mop. If LEV is unavailable a dust mask (FFP3 Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science) can be used as an interim control.
Goggles or a face shield must be worn to protect eyes, particularly when using cold-adhesive cement. Safer alternative adhesives are available for abrasive discs (eg, Evo-Stik Impact 2).
Hands should be washed thoroughly after using any polishing compound.

41 EH 40/2005.

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RESTRICTIONS	Polishing wheels should be prepared with cold-adhesive cement only by a teacher or technician.
Disposal	Large quantities via an authorised waste disposal contractor.
Storage	Store large amounts of liquid metal polish as highly flammable liquids.

FURTHER INFORMATION

Gloves **must not** be worn when polishing is done because of the risk of entanglement with the spinning polishing wheels or mops. Similarly the work should not be held in a cloth or an overall. If the work becomes too hot to hold it should be cooled under cold running water.
Modern polishing machines are normally fitted with local exhaust ventilation that will reduce the problems from dust.

IMMEDIATE REMEDIAL MEASURES

Swallowed	DO NOT INDUCE VOMITING. If large amounts are ingested, seek medical advice.
Contact with skin	Wash with soap and water.
Polish splashes into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Liquid polish catches fire	Cover it with a fire blanket.

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1.042 Man Regs	Metal working: Portable Power tools - angle Grinders	Applicable to: most resistant materials	See also: 1.034

Process(es) covered: Used to remove small amounts of waste material and for cleaning up of welded joints. Normally an impregnated cutting or abrasive disc is used, rather than a conventional grinding wheel.
Most portable power tools are electrically operated but pneumatic tools are used where compressed air is available. The use of tools with integral low-voltage battery packs is increasing.

Hazards

Flying material	Off-cuts or broken discs can be ejected violently. Sparks can be ejected when working on mild steel.
User injury	Human contact with rotating parts and swarf can cause cuts or abrasions. Wrist sprains can result from jammed tools
Tripping	Power leads or compressed air pipes present a tripping hazard.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Manual handling	Heavy workpieces and the gyroscopic effect of rotating motors can present a manual-handling hazard.
Burns	Workpieces cut with a grinder can become hot.

Risk Assessment

Flying material	Flying off-cuts are unlikely to occur but streams of hot sparks can make the user jump and cause injury.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts. If a grinding disc jams, some users may not be able to restrain the tool.
Tripping	Trailing leads or pipes present a risk of tripping.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk. Novices may have difficulty controlling the tool.
Burns	Burns from grinding are usually superficial.

Control measures

It is impracticable to guard all the hazardous areas when using portable power tools. The tool should be used so that sparks are not directed towards others in the vicinity.
Eye protection is needed. For some users a dust mask (FFP3 Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science) may be advisable.
Guards around rotating parts will reduce the risk of hand or finger injury but training and experience are essential in reducing risks.
The route of power leads and pipes should be chosen to minimise the tripping hazard. Battery-powered tools avoid this problem.
Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.
The risk of back injury is reduced if two persons handle heavy items. The strength of young persons using portable tools must be assessed to be adequate before they are allowed to use them.
Heat resistant gloves could be used to handle any material that might be hot.

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RESTRICTIONS	Immature pupils should not use portable power tools. Learners may only use portable grinders when they have been assessed as competent and are under appropriate supervision by specifically trained employees.

FURTHER INFORMATION

Portable grinders should only be used under the supervision of qualified staff.
Precautions to be taken with compressed air supplies are listed in the introduction to this part.
For general requirements on electrical supplies including a discussion on the use of 110 V, see the introduction to this part.
Portable tools should be examined before use and should have regular formal inspections and tests. The frequency depends on use but half-termly would be typical.
Useful guidance on grinding is available from HSE Books in HSG 17, *Safety in the Use of Abrasive Wheels* but there is a charge for this publication.

IMMEDIATE REMEDIAL MEASURES

A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Coolant is in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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1.043 Man Regs	Metal working: Portable Power tools - drills	Applicable to: most resistant materials	See also:

Process(es) covered: Drilling holes in resistant materials. Cutting oils or other lubricants may sometimes be required.
Most portable power tools are electrically operated but pneumatic tools are used where compressed air is available. The use of tools with integral low-voltage battery packs is increasing.

Hazards

Flying material	Chuck keys or broken drill bits can be ejected violently.
User injury	Human contact with rotating parts and swarf can cause cuts or abrasions. Wrist sprains can result from a jamming drill bit.
Tripping	Power leads or compressed air pipes present a tripping hazard.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Manual handling	Heavy workpieces and the gyroscopic effect of rotating motors can present a manual-handling hazard.
Burns	When drilling metal the work piece and the drill bit can become hot.

Risk Assessment

Flying material	Flying off-cuts are unlikely to occur but there is a high risk that inexperienced users will break drills.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts. When a drill bit jams, some users may not be able to restrain the tool.
Tripping	Trailing leads or pipes present a real risk of tripping.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk. Novices may have difficulty controlling the tool.
Burns	Burns from hot metal or drill bits are usually superficial.

Control measures

It is impracticable to guard all the hazardous areas when using portable power drills. Correct selection of the bit speed will reduce the risk of drill breakage. Eye protection is needed.
Guards around rotating parts will reduce the risk of hand or finger injury but training and experience are essential in reducing risks.
The route of power leads and pipes should be chosen to minimise the tripping hazard. Battery-powered tools avoid this problem.
Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.
The risk of back injury is reduced if two persons handle heavy items. The strength of young persons using portable tools must be assessed. Low voltage battery operated tools generate less torque and are more suitable for younger pupils.

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RESTRICTIONS	Immature pupils should not use portable power tools.

FURTHER INFORMATION

Chuck keys should not be dangled on chains near the working area as this increases the risk of entanglement.

The use of batteries with a lower voltage, and which do not allow the machine to produce a large torques are preferable for younger pupils who usually do not have the physical strength to control more powerful machines, especially if the drill bit jams in the work piece.

Using a bench or pillar drilling machine will usually give more accurate work, and with fewer hazards.

Precautions to be taken with compressed air supplies are listed in the introduction to this part.

For general requirements on electrical supplies including a discussion on the use of 110 V, see the *General Introduction*.

Portable tools should be examined before use and should have regular formal inspections and tests. The frequency depends on use but half-termly would be typical.

IMMEDIATE REMEDIAL MEASURES

A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Coolant is in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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1.044 Man Regs	METAL WORKING: PORTABLE POWER TOOLS - sHEET METAL SHEARS	Applicable to: hand-operated and hand-held power nibblers, notchers and shears	See also: 1.036

Process(es) covered: The cutting of sheet metal using power-operated shears, nibblers or notchers, either mains- or battery-driven, which work with a shearing action.
Hand-held nibblers may consist of an accessory fitted to a portable drill.
Most portable power tools are electrically operated but pneumatic tools are used where compressed air is available. The use of tools with integral low-voltage battery packs is increasing.

Hazards

User injury	Human contact with rotating or oscillating parts can cause cuts or abrasions. The edges of the cut metal and any small pieces that are cut off can cause cuts.
Tripping	Power leads or compressed air pipes present a tripping hazard.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating or oscillating parts, dragging the user onto them.
Manual handling	Heavy workpieces and the gyroscopic effect of rotating motors can present a manual-handling hazard.
Electric shock	A power cable to a portable tool may be damaged on a sharp metal edge.

Risk Assessment

User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts. When a blade jams, some users may not be able to restrain the tool. The edges of cut metals are often very sharp and can cause deep cuts.
Tripping	Power leads or compressed air pipes present a real risk of tripping.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk. Novices may have difficulty controlling the tool.
Electric shock	The risk of damage to a power cable is low.

Control measures

It is impracticable to guard all the hazardous areas when using this type of equipment, however, all guards supplied with the machine should be used. Immature pupils should not use portable power tools. Gloves should be used when handling metal with sharp edges.
The route of power leads and pipes should be chosen to minimise the tripping hazard. Battery-powered tools avoid this problem.
Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.
The risk of back injury is reduced if two persons handle heavy items. The strength of young persons using portable tools must be assessed. Low voltage battery operated tools generate less torque and are more suitable for younger pupils.
Regular inspection and maintenance minimises the electric shock risk.

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RESTRICTIONS	Immature pupils should not use portable power tools. Learners may only use portable grinders when they have been assessed as competent and are under appropriate supervision by specifically trained employees.

FURTHER INFORMATION

Precautions to be taken with compressed air supplies are listed in the introduction to this part.
For general requirements on electrical supplies including a discussion on the use of 110 V, see the introduction to this part.
Portable tools should be examined before use and should have regular formal inspections and tests. The frequency depends upon use but half-termly would be typical.

IMMEDIATE REMEDIAL MEASURES

A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Coolant is in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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1.045 Man Regs	METAL WORKING: Power saws	Applicable to: all metals	See also: 1.033

Process(es) covered:

Power sawing: The cutting to required length of workpieces from stock bars or rods of both ferrous and non-ferrous material using a power saw, possibly with coolant / cutting oil. Power sawing can be done by reciprocating power hacksaws, by metal cutting band saws and by special chop saws designed for cutting metal. This last type of machine may be fitted with an abrasive cutting disc rotating at high speed or by a saw type cutter that rotates at a slow speed.

Hazards

Trapping	Closing movements between parts under power can present a trapping hazard.
Flying workpiece	Workpieces can be ejected violently if not held correctly or if the machine starts unexpectedly.
User injury	Human contact with rotating or reciprocating parts and swarf can cause cuts or abrasions. Because of friction the ends of cut metal will be hot.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating or reciprocating parts, dragging the user onto them.
Manual handling	Heavy parts such as stock bars can present a manual-handling hazard.

Risk Assessment

Trapping	On reciprocating power hacksaws the movement of the blade and blade frame is fast. There is a high risk of harm from this type of machine.
Flying workpiece	There is a high risk that trainees will not clamp these items securely.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts. Correct handling of cut lengths will reduce the risk of harm from hot ends.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.
Manual handling	Handling large stock bars or awkward manipulation will not occur frequently but will present a real risk.

Control measures

It is very difficult to guard the moving parts of these machines. These machines should normally be used by qualified teachers or technicians and should normally be located in an area to which pupils do not have access.
Work pieces should be held securely. If short lengths of material are cut then a piece of metal of the same size should be put at the other side of the vice to ensure the vice jaws remain parallel when tightening up.
Hands and fingers should be kept out of the way whilst the machine is cutting. The use of cutting oil will reduce the temperature of the cut ends. If no cutting oil supply is available, the cut material should be left to cool.
Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.
The risk of back injury is reduced greatly if two persons handle heavy items.

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FURTHER INFORMATION

There should be sufficient space around these machines to ensure that the user is not pushed into the machine by a passer-by and the floor surface should not be slippery to avoid accidental slips while using the machine. Cutting oil can spill onto the floor and cause a slip hazard. These machines should be located in areas to which pupils do not normally have access. There should be sufficient space allowed so that stock bars being cut do not project across doorways, passage ways or across other machines.

Senior pupils may use reciprocating power hacksaws but only with direct supervision from a suitably qualified person. Students should not use metal cutting band saws, or other types of metal sawing machines.

If an abrasive cutting disc is used then the disc must always be fitted by a suitably qualified person.

For requirements of controls for electrical machines, see the introduction to this part.

These machines should be included in the planned annual maintenance programme.

IMMEDIATE REMEDIAL MEASURES

A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Coolant is in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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1.046 Asbestos Regs	Motor vehicle engineering: Asbestos	Applicable to: brake linings brake pads heat insulation	See also:

Process(es) covered: Demonstrations and exercises done by students on old motor vehicles may reveal asbestos products particularly as disc pads, brake linings, clutch linings and heat insulation around exhaust pipes.

Hazards

Toxic — Even low levels of asbestos fibres in the air are carcinogenic while prolonged exposure may produce serious damage to health in other ways.

Risk Assessment

Toxic — The control limits for asbestos dusts in the air are very low (eg, 0.1 f/cm3 air)[42] This is not a 'safe' level and exposure should be reduced as far below the control limit as possible. Consequently, any dust that might contain asbestos should be collected on clean wet rags that are then placed in a plastic waste bag immediately after use.

Control measures

The only sensible procedure is to remove all suspect materials from a vehicle to be used in training and replace them with asbestos-free equivalents.

[42] *Control of Asbestos at Work Regulations* 2012.

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FURTHER INFORMATION

When preparing a motor vehicle for trainees to work on, staff should assume that brake and clutch linings may contain asbestos and that brake and clutch dust is potentially harmful. If the trainees are to be taught to handle such items, then the guidance in *Health & Safety in Motor Vehicle Repair*, HSE Guidance Note HSG261, must be followed. If items possibly containing asbestos are to be replaced by staff, a toxic-dust face mask, meeting standard BS EN 149 and rated FFP3 (Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science), must be worn. Dust from brake drums or clutch housings must be collected with a type H vacuum cleaner or with clean wet rags; brushes should **not** be used. Any waste that contains asbestos is classed as 'hazardous' or 'special' and must be disposed of according to the regulations summarised in *EM9 disposal of asbestos waste.*

IMMEDIATE REMEDIAL MEASURES

Asbestos dust is inhaled	There are no measures that can be taken to reduce the chance of ill effects. However, the casualty should be reassured by explaining that the chance of ill effects is a small one.

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1.047 COSHH Regs	Motor vehicle engineering: batteries, Electrolyte and fumes	Applicable to: boats; cars; motorcycles	See also: 1.048

Process(es) covered: The provision of an electric current at fixed voltage from a number of lead-acid cells in series. The use and maintenance of this equipment.

Hazards

Corrosive — The electrolyte is a corrosive solution of sulfuric acid (R35).

Risk Assessment

Corrosive — The electrolyte used is about 34% sulfuric acid (4 M). It is hazardous to the eyes or skin and will attack most clothing. During charging, the gases released will carry droplets of this acid (WEL 3 mg/m^3, 15 min ref period)[43].

Control measures

Eye protection must be worn when handling and maintaining lead-acid batteries. Rubber gloves and aprons are needed for the preparation of battery acid and for the filling of new batteries.

[43] EH 40/2005.

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RESTRICTIONS	No attempt must be made to repair a battery. This work can only be undertaken by an industry-trained person that fully understands the hazards involved.
Disposal	The acid may be poured slowly into a very large volume of water, neutralised with sodium carbonate (added until it stops fizzing) and flushed away. The empty battery may then be rinsed and sold as scrap for recycling.
Storage	Batteries should be stored in ventilated areas. Stock acids should be stored at low level in a store where they are not likely to be kicked.

FURTHER INFORMATION

Fire risk	The internal resistance of lead-acid batteries is very low so a very high current will flow if the terminals are short-circuited. Sparks and molten metal may be ejected.
Diluting concentrated acid	If it is necessary to dilute concentrated sulfuric acid to the strength required for lead-acid accumulators, it is wise to consult the technicians in the science department who will have the relevant CLEAPSS *Recipe Card*.
Explosion risk	Hydrogen and oxygen are emitted from a battery when it is being charged and possibly at other times, eg, when being moved or shaken. A hydrogen / oxygen mixture can produce a violent explosion if ignited and it must be assumed that this mixture is present in the immediate vicinity of the cell tops at all times. Charging should be carried out in a well-ventilated area, taking care to avoid sparks and other sources of ignition.

IMMEDIATE REMEDIAL MEASURES

Acid is splashed into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Acid is splashed onto the skin	Wash off immediately with plenty of water, removing any contaminated clothing.
Spilt in workshop	Ensure suitable personal protection during removal of any spill. Small spills may be swilled away with volumes of water. Alternatively, contain the spill with sand, earth or any absorbent **other than sawdust** and add sodium carbonate (soda ash) to neutralise it before scooping it into a bucket. Add water and stir, then leave to settle. Pour off the water, flushing it away down a toilet. The wet absorbent can be tipped into a strong plastic bag that is disposed of in the ordinary waste.

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1.048 Man Regs	Motor vehicle engineering: Demonstration Engines	Applicable to: boats; cars; models; motorcycles	See also: 1.046 1.047 1.049 1.050

Process(es) covered: Schools have built and run small engine test beds to allow study of torque: speed characteristics and fuel consumption. These typically use a small lawn-mower engine but much smaller systems have used model aircraft engines.

Hazards

Fire	The fuels are often extremely flammable liquids.
Electric shock	Many engines will require a high-tension supply for a spark plug.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts and belts, dragging the user onto them.
Burns	Some components (eg, exhaust pipes) can be hot enough to burn skin.

Risk Assessment

Fire	The risk of fire with even small amounts of fuel is high.
Electric shock	Although spark plugs often require hundreds of volts, the maximum current that can flow in an electric shock is unlikely to harm.
Entanglement	In unguarded systems, this risk is quite high.
Burns	Serious burns could result from the hot components.

Control measures

All possible sources of ignition must be removed before handling fuel and when running the engine.
Leads to spark plugs must be adequately insulated.

Rotating parts and belts must be guarded to minimise the possibilities of entanglement.
Exhaust pipes and other hot parts should be provided with thermal insulation to prevent accidental contact.

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RESTRICTIONS

Engine test beds of any size should only be run under close adult supervision.

Storage

See *Engine fuels* (sheet 1.049) for guidance on their storage.

FURTHER INFORMATION

See the associated pages for risk assessments on asbestos, oils, fuels and exhaust fumes.
The appropriate fire extinguisher for an engine test area is a foam type.

IMMEDIATE REMEDIAL MEASURES

Fumes are inhaled	In the event of dizziness occasioned by fume, remove the affected person to the fresh air until recovered.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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1.049 COSHH Regs	Motor vehicle engineering: Engine fuels, Engine oils	Applicable to: diesel; engine oil; glow-plug fuel; petrol; petroil; two-stroke fuel	See also: 1.048 1.050

Process(es) covered: Motor vehicle engineering is taught mainly in colleges of FE where it is necessary to handle fuels and lubricants. Oils are used to reduce friction and improve piston seals. Pupils in schools may however experience motor vehicle work, either in the school or at a local college.

Hazards

Toxic Cancer may be caused by used engine oils (in which the carcinogen has not been identified) and by petrol because of its benzene content (Carc, Sk, R45, 46, 11, 36/38, 48/23/24/25, 65).

Harmful Inhalation of fumes has a narcotic effect and high levels are moderately poisonous.

Irritant Engine fuels are slightly irritating to the skin with a defatting action.
Splashes in the eye may cause irritation and some discomfort.
Diesel fuel is considered less hazardous than petrol.

Highly flammable Engine fuels, particularly petrol (leaded or unleaded), are extremely flammable.

Risk Assessment

Toxic Used engine oils and petrol must be treated as potential carcinogens[44].

Harmful Under normal conditions of use, engine fuels are not expected to present an inhalation hazard. Toxicity following single exposure to high levels (orally, dermally or by inhalation) of all fuels is of a low order. However, exposure to higher vapour concentrations can lead to nausea, headache, dizziness and, in extreme cases, loss of consciousness. No WEL values are available.

Irritant Problems are not expected unless exposure is frequent. This may not happen in school workshops but staff in colleges may need to take precautions.

Highly flammable No equipment with an open flame or source of ignition must be used within 5 m of a fuel container or vehicle.

Control measures

Used engine oils must be handled only when wearing suitable gloves (eg, nitrile rubber).
Good natural ventilation is sufficient to reduce the inhalation risk from fuels to acceptable levels.
The use of disposable PVC gloves is recommended for handling fuels when exposure will be short. Industrial nitrile gloves are recommended for frequent exposure. (See *Further Information* overleaf.)
All electrical switch gear, fittings and equipment within 1.25 m of the floor and within a radius of 5 m of a vehicle or engine test bed, must be of an approved, protected pattern.

[44] EH 40/2005.

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RESTRICTIONS	Fuels must not be used as solvents or cleaning agents. To start a siphon by sucking up a tube by mouth is very risky. Vehicles brought into the workshop should not have more than 15 L (3 gallons) of fuel in the tank and must be fitted with a lockable cap.
Disposal	Engine fuels are governed by the *Hazardous Waste Regulations* 2015 and subsequent amendments, and must be disposed of via an authorised waste disposal contractor along with other Hazardous Waste produced in the school[45]. Do not allow fuels to enter the drainage system. Used engine oil must be placed in the tank at a public amenity site.
Storage	Fuel not in vehicle tanks must be held in suitable containers (eg, metal petrol cans or approved plastic petrol containers), and in a 'highly-flammable liquids cabinet'. Where more than 15 L (3 gallons) of fuel is to be stored, a Petroleum Licence must be obtained from the local authority Petroleum Officer and the fuel must then be stored in a purpose-built, external store.
FURTHER INFORMATION	Ensure that the controlling authority and the local fire service's Fire Prevention Officer have been consulted over any proposed use of engine fuels and over the appropriate fire precautions to be taken. The filling of tanks or containers (metal screw top) from storage vessels should be carried out in the open air, away from all sources of ignition. The type and degree of hand protection depends on the glove material and the way in which it is constructed. Barrier creams may sometimes be used as an aid to skin hygiene in situations where gloves cannot be used. Experience shows, however, that barrier creams are less reliable than suitable gloves as a means of protection[46] from chemicals. There is no evidence of hazards from hydraulic fluids.
IMMEDIATE REMEDIAL MEASURES	
Inhalation	Remove the affected person(s) to the fresh air.
Fuels or oils are swallowed	Accidental ingestion is unlikely but, in the event, DO NOT INDUCE VOMITING. Wash out the mouth with water and if ingestion is suspected, send to hospital immediately.
Fuels or oils are on the skin	Flush contaminated skin with water, then wash with soap and water. Contaminated clothing should be soaked with water and removed. Do not reuse until laundered.
Fuels or oils are in the eye	Flush the eye(s) with copious quantities of running water from a tap. If irritation persists then seek medical attention.
Fuels or oils are spilt in workshop	In the event of a spill in a badly-ventilated area, persons should not be allowed to enter the area even in an emergency until the atmosphere has been checked by a competent person and passed as safe for entry.

[45] See CLEAPSS guidance leaflet PS31 *Disposal of Waste in Design & Technology* and ring the *Helpline* for the latest advice.

[46] Paragraph 99 from *Personal protective equipment at work*, HSE 1992, ISBN 0118863347.

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1.050 COSHH Regs	Motor vehicle engineering: Exhaust fumes	Applicable to: internal combustion engines	See also: 1.048 1.049

Process(es) covered: The testing or demonstration of tuning procedures on two- or four-stroke internal combustion engines. Products generated by the combustion of fuels are mainly carbon dioxide and water together with traces of carbon monoxide, hydrocarbons, nitrogen oxides, sulfur oxides and organic lead compounds.

Hazards

Harmful — Exhaust gases, especially carbon monoxide (R12, 23, 48/23, 61).

Risk Assessment

Harmful — Apart from water, all the exhaust gases are considered harmful to health. Inhalation of combustion products can result in nausea, headache and dizziness and, in extreme cases, loss of consciousness.
The control of exposure to products of combustion may be based on the exposure limit for carbon monoxide, which has a WEL of 200 ppm (15 min ref period)[47].
It is essential for exhaust gases to be vented to the outside air.

Control measures

Engines mounted in movable chassis or wheeled assemblies may be tested or demonstrated outside the building.
For exhaust gases to be vented to the outside air in such a way that they are not drawn back into the building, a duct leading to a roof-level stack will be required but a fan should not be necessary.
If small engines are mounted in frames in the workshop and adequate ventilation can be provided by opening external doors and windows, an engine may be run within the building if confined to a period no greater than ten minutes in any half hour.

[47] EH 40/2005.

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FURTHER INFORMATION

The employer must be consulted on plans to set up an engine-running facility, as should the local fire prevention officer whose advice must be followed at all times.

IMMEDIATE REMEDIAL MEASURES

Fumes are inhaled	If adverse effects of exhaust fumes are experienced, remove those affected to the fresh air until recovered.

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1.051 Man Regs (LOLER)	Motor vehicle engineering: Lifting and holding equipment	Applicable to: batteries; engines; gear-boxes; vehicles	See also: 1.047 1.048 1.049

Process(es) covered: It is often necessary to have access to the underside of vehicles or all-round assemblies such as engines, gear-boxes, etc. All of these are heavy so hoists, jacks, cranes and lifts are needed.

Hazards

Collapse of lift etc	Hoists, lifts, jacks and cranes may fail under load if they are not properly maintained.
Failure of tackle	Chains, ropes, slings etc may fail if they are over-stressed or worn.
Falling load	The load may fall if it is not properly held by the tackle.
Movement of vehicle	Vehicles, having wheels, may move and fall from hoists, lifts and stands.

Risk Assessment

Collapse of lift etc	Lifting equipment is subject to repeated stresses and will fail at some point, which depends on its history.
Failure of tackle	Chains, ropes and webbing slings wear and may fail.
Falling load	If the tackle is not attached correctly, there is a high risk that heavy assemblies will fall.
Movement of vehicle	There is a high risk that unrestrained vehicles may move and roll off hoists, lifts and ramps.

Control measures

Because lifting equipment is subject to repeated stresses, it must be checked before each use for obvious faults or defects. Employers must choose whether it is tested and examined at regular intervals or in accordance with a written examination scheme. Where lifting equipment is hired or loaned, it must be accompanied by evidence of its last examination including the safe working load.
Chains, ropes and other lifting tackle must be included with other lifting equipment in checks and thorough examinations.
Users of lifting equipment must be trained in its correct use and in the checks to be made before use.
It is essential to use the vehicle hand brake, chocks and/or other restraints to prevent the vehicle from rolling off a hoist, etc.

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RESTRICTIONS

Many educational workshops have been provided with inspection pits in the past. As a result of experience with the accumulation of heavy vapours, these are no longer considered sufficiently safe. INSPECTION PITS SHOULD NOT BE USED.
Jacks must be used only to raise a vehicle. Before work begins underneath it, the jacks must be replaced with axle stands or other suitable supports.

FURTHER INFORMATION

It should be noted that some hydraulically-operated vehicle lifts can be lowered even though the hydraulic power unit may be turned off. It may be necessary to introduce additional safeguards such as locking covers over operating controls to prevent this.
The examination and testing of lifting equipment was subject to the *Factories Act* of 1961. This has been replaced by PUWER 1998 and LOLER 1998. These regulations require the employer to decide whether safety is best served by regular thorough examinations (including any tests deemed necessary by a competent person) or by examinations according to a prepared scheme. Where lifting equipment is used irregularly, the scheme can reflect this but must be drawn up by a person deemed competent to do so.
This table may help to clarify the requirements of LOLER 1998.

Plant	**Checks for obvious faults**	**Alternatives:**		**When changing premises**
		Regular thorough examination	**According to scheme**	
Equipment and accessories used to lift persons, eg, a driver.	By the user, before each use.	At six-monthly intervals and after any modification or repair.	As decided by the competent person.	Must be accompanied by certificate or report including safe working load.
Equipment and accessories not used to lift persons.	By the user, before each use.	At 12-monthly intervals and after any modification or repair.	As decided by the competent person.	Must be accompanied by certificate or report including safe working load.

IMMEDIATE REMEDIAL MEASURES

Crushing injuries (casualty crushed for more than 15 minutes)	DO NOT RELEASE THE CASUALTY. Send for an ambulance, giving details of the incident. Comfort and reassure the casualty until help arrives.
Crushing injuries (casualty crushed for less than 15 minutes)	Release the casualty as quickly as possible. Control any external bleeding and cover wounds. Send for the trained first aider who will secure and support any suspected fractures, examine and observe the casualty for signs of shock and treat accordingly.

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1.052 Man Regs	PLASTICS: Abrading and trimming Equipment	Applicable to: acrylics; nylon; polypropylene; polystyrene	See also: 1.010 1.052 1.054 1.055

Process(es) covered: Shaping and cutting plastic materials by machine (bandsaw, drilling, metal centre lathe and moulding trimmer).

Hazards

Ejection of material	Acrylics can shatter when being machined, with the ejection of fine splinters.
User injury	Human contact with rotating tools can cause cuts or abrasions. Injuries can also arise from loss of control of the workpiece when heat-softened plastics cause tools to jam, putting strains on holding devices and on the material itself.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.

Risk Assessment

Ejection of material	The risk of shattering is greatest when cutting or drilling acrylic sheet, particularly if it is old stock.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and will forget the particular properties of the material they are using.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.

Control measures

Masking tape can be used to prevent sharp fragments from flying. When drilling, a slow feed rate should be used so as not to increase the stress in the material unduly. Clamping the work piece firmly to the table of the drilling machine will considerably reduce the risk of shattering. Re-grinding the drill bit to give a zero rake angle, and changing the point angle of the drill to about 130° will also reduce the risk of shattering. 'Soluble oil' can be used as a coolant.

Guards around rotating parts will reduce the risk of hand or finger injury but training and experience are essential in reducing risks. When drilling plastics, a slow speed should be used so as not to increase the temperature of the material unduly.

Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.

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RESTRICTIONS	Persons suffering from asthmatic conditions are particularly prone to health hazards from abrading and should not undertake this process.
Storage	All plastics should be kept in cool, dry conditions. Sheet material that may be machined should be kept in the dark to minimise the embrittlement that is caused by UV radiation.
FURTHER INFORMATION	When using a moulding trimmer, it is essential to keep the work flat on the machine bed and to ensure that the cutter is set at the correct height for the thickness of material being cut.

IMMEDIATE REMEDIAL MEASURES

Particle in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Coolant is in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.

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1.053 COSHH Regs	Plastics: Abrading Dust and Fumes	Applicable to: acrylics; nylon; polypropylene; polystyrene	See also: 1.059

Process(es) covered: Shaping and cutting plastic materials by hand and by machine (bandsaw, drilling, metal centre lathe, moulding trimmer).

Hazards

Dust	Hazardous by inhalation.
Harmful	Rigid polystyrene when heated to the point of decomposition may release styrene fumes.

Risk Assessment

Dust	Many plastics give rise to dust and fine particles when they are machined or abraded. Exposure to high concentrations may cause irritation to nose, throat and eyes. The action level here is the total dust concentration of 10 mg/m^3 (8 h TWA)[48]. On the scale of school work, this process will not require local exhaust ventilation.
Harmful	Unless care is taken to keep the work cool, machining of rigid polystyrene may release styrene (R10, 20, 36/38) which has a WEL of 100 ppm (8 h TWA) and 250 ppm (15 min ref period)[1]. A coolant is therefore required.

Control measures

Instructions concerning specific hazards associated with particular materials issued by manufacturers must be followed scrupulously.
Water should be used as a lubricant where possible without introducing electrical hazards, to keep production of dust to a minimum. The wearing of nuisance dust masks is advised when machining. Suitable eye protection must be worn.
When using a circular saw or bandsaw to cut plastic sheet, the material should be fed slowly and steadily to the blade to minimise heating. To prevent the cut being re-welded by melted dust, the surface of the sheet can be covered with sticky tape or paper (eg, masking tape).
Work should be undertaken only in a well-ventilated area.
When drilling plastics, a slow speed should be used so as not to increase the temperature of the material unduly. ‘Soluble oil’ can be used as a coolant.
Work should be clamped down to lessen the risk of shattering.

48 EH 40/2005.

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RESTRICTIONS	Persons suffering from asthmatic conditions are particularly prone to health hazards from abrading and should not undertake this process.
Disposal	Small quantities may be added to ordinary dry waste.
Storage	All plastics should be kept in cool, dry conditions. The main store should preferably be outside and built of brick, away from heat sources, open flames and other sources of ignition. Foamed plastics are more flammable and need extra care in storage.
FURTHER INFORMATION	Machines such as bandsaws, drills, centre lathes and sanders that were designed for use on wood or metal are often used for working plastics. The risk assessments for these applications can be consulted for plastics work too. It should be noted that there is a risk of explosion from static electricity within local exhaust systems designed to extract wood dust, if the same system is used to extract dust from plastics. Wherever possible separate systems should be used for machines that are only used to machine plastics. Where this is not possible the wood dust should be emptied before the system is used for plastics and the plastic dust should be removed after use.

IMMEDIATE REMEDIAL MEASURES

Inhalation of fumes	If fumes are inhaled, remove person to fresh air and seek medical advice.
Dust or fumes in the eyes	If eyes water due to fumes or dust, flush with water and remove person to fresh air. If the condition persists, seek medical advice.

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1.054 COSHH Regs	Plastics: GLASS-REINFORCED PLASTIC, Resin casting, Chemicals and Fumes	Applicable to: Botbilda; Cibaform; Gelcoat; Plastic Padding; Resin	See also: 1.053 1.055

Process(es) covered: A polyester resin, dissolved in styrene, is hardened by mixing with a catalyst. It sets in 10 to 30 minutes. All mixing vessels, etc, are disposable and are not cleaned with solvents. The resin is often used with glass-fibre reinforcement to give glass-reinforced plastic (GRP) which may be machined, cut or abraded.
Small scale repair kits use similar materials but with the catalyst supplied as a paste.

Hazards

Harmful	Fumes from the solvents, styrene and possibly vinyl toluene (2-methylstyrene) are harmful by inhalation.
Explosion	Some peroxide catalysts can be explosive.
Dust	Glass fibres, although not classified as irritant under CHIP, can irritate the skin and respiratory system.
Irritant	Methyl methacrylate, α-methylstyrene (2-phenylpropene), styrene and catalysts are all irritant to eyes, skin and respiratory system.
Highly flammable	Vapours, especially acetone (propanone), if used for cleaning brushes.

Risk Assessment

Harmful	Styrene fumes (R10, 20, 36/38) are liberated until curing has ceased. For the low-emission resins, where the maximum total quantity of material laid up or curing in a workshop at any time is 1 m^2 or 0.25 kg of casting resin, the WEL for styrene (100 ppm, 8 h TWA)[49] will not be approached.
Explosion	While pure dibenzoyl peroxide (R2, 36, 43) is explosive (WEL 5 mg/m^3, 8 h TWA)[1], the formulations used here are most unlikely to explode. The paste catalysts used with repair kits are even safer.
Dust	Dust rich in glass fibres is produced when GRP mouldings are machined or abraded. This can irritate the skin, nose and throat and may exacerbate existing chest conditions. Consequently, dust levels must be controlled.
Irritant	Styrene and combinations of methyl methacrylate (R11, 37/38, 43), α-methylstyrene (R10, 36/37, 51/53) and/or vinyl toluene (R10, 36/37/38) are used in unsaturated resin solutions. These degrease the skin and prolonged contact may cause dermatitis. All will cause irritation to the eyes for several hours after exposure. This risk calls for ventilation. Catalysts are usually organic peroxides, very irritant to eyes, nose, throat and airways. Irreversible damage to the eyes will result from prolonged contact. Careful dispensing is therefore essential.
Highly flammable	Solvent fumes, eg, propanone (R11, 36, 66, 67), could be ignited by a naked flame.

Control measures

If low-emission resins are not available, or more than the above amounts are used and forced ventilation is not available, work must be removed to an unoccupied room until completely cured.

A standard, calibrated dispenser must be used for storing liquid catalyst and dispensing must be done by a teacher or technician wearing eye protection.

49 EH 40/2005.

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	A nuisance-dust mask may be helpful when laying up moulds with some types of cut glass-fibre mat. Trimming of GRP may be done out-of-doors or in rooms with a floor area exceeding 80 m^2 with all available windows open. Eye protection and disposable gloves must be worn. All sources of ignition must be kept away, especially when cleaning brushes.

Plastics: Glass-Reinforced Plastic, Resin Casting, Fumes and Chemicals (Continued)

RESTRICTIONS	Do not work on the floor as styrene gas is heavier than air. Do not work in a confined space, eg, inside a canoe, unless fumes are extracted mechanically from the space.
Disposal	Wherever possible, disposal is achieved by mixing the resin and catalyst, allowing them to harden and then placing them in a sealed plastic bag in the waste. Excess catalyst should be mixed with 10 parts of paraffin (kerosene) and cautiously burnt in the open air.
Storage	Store resin, catalyst and acetone (propanone) as highly flammable liquids in suitable unbreakable containers that are clearly labelled. Unused resin and catalyst should be discarded after 1 year.

FURTHER INFORMATION

The polyester resins supplied to schools (eg, Trylon AP101PA) are designed to produce as little fume as possible.
Dust produced in work with GRP can be reduced if the material is trimmed at the 'green' stage.
The colour pastes that are often added to the gel coat may contain up to 60% lead chromate. This material is toxic and controlled under the *Control of Lead at Work Regulations* 2002. These regulations require the concentration of lead in the atmosphere to be kept below 0.15 mg/m^3 (8 h TWA). It would be wise to wear disposable gloves when handling these pastes and for a member of staff to mix the colour paste with the gel coat or resin since only small amounts are needed to give quite intense colours.

IMMEDIATE REMEDIAL MEASURES

Swallowed	Give plenty of water. DO NOT INDUCE VOMITING. Obtain medical attention.
Vapour is inhaled	Remove casualty to fresh air to rest. If breathing is even slightly affected, obtain medical attention.
Substances are in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Spilt on the skin or clothes	Remove contaminated clothing. Wash affected area thoroughly with soap and tepid water. If a large area is affected or blistering occurs, obtain medical attention. Scrape resin off clothing, wash in tepid water and rinse repeatedly.
Spilt in workshop	Scrape and wipe up as much as possible, using newspaper, old rags etc. Dispose of in plastic bags.

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1.055 COSHH Regs	Plastics: Hazards of materials	Applicable to: nylon; polystyrene; polyurethanes; PVC, etc	See also: 1.001 1.005 1.052 to 1.062

Process(es) covered: All plastics (polymers) degrade at sufficiently high temperatures, producing fumes with various hazards. Those materials presenting hazards at lower temperatures are discussed here.

Hazards

Toxic Decomposition of polyvinyl chloride (PVC) (whether plasticised or not) may occur to give vinyl chloride which may cause cancer.
Polyurethane foams produce toxic fumes when heated to melting.

Harmful Styrene vapour is harmful by inhalation.

Dust PVC and nylon dust is harmful by inhalation.

Irritant Many powders irritate eyes and skin.

Risk Assessment

Toxic Decomposition of PVC powder in air starts at around 150 °C with the release of vinyl chloride monomer (Carc, R45, 12) (WEL 3 ppm, 8h TWA)[50] which must be regarded as a carcinogen. Unless these vapours can be removed, heat processes should be avoided.
Polyurethane foam may produce hydrogen cyanide (Sk, R12, 26, 50/53) (WEL 10 ppm, 15 min ref periood) and nitrogen oxides (R26) when heated.

Harmful Styrene vapour (R10, 20, 36/38) is released during curing of polystyrene resin and when polystyrene or ABS are heated. However, measurements show that, in school processes, the concentration is well below the WEL of 100 ppm (8 h TWA)[1].

Dust PVC - long term exposure to dust may result in a reduction in lung function and the dust has a WEL of 10 mg/m^3 (8 h TWA)[1]. This level will not be reached with occasional use in a school workshop.
Nylon dust is subject to a similar WEL, which will not be reached with occasional use in a school workshop.

Irritant Risk of skin and eye irritation from pouring powders.

Control measures

If PVC must be used in heat processes, local exhaust ventilation will be required with testing every 14 months. Polyurethane foam must never be heated, eg, with a hot wire for cutting.
Polystyrene resin may be used on a small scale in a well-ventilated workshop.
Expanded polystyrene may be cut with a hot wire. ABS should not be heated above its softening point.
Powdered plastics should be handled carefully to avoid the formation of dust clouds but abrading PVC or nylon with hand tools will not cause a problem.
Hands should be washed thoroughly after handling the powder.
Eye protection and protective gloves should be worn when pouring.

50 EH 40/2005.

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Disposal	Large quantities must be handled by an authorised contractor.
Storage	Store materials in a clean, dry area at ambient temperature (< 30 °C).

FURTHER INFORMATION

The following polymer materials present only minimal COSHH hazards in normal use:

Systematic name	**Common names**
Acrylonitrile, butadiene, styrene	ABS mixed polymer
Cellulose acetate butyrate	CAB mixed polymer, butyrate sheet
Cross-linked polyesters (dicarboxylic acids with diols & triols)	Glyptals, alkyd resins
Polyamide	Nylon (various forms)
Polycarbonate	PC sheet
Polyester and polyester copolymer	Terylene, Crimplene, Dacron, Trevira
Polyethers	Epoxy resins
Polyethylene	Polythene, Alkathene, HDPE, Plastazote foam, Polymorph
Polyisoprene, polybutadiene, polychloroprene	Rubbers: natural, buna, neoprene
Polymethylmethacrylate	Acrylic, Perspex, Lucite, Plexiglass
Polymethylpentene	TPX
Polypropylene	Corriflute, Correx
Polystyrene	Available as rigid or foamed sheet. Rigid sheet is clear, hard and brittle
Polystyrene, high impact	HIPS. Contains 5 to 15% rubber
Polytetrafluoroethene	PTFE, Teflon, Fluon
Polyvinyl acetate	PVA

IMMEDIATE REMEDIAL MEASURES

Powder is swallowed	Drink plenty of water and seek medical attention.
Vapour is inhaled	Remove casualty to fresh air and seek medical attention.
Dust in the eyes	Wash thoroughly for at least ten minutes with water to prevent scratching of the eye. Seek medical attention if irritation persists.
Spilt in the workshop	If possible, use an industrial vacuum cleaner to get the powder into bags. If sweeping, dampen powder first. Rinse area with soapy water.

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1.056 COSHH & Man Regs	PLASTICS: HOT-AIR WELDING	Applicable to: combined machines; plastics welding machines	See also: 1.055

Process(es) covered: Thermoplastic materials (eg, polyethylene, polyproylene, ABS or, exceptionally, PVC) are joined using a jet of hot air to melt and fuse the plastics material. A filler rod of the same material may be used to reinforce the joint. The blower may be integral with or remote from the welding nozzle.

Hazards

Toxic	Heating PVC releases toxic vinyl chloride monomer and heating polyurethane may release very toxic hydrogen cyanide and nitrogen oxides.
Harmful	Heating ABS or polystyrene may release harmful styrene vapour.
Burns	Burns can be caused by contact with the hot air or the gun. Burns can also be caused by contact with the hot material.
User injury	Unstable work or equipment can lead to injury if it falls onto the user.
Tripping	Leads and hoses are a trip hazard.
Electric shock	Mains-powered equipment presents the possibility of harm from electric shock.

Risk Assessment

Toxic	Polyurethane presents too high a risk to weld by this method.
Harmful	The risk from welding ABS or polystyrene is minimal provided that correct working temperatures are used. Styrene (R10, 20, 36/38) has a WEL of 100 ppm (8 h TWA) and 250 ppm (15 min ref period)[51], vinyl chloride monomer (Carc, R45, 12) has a WEL 3 ppm, 8 h TWA.
Burns	The hot air stream (typically at 300 °C) could give rise to serious burns. Hot plastics material can cause unpleasant burns.
User injury	Care must be taken when welding large sheets, tubes or structures to prevent the work falling. Some hand-held equipment will be too heavy for young persons to control.
Tripping	Trailing leads or air pipes present a real risk of tripping.
Electric shock	The risk of harm from electric shock will be reduced if the equipment is properly maintained.

Control measures

The manufacturer's instructions for the materials to be used and the temperature settings must be followed.
Heat-proof gloves should be available. Suitable eye protection should be worn and training provided in the use of the equipment.
Both work and equipment should be supported adequately.

The route of power leads and hoses should be chosen to minimise the tripping hazard.
Regular inspection and testing of electrical equipment minimises the risks.

[51] EH 40/2005.

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RESTRICTIONS	It may be necessary to restrict the use of this equipment to adults.

FURTHER INFORMATION

Thermoplastics are those which can be reformed by the application of heat (eg, Polythene) as distinct from those which are set by the application of heat (eg, Bakelite).
Most hot air welding guns used in schools are part of a combined thermo-forming unit. Where this is the case care should be taken to ensure that the equipment is in good working order and that the correct switching has been set to use the hot air gun.
Machines used for hot air welding should be included in a planned annual maintenance programme.

IMMEDIATE REMEDIAL MEASURES

Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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1.057 COSHH Regs	Plastics: HOT-WIRE cutting, Fumes	Applicable to: expanded polystyrene; Styrofoam	See also: 1.055

Process(es) covered:

The cutting of expanded polystyrene by means of a wire heated to about 300 °C.
NB Only **expanded polystyrene** may be cut using this equipment,
NOT polyurethane foam; rigid polyurethane may be cut and shaped by abrasion in a well-ventilated area while springy polyurethane can be cut by knife.
The electrical supply to the cutting wire should not exceed 25 volts and should be supplied through a separated extra-low voltage (SELV) source.

Hazards

Harmful

Fumes of styrene vapour are harmful by inhalation.

Irritant

Styrene fumes can irritate the eyes.

Risk Assessment

Harmful

Styrene fumes (R10, 20, 36/38) are produced as the material degrades when overheated. Styrene has a WEL of 100 ppm (8 h TWA) and 250 ppm (15 min ref period)[52]. However, even with up to 5 cutters in simultaneous use in a well-ventilated workshop, the level of styrene fumes will not approach these limits. (See overleaf.)

Irritant

The eye irritation becomes severe only at exposures of 200 ppm and above but eyes may water at levels below the WEL.

Control measures

Small, hand-held cutters may be used in well-ventilated conditions. Large, bench-mounted types may require local exhaust ventilation: a special risk assessment is necessary.
The ventilation required to control the harmful hazard will also control the irritant one.

[52] EH 40/2005.

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Disposal	Small amounts of polystyrene foam can be taken to a domestic recycling centre.
Storage	Expanded polystyrene should be stored in cool, dry conditions away from heat and other sources of ignition.

FURTHER INFORMATION

Only small quantities of styrene fumes are produced as the material degrades when overheated with a hot-wire cutter. However, the odour of styrene can be detected at very low levels, well below the WEL of 100 ppm. The fumes can cause dizziness and children[53] are particularly vulnerable to high concentrations. However, measurements while using a hand-held cutter have shown that, with reasonable ventilation and moderate care, styrene levels in the operator's breathing zone are less than 10% of the WEL.

The process does not require the material to be heated beyond its melting point. In practice, because the wire has a very low thermal mass, its temperature tends to rise very rapidly when it is not being constantly cooled by the feed of the material being cut.

On a basic bench machine with no means of quickly disconnecting the heating power to the wire, residual material adhering to the wire at the end of the cutting operation will quickly overheat and, in small quantities, degrade to produce styrene fumes. Effective ventilation must sweep these away immediately. It is important to ensure that the equipment operates at the lowest temperature that allows free cutting. Controlled electrical heating is desirable to obtain an even wire temperature. **If smoke is given off, then the wire is too hot.** Some bench hot-wire cutters have a foot switch which, if correctly used, will virtually eliminate the production of harmful fumes.

IMMEDIATE REMEDIAL MEASURES

Inhalation	If styrene fumes are inhaled, remove person to fresh air and seek medical advice.
In the eyes	If eyes water due to styrene fumes, flush with water and remove person to fresh air. If the condition persists, seek medical advice.

[53] A 'child' is defined as one below statutory school-leaving age.
A 'young person' is one over school-leaving age but below the age of 18.

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1.058 Man Regs	PLASTICS: Injection-Moulding Equipment	Applicable to: injection & extrusion; thermo-forming centres	See also: 1.055

Process(es) covered: Plastic materials are heated to such a temperature that they will flow and are then forced under pressure into a metal mould or through a die. Nylon and polyethylene are the materials most commonly used.

Hazards

Burns	Components can reach temperatures as high as 300 °C. Hot plastic can be ejected if the mould sections part.
Explosion	Nylon granules can absorb moisture in storage, which then turns to steam explosively when the material is heated.

Risk Assessment

Burns	Unguarded components could give rise to serious burns. Molten plastic could be ejected at the user if the mould is not clamped tightly.
Explosion	The risk is real if the nylon is not stored correctly.

Control measures

Heat-proof gloves should be available for opening moulds and extracting hot plastic forms. Guards should be fitted to prevent plastic being ejected at the user.
The guards must be adequate to withstand explosive failure of the mould or its clamp. Nylon must be dried before use, following the manufacturer's instructions.
Eye protection should be worn when moulding nylon.

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Storage	It is essential to store nylon in airtight drums and in a dry place.

FURTHER INFORMATION

Injection-moulding machines may incorporate pressure systems as well as electrical items. The pressure system of most educational equipment will have a pressure volume product that is less than 250 bar litres and therefore is excepted from some requirements laid down in the *Pressure Systems Safety Regulations* 2000. It will, therefore, **not** be necessary to examine this equipment in accordance with a written scheme. Nevertheless, the user is required to ensure that the system is properly maintained in good repair so as to prevent danger.
Injection-moulding machines should therefore be included in a planned annual maintenance programme.

IMMEDIATE REMEDIAL MEASURES

Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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1.059 Man Regs	PLASTICS: Polishers	Applicable to: acrylics	See also: 1.040 1.055 1.060

Process(es) covered: Production of a high-quality surface finish using polishing compounds and a power-driven mop. Final finishing by hand using liquid polish and cloth.

Hazards

Flying workpiece	Workpieces can be thrown violently if not held correctly or if the machine starts unexpectedly.
User injury	Human contact with moving or rotating parts can cause cuts or abrasions and particles from the polishing process can enter the eye.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.

Risk Assessment

Flying workpiece	Workpieces are usually held in the hand for polishing, allowing the pressure on the mop or wheel to be released quickly. This risk is small.
User injury	If guards are positioned to enclose those moving or rotating parts that are not being used then the risk is reduced but in some applications this is difficult. This risk must be re-assessed for each application.
Entanglement	Entanglement is likely to occur if rotating spindle ends are exposed.

Control measures

Instruction and practice should be sufficient to control the small risk from flying workpieces.
Eye protection should always be worn. Guards should be used to reduce the risk of injury when the assessment shows them to be practicable.
The whole of the exposed spindle on both sides of the polishing mop should always be guarded, eg, by the use of adjustable telescopic guards. Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.

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Storage	Liquid ‘Perspex polish’ should be stored in dry conditions at moderate temperatures and in containers kept tightly closed.

IMMEDIATE REMEDIAL MEASURES

A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Vapour from polish inhaled	Move casualty to fresh air to rest; give nothing by mouth. Seek medical attention.
Vapour from polish inhaled	Move casualty to fresh air to rest; give nothing by mouth. Seek medical attention.
Polish is in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Liquid polish comes into contact with skin	Wash with soap and water.
Liquid polish is spilt in workshop	Contain the spill with sand, earth or any suitable absorbent. Transfer to a container for disposal. Do not allow to enter drains.
Liquid polish is swallowed	DO NOT INDUCE VOMITING. Seek medical attention.

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1.060 COSHH Regs	Plastics: Polishing Dusts	Applicable to: acrylics	See also: 1.059

Process(es) covered: Production of a high-quality surface finish using polishing compounds and a power-driven mop. Final finishing by hand using liquid polish and cloth.

Hazards	
Harmful	Vapour from liquid 'Perspex polish' is harmful.
Irritant	Liquid 'Perspex polish' is irritant to skin and eyes.
Dust	The dust produced by mechanical polishing is hazardous by inhalation.

Risk Assessment	
Harmful	High concentrations of vapour may cause drowsiness and giddiness. The ventilation required depends on the size of the room and the amount of polish used in one session.
Irritant	The eyes must be protected from splashes. Prolonged contact with skin may cause dermatitis but, in a school workshop, one person will not be polishing for more than 30 minutes.
Dust	Hazardous by inhalation. However, dust concentrations will not exceed the 10 mg/m^3 action limit[54] during normal educational activities.

Control measures	
	Natural ventilation will be sufficient with the amount of polishing done in schools. Goggles or a face shield must be worn to protect eyes in mechanical operations. Hands should be washed thoroughly after using any polishing liquid or compound. The use of a cleansing cream is advised. A nuisance dust mask should be worn in cases of prolonged use or if excessive amount of dust or lint are being shed from a mop.

[54] EH 40/2005.

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Disposal	Large quantities of unwanted polishes should be disposed of through an authorised waste disposal contractor.
Storage	Liquid 'Perspex polish' should be stored in dry conditions at moderate temperatures and in containers kept tightly closed.

FURTHER INFORMATION

Gloves **must not** be worn when polishing is done because of the risk of entanglement with the spinning polishing wheels or mops. Similarly the work should not be held in a cloth or an overall. If the work becomes too hot it can deform and may be too hot to hold, it should be cooled under cold running water.
Modern polishing machines are normally fitted with local exhaust ventilation that will reduce the problems from dust.

IMMEDIATE REMEDIAL MEASURES

Vapour from polish inhaled	Move casualty to fresh air to rest; give nothing by mouth. Seek medical attention.
Polish is in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Liquid polish comes into contact with skin	Wash with soap and water.
Liquid polish is spilt in workshop	Contain the spill with sand, earth or any suitable absorbent. Transfer to a container for disposal. Do not allow to enter drains.
Liquid polish is swallowed	DO NOT INDUCE VOMITING. Seek medical attention.

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1.061 Man Regs	PLASTICS: Sheet Benders	Applicable to: hot-wire strip heaters; sheet heaters	See also: 1.055

Process(es) covered:

Thermoplastic sheet is heated along a straight line so that it can be folded through a controlled angle.
The heat may be supplied by a silica-insulated mains element, one or more bare wires or by ceramic-insulated elements.
Line bending heaters with heated tensioned resistance wire have the wire supplied with a current through a separated extra-low voltage (SELV) source.

Hazards

Electric shock

Many plastics benders use a bare-wire heating element.

Burns

The element is hot enough to cause burns and the plastic sheets become hot enough to burn skin.

Risk Assessment

Electric shock

The bare-wire types use safety extra-low voltage and the mains-powered heaters are insulated so the risk is trivial.

Burns

The risk of burn from the element is so obvious that it is rare. Serious burns could result from the hot material.

Control measures

Normal maintenance is sufficient to control the risk of electric shock.

Some pupils will need warnings not to touch the hot element. Heat-proof gloves should be available for handling hot plastic forms.
Long hair and loose clothing should be tied back to avoid entering the heated area if the pupil leans over.
Do not leave work unattended on the heater.

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FURTHER INFORMATION

The process does not require the material to be heated to its melting point, only to the softening range. Consequently, there is little risk of hazardous fumes being generated. However work should not be left unattended as it is possible to overheat the plastic.

It should be noted that some makes of line benders that use a tensioned resistance wire as the source of heat have a clamping bar that has to be lifted to slide the plastics sheet underneath. There is a risk of burns when this is done. Pupils need to be warned of this hazard. If the clamping function is not required then two small pieces of wood can be used to prop the clamping bar permanently in the raised position.

IMMEDIATE REMEDIAL MEASURES

Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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1.062 Man Regs	PLASTICS: Vacuum- and Pressure-forming Equipment	Applicable to: combined machines; dome-blowing units; vacuum former	See also: 1.055

Process(es) covered:

In both processes, a thermoplastic sheet is clamped around its edges and heated. In vacuum forming, the air between the mould and the work is evacuated. The mould is then elevated into the sheet. Atmospheric pressure on the material then presses it onto the mould.
In pressure forming, air pressure is applied to the underside of the hot sheet forming it into part of a sphere.
Some plastics must be pre-heated to dry them.

Hazards

User injury

The pressure or vacuum systems might fail explosively, causing injury.

Burns

Hot plastic sheets can adhere to skin and cause dangerous burns.

Risk Assessment

User injury

The maximum pressure is typically 4 bar and the vacuum 0.8 bar below atmospheric pressure. Machines used in education do not usually incorporate a vacuum or pressure reservoir so the risks are minimal.

Burns

Serious burns could result from the hot material when moving it from the oven to the pressure-forming plate but there is no need to handle it when vacuum forming.
Drying uses low temperatures for several hours and presents little risk.
Overheating the thermoplastic sheet (to a temperature where de-composition takes place) produces fumes that are harmful or irritant (see *Plastics: Hazards of materials*, sheet 1.055). Provided the temperature is raised only to the point when the plastic softens visibly, there is little risk.

Control measures

Simple maintenance checks are sufficient to deal with the pressure system risks.

Heat-resistant gauntlet gloves must be used when moving hot plastic sheets.
Care should be taken to select the heating rate and/or timer setting to be appropriate for the plastic in use, following the manufacturer's instructions.

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Storage	All plastics should be stored in cool, dry conditions. The main store should preferably be outside and built of brick, away from heat sources, open flames and other sources of ignition.

FURTHER INFORMATION

Instructions and warnings concerning specific hazards associated with particular materials issued by manufacturers should be scrupulously followed.
The heater unit should be protected to reduce the risk of contact with the operator.
In multi-function machines, care must be taken to see that the user cannot be harmed by one section while using another. For example, parts that have become hot in one operation are normally guarded automatically when a different function is in use. It is important that checks are made to see that such guards are operating correctly.

IMMEDIATE REMEDIAL MEASURES

Vapour is inhaled	Remove casualty to the fresh air and seek medical advice.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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1.063 Man Regs	pneumatics equipment and compressed air	Applicable to: use of compressed air to drive portable power tools and experiments with pneumatics	See also: 1.065

Process(es) covered: The use of compressed air to drive portable power tools.
The use of compressed air and related equipment to teach the use of pneumatics.

Hazards

Trapping	Fingers can become trapped between moving and fixed parts of pneumatics equipment, both on fixed equipment and on experimental circuits.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with moving parts that are not fully enclosed.
Tripping	Trailing air hoses present a tripping hazard and may become damaged.
User injury	Air which is forced into the bloodstream or body orifices can be life threatening. Air hoses can thrash about under pressure. Incorrect air pressure can be a hazard.
Corrosion	Compressed air receivers can corrode due to condensation in the receiver, leading to explosion.

Risk Assessment

Trapping	Inadequate guarding, or a lack of guards as will occur in experimental circuits, increases the risk of trapping.
Entanglement	Entanglement could occur if the user is too close to moving parts.
Tripping	Trailing hoses present a real risk from tripping and damage in crowded workshops.
User injury	The risk of air entering the bloodstream or body orifices is low provided appropriate instruction is given and proper supervision is available. When setting up experimental systems, inexperienced users may not connect air lines correctly.
Corrosion	Receivers that are used infrequently may be allowed to stand for some time with condensation present. Corrosion may then be excessive.

Control measures

Fixed equipment should be properly guarded. It is not possible to guard experimental circuits and users should be warned of the dangers of trapping. Some pneumatic teaching systems use components made of plastics and work on much lower air pressures. The use of these systems greatly reduces injury as a result of trapping.

Users should be warned of the dangers of entanglement. Long hair should be tied back and loose clothing secured.
Tools and experimental systems should be used at the correct pressure.

A regulator and pressure gauge should be fitted between the air supply and any equipment connected to it. Flexible air hoses should be kept to a minimum, and should be able to withstand the safe working pressure. Hose fittings on portable power tools should automatically cut off the air supply when disconnected.
When constructing experimental systems, users should be instructed to check all connections. In some circumstances the teacher may also need to check before air is turned on. Air receivers should conform to BS 5169 and should be subject to regular internal examination. There should be a system for draining any condensate from the receiver.
The receiver must be drained of moisture after use to minimise corrosion.

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FURTHER INFORMATION

Compressed air equipment should not be used to remove dust and swarf from machines or other equipment. If a large compressor is used to operate an air brush then a suitable regulator must be fitted to ensure that air at the correct pressure is supplied to it. The normal operating pressure for larger pneumatics teaching equipment should be between 2 and 3 bar. Pneumatics teaching systems are available which operate at lower pressures and are preferable.
If large compressed air systems are in operation (in which the pressure multiplied by the internal volume of the air receiver exceeds 250 bar litre), the requirements of the *Pressure Systems Safety Regulations* 2000 must be observed. Employers must make arrangement for the regular examination of such equipment by a competent person. Guidance is available in *Safety of Pressure Systems* (Approved Code of Practice to the *Pressure Systems Safety Regulations* 2000), ISBN 071761767X, from HSE Books.

IMMEDIATE REMEDIAL MEASURES

Dust is in the eye	Irrigate immediately with water for several minutes, telling the casualty to hold eyelids apart.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.

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1.064 COSHH Regs	Surface finishes: Acid Treatments (Pickling & Sample etching)	Applicable to: corrosion study; microscopic examination; scale removal	See also:

Process(es) covered:

The corrosion resistance of iron and steel can be improved by treatment with sulfuric and phosphoric acids. The Footner process uses immersion in 5% (about 0.5 M) sulfuric acid at 60 °C for 15 minutes, two rinses in hot water and then five minutes in 2% (about 0.2 M) phosphoric acid.
When beating copper or gilding metal, it is heated to anneal it from time to time. The copper oxide can be removed by immersing the copper in 0.5 M sulfuric acid for a few minutes.
If specimens are being prepared for examination under a metallurgical microscope, the polished surface is often etched with particular solutions to reveal the crystal structure.
SEE OVERLEAF FOR DETAILS OF SOLUTIONS.

Hazards

Toxic	Some etchants contain toxic constituents but at the concentrations used this is not a problem.
Harmful	The solution used for etching lead is harmful.
Corrosive	Sodium hydroxide solution for etching aluminium and Fry's reagent for etching iron are corrosive. The undiluted acids are corrosive.
Irritant	Most of these solutions are irritant to the eyes, skin and respiratory system.
Highly flammable	Nital solution (which contains ethanol) for etching iron is a highly flammable liquid.

Risk Assessment

Toxic & Harmful	The diluted acids used for pickling and cleaning copper present minimal risks to the user so long as the metal is first cooled in water.
Corrosive	When preparing solutions of acids or the sodium hydroxide, there is a risk of injury from splashes or droplets.
Irritant	Splashes to the eye will cause discomfort and possible damage.
Highly flammable	There is a serious risk of fire when handling ethanol.

Control measures

When staff are diluting the acids they must wear eye protection and add the acid slowly to the water. The sulfuric acid will need cooling between additions.
When staff are preparing, and students are using, the etching solutions, they MUST wear eye protection.
When adding nitric acid to ethanol, there should be no naked flames in the room.

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Disposal	Small quantities of these solutions can be diluted in a large volume of water and flushed into the foul-water drain. Large quantities (more than 500 ml) require an authorised waste disposal contractor.
Storage	If Nital has to be used then it should be prepared on each occasion that it is needed and **NOT** stored.

FURTHER INFORMATION

Details of etching solutions

Aluminium etching	Use 2 M sodium hydroxide solution (R35) at 60 to 70 °C (ie, 20 g solid sodium hydroxide in 250 ml water). Sodium hydroxide spray has a WEL of 2 mg/m^3, 15 min ref period. Label the solution **corrosive**.
Copper etching	Dissolve 20 g hydrated iron(III) chloride (ferric chloride) (R22, 38, 41) WEL 2 mg/m^3, 15 min ref period, in 80 ml water and add 20 ml concentrated hydrochloric acid (R34, 37) WEL 8 mg/m^3, 15 min ref period. Label the solution **irritant**.
Iron or steel etching (Fry's Reagent)	Dissolve 59 g hydrated copper(II) chloride (R22, 50/53) in 40 ml water and add 60 ml concentrated hydrochloric acid (R34, 37) WEL 8 mg/m^3, 15 min ref period. Label the solution **corrosive**.
Iron or steel etching (Nital solution)	Add **no more than** 2 ml concentrated nitric acid (R8, 35) WEL 4 ppm 15 min ref period, **slowly** to 98 ml ethanol (industrial denatured alcohol) (R11) WEL 1000 ppm 8 h TWA. Label the solution **highly flammable** but **do not store**.
Lead etching	Just before use, mix together equal volumes of 5 M nitric acid (R8, 35) WEL 4 ppm 15 min ref period and 15% ammonium molybdate solution (R20/21/22) WEL 10 mg/m^3, 15 min ref period (ie, 1.5 g in 10 ml water). Wearing gloves, apply with a swab for 30 s and rinse. Label the solution **corrosive** and **harmful**.
Cleaning cast silver	Oxide and flux residues can be removed with 2 M nitric acid (R8, 35) WEL 4 ppm 15 min ref period. Label the solution **corrosive**.

IMMEDIATE REMEDIAL MEASURES

Swallowed	DO NOT INDUCE VOMITING. Keep casualty at rest and obtain medical attention.
Fumes are inhaled	Remove casualty to fresh air. Keep warm and at rest. If breathing is irregular or has stopped, administer artificial resuscitation. Obtain medical attention.
Sodium hydroxide is in the eyes	Irrigate immediately with water, holding eyelids apart. Send for an ambulance and continue irrigation all the way to hospital and until attention is received.
Acid is in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. If discomfort continues, obtain medical attention.
Solutions splash onto skin	Remove contaminated clothing. Wash skin thoroughly with soap and water or use a proprietary skin cleanser.
Spilt in the workshop	If Nital is spilt, remove sources of ignition. Ventilate area. Contain and collect the spill with non-flammable absorbent material, eg, sand or earth. Store safely pending disposal. Do not allow to enter drains.

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1.065 COSHH Regs	Surface Finishes: air brushes and paint sprays	Applicable to: spraying of paint, inks & similar liquids, using an air brush	See also: 1.063 1.068 1.069 1.070

Process(es) covered:

The application of paints to 3D graphics models.
The application of paint, inks and similar liquids to graphic art work.
The air source for an air brush can be one of the following:

- a can of air-brush propellant similar to a standard aerosol can;
- a car tyre;
- a reciprocating air compressor fitted directly to the air-brush hose;
- an air compressor with air receiver and suitable regulator.

This last method may be through a fixed compressed air line.

Hazards

Harmful	Vapours from oil-based, spirit-based and other solvent-based liquids are harmful by inhalation. The pigments in some water-based liquids may be toxic.
Irritant	Solvent-based liquids and/or aerosols (mists) are irritant to the eyes, skin or respiratory system.
User injury	Air which is forced into the bloodstream or body orifices can be life threatening. Air hoses can thrash about under pressure. Incorrect air pressure can be a hazard.
Highly flammable	Oil-based, spirit-based and other solvent-based liquids are highly flammable.
Aerosol (mist)	Extensive use of an airbrush can result in an excessive mist in the surrounding area.

Risk Assessment

Harmful	The WEL for the liquid may be exceeded during prolonged spraying.
Irritant	Splashes to the eye will cause discomfort and possible damage. Prolonged contact may have a defatting (drying) effect that may lead to skin irritation and dermatitis.
User injury	The risk of air entering the bloodstream or body orifices is low provided appropriate instruction is given and proper supervision is available. Any hose containing air at high pressure presents a significant risk if punctured or handled carelessly. Provided that the air pressure is set correctly, the risk of injury from air hoses is low.

Highly flammable	There is a serious risk of fire if any source of ignition is present when liquids that contain flammable solvents are being sprayed.
Aerosol (mist)	There is a risk of the mist from spraying entering the respiratory system.

Control measures

The exact content of the liquid being sprayed should be checked and steps taken to ensure that the WEL is not exceeded. This is particularly important with students engaged in examination work who may spend considerable periods of time using an air brush. A suitable extraction system designed for air-brush work should be used when spraying oil-based, spirit-based and other solvent-based liquids. Some of these systems make use of a filter to absorb fumes and overspray. Such systems may not be suitable for large volume work that may require the use of fan-assisted extraction. The manufacturers' specifications should be checked. Water-based liquids are preferable to oil-, spirit- and other solvent-based liquids.

It may be necessary to use a suitable face mask in addition to any extraction system. Eye protection may be necessary. Thin protective gloves (preferably nitrile, to avoid the risk of latex allergy) may be used to prevent the hands being covered with the liquid being sprayed. The work should be mounted in a suitable holding device.

Refer to sheet 1.063 for information about the use of air lines and air compressors.

All naked flames and other sources of ignition should be removed before spraying oil-based, spirit-based and other solvent-based liquids.

A suitable extraction system will reduce some of the problems caused by excessive mist. Beware of vapour that may remain in the air after spraying is finished.

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Disposal	The disposal of aerosol propellant cans should be as for aerosol paint cans. See sheet 1.068 for details.
Storage	Oil-, spirit- and cellulose-based spraying liquids should be stored in a cool, dry, well-ventilated place and away from sources of ignition. Storage should be in accordance with the requirements of the *Storage of Dangerous Substances, Approved Code of Practice and Guidance,* HSE 2003. Guidance from the HSE allows up to a total of 50 litres to be held in small containers in a fire-resisting, 'highly-flammable liquids cupboard or bin'.

FURTHER INFORMATION

See also sheet 1.068 *Surface Finishes: Solvent-based Paints (Aerosols)*. The hazards from larger-scale or more prolonged work are emphasised on this sheet. The normal working pressure for an air brush should be 2 bar. If aerosol-propellant cans are used as a source of air, two cans are required, since the can will freeze when in use. Changing to a second can will allow spraying to continue. A can that is frozen should be allowed to warm up naturally to room temperature and should not be heated. If a car tyre is used as a source of air, care should be taken not to inflate the tyre beyond its designed working pressure. Because of the need to reinflate the tyre constantly, this source of air may not be practicable. Reciprocating air compressors can normally be connected directly to an air brush although a moisture trap is useful. If this type of compressor is used, an air-bleed hole of 0.5 mm diameter should be provided in the air outlet fitting. Compressors that include an air receiver need to be fitted with a pressure switch that will turn off the motor once the working pressure has been reached. A pressure gauge is needed when using an air receiver and when using air from a fixed air line. Care should be taken to ensure that any adapters used to give the correct size of fitting for the air-brush hose are secure and fully tightened. PTFE tape may be needed to ensure an airtight seal. A braided air hose should be used on all air sources except aerosol cans for which a plastic hose may be used.

IMMEDIATE REMEDIAL MEASURES

Spraying liquids are swallowed	DO NOT INDUCE VOMITING. Keep casualty at rest and obtain medical attention.
Vapour is inhaled	Remove casualty to fresh air. Keep warm and at rest. If breathing is irregular or has stopped, administer artificial resuscitation. Obtain medical attention.
Liquids are sprayed into eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. If discomfort continues, obtain medical attention.
On the skin	Remove contaminated clothing. Wash skin thoroughly with soap and water or use a proprietary skin cleanser. Do not use solvents.

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1.066 Man Regs	Surface finishes: Enamelling Kilns	Applicable to: jewellery enamels on copper, gilding metal, silver and gold	See also: 1.067

Process(es) covered: Finely-ground borosilicate glass (coloured by trace metallic compounds) which melts at 800 to 820 °C is fused to the surface of certain metals. Kilns may be either electric or gas fired but some work is done with a blowpipe (torch).

Hazards

Toxic	Gas-fired kilns will produce carbon dioxide, WEL 5000 ppm (8 h TWA) and 15000 ppm (15 min ref period), with traces of nitrogen oxides (R26) (WEL too low to quote) and carbon monoxide (R12, 23, 48/23, 61), WEL of 200 ppm (15 min ref period)[55] present as combustion products.
Electric shock	Electrically-heated kilns sometimes have exposed elements which can be touched when the door is open.
Burns	The enamelled product may be extremely hot when removed from the source of heat. The kiln and surrounding surfaces can be hot enough to burn.

Risk Assessment

Toxic	The combustion products from gas-fired kilns and torches present a risk if they are allowed to accumulate.
Electric shock	There is a serious risk to users of indirect electrical contact through metal tools if the element is exposed and 'live'.
Burns	Handling hot metals (particularly when at 'black heat' which may not appear hot) presents a real risk of burns. Touching the kiln or surrounding surfaces presents a real risk of burns.

Control measures

If gas-fired kilns are used in D&T, provision should be made to extract the fumes through a flue.
Small torches, especially the needle-flame type, require no special precautions.
Electric kilns with exposed elements must have an interlock that interrupts the power when the door is opened.
Hot materials should be handled with tongs or other suitable tools.
When in use the kiln should be clearly marked as hot and surrounding surfaces marked to make staff and pupils aware that touching the surfaces could burn.

[55] EH 40/2005.

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FURTHER INFORMATION

Overheating and bending should be avoided as the glazed surface may shatter. Any type of kiln should be included in the planned annual maintenance programme 7.

IMMEDIATE REMEDIAL MEASURES

Fumes are inhaled	In the event of dizziness occasioned by fume, remove the affected person to the fresh air until recovered.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Do not cover the burn.

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1.067 COSHH Regs	Surface finishes: Enamelling materials	Applicable to: jewellery enamels on copper, gilding metal, silver and gold	See also: 1.066

Process(es) covered: Finely-ground borosilicate glass (coloured by trace metallic compounds) which melts at 800 to 820 °C is fused to the surface of certain metals.

Hazards

Toxic	The enamels are hazardous by swallowing.
Dust	Dust from the enamels is hazardous by inhalation.
Irritant	Enamels are irritant to the eyes. Prolonged contact with skin may cause irritation and inflammation.

Risk Assessment

Toxic	Enamels need not contain lead. However, they will contain small quantities of insoluble compounds of chromium(III), cobalt(II), copper(II), nickel(II), antimony(V), cadmium(II) or manganese(II). These present minimal risk when handled carefully in the small quantities required.
Dust	Although cadmium pigments have a WEL of 0.025 mg/m^3 (8 h TWA)[56] and certain chromium compounds have a limit of 0.05 mg/m^3 (8 h TWA), these compounds are present as minor constituents of the enamelling glass and these limits will not be approached in a school workshop. The other trace compounds have higher WEL values and these limits too will not be approached in work on the scale of this activity.
Irritant	Eye protection and hand washing after use will prevent irritation.

Control measures

Ensure chosen enamels are lead-free.

Do not eat, drink, smoke or apply cosmetics in areas where the material is being used.

Wash hands thoroughly after handling.

Wear eye protection when heating enamelled surfaces by blowpipe (torch).

[56] EH 40/2005.

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Disposal	Do not attempt to discard waste enamel by washing into the drainage system. Dispose of spills or unwanted materials in a sealed plastic bag in the ordinary waste.
Storage	Enamels should be stored in sealed, clearly-marked containers which should be in a dry, ventilated area.

FURTHER INFORMATION

Overheating should be avoided as the glazed surface may shatter.

IMMEDIATE REMEDIAL MEASURES

Enamels are swallowed	Give plenty of water and seek medical advice.
Enamels are spilt in the workshop	Use industrial vacuum equipment where practicable. Moisten prior to sweeping. Do not attempt to sweep a spill in a dry state from a bench.
Enamels are blown into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Enamels are in contact with the skin	Wash with soap and water.

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1.068 COSHH Regs	Surface finishes: Solvent-based paints (Aerosol)	Applicable to: acrylic paints rust proofing fluorescent paints	See also: 1.065 1.069 1.070

Process(es) covered:

Many different paints are available in cans to be applied as aerosols. These finishes are very convenient for objects small enough to be placed in a large cardboard box (on its side) to contain the over-spray.
Zinc-rich primers often contain toluene in the solvent mixture, others contain up to 35% of xylene. Possible other constituents include MEK, acetone, alcohols and less-hazardous components. The propellant is usually butane.

Hazards

Harmful

Toluene (methyl benzene) (Sk, R11, 38,48/20, 63, 65, 67) and xylene (dimethyl benzene) (Sk, R10, 20/21, 38) vapours are harmful by inhalation, causing headaches, dizziness and nausea.

Irritant

Xylene and acetone (propanone) (R11, 36, 66, 67) are irritating to the eyes, skin and respiratory system.
Methyl ethyl ketone (MEK or butanone) (Sk, R11, 36, 66, 67) is irritating to the eyes and respiratory system.

Highly flammable

All types use extremely flammable solvents and propellants.

Risk Assessment

Harmful

The WEL for toluene vapour is 50 ppm (8 h TWA) and 150 ppm (15 min ref period)[57]. These values can easily be exceeded if sanding sealer is used extensively or if jars of thinner are used to hold brushes between use.
The WEL for xylene vapour is 50 ppm (8 h TWA) and 100 ppm (15 min ref period). These values could be exceeded if Hammerite paint is used extensively or if jars of thinner are used to hold brushes between use.

Irritant

Splashes to the eye will cause discomfort and possible damage. Prolonged contact with the skin may have a defatting effect that may lead to skin irritation and dermatitis.

Highly flammable

There is a serious risk of fire if any source of ignition is present close to where sanding sealer is being used or handled.

Control measures

The use of zinc-rich primer should be avoided unless local exhaust ventilation is available or it is practicable to work in the open air.
Other paints can be used on a small scale in areas with good general ventilation.
Eye protection must be worn and skin contact avoided.

All naked flames and other sources of ignition must be removed before using aerosol finishes.

57 EH 40/2005.

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Disposal	An authorised waste disposal contractor should be used. Waste materials must be treated as a fire hazard and disposed of in accordance with the *Hazardous Waste Regulations* and subsequent amendments.
Storage	Normally in a steel cupboard specifically designed for the storage of highly flammable materials. Away from sources of ignition. In accordance with the requirements of the *Dangerous Substances and Explosive Atmospheres Regulations 2002*. Guidance from the HSE allows up to a total of 50 litres to be held in small containers in a fire-resisting 'highly-flammable liquids cupboard or bin'.

FURTHER INFORMATION

Although these finishes dry quickly to give attractive surfaces (shiny or matt), their use is an expensive way to provide a range of colours or for coating a large area.

IMMEDIATE REMEDIAL MEASURES

Paints are swallowed	DO NOT INDUCE VOMITING. Keep casualty at rest and obtain medical attention.
Vapour is inhaled	Remove casualty to fresh air. Keep warm and at rest. If breathing is irregular or has stopped, administer artificial resuscitation. Obtain medical attention.
Sprayed into eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. If discomfort continues, obtain medical attention.
On the skin	Remove contaminated clothing. Wash skin thoroughly with soap and water or use a proprietary skin cleanser. Do not use solvents.

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1.069 COSHH Regs	Surface finishes: Solvent-based paints (Liquid)	Applicable to: Hammerite; Sanding Sealer; Brushing cellulose	See also: 1.065 1.068 1.070

Process(es) covered:

Sanding Sealer is a popular wood finish that dries quickly to give a shiny and attractive surface. The main constituent of the recommended thinner is toluene.
Hammerite paints (and other 'hammer finish' or 'wrinkle' paints), often used on metals, contain ground glass in resin with xylene as a major constituent of the solvent.
Brushing cellulose also uses a solvent based on xylene.

Hazards

Harmful

Toluene (methyl benzene) (Sk, R11, 38,48/20, 63, 65, 67) and xylene (dimethyl benzene) (Sk, R10, 20/21, 38) vapours are harmful by inhalation, causing headaches, dizziness and nausea.

Irritant

Xylene is irritating to the eyes, skin and respiratory system.

Highly flammable

Sanding sealer and the thinner are highly flammable.

Risk Assessment

Harmful

The WEL for toluene vapour is 50 ppm (8 h TWA) and 150 ppm (15 min ref period)[58]. These values can easily be exceeded if sanding sealer is used extensively or if jars of thinner are used to hold brushes between use.
The WEL for xylene vapour is 50 ppm (8 h TWA) and 100 ppm (15 min ref period). These values could be exceeded if Hammerite paint is used extensively or if jars of thinner are used to hold brushes between use.

Irritant

Splashes to the eye will cause discomfort and possible damage. Prolonged contact with the skin may have a defatting effect that may lead to skin irritation and dermatitis.

Highly flammable

There is a serious risk of fire if any source of ignition is present close to where sanding sealer is being used or handled.

Control measures

The use of sanding sealer should be avoided unless local exhaust ventilation is available or it is practicable to work in the open air.
Hammerite paints and brushing cellulose can be used on a small scale in areas with good general ventilation.
Eye protection (spectacles) must be worn and skin contact avoided.

All naked flames and other sources of ignition must be removed before pouring toluene thinner or toluene-based finishes.

58 EH 40/2005.

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Disposal	An authorised waste disposal contractor should be used. Waste materials must be treated as a fire hazard and disposed of in accordance with the *Hazardous Waste Regulations* and subsequent amendments.
Storage	Normally in a steel cupboard specifically designed for the storage of highly flammable materials. Away from sources of ignition. In accordance with the requirements of the *Dangerous Substances and Explosive Atmospheres Regulations 2002*. Guidance from the HSE allows up to a total of 50 litres to be held in small containers in a fire-resisting 'highly-flammable liquids cupboard or bin'.

FURTHER INFORMATION

NB Benzene is very toxic and a category 1 carcinogen. It must **not** be used in schools and any old stocks, formerly used as a cleaning solvent, must be disposed of responsibly.

Only specialist paints now contain lead but it is just possible that old stock, containing lead, is still liquid! Such stocks should be disposed of and certainly not used.

Water-based wood dyes applied by rag, brush or dipping present minimal hazards. If they are sprayed, precautions should be taken to minimise breathing in the spray.

IMMEDIATE REMEDIAL MEASURES

Paints are swallowed	DO NOT INDUCE VOMITING. Keep casualty at rest and obtain medical attention.
Vapour from paints is inhaled	Remove casualty to fresh air. Keep warm and at rest. If breathing is irregular or has stopped, administer artificial resuscitation. Obtain medical attention.
Paint is splashed into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. If discomfort continues, obtain medical attention.
On the skin	Remove contaminated clothing. Wash skin thoroughly with soap and water or use a proprietary skin cleanser. Do not use solvents.
Spilt in the workshop	Remove sources of ignition. Ventilate area. Contain and collect the spill with non-flammable absorbent material, eg, sand or earth. Store safely pending disposal. Do not allow to enter drains.

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1.070 COSHH Regs	Surface finishes: VARNISHES and Wood polishes	Applicable to: Button polish; French polish; polyurethane; cellulose	See also: 1.065 1.068 1.069

Process(es) covered: Traditional polishes are formulated for multiple thin-coat application to wood to give, with suitable manual polishing, a high-quality finish. They are not intended for exterior use. Polyurethane varnish gives a tough and resistant finish in indoor and outdoor applications. (Some twin-pack polyurethane finishes are not considered suitable for school use: see overleaf.)

Hazards

Toxic Fumes and liquid varnishes contain toxic components.

Irritant Fumes and liquid varnishes can irritate the eyes, skin and respiratory system.

Highly flammable The polishes are highly flammable liquids.

Risk Assessment

Toxic The polishes contain mixed alcohols, including ethanol (R11) and methanol (Sk, R11, 23/24/25, 39/23/24/25). Excessive concentrations of vapour may produce effects on the central nervous system including drowsiness. In extreme cases, loss of consciousness may result.
The WEL for ethyl alcohol (ethanol) is 1000 ppm (8 h TWA)[59].
The WEL for methyl alcohol (methanol) is 250 ppm (15 min ref period) and is toxic by inhalation, swallowing and via the skin.
Polyurethane varnish contains white spirit, which has a derived WEL of typically 550 mg/m^3 (8 h TWA)[60] or about 300 ppm (15 min ref period). In normal school workshop operations, these limits will not be reached. However, cellulose-based finishes use toluene as the main solvent. The WEL is 100 ppm (15 min ref period) and this could be reached.

Irritant Splashes to the eye will cause discomfort and possible damage. Prolonged contact with the skin may have a defatting effect that may lead to skin irritation and dermatitis.

Highly flammable If wood polishes are used with open containers, there is a risk of fire.

Control measures

Natural ventilation is sufficient to control the toxic hazards in the use of polishes and simple polyurethane varnish.
Cellulose-based finishes, including sanding sealer and final coats applied as aerosols, should be avoided unless local exhaust ventilation is available.
Eye protection must be worn and skin contact avoided.
All sources of ignition must be removed when using these varnishes.

59 EH 40/2005.

60 White spirit is a mixture of varying composition and the limit value has to be calculated according to the proportions of hazardous components present.

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Disposal	An authorised waste disposal contractor should be used. Waste materials must be treated as a fire hazard and disposed of in accordance with the *Hazardous Waste Regulations* and subsequent amendments.
Storage	Normally in a steel cupboard specifically designed for the storage of highly flammable materials. Away from sources of ignition. In accordance with the requirements of the *Dangerous Substances and Explosive Atmospheres Regulations 2002*. Guidance from the HSE allows up to a total of 50 litres to be held in small containers in a fire-resisting 'highly-flammable liquids cupboard or bin'.

FURTHER INFORMATION

Some twin-pack polyurethane finishes contain isocyanates (Sen, under review) which are toxic or harmful and irritant. They have a WEL of only 0.02 mg/m^3 (8 h TWA) or 0.07 mg/m^3 (15 min ref period)[61]. These values are so low that such preparations are **totally unsuitable** for use in schools by students or staff.

On the other hand, polyurethane varnishes that are based on white spirit are very suitable for use in schools. As shown above the fumes are not considered harmful unless the concentration is very high, the flammability is low and these should be the finish of choice in most cases.

Some traditional finishes such as linseed oil have been found to cause an allergic reaction in some users but this is not common.

IMMEDIATE REMEDIAL MEASURES

Paints are swallowed	DO NOT INDUCE VOMITING. Keep casualty at rest and obtain medical attention.
Vapour from paints is inhaled	Remove casualty to fresh air. Keep warm and at rest. If breathing is irregular or has stopped, administer artificial resuscitation. Obtain medical attention.
Paint is splashed into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. If discomfort continues obtain medical attention.
On the skin	Remove contaminated clothing. Wash skin thoroughly with soap and water or use a proprietary skin cleanser. Do not use solvents.
Spilt in the workshop	Remove sources of ignition. Ventilate area. Contain and collect the spill with non-flammable absorbent material, eg, sand or earth. Store safely pending disposal. Do not allow to enter drains.

[61] EH 40/2005.

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1.071 COSHH Regs	Wood working: Dust	Applicable to: blockboard; hard wood; MDF; particle boards; plywood; soft wood	See also: L225 1.074 to 1.086

Process(es) covered: Hand operations do not usually produce large quantities of dust but machine operations often do.
Operations such as checking dust control equipment and emptying dust bags are also covered.

Hazards

Dust — Wood process dust is hazardous by inhalation. (See over for further details.)

Flammable — Sawdust is flammable.

Risk Assessment

Dust — Hard-wood and soft-wood dusts have a WEL of 5 mg/m^3 (8 h TWA)[62]. Wood dust irritates eyes and the respiratory tract. Exposure to wood dusts above the quoted limits can give rise to skin and lung disorders. Individual wood-working machines without extraction equipment have produced levels of 5 to 10 times the WEL during periods of use. Because of this limit, employers have the duty to keep the dust level so far below the limit as reasonably practicable.
When considering individual employees' exposure to wood dust, the employer must take into account their exposure from all sources. For example, 30 minutes at the circular saw, 20 minutes at the planer, 10 $\times$ 2 minutes observing pupils at the sander and exposure to background levels throughout the day.
The risk of cancer is extremely low.
In general, extraction will be needed at machine saws of all types, sanding machines and any other type of wood working machine where fine dust is produced, including portable power tools.

Flammable — General dispersion of sawdust should be controlled.
The design of dust collection equipment should be such that it does not increase the risk of fire and explosion.

Control measures

So far as reasonably practicable, local exhaust ventilation **must be** provided to control the dust at its source.
Eye protection must be worn at all times when using machines.
If staff may be exposed to high dust levels while checking dust control equipment or emptying dust collection bags, a dust mask must be worn. If the task is likely to take more than 15 minutes or if the dust comes largely from MDF, the mask should be to FFP3. Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science.
Regular cleaning using a dustless method (eg, an industrial vacuum cleaner) is needed to reduce background dust levels and prevent fire.

62 EH 40/2005.

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Disposal	Dust should be collected in heavy-duty plastic sacks and disposed of via the normal refuse collection. If the dust has been contaminated, eg, with engine oil, disposal should be as for the contaminant.
Storage	Collected dust should not be stored, the sacks should be placed immediately in the refuse bins.

DETAILS OF DUST HAZARDS

The hazards of wood dust are discussed in the HSE Information Sheet WS 30: *Toxic Woods*. While hardwoods tend to give rise to more effects than softwoods, there is a large variation from one tree to another of the same species.
Any person, including a pupil, who suffers from any of the complaints below or suspects they may have been induced, should seek medical advice.

Examples of the attributes of certain woods fall into the following categories:

Strongly allergenic	Box, Mahogany, Iroko, Rosewood, Satinwood, Yew and Teak.
Biologically active	Larch, Pine, Cedar, Ebony, Sapele, African Mahogany and Poplar. Significant exposure could result in symptoms of rhinitis, asthma, dermatitis or eczema.
Allergenic	Chipboard, Blockboard and Plywood are manufactured using phenolic and amino resins and the resulting dust may cause allergic reactions in persons who have already been sensitised.
Carcinogenic	Hardwoods, particularly Oak and Beech, have been blamed for the very rare cancers observed in the furniture and cabinet-making industries. The much shorter exposure times in school workshops make the risks there extremely low.

Medium density fibreboard (MDF) uses a urea-formaldehyde resin as bonding agent and has been accused of producing hazardous fumes when worked. There is still **no evidence** that this is true but it **does** give rise to much fine dust which must be controlled. CLEAPSS document PS33, *Medium density fibreboard (MDF)*, gives up-to-date information. Note that hand sanding of MDF can produce large amounts of dust, which should be controlled.
Waterproof MDF (usually coloured green) presents the same hazards as ordinary MDF: it is treated to absorb less water and is so more suitable for use in kitchens and bathrooms.
Some people are allergic to the dust from any sort of timber and special measures may be needed.
Some employers prohibit the use of some or all tropical hardwood timber. Iroko dust has particular problems. D&T departments may be offered old iroko science bench worktops following refurbishment of laboratories.
The general advice from CLEAPSS is that iroko should not be used but if it is then no hand or machine sanding should be done by pupils and when being cut by machine the operator should wear a face mask to FFP3 (Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science) whilst cutting is in progress. Teachers should check with their employer for any such restrictions.

local exhaust ventilation

CLEAPSS guide L225, *Local Exhaust Ventilation in Design and Technology*, gives details on the regulations covering LEV, ways of providing it, appropriate tests and sources.

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1.072 Man Regs	Wood working: Hand Tools - Chisels and Gouges	Applicable to: all edge tools	See also:

Process(es) covered: Chisels and gouges are used for wood carving and hand cutting of mortises, dovetails, etc.

Hazards

Cuts	Incorrect use or careless handling of sharp tools can cause cuts.
Impact injury	The use of a hammer or mallet may give rise to an impact injury if used incorrectly. The work may also fly off the bench if it is not held securely.

Risk Assessment

Cuts	Serious cuts have resulted from the use of chisels and gouges, particularly when they are knocked off the bench and fall onto a foot or when excessive force is used on them.
Impact injury	Novices are quite likely to hit their fingers with a hammer or mallet while attempting to use a chisel or gouge but the resulting injury is usually trivial. Injuries from flying workpieces are also usually trivial.

Control measures

A really sharp tool is less likely to give rise to cuts because less force is needed to use it. All users must be instructed in carrying tools safely (with edges protected or pointed down) and in placing tools away from the edge of the bench between uses. All users must be trained to use tools correctly. Chisels with ferrules at the end of the handle must be checked to ensure that the ferrule is undamaged.
The use of hammers to strike chisel handles should be avoided in preference to the use of mallets.

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Storage	Hand tools should be stored at a height appropriate for safe collection by the students. The storage system should be such that it is easy to check that all tools have been returned. In some situations, it might be considered necessary to lock the cupboard(s) containing hand tools.

IMMEDIATE REMEDIAL MEASURES

Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Impact injury	Rest the injured part; apply ice to reduce the bruising and pain; attention from the trained first aider is required.

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1.073 Man Regs	Wood working: HAND TOOLS - SAWS	Applicable to: saws for wood	See also:

Process(es) covered: The use of hand saws, tenon saws, dovetail saws, coping saws and bow saws to cut wood.

Hazards

Cuts to user	Incorrect or careless use can cause cuts. Poor work holding can cause saws to slip and cause cuts.
Eye injury	Dust may enter the eyes if blown away from the saw cut.

Risk Assessment

Cuts to user	Although most cuts are trivial, serious cuts may occur if the work is not held correctly or if a saw slips from a saw cut.
Eye injury	When dust enters the eye, either if it is blown away from the saw cut or if eyes are rubbed and sawdust is on the fingers, it is usually fine and unlikely to give rise to a permanent injury.

Control measures

With all of the tools covered by this risk assessment, inexperienced users should be given appropriate instructions in their use. When using any type of saw, the work being cut should be held securely. Inexperienced users may lack the physical strength to do this and some form of clamping will be required. When using a large hand saw, the work should be held against a suitable flat surface with a G clamp or bench hold-fast. When using a tenon or dovetail saw, the work should be held on a bench hook (sawing board) or in a wood-working vice. Users who lack the physical strength to hold the wood on a bench hook should use a G clamp to assist in the task.

When sawing, hazards can occur when the work is too large to fit into a suitable vice. In such situations, the work should be held as securely as possible, perhaps with the aid of G clamps. Care should be taken to ensure that at no time is the saw cutting towards any part of the body of the operator, or any assistant who may be holding the work.

Pupils should be warned of the hazards of blowing dust. A portable dust collection system may be helpful for processes producing much dust.

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Storage	Hand tools should be stored at a height appropriate for safe collection by the students. The storage system should be such that it is easy to check that all tools have been returned. In some situations it might be considered necessary to lock the cupboard(s) containing hand tools.

FURTHER INFORMATION

Woodworking hand saws, tenon saws and dovetail saws should be kept sharp since less force is then needed to use the tool. These saws can be sharpened by an experienced teacher or technician but if no one in the establishment possesses the skills to do this then the saws should be sharpened by a suitable contractor.
Coping saw blades are usually set to cut on the return stroke so users should be reminded of this when using them.

IMMEDIATE REMEDIAL MEASURES

Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves then the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Impact injury	Rest the injured part; apply ice to reduce the bruising and pain; attention from a first aider may be required.
A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.

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1.074 Man Regs	Wood working: Portable POWER tools - BISCUIT CUTTERS	Applicable to: biscuit jointers; routers with biscuit cutter attachments	See also: 1.071

Process(es) covered: The construction of biscuit joints, often in manufactured board. A small circular cutter, similar to a small circular saw blade is used to create a curved recess that will accept the 'biscuit' that forms the joining piece.

Most portable power tools are electrically operated but pneumatic tools are used where compressed air is available. The use of tools with integral low-voltage battery packs is increasing.

Hazards

Flying material	Broken blades can be ejected violently. If machines are used with accessories or adapters then the accessory can become detached from the machine causing parts to fly off.
User injury	Human contact with rotating parts can cause cuts or abrasions. Wrist sprains can result from a jamming cutter.
Tripping	Power leads or air pipes present a tripping hazard and may be damaged, presenting electrical or compressed-air hazards.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Manual handling	Heavy workpieces and the gyroscopic effect of rotating motors can present a manual-handling hazard.
Dust	See sheet 1.071 for the dust hazards.

Risk Assessment

Flying material	Flying off-cuts are unlikely to occur.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts. When a blade jams, some users may not be able to restrain the tool.
Tripping	Trailing leads or pipes present a real risk of tripping and damage.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed. Single-purpose machines have better guarding than multi-purpose ones fitted with biscuit cutters.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk. Novices may have difficulty controlling the larger versions of this tool.
Dust	Considerable dust and fine shavings can be produced, especially when used on manufactured boards.

Control measures

It is impracticable to guard all the hazardous areas when using portable biscuit cutters. However, all guards supplied with the machine should be used.

Eye protection is needed.

Guards around rotating parts will reduce the risk of hand or finger injury but training and experience are essential in reducing risks. Immature pupils should not use portable power tools.

The route of power leads and pipes should be chosen to minimise tripping and damage. Battery-powered tools avoid this problem.

Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.

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	The risk of back injury is reduced if two persons handle heavy items. LEV equipment or a suitable face mask (FFP3) should be used to reduce the hazards from dusts.

Wood Working: Portable Tools - Biscuit Cutters (Continued)

RESTRICTIONS	Students may only use biscuit cutters when they have been assessed and the assessment has shown that they are competent. Students should be given appropriate supervision by specifically trained staff when using a biscuit cutter. However, of all the portable power tools, a small biscuit jointer could be considered as the most appropriate one for a student to use.
FURTHER INFORMATION	
	Precautions to be taken with compressed air lines are listed in the introduction to this part. For general requirements on electrical supplies including a discussion on the use of 110 V, see the introduction to this part. Portable tools should be examined before use and should have regular formal inspections and tests. The frequency depends on use but half-termly would be typical.
IMMEDIATE REMEDIAL MEASURES	
A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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1.075 Man Regs	Wood working: Portable POWER tools - Drills	Applicable to: mains powered portable drills; Battery powered portable drills	See also: 1.071

Process(es) covered: The drilling of holes in workpieces too large to bring to fixed machines.
Most portable power tools are electrically operated but pneumatic tools are used where compressed air is available. The use of tools with integral low-voltage battery packs is increasing

Hazards

Flying material	Off-cuts, chuck keys or broken bits can be ejected violently. If machines are used with accessories or adaptors, the accessory can become detached from the machine causing parts to fly off.
User injury	Human contact with rotating parts and swarf can cause cuts or abrasions. Wrist sprains can result from a jamming drill bit.
Tripping	Power leads or air pipes present a tripping hazard and may be damaged, presenting electrical or compressed-air hazards.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Manual handling	Heavy workpieces and the gyroscopic effect of rotating motors can present a manual-handling hazard.
Burns	Drill bits can become hot.

Risk Assessment

Flying material	Flying off-cuts are unlikely to occur but there is a high risk that inexperienced users will break drills or not assemble multi-function systems correctly.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts. When a bit jams, some users may not be able to restrain the tool.
Tripping	Trailing leads or pipes present a real risk of tripping and damage.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk. Novices may have difficulty controlling the tool.
Burns	Burns from machines and blades are usually superficial.

Control measures

It is impracticable to guard all the hazardous areas when using portable power tools.
Correct selection of the bit speed will reduce the risk of drill breakage.
Eye protection is needed.
Guards around rotating parts will reduce the risk of hand or finger injury but training and experience are essential in reducing risks. Higher powered battery powered drills can exert considerable torque.
The route of power leads and pipes should be chosen to minimise tripping and damage. Battery-powered tools avoid this problem.
Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.
The risk of back injury is reduced if two persons handle heavy items.
Gloves or pliers could be used to handle any items that might be hot.

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RESTRICTIONS	Immature pupils should not use portable power tools.

FURTHER INFORMATION

Precautions to be taken with compressed air lines are listed in the introduction to this part. Pneumatics teaching kits present minimal risks because the pressures used (typically 3 bar) are low but this would be a good opportunity to teach about the hazards of using high-pressure compressed air.
For general requirements on electrical supplies including a discussion on the use of 110 V, see the introduction to this part.
Portable tools should be examined before use and should have regular formal inspections and tests. The frequency depends on use but half-termly would be typical.

IMMEDIATE REMEDIAL MEASURES

A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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1.076 Man Regs	Wood working: Portable Power tools - PLANers	Applicable to: hand-held planers	See also: 1.071

Process(es) covered: The smoothing of sawn timber, or the reducing of planed timber to a required size, especially when the work piece is too large for a fixed machine, or where a fixed machine is not available.

Hazards	
Flying material	It is possible for broken blades to be ejected from the machines.
User injury	Human contact with moving parts can cause cuts or abrasions.
Tripping	Power leads or air pipes present a tripping hazard and may be damaged presenting electrical or compressed-air hazards.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Manual handling	Heavy workpieces and the gyroscopic effect of rotating motors can present a manual-handling hazard. 'Kick-back' can occur under some circumstances.
Dust	See sheet 1.071. Dust will present a hazard especially when cutting manufactured board.

Risk Assessment	
Flying material	Ejection of broken blades is rare, but is a real risk.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts.
Tripping	Trailing leads or pipes present a real risk of tripping and damage.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk. Novices may have difficulty controlling the tool.
Dust	Fine dust is produced by these machines, especially when cutting manufactured boards.

Control measures
It is impracticable to guard all the hazardous areas when using portable power tools. Blades should be fitted by a suitable qualified person and the condition of the blades checked before each use. Eye protection is needed. Guards around rotating parts will reduce the risk of hand or finger injury and should always be fitted but training and experience are essential in reducing risks. Immature pupils should not use portable power tools. The route of power leads and pipes should be chosen to minimise tripping and damage. Battery-powered tools avoid this problem. Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall. The risk of back injury is reduced if two persons handle heavy items. Local exhaust ventilation should be provided where practicable. If the dust control system is not adequate then an FFP3 (Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science) dust mask should be worn by the user.

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RESTRICTIONS	Students may only use portable planing machines when they have been assessed and the assessment shows that they are competent. During training, they may use the machines but must be adequately supervised. After training, adequate supervision must still be provided from a competent person. Portable planers **must not** be clamped upside down and used as a surface planer.
FURTHER INFORMATION	The blades of portable planning machines should be kept sharp and discarded when blunt. The condition of the blade should be checked before use. The machines should not be used if the operator could be distracted. Precautions to be taken with compressed air lines are listed in the introduction to this part. Portable tools should be examined before use and should have regular formal inspections and tests. The frequency depends on use but half-termly would be typical.

IMMEDIATE REMEDIAL MEASURES

A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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1.077 Man Regs	Wood working: Portable POWER tools - ROUTERS	Applicable to: Hand-held routers mounted in a propriety made router table; Portable hand-held routers	See also: 1.071

Process(es) covered: The creation of grooves, rebates and shaped edges of boards using a rotating cutter. Most portable power tools are electrically operated but pneumatic tools are used where compressed air is available. The use of tools with integral low-voltage battery packs is increasing.

Hazards

Flying material	Broken cutters can be ejected violently. If machines are used with accessories or adapters, the accessory can become detached from the machine causing parts to fly off.
User injury	Human contact with rotating parts can cause cuts or abrasions. Routers can jam or kick back especially if not controlled correctly at the start and end of a cut.
Tripping	Power leads or air pipes present a tripping hazard and may be damaged, presenting electrical or compressed-air hazards.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Manual handling	Heavy workpieces and the gyroscopic effect of rotating motors can present a manual-handling hazard.
Dust	See sheet 1.071.

Risk Assessment

Flying material	Broken cutters are unlikely to occur but there is a high risk that inexperienced users will not fit cutters correctly.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts. When a cutter jams or kicks back, some users may not be able to restrain the tool.
Tripping	Trailing leads or pipes present a real risk of tripping and damage.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk. Novices may have difficulty controlling the tool.
Dust	Cutting of some materials, especially manufactured boards such as MDF can create fine dust.

Control measures

It is impracticable to guard all the hazardous areas when using a portable router. Correct selection and fixing of the cutting tool will reduce the risk of drill breakage.
Eye protection is needed.

Guards around rotating parts will reduce the risk of hand or finger injury but training and experience are essential in reducing risks. Immature pupils should not use portable power tools. Appropriate supervision is needed.

The route of power leads and pipes should be chosen to minimise tripping and damage. Battery-powered tools avoid this problem.

Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.

The risk of back injury is reduced if two persons handle heavy items.

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	A specific risk assessment for the material used should be carried out. Purpose -made extraction tables are available and these are designed to collect dust when routing is carried out. These are to be preferred. Where such devices are not available a suitable dust mask grade FFP3 should be worn Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science. Some portable routers have a facility to attach a lightweight tube that is then connected to a suitable dust extraction unit or vacuum cleaner This is an appropriate method of controlling the dust. Any vacuum cleaner used for this purpose must be fitted with a HEPA filter to control the fine dust.

Wood Working, Portable Power Tools: Routers (Continued)

RESTRICTIONS	Hand-held routers may be turned over and mounted in a proper propriety-designed router table. The table should have a guard that covers the cutter and should be fitted with a no-volt and overload push button starter. In this case, the table should be connected to the workshop dust collection system or a suitable portable dust collection unit. **On no account** should home-made router tables be used. When mounted in a router table the machine is classed as a high risk woodworking machine and should only be used by a member of staff specifically trained in the use of the machine. Learners under the age of 18 may only use portable routers when they have been assessed as competent and are under appropriate supervision by specifically trained employees. When using a portable router, students must be directly supervised at all times by specifically trained D&T staff and should not use the machine unless they have the necessary maturity and competence. Students **must not** use a portable router that has been mounted in a router table. The cutter guard must always be used.
FURTHER INFORMATION	
	Precautions to be taken with compressed air lines are listed in the introduction to this part. For general requirements on electrical supplies including a discussion on the use of 110 V, see the introduction to this part. Portable tools should be examined before use and should have regular formal inspections and tests. The frequency depends on use but half-termly would be typical.
IMMEDIATE REMEDIAL MEASURES	
A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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1.078 Man Regs	Wood working: Portable Power tools - Sanders	Applicable to: Belt, disc and orbital sanders	See also: 1.071

Process(es) covered: The finishing of large sheets or workpieces too large to bring to fixed machines. Most portable power tools are electrically operated but pneumatic tools are used where compressed air is available. The use of tools with integral low-voltage battery packs is increasing.

Hazards

Flying material	It is possible for torn sanding sheets or belts to be ejected from the machines.
User injury	Human contact with moving parts can cause cuts or abrasions.
Tripping	Power leads or air pipes present a tripping hazard and may be damaged presenting electrical or compressed-air hazards.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Manual handling	Heavy workpieces and the gyroscopic effect of rotating motors can present a manual-handling hazard.
Burns	Sanding sheets or belts and sanded surfaces can become hot.
Dust	See sheet 1.071. Dust will present a hazard especially when sanding manufactured board.

Risk Assessment

Flying material	Flying pieces of sanding sheets or belts are unlikely to occur but there is a high risk that inexperienced users will not fit sheets or belts correctly.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts.
Tripping	Trailing leads or pipes present a real risk of tripping and damage.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk. Novices may have difficulty controlling the tool. This particularly applies to portable belt sanders.
Burns	Burns from sanding sheets and hot surfaces are usually superficial.
Dust	These tools often have integral dust collection although it is not always adequate for the purpose.

Control measures

It is impracticable to guard all the hazardous areas when using portable power tools. Correct selection of the tool will reduce the risks. Eye protection is needed.
Guards around rotating parts will reduce the risk of hand or finger injury but training and experience are essential in reducing risks. Immature pupils should not use portable power tools.
The route of power leads and pipes should be chosen to minimise tripping and damage. Battery-powered tools avoid this problem.
Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.
The risk of back injury is reduced if two persons handle heavy items.

If the dust control system is not adequate, an FFP3 dust mask should be worn by the user. Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science

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RESTRICTIONS	Sanders are considered 'high-risk wood-working machines'. This means that 'pupils and young persons' (ie, anyone under 18) should not use them unsupervised **unless** they have the necessary maturity and competence. During training, they may use the machines but must be adequately supervised. After training, adequate supervision must still be provided if the young person is not sufficiently mature.
FURTHER INFORMATION	Precautions to be taken with compressed air lines are listed in the introduction to this part. For general requirements on electrical supplies including a discussion on the use of 110 V, see the introduction to this part. Portable tools should be examined before use and should have regular formal inspections and tests. The frequency depends on use but half-termly would be typical.

IMMEDIATE REMEDIAL MEASURES

A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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1.079 Man Regs	Wood working: Portable Power tools - sawS	Applicable to: portable circular saws; portable jig saws	See also: 1.071

Process(es) covered: *Circular Saws* – the cutting of large sheets of material to size. The forming of rebates or grooves in wood based materials.
Jig saws – the cutting of curved or irregular shapes from wood-based materials.

Hazards

Flying material	It is possible for broken saw blades or the tips of tungsten tipped blades to be ejected from the machines.
User injury	Human contact with moving parts can cause cuts or abrasions.
Tripping	Power leads or air pipes present a tripping hazard and may be damaged presenting electrical or compressed-air hazards.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Manual handling	Heavy workpieces and the gyroscopic effect of rotating motors can present a manual-handling hazard. 'Kick-back' can occur under some circumstances.
Dust	See sheet 1.071. Dust will present a hazard especially when cutting manufactured board.

Risk Assessment

Flying material	Ejection of broken blades is rare, but ejection of the tungsten tips is more common.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts.
Tripping	Trailing leads or pipes present a real risk of tripping and damage.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk. Novices may have difficulty controlling the tool.
Dust	Fine dust is caused by these machines especially when cutting manufactured boards.

Control measures

It is impracticable to guard all the hazardous areas when using portable power saws. Correct selection of the tool will reduce the risks. Eye protection is needed.
Guards around rotating parts will reduce the risk of hand or finger injury but training and experience are essential in reducing risks. Immature pupils should not use portable power tools.
The route of power leads and pipes should be chosen to minimise tripping and damage. Battery-powered tools avoid this problem.
Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.
The risk of back injury is reduced if two persons handle heavy items.

Local exhaust ventilation should be provided where practicable. If the dust control system is not adequate then an FFP3 dust mask should be worn by the user. Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science

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RESTRICTIONS	Learners may only use portable power saws when they have been assessed as competent and are under appropriate supervision by specifically trained employees. During training, they may use the machines but must be adequately supervised. After training, adequate supervision must still be provided from a competent person.

FURTHER INFORMATION

It should be recognised that large sheets of manufactured board can usually be cut into smaller pieces more safely by the use of a portable hand-held circular saw or jig saw than by trying to manipulate the sheet on a circular saw bench. When sheets are cut in this way, a piece of wood clamped to the sheet can be used as a guide for the saw. Provided that the blade is correctly guarded, and the machine is sufficiently supported, portable circular saws can be used safely to cut grooves and rebates. Lengths of wood clamped on each side of an edge can be used to provide additional support. The blades of jig saws should be kept sharp and discarded when blunt. On both machines the condition of the blade should be checked before use. These machines should not be used if the operator could be distracted.

Precautions to be taken with compressed air lines are listed in the introduction to this part.

Portable tools should be examined before use and should have regular formal inspections and tests. The frequency depends on use but half-termly would be typical.

IMMEDIATE REMEDIAL MEASURES

A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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1.080 Man Regs	WOOD-WORKING MACHINES: Lathes - Wood Turning	Applicable to: wood lathes	See also: 1.071

Process(es) covered: The cylindrical shaping, by use of hand-held turning tools, of a length of wood or, in the case of bowl turning, of a prepared block. Wood turning lathes may be used to produce hemispherical shapes for vacuum forming.

Hazards

Trapping	Hand-held turning tools can become trapped between the rest and the workpiece.
Flying objects	Workpieces can be thrown violently if not mounted securely on a faceplate, in a chuck or between centres on the lathe. Tools can also be projected. Faceplates may also fly off if a brake is applied too fiercely.
User injury	Human contact with moving parts can cause cuts or abrasions.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Dust	See sheet 1.071 and specific comments below and overleaf. Dust can be a hazard, depending on the nature of the material being cut.

Risk Assessment

Trapping	Tools trapped between the rest and the workpiece do not constitute a serious risk provided that the tool rest is correctly set.
Flying objects	Inappropriate setting of the rest for initial turning can cause a tool to be pulled out of the user's hand and catapulted across the workshop. Since quite large workpieces can be used, failure to fix them securely can present a significant risk. Most wood-working lathes do not have brakes so the risks from rapid deceleration do not apply.
User injury	Unguarded drive belts and pulleys present a significant risk. There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts.
Entanglement	As rotating parts are necessarily exposed, entanglement is likely.
Dust	Little dust is produced when turning natural wood but man-made materials, particularly MDF, may do so.

Control measures

The trapping risk will be reduced by the correct setting of the tool rest.

Timber should be prepared carefully to a roughly octagonal shape, free from major defects before turning. Careful mounting is essential. Proper, sharp, turning tools must be used, not chisels or those improvised from old files.

Guards preventing inadvertent contact with belt drives should require a tool to remove them or be interlocked with the power supply to prevent trapping when moving the drive belt. Interlocked guards are recommended.

Eye protection must be worn.

Particular care is needed to protect the unused side of the headstock mandrel to prevent entanglement.

LEV should be provided where the risk assessment shows it is required.

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FURTHER INFORMATION

It is difficult to fit effective dust collection equipment to a wood turning late since the bulk of the chips and dust are thrown off at the front of the machine. However dust collection equipment should still be provided since it will help to collect fine dust. Face masks may be required in some circumstances. For details of dust control systems see CLEAPSS guide L225, *Local Exhaust Ventilation in Design and Technology*.

Tools should be kept sharp since a blunt tool will tend to produce dust rather than shavings. It will often be found necessary to sharpen tools at frequent intervals during the course of working.

It should be noted that some types of timber are unsuitable for turning due to the nature of the dust produced. See 1.071 for details.

The turning of built up work made from small segments of timber, often in contrasting colours, is not recommended due to the difficulty of making a good strong glued joint between the segments. However, it is acceptable to glue two or more pieces of timber together face to face since the larger area available for gluing should produce a joint of sufficient strength. At least 24 hours should be allowed for the glue to properly dry before the work is turned.

The use of traditional three jaw and four jaw chucks, as usually fitted to a metal turning centre lathe, is not recommended due to the risk of catching the jaws with the turning tool. There are however a range of work holding chucks available, that are specifically designed for use on a wood turning lathe. These devices do not normally have projecting jaws and are usually safer to use.

IMMEDIATE REMEDIAL MEASURES

Dust is in the eye	Irrigate immediately with water for several minutes, telling the casualty to hold eyelids apart.
A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.

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1.081 Man Regs	WOOD-WORKING MACHINES: Mortising	Applicable to: mortising machines and attachments	See also: 1.071

Process(es) covered: The cutting of a mortise using a hollow chisel-type machine that incorporates a drill bit within the chisel.

Hazards

Flying objects	Workpieces can slip if not clamped securely. Long pieces of timber can slip in the vice if not clamped firmly.
User injury	Human contact with moving parts can cause cuts or abrasions.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Dust	Dust may be a hazard, depending on the material being cut.

Risk Assessment

Flying objects	Since quite large workpieces can be used, failure to fix them securely can present a significant risk.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts.
Entanglement	Entanglement is likely if rotating parts are not guarded.
Dust	Little dust is produced when mortising natural wood but man-made boards, particularly MDF, may do so.

Control measures

Additional supports or clamps may be needed to hold large workpieces securely.

Mortising machines normally have a direct drive from the motor to the chuck that holds the auger bit. This reduces the risk of entanglement. However, on many mortising machines the chuck holding the auger bit is exposed or if a cover is fitted, the cover is often fixed with knurled or thumb screws. If not guarded then the chuck should be enclosed by a suitable cover made from sheet metal and fixed in place with machine screws. Knurled or thumb screws should be replaced with bolts or machine screws that require a tool to loosen. It is virtually impossible to guard the bottom part of the auger bit and chisel and students will need to be warned of the hazards of these parts of the machine.

Eye protection must be worn.

LEV should be provided where the risk assessment shows that it is required.

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FURTHER INFORMATION

If the auger bit and chisel of the mortising machine are kept sharp then large chips of wood rather than fine dust should be produced. Dust collection equipment is therefore not normally required but may be needed if fine dust is produced. A risk assessment should be carried out. For details of dust control systems see CLEAPSS guide L225, *Local Exhaust Ventilation in Design and Technology*.
Chain-type mortising machines are inappropriate for use in schools. Any college using one should note that this model assessment has **not** covered the use of such a machine.

IMMEDIATE REMEDIAL MEASURES

Dust is in the eye	Irrigate immediately with water for several minutes, telling the casualty to hold eyelids apart.
A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.

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1.082 Man Regs	WOOD-WORKING MACHINES: Planing and Thicknessing	Applicable to: all timber	See also: 1.071

Process(es) covered: The preparation of timber, particularly if from sawn stock, providing a usable surface, square edge and finished thickness separately or in combination.

Hazards

Flying objects	Workpieces can be thrown violently as a result of 'kickback' or if the machine starts unexpectedly.
User injury	Human contact with moving or rotating parts can cause cuts or abrasions.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Noise	See the introduction to this part.
Dust	Dust may be a hazard, depending on the material being cut.

Risk Assessment

Flying objects	When thicknessing, kickback is caused by the blade biting too deeply into the wood: it can happen to experienced and trained users of hand-fed machines. The workpiece can be flung violently at the operator.
User injury	Serious cuts and abrasions can result from putting fingers onto the cutters.
Entanglement	Entanglement is likely to occur if rotating parts are exposed.
Dust	The planer will exhaust large amounts of timber waste including dust and this should be controlled.

Control measures

An anti-kickback device should be fitted over the whole working width of machines used for thicknessing. If a kick back device is not available then only one piece of timber should be fed into the machine at a time.
Guards over the upper part of the machine must prevent accidental access to the cutter block and in-feed rollers. When used in overhand mode the hands must not pass directly over the cutter block.
Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.
Where a Risk Assessment requires it, LEV should be provided to capture and remove the wood waste material, this will also control much of the dust. If dust is still escaping during operation the user should wear a dust mask (FFP3 Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science).

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RESTRICTIONS	Planing machines are classed as 'high risk wood-working machines'. This means that 'young persons' (anyone under 18) **should not use** them unsupervised **unless** they have the necessary maturity and competence. No students in schools or sixth form colleges should use a planing machine; use by students is restricted to students in colleges of further education who are following a specific course in the use of woodworking machines. During training, they may use the machines but must be adequately supervised. After training, students may use a planing machine when they have been formally assessed and the assessment shows they are competent and they are under the direct supervision of specifically trained staff. (Direct supervision is defined as the supervisor standing immediately alongside the user and giving their full attention to the user.) No **child** (ie, one of statutory school age) would be expected to have sufficient maturity and competence to use a planning machine of any design.
FURTHER INFORMATION	The blades of all of all types of planing machine must come to rest within ten seconds of the power being turned off. Where a machine does not do this, it must be fitted with a braking device[63]. The cutter block must be guarded at all times. No operation should be carried out without a suitable guard in place. These machines usually produce chips of wood rather than fine dust so the provision of dust collection equipment is less essential. However, if the use is such that dust is produced, it must be collected. For details of dust control systems see CLEAPSS guide L225, *Local Exhaust Ventilation in Design and Technology*.

IMMEDIATE REMEDIAL MEASURES

Dust is in the eye	Irrigate immediately with water for several minutes, telling the casualty to hold eyelids apart.
A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.

63 See HSE *Woodworking Information Sheet* Number 38.

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1.083 Man Regs	WOOD-WORKING MACHINES: sanders - Belt, BOBBIN, Disc	Applicable to: vertical and horizontal belt sanders; disc and combined machines; bobbin sanders	See also: 1.071

Process(es) covered: The use of bench or pedestal machines to finish wood components, for which only light pressure is required, principally on end grain. Bobbin sanders consist of a cylindrical sanding bobbin mounted in the centre of a supporting table and which rises and falls as it rotates. Different sizes of bobbin are available.

Hazards

Trapping	Fingers or material can become trapped between the belt and drive pulleys or between the sanding surface and a fence, or between the bobbin and the table.
Flying objects	Workpieces can be thrown violently if not held correctly or if the machine starts unexpectedly. Torn belts or discs can be ejected violently.
User injury	Human contact with moving or rotating parts can cause cuts or abrasions and particles from the sanding process can enter the eye. If the support table is not correctly set there is a high risk of the material being sanded being dragged into the gap between the table and the disc or belt.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Dust	See sheet 1.071 and specific comments overleaf.

Risk Assessment

Trapping	Inadequate guards cause an increased risk.
Flying objects	Workpieces are usually held in the hand, often against a fence or rest, allowing the pressure on the belt or disc to be released quickly. This risk is small provided that the rest correctly set.
User injury	If guards are positioned to enclose those moving or rotating parts that are not being used, the risk is reduced but in some applications this is difficult. This risk must be reassessed for each application.
Entanglement	Entanglement is likely to occur if rotating parts are exposed.
Dust	Fine dust will be produced when sanding.

Control measures

To minimise the trapping risk, the drive mechanisms must be enclosed and fences must be set correctly. On a disc sanding machine the upward turning part of the sanding disc should be covered by a suitable quadrant guard. For sanding an angle edge, the table must be inclined downwards away from the sanding surface. The position of the support table should be checked at regular intervals and the gap between the table and the disc or belt should be as small as possible, normally not more than 3 mm.

A belt must be fitted to rotate in the correct direction. If flying objects are to be avoided then users must be instructed in the level of pressure to apply to the workpiece. The setting of rests should be checked frequently to ensure that they are as close to the abrasive as possible.

Guards must be in place and eye protection must be worn when using any sander.

Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.

A suitable LEV system must be fitted and must always be used.

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RESTRICTIONS

Sanding machines are categorised as ‘high-risk wood-working machines’. This means that ‘pupils and young persons’ (ie, anyone under 18) should not use them unsupervised **unless** they have the necessary maturity and competence. During training, they may use the machines but must be adequately supervised. After training, adequate supervision must still be provided if the young person is not sufficiently mature.

Disposal

See sheet 1.071 for details on the collection and disposal of wood dust.

FURTHER INFORMATION

Disc sanding machines should be fitted with a quadrant guard that will cover the upward turning part of the sanding disc. This guard **must not** be removed to allow the sanding of large work pieces. When sanding wood and particle boards, the machines should be fitted with dust collection equipment which is powered when the sander is started. In the event of a breakdown of the dust collector, this unit must not be by-passed electrically to allow continued use of the sander; it must be repaired. For details of dust control systems see CLEAPSS guide L225, *Local Exhaust Ventilation in Design and Technology*.

Neither metal nor acrylic material should be finished on a disc or belt sander used for wood-working without cleaning and emptying the dust extraction system. The resultant sparks from metal, and the high temperature generated in acrylic dust, could ignite wood dust contained in the dust extractor unit. It is an advantage to restrict the size of the material that may be sanded. As a general rule, material that is smaller than 40 mm square would be considered too small to be sanded on a disc machine.

IMMEDIATE REMEDIAL MEASURES

Dust is in the eye	Irrigate immediately with water for several minutes, telling the casualty to hold eyelids apart.
A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.

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1.084 Man Regs	WOOD-WORKING MACHINES: saws - BAND	Applicable to: bench and floor-mounted narrow band saws	See also: 1.045 1.071

Process(es) covered: The cutting of wood, manufactured boards and plastic sheet to approximate profile using an endless saw blade running on guide wheels.

Hazards

Trapping	Fingers or material can become trapped between belts and drive pulleys or between the blade and a fence or guard.
Flying objects	Workpieces can be thrown violently if not held correctly, as a result of 'kickback' or if the machine starts unexpectedly.
User injury	Human contact with moving or rotating parts can cause cuts or abrasions and particles from the sawing process can enter the eye.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Dust	See sheet 1.071 and specific comments below and overleaf.
Noise	See the introduction to this part.

Risk Assessment

Trapping	Inadequate guards on band saws present a risk. Trapping can occur when fitting a new blade to a band saw.
Flying objects	'Kickback' can occur as a result of missing teeth or from the nature of the material being cut but is rare on band saws.
User injury	All pulleys, drive belts and saw blades present a high risk unless adequately guarded.
Entanglement	Entanglement is likely to occur if rotating parts are exposed.
Dust	Dust will always be a hazard when using any type of sawing machine and must be adequately controlled.
Noise	It is possible but unlikely that a bandsaw will produce noise above the first action level.

Control measures

Band saws must have all moving parts enclosed or covered with a guard. Only the part of the blade required for cutting should be exposed. The top guide should be adjusted so that it is a close as is practicable above the surface of the material being cut (normally within 10 mm).

Band saw blades must be checked regularly for missing teeth.

Eye protection should be worn for all sawing operations. Push sticks or other aids to guiding the material being cut should always be used when fingers are at risk.

Rotating parts must always be covered when the machine is in use. Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.

A suitable LEV system must be fitted and must always be used.

If the process generates noise above the action level, hearing protection must be used.

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RESTRICTIONS	Band saws are 'high risk wood-working machines'. This means that learners may only use band saws when they have been assessed as competent and are under appropriate supervision by specifically trained employees. During training, students may use the machines but must be adequately supervised. After training, students may use a band saw when they have been formally assessed and the assessment shows they are competent and they are under the direct supervision of specifically trained staff. (Direct supervision is defined as the supervisor standing immediately alongside the user and giving their full attention to the user.) Normally, student use of band saws should be confined to those over the age of 16 years.
FURTHER INFORMATION	The blade of a band saw must come to rest within ten seconds of the power being turned off. Where a band saw does not do this, it must be fitted with a braking device[64]. Braking devices can take several forms and can include suitable foot brakes. When sawing wood and particle boards, the machines should be fitted with dust-collection equipment which is powered when the machine is started. In the event of a breakdown of the dust collector, this unit must not be by-passed electrically to allow continued use of the saw; it must be repaired. For details of dust control systems see CLEAPSS guide L225, *Local Exhaust Ventilation in Design and Technology*. Small bench mounted band saws usually designed for home use are often found in schools. These machines must conform to PUWER requirements and should be connected to the electrical supply as described in the introduction to this part. Such machines present the same sort of hazards as larger floor mounted machines and should have the same restrictions on their use.
IMMEDIATE REMEDIAL MEASURES	
Dust is in the eye	Irrigate immediately with water for several minutes, telling the casualty to hold eyelids apart.
A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.

64 See HSE Woodworking Information Sheet No 38.

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1.085 Man Regs	WOOD-WORKING MACHINES: saws - Bench-Mounted, fret, jig, scroll	Applicable to: cutting of intricate shapes in timber and rigid plastics	See also: 1.071

Process(es) covered: The cutting of curved and irregular shaped lines in thin wood and plastics, using electrically-powered saws, eg, jig, scroll or fret saws.

Hazards

User injury Human contact with moving, rotating or reciprocating parts, including the saw blade, can cause cuts or abrasions. Vibrations from the movement of the saw blade can cause the machine to move about on the bench top.

Entanglement Long hair, dangling jewellery or loose clothing can become entangled with rotating or reciprocating parts.

Dust See sheet 1.071 and specific comments below and overleaf.

Risk Assessment

User injury There may be a significant risk from cuts if the blade is not adequately guarded (unless the amplitude of the blade movement is small). All rotating parts should be adequately guarded. On some machines, reciprocating parts may also need guards. If the machine is not fixed securely, it may fall from the bench top. Some machines are supplied on a stand that may topple over.

Entanglement Entanglement is likely to occur if rotating or reciprocating parts are exposed.

Dust Efficient dust extraction is required when cutting dusty materials, eg, MDF.

Control measures

Eye protection should be worn. To minimise user injury, the saw blade must be adequately guarded so that, in normal use, the fingers of the operator cannot come into contact with it. The machine should not be used without a suitable guard in place and correctly set. It is preferable for the machine to include a 'foot' that can be set to rest on the top surface of the material being cut to avoid the material vibrating. The machine should be fixed to the bench. Machines fitted on a stand may need the stand fixing to the floor. See the introduction to this part for related issues of electrical safety.

Long hair should be tied back and jewellery removed or covered. Sleeves should be turned back.

Dust extraction should be provided where the risk assessment shows that it is required. An FFP3 dust mask may be needed while cleaning, Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science.

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Disposal

See sheet 1.071 for details on the collection and disposal of wood dust.

FURTHER INFORMATION

Powered jig and fret saws should be fitted with dust-collection equipment that is powered when the machine is started. In the event of a breakdown of the dust collector, this unit must not be bypassed electrically to allow continued use of the machine; it must be repaired. For details of dust-control systems, see CLEAPSS guide L225, *Local Exhaust Ventilation in Design and Technology*.

Some types of these saws, sometimes called vibro saws, are fitted with very thin, fine blades, similar to those used in piercing saws. These machines have limited blade travel and risks from cuts are minimal since the skin vibrates with the saw blade. Most types of bench-mounted jig saw or fret saw are fitted with saw blades of a fairly coarse pitch and these do present significant hazards. Blade guards are always required on these machines

IMMEDIATE REMEDIAL MEASURES

Dust is in the eye	Irrigate immediately with water for several minutes, telling the casualty to hold eyelids apart.
A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves then the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.

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1.086 Man Regs	WOOD-WORKING MACHINES: SAWS - CHOP, CROSS-CUT, MITRE, Radial arm	Applicable to: 'chop saws'; cross-cut saws; mitre saws; radial arm saws	See also: 1.071

Process(es) covered:	*Cross-cut (Mitre) and radial arm saw:* This type uses a circular blade and the main use of this type is cross-cutting although some radial arm saws claim the facility to rip timber along the grain. *Chop saws;* The cutting of timber to length by means of a downward movement of the saw blade and motor.
Hazards	
Trapping	Fingers or material can become trapped between the blade and a fence or guard.
Flying objects	Workpieces can be thrown violently if not held correctly, as a result of 'kickback' or if the machine starts unexpectedly.
User injury	Human contact with moving or rotating parts can cause cuts or abrasions and particles from the sawing process can enter the eye. On some radial arm saws, the blade can move forward inadvertently particularly when removing cut timber from the saw table.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Dust	See sheet 1.071 and specific comments below and overleaf.
Noise	See the introduction to this part.
Risk Assessment	
Trapping	Trapping generally presents a low risk on this type of machine.
Flying objects	'Kickback' can occur as a result of missing teeth or from the nature of the material being cut. The risk is high with radial arm saws set to rip.
User injury	All pulleys, drive belts and saw blades present a high risk unless adequately guarded. All machine saws generate flying particles. The risk of harm when removing timber can be reduced by careful instruction.
Entanglement	Entanglement is likely to occur if rotating parts are exposed.
Dust	Dust must be adequately controlled.

Control measures
A control measure to limit trapping is unnecessary.
Radial arm saws should not be used for ripping unless a correctly designed and fitted riving knife[65] and a 'featherboard' or metal fingers to hold boards onto the table are available.
On all these machines the saw blade must be adequately guarded. Chop saws generally have a guard that encloses the whole of the blade, which is progressively revealed as the blade is lowered into the work. On radial arm saws the blade should be fitted with side guards that rise up when the saw is pulled across the work. All these guards should be checked to ensure that they function correctly. Radial arm saws should retract so that the whole of the blade is behind the rear stop of the table. Cut timber should only be removed when the blade is fully retracted. A push stick may be required. Eye protection should be worn.
Drive mechanisms on all these saws must be fully enclosed and crown guards or nose guards fitted and used.
A suitable LEV system must be fitted and must always be used.

[65] See HSE *Woodworking Information Sheets* Nos 16, 35 and 36.

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RESTRICTIONS

All these saws are classes as 'high risk wood-working machines'. This means that 'young persons' (anyone under 18) **should not use** circular saws, unsupervised **unless** they have the necessary maturity and competence. No students in schools or sixth form colleges should use a chop saw, mitre saw or radial arm saw; use by students is restricted to students in colleges of further education who are following a specific course in the use of woodworking machines. During training, they may use the machines but must be adequately supervised. After training, students may use one of these types of sawing machine when they have been formally assessed and the assessment shows they are competent and they are under the direct supervision of specifically trained staff. (Direct supervision is defined as the supervisor standing immediately alongside the user and giving their full attention to the user.)

No **child** (ie, one of statutory school age) would be expected to have sufficient maturity and competence to use any of the saws in this group.

FURTHER INFORMATION

The blades of all of the saws in this group must come to rest within ten seconds of the power being turned off. Where a machine does not do this, it must be fitted with a braking device[66].

When sawing wood and particle boards, the machines should be fitted with dust-collection equipment which is powered when the machine is started. In the event of a breakdown of the dust collector, this unit must not be by-passed electrically to allow continued use of the saw; it must be repaired. For details of dust control systems see CLEAPSS guide L225.

The work table of a radial arm saw has a back stop or rest to support the timber being cut. This should be positioned so that the whole of the saw blade is behind the front edge of the back stop. Radial arm saws should be fitted with a spring return or similar device to return the blade to its safe position. The back stop will often become damaged due to close saw cuts through it and the work table will become scarred with shallow saw cuts in time. Both these items should be replaced when necessary.

Chop saws are often supplied with a small bag to collect the dust. These are usually inadequate for the purpose and alternative arrangements to control the dust are required.

See the introduction to this part for related issues of electrical safety.

IMMEDIATE REMEDIAL MEASURES

Dust is in the eye	Irrigate immediately with water for several minutes, telling the casualty to hold eyelids apart.
A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.

66 See HSE *Woodworking Information Sheet* No 38.

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1.087 Man Regs	WOOD-WORKING MACHINES: saws - CIRCULAR & VERTICAL PANEL	Applicable to: bench-mounted and floor-mounted circular saws; vertical panel saws	See also: 1.071

Process(es) covered:

Circular saw: The preparation of workpieces from sheet, board or section material.
Vertical panel saw: a machine designed for cutting large sheets to size using a saw blade and motor on a sliding framework.

Hazards

Trapping	Fingers or material can become trapped between belts and drive pulleys or between the blade and a fence or guard.
Flying objects	Workpieces can be thrown violently if not held correctly, as a result of 'kickback' or if the machine starts unexpectedly.
User injury	Human contact with moving or rotating parts can cause cuts or abrasions and particles from the sawing process can enter the eye.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Dust	See sheet 1.071 and specific comments below and overleaf.
Noise	See the Introduction to this part.

Risk Assessment

Trapping	On these saws, trapping presents a low risk.
Flying objects	'Kickback' can occur as a result of material being trapped between the fence and the blade and ejected violently in the direction of the operator.
User injury	All pulleys, drive belts and saw blades present a high risk unless adequately guarded.
Entanglement	Entanglement is likely to occur if rotating parts are exposed.
Dust	All machine saws generate flying dust. Dust will always be a hazard when using any type of sawing machine and must be adequately controlled.
Noise	These saws frequently generate noise above the first action level.

Control measures

Drive mechanisms on all circular saws must be fully enclosed and crown guards or nose guards fitted and used. The crown guard should extend downward to cover the root of the teeth on both sides of the blade.
A correctly designed and fitted riving knife[67] must be used to control the risk of 'kickback' when ripping. The risk of kickback can be reduced by ensuring that the fence does not extend more then 50 mm from the front of the saw blade.
The crown guard should never be removed to allow any operation to be done. Push sticks should be used where necessary. On vertical panel saws too the blade must be adequately guarded.
Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall.
A suitable LEV system must be fitted and must always be used.
If the process generates noise above the action level, hearing protection must be used.

[67] See HSE *Woodworking Information Sheets* Numbers 16, 35 and 36.

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RESTRICTIONS	Circular saws are classes as 'high risk wood-working machines'. This means that pupils and 'young persons' (ie, anyone under 18) **should not use** circular saws unsupervised **unless** they have the necessary maturity and competence. No students in schools or sixth form colleges should use a circular saw; use by students is restricted to students in colleges of further education who are following a specific course in the use of woodworking machines. During training, they may use the machines but must be adequately supervised. After training, students may use a circular saw when they have been formally assessed and the assessment shows they are competent and they are under the direct supervision of specifically trained staff. (Direct supervision is defined as the supervisor standing immediately alongside the user and giving their full attention to the user.) No **child** (ie, one of statutory school age) would be expected to have sufficient maturity and competence to use a circular saw of any design.
FURTHER INFORMATION	
	The blades of circular saws and vertical panel saws must come to rest within ten seconds of the power being turned off. If a machine does not do this then it must be fitted with a braking device[68]. If sawing wood and particle boards then the machines should be fitted with dust-collection equipment which is powered when the machine is started. In the event of a breakdown of the dust collector, this unit must not be by-passed electrically to allow continued use of the saw; it must be repaired. For details of dust control systems see CLEAPSS guide L225. When using a circular saw the hands should not be placed closer than 300 mm to the saw blade. A push stick should be used for timber shorter than 300 mm or for the last 300 mm of any cut. A second push stick may be needed to hold the wood against the fence. If the fence supplied with the machine extends across the whole width of the circular saw table, then a suitable wooden sub-fence should be fitted that only extends 50 mm in front of the leading edge of the saw blade. If grooves and rebates are to be cut on a circular saw then a proper purpose-made guard must be provided. These are normally known as tunnel or 'Shaw' guards. CLEAPSS recommends that grooves and rebates are never cut on a circular saw in a school. No operation should be done on a circular saw if the blade is not guarded.
IMMEDIATE REMEDIAL MEASURES	
Dust is in the eye	Irrigate immediately with water for several minutes, telling the casualty to hold eyelids apart.
A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood

[68] See HSE *Woodworking Information Sheet* No 38.

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1.088 COSHH & Man Regs	Additive manufacturing: 3D Printing	Applicable to: Extrusion deposition Binding granular materials Lamination Photopolymerisation	See also: 1.010 1.024 1.032 1.052 1.062

Process(es) covered: Manufacturing of products using some form of stereo lithography process. The heating or bonding of materials to form shapes which can then be finished to provide a 3 dimensional representation of a CAD image. The use of various polymer-based materials and solvents in the process of 3D printing, these may be heated and extruded, bonded using laser or heat application, laminated by the introduction of a solvent or activated by the application of specific light frequencies. The resultant product then undergoes a variety of finishing processes which may include the application of solvents.

Hazards

Trapping	Fingers can become trapped between moving and fixed parts of machines that are not fully enclosed.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with moving parts that are not fully enclosed.
Dust	Dust can be emitted when working with polymer powders if the machine is not fully enclosed.
Fire	Machines left unattended can generate heat which could ignite flammable materials.
Burns	Heated base plates and extrusion nozzles may reach a temperature high enough to cause skin burns. In some cases the final product will be at a temperature that can adhere to skin and cause burns.
Irritant	If the polymers are overheated they release irritant fumes and particulates.
Eye damage	If used, lasers or specific-frequency lights can be a source of ultra-violet and visible radiation.

Risk Assessment

Trapping	Machines that are not fully enclosed present a risk from trapping.
Entanglement	Entanglement could occur if the user is too close to a machine which is not fully enclosed or which starts unexpectedly when being set up.
Dust	Dust will be produced in the powder polymerisation machines. Where machines are not fully enclosed, this will present a risk.
Fire	Machines can be set to work unattended and at temperatures that could ignite flammable materials.
Burns	There is no need to touch hot parts of the machines, or hot plastic products.
Irritant	Heating polymers increases the emission of nanoparticles, overheating the filaments or other polymers (to a temperature where de-composition takes place) produces fumes that are harmful or irritant (see *Plastics: Hazards of materials*, sheet 1.055). The temperature should be raised only to the point when the plastic softens visibly.
Eye Damage	Laser light and ultra-violet radiation as used in SLS machines, can cause eye damage. Provided the laser beams are totally enclosed (reducing the hazard class of the system to 1), this risk is minimal.

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Control measures	Some 3D printers are fitted with guards that enclose the working area of the machine, in some cases additional guarding may be required to prevent access. Placing the machine in a suitable enclosure will restrict access to moving parts. Where machines are not fully enclosed, long hair should be tied back, jewellery should be removed or covered, and loose clothing should be secured. Users and observers should be instructed to take care when observing the process. At present there are no Work Exposure Limits (WELs) for 3D printing, ordinary ventilation may not be sufficient to control the increased emission of nanoparticles, placing the machine in a suitable enclosure with filtered exhaust will minimise exposure. When the print is completed it may need to stay within the enclosure for some time to remove the fumes or particulates. The use of solvents, in either preparing materials or the finishing processes, is covered in *Plastics: Hazards of materials*, sheet 1.055. Machines should not be left unattended and care should be taken over the storage and use of flammable materials to avoid accidental ignition. Operators should not touch any of the heated parts until they have cooled sufficiently, the final product should be left to cool before removal from the machine. Instruction and training in safe use will normally be sufficient to control the risk of overheating the materials. Where a laser is used, an interlock, to prevent laser operation unless the system is enclosed, is essential and must not be over-ridden.

Disposal	Small quantities of polymer materials can be disposed of as normal waste, large quantities must be handled by an authorised contractor. Solvents should be disposed of as instructed in the appropriate guidance. Saturated filters should be disposed of following manufacturer's instructions.
Storage	Store materials in a clean, dry area at ambient temperature (< 30 °C).

IMMEDIATE REMEDIAL MEASURES

Powder is swallowed	Drink plenty of water and seek medical attention.
Vapour is inhaled	Remove casualty to fresh air and seek medical attention.
Dust in the eyes	Wash thoroughly for at least ten minutes with water to prevent scratching of the eye. Seek medical attention if irritation persists.
Powder spills in the workshop	If possible, use an industrial vacuum cleaner fitted with a HEPA filter to get the powder into bags. If sweeping, dampen powder first. Rinse area with soapy water.
In case of fire	If the polymer or solvent is ignited, evacuation of the area should take place as thermal decomposition may create hazardous fumes. The fire service should be summoned.
Skin burns	As soon as possible, plunge the skin into cold water or hold it under a running cold tap. Keep the burn in cold water for at least 5 minutes (10 minutes if the casualty continues to experience discomfort). If extensive, seek first-aid treatment as for any other burn. DO NOT APPLY CREAMS OR OINTMENTS OF ANY TYPE
Solvent spills in the workshop	Ensure suitable personal protection during removal of the spill. Contain the spill with sand, earth or any suitable absorbent. Transfer to a container for disposal.

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1.089 Man Regs	PLASTICS: Dip-coating	Applicable to: dip coating, fluidising; thermo-forming centres	See also: 1.058

Process(es) covered: Metal objects are heated to a temperature that will cause plastic powders to adhere to the heated surface and, when cooled, produce a plastic covering. Nylon and polyethylene are the materials most commonly used.

Hazards

Burns	Components can reach temperatures as high as 400 °C. Careless handling of hot metal.
Explosion	Nylon granules can absorb moisture in storage, which then turns to steam explosively when the heated metal is placed within the fluidising bath.
Tripping	Leads and hoses are a trip hazard.
Electric shock	Mains-powered equipment presents the possibility of harm from electric shock.

Risk Assessment

Burns	Heated metal components could give rise to serious burns. Molten plastic could adhere to skin.
Explosion	The risk is real if the nylon is not stored correctly.
Tripping	Trailing leads or air pipes present a real risk of tripping.
Electric shock	The risk of harm from electric shock will be reduced if the equipment is properly maintained.

Control measures

Metal items should be heated in a thermostatically controlled oven.
Heat-proof gloves should be available for handling metal components prior to dipping and upon extracting components from the fluidising bath.
Tongs or magnetic pick up tools should be provided to take the heated metal from the oven and introducing it to the fluidising bath.
Suitable eye protection should be worn and training provided in the use of the equipment.
The manufacturer's instructions for the materials to be used and the temperature settings must be followed.
Powders should be stored according to manufacturer's advice and the fluidising bath should have a sealed lid for when the bath is not in use.
The route of power leads and hoses should be chosen to minimise the tripping hazard.
Regular inspection and testing of electrical equipment minimises the risks.

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Storage	It is essential to store nylon (and preferable for other powders) in airtight drums and in a dry place.
Disposal	Large quantities must be handled by an authorised contractor.

FURTHER INFORMATION

Ovens used for heating metal should not be used for heating food stuffs.
Fluidising machines may incorporate pressure systems as well as electrical items. The pressure system of most educational equipment will have a pressure volume product that is less than 250 bar litres and therefore is excepted from some requirements laid down in the *Pressure Systems Safety Regulations* 2000. It will, therefore, **not** be necessary to examine this equipment in accordance with a written scheme. Nevertheless, the user is required to ensure that the system is properly maintained in good repair so as to prevent danger.
Fluidising machines should therefore be included in a planned annual maintenance programme.

IMMEDIATE REMEDIAL MEASURES

Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.
Dust in the eyes	Wash thoroughly for at least ten minutes with water to prevent scratching of the eye. Seek medical attention if irritation persists.
Powder is swallowed	Drink plenty of water and seek medical attention.

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MODEL RISK ASSESSMENTS
FOR DESIGN AND TECHNOLOGY
IN SECONDARY SCHOOLS AND COLLEGES

Part 2
Work with compliant materials

CLEAPSS®, The Gardiner Building, Brunel Science Park, Kingston Lane, Uxbridge UB8 3PQ
Tel: 01895 251496 *Fax/Answerphone:* 01895 814372 *E-mail:* science@cleapss.org.uk *Web site:* www.cleapss.org.uk

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Part 2: Work with Compliant Materials

2.001 Adhesives used with compliant materials
2:002 Batik pots / Wax kettles
2.003 Cleaning agents: bleaches
2.004 Cleaning agents: detergents
2.005 Cleaning agents: solvents
2.006 Cleaning fabrics
2.007 Cutting with scissors, scalpels and craft knives
2:008 Distressing fabrics
2.009 Dyes & mordants
2.010 Fabric identification: activities
2.011 Fabric identification: chemicals
2.012 Flammable substances: liquids
2.013 Flammable substances: non-liquids
2:014 Heat presses
2.015 Inks & paints used with textiles
2.016 Ironing
2.017 Knitting machines
2.018 Sewing equipment: general-purpose machines
2.019 Sewing equipment: overlockers
2.020 Sewing equipment: small items
2.021 Wear tests on textiles

Appendix 1: Burning tests on fabrics
Appendix 2: Chemical tests on fabrics

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2.001 COSHH Regs	Adhesives used with Compliant Materials	Applicable to: Araldite; Balsa cement; Copydex; Pritt stick; PVA; Rubber cement; Superglue	See also: 1.002 1:004 1.005 1.007 1.008 1.009

Process(es) covered: Adhesives are mainly used to hold textiles together temporarily or to affect a repair. Other compliant materials are often held together by glues of many different types.

Hazards

Harmful vapour

Inhalation of vapour from some organic, solvent-based adhesives, eg, rubber or balsa cements containing toluene (R11, 38,48/20, 63, 65, 67), may cause nausea, headaches, dizziness, breathing difficulties and, eventually, unconsciousness. Such adhesives, if acquired by pupils, may be used in 'solvent abuse'.
Some adhesive vapours are flammable, for example, those using propanone (R11, 36, 66, 67).

Harmful substance

Epoxy or polyester resin adhesives (eg, Araldite) involve a curing reaction in which the resin is mixed with a hardener. The uncured material may be harmful if ingested or absorbed through the skin. Hot adhesives can burn.

Irritant

Some adhesives in contact with the skin and eyes may cause possible irritation or allergic reaction in sensitive individuals. Cyanoacrylate vapour is irritating to the skin and nasal passages (R36/37/38).

Skin adhesion

Cyanoacrylate adhesives (eg, Superglue) may bond the skin or eyelids.

Risk Assessment

Harmful vapour

Organic solvent-based adhesives, used to glue card, can release vapours leading to illness as above. Tests on a typical rubber cement indicated that, even if 1 m^2 (about 12 A4 sheets) were being glued at once and the solvent was all propanone (WEL 1500 ppm, 15 ref period)[69] the limit would not be approached.

Harmful substance

The amounts of epoxy or polyester resin adhesives (eg, Araldite) used in this work are so small that these hazards do **not** represent a significant risk to health.

Irritant

Organic solvent-based adhesives (eg, Balsa cement) are often irritant. The nozzles of tubes of adhesives may become blocked and, when pressure is applied to clear the blockage, spurting can occur. Cyanoacrylates are irritant but the risk is trivial in areas with normal ventilation.

Skin adhesion

The use of cyanoacrylate adhesives (eg, Superglue) may easily lead to the skin sticking within seconds.

Control measures

Organic solvent-based adhesives should not be used in confined spaces but ordinary rooms require no extra measures.
It may be necessary to avoid adhesives in tubes with some classes to control the risk of spurting into eyes, and prolonged skin contact with organic solvent-based ones must be avoided.
Cyanoacrylate adhesives are **not** suitable for use by pupils under 16.
Eye protection should be worn.

[69] EH 40/2007

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RESTRICTIONS	Solvent abuse. Strict control over the use and storage of solvent-based adhesives should be enforced to ensure that the deliberate inhalation of vapour does not take place. Adhesives should not be used where they can come into contact with food, utensils or surfaces on which food is prepared.
Disposal	Moderate amounts and empty containers may be placed in normal refuse.
Storage	Store all adhesives in a dry place in the temperature range 5 to 25 °C. Protect water-based ones from frost. One aerosol container and a few organic solvent-based adhesives marked 'Highly flammable' may be kept 'ready for use' in containers not larger than 500 ml. Spare containers should be kept well away from sources of ignition such as sparks, pilot lights and other naked flames, in a highly-flammable liquids cupboard. All storage for 'sniffable' glues must be secure.

FURTHER INFORMATION

Safe adhesives

Most adhesives will be applied only in small amounts and are very safe, though it is always wise to avoid contact with the eyes and hands, particularly for individuals having sensitive skin. Water-based, polyvinyl acetate (PVA) and rubber latex types are all safe to handle; such adhesives include cellulose powders (wallpaper pastes so long as they do not contain fungicides), glue sticks and 'Copydex'.

Although PVA and rubber latex adhesives are among the safest available, they should not be used by those pupils who might put them in their noses or mouths. This action could lead to a dangerous obstruction to breathing if the solidifying products were inhaled; there is similarly a danger that they might be swallowed. This risk is reduced if the adhesive is supplied in a tub rather than in a tube.

IMMEDIATE REMEDIAL MEASURES

In case of fire	Small fires of fabrics or solvents are most easily controlled by covering them with a fire blanket or damp cloth.
Adhesives are on the skin	Wipe off excess with a paper towel and wash skin with soap and water. If 'Superglue' bonds the skin together, **do not panic**. Do **not** attempt to *pull* the skin apart; soak in warm water and ease the skin apart with a gentle peeling action using a blunt edge such as a spoon handle. (If the eyelids are stuck together, wash with warm water for at least 10 minutes and seek medical attention.)
Much vapour is inhaled	Remove individual to fresh air and seek medical attention.
Adhesives are in the eyes	Irrigate immediately with water for at least 10 minutes, holding the eyelids apart. Obtain medical attention.
Adhesives are swallowed	For most adhesives, rinse out the mouth and drink plenty of water. For solvent-based adhesives, do not induce vomiting. Seek medical attention.
Effects of solvents on skin	Repeated and prolonged contact with the skin may cause removal of natural greases, resulting in dryness, cracking and possible dermatitis. Wash with mild antiseptic and apply moisturising cream.

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2.002 COSHH & Man Regs	Batik Pots / Wax Kettles	Applicable to:	See also: 2.012

Process(es) covered: Melting of paraffin wax for application to fabrics using self-contained, electrically heated pots or wax kettles on hotplates.

Hazards	
Burns or scalds	Hot wax can cause scalds and the edges of the pot become sufficiently hot to cause burns.
Tripping / Tipping	The mains cord presents a possible tripping or tipping hazard with a further hazard presented by the falling pot.
Electric shock	The mains cord is subject to considerable wear and may present a shock hazard.
Fumes	Fumes from melted wax present a fire hazard and may irritate the respiratory system.
Risk Assessment	
Burns or scalds	The sides of self-contained pots are well insulated although some areas could get hot enough to cause a minor burn. However, the casualty is very unlikely to require more than immediate remedial aid. The pots are thermostatically controlled but, when melted, wax can stick to the skin and cause scalds.
Tripping / Tipping	The risk of tripping depends much more on the location of the socket outlets relative to the positions of the Batik pots than on anything else. This is a matter that has to be assessed locally. A falling pot could cause a foot injury. Tipping could cause a wax spill that could scald.
Electric shock	The rate of wear and the severity of the harm makes this a significant risk.
Fumes	The WEL for paraffin wax is 2 mg/m^3 (8 h TWA) or 6 mg/m^3 (15 min ref period[70]). These levels may well be exceeded especially if more than one pot is in use at a time. Fumes from melted wax have been known to cause headaches and can cause lung irritation although it is unlikely that any permanent harm will be caused. Paraffin wax fumes are unlikely to ignite unless heated to a very high temperature.

Control measures
Clear instruction should be sufficient to minimise the risks of burns and scalds. Protective gloves might be needed to hold the handle of a wax kettle. Careful arrangement of the Batik pot in relation to the socket outlets will minimise the risk of tripping. Awareness and instruction will minimise the risk of tipping a separately-heated wax kettle. Batik Pots should be inspected visually for wear to the power cord every time they are taken out for use. They may need a formal inspection more frequently than some other portable electric items. Use the lowest possible temperature setting to melt the wax. The pot should be located near an open window. If the fumes cause distress then only one pot should be in use at a time Pupils or staff who suffer from asthma or other respiratory problems would be advised not to do the process.

[70] EH 40/2005

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RESTRICTIONS	Batik work should be carried out by children under close supervision.
Storage	Batik Pots must be allowed to cool before having the power cord wound around them to be put away. A major cause of damage to the cord is winding it up too tightly.

FURTHER INFORMATION

Choice of Batik Pots

The safest equipment to use for melting wax in this work is a self-contained electrically-heated Batik pot with interchangeable wax kettles where necessary.
A 'HOT' warning sign is also advisable.

IMMEDIATE REMEDIAL MEASURES

Burns and scalds	Cool the affected area under a running cold tap for 10 minutes.
Electric shock	Send for first aider immediately. Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a trained first aider does not arrive quickly and the pulse is absent, consider carrying out cardio-pulmonary resuscitation.

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2.003 COSHH Regs	Cleaning Agents: Bleaches	Applicable to: Bleach; Brobat; Domestos; Parozone; Stain Devils; Vortex	See also: 2.006

Process(es) covered:

Liquid bleaches: mostly contain sodium hypochlorite, which releases chlorine as the active ingredient. Some types, eg, Stain Devils 4 & 6, may use peroxides instead.
Solid bleach powders: contain either calcium hypochlorite or possibly sodium perborate. *Bleach tablets* release chlorine in solution from sodium dichloroisocyanurate.

Hazards

Corrosive	Solutions containing sodium chlorate(I) (hypochlorite) (R31, 34) with more than 10% active chlorine and solids containing calcium chlorate(I) (hypochlorite) (R8, 22, 31, 34, 50) are corrosive.
Harmful	Sodium peroxoborate tetrahydrate (perborate) (R8, 36), sodium dichloro-isocyanurate (R8, 22, 31, 36/37 50/53) and calcium hypochlorite are rated harmful.
Irritant	Most 'concentrated' chlorine-bleaching solutions available commercially contain 5 to 10% active chlorine and are merely irritant to the eyes or skin. At even lower concentrations (< 5% active chlorine or < 5% hydrogen peroxide), bleaches will have no hazard warnings on their labels but may affect the skin or eyes of sensitive persons.
Toxic gas	Chlorine gas (R23, 36/37/38, 50) is released when acids (eg, some cleaning agents) are mixed with chlorine bleaches.

Risk Assessment

Corrosive	Bleach solutions classified as corrosive are very hazardous, causing severe damage to the eyes and burns to the skin or alimentary canal, if swallowed, but these are rarely used in textile technology teaching.
Harmful	Bleaching powders readily give rise to dust that could be inhaled or damage the eyes. The tablets are harmful if swallowed.
Irritant	There is a small risk that 'concentrated' bleach solutions will splash onto the skin or eyes when solutions are being prepared. At the lower concentrations, care should still be taken to avoid skin or eye contact.
Toxic gas	Some people, particularly asthmatics, are sensitive to extremely low levels of chlorine (WEL 1.5 mg/m^3 15 min ref. period). The risk of mixing acids with hypochlorites in a textile technology room is low.

Control measures

The solution chosen should have the lowest concentration compatible with the task to be performed. If corrosive bleach is ever needed, it must be handled while wearing a face shield and latex or nitrile gloves.

Powders can be handled wearing safety spectacles and gloves so long as care is taken to avoid raising dust. Access to bleaching tablets must be controlled if there is a possibility that one could be ingested.

In most cases, gloves alone will provide sufficient protection.

The release of chlorine is prevented if no acid materials are available.

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RESTRICTIONS	Pupils below under 16 **must not** be permitted to use bleach solutions or powders that are *corrosive*, though they may use diluted solutions, under supervision. Bleaches must not be mixed with other cleaning agents. If bleach containing sodium hypochlorite is mixed with acids, the toxic gas chlorine will be released but it may not always be possible to determine if other cleaners have acidic contents. **Therefore, under no circumstances must bleach be mixed with, stored near, or used at the same time as, any other cleaning agent.**
Disposal	Used or surplus bleach solutions can be diluted, greatly if they are initially concentrated, and flushed into the foul-water drain. See CLEAPSS guidance leaflet PS 31, *Disposal of Waste in Design & Technology* for discussion of regulations.
Storage	All bleaches should be stored away from food areas and in a safe place (ie, behind a lock) so that they cannot be taken by pupils without permission and misused. However, they should not be stored in the same cupboard as acids. Discard any stock of liquid bleaches more than 2 years old since they lose their effectiveness in storage.
FURTHER INFORMATION	Bleaching powders contain oxidising agents; cloths used with the powder might ignite on drying out. To prevent this, all such cloths must be rinsed out thoroughly to remove traces of the powder after use.

IMMEDIATE REMEDIAL MEASURES

Swallowed	Give plenty of water and seek medical attention. Do not induce vomiting.
Bleach is in the eyes	Obtain medical attention. Irrigate immediately with water, holding eyelids apart and continue until the patient reaches hospital.
Chlorine is liberated and inhaled	Remove individual to fresh air and seek medical attention.
Bleach is spilt on the skin or clothes	Remove contaminated clothing. Wash affected area thoroughly with a large amount of water. If a large area is affected or blistering occurs, seek medical attention. Soak contaminated clothing and rinse repeatedly.

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2.004 COSHH Regs	Cleaning Agents: Detergents	Applicable to: Liquids and powders for washing clothes; Stain Devils	See also: 2.006

Process(es) covered: Clothes-washing detergents are designed to link grease and particulate dirt to water. They may also contain phosphates, enzymes and bleaches such as sodium perborate.
Pre-wash soaking agents and stain-removing agents may also contain sodium carbonate.

Hazards

Allergic reaction	Sensitisation and/or allergy may develop from exposure to enzymes (R36, 41, 42) included in some brands, ie, the 'biological' types.
Harmful	Sodium peroxoborate tetrahydrate (perborate) (R8, 36) is rated harmful by inhalation, skin contact and if swallowed.
Irritant	Agents containing sodium carbonate (R36) could be irritant to the skin. All detergents also remove natural oils from the skin leading to possible dryness, chafing and other dermatological problems.

Risk Assessment

Allergic reaction	All detergents, by their property of dissolving grease, tend to aggravate allergic reactions after contact with enzyme additives.
Harmful	Solid detergents containing sodium perborate could harm the skin but are unlikely to be inhaled or swallowed in schools.
Irritant	The risk of dermatological problems is real where detergents are used frequently, particularly in individuals with sensitive skin. Such effects may be aggravated by alkaline additives such as sodium carbonate.

Control measures

Although many detergent preparations are not classed as hazardous, it is strongly advised that all contact with the skin is avoided by wearing rubber gloves, particularly for individuals who are recognised as having sensitive, damaged or dry skin or where washing powders containing enzymes are used.
Powders with bleaching agents can be handled safely so long as care is taken to avoid raising dust.
Gloves alone will provide sufficient protection to control the irritant risk unless there is an additional risk of splashing, when eye protection is also needed.

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RESTRICTIONS

Disposal	Unwanted detergents can be put in the ordinary waste.
Storage	Detergents classed as ‘irritant’ should be stored in a safe place away from food areas.

IMMEDIATE REMEDIAL MEASURES

Swallowed	Give plenty of water and seek medical attention. Do not induce vomiting.
Alkaline detergent is in the eyes	Obtain medical attention. Irrigate immediately with water, holding eyelids apart and continue until the patient reaches hospital.
Ordinary detergent is in the eyes	Irrigate immediately with water, holding eyelids apart for at least 10 minutes. If pain or discomfort continues, obtain medical attention.
Irritant detergents are spilt on the skin or clothes	Remove contaminated clothing. Wash affected area thoroughly with a large amount of water. Soak contaminated clothing and rinse repeatedly.
Allergic reaction	If the patient shows anxiety, red, blotchy skin, swelling of the face and neck and puffiness around the eyes, they could be suffering from a serious allergic reaction. Call an ambulance and prop the patient in a sitting position in case breathing problems develop.

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2.005 COSHH Regs	Cleaning Agents: Solvents	Applicable to: dry cleaning techniques; specialist spot cleaners	See also: 2.006 2.012

Process(es) covered: Solvents may be used for removing stains from fabrics and in tests to determine their suitability for use with different synthetic fibres.
Substances which have been used in the past include:
methylated spirit; acetone or nail-varnish remover; carbon tetrachloride; 1,1,1-trichloroethane; white spirit (turpentine); perchloroethylene or tetrachloroethylene; tetrahydrofuran.

Hazards

Toxic	Tetrachloromethane (carbon tetrachloride) (Sk, R 11, 36/38, 48/23, 62, 63) is toxic by inhalation, skin contact and if swallowed.
Harmful	Solvents such as perchloroethylene, ie, tetrachloroethylene (1,1,2,2-tetrachloroethene) (R40, 51/53) and 1,1,1-trichloroethane (R20, 59) are rated as harmful.
Highly flammable	Some solvents, particularly ethanol (methylated spirit) (R11, 22), are highly flammable. See 2.012 for a full assessment.
Irritant	Propanone (acetone) (R11, 36, 66, 67), nail-varnish remover (often ethyl acetate R11, 36,66,67) and other cleaning solvents are irritant to the skin. They remove natural oils from the skin leading to dryness, chafing and other dermatological problems. Tetrahydrofuran is irritant to skin and eyes. Tetrahydrofuran can form explosive peroxides in storage but this will not be a problem unless the textiles are heated after cleaning with this substance.
Environmental impact	Many chlorinated solvents are harmful to the environment. Those that attack the ozone layer, eg, carbon tetrachloride and 1,1,1-trichloroethane, are no longer available. Others affect the aquatic environment, eg, perchloroethylene, and are still used.

Risk Assessment

Toxic	Carbon tetrachloride is too toxic to use.
Harmful	Perchloroethylene (WEL 689 mg/m^3 15 min ref. period) and 1,1,1-trichloroethane (WEL 1110 mg/m^3 15 min ref. period) could be used in small quantities with little risk but see below.
Irritant	All grease solvents lead to possible dryness, chafing and other dermatological problems, particularly in individuals with sensitive skin.
Environmental impact	'Ozone depleters' must not be used now because the risk to the environment is considered too high.

Control measures

Any stocks of unusable solvents must be disposed of responsibly. Advice should be sought from the science department or direct from CLEAPSS.
Ordinary room ventilation will deal adequately with vapours from small amounts of dry-cleaning solvents.
Rubber gloves will provide sufficient protection to control the irritant risk unless there is an additional risk of splashing, when eye protection is also needed.

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RESTRICTIONS	Solvent abuse. Strict control over the use of solvents should be enforced to ensure that the deliberate inhalation of vapour does not take place. Methanol (which is much cheaper than ethanol) must **not** be used in place of methylated spirit: due to the increased toxicity.
Disposal	Waste solvents, including emptied containers, must be transported to a domestic recycling or disposal site. Large quantities and all ozone depleters require collection by an authorised waste disposal contractor. (See CLEAPSS guidance leaflet PS 31, *Disposal of Waste in Design & Technology*.)
Storage	Secure storage is necessary for all 'sniffable' solvents. These solvents should be stored in sealed containers, in a dry place, within the temperature range of 5 to 30 °C and well away from sources of ignition such as sparks, pilot lights and other naked flames, in a highly flammable liquids cupboard if the containers are bigger than 500 ml.

FURTHER INFORMATION

Of all the cleaning solvents, white spirit is considered the least hazardous.

IMMEDIATE REMEDIAL MEASURES

Solvents are swallowed	DO NOT INDUCE VOMITING. Seek medical attention.
Vapour is inhaled	Remove patient to fresh air and seek medical attention.
Solvent is splashed into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Effects on skin	Repeated and prolonged contact with the skin may cause removal of natural greases, resulting in dryness, cracking and possible dermatitis. Wash with mild antiseptic and apply moisturising cream.
Spilt in workplace	Remove all sources of ignition and ventilate the area thoroughly. Cover the spill with sand or mineral cat litter, pick up the resultant paste with spark-proof tools and place in a sealable, metal container. Store safely pending disposal.

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2.006 Man Regs	Cleaning Fabrics	Applicable to: dry cleaning; hand washing; machine washing; pre-wash soaking; spot cleaning	See also: 2.003 2.004 2.005

Process(es) covered:

The removal of grease and dirt with soaps, detergent powders and liquids.
Stain removal by treatment of the whole garment or just the stained area with solvents, bleaches and enzymes.
Drying the cleaned fabrics.

Hazards

Chemicals	See the appropriate sheets for bleaches, detergents and solvents, and hazards to unprotected hands.
Injury to children	Small children have been known to hide in washing machines or tumble-dryers and have been injured when the machine was started.
Entanglement	All rotating machinery, such as washing machines or tumble-dryers, presents the possibility of entanglement or injury.
Solvent leaks and spills	Dry-cleaning equipment includes provision for recirculation of the solvent and leaks are possible. Some spot-cleaning preparations contain hazardous solvents and bottles may break or leak. Secure storage is required and solvents rated as 'highly flammable' should be stored in suitable lockable metal cupboards.

Risk Assessment

Injury to children	Although children in secondary schools and colleges should be too large to hide in machines, cleaners have brought in children during their work and have left them unsupervised at times. The risk of this happening in educational establishments is low but it happens at home.
Entanglement	Machines used for washing domestic items usually have interlocks that prevent high-speed operation unless the access door is closed. This makes the risk of entanglement and injury trivial.
Solvent leaks and spills	Although leaks have been reported as the cause of adverse effects on staff, this is not a major concern. Some solvents are highly flammable and should not be used near naked flames or hot plates.

Control measures

Anyone using laundry equipment should check before closing it that there is nothing in the machine other than the items that should be there.
Risks from both entanglement and solvent leaks are controlled by regular and adequate maintenance procedures.
The use of spot cleaners will release little vapour and general ventilation should be adequate. Any work with commercial dry cleaning equipment will require a proper ventilation system.

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RESTRICTIONS

Movement	Washing machines are very heavy and relocation should be done only by trained persons with suitable manual handling equipment.

FURTHER INFORMATION

Although it is possible to select the wrong program for washing or drying fabrics and so to damage the fabric or garment, such errors do not present hazards to the health and safety of the persons present.

Because serious injuries have occurred with washing and drying machines, possibly when interlocks have failed, these machines must be included in the planned annual maintenance programme.

IMMEDIATE REMEDIAL MEASURES

Bruising	Raise and support the injured part and apply a cold compress. If internal injury is suspected, seek medical aid.
Serious injuries	Obtain medical aid. Lower the casualty to the floor and raise the wound as high as possible. Comfort and reassure the casualty until help arrives. **Protect yourself from contamination by blood**.
Effects of solvents on skin	Repeated and prolonged contact with the skin may cause removal of natural greases, resulting in dryness, cracking and possible dermatitis. Wash with mild antiseptic and apply moisturising cream.
Sufficient vapour is inhaled to produce drowsiness	Remove casualty to fresh air and seek medical attention.

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2.007 Man Regs	Cutting with Scissors, Scalpels and Craft Knives	Applicable to: craft knives & mats; scalpels; scissors (hand & powered)	See also: 1.011

Process(es) covered: The use of scissors for cutting fabrics, paper and boards.
The use of craft knives and scalpels with and without cutting mats.

Hazards

Cuts to user — Craft knives and scissors (whether powered or not) can cut fingers.

Injury when carried — Knives and scissors can injure the user or others when being carried or as a result of misbehaviour in the workplace.

Risk Assessment

Cuts to user — Cuts are received from craft knives by slicing when cutting along a straight edge or template or when the knife slips out of the material.
Cuts also result from changing blades in scalpels and craft knives, particularly the type with snap-off blades.
Scissors, particularly the fine-pointed, embroidery type, can nick the skin if used carelessly; however, this is a trivial risk since the resulting injury is very minor and it happens infrequently.

Injury when carried — There is a real risk of injury if scissors or knives are carried with the blade exposed. This risk is increased where desks / tables are close together or where bags on the floor give a risk of tripping.

Control measures

The use of a cutting mat greatly reduces the risk of cuts from craft knives. The mat reduces the risk of the work slipping and of loss of control of the knife when the end of the cut is reached.
The use of steel ‘safety rules’ reduces the risk of slicing fingers and the hand holding the material should always be behind the direction of cutting.
It is necessary to teach how to use craft knives properly and the safe ways to change blades.
Craft knives with retractable or rotary blades are safer to carry than those with open ones, however, it may be wise to distribute knives directly from box to user.
Children must be taught how to carry scissors safely with the blades enclosed by the fist.
Clear instructions must be given to ensure the circulation space is kept clear of obstructions.

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RESTRICTIONS	With most KS 3 classes, blade changing should be restricted to adults. This is especially true of the 'snap-off' type. With some classes, it may be necessary to restrict the use of craft knives to an inherently safe type.
Disposal	Used blades must be disposed of responsibly. A small 'sharps box' as used in first-aid rooms could be used.
Storage	Scissors and knives must be stored in a secure place to control access. It is important to ensure that pins, needles, scissors, knives and other small items of equipment are collected in after use since they could constitute a hazard if removed by children or if left on tables, chairs or on the floor.

FURTHER INFORMATION

Battery-powered scissors (eg, Pifco Speedcut) may be safer than ordinary ones because the opening of the blades is small and the length of exposed blade is short. They may also help children with certain physical disabilities.
Teachers should be aware that some pupils may attempt to do self-harm using scissors and/or craft knives.

IMMEDIATE REMEDIAL MEASURES

Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Severe cuts	Send for a first aider. Apply pressure on or as close to the cut as possible, using fingers or a pad of clean cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. **Protect yourself from contamination by blood**.

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2.008 COSHH & Man Regs	Distressing fabrics	Applicable to: heat pens; pyrography tools	See also:

Process(es) covered: Using heat, either from a pyrography tool or heat gun to distress the surface of fabrics to create an aesthetic effect.

Hazards

Burns	Burns are a hazard and may be caused by tools resembling soldering irons or heat guns.
Fire	Although some fabrics will melt or smoulder, the greatest hazards come from handling highly flammable materials.
Irritant	Fumes from some fabrics can be a respiratory irritant.

Risk Assessment

Burns	Heat guns are more likely to give rise to accidental burns than pyrography tools because the hot air from a gun is less obvious than the hot bit of a tool.
Fire	The temperatures involved are unlikely to cause most fabrics to ignite but it is possible for this to happen to some synthetics (see *Appendix 1*).
Irritant	Fumes from some fabrics especially those of a synthetic origin can be an irritant.

Control measures

If heat guns are used, close supervision is required.

Naked flames, such as those from a blowtorch, must not be used for this process.

Should clothing that is being worn catch fire, staff must be aware of the appropriate immediate remedial measure.

This activity should have close supervision and should be done in a dedicated clear area with a heat resistant mat and fire blanket nearby. There should be good ventilation.

Control exposure time to avoid overheating and build-up of fumes. Staff or pupils with asthma or other breathing difficulties should consider avoiding this activity.

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RESTRICTIONS	This type of work should only be done by year 12 or 13 students who should have close supervision at all times.

IMMEDIATE REMEDIAL MEASURES

Burns	Cool the affected area under gently running water until first aid arrives
Fire	Small fires of fabrics or solvents are most easily controlled by covering them with a fire blanket or damp cloth. Clothing on fire: Smother by pushing the casualty to the ground, flames on top, and spread a thick cloth or garment over the burning material.
Smoke or fumes are inhaled	Remove from exposure. Keep warm and at rest. Obtain medical attention.

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2.009 COSHH Regs	Dyes and Mordants	Applicable to: alum & ferrous sulfate, etc; natural dyes; reactive dyes	See also: 2.015

Process(es) covered:

Cold water dyes: Textiles may be prepared in one of several ways and then left to soak in a room-temperature dye bath.

Hot water dyes: Quicker results can be achieved by using a hot dye bath but this is not possible when wax is used to create a pattern.

Dyeing with mordants: Some fabrics must be pretreated with a mordant to make the coloured dye stick to the fibres, eg, alum, ferrous sulfate, tin(II) chloride, potassium dichromate.

Hazards

Toxic

Some dyes are suspected as cancer-causing agents. They are now labelled Toxic. Potassium dichromate(VI) (Carc, R8, 21, 25, 26, 34, 42/43, 45, 46, 48/23, 50/53, 60, 61) is carcinogenic by inhalation (of the dust) and toxic if swallowed.

Harmful

Some mordants, including iron(II) (ferrous) sulfate (R22) and tin(II) (stannous) chloride (R21/22, 36/37/38) are harmful if swallowed.

Irritant

Some dyes, eg, Disperse Yellow 7, (R36/37/38) and dye fixatives, eg, containing sodium silicate, and mordant solutions containing more than 7% potassium dichromate(VI) are irritant to the skin.

Allergic reaction

Certain reactive dyes have been identified as giving rise to allergy and/or sensitisation. Potassium dichromate(VI) solutions (> 0.5%) may cause sensitisation.

Risk Assessment

Toxic

Warnings on dyes suspected to be carcinogenic have usually arisen from data obtained in studies on laboratory animals given very high doses. If such dyes are used with the care normally taken when handling chemicals, there should be no reason to worry about long-term adverse effects on human health. However, potassium dichromate dust presents a risk that must be controlled (WEL 0.15 mg/m^3 15 min ref period).

Harmful

Iron(II) (ferrous) sulfate has an WEL of 2 mg/m^3 15 min ref period. Tin(II) chloride has an WEL of 4 mg/m^3 (15 min ref period)[71]. When solutions are being used as mordants, they are unlikely to give rise to spray at these concentrations but there could be a problem when preparing solutions.

Irritant

Several of these solutions could have an effect on sensitive skin, particularly solutions of tin(II) chloride and potassium dichromate(VI) used as mordants (1%).

Allergic reaction

In some cases, an individual may become sensitised to a dyestuff so that the briefest subsequent exposure will trigger an immune response (sensitisation). Contact can be through inhalation, ingestion or skin absorption. Certain very reactive dyes, eg, Procion Yellow MX-8G, are more likely than others to trigger a response. The hazard is greatest when handling the solid dye; solutions are much safer.

Control measures

All solid dyes should be handled with care. Containers of toxic materials should be opened and the solid weighed out in a laboratory fume cupboard; once covered with water the risk becomes minimal. Gloves and eye protection should be worn.

When using dyes, fixers and mordants that are irritant, the eyes should be protected with safety spectacles from the risk of splashes and dust. It is best if the Procion MX range of dyes is avoided; Procion HE dyes are safer. In most cases, gloves alone will provide sufficient protection from irritation.

When handling mordant solutions and reactive dyes in solid form, rubber gloves will usually provide sufficient protection from sensitisation. If Procion MX dyes are used, they should be handled in the science department fume cupboard.

[71] EH 40/2005

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RESTRICTIONS

It is best if pupils handle dyes in solution rather than as solids. If powdered dyes must be employed, they **should not be used below Year 9**, and then only with **close supervision below Year 12**. Pupils should **not** be allowed to handle the powder of very reactive dyes, such as Procion Yellow MX-8G.

Disposal

Small quantities (ie, typical of domestic use) of unwanted dyes are best made into solutions and flushed away. Large quantities are best disposed of by an authorised waste contractor.

Storage

All dyes, fixers and mordants should be kept away from food areas in a secure place. It may be sensible to store mordant chemicals along with similar substances in the science department. Potassium dichromate(VI) and its solutions are oxidising agents which will assist fire; store them away from flammable and other combustible materials.

FURTHER INFORMATION

Many of the dyes used for work with fabrics in textiles have been produced so that they do not pose a significant risk to most users, though they should nevertheless be handled with care. Some mordants, such as alum (aluminium potassium sulfate), are not classified as hazardous.

It is not possible to advise which mordants to use with which natural dyes on which fabrics but this could form an interesting investigation.

IMMEDIATE REMEDIAL MEASURES

Swallowed	Give plenty of water and seek medical attention. Do not induce vomiting.
Dye or mordant is in the eyes	Obtain medical attention. Irrigate immediately with water, holding eyelids apart and continue until the patient reaches hospital.
Spilt on the skin or clothes	Remove contaminated clothing. Wash affected area thoroughly with a large amount of water. If a large area of skin is affected, seek medical attention. Soak contaminated clothing and rinse repeatedly.
Allergic reaction	If the patient shows anxiety, red, blotchy skin, swelling of the face and neck and puffiness around the eyes, they could be suffering from a serious allergic reaction. Call an ambulance and prop the patient in a sitting position in case breathing problems develop.

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2.010 Man Regs	FABRIC IDENTIFICATION: Activities	Applicable to: acid / alkali tests; burning tests; constituent tests; solvent tests	See also: 2.011 2.012

Process(es) covered: Burning tests on very small samples.
Chemical tests of fabrics, yarns and threads using the reagents listed below. This activity is suitable for advanced classes only.

Hazards

Chemicals See sheets 2.011 and 2.012 for the hazards of these substances.

Lack of experience Pupils and students necessarily lack knowledge and experience which leads inevitably to hazards when handling chemicals.
Some staff may also lack experience in activities on this topic and facilities, eg fume cupboards, may not be available.

Flammability Deliberately setting fire to samples of materials produces the possibility of larger fires.

Risk Assessment

Lack of experience The qualifications and experience of both teaching and technical staff form an essential part of the assessment of the risks, particularly in this activity.

Flammability If the location used for flammability tests is close to other flammable materials, the risk of causing larger fires is significant.

Control measures

Training of two distinct types may be needed:

1. basic instruction on safe use of chemicals;
2. practice on the tests to be performed (which could be in-house).

It is necessary to separate flammability testing from other activities and confine all the tests to small samples, using correct equipment and in appropriate surroundings such as using a fume cupboard.

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RESTRICTIONS	Students should not prepare the test solutions from concentrated stock; this work is appropriate for a trained technician. Fibre investigation tests (as outlined above) **should not** be carried out by students under 14yrs old. Students under 16s **should not** carry out tests with corrosive chemicals.
Disposal	Samples of fabrics should be allowed to dry (to eliminate solvents) and then rinsed with water, placed in a plastic bag and then added to the solid waste.

FURTHER INFORMATION

The following burning tests are envisaged.

Using a few threads or not more than a 1 cm square of fabric (not PVC) held in tongs, put the sample into a small flame to see whether or not it ignites, then answer the questions below.

Does the material continue to burn when withdrawn from the flame and does it melt?
Is the smoke sooty or not?
Do the fumes smell acrid, of burning paper, of singed feathers, of singed hair or of vinegar?
How do the fumes affect damp red and blue litmus paper? (NB Difficult to obtain a result!)
What is the colour and nature of the ash: is it powdery, easily crushed beads or hard beads?

The results to be expected with different fibres are listed in *Appendix 1*.

The following chemical tests are envisaged. See sheets 2.011 and 2.012 for the hazards of the chemicals.

Test for cellulose	Prepare a 0.01 M solution of iodine in potassium iodide (CLEAPSS *Recipe Card* 39) and a concentrated solution of zinc chloride by dissolving 13.6 g in 10 ml of water. Choose a light-coloured fabric for this test. Test the fabric with a drop of the iodine solution. If it goes blue, starch is present which must be washed out before the test for cellulose. Add a few drops of iodine to 1 ml of the zinc chloride solution in a test tube. Agitate it gently and put a few drops on the fabric. If it now goes blue, cellulose is present.
Test for nitrogen	Place a 1 cm square of fabric in the bottom of a test tube and just cover it with soda lime. Heat gently; if nitrogen is present, ammonia is produced and is detected with damp red litmus paper, which turns blue. The test must be conducted in a well-ventilated area and no attempt should be made to inhale the fumes as they are given off.
Test for protein	Shred a 1 cm square of fabric, ideally of pale colour, and push the bits to the bottom of a test tube. Carefully add about 1 ml of concentrated nitric acid. Warm the tube gently over a flame for a few minutes and then cool it by holding the closed end under a slowly running cold tap. Add about 1 ml of 2 M ammonia solution (CLEAPSS *Recipe Card* 4). A deep yellow colour that goes bright orange when the ammonia is added shows the presence of protein.
Test for sulfur	Prepare some 2 M sodium hydroxide solution (CLEAPSS *Recipe Card* 65) and lead(II) ethanoate solution by dissolving 32 g in 100 ml of water. Take a few light-coloured threads and push them to the bottom of a test tube. Add about 3 ml of the sodium hydroxide solution and heat. Cool under a cold tap, add a few drops of lead ethanoate solution. A black or dark brown colour indicates sulfur.
Effect of acetone	Use a sample of fabric about 1 cm square in a test tube. Cover it with propanone (acetone) and leave for 10 minutes, agitating occasionally. Acetate rayon dissolves.
Effect of dichloromethane	Test as above with dichloromethane (instead of chloroform). Tricel dissolves.
Effect of dilute acid	Use 1 M hydrochloric acid (CLEAPSS *Recipe Card* 31).
Effect of dilute alkali	Use 2 M sodium hydroxide solution (CLEAPSS *Recipe Card* 65).
Effect of undiluted bleach	Use commercial bleach, straight from the bottle.

The results to be expected with different fibres are listed in *Appendix 2*.

IMMEDIATE REMEDIAL MEASURES

These chemicals are swallowed	Give plenty of water and seek medical attention. Do not induce vomiting.
Soda lime or sodium hydroxide is in the eyes	Obtain medical attention. Irrigate immediately with water, holding eyelids apart and continue until the patient reaches hospital.
Much vapour is inhaled	Remove individual to fresh air and seek medical attention.
Spilt on the skin or clothes	Remove contaminated clothing. Wash affected area thoroughly with a large amount of water. If a large area of skin is affected, seek medical attention. Soak contaminated clothing and rinse repeatedly.

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2.011 COSHH & Lead at Work Regs	FABRIC IDENTIFICATION: Chemicals	Applicable to: the chemicals on sheet 2.008	See also: 2.003 2.010 2.012

Process(es) covered: A variety of chemical tests may be performed to identify the nature of fibres, eg, the substances present in them, such as cellulose or protein. Some tests involve the use of solvents in testing for synthetic fibres.

Hazards

Toxic The lead(II) ethanoate (acetate) solution (R40, 61, 62), used in the test for sulfur, is toxic, as is the ammonia (R10, 23, 34, 50) given off in the test for nitrogen.

Corrosive Many chemicals used in these tests are corrosive:
hydrochloric acid (25%) (R34, 37), concentrated nitric acid (70%) (R8, 35), soda lime (R34), sodium hydroxide (2M) (R35) and zinc chloride (R22, 34, 50/53).

Harmful Iodine solution (R20/21, 50), used in the test for cellulose, and dichloromethane (methylene chloride) (R40), used to distinguish between acetate rayon and tri-acetate rayon are harmful.

Irritant Propanone (acetone) and ethyl acetate (R11, 36, 66, 67), either of which may be used to identify acetate rayon, are both irritant to eyes, skin and respiratory system.
Sodium chlorate(I) (hypochlorite) bleaches (R31, 34) are irritant to the eyes and skin, see sheet 2.004.

Highly flammable Propanone (acetone) is highly flammable, see 2.012.

Risk Assessment

Toxic Lead(II) acetate solution is subject to the *Control of Lead at Work Regulations* which limit the maximum exposure to 0.15 mg/m^3 (8 h TWA). This limit should not be reached when using a few drops of this solution.
So long as small samples are used for the nitrogen test, the amount of ammonia released will be small.

Corrosive The WEL values for these substances (15 min ref period) are:
hydrochloric acid (25% or 6.9 M) 8 mg/m^3, conc nitric acid (70%) 2.6 mg/m^3, soda lime and sodium hydroxide as hydroxide mist 2 mg/m^3, zinc chloride 2 mg/m^3 [72].
Clearly the risks of handling these substances are similar to those in an advanced chemistry laboratory.

Harmful Iodine has an WEL of 0.1 ppm (15 min ref period)[1] but this refers to the vapour which is not produced by a solution of iodine in potassium iodide. Dichloromethane has a WEL of 300 ppm (15 min ref period) but, even with 15 students carrying out small-scale tests, the vapour would not approach this concentration.

Irritant Propanone has an WEL of 1500 ppm (15 min ref period)[1] and the value for ethyl acetate is 400 ppm so neither of these presents a significant risk as vapours but will degrease the skin.

Control measures

All testing should be done in an appropriate environment with the correct equipment.
Goggles should be worn when using toxic solutions with dropping pipettes.
The corrosive solutions would be best handled in a laboratory where goggles should be worn to protect the eyes. Face shields would be better for preparing the solutions.
Safety spectacles and gloves should be worn when handling acetone or ethyl acetate.

[72] EH 40/2005

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RESTRICTIONS

If these tests are considered relevant to courses followed by students under 16, they should be demonstrated by the teacher. Students under 16 **should not** carry out tests with corrosive chemicals unless laboratory facilities are available to them.
The chemicals should be used only for the tests described on the *Fabric Identification: Activities* sheet (2.010) since violent reactions can occur if they are mixed in other ways.
Many of the tests that may be contemplated involve a high level of risk; they must not be carried out unless adequate facilities are available for working with chemicals and all people concerned are fully aware of the risks, the precautions required and the action to take in the event of accidents.
Some books recommend the use of chloroform to distinguish between acetate rayon and tri-acetate rayon. Trichloromethane (chloroform) is considered too hazardous to use for this purpose and dichloro-methane is used instead.

Disposal

Small quantities of these chemicals can be disposed of by the methods described on the CLEAPSS *Hazcards* (held by the science department). Large quantities must be removed by an authorised waste disposal contractor.

Storage

These chemicals and prepared solutions should be stored in a locked and ventilated store, away from food. Concentrated acids and the zinc chloride solution are best stored with the bottle in an outer container with soda lime between the two.
Commercial bleach [sodium chlorate(I) or hypochlorite] is often (but not always) so dilute that it does not warrant a hazard rating; it should not be kept next to the acids whether marked irritant or not.

FURTHER INFORMATION

Particular care must be observed when solutions are prepared for the tests. This will involve handling chemicals in their most hazardous form before they are diluted.
When making up solutions of acids, **always add the acid to water** and not the other way round; much heat is produced (also when adding sodium hydroxide to water).
Solutions should be made by a science technician and the facilities of the science department may be helpful when conducting the tests.

IMMEDIATE REMEDIAL MEASURES

These chemicals are swallowed	Give plenty of water and seek medical attention. Do not induce vomiting.
Soda lime or sodium hydroxide is in the eyes	Obtain medical attention. Irrigate immediately with water, holding eyelids apart and continue until the patient reaches hospital.
Much vapour is inhaled	Remove individual to fresh air and seek medical attention.
Spilt on the skin or clothes	Remove contaminated clothing. Wash affected area thoroughly with a large amount of water. If a large area of skin is affected, seek medical attention. Soak contaminated clothing and rinse repeatedly.

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2.012 Mainly Man Regs	FLAMMABLE Substances: Liquids	Applicable to: acetone; methylated spirit; molten wax; white spirit	See also: 2.002 2.005 2.006 2.010 2.011 2.013

Process(es) covered: In 'Batik' work, molten wax is applied to fabrics before dyeing them.
Some chemicals used in identifying and cleaning fabrics are highly flammable, eg, methylated spirit and acetone.

Hazards

Fire	Molten wax and fabrics, accidentally ignited, cause fires. If a flammable solvent is used, eg, methylated spirit (ethanol) or propanone (acetone), flammable or explosive vapour-air mixtures may form.
Burning and scalding	Burning molten wax and flammable chemicals in contact with the skin may cause burns or scalds.
Irritant	Some individuals will have skin that is sensitive to some cleaning solvents.
Electric shock	Electrically-heated Wax kettles or Batik pots present a hazard of electric shock.

Risk Assessment

Fire	Wax will not ignite until its temperature is above that of boiling water unless a wick is formed.
Burning and scalding	The greatest risks come from handling highly flammable cleaning materials. Should clothing that is being worn catch fire, staff must be aware of the appropriate immediate remedial measure. Wax kettles or Batik pots present a scalding risk from both hot water and hot wax, particularly electrically-heated types with trailing leads.
Irritant	It is difficult to identify in advance which individuals will have sensitive skin. White spirit is considered the least hazardous.
Electric shock	As with other portable electrical appliances, the major risks arise from damage and neglect.

Control measures

When highly flammable materials are in use, there should be no naked flames in the room, including pilot lights in gas water heaters.
The precaution taken to minimise the fire risk from solvents will also control scalding.
Wax kettles or Batik pots must be moved by their handles or with heat-proof gloves.
Power cables must be positioned to minimise the risk of pulling them over.
For several materials, it will be necessary to protect the hands by wearing gloves but, because of the difficulty of identifying individuals with sensitive skin, this is also desirable even when using agents for which such protection is not demanded.
Regular inspection and testing reduces the risk of electric shock to a very low level.

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RESTRICTIONS	Solvent abuse. Strict control over the use and storage of solvent-based products should be enforced to ensure that the deliberate inhalation of vapour does not take place.
Disposal	Waste solvents, including emptied containers, must be transported to a domestic recycling or disposal site. Large quantities require collection by an authorised waste disposal contractor. (See CLEAPSS guidance leaflet PS 31, *Disposal of Waste in Design & Technology*.)
Storage	A few bottles of highly flammable chemicals such as acetone or methylated spirit may be kept 'ready for use' in bottles not larger than 500 ml. Liquids such as turpentine or turpentine substitute (white spirit) are only flammable and are not subject to restrictions. All cleaning agents containing hazardous substances must be securely stored appropriately, away from food areas, so that they cannot be misused. It is important to ensure that aerosol cans are stored away from sources of heat (ie, at temperatures below 50 °C).

FURTHER INFORMATION

The molten wax can be transferred to the fabric either with a brush or with a 'tjanting'. The wax sets quickly on a brush so only simple designs can be created by this method. The tjanting, having a small metal cup that can be warmed, allows the wax to be kept molten longer, and so more complex designs can be created.
The *Regulatory Reform (Fire Safety) Order* 2005 requires the employer to make a fire risk assessment. This must cover the use of the rooms as well as fire escape routes, etc. So, if the materials used in a room change, the fire risk assessment may need revision and the attention of school or college management may need to be drawn to this need.

IMMEDIATE REMEDIAL MEASURES

In case of fire	Small fires of fabrics or solvents are most easily controlled by covering them with a fire blanket or damp cloth.
Clothing on fire	Smother by pushing the casualty to the ground, flames on top, and spread a thick cloth or garment over the burning material.
Smoke or fumes are inhaled	Remove from exposure. Keep warm and at rest. Obtain medical attention.
Burns	Cool the affected area under gently running water until first aid arrives.
Chemicals are swallowed	Give plenty of water and seek medical attention. Do not induce vomiting.
Effects of solvents on skin	Repeated and prolonged contact with the skin may cause removal of natural greases, resulting in dryness, cracking and possible dermatitis. Wash with mild antiseptic and apply moisturising cream.

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2.013 Man Regs	FLAMMABLE Substances: Non-Liquids	Applicable to: cotton; paper; polyurethane; PVC; rayons	See also: 2.002 2.005 2.010 2.011 2.012

Process(es) covered: In any use of compliant materials (paper, dress and upholstery fabrics, etc) they may burn rapidly if accidentally ignited by a naked flame and the fumes and smoke produced, particularly from synthetic materials, may be an additional hazard.

Hazards

Fire — Fires may be caused by accidentally ignited fabrics.

Toxic — With synthetic fibres and plastics, thermal decomposition may evolve toxic vapours in the smoke.

Burning — Burning fabrics, in contact with the skin, may cause burns.

Risk Assessment

Fire — The Regulations and Standards for fire safety referred to below will identify those with high risks but polyester wadding presents a particular risk.

Toxic — PVC and polyurethane foam are the two worst materials. If either of these materials is used, fire precautions must be good.

Burning — The greatest risks come from handling highly flammable cleaning materials. Should clothing that is being worn catch fire, staff must be aware of the appropriate immediate remedial measure.

Control measures

When highly flammable materials are in use, there should be no naked flames in the room.
Polyurethane foam should never be used in teaching about compliant materials.
When PVC or PVC-coated fabric is used, it must never be heated above 150 °C.
Flammable materials must be kept away from sources of ignition. Constant vigilance is required, particularly over waste. (See *Disposal* overleaf.)

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Disposal	Fabric scraps should be removed from the floor and all surfaces cleared at the end of each lesson to ensure that loose fabric and fibres cannot accumulate and constitute a fire risk. Waste bins in textile areas should be emptied regularly - at least daily.
Storage	Fabric scraps should be stored in bins or other secure containers with a lid; polyester wadding is a particular fire hazard and is best kept in a secure cupboard.

FURTHER INFORMATION

Safe use of fabrics

The materials that can be used in the manufacture of night dresses, furniture and furnishings are controlled by the *Nightware (Safety) Regulations* 1985 (S1 1985/2043) with amendment (SI 1987/286) and the *Furniture and Furnishings (Fire Safety) Regulations* 1988 (SI 1988/1324) with amendment (SI 1989/2358), designed to reduce the incidence of fires and burns caused by unsuitable materials. **Every teacher involved in work with textiles should have access to these Regulations**[73] **to ensure that no garment or item of furnishing / upholstery is made in school in contravention of the Regulations.**

Several British Standards[74] are also relevant for the safe use of fabrics: BS 5722 (*Specification for flammability performance of fabrics and fabric combinations used in nightwear garments*), BS 5867 Part 2 *(Specification for fabrics for curtains or drapes - Flammability requirements*) and BS 5438 (*Methods of test for flammability of textile fabrics*). If toys are being made, it would also be sensible to consult BS EN 71-2, *Safety of Toys - Flammability*.

The *Regulatory Reform (Fire Safety) Order* 2005 requires the employer to make a fire risk assessment. This must cover the use of the rooms as well as fire escape routes etc. So, if the materials used in a room change, the fire risk assessment may need revision and the attention of school or college management may need to be drawn to this need.

IMMEDIATE REMEDIAL MEASURES

In case of fire	Small fires of fabrics or solvents are most easily controlled by covering them with a fire blanket or damp cloth.
Clothing on fire	Smother by pushing the casualty to the ground, flames on top, and spread a thick cloth or garment over the burning material.
Smoke or fumes are inhaled	Remove from exposure. Keep warm and at rest. Obtain medical attention.
Burns	Cool the affected area under gently running water until first aid arrives.
Chemicals are swallowed	Give plenty of water and seek medical attention. Do not induce vomiting.
Effects of solvents on skin	Repeated and prolonged contact with the skin may cause removal of natural greases, resulting in dryness, cracking and possible dermatitis. Wash with mild antiseptic and apply moisturising cream.

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73 Statutory Instruments are available from The Stationery Office Ltd, The Publications Centre, PO Box 29, Norwich NR3 1SN. Tel 0870 600 5522, Fax 0870 600 5533.

74 British Standards Institution: BS 5722 (1991) ISBN 0580196097; BS 5867-1:2004 ISBN 0580439011;
BS 5438 (1989) ISBN 0580173410. Available from Customer Services, BSI, 389 Chiswick High Road, London W4 4AL. Tel 020 8996 9001, Fax 020 8996 7001 or from www.standardsuk.com.

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2.014 Man Regs	Heat Presses	Applicable to: dye sublimation printing	See also:

Process(es) covered: Application of digital images onto synthetic fabrics. Images can also be applied to polyester-coated wood, metal, plastics and ceramics. A heat press is used to transfer an image from sublimation paper onto the chosen material. This is usually done onto flat material but presses are available that will transfer the image onto ceramic mugs.

Hazards

Burns	The soleplate of the press can be hot enough to burn flesh.
Tripping	The mains cord presents a possible tripping hazard with a further hazard presented by the falling press.
Electric shock	The mains cord can be subject to wear and may present a shock hazard.
Trapping	Fingers or hands can be trapped between the two platens of the press.

Risk Assessment

Burns	Minor burns are possible if care is not taken. However, the casualty is very unlikely to require more than immediate remedial aid.
Tripping	The risk of tripping depends much more on the location of the socket outlets relative to the position of the heat press than on anything else. This is a matter that has to be assessed locally. A falling heat press could cause a foot injury.
Electric shock	The rate of wear is unlikely to cause a significant risk but it may be possible to trap the power cable between the two platens.
Trapping	Trapping is a real hazard, either as a result of lack of care or by deliberate action.

Control measures

Clear instruction and an appropriate level of supervision should be sufficient to minimise the risks of burns and scalds.
Signage or labelling to indicate hot surfaces may be needed.
Careful arrangement of the heat press in relation to the socket outlets will minimise the risk of tripping.
An annual portable appliance test should be sufficient to avoid electric shock but it would be advisable to check the equipment at suitable intervals for damage to the power cable.
Students must be taught to handle the equipment to minimise finger trapping. Close supervision may be needed.

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RESTRICTIONS

An appropriate level of supervision should be in pace when heat presses are used.

Storage

Heat presses must be allowed to cool before being put away. The power cable may be damaged by winding it up too tightly.

FURTHER INFORMATION

Some designs of heat press may tip forward when pressure is applied to the operating handle. In such cases the press should be bolted to a suitable flat board which can be clamped to a bench.
It is advisable to store heat presses in a storeroom when not in use because of the risk of harm and deliberate trapping of a pupil's hand. If this is not possible then it may be necessary to devise a suitable locking device so that the handle cannot be moved or to make a suitable wooden cover that can be locked in place over the press.

IMMEDIATE REMEDIAL MEASURES

Burns and scalds	Cool the affected area under a running cold tap for 10 minutes.
Electric shock	Send for first aider immediately. Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply then use a broom handle or wooden window pole, or wear rubber gloves. If the casualty is unconscious and not breathing then check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a trained first aider does not arrive quickly and the pulse is absent then consider carrying out cardio-pulmonary resuscitation.

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2.015 COSHH Regs	Inks & Paints used with Textiles	Applicable to: marbling; screen printing	See also: 2.009 2.012

Process(es) covered:

As an alternative to dyes with mordants, a variety of pigments, paints or inks can be used. Some products contain small amounts of hazardous substances such as ammonia solution and glycol.

Some techniques involve hazardous substances, eg, marbling using paints with ethanol, turpentine or white spirit or DIY screen printing using ammonium dichromate.

Hazards

Very Toxic

Ammonium dichromate(VI) (bichromate) powder (Carc, R2, 8, 21, 25, 26, 34, 42/43, 45, 46, 48/23, 50/53, 60, 61) is very toxic by swallowing or by inhalation and may cause cancer. Its solutions are toxic if swallowed or absorbed through the skin.

Harmful

Methylated spirit, in both the clear industrial and the blue mineralised forms, is harmful by swallowing. Natural turpentine is harmful by inhalation, swallowing or through the skin. White spirit (turpentine substitute) and diethylene glycol (glycol), even in small quantities, are also harmful by swallowing.

Irritant

Ammonium dichromate and glycol are irritant to the eyes, skin and respiratory system.

Flammable or Highly flammable

Ethanol (methylated spirit), white spirit and turpentine used in marbling. See 2.012 for the risk assessment.

Risk Assessment

Very Toxic

Ammonium dichromate(VI) powder presents serious risks to the user
WEL 0.15 mg/m^3 15 min ref period.

Ammonium dichromate(VI) solutions, used as a sensitiser with photoemulsions in screen printing, also present serious risks.

Harmful

The hazardous substances contained in pigments, paints and inks are present in such small proportions that the risk is trivial.

The solvents used in marbling present a more significant risk if they could be swallowed. The narcotic effect of ethanol is well known (WEL 5760 mg/m^3 15 min ref period) and may result from inhalation of the vapour.

Irritant

Pigments containing glycol could cause skin irritation and the solvents could produce dermatitis from the 'defatting' effect.

The use of ammonium dichromate(VI) is highly irritant to the skin, eyes and respiratory tract. It has also produced allergic reactions by skin contact or inhalation.

Control measures

Ammonium dichromate(VI) powder must be handled in a fume cupboard. Eye protection must be worn when handling its solutions.

Work on textiles, using paints and inks and associated techniques such as marbling, must be carried out in a well-ventilated area.

Wearing gloves is obviously a sensible precaution to avoid contaminating the skin with paints and inks but such protection is *essential* with any irritant substances such as photoemulsion sensitiser.

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RESTRICTIONS	The use of ammonium dichromate should be restricted to those on advanced courses.
Disposal	An authorised waste disposal contractor should be used for solvents or solvent-based paints. Waste materials must be treated as a fire hazard and disposed of in accordance with regulations. See PS 31, *Disposal of Waste in Design & Technology*. Ammonium dichromate solutions are hazardous to the environment and must be treated before disposal via the foul-water drain. (See CLEAPSS *Hazcard 7* held in the Science Department.)
Storage	Solvents and solvent-based paints must be stored in a cool, dry, well-ventilated place, away from sources of ignition, in accordance with the requirements of the *Dangerous Substances & Explosive Atmospheres Regulations 2002*. Guidance from the HSE allows up to a total of 50 litres to be held in small containers in a fire-resisting 'highly-flammable liquids cupboard or bin'. Ammonium dichromate is attractive to students and must be stored in a secure place to prevent unauthorised use.
FURTHER INFORMATION	The Internet is a source of information on DIY screen-printing techniques that students may consult and then wish to try. See the warnings above on the use of ammonium dichromate.

IMMEDIATE REMEDIAL MEASURES

Paints are swallowed	DO NOT INDUCE VOMITING. Keep casualty at rest and obtain medical attention.
Ammonium dichromate is swallowed	Vomiting normally ensues. Wash out the mouth and then give the casualty a glass or two of water. Obtain medical attention.
Vapour from paints is inhaled	Remove casualty to fresh air. Keep warm and at rest. If breathing is irregular or has stopped, administer artificial resuscitation. Obtain medical attention.
Paint or ammonium dichromate solution is splashed into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. If discomfort continues then obtain medical attention.
Paints or solvents are on the skin	Remove contaminated clothing. Wash skin thoroughly with soap and water or use a proprietary skin cleanser. Do not use solvents as cleaning agents.
Ammonium dichromate is on the skin	Brush off as much solid as possible, taking care not to inhale the powder. Flood affected areas with large quantities of water. Remove contaminated clothing and rinse it repeatedly until no yellow colour remains in the water.
Highly-flammable liquids are spilt in the work room	Remove sources of ignition. Ventilate area. Contain and collect the spill with non-flammable absorbent material, eg, sand or mineral cat litter. Store safely pending disposal. Do not allow to enter drains.

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2.016 Man Regs	Ironing	Applicable to: dry irons; ironing boards; steam irons	See also:

Process(es) covered: Manual ironing with steam and dry irons.

Hazards

Burns	The soleplate of any iron can be hot enough to burn flesh.
Scalding	A steam iron could cause scalding from hot water sprays as well as from steam jets. A damp pressing cloth, immediately after use, could be hot enough to scald.
Tripping	The mains cord presents a possible tripping hazard with a further hazard presented by the falling iron.
Electric shock	The mains cord is subject to considerable wear and may present a shock hazard.
Trapping	Ironing boards may trap fingers or collapse onto feet if not erected correctly or if folded away inappropriately.

Risk Assessment

Burns	Minor burns are quite likely when students are learning to iron textiles, particularly if pupils are allowed to pass a hot iron from hand to hand. However, the casualty is very unlikely to require more than immediate remedial aid.
Scalding	Since the irons are designed for domestic use, the steam production is slow and the risks are again minor.
Tripping	The risk of tripping depends much more on the location of the socket outlets relative to the positions of the ironing boards than on anything else. This is a matter that has to be assessed locally. A falling iron could cause a foot injury.
Electric shock	The rate of wear and the severity of the harm makes this a significant risk.
Trapping	Some designs of ironing board are more prone to collapse or finger trapping than others.

Control measures

Clear instruction should be sufficient to minimise the risks of burns and scalds.

Careful arrangement of the ironing boards in relation to the socket outlets will minimise the risk of tripping.

Instruction may be needed to remind students to store equipment safely when not in use, allowing the iron to cool before being stored.

Electric irons should be inspected visually for wear to the power cord every time they are taken out for use. They may need a formal inspection more frequently than some other portable electric items.

Students must be taught to handle ironing boards to minimise finger trapping and to prevent collapse.

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RESTRICTIONS

Care must be taken at all times when ironing fabrics to ensure that students do not lean against ironing boards and they need to be taught to place hot irons on their ends on a suitable heat-proof surface during use. A 'HOT' warning sign is also advisable.

Storage

Irons must be allowed to cool before having the power cord wound around them and being put away. A major cause of damage to the cord is winding it up too tightly.

FURTHER INFORMATION

Choice of ironing equipment

The equipment used in a place of work is subject to the *Provision and Use of Work Equipment Regulations* and, as such, must be safe and suitable for the intended purpose. Ironing boards chosen for use in education must be stable, properly maintained and capable of secure fixing to guard against collapse during use. Consequently, the cheapest designs may not be 'safe and suitable'.

IMMEDIATE REMEDIAL MEASURES

Burns and scalds	Cool the affected area under a running cold tap for 10 minutes.
Electric shock	Send for first aider immediately. Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a trained first aider does not arrive quickly and the pulse is absent then consider carrying out cardio-pulmonary resuscitation.

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2.017 Man Regs	Knitting Machines	Applicable to: Hand and CNC knitting machines	See also:

Process(es) covered: Manually-operated knitting machines and those fitted with a power-drive accessory.

Hazards

Injury	Manually-operated knitting machines, which are operated enthusiastically, fall off the tables on which they are used onto the lap or feet of the user or other person nearby. The wires that tension the wool may also spring into the face of an unwary operator or observer.
Stabbing	Users can stab their fingers on the 'needles' (which must be threaded with wool before the knitting starts).
Entanglement	It is possible for hair to become entangled in the tension wires.
Upper limb disorder (RSI)	The operation of the machine is very repetitive and puts strain on the shoulder and upper arm possibly causing a repetitive strain injury.

Risk Assessment

Injury	The clamps provided with many machines will not fit onto some tables used in school textile technology areas. In this case, the risk of injury is high but the injury is still not likely to be serious. The risk of injury to the user from a spring tension wire is small but observers standing or sitting behind the machine may be more at risk.
Stabbing	Inexperienced users are quite likely to stab themselves once but the injury is not likely to be serious.
Entanglement	The tension wires vibrate vertically but will not pull the user into the mechanism by the hair. This presents a trivial risk.
Upper limb disorder (RSI)	It is unlikely that anyone in education will be using the machine for long enough on any one day to develop this injury but, in extended use, students or staff could be at risk.

Control measures

It is essential that knitting machines are clamped securely in use. It may be necessary to purchase tables specially for this purpose or to modify existing tables to allow the clamps to be fitted.

If observers stand behind the machine, a plastic safety screen or eye protection should be provided. In any case, the tension should be relaxed when the machine is not in use, taking care to control the movement of the tension wires when doing so.

Instruction in the setting-up of the machine should control the stabbing risk.

Staff should be aware of the risk of RSI and control the time spent using the machines.

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RESTRICTIONS	It is necessary to ensure that there is adequate space for the operation of the knitting machine and it may be advisable to restrict the position of observers. (See *Control Measures* above.)

FURTHER INFORMATION

Choice of knitting machines

The equipment used in a place of work is subject to the *Provision and Use of Work Equipment Regulations* and, as such, must be safe and suitable for the intended purpose. Knitting machines chosen for use in education must be capable of secure fixing to guard against them 'walking' to the edge of the table during use. Consequently, the cheapest designs may not meet the 'safe and suitable' criterion.

IMMEDIATE REMEDIAL MEASURES

Minor stabbing wounds	If wounds are minor, ie, of a sort which casualties would normally treat themselves, they should be washed clean and a small, sterilised dressing applied by the casualty.
Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Impact injury	Rest the injured part; apply ice to reduce the bruising and pain; attention from the trained first aider is required.

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2.018 Man Regs	Sewing Equipment: GENERAL-PURPOSE MACHINES	Applicable to: programmable or computer-controlled (CNC) machines; sewing machines and overlockers	See also: 2.019

Process(es) covered: Setting up and using electrically-driven sewing machines including computer controlled sewing machines.

Hazards	
Manual handling	Carrying and lifting a sewing machine presents a hazard of lower back injury.
Electric shock	Making connections and changing lamps can introduce electric shock hazards.
Stabbing	The needle can pass through a finger including the nail.
Flying needle parts	If a needle breaks in use, fragments can fly into the face and eye of the operator.
Tripping	This hazard can arise from trailing mains cords.
Entanglement	Hair, clothing and fingers can become caught up in the machine.

Risk Assessment	
Manual handling	Many machines approach the safe load for anyone to carry and lift, making this a significant risk for children of small build or anyone pregnant. Some machines are so heavy that a special risk assessment is required before moving them. Incorrectly fitted casings can allow the machine to fall during a lift and cause injury.
Electric shock	Mains cords pull out of plugs and connectors and also become damaged by trapping. Live contacts may be exposed when changing a lamp bulb.
Stabbing	The risk of a needle passing through a finger is low when using a single-needle machine with presser foot attached. The risk is increased when multiple needles are in use or the presser foot is removed for free embroidery work.
Flying needle parts	Broken needles may arise when the machine needle hits a pin or a thick fold in the fabric. This is more likely when a novice user has not mastered the foot pedal and loses control of the fabric movement.
Tripping	The risk of tripping over a mains cord depends on the layout of the work room and the spacing between tables.
Entanglement	Long hair or loose clothing may be caught in the mechanism or sewn into the work. Fingers can be trapped by moving parts but serious injuries are unlikely.

Control measures	
	All persons must be taught to fit covers and lift machines correctly. A suitable trolley must be used whenever machines are transported any distance. The heavier ones should be handled by two persons. Sewing machines where cords are at risk must be inspected before each use and have a formal inspection regularly. Users must be taught to unplug the machine from the power before changing lamps. Users must be carefully trained when starting work on machines especially those with multiple needles or when using one without a presser foot. Only one pupil must be allowed to use a machine at a time to minimise the chance of pushing each other. Eye protection would be advisable for novice users. Good lighting and careful instruction should reduce the risk from flying needle parts to a level where injury becomes very rare. The siting of sewing machines and power points must provide adequate space for pupils (as users) and teachers (as supervisors) to move between them. Seating must provide support and encourage good posture.

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RESTRICTIONS

Where a programmable machine is fitted with a guard, this must be in place during use.

Storage

If it is necessary to put sewing machines away after use, they should be stored (if possible) at such a height that lifting or lowering them onto a trolley is avoided.

FURTHER INFORMATION

Sewing machines should be regularly serviced by a suitably competent and trained person.

It should be noted that whilst sewing machine needles normally break into two pieces, and one piece remains in the machine and the other remains in the fabric, there have been instances where a sewing machine needle breaks into three or more pieces and one of these enters the eye of the user. Teachers should therefore give particular emphasis to the care needed to avoid breakage of needles.

IMMEDIATE REMEDIAL MEASURES

Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Electric shock	Send for first aider immediately. Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a trained first aider does not arrive quickly and the pulse is absent, consider carrying out cardio-pulmonary resuscitation.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Needles in fingers	If the needle is protruding, it may be extracted but, if it is broken, that part in the finger may be difficult to remove and attention from a trained first aider or doctor will be required. Once the needle has been removed, the finger may be squeezed to encourage bleeding, the wound washed and a small, sterilised dressing applied by the casualty.

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2.019 COSHH & Man Regs	Sewing Equipment: overlockers	Applicable to: overlockers only	See also: 2.018

Process(es) covered: Setting up and using electrically-driven overlockers.

Hazards

General hazards	See 2.018 *Sewing machines*, for hazards and risks applying to both machines.
Dust	An overlocker can produce dust and fibres from fabrics with a deep pile.
Cuts	An overlocker has a power-operated trimming blade.

Risk Assessment

Dust	Wool process dust has an WEL of 10 mg/m^3 (8 h TWA)[75] and cotton dust has an WEL of 2.5 mg/m^3 (8 h TWA) but neither of these apply to finished fabrics. There is some indication that the dusts may cause an allergic reaction.
Cuts	The blade on an overlocker is small and unlikely to produce more than a nick in a finger. This is then a trivial risk.

Control measures

If there is any significant production of dust, local exhaust ventilation may be considered but the risks are too low for it to be mandatory.
Care must be taken to remove the dust from the work after using the overlocker to ensure that it is not shaken into the user's eyes.

[75] EH 40/2005

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RESTRICTIONS	Dust may be a problem for some users, particularly those with asthma or other breathing difficulties.
FURTHER INFORMATION	Overlockers should be regularly serviced by a suitably competent and trained person.

IMMEDIATE REMEDIAL MEASURES

Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Electric shock	Send for first aider immediately. Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a trained first aider does not arrive quickly and the pulse is absent, consider carrying out cardio-pulmonary resuscitation.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Dust is blown into the eyes	Wash thoroughly for at least ten minutes with water to prevent scratching of the eye. Seek medical attention if irritation persists.
Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Allergic reaction	If the patient shows anxiety, red, blotchy skin, swelling of the face and neck and puffiness around the eyes, they could be suffering from a serious allergic reaction. Call an ambulance and prop the patient in a sitting position in case breathing problems develop.

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2.020 Man Regs	Sewing Equipment: Small items	Applicable to: hand needles; pins; unpickers	See also:

Process(es) covered: Hand sewing, pinning for machine sewing and unpicking stitching.

Hazards

Stabbing	The needles and pins can cause pricking injuries, usually to a finger. Stitching unpickers have a sharp, pointed blade that can produce a more serious injury.
Flying needle parts	If a needle breaks in use, fragments can fly into the face and eyes of the user. If pins are left in the fabric as the machine passes over them, they may cause the machine needle to snap.

Risk Assessment

Stabbing	An ordinary sewing needle presents a low risk because the injury resulting from a needle prick is minor. The risk from an unpicker is greater since stabbing with this small, sharp blade could injure a blood vessel in the wrist.
Flying needle parts	Hand sewing needles are unlikely to break if an appropriate size is chosen for each task. If pins are not removed from fabric just before reaching the presser foot of the sewing machine then there is a significant risk of needle breakage.

Control measures

It is essential to teach the safe use of the unpicker, pointing it away from the body and not near to another person. The risk of injury is reduced if furniture is arranged appropriately and there is adequate lighting for pupils to carry out fine, close work.
As long as the size and type of needle is chosen to match the task, bearing in mind the age and ability of the children, the risk from flying needle parts will be trivial.
Pins with glass heads are easier to see and remove while machining.

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RESTRICTIONS	With some classes, it may be necessary to restrict the use of unpickers.
Storage	It is important to ensure that pins, needles, scissors and other small items of equipment are collected in after use since they could constitute a hazard if left on tables, chairs or on the floor.

IMMEDIATE REMEDIAL MEASURES

Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Severe cuts	Send for a first aider. Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. **Protect yourself from contamination by blood**.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.

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2.021 Man & COSHH Regs	Wear tests on Textiles	Applicable to:	See also:

Process(es) covered: Accelerated wear tests on different fabrics. The fabrics under test are fixed to the rim of the wear wheel, which is rubbed by an arm covered with sandpaper.

Hazards

Dust — The wearing process will reduce some fabrics to dust and loose fibres.

Electric shock — The wear wheel is normally driven by a low-voltage motor but the low-voltage power unit may present an electric shock hazard.

Risk Assessment

Dust — Wool process dust has a WEL of 10 mg/m^3 (8 h TWA) and cotton dust has a WEL of 2.5 mg/m^3 (8 h TWA)[76] but neither of these apply to finished fabrics. There is some indication that the dusts may cause an allergic reaction on the skin or initiate an asthmatic attack.
Dust and fibres may also be blown into eyes.

Electric shock — A school low-voltage power unit that is properly maintained presents a trivial risk of electric shock.

Control measures

If there is any significant production of dust, local exhaust ventilation may be considered but the risks are too low for it to be mandatory.

[76] EH 40/2005

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FURTHER INFORMATION

Most of the wear wheels are designed to compare the results for six different fabrics so samples of six textiles from the list Acrylic, cotton, glass fibre cloth, linen, nylon, Tricel and wool, are commonly suggested.

IMMEDIATE REMEDIAL MEASURES

Dust is blown into the eyes	Wash thoroughly for at least ten minutes with water to prevent scratching of the eye. Seek medical attention if irritation persists.
Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Allergic reaction	If the patient shows anxiety, red, blotchy skin, swelling of the face and neck and puffiness around the eyes, they could be suffering from a serious allergic reaction. Call an ambulance and prop the patient in a sitting position in case breathing problems develop.

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Appendix 1 Burning tests on fabrics

Fabric	Ignites?	Continued burning?	Does it melt?	Smoke	Smell	Litmus test	Colour of ash	Nature of ash
Acrylic	Yes	Yes	Yes when hot enough	Sooty	Very little	Inconclusive	Black	Bead, hard to crush
Cotton & linen	Yes	Yes	No		Burning paper	Goes red: just acidic	White or grey	Powdery
Nylon (polyamide)	No	No	Yes		Fishy	Inconclusive	Black	Bead, hard to crush
Rayon, Acetate	Yes	Yes	Yes		Vinegar	Goes red: acidic	Black	Bead, hard to crush
Rayon, Viscose & CuAm[1] rayons	Yes	Yes	No		Burning paper	Goes red: just acidic	Grey or black	Powdery
Terylene (polyester)	No	No	Yes	Sooty	Unique	Inconclusive	Black	Bead, hard to crush
Tricel (tri-acetate rayon)	Yes	Yes	Yes		Vinegar	Goes red: acidic	Black	Bead, hard to crush
Silk	Smoulders	No	No		Burning feathers	Goes blue: alkaline	Black	Bead, easy to crush
Wool	Smoulders	No	No		Burning feathers	Inconclusive	Black	Powdery

NB It is not safe to carry out a burning test on PVC or PVC-coated fabrics unless it can be done in a fume cupboard.

[1] CuAm is an abbreviation for Cuprammonium.

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Appendix 2 Chemical tests on fabrics

Fabric	Tests for:				Tests with:				
	Cellulose	**Nitrogen**	**Protein**	**Sulfur**	**Acetone**	**Dichloro-methane**	**Dilute acid**	**Dilute alkali**	**Undiluted bleach**
Acrylic	No	No	No	No	No effect	No effect	No effect	No effect	No effect
Cotton & linen	Yes	No	No	No	No effect	No effect	Rots	No damage, yellows	Whitens, weakens slowly
Nylon (polyamide)	No	Yes	No	No	No effect	No effect	Weakened	No effect	Little effect
Rayon, Acetate	No	No	No	No	Dissolves	No effect	Little damage	Weakened	Weakened
Rayon, Viscose & CuAm[1]	Yes	No	No	No	No effect	No effect	Rots	Damaged	Easily damaged
Terylene (polyester)	No	No	No	No	No effect	No effect	No effect	No effect	No effect
Tricel (tri-acetate rayon)	No	No	No	No	No effect	Dissolves	Little damage	Weakened	Weakened
Silk	No	Yes	Yes	No	No effect	No effect	Little effect	No effect	Easily damaged
Wool	No	Yes	Yes	Yes	No effect	No effect	No effect	Dissolves when hot	Easily damaged

[1] CuAm is an abbreviation for Cuprammonium.

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MODEL RISK ASSESSMENTS
FOR DESIGN AND TECHNOLOGY
IN SECONDARY SCHOOLS AND COLLEGES

Part 3
Work in food technology

CLEAPSS®, The Gardiner Building, Brunel Science Park, Kingston Lane, Uxbridge UB8 3PQ
Tel: 01895 251496 *Fax/Answerphone:* 01895 814372 *E-mail:* science@cleapss.org.uk *Web site:* www.cleapss.org.uk

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Part 3: Work in Food Technology

Model Risk Assessments for substances and activities in Food Technology.

If this part is to be stored separately from the other parts then it will be helpful to photocopy the *General Introduction* and to keep a copy with this part.

ISSUES SPECIFIC TO FOOD TECHNOLOGY

Food safety Regulations

The HACCP is a world-wide system for food safety. The initials stand for **H**azard **A**nalysis and **C**ritical **C**ontrol **P**oint and the system is designed to address biological, chemical and physical hazards through anticipation and prevention. The origins of the system date from the 1960s and lie in the necessity to provide astronauts with totally safe foods

This system should certainly be studied as part of any advanced course and has been considered in the construction of the model risk assessments in food technology.

Particular items from the *Food Safety Act* 1990

The Act applies whenever food is supplied for human consumption, whether it is sold or not. It aims to ensure that all food produced for consumption by members of the general public is safe to eat and not misleadingly presented. The requirements of the Act do not apply where food is prepared for personal consumption or for subsequent consumption by others in the home. For much work in food technology departments, the Act will **not**, therefore, apply.

In situations, however, where food is prepared which is then consumed by others, for example, when the department is involved in providing food for school events such as parents' evenings etc, then it is possible that the requirements of the Act will be applicable. (Note that the Act may apply even if food is given away.) The general rule adopted by Environmental Health Officers of local authorities is that where food is provided on a **very** regular basis, ie, on more than five occasions in five consecutive weeks, it is likely that the Act will apply. Where the department organises and runs a regular shop or restaurant, it is **certain** that the provisions of the Act will apply.

The legislation in Scotland is slightly different but has the same effects.

The relevant sections are as follows.

Section 7	Makes it an offence to render food injurious to health.
Section 8	Makes it an offence to supply food unfit for human consumption or that is contaminated with a pathogenic organism or other material injurious to health.

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Particular items from the *Food Safety (General Food Hygiene) Regulations* 1995

The relevant regulations are as follows.

Regulation 4(1)	Requires proprietors of food businesses to ensure that all stages of food preparation and serving are carried out in a hygienic way.
Regulation 4(2)	Specifies the condition of the premises and equipment used for food preparation and requires training to be provided in food hygiene.
Regulation 4(3)	Requires proprietors to identify any stage that is critical to ensuring food safety and put in place measures to control the risks.
Regulation 5	Requires any person suffering from a medical condition which might cause contamination of food to report that to the proprietor.

Particular items from *Food Safety (Temperature Control) Regulations* 1995

The relevant regulations apply to 'persons working in food premises' and are as follows.

Regulations 4 to 7	Require chilled food to be kept at a temperature below 8 °C.
Regulations 8 to 12	Require hot food to be kept at a temperature above 63 °C.
Regulations 13 to 16	Express the differences necessary to make Scottish regulations conform.

Care needs to be taken to ensure that food prepared in food technology lessons which need to be kept cool are cooled as soon as possible and are stored in refrigerators until taken home by pupils. This may require schools to invest in blast chillers and additional refrigerators.

Maintenance of gas cookers in schools

All the available regulations have been checked and none was found to require maintenance to be carried out at any specified interval. BS 4163:2014, *Health and Safety for Design and Technology in schools and similar establishments* recommends 'appropriate' inspections and tests every 12 months.

However, there is a general requirement for employers to ensure that gas pipework and appliances are maintained in a safe condition. The publication IM/25, *Guidance Notes on Gas Safety in Educational Establishments,* available from the Institution of Gas Engineers, 21 Portland Place, London W1N 3AF, is most helpful. It recommends that the gas pipework and controls (in particular the isolating valve serving each work area) should be visually inspected at least once a year for any signs of damage, deterioration or corrosion. Even in more recent publications, nothing has been found which says that such inspections must be carried out by a *Gas Safe Registered* person so the deduction is that any person deemed **competent by the employer** (either a teacher or technician) may carry out such inspections and checks. CORGI registration was replaced by Gas Safe Registration from 1st April 2009. The website www.gassaferegister.co.uk lists all engineers currently registered.

[IM/25 goes on to recommend a thorough check of all pipework (presumably a pressure test) once every five years and this **should** be done by a Gas Safe Registered fitter.]

IM/25 also recommends that all appliances should receive planned maintenance with records being kept by the employer with copies at the school. The HSE are most likely to suggest that the regular maintenance should be done 'at a frequency decided in the light of experience'. So if a visit is made this year and again in twelve months, that experience could be used to decide whether a five-year interval is sufficient or whether a more frequent check is necessary (eg, in schools where vandalism is a problem).

In the days of the monopoly, British Gas would often supply cookers to schools on an economical rental scheme which included maintenance and replacement by new models every five years or so. It might be worth contacting local suppliers to see whether they would enter into any similar contract in return for a suitable advert attached to each cooker!

Electrical supplies and equipment

The particular hazard of using electrical equipment in the food technology area is that of an electric shock which harms the user.

Any item of mains-operated electrical equipment presents this hazard if misused, badly installed or not maintained properly. The risks are greater where there are damaged and incorrectly wired plugs, plugs containing a fuse with an inappropriate rating and flexible cables which have been damaged or allowed to become worn, impairing the insulation.

When touching faulty, live equipment, the human body may conduct the electric current between a live conductor and earth; the current that flows will vary according to skin resistance. When the skin is wet, a better contact is made and more current will flow through the body; severe electrical burns and/or electrocution may result. Activities in food technology, especially if staff or students are working near a sink with wet hands, can, therefore, be particularly hazardous, eg, with connections made between faulty equipment, the body and water or gas pipes which conduct electricity to earth.

The risks are minimised by:

- good wiring installation with adequate numbers of socket outlets positioned near to the work surfaces,
- good equipment, and
- high standards of maintenance.

Where the risk assessment shows a need, consideration should be given to installing a mains-isolating switch, under teacher control and preferably key operated and situated near an exit, which is clearly labelled and known to all staff. If such a switch is provided equipment such as refrigerators and freezers and appliances with clocks and timers should be supplied by separate circuits not under the control of the main switch. There is no requirement for emergency stop buttons to be provided in food technology rooms. While it is not a legal requirement, socket outlets should be supplied via a residual current device (not time delayed) with a maximum tripping current of 30 mA.

Electrical equipment should not be sited too close to sinks but, as in a domestic kitchen, it is often impossible to achieve real separation. Plug-in two- or three-way adaptors and four way distribution blocks should not be used; instead, additional outlets should be installed. Extension leads should be avoided.

Fixed appliances such as cookers, washing machines, dryers and dishwashers should be fitted and serviced only by appropriately qualified personnel. If these items of equipment are installed via a permanent cable, it is essential that they are provided with a suitable isolating switch that is clearly labelled and accessible. Where equipment such as washing machines, dryers and dishwashers is connected by a plug and socket, the socket should be accessible so that the equipment can be easily turned off.

All electrical appliances should conform to the appropriate British Standard and bear the BS Kite Mark[77]. It is preferable for all appliances to have a clear indication, such as a power-on pilot light, to show when they are switched on.

All appliances, if designed for the domestic market, must now be sold already fitted with a plug conforming to British Standard BS 1363 or BS 1363A (for a stronger plug) and have sleeved pins. It is still necessary for users to replace damaged plugs and new ones should similarly conform; be suspicious of cheap plugs available from market stalls, etc.

[77] The mark formerly used by the British Electro-technical Approvals Board (BEAB) has been replaced by the Kite Mark for simplicity of recognition.

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When replacing plugs, it is essential to ensure that wires to the plug terminals are correctly colour-coded and are connected correctly:

neutral - blue,
earth - yellow and green, and
live - brown.

If there are only two wires, these should be brown and blue and must be connected to the live and neutral terminals, never to the earth. If the lead contains any other colours, the appliance is either old or not designed for UK use; in either case, it needs careful attention from an electrician before being used, so that a lead with standard colour codes can be fitted if safe to do so. It should be noted that in schools, plugs should only be fitted by people that have received specific training to do this task.
Flexible leads on appliances should be short, undamaged and possibly of the safety-coiled type; they should not be long enough to hang dangerously loose over the edges of the work surface. Although the risks are greatly reduced with IEC appliance couplers, it is good practice for leads to be short so that a live coupler cannot dangle in water.
Guidance on the safe use of equipment is given on individual risk assessment sheets but, in general:

- manufacturers' instructions / operating manuals should be readily accessible and used,
- appliances should not be connected to lighting circuits,
- equipment should be switched off after use, before cleaning or making adjustments and portable equipment should be disconnected from the mains socket,
- electrical apparatus should never be handled with damp or wet hands.

Routine inspections of electrical equipment
The *Electricity at Work Regulations*[78] require employers to ensure that all items of portable electrical equipment in schools are maintained in good working order. Most schools choose to do this by having a portable appliance test carried out on each piece of equipment every year. Such a system of inspection and testing will be determined by the employer and is not the responsibility of the design and technology department. (The employer may require the work to be done by school staff or at school expense.)
Nevertheless, much can be done by staff to ensure that electrical appliances are safe. Around 90% of faults in electrical equipment can be identified by visual inspection alone. Therefore, before any appliance is plugged into the supply, it should be checked quickly for a broken plug or damaged lead. Where a lead plugs into the appliance or there is a plug moulded onto the cable, the simplest procedure is to replace the entire lead but it is essential that the correct type is used.
Suspect or faulty electrical equipment should be taken out of use, put in a safe place and be labelled 'do not use' until repairs can be carried out by a competent person. It should be noted that any equipment that is the personal property of a member of staff should have a portable appliance test before it is used in a school.
Although there is no legal requirement for a system of inspections and tests to be carried out on appliances in the home, it is sensible for students to be encouraged to carry out visual safety inspections on domestic equipment.

[78] See the *General Introduction*.

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Rules for personal hygiene

Strict adherence to the highest standards of hygiene is essential, not just to ensure that food prepared in the food technology area cannot have been contaminated but also to educate students about the appropriate behaviour to adopt at home. The following rules should be observed at all times.

- Avoid preparing food for others to consume if suffering from sickness, diarrhoea, colds, coughs or other infections.
- Wash hands thoroughly after using the toilet.
- Cover all cuts and wounds with a sterile, waterproof dressing. (The blue plasters are easily detectable if they fall off in the food!)
- When cooking in the food technology area tie long hair back, wear a clean, protective apron and avoid touching the hair and face during food preparation.
- Make sure hands are washed clean before touching food. Wash them thoroughly in between handling raw and cooked or ready-to-eat foods and use a hygienic drying method.
- Remove jewellery from fingers (and preferably wrists) before cooking.
- Never smoke when preparing food.
- Spills must be cleaned up promptly to prevent slips and falls.

Appropriate facilities for washing and drying hands hygienically should obviously be provided[79]; the use of communal cloth towels should be avoided and paper towels or hot-air dryers provided instead. (Paper towels have clear advantages when many hands need drying at once.)

It is clearly important for food technology areas to be kept very clean and senior staff may have to make special arrangements with the cleaning staff and monitor that the standards are being maintained. Free posters describing problems caused by microorganisms are available[80].

Use of liquid petroleum gases (LPGs) for heating

In some parts of the country, there may be no permanent supply of natural gas for cookers. Where food technology rooms have a piped supply of LPGs, leaks may be more hazardous than with natural gas because LPGs are heavier than air and tend to accumulate in closed spaces.

If cooking equipment is fuelled by cylinders of LPG, particular care must be taken in the use and storage of this fuel supply[81] and when fitting a new cylinder. Some employers have insurance arrangements that cover LPG tanks, pipework and cylinder storage. The insurance company may then require regular inspection.

Ventilation

A well-designed room should have at least 3 air changes per hour with some windows open on a day with a light breeze. Many teaching spaces used for food technology need extraction fans to reach 5 air changes per hour when several cookers are in use but opening all windows may be sufficient. The test for adequate ventilation is usually to use the nose. If smells linger for more than five minutes after cooking has ceased then more ventilation is needed.

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79 Hand-washing facilities are required by the *Food safety (General Food Hygiene) Regulations* 1995 which apply if the *Food Safety Act* applies (see p12).

80 From the Society for General Microbiology, Marlborough House, Basingstoke Road, Spencers Wood, Reading, RG7 1AG. Tel: 0118 988 1809, Fax 0118 988 5656.

81 The Health and Safety Executive has published helpful advice in the following Guidance Notes: CHIS4 *Use of LPG in small bulk tanks*, HSE, 1999 and CHIS5 *Small-scale use of LPG in cylinders*, HSE, 1999. The L P Gas Association has published advice in Code of Practice 1, *Bulk LPG Storage at Fixed Installations* and Code of Practice 7, *Storage of Full and Empty LPG Cylinders and Cartridges*.
(L P Gas Association, Pavilion 16, Headlands Business Park, Salisbury Road, Ringwood, Hants BH24 3BP. Tel: 01425 461612, Fax: 01425 471131.)

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Aspects of design of food technology areas

This document is not a guide to the design of teaching areas for any aspect of D & T but those who find themselves in a position of drawing up a specification for a food technology teaching area could bear in mind the following safety points.
Work tops and floor should have easy-clean surfaces without cracks or joints.
Space must be allowed for storage of student bags.
Master controls for both gas and electricity should be provided in each room for emergency use.
In food rooms it is considered good practice to provide all taps for washing up with water at a supply temperature of 60 °C. This temperature, which is higher than is suitable for hand washing, is needed for the removal of grease and helps to kill bacteria.
There should be at least one wash hand basin in each room that is dedicated for the washing of hands and this should be fitted with a blended water supply.
Further advice on the design and layout of food technology rooms is contained in Building Bulletin 81 and in BS 4163:2014. G79 Auditing H&S in a Secondary School D&T Department and G79A and G79B have further details on room requirements and layout (available from the CLEAPSS website).

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Part 3: Work in food technology

CONTENTS

3.001 Blast chillers
3.002 Chemical testing of food
3.003 Cleaning activities: general
3.004 Cleaning agents for food handling areas: bleaches
3.005 Cleaning agents for food handling areas: descalers
3.006 Cleaning agents for food handling areas: detergents
3.007 Cleaning agents for food handling areas: disinfectants
3.008 Cleaning agents for food handling areas: drain & sink cleaners
3.009 Cleaning agents for food handling areas: oven cleaners
3.010 Conventional ovens
3.011 Cooking and reheating, food poisoning
3.012 Deep fat fryers
3.013 Defrosting foods
3.014 Eating and tasting
3.015 Enzymes
3.016 Food processors
3.017 Food storage: dry foods
3.018 Food storage: high temperatures
3.019 Food storage: low temperatures
3.020 Freezing food: freezer, refrigerator
3.021 Frying and grilling food
3.022 Handling food
3.023 Hob, kettle, urn
3.024 Knives
3.025 Liquidising, mincing, mixing
3.026 Microorganisms used in food production
3.027 Microwaves
3.028 Pest control
3.029 Portable food processors, mixers & powered tools
3.030 Pressure cookers
3.031 Purchase and selection of food
3.032 Toasting food
3.033 Tunnel ovens
3.034 Waste disposal

Appendix 3: Food poisoning: the major causes of food poisoning
Appendix 4: Food tests: details of suggested tests

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3.001	Blast chillers	Applicable to: commercial blast chillers	See also: 3.020

Process(es) covered: Use of commercial blast chillers to reduce the temperature of food quickly.

Hazards

Electric shock	Any electrically powered item presents a shock risk if it is damaged.
Food poisoning (Infection)	Gastrointestinal infection results from eating, or hand to mouth contact with, food carrying pathogenic microorganisms and/or their toxic products.

Risk Assessment

Electric shock	With all electrical equipment there is a risk of electric shock. However blast chillers should be installed by a qualified electrician / plumber and have an appropriately fused switch-disconnect or if hard wired an isolating plug. If the appliance's rating requires one it should also have a ventilation extraction system. Correct installation and regular maintenance checks reduce the shock risk to minimal.
Food poisoning (Infection)	Harmful bacteria require food, moisture, warmth and time to survive and multiply. All reproduce rapidly at temperatures around 37 °C (ie, body temperature) but many can multiply at lower or higher temperatures. By blast chilling the risk of bacterial reproduction is considerably reduced.

Control measures

The blast chiller should be included in a regular planned maintenance programme and also be part of regular visual checks by a competent person at suitable frequencies to identify any faults that require maintenance to reduce the risk of incorrect operation.
Manufacturers instructions should be followed at all times. Only suitable ingredients or foods should be put into the blast chiller.
Protective gloves should be worn when removing cold items from the chiller.

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Disposal	For disposal see 3.034.

FURTHER INFORMATION

Blast chillers should be included in a regular planned maintenance programme and also be part of regular visual checks by a competent person at suitable frequencies to identify any faults that require maintenance to reduce the risk of incorrect operation.

IMMEDIATE REMEDIAL MEASURES

Freezer burns to the skin	Run affected area under tepid running water for 10 minutes. Cover with a dry dressing. If severe seek further medical advice.

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3.002 COSHH Regs	Chemical Testing of food	Applicable to: tests for the constituents of food	See also: Appendix 4

Process(es) covered: Tests to identify the presence of sugars, starch, proteins, fats and vitamin C.

Hazards	
Corrosive	Solutions of sodium hydroxide at sufficient strength and Millon's reagent are corrosive.
Toxic	Millon's reagent contains toxic components.
Harmful	The precipitate in Benedict's test and solid iodine are harmful.
Irritant	The CLEAPSS modification of the Biuret test uses an irritant solution.
Highly Flammable	The test for fats uses highly flammable ethanol (methylated spirit).

Risk Assessment	
Corrosive	Tests using corrosive solutions can be avoided.
Toxic	Tests using toxic solutions can be avoided.
Harmful	The main risk here is to the person preparing the iodine solution with a minor risk when washing up after the Benedict's test.
Irritant	There is a risk to the eyes when using these irritant solutions.
Highly Flammable	Ethanol always presents a risk of fire.

Control measures
Food chemical testing is best done in a properly equipped Science laboratory with specialist science technician help. The corrosive and toxic risks can be avoided by using alternatives.
Solutions should be prepared by a trained technician wearing gloves and eye protection.
Those using irritant solutions should wear eye protection.
Whenever ethanol is used, all naked flames and pilot lights in the vicinity should be extinguished.

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RESTRICTIONS

Millon's reagent should not be used by pupils or students below year 12. Fehling's solutions and Clinitest tablets should not be used by those below year 9 (see over). All the other tests are suitable for use by responsible pupils of year 7 & above.

Disposal

Small quantities of reagents after tests may be diluted with lots of water and flushed into the foul-water drain. (See PS 31, *Disposal of Waste in Design & Technology*.)

Storage

All of these test reagents should be stored in a secure place, away from food. If more than 500 ml of ethanol is kept, it should be in a cabinet designed for highly flammable liquids.

FURTHER INFORMATION

Test	Food detected	Hazards	Comments
Fehling's	Reducing sugars	CORROSIVE	THE USE OF BENEDICT'S TEST IS PREFERRED. Solution A contains copper(II) sulfate; solution B contains sodium hydroxide. Wear eye protection and heat test tubes in a bath of hot water.
Benedict's	Reducing sugars	Product formed is HARMFUL	Contains copper(II) sulfate. Preferable to Fehling's solution as it is less corrosive but still use eye protection. Heat solution in a bath of hot water.
'Clinitest' tablets	Testing for glucose	CORROSIVE	THE USE OF 'CLINISTIX' STRIPS IS PREFERRED. The tablets contain sodium hydroxide; boiling occurs when placed into solutions. Wear eye protection.
'Clinistix' strips	Testing for glucose		The tips of the strips contain a *minute* amount of a known carcinogen and should not be touched. Store and dispose of the strips safely.
Iodine	Starch	HARMFUL	Iodine solid is HARMFUL; wear eye protection and gloves when making up solution. Wear eye protection.
Millon's (Cole's modification)	Proteins	CORROSIVE & TOXIC	THE USE OF THE BIURET TEST IS PREFERRED. Solution A contains mercury(II) sulfate in sulfuric acid; solution B uses sodium nitrate. Wear eye protection.
Biuret (CLEAPSS modification)	Proteins	IRRITANT	Uses sodium hydroxide; wear eye protection.
Emulsion	Fats	HIGHLY FLAMMABLE	Test uses ethanol; avoid all naked flames.
DCPIP [PIDCP]	Vitamin C	NONE	Despite a common belief to the contrary, there is no recognised hazard in using DCPIP.

See *Appendix 4* for details of the tests.

If it is not thought appropriate that food tests should be carried out in food technology areas of the D & T department, where essential safety equipment may not be available and because of the dangers of contamination, it may be possible to use a science laboratory which has appropriate facilities. Members of the science department could be consulted, as appropriate, for information on how such investigations should be carried out and how the control measures involved in such work should be applied[82].

IMMEDIATE REMEDIAL MEASURES

Chemicals are swallowed	Give plenty of water and seek medical attention. Do not induce vomiting.
Sodium hydroxide is in the eyes	Obtain medical attention. Irrigate immediately with water, holding eyelids apart and continue until the patient reaches hospital.
Much vapour is inhaled	Remove individual to fresh air and seek medical attention.
Spilt on the skin or clothes	Remove contaminated clothing. Wash affected area thoroughly with a large amount of water. If a large area of skin is affected, seek medical attention. Soak contaminated clothing and rinse repeatedly.

[82] Reference may be required to *Topics in Safety* (Association for Science Education, 3rd edition 2001)
ISBN 0863573169 or *Hazcards* produced by the CLEAPSS. (See the information about the *COSHH Regulations* given in the *General Introduction*.)

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3.003 COSHH Regs	Cleaning Activities: General	Applicable to: all cleaning agents	See also: 3.004 to 3.009

Process(es) covered: General cleaning activities.

Hazards

Allergic reaction	Some agents contain substances that produce allergic reactions.
Toxic or harmful	Some agents contain substances that are toxic or harmful.
Corrosive	Some agents contain substances that are corrosive.
Irritant	Some agents contain substances that are irritant.
Flammable or highly flammable	Some agents contain substances that are flammable or highly flammable.

Risk Assessment

Allergic reaction	Many people are aware of allergic reactions to some substances or groups of substances. Some people have become 'sensitised', ie, even a very small dose of the allergen then produces the reaction. Substances likely to cause sensitisation are identified by risk phrases R42 & 43.
Toxic or harmful	Agents presenting these risks are identified by hazard warnings that may vary with different formulations of the same substance.
Corrosive	Agents presenting these risks are identified by hazard warnings.
Irritant	Agents presenting these risks are identified by hazard warnings.
Flammable or highly flammable	Cleaners may contain flammable components but a greater risk is presented by preparations applied as aerosols: the propellant is often highly flammable.

Control measures

Training in the safe use of cleaning agents is required by all staff likely to use them.

Simple allergic reactions (dermatitis) can be prevented by the use of gloves or by avoiding the agent. Once sensitisation has occurred, it is difficult to avoid the reaction other than by a change of job.

It is essential to read the label on the container to ascertain the level of risk and the precautions required to control it.

Gloves and eye protection must be worn when using any agent with 'corrosive' on the label.

An irritant agent should be handled with gloves.

If possible, the use of cleaning agents in aerosol spray cans should be avoided but, if used, all naked flames should be extinguished. Care should be taken to see that the contents are not sprayed into the eyes or where they will be inhaled.

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RESTRICTIONS	The separate sheets describe restrictions in the use of certain cleaning agents, where relevant. Because of the possibility of misuse and materials being sprayed into eyes or flames, it would probably be advisable to restrict the use of pressurised, aerosol cans and other sprays to responsible pupils 16yrs old and over.
Disposal	Unwanted cleaning liquids may be diluted and flushed away down the foul-water drain so long as the acidity / alkalinity is adjusted to a pH between 5.5 and 9. Empty containers should be rinsed out before placing them in the refuse. Empty aerosol cans should not be incinerated as the residual propellant may explode.
Storage	All cleaning agents containing hazardous substances must be stored adequately, away from food areas, so that they cannot be misused. The cupboard should be locked and labelled. Aerosol cans must be stored away from sources of heat (ie, below 50 °C).

FURTHER INFORMATION

It is necessary to wash all work surfaces thoroughly and regularly, on every day that practical work with food is done, using hot water and detergent. The inside of the refrigerator and shelves of food storage cupboards should also be washed before drips or spills accumulate, at least once each week. After washing, the surfaces should be dried with a clean, dry cloth or disposable paper towel. Wet surfaces are a potential breeding ground for bacteria. See individual sheets 3.004 to 3.009. Co-operation with cleaning staff over the methods to be used in food technology areas is essential.

IMMEDIATE REMEDIAL MEASURES

Cleaning agents are sprayed into the eyes	Obtain medical attention. Irrigate immediately with water, holding eyelids apart and continue until the patient reaches hospital.
Allergic reaction	If patients show anxiety, red, blotchy skin, swelling of the face and neck and puffiness around the eyes, they could be suffering from a serious allergic reaction. Call an ambulance and prop such a patient in a sitting position in case breathing problems develop.
Anaphylactic shock (major allergic reaction)	If patients suffer from impaired breathing and also has a rapid pulse, they may be going into anaphylactic shock. Check to see if the patients are carrying an Epi-Pen or syringe of adrenaline; if so help them to administer it. Call an ambulance and prop such a patient in a sitting position.

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3.004 COSHH Regs	Cleaning Agents for food handling areas: Bleaches	Applicable to: Ajax powder; Bleach; Brobat; Domestos; Parozone; Vortex	See also: 3.003

Process(es) covered: Cleaning operations to remove stains using liquids, powders or tablet cleaners.

Hazards

Corrosive Bleaching solutions containing sodium hypochlorite [sodium chlorate(I)] with more than 10% active chlorine and bleaching powder containing calcium hypochlorite [calcium chlorate(I)] are rated corrosive.

Irritant Bleaching solutions containing sodium hypochlorite (with between 5 and 10% active chlorine) or hydrogen peroxide and bleach tablets containing sodium dichloroisocyanurate are rated irritant. Powders containing sodium perborate are also irritant.

Risk Assessment

Corrosive Solutions classified as corrosive are very hazardous, causing severe damage to the eyes and burns to the skin or alimentary canal, if swallowed. Most 'concentrated' bleach solutions available commercially are, however, not so strong as this. Calcium hypochlorite is very dangerous to the skin and eyes. It readily raises dust that could be inhaled or damage the eyes.

Irritant Bleaches employing hydrogen peroxide as the active ingredient will not usually be sufficiently concentrated to present a major risk in normal use but should be treated as irritant. 'Bleach' powders containing sodium perborate will be irritant to the eyes.

Control measures

Bleaches that are corrosive require the user to wear a **face shield** and gloves when dispensing a liquid. Gloves are sufficient when using a scouring powder[83].
Bleaches that are labelled irritant require the eyes to be protected with **safety spectacles** and gloves should be worn to protect the skin.

[83] Marigold Suregrip GO4Y or Blue Nitrile G25B are recommended. See CLEAPSS publication PS 50, *Gloves as personal Protective Equipment* for a full discussion.

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RESTRICTIONS	Pupils below year 12 should not be permitted to use bleach solutions or powders that are *corrosive*, though they may use diluted solutions under supervision. Do not mix bleach with other cleaning agents
Disposal	Small quantities of bleaches can be mixed with a bucket-full of water and flushed down the foul-water drain. Solids and empty containers can be added to other solid waste.
Storage	All bleaches should be stored away from food areas and in a safe and secure place so that they cannot be taken by pupils without permission and misused. As hypochlorite and hydrogen peroxide bleaches deteriorate over time, it is safest to discard any stock that is more than 2 years old.
FURTHER INFORMATION	It is essential to rinse containers thoroughly after cleaning them with bleaches. Bleaching powder, calcium hypochlorite, is an oxidising agent; cloths used with the powder might later ignite. Always rinse out such cloths thoroughly to remove traces of the powder. If bleach containing sodium hypochlorite is mixed with acids, the toxic gas chlorine will be released. Cleaning agents such as descalers and some lavatory cleaners contain acid but it may not always be possible to determine if other cleaners have acidic contents. **Therefore, under no circumstances must bleach be mixed with, or used at the same time as, any other cleaning agent.** Co-operation with cleaning staff over the methods to be used in food technology areas is essential.

IMMEDIATE REMEDIAL MEASURES

Bleach is in the eyes	Obtain medical attention. Irrigate immediately with water, holding eyelids apart and continue until the patient reaches hospital.
Chlorine is liberated and inhaled	Remove individual to fresh air and seek medical attention.
Bleach is swallowed	Give plenty of water and seek medical attention. Do not induce vomiting.
Bleach is spilt on the skin or clothes	Remove contaminated clothing. Wash affected area thoroughly with a large amount of water. If a large area is affected or blistering occurs, seek medical attention. Soak contaminated clothing and rinse repeatedly.

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3.005 COSHH Regs	Cleaning Agents for food handling areas: Descalers	Applicable to: Calgon; KleenOff; Limelight; Scale Away; Viakal	See also: 3.003

Process(es) covered: The removal of scale from hard water from sinks, taps, toilet bowls, washbasins, baths, kettles and steam irons. All use some form of acid as the active ingredient.

Hazards

Corrosive — The acid component may be sodium hydrogensulfate or citric, formic, hydrochloric, phosphoric or sulfamic (aminosulfonic) acid. Those containing more than 10% formic acid, 25% hydrochloric acid, 25% phosphoric acid or 18% sodium hydrogensulfate are corrosive.

Irritant — Descalers containing between 2 to 10% formic acid, 10 to 25% hydrochloric acid, 10 to 25% phosphoric acid, 6 to 18% sodium hydrogensulfate or sulfamic acid are irritant.

Risk Assessment

Corrosive — The concentration of acid used varies considerably so that the level of risk in using different products is similarly variable. The 'heavy duty' formulations, classified as corrosive, are very hazardous, causing severe damage to the eyes and burns to the skin or alimentary canal, if swallowed.

Irritant — The majority of descalers are more dilute but still irritant to the eyes or skin. At even lower concentrations of acid or if citric acid is the active ingredient, there may be no hazard warning on the product label but sensitive skin could be affected and eye contact gives discomfort.

Control measures

It is **essential** to wear gloves when using corrosive products. It is very strongly advised that the user wears a **face shield** when dispensing corrosive liquids and that these strong ones are avoided if this protection is not available. When using products which are powders, ensure that no dust is raised which could be inhaled or get into the eyes.

When using irritant descalers, it is recommended that gloves are worn and that the eyes should be protected with **safety spectacles**.

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RESTRICTIONS	Descalers containing hydrochloric acid are not suitable for use with stainless steel surfaces. Pupils below year 12 must not be permitted to use descalers that are *corrosive*, though they may use less concentrated products, under supervision. Descalers must not be mixed with bleach because if a cleaner containing acid is mixed with bleach containing sodium (or calcium) hypochlorite, the toxic gas chlorine will be released. **Therefore, under no circumstances must a descaler be mixed with, or used at the same time as, bleach or other cleaning agents.**
Disposal	Unwanted descaling liquids should be diluted by adding no more than 100 ml to a bucket of water before flushing down the foul-water drain. Alternatively, they can be neutralised by adding sodium carbonate (washing soda) until the fizzing stops, and then flushed away in any quantity. Empty containers may be added to ordinary waste.
Storage	All descalers should be stored away from food areas and in a safe and secure place so that they cannot be taken by pupils without permission and misused.

FURTHER INFORMATION

It is safest to use a descaling agent containing citric acid or one with the lowest concentration of acid compatible with the task to be performed.
Cooperation with cleaning staff over the methods to be used in food technology areas is essential.

IMMEDIATE REMEDIAL MEASURES

Descalers are in the eyes	Wash thoroughly for at least ten minutes with water, holding the eyelids apart. Seek medical attention if irritation persists.
Descalers are swallowed	Give plenty of water and seek medical attention. Do not induce vomiting.
Chlorine is liberated	Remove patient to fresh air and seek medical attention.
Spilt on skin or clothes	Remove contaminated clothing. Wash affected area thoroughly with a large amount of water. If a large area of skin is affected, seek medical attention. Soak contaminated clothing and rinse repeatedly.

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3.006 COSHH Regs	Cleaning Agents for food handling areas: Detergents	Applicable to: detergents used in food technology (many makes and trade names)	See also: 3.003

Process(es) covered: Cleaning of hard surfaces, washing up pots, pans and cutlery by hand or with a machine.

Hazards

Allergic reaction	Some brands of detergents may contain enzymes and present the hazards of sensitisation and/or allergy.
Irritant	Dishwasher chemicals often contain sodium silicate (metasilicate) and a bleaching agent such as sodium dichloroisocyanurate or sodium perborate; they may be very alkaline. Some hard-surface cleaners may contain sodium carbonate or 10 to 35% ammonia solution which also makes them alkaline. In such cases there is a serious hazard to the eyes.

Risk Assessment

Allergic reaction	True allergic reactions to these detergent mixes are not common but, when they occur, they can be very troublesome to the sufferer.
Irritant	All detergents, by their property of helping to dissolve grease, also remove natural oils from the skin leading to possible dryness, chafing and other dermatological problems, particularly in individuals with sensitive skin. The bleaching agents are also usually irritant.

Control measures

Where cleaning agents containing enzymes are used, protection with gloves is essential.

When dispensing washing powders, avoid raising dust that might be inhaled or blow into the eyes. Although many detergent preparations are not classed as hazardous, it is strongly advised that all contact with the skin is avoided by wearing gloves, particularly for individuals who are recognised as having sensitive, damaged or dry skin. Where more aggressive cleaning agents marked ‘irritant’ are used, protection with gloves is essential. The eyes should be protected with safety spectacles when detergent preparations marked ‘irritant’ are handled.

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RESTRICTIONS	Although any preparation marked *corrosive* will normally be used only by adults or pupils below year 12 under close personal supervision, *irritant* cleaners could be used, with care, by younger pupils.
Disposal	Cleaning agents used in food technology departments can be disposed of in the waste if solid or flushed down the foul-water drain if liquid.
Storage	Detergents classed as 'irritant' and other cleaning materials should be stored in a safe place away from food areas.

FURTHER INFORMATION

In the past, the detergents used in dishwashers have been strongly alkaline and rated corrosive. It appears that this is no longer true. The manufacturers have found alternative formulations that are just as effective at washing the pots and cutlery without the hazard.

IMMEDIATE REMEDIAL MEASURES

Detergents are in the eyes	Obtain medical attention. Irrigate immediately with water, holding the eyelids apart and continue irrigation until the casualty reaches hospital.
Swallowed	Give plenty of water and seek medical attention. Do not induce vomiting.
Detergents likely to be irritant contaminate the skin or clothes	Remove contaminated clothing. Wash affected area thoroughly with water. Apply a moisturising cream to affected skin. Soak contaminated clothing and rinse repeatedly.

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3.007 COSHH Regs	cleaning agents for food handling areas: Disinfectants	Applicable to: Dettol; Dettox; Domestos; Jeyes Fluid; Milton; Oxy-Gel; Presept; Savlon; Shield; VirKon	See also: 3.003

Process(es) covered: The use of disinfectants to attempt to destroy microorganisms which may be present on surfaces etc in food technology areas.

Hazards

Toxic	Some industrial formulations of clear phenolic disinfectants are toxic.
Harmful	Disinfectants containing some formulations of clear phenolics intended for domestic use are rated harmful.
Corrosive	Certain phenolics, such as 'Lysol', are rated as corrosive and so is sodium hypochlorite when purchased at over 10% concentration.
Irritant	Disinfectants containing sodium hypochlorite with between 5 to 10% active chlorine, sodium dichloroisocyanurate, 'VirKon' powder and some phenolics (including 'Jeyes fluid') are all rated irritant. Formulations containing between 0.2% and 1% formaldehyde (methanal) are also irritant.

Risk Assessment

Toxic	No disinfectants labelled toxic are needed in food technology.
Harmful	Concentrated disinfectants labelled harmful, present risks if they are swallowed.
Corrosive	No disinfectants labelled corrosive are needed in food technology.
Irritant	Some disinfectants labelled irritant present risks to the skin and eyes. 'VirKon' powder and phenolics such as 'Jeyes Fluid' should also be kept off skin and away from the eyes and nose.

Control measures
Gloves and safety spectacles should be worn if concentrated, harmful disinfectants are handled. Handling phenolic disinfectants and preparing VirKon solutions also requires the use of gloves and safety spectacles.

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RESTRICTIONS	Pupils below year 12 must not be permitted to use disinfectants that are corrosive or toxic except under close personal supervision, though they may use disinfectants that are harmful or irritant. Dirty surfaces significantly reduce the effectiveness of disinfectants. Surfaces should be wiped clean prior to applying and using disinfectant products.
Disposal	Small quantities of disinfectants can be mixed with a bucket-full of water and flushed down the foul-water drain. Solids and empty containers can be added to other solid waste.
Storage	All hazardous disinfectants should be stored away from food areas and in a safe place so that they cannot be handled by pupils without permission and misused.
FURTHER INFORMATION	
	There are many different brands and types of disinfectant, varying considerably in their ability to destroy microorganisms.
Chlorine-releasers	Disinfectants with bleach (*sodium hypochlorite*) as the active ingredient, eg, 'Domestos'; 'Milton', or *sodium dichloroisocyanurate,* eg, 'Presept', release chlorine in solution. These should be effective against a wide range of microorganisms (including viruses, if the strength is high enough) but are less suitable for very dirty conditions because they are degraded by organic matter; also they corrode metals. Bleach solution is recommended for all disinfection involving blood. Dilute hypochlorite solution is non-tainting and suitable for food preparation areas. Do not mix chlorine-releasing disinfectants with other cleaning agents. If the disinfectant in use is one containing sodium hypochlorite or dichloroisocyanurate and is mixed with acids, the toxic gas chlorine will be released. **Therefore, under no circumstances must such disinfectants be mixed with, or used at the same time as, any other cleaning agent.**
Chloroxylenols	These disinfectants, eg, 'Dettol', are not regarded as giving the best protection against a wide range of microorganisms and they are easily inactivated. They are, however, neither corrosive nor irritant.
Diguanides	Disinfectants which contain chlorhexidine, eg, 'Hibitane', or chlorhexidine mixed with the QAC cetrimide, eg, 'Savlon', are only really useful for skin disinfection. They should not be used for general disinfection tasks as they have limited activity.
Formaldehyde	Formaldehyde (methanal) is very effective in killing microorganisms but it is doubtful whether the concentrations used in cleaning agents is sufficient to do so quickly.
Quaternary Ammonium Compounds (QACs) and Ampholytic Surfactants	Disinfectants with QACs as their active ingredient, eg, 'Dettox' or 'Cetavlon', have a limited activity against microorganisms and are easily inactivated. They are not appropriate for general disinfection tasks but are employed for cleaning equipment and surfaces within the food and catering industries. Ampholytic surfactant disinfectants, such as 'Tego', have properties and limitations similar to QACs.
Phenolics	*Clear phenolic* disinfectants, eg, 'Printol', are active against bacteria and fungi but not viruses; unlike bleach, they are not readily broken down by organic matter, such as food remains or grease. They are unsuitable for use on any food preparation surface and are now difficult to obtain in sensible quantities. The use of other phenolic disinfectants is discouraged: black fluids or white fluids, eg, 'Jeyes Fluid', 'Izal' and especially 'Lysol' (because it is toxic and less effective than the others).
'VirKon'	This powerful disinfectant is supplied as a powder and is effective against bacteria, fungi and viruses. The powder is rated irritant but, when made up as a 1% solution, is neither toxic nor irritant. The main active constituent is potassium peroxomonosufate, which works by oxidising the infective material. It should be used as the powder on blood spills.
IMMEDIATE REMEDIAL MEASURES	
Disinfectants are in the eyes	Wash thoroughly for at least ten minutes with water, holding the eyelids apart. Seek medical attention if irritation persists.
Swallowed	Give plenty of water and seek medical attention. Do not induce vomiting.
Disinfectants are spilt on the skin or clothes	Remove contaminated clothing. Wash affected area thoroughly with a large amount of water. Soak contaminated clothing and rinse repeatedly.

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3.008 COSHH Regs	cleaning agents for food handling areas: drain & Sink cleaners	Applicable to: Drain Clear; Flowfree; Kleenoff; Mister Muscle Sink Cleaner	See also: 3.003

Process(es) covered: The use of chemical cleaning agents to improve the flow through the drain from a sink and remove stains from the sink itself; many use strong acids or alkalis, others contain enzymes or hypochlorite.

Hazards

Corrosive The majority of cleaners utilise caustic soda or potash (sodium or potassium hydroxide) as their active ingredient but some brands use sulfuric acid instead. (Many brands contain more than 50% active chemical; some even use pure sodium hydroxide pellets or undiluted acid.)

Allergic reaction Enzyme-based products may provoke a response in some people.

Irritant Products containing sodium hypochlorite with between 5 to 10% active chlorine or sodium dichloroisocyanurate are rated irritant.

Explosion Some cleaners contain a mix of sodium hydroxide and powdered aluminium that generates extremely flammable hydrogen gas.

Risk Assessment

Corrosive Brands are corrosive if the concentration is more than 2% sodium or potassium hydroxide or more than 15% sulfuric acid. They present high risks, causing severe damage to the eyes and burns to the skin or alimentary canal, if swallowed. Pellets or strong acid react with water making it hot enough to boil and cause splashes of corrosive chemical.

Allergic reaction Although *much* safer than the conventional caustic cleaners, there is a very small chance of an allergic response to the enzymes in these products. As it is impossible to identify in advance those individuals who may be hypersensitive, precautions should be observed.

Irritant Those products labelled irritant present risks to the skin and eyes.

Explosion Hydrogen-generating cleaners are used for clearing blocked drains and may present significant risks.

Control measures

Care must be taken to avoid splashes of liquid or raising dust when the corrosive cleaners are handled, protecting against inhalation or entry into the eyes.
The skin must be protected by wearing suitable gloves[84]. A **face shield** must be used to protect the eyes when using pellets or liquid cleaners using more than 15% sulfuric acid. With dilute formulations, safety spectacles should be sufficient.
The skin must be protected from any contact with enzymic cleaners by wearing gloves if there is any chance of an allergic reaction.
When using sink or drain cleaners that are labelled irritant, safety spectacles should be worn if there is any risk of splashes to the eyes and gloves should be worn to protect the skin.
All sources of ignition must be removed or extinguished when using cleaners that generate hydrogen.

[84] Marigold Suregrip GO4Y or Blue Nitrile G25B are recommended. See CLEAPSS guidance leaflet PS 50, *Gloves as personal Protective Equipment* for a full discussion.

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RESTRICTIONS	Pupils must never be allowed to use corrosive sink cleaners. Any use to clear blockages must be the responsibility of staff who must read, and follow carefully, the instructions on the package.
Disposal	Strong acids and alkalis may not be flushed directly into the drains except when using them for cleaning! Unwanted acid cleaners should be poured slowly into water (eg, a half bucket full for 200 ml of cleaner) while wearing a face shield, apron and gloves. Sodium carbonate (washing soda) can then be added until it stops fizzing. Strongly alkaline cleaners (sodium or potassium hydroxides or strong ammonia) are best disposed of with the help of the science department.
Storage	All corrosive sink and drain cleaners should be stored away from food areas and in a safe and secure place so that they cannot be handled by pupils without permission and misused.

IMMEDIATE REMEDIAL MEASURES

Alkaline cleaners are in the eyes	Obtain medical attention. Irrigate immediately with water, holding the eyelids apart and continue irrigation until the casualty reaches hospital.
Acid cleaners are in the eyes	Wash thoroughly for at least ten minutes with water, holding the eyelids apart. Seek medical attention if irritation persists.
Swallowed	Give plenty of water and seek medical attention. Do not induce vomiting.
Spilt on the skin or clothes	Remove contaminated clothing. Wash affected area thoroughly with a large amount of water. If a large area is affected or blistering occurs, seek medical attention. Soak contaminated clothing and rinse repeatedly.

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3.009 COSHH Regs	cleaning agents for food handling areas: Oven cleaners	Applicable to: Brillo oven and grill cleaner; Kleenoff oven pad and cleaner; Mister Muscle Oven Cleaner	See also: 3.003

Process(es) covered: Cleaning the insides of ovens using powders, liquids, gels, sprays and pads.

Hazards

Corrosive	Oven cleaners containing more than 2% sodium / potassium hydroxide are corrosive.
Irritant	Oven cleaners containing between 0.5 to 2% sodium / potassium hydroxide are regarded as irritant.
Allergic reaction	Enzyme-based products may provoke a response in some people.

Risk Assessment

Corrosive	Oven cleaners are caustic; those that are most powerful contain high concentrations of (usually) sodium hydroxide and are corrosive. The cleaners may be applied as a thick gel (sometimes using a special applicator), with a pad or as a foam spray. The necessity of having to work in a confined area and reach into crevices and corners increases the risk of accidents during the use of such cleaners. Oven cleaners are easier to apply as a foam but may then be more readily sprayed onto exposed skin or into the eyes with potentially serious effects.
Irritant	Formulations with lower concentrations of active ingredient are safer but nevertheless still irritant to skin and eyes.
Allergic reaction	Although *much* safer than the conventional caustic cleaners, there is a very small chance of an allergic response to the enzymes in these products. As it is impossible to identify in advance those individuals who may be affected, precautions should be observed.

Control measures

Great care must be taken when using all corrosive oven cleaners, particularly those that are sprayed onto surfaces. The instructions supplied with the cleaners must be followed precisely. It is wise to apply the cleaning agent at arm's length and to protect the skin from all contact with the cleaning agent and oven surfaces that have already been treated. The gloves should be long enough to cover the lower arm and the skin of the upper arm should not be exposed. The eyes must be adequately protected when using caustic cleaners. A **face shield** must be worn if there is a risk of corrosive materials being sprayed, splashed or wiped onto the face or into the eyes.

The skin must be adequately protected from all contact with irritant cleaning agents. Gloves should be long enough to cover the lower arm and the skin of the upper arm should not be exposed. With agents that are marked irritant and with solid preparations, safety spectacles should provide sufficient eye protection.

Gloves must be worn when using enzymic cleaners.

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RESTRICTIONS	Pupils below year 12 must not be permitted to use *corrosive* oven cleaners, though they may use less hazardous products under close supervision. It may be appropriate for older students to use oven cleaners that are corrosive but only if they are closely supervised and all the precautions listed above are followed. Spray or foam formulations, which are potentially more dangerous if misused, are not recommended for application by pupils.
Disposal	Unwanted liquid cleaners can be mixed with a bucket-full of water and flushed down the foul-water drain. Other cleaners and empty containers can be added to other solid waste.
Storage	All oven cleaners should be stored away from food areas and in a safe place so that they cannot be taken by pupils without permission and misused.
FURTHER INFORMATION	
	If the oven cleaning operation produces an unpleasant smell, windows should be opened or extract fans used. Hazardous fumes are unlikely to be produced.

IMMEDIATE REMEDIAL MEASURES

Oven cleaners are in the eyes	Obtain medical attention. Irrigate immediately with water, holding the eyelids apart and continue irrigation until the casualty reaches hospital.
Oven cleaners are swallowed	Give plenty of water and seek medical attention. Do not induce vomiting.
Oven cleaners contaminate the skin or clothes	Remove contaminated clothing. Wash affected area thoroughly with a large amount of water. If a large area is affected or blistering occurs, seek medical attention. Soak contaminated clothing and rinse repeatedly.

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3.010 Man Regs	conventional ovens	Applicable to: gas ovens and electric ovens that do not use microwaves	See also: 3.011 3.033

Process(es) covered: The use of a conventional oven for initial cooking and reheating of precooked food. See sheet 3.011 for the hazards of food poisoning and 3.023 for heating on hobs.

Hazards

Burning and scalding	Cooking or reheating foods may result in a burn or scald to the skin.
Fire	Overheated food, fats or cooking oil may ignite.
Explosion	Gas that has not ignited presents a potential explosion hazard.

Risk Assessment

Burning and scalding	Handling oven shelves and hot containers often result in minor burns and scalds. Cookers with controls at the back present an increased risk. The greatest risk occurs when putting items into, and removing them from, an oven particularly if hot shelves must be moved. When opening oven doors, blasts of hot, moist air / steam can cause involuntary movement and mist up spectacles.
Fire	Oils and fats present the greatest risk of fire in the kitchen. Build up of debris in oven can cause fires.
Explosion	Gas cookers should, if possible, be installed away from windows, otherwise sunlight can make flames invisible or draughts can blow out pilot lights and small flames.

Control measures

Correct instruction and appropriate use of oven gloves or cloths should minimise the risk of burns when putting dishes into or removing them from an oven.

Oven gloves must always be used when putting items into, and removing them from, a hot oven. Oven shelves should be checked to see that they are in the required position, are level on their runners and cannot tip up when pulled out, laden with food. Care must be taken when opening oven doors, to guard against blasts of hot air. To reduce the dangers of accidents, the number of pupils working at any one time around heating equipment must be controlled.

It is difficult to reduce the risk of fat-pan fires to zero so everyone must be taught how to deal safely with such a fire when it occurs. Open deep fat frying is not recommended in Food technology.

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

Where siting is less than ideal, extra care must be taken to check pilot lights regularly or to confirm that gas has ignited properly.

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RESTRICTIONS

Food should not be heated or reheated while covered with certain plastic films; see sheet 3.019 for more information.

Disposal

Cookers and other kitchen equipment should be disposed of in accordance with the *Waste Electrical and Electronic Equipment Regulations* 2006 (the *WEEE Regulations*)
See 3.034. Items should be taken to the local recycling point.

FURTHER INFORMATION

If food covered with cling film is heated in an oven, it is important to ensure that the film is not touching the food.
Care must be taken not to look too closely at roasting foods in case hot fat splashes into the eyes.
Ensuring adequate heating of foods
If cooking in a microwave oven then see sheet 3.027.
If food is to be cooked at all, it is important to cook it thoroughly, following the correct conditions for each heating method and type of food and ensuring that the food is really very hot at the centre. It is safer to heat food during cooking or reheating until it is too hot and allow it to cool, rather than undercook or under-reheat food. If food is not piping hot throughout after cooking, bacteria causing gastroenteritis may still be present.
It could be useful to check the settings on a conventional oven with a special oven thermometer from time to time.
Where it is essential to keep cooked food hot for a period before it is consumed, see sheet 3.018.
Dealing with fat-pan fires
Although there are special fire extinguishers that are suitable for dealing with burning oil or fat, it is safest to use a fire blanket, damp towel or a tight-fitting lid to cut off the oxygen supply to the fire. This cover must stay in place until the pan is cold to prevent re-ignition. The use of water or the wrong extinguisher can seriously spread the fire with disastrous consequences.

IMMEDIATE REMEDIAL MEASURES

Burns or scalds to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Seek further medical assistance. Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.
Hot fat is splashed into the eyes	Wash thoroughly for at least ten minutes with water to cool the eye as quickly as possible. Seek medical attention if irritation persists.

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3.011 COSHH Regs	Cooking and REHEATING, Food Poisoning	Applicable to: hobs and ovens	See also: 3.010 3.012 3.027 3.033

Process(es) covered: The food poisoning hazards associated with use of any type of oven for initial cooking and reheating of precooked food. See sheet 3.010 for the burning and fire hazards.

Hazards

Food poisoning (Infection)

Gastrointestinal infection results from eating, or hand-to-mouth contact with, food carrying pathogenic microorganisms (particularly *E. coli* 0157 and *Salmonella*) and/or their toxic products.

Risk Assessment

Food poisoning (Infection)

While initial cooking destroys microorganisms and toxins, the temperature must be held sufficiently high for long enough to achieve this. Food chilled after cooking may become re-infected or remaining organisms may replicate (slowly) while chilled so that it must again reach a high temperature to ensure safety.

Control measures

Chicken and pork are the foods most likely to contain *Salmonella* while any meat could be contaminated with *E. coli* 0157 and cooking these foods thoroughly is essential. Pre-stuffed joints and poultry are sometimes difficult to heat throughout in a conventional oven and testing with a suitable, clean thermometer is advisable.

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RESTRICTIONS

Food should not be heated or reheated while covered with cling film; see sheet 3.019 for more information.
Chilled food should not be left on tables or worktops before reheating: this allows the microorganisms to replicate and increases the risk that they will not be destroyed by the reheating process. Chilled food should go directly from the refrigerator to the oven.
Cooked foods need to be cooled quickly, ideally using a blast chiller and then refrigerated.

Disposal

See 3.034.

FURTHER INFORMATION

Ensuring adequate heating of foods
If food is to be cooked at all, it is important to cook it thoroughly, following the correct conditions for each heating method and type of food and ensuring that the food is really very hot at the centre. If cooking in a microwave oven (see sheet 3.027), the conditions and standing times recommended by the manufacturer must be observed. To destroy bacteria during heating, food must reach an internal temperature of at least 70 °C for a minimum of 2 minutes. It is safer to heat food during cooking or reheating until it is too hot and allow it to cool, rather than undercook or under-reheat food. If food is not piping hot throughout after cooking, bacteria causing gastroenteritis may still be present.
Food should normally be prepared just prior to serving; leaving perishable food out at room temperature for more than one hour or keeping food warm for extended periods should be avoided. Where it is essential to keep cooked food hot for a period before it is consumed, particular care over the temperature must be observed and regular checks of the temperature made.
Reheating foods
Liquid foods such as soups, stocks, sauces and gravy provide an ideal breeding ground for rapid microbial growth; such liquids can, however, be preserved by freezing after their preparation. If not frozen immediately, they should not be kept or reheated.
Cooked food should be reheated only once, whether originally cooked in the home or purchased as a cook / chill product; any left-overs after reheating should be thrown away. Food should be reheated thoroughly, otherwise any bacteria that may have contaminated the food after the initial cooking or during storage can survive and reproduce. If bacteria such as *Staphylococcus aureus* have multiplied in the food, they are capable of forming a heat-resistant toxin, so the food may still be unsafe even though it has been thoroughly heated. Cooked rice is particularly likely to contain spores of *Bacillus cereus* that have survived the cooking process.

IMMEDIATE REMEDIAL MEASURES

Poisoning is suspected

If a casualty is suffering from nausea, vomiting or diarrhoea with drowsiness or unconsciousness, do not induce vomiting. Provided the casualty is conscious, wash out mouth with water. Obtain medical attention.

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3.012 Deep fat fryers

Applicable to: deep-fat fryer

See also: 3.021

Process(es) covered: Deep fat frying using a thermostatically controlled closed deep fat fryer.

Hazards

Tripping and falling	Trailing mains leads present a tripping hazard with a further hazard from the falling fryer.
Electric shock	Electrically heated deep fat fryers present a hazard of electric shock.
Burns and Scalds	Hot oil in contact with the skin may cause burns or scalds.
Overheating and Fire	Hot oil is at risk of catching fire if heated to too high a temperature.
Environmental hazard	Used oil can cause environmental damage.

Risk Assessment

Tripping and falling	The risk of tripping depends much more on the location of the socket outlets relative to the position of the deep fat fryer. This matter needs to be assessed locally. A falling fryer could cause a foot injury.
Electric shock	The rate of wear and severity of the harm makes this a significant risk.
Burns and Scalds	An increased risk when putting things into the fryer and the hand is likely to be closest. Removing hot items from the fryer could also present a risk.

Control measures

Frequent visual checks and regular formal inspections reduce the risk of electric shock.
The fryer should be positioned in a dedicated area near to a socket outlet.
Care should be taken that trailing leads are kept clear of work surfaces and people nearby. Signs indicating ‘HOT’ would raise awareness to other classroom users.
Instruction should be given on the correct use of deep fat fryers and adult supervision is advisable for pupils below Year 10.
Only suitable ingredients and materials should be used in the deep fat fryer.
Excess moisture should be removed from the ingredients before cooking.
Fats and oils should be changed regularly. Attention needs to be paid to the correct disposal of used oil. Many local authorities have procedures to deal with this.
It is difficult to reduce the risk of fat-pan fires to zero so everyone must be taught how to deal safely with such a fire when it occurs.
Oven gloves should be used when handling hot food.

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RESTRICTIONS

Pupils under 15 should be closely supervised whilst using deep fat fryers.
Deep fat fryers must be left to cool after use before removing oil.
Waste oil should be stored in suitably marked containers prior to disposal.

Disposal

For disposal see 3.034.

IMMEDIATE REMEDIAL MEASURES

Tripping and falling	Wash thoroughly for at least ten minutes with water to prevent scratching of the eye. Seek medical attention if irritation persists.
Electric shocks	Send for a first aider immediately. Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a trained first aider does not arrive quickly and the casualty has no pulse, consider carrying out cardio-pulmonary resuscitation.
Burns and scalds	If hot fat is splashed into the eyes: Wash thoroughly for at least ten minutes with water to cool the eye as quickly as possible. Seek medical attention if irritation persists. If burns to the skin occur: Cool the affected area under a running cold tap for ten minutes. If serious burns to the skin occur: Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.
Fire	Although there are special fire extinguishers that are suitable for dealing with burning oil or fat, it is safest to use a fire blanket, damp towel or a tight-fitting lid to cut off the oxygen supply to the fire. This cover must stay in place until the pan is cold to prevent re-ignition. The use of water or the wrong extinguisher can seriously spread the fire with disastrous consequences.

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3.013 COSHH Regs	Defrosting Foods	Applicable to: commercially frozen foods; domestically frozen foods	See also: 3.019 3.020

Process(es) covered: Defrosting foods that are precooked and defrosting food that is to be cooked.

Hazards	
Food poisoning (Infection)	Gastrointestinal infection results from eating, or hand-to-mouth contact with, food carrying pathogenic microorganisms and/or their toxic products.

Risk Assessment	
Food poisoning (Infection)	Freezing does not kill the organisms causing food poisoning, it stops them from multiplying rapidly. There is a negligible risk with precooked food which is eaten cold (eg, a frozen cake). Frozen meat, particularly poultry, may not reach a temperature high enough to kill *Campylobacter* or *Salmonella* during cooking if cooked from frozen. The cooking can then encourage the growth of pathogenic microorganisms in parts of the food.

Control measures	
	It is essential to follow the supplier's instructions that are printed on frozen poultry. Should there be no instructions, the bird should be thawed thoroughly by leaving at room temperature for up to 8 hours. Other meat is usually defrosted by leaving it overnight in a refrigerator. Prepared dishes are often cooked from frozen but those that have been frozen in a domestic freezer are best defrosted before reheating.

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RESTRICTIONS

Food that has become defrosted as a result of a power or freezer failure should be disposed of and not eaten.

Disposal

Any frozen food that is discovered to be well-past its 'best-before date' should be placed in the solid waste.

Storage

Commercially frozen food is given a 'star rating' to indicate how long it should be stored in a freezer:

- □ 1 week
- □□ 1 month
- □□□ until 'best-before date'.

FURTHER INFORMATION

When shopping, it is best to select chilled and frozen foods last to minimise the amount of time during which the food can warm up in transit. If possible, also avoid purchasing such foods at times when queues could build up at the check-out. Pack frozen and chilled foods in separate bags and, wherever possible, use an insulated food bag for transporting such items to avoid any significant temperature increase. All chilled and frozen foods must be placed immediately into a well maintained refrigerator or freezer.

It is essential to read and follow thawing instructions on frozen foods thoroughly and carefully. This will not only be safer but also restores the best flavour and texture. Items should be placed on a tray, plate or dish that is sufficiently deep to collect any liquid that drips from the thawed product. Overloading the dish with several frozen items should be avoided because this prolongs the thawing time and results in the food on the outside of the dish thawing first.

While the food is thawing, it should be covered to prevent contamination from the atmosphere and kept in a cool place; although this takes longer, the food will thaw more thoroughly and will be safer.

If defrosting is to be done in a microwave oven, see sheet 3.027.

Thawing times depend on the thickness and mass of foods and many small items, such as fish fillets, burgers and vegetables, may be cooked straight from the frozen state.

Thawed food should not be refrozen unless cooked thoroughly.

IMMEDIATE REMEDIAL MEASURES

Poisoning is suspected

If a casualty is suffering from nausea, vomiting or diarrhoea with drowsiness or unconsciousness, do not induce vomiting. Provided the casualty is conscious, wash out mouth with water. Obtain medical attention.

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3.014 COSHH Regs	Eating and Tasting	Applicable to:	See also: 3.010 3.011 3.018 3.019 3.034

Process(es) covered: Tasting during preparation (for flavour adjustment) and consuming food after preparation and cooking as the end point of the activity.
Sensory analysis activities.

Hazards	
Food poisoning (Infection)	Gastrointestinal infection results from eating or hand-to-mouth contact with, food carrying pathogenic microorganisms and/or their toxic products.
Poisons on food	Poisoning which is not an infection results from eating or hand-to-mouth contact with, food containing natural toxic chemicals or contaminants from the environment.
Food contamination	Food may become contaminated during or after preparation by someone carrying an infectious disease.
Allergic reaction	Allergic reactions may develop from exposure to many foods. Some people have become 'sensitised', ie, even a very small dose of the allergen then produces the reaction. Substances likely to cause reactions include peanuts, milk, flour (gluten) and food additives.

Risk Assessment	
Food poisoning (Infection)	Even fresh food of the highest quality should be expected to be carrying organisms that will lead to decay. One purpose of cooking food is to control this process but, if food is not sufficiently fresh when purchased, cooking it may be too late to prevent problems. Careless handling within the kitchen may also lead to contamination, in particular, storing food inappropriately.
Poisons on food	Foods are frequently contaminated with pesticides, fungicides or fertilisers during their production. Even foods that are produced by 'organic' methods are not necessarily free of natural poisons.
Food contamination	Tasting food with a dirty spoon may be a source of infection. Similarly, when food is tasted by a group of pupils, shared spoons, forks and dishes may lead to the transmission of microorganisms.
Allergic reaction	Any 'foreign' protein may produce an allergic response in sensitive individuals and inadvertent consumption of traces of nuts have been known to cause anaphylactic shock.

Control measures	
	The highest standards of hygiene must be maintained at all times and particularly when pupils are working closely together in the same area. (See *Food Safety Regulations* in the *Introduction to Part 3*.) The normal methods of preparation of food are designed to minimise any harmful effects that result from contaminants on the surface. When tasting food while cooking, a clean utensil must be used by each individual with immediate washing. If further tasting is necessary, another clean utensil must be used, again washing it as soon as tasting is completed. For group tasting sessions, it is sensible to provide a collection of disposable materials, such as paper plates and cups together with plastic spoons, etc. Allergic reactions can only be controlled by awareness of problems and separation of sufferers from their allergens.

Eating and Tasting (Continued)

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RESTRICTIONS

'At risk' groups should avoid some foods altogether or eat them with caution. Everyone is potentially at risk from the effects of food poisoning but certain groups are more susceptible than others.

On December 13th 2014[85] the requirement of notifying potential customers about the 14 main allergens that may be present in the food that they purchase came into force. This places a responsibility to display allergen information by anyone selling pre-packed and loose food, and to notify customers in a clear and consistent way. This legislation should be considered when developing food activities in schools and by the school catering provider.

Food businesses (and good practice would dictate, food rooms) should provide information on the following allergenic ingredients:

Cereals including gluten	Peanuts
Nuts	Milk
Soya	Mustard
Lupin	Eggs
Fish	Crustaceans
Molluscs	Sesame Seeds
Celery	Sulphur Dioxide

FURTHER INFORMATION

An unpleasant smell, unusual texture or tainted flavour may indicate the presence of large numbers of microbes in food. Pathogens and microorganisms producing toxins may also be present even if food does not appear to be contaminated. With sufficient time, nutrients, moisture and a suitable temperature, bacteria and other microorganisms will replicate rapidly. (A bacterium reproducing every 20 minutes will produce a colony containing 16,777,216 cells within 8 hours. Less than 1 million bacteria are sufficient to cause food poisoning in some cases.)

The symptoms of food poisoning vary according to the microorganism involved but may include nausea, headache, aching joints, vomiting and diarrhoea. Symptoms may develop rapidly or after an incubation period. If this delay is longer than 2 days, it is difficult to trace the poisoning incident to the food responsible. (See *Appendix 3* for an illustration of the major causes of food poisoning.)

If charges are made for food, it will be necessary to comply with the various food safety regulations, eg, to ensure that hair is covered etc. Charging for refreshments may also lead to inspection.

IMMEDIATE REMEDIAL MEASURES

Poisoning is suspected — If a casualty is suffering from nausea, vomiting or diarrhoea with drowsiness or unconsciousness, do not induce vomiting. Provided the casualty is conscious, wash out mouth with water. Obtain medical attention.

A particular source is suspected — Seal a sample in a plastic container for investigation.

Anaphylactic shock (major allergic reaction) — If the patient suffers from impaired breathing and a rapid pulse, they may be going into anaphylactic shock seek further medical help immediately. Check to see if the patient is carrying an Epi-Pen or syringe of adrenaline; if so then help them to administer it. Call an ambulance and prop the patient in a sitting position.

[85] Further information and free resources on the legislation is available from www.food.gov.uk

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3.015 COSHH Regs	Enzymes	Applicable to: cellulase; chymosin / rennin; papain; pectinase; pepsin	See also:

Process(es) covered: Enzymes may be used in making cheese and junket, to tenderise meat, in extracting juice from fruit purées and for a variety of other tasks.

Hazards

Allergic reaction

Allergic reactions may develop from exposure to culinary enzymes used in preparing foods. Some people have become 'sensitised', ie, even a very small dose of the allergen then produces the reaction. Substances likely to cause sensitisation are identified by risk phrases R42 (May cause sensitisation by inhalation) & R43 (May cause sensitisation by skin contact).

Risk Assessment

Allergic reaction

Enzymes are proteins and any 'foreign' protein may produce an allergic response in sensitive individuals. An individual may initially become sensitised to the enzyme so that the briefest subsequent exposure will trigger an allergic response.
In food technology, a significant exposure to enzymes will be extremely unlikely and they therefore present little, if any, risk for most individuals. It is those making up the enzyme solution who are most at risk because of the possibility of inhaling the powdered enzyme. It is, however, impossible to predict or identify in advance those who might be affected when handling the enzymes, so precautions should be taken by all.

Control measures

When enzyme solutions are being prepared from powders, it is important to avoid creating and inhaling any dust. If dust is likely to be inhaled, a dust mask (type FFP3) should be worn (Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science).
Any direct contact between enzyme powders or strong solutions and the skin should also be avoided, so protective gloves[86] should be worn. Specialist advice and support should be sought (eg, from Science teachers or technicians)

[86] See CLEAPSS leaflet PS 50, *Gloves as Personal Protective Equipment*.

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RESTRICTIONS	Persons with known allergic reactions to enzymes should be particularly careful to take appropriate control measures because of the risk of anaphylactic shock. Information related to allergens is in 3.014 eating and Tasting
Disposal	Any unwanted stocks of enzymes should be mixed with a lot of water and flushed into the foul-water drain.
Storage	Enzyme solutions should not be stored for more than a few weeks since they work better when fresh but, if it is necessary, they should be kept cool.
FURTHER INFORMATION	There should be no risks involved in consuming the enzymes naturally contained in food.

IMMEDIATE REMEDIAL MEASURES

Enzyme powders or solutions are in the eyes	Immediately wash the eye thoroughly for at least ten minutes with water. Seek medical attention whether or not irritation persists.
Enzyme powders or solutions are spilt onto the skin	Immediately wash the affected area thoroughly with water.
Anaphylactic shock (major allergic reaction)	If the patient suffers from impaired breathing and a rapid pulse, they may be going into anaphylactic shock. Check to see if the patient is carrying an Epi-Pen or syringe of adrenaline; if so help them to administer it. Call an ambulance and prop the patient in a sitting position.

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3.016 Man Regs	Food PROCESSORS	Applicable to: free-standing food processors	See also: 3.024 3.029

Process(es) covered: Using food processors that are not held in the hand during use.

Hazards

Cuts	The sharp blades may give rise to cuts.
Electric shock	Damage to the casing of the processor or to the power cord can present an electric shock hazard. Water inside the motor or control sections could defeat the electrical insulation.
Manual handling	Some machines are heavy and present a manual handling hazard.

Risk Assessment

Cuts	The blades are very sharp and can cause cuts even when not rotating. If they are accessible when the processor is running they present a high risk.
Electric shock	Risks may arise from damaged and incorrectly wired plugs, the fitting in the plug of a fuse with an inappropriate rating for the equipment and flexible cables which have been damaged or allowed to become worn, impairing the insulation. The risk of shock from water inside the electrical section is probably small but still significant.
Manual handling	Lifting a heavy machine from a low cupboard or carrying it between rooms present a risk of injury to the back or arms.

Control measures

Manufacturer's instructions should be followed at all times. Instruction should be given on the use of machines.

All processors should be fitted with an interlock to prevent operation unless guarded against insertion of fingers. The correct functioning of this interlock should be confirmed regularly. Users must be trained to isolate the machine from the power supply before dismantling it for cleaning. Clear instructions for dismantling and cleaning must be available. Blades should be stored appropriately.

Frequent visual checks and regular formal inspections reduce the risk of electric shock from faults to a low level. Cleaning methods must not allow water inside the electrical parts.

Users must be trained to move heavy machines correctly, using two persons if necessary. Any movements between rooms or buildings should have an individual risk assessment to identify a safe method and route.

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RESTRICTIONS

Although food processors are very safe to use, some classes may contain pupils who are too disruptive to be trusted with such equipment.

Disposal

See 3.034. The *Waste Electrical and Electronic Equipment Regulations* 2006 (the *WEEE Regulations*) apply.

Storage

Heavy food processors should not be stored on shelves that are very high or very low, nor on shelves incapable of supporting the weight.

FURTHER INFORMATION

An electrical safety inspection and test may miss a mechanical interlock which prevents the processor being used unless it is correctly assembled with covers or lids in place. It is therefore strongly recommended that a regular inspection is used to confirm that the safety system is working correctly. If the processor is used irregularly, an inspection before each use may be more practicable.

IMMEDIATE REMEDIAL MEASURES

Cuts

If cuts are minor, ie, of a sort which casualties would normally treat themselves, the wound should be washed clean and a small, sterilised dressing applied.

Severe cuts

Send for a first aider. Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible.
Protect yourself from contamination by blood.
Blood splashes or drips should be cleaned up with VirKon as on sheet 3.007.

Electric shock

Send for a first aider immediately. Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance.
If a trained first aider does not arrive quickly and the casualty has no pulse, consider carrying out cardio-pulmonary resuscitation.

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3.017 COSHH Regs	Food storage: Dry foods	Applicable to: dry items, eg: beans, flour, pasta, peas, rice, sugar and sealed cans or bottles	See also: 3.018 3.019 3.028 3.031

Process(es) covered: Storage of dry food items such as flour, sugar, pulses, rice and canned foods.

Hazards

Food poisoning (Infection)	Gastrointestinal infection results from eating, or hand-to-mouth contact with, food carrying pathogenic microorganisms and/or their toxic products.
Poisons on food	Poisoning which is not an infection results from eating, or hand-to-mouth contact with, food containing natural toxic chemicals or contaminants from their environment.

Risk Assessment

Food poisoning (Infection)	Bacteria will not multiply in dry foods but they can be introduced by pests and multiply during food preparation. They should not be present in intact cans or other food containers but may enter if the container has been accidentally damaged or once it has been opened. The longer food is kept, the more likely it is to become infested.
Poisons on food	The risks of food becoming contaminated by transfer from other foods or from their environment are greater in storage without adequate segregation. If dry foods are stored with cleaning agents or equipment, the risk of contamination is significant.

Control measures

The storage cupboard should be designed to provide an effective storage space that can be easily monitored and maintained.
Shelves should be cleaned and tidied on a regular basis with stock rotated so that the oldest items are always used first.
All food should be kept labelled and covered; opened packs should be placed in airtight containers. Staff should be vigilant for signs of pests.
Cans should be inspected for rust, dents or ‘blown’ ends; if there is reason to be suspicious, their contents should not be eaten.
Proper segregation in storage necessary to prevent contamination.

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RESTRICTIONS

Storage cupboards and their contents should be regularly monitored by staff

Disposal

See 3.034.

Storage

Use by dates should be observed. Dry foods stored in airtight containers will keep for a long time but should be inspected before use (for weevils or mould) and pulses may need longer cooking times than fresh ones.
Cans should keep, unopened, for up to 3 years. Once they have been opened, and if their contents will not all be used at once, the food should be emptied into a non-metallic container, covered and refrigerated.

FURTHER INFORMATION

The store cupboard for dry foodstuffs should be:

- cool, dry, well-ventilated and, if appropriate, well-lit;
- designed so that pests have no way of entering;
- such that all food can be stored above floor level;
- ideally of such a size that similar foods can be placed together with space for an unopened container behind the one in use;
- not used for storage of anything else.

It is important to use up stock in rotation so that the oldest is used first.

IMMEDIATE REMEDIAL MEASURES

Poisoning is suspected

If a casualty is suffering from nausea, vomiting or diarrhoea with drowsiness or unconsciousness, do not induce vomiting. Provided the casualty is conscious, wash out mouth with water. Obtain medical attention.

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3.018 COSHH Regs	Food Storage: High Temperatures	Applicable to: heated trolleys; hotplates; hot storage cabinets	See also: 3.017 3.019

Process(es) covered: Keeping cooked food warm until it is to be consumed.

Hazards	
Food poisoning (Infection)	Gastrointestinal infection results from eating, or hand-to-mouth contact with, food carrying pathogenic microorganisms and/or their toxic products.

Risk Assessment	
Food poisoning (Infection)	Food that is to be eaten hot, but cannot be consumed immediately, may harbour microorganisms which multiply during the period between cooking and eating when the food is still warm.

Control measures	
	It is essential to store the food in such a way that its temperature is raised above 63 °C throughout the period between cooking and consumption. Steps must be taken to ensure that the heat supply is such that all of the food is maintained at the required temperature. Regular temperature checks with a food probe should be made.

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RESTRICTIONS

If a suitable thermometer is not available to demonstrate that this temperature is being achieved, no attempt should be made to keep food hot in this way.

Disposal

See 3.034.

FURTHER INFORMATION

It is always recommended that food should be consumed immediately after cooking. If this is impossible for some reason, it is preferable to cool the food quickly, ideally using a blast chiller, store it in a refrigerator and then reheat thoroughly later.
Advice should be given to pupils on the reheating of dishes prepared in school and then taken home.
It is unusual for food technology in schools and colleges to need to keep cooked food hot. However, it is necessary for special projects or occasions when visitors are involved.

IMMEDIATE REMEDIAL MEASURES

Poisoning is suspected

If a casualty is suffering from nausea, vomiting or diarrhoea with drowsiness or unconsciousness, do not induce vomiting. Provided the casualty is conscious, wash out mouth with water. Obtain medical attention.

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3.019 COSHH Regs	Food Storage: Low Temperatures	Applicable to: freezers; refrigerators	See also: 3.001 3.013 3.020

Process(es) covered: Preserving the quality of food by chilling and freezing.

Hazards

Food poisoning (Infection)	Gastrointestinal infection results from eating, or hand-to-mouth contact with, food carrying pathogenic microorganisms and/or their toxic products.
Poisons on food	Contamination of fatty foods wrapped in plastic films with chemicals from the plastic.

Risk Assessment

Food poisoning (Infection)	Harmful bacteria require food, moisture, warmth and time to survive and multiply. All reproduce rapidly at temperatures around 37 °C (ie, body temperature), but many can multiply at lower or higher temperatures. Some can do so, although slowly, at temperatures even as low as 5 °C. Some foods are a greater risk than others (see below). Neglect of temperature control may have been the cause of a majority of food poisoning cases in recent years.
Poisons on food	Problems that were identified in the 1970s with PVC-based films have largely been eliminated by changing the formulation of the plastic used. Nevertheless, fatty foods are more likely than others to absorb any chemicals released by plastic packaging. Even in the worst cases, the concentration of such contaminants is likely to be very low and so present no problem.

Control measures

A refrigerator that stores food at a temperature below 5 °C can delay bacterial growth for up to 5 days. Those foods that are listed below should be kept in such a refrigerator for even short-term storage. See *Further Information* for *Good practice in safe refrigerator management*.

For long-term storage, food should be kept at -18 °C. Although bacteria will survive at this temperature, they will not be able to multiply until the temperature is raised. See *Further Information* for *Good practice in safe freezer management*.

Although film made from polyethylene or from VDC copolymer plastics, eg, 'microwave and freezer wrap', is safer, the advice of the Ministry of Agriculture, Fisheries and Food was that it is unwise to distinguish between different types of food wrap. There is no evidence of a health hazard from any type of cling film but little is known of the chemicals that migrate from the plastics into food and so it is sensible to minimise the contact between fatty foods and films.

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Disposal

Frozen or chilled foods past their use-by dates must be disposed of (see 3.034).

FURTHER INFORMATION

Those foods that are a greater risk and therefore need more care include the following.

- All meat and poultry products which may be contaminated with food poisoning bacteria.
- Raw fish and shellfish are especially likely to harbour bacteria able to multiply at low temperatures and may have come from polluted waters.
- Milk, eggs and foods containing them such as cream, custard or mayonnaise that provide an ideal mixture of nutrients needed by multiplying bacteria.
- Cooked meat and gravy, soups and stock which are also ideal media for bacteria.
- Cooked rice is likely to contain bacterial spores that have survived the cooking process.

If such foods are not cool enough, a small number of bacteria can become millions very quickly.

Good practice in safe refrigerator management

1 Keep the refrigerator door tightly closed, open only when necessary and close it promptly.
2 Keep the refrigerator clean and free from any build-up of ice.
3 Remove old items once use by date has been reached.
4 Fit a thermometer, which can be seen easily and checked daily, on the inside wall or wire shelf 15 cm from the outside edge and half way down the refrigerator. Temperatures should be between 1 and 4 °C. (There will be a variation of 2 or 3 degrees between different parts of the refrigerator.)
5 Allow cold air to circulate; do not overfill the refrigerator.
6 Follow storage instructions and observe 'eat-by' dates on labels.
7 Keep all food covered.
8 Food should be cool before being put into the refrigerator, eg, do not use it to set jelly quickly.
9 Raw food and cooked food must be kept entirely separate to avoid cross-contamination.
10 Raw meat and poultry should be isolated and placed where juices cannot drip onto other food.
11 Fresh fruit and vegetables should be washed before storage in a salad crisper drawer.
12 Food to be stored should be clearly labelled with contents, date of storage and use-by date.

Good practice in safe freezer management

1 Frozen food deteriorates in flavour and texture with time. How long it should be stored depends on the type of food and the rating of the freezer, usually from 3 months to 1 year.
2 Keep the door or lid tightly closed, open only when necessary and close it promptly.
3 Keep the freezer clean and free from any build-up of ice.
4 Defrost regularly and dispose of any out of date items.
5 Display a freezer thermometer where it can be seen so the reading checked easily (-18 °C).
6 Wrap food adequately (see below), seal, label **and date** so that it can be used in rotation.
7 Display and follow manufacturers' instructions on storage times and temperatures.
8 **Never** refreeze food that has been thawed.

Wrapping foods for storage in refrigerators and freezers

Do not use cling film to wrap fatty foods (eg, cheese, butter, cooked meats or cakes / biscuits with chocolate or cream coatings, etc). Either place the food in containers which are then covered with cling film so that it is not in contact with the food or use sealable containers, plastic bags or aluminium foil instead. Cling film can be used to wrap non-fatty foods such as most fruit and vegetables.

IMMEDIATE REMEDIAL MEASURES

Poisoning is suspected — If a casualty is suffering from nausea, vomiting or diarrhoea with drowsiness or unconsciousness, do not induce vomiting. Provided the casualty is conscious, wash out mouth with water. Obtain medical attention.

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3.020 COSHH Regs	Freezing Food: Freezer, Refrigerator	Applicable to: freezer; refrigerator	See also: 3.001 3.013 3.019

Process(es) covered: The use of domestic-type freezers and refrigerators for freezing raw and cooked foods.

Hazards

Food poisoning (Infection)

Gastrointestinal infection results from eating, or hand-to-mouth contact with, food carrying pathogenic microorganisms and/or their toxic products.

Risk Assessment

Food poisoning (Infection)

Harmful bacteria require food, moisture, warmth and time to survive and multiply. All reproduce rapidly at temperatures around 37 °C (ie, body temperature), but many can multiply at lower or higher temperatures. If food is not frozen through to the centre, the bacteria can continue to multiply so that when the food is de-frosted and consumed infection can result.
If the food to be frozen is above room temperature when placed in the freezer, it may cause local thawing of other foods before the cooling system extracts the heat. This may allow bacteria to multiply in the neighbouring items.

Control measures

Food to be frozen must be placed in the coldest part of a domestic refrigerator or freezer with any controls also set to achieve the lowest possible temperature.
Food to be frozen must already be close to room temperature before being frozen.
Food to be frozen should be labelled clearly with contents and date.

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RESTRICTIONS

Cook / chill foods must not be kept, even in a refrigerator at a temperature below 5 °C, after the 'use-by' date. They must also be discarded if the temperature of the refrigerator rises above 5 °C. Similarly, any frozen food should be discarded (or used immediately) if the freezer temperature rises above the temperature indicated by the 'star rating' of the food. (See 3.013.)

Disposal

See 3.034.

FURTHER INFORMATION

Food which is preserved by freezing must not only be safe (ie, not containing significant quantities of harmful bacteria or their toxic products) but must also be nutritious while maintaining an acceptable texture and flavour. This can be achieved if the food is of high quality initially, is properly prepared and frozen quickly (to ensure that the ice forms small crystals). Natural enzymes in the food remain active at chilling temperatures around 8 °C. This can be useful in tenderising meat but, in vegetables and fruit, it causes loss of vitamin C and carotene. The preparation therefore depends on the foodstuff as below.

- Fish tenderises rapidly and is frozen within hours of being caught.
- Poultry is chilled overnight and then frozen quickly.
- Veal and pork are chilled for two or three days before being frozen.
- Beef and lamb are chilled for about a week before freezing.
- Vegetables are blanched (but not cooked) to destroy the enzymes, cooled with iced water and then frozen quickly.
- Fruit is washed and frozen in sugar solution.

Commercial freezing methods

Because of the advantages of freezing foods quickly, commercial freezers use several different techniques to achieve this.

- Plate freezing - the oldest method, where the food in containers is gently pressed onto very cold plates.
- Air-blast freezing - very commonly used, where the food is placed on trays and passed under a blast of very cold air.
- Immersion freezing - used for large items (eg, turkeys), where the food is immersed in a freezing solution (salt water, sugar solution or polyethylene glycol). Once frozen, the food is centrifuged to remove the remaining solution.
- Spray freezing - used for delicate or high-cost items, where the food is sprayed with liquid nitrogen or liquid carbon dioxide to achieve very rapid cooling.
- Flow freezing - used for vegetables and berries, where the food is supported on a cushion of cold air (a fluidised bed) as it passes through a freezer chamber.

Cook / chill foods

Cook / chill foods cannot be prepared using a conventional refrigerator or freezer; once chilled using a blast-chiller, they must be kept in a refrigerator at a temperature below 5 °C. They may be stored for up to 5 days after preparation. If they are not eaten by then they **must** be discarded. They must also be discarded if the temperature of the refrigerator rises above 5 °C. Cook / chill foods should be heated immediately before being eaten, to at least 75 °C, for 10 to 30 minutes, depending on the size of the portion.

Keeping food after a lesson

In many educational establishments, classes will not be able to consume food immediately it has been prepared but will want to take it home at the end of the day. Arrangements should ideally be made to keep this food covered and cool until the individual pupil or student can collect it.

IMMEDIATE REMEDIAL MEASURES

Poisoning is suspected

If a casualty is suffering from nausea, vomiting or diarrhoea with drowsiness or unconsciousness, do not induce vomiting. Provided the casualty is conscious, wash out mouth with water. Obtain medical attention.

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3.021 Man Regs	Frying and grilling Food	Applicable to: chip pan; frying pan; grill; wok	See also: 3.010 3.012 3.023 3.027

Process(es) covered: The use of a frying pan for shallow frying and a powered deep-fat fryer with or without a lid. The use of a gas- or electrically-heated grill.

Hazards

Fire	Oil and fat, when heated to a sufficiently high temperature, produce vapours that ignite easily.
Burns	Hot oil, flames, hotplates and elements, together with hot pans and lids, all present a burn hazard.
Eye damage	The eye may be damaged by splashes or spitting of hot fat or oil.

Risk Assessment

Fire	The risk of fire is greatest when using a pan of deep fat on a hob. The consequent risk of injury is greatest in busy areas with several students working together around one appliance. Open deep fat frying is not recommended. Oil in a wok is easily ignited but is not serious if there is only a little in use.
Burns	Sunlight can make flames invisible. An increased risk occurs when putting items into a fryer and the hand is likely to be closest. Removing a hot and heavy pan from a hob to a worktop may also present a high risk.
Eye damage	The risk is greatest when turning food during frying or when adding items to a pan of hot fat or oil.

Control measures

To reduce the dangers of accidents, the number of pupils working at any one time around heating equipment must be controlled. All persons must be trained to deal correctly with a fat or oil fire. Woks should not be left unattended during heating.
Gas cookers and hobs should, if possible, be installed away from windows, to improve the visibility of flames and reduce the effects of draughts on pilot lights and small flames. It may be necessary to use oven gloves when moving a hot fryer or its lid.
It is necessary to check that rings above gas burners are firmly in place before starting to use a hob.
Although one would not normally use eye protection in a domestic kitchen, in a place of work such as a food technology department, protective spectacles should be worn to control the risk to the eyes.

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RESTRICTIONS	Immature pupils should not use chip pans on hobs.
Disposal	For disposal see 3.034.

FURTHER INFORMATION

Dealing with fat-pan fires

Although there are special fire extinguishers that are suitable for dealing with burning oil or fat, it is safest to use a fire blanket, damp towel or a tight-fitting lid to cut off the oxygen supply to the fire. This cover must stay in place until the pan is cold to prevent re-ignition. The use of water or the wrong extinguisher can seriously spread the fire with disastrous consequences.

IMMEDIATE REMEDIAL MEASURES

Hot fat is splashed into the eyes	Wash thoroughly for at least ten minutes with water to cool the eye as quickly as possible. Seek medical attention if irritation persists.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Seek further medical assistance. Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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3.022 COSHH Regs	handling Food	Applicable to: cooked food; precooked food; uncooked food	See also: 3.017 3.018 3.019 3.034

Process(es) covered: Handling all food substances and products.

Hazards

Food poisoning (Infection)	Eating, or hand-to-mouth contact with, food carrying pathogenic microorganisms and/or their toxic products may result in gastro-intestinal infection.
Poisons on food	Poisoning which is not an infection results from eating, or hand-to-mouth contact with, food containing natural toxic chemicals or contaminants from the environment.
Allergic reaction	Allergic reactions may develop from exposure to many foods. Some people have become 'sensitised', ie, even a very small dose of the allergen then produces the reaction. Substances likely to cause reactions include peanuts, milk, flour (gluten) and food additives.

Risk Assessment

Food poisoning (Infection)	If high standards of hygiene are not maintained while preparing food, pathogenic microorganisms may be transferred to the food from the handler or from other foods via the work surface or utensils as well as from other foods directly.
Poisons on food	Carelessness or ignorance of the appropriate preparation techniques increases the risk of natural toxins being consumed but items presenting risks are restricted to red kidney beans, green or sprouting parts of potatoes and rhubarb leaves. Chemical residues, eg, from pesticides, may also be present but rarely at significant concentrations.
Allergic reaction	Any 'foreign' protein may produce an allergic response in sensitive individuals but simply handling the offending substance is unlikely to produce anything worse than skin irritation. However, inadvertent consumption of traces of nuts have caused anaphylactic shock.

Control measures

Strict adherence to the highest standards of personal hygiene is required (see the *Introduction to Part 3*). Every effort must be made to ensure clean working conditions (see 3.003) and to avoid contamination from other foods via utensils (see also 3.011 & 3.024).

Washing is adequate to remove chemical residues from most fruit and vegetables. The treatment for natural toxins depends on the food. Rhubarb stalks should have all the leaves removed before cooking as should green and sprouting parts of potatoes. Red kidney beans must be cooked as thoroughly as during the canning process.

Allergic reactions can only be controlled by awareness of problems and separation of sufferers from their allergens (see 3.014).

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RESTRICTIONS

Persons suffering from sickness, diarrhoea, colds, coughs or other infections should not prepare food for consumption by others.

Disposal

See 3.034.

Storage

See 3.001, 3.017, 3.018, 3.019 & 3.020.

FURTHER INFORMATION

International food safety requirements

Under the auspices of the Food and Agriculture Organization of the United Nations, the Codex Alimentarius Commission has created a series of guidelines, standards and other recommendations to ensure food hygiene internationally. These include a *Recommended International Code of Practice - General Principles of Food Hygiene* that uses a *Hazard Analysis and Critical Control Point (HACCP) system* for its application. If this system is followed, purchased foodstuffs will meet common standards for safety, wholesomeness and safe levels of chemical contaminants.

Preventing contamination of food after purchase

Avoid putting cooked or ready-to-eat foods on to a surface that has just had raw food prepared on it. Raw food, especially meat and fish, is more likely to have bacteria on it than cooked food. Cheese should therefore not come into direct contact with meat or surfaces where meat has been prepared. Raw and cooked foods should be kept separate and where possible and appropriate, covered or wrapped. Avoid adding freshly-prepared food to items prepared previously or putting freshly-prepared food into unwashed containers.

Wash poultry, fish and offal thoroughly in clean, cold, running water. Keep these items cool and covered in between preparation processes, so far as possible. Wash fruit, vegetables and salads in clean, cold, running water and keep cool in clean, covered containers until required.

Throw away old food wrappings such as foil, cling film or polythene bags and use fresh, clean, food wrappings. Do not wrap fatty foods with cling film; chemicals may leach out of the film into the food. (See 3.019 for more information.)

Look out for the appearance of insect pests, particularly in food cupboards, and deal with infestations before they build up; animals carry bacteria that can contaminate food preparation areas and work surfaces. Students should be advised to keep pet animals at home out of the kitchen and away from food storage and preparation areas.

Change and wash tea towels and dish cloths *daily*, otherwise bacteria can build up and contaminate any surface with which the cloths come into contact. Students should be advised to exercise special care and caution after handling domestic washing at home. Soiled washing can spread bacteria, especially if a family member has an infection or diarrhoea. They should be instructed never to sort out soiled washing on surfaces where food is prepared and always to wash hands after handling soiled washing.

IMMEDIATE REMEDIAL MEASURES

Poisoning is suspected

If a casualty is suffering from nausea, vomiting or diarrhoea with drowsiness or unconsciousness, do not induce vomiting. Provided the casualty is conscious, wash out mouth with water. Obtain medical attention.

Anaphylactic shock (major allergic reaction)

If the patient suffers from impaired breathing and a rapid pulse, they may be going into anaphylactic shock. Seek further medical help immediately. Check to see if the patient is carrying an Epi-Pen or syringe of adrenaline; if so then help them to administer it. Call an ambulance and prop the patient in a sitting position.

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3.023 Man Regs	Hob, Kettle, Urn	Applicable to: appliances for heating and re-heating food and water	See also: 3.021

Process(es) covered: The use of a hob, either as a separate unit or as part of a 'cooker' powered by gas or electricity. The use of a kettle or urn for heating water.

Hazards

Burns & scalds Flames, hotplates and elements together with hot pans, oven shelves and doors all present a burn hazard.
Containers of hot and boiling water also present a scalding hazard.

Fire Overheated food or cooking oil and other flammable materials may ignite.

Electric shock Any item powered from the electrical mains presents a shock risk if it is damaged.

Risk Assessment

Burns & scalds Sunlight can make flames invisible and some electric hot plates give no indication of being hot.
Pans of boiling water are more difficult to control than kettles with a central handle but carrying either a pan or kettle presents a risk of spills. High risk activities include straining water from cooked vegetables, pouring carelessly and reaching over a kettle or pan. The risk of injury is greatest in busy areas with several students working together around one appliance.

Fire Oils and fats present the greatest risk of fire in the kitchen.

Electric shock A permanently connected item such as a hob presents little risk but a kettle or urn connected via a flexible cable presents a risk if damaged.

Control measures

Gas cookers and hobs should, if possible, be installed away from windows, to improve the visibility of flames and reduce the effects of draughts on pilot lights and small flames. The risk of scalding from pans on a hob is controlled by good technique (eg, avoiding overhanging pan handles) which must be taught and by avoiding overcrowding.
It is necessary to check that rings above gas burners are firmly in place before starting to use a hob. Care must always be taken with containers of boiling water, avoiding the need to carry them where possible.
It is difficult to reduce the risk of fat-pan fires to zero so everyone must be taught how to deal safely with such a fire when it occurs. Open deep fat frying should be avoided.
Hair should be tied back and appropriate protective wear should be worn when using the cooker.
Frequent visual checks and regular formal inspections reduce the risk of electric shock from faults to a low level. Cleaning methods must not allow water inside the electrical parts.
Only kettles with automatic switch off devices should be used.

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RESTRICTIONS

It may be necessary to restrict activities involving hobs unless they are set at an appropriate height for the children using them and fitted with accessible controls.

Disposal

For disposal see 3.034.

FURTHER INFORMATION

Pupils should be taught not to lean across lighted gas burners or hot electric plates. Particular care must be taken with ceramic hobs, which do not show that they are hot, and also after hobs have been turned off, when the rings and plates are no longer visibly hot but have yet to cool down. Care is also required over the positioning of pan handles and guarding against scalds from steam when lifting a saucepan lid.

Hair should be tied back and appropriate protective wear should be worn when using the cooker.

Dealing with fat-pan fires

Although there are special fire extinguishers that are suitable for dealing with burning oil or fat, it is safest to use a fire blanket, damp towel or a tight-fitting lid to cut off the oxygen supply to the fire. This cover must stay in place until the pan is cold to prevent re-ignition. The use of water or the wrong extinguisher can seriously spread the fire with disastrous consequences.

Kettles

Children need to be taught to think about the risks when handling boiling water. Any kettle chosen for use in food technology should be well balanced when full, have a handle that does not become hot and a lid that cannot fall out when the water is poured. Children must be taught not to remove the lid while the water is being heated, to switch off an electric kettle before pouring and to unplug the lead from the socket before removing it from the kettle.

Modern jug kettles are usually safer than types with a central handle on the top but both types can produce a jet of steam at the handle under certain circumstances.

IMMEDIATE REMEDIAL MEASURES

Burns or scalds to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.
Electric shock	Send for a first aider immediately. Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a trained first aider does not arrive quickly and the casualty has no pulse, consider carrying out cardio-pulmonary resuscitation.

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3.024 Man & COSHH Regs	Knives	Applicable to: peelers; unpowered knives, etc	See also: 3.016 3.025 3.029

Process(es) covered: Scraping, peeling and cutting vegetables, cutting and trimming meat, filleting and cutting fish, cutting bread.

Hazards

Cuts	Fingers and hands may be cut while using knives.
Stabbing	Stabbing injuries may occur while knives are being carried from the place of storage to the work place or to a sink after use.
Juice in the eye	Juice may spurt into an eye from fruit while cutting it with a knife.
Infection	Clean food may become contaminated via the knife or chopping board if it is also used for food that is carrying pathogenic microorganisms and/or their toxic products.

Risk Assessment

Cuts	The risk is increased when the knife is blunt as greater pressure has to be used to effect the cut and the knife is then more difficult to control. Novices are more likely to cut their fingers than those who have learned appropriate techniques. Risks are greatest in busy areas with students working close together.
Stabbing	The layout of the workplace can have a major impact on the risks of stabbing. Where knives are carried around the room, the risks are high. Again, risks are greatest in busy areas with students working close together but, with some pupils, there is also a risk of deliberate attacks on each other.
Juice in the eye	The risk is greatest when cutting fruit such as lemons.
Infection	The risk of cross-infection is high, particularly if the chopping board is used to prepare food which is to be eaten raw after it has been used for cutting meat.

Control measures

Knives should be kept sharp and users must be trained in appropriate techniques. In particular, a chopping board must be used for cutting vegetables.
Teaching of the bridge technique for cutting foods will reduce risks.
Serrated knives are safer than smooth blades.
Knives should be kept centrally, however this increases the risk of accidental cutting and stabbing. Good management and discipline is essential and overcrowding should be avoided if the risk of stabbing is to be controlled.
The use of a sawing action to cut fruit is less likely to make the juice spurt than attacking the fruit with a knife point.
Although wooden boards are probably safe enough, plastic (eg, polypropylene) boards are preferred for chopping foods because these are easier to sterilise or clean thoroughly and do not harbour bacteria. Separate boards and different knives for meat, fish, vegetables and fruit are a distinct advantage; colour-coded boards are now available.

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RESTRICTIONS	It may be necessary to avoid the use of knives with some classes. While vegetable peelers can be used for some manual tasks, they cannot be used for all. Slicers of the mandolin type (with many parallel blades), which are supplied under varying brand names, are *not* recommended for use in schools. Food processors may be safer to use than knives. (See 3.016.)
Disposal	See 3.034.
Storage	All sharp knives should be stored safely with blades pointing downwards, either in a drawer or a special rack. A 'shadow board' or a rack with a space for each rack will assist with checking that all knives have been returned after use.

IMMEDIATE REMEDIAL MEASURES

Juice is in the eyes	Wash thoroughly for at least ten minutes with water, holding the eyelids apart. Seek medical attention if irritation persists.
Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, the wound should be washed clean and a small, sterilised dressing applied.
Severe cuts	Send for a first aider. Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. **Protect yourself from contamination by blood**. Blood splashes or drips should be cleaned up with VirKon as on sheet 3.007.

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3.025 COSHH & Man Regs	Liquidising, Mincing, Mixing	Applicable to: food mixers with accessories	See also: 3.016 3.024 3.029

Process(es) covered: The use of table-top mixing machines with liquidising and mincing accessories.

Hazards	
Electric shock	Damage to the casing of the appliance, the plug or to the power cord can present an electric shock hazard.
Injury	The accessories have sharp cutting blades or screw feeds which may produce injuries if the equipment is misused or if care is not taken during cleaning.
Manual handling	Some machines are so heavy that they present a manual-handling hazard.
Dust	Flour dust presents both a health and an allergic reaction hazard.

Risk Assessment	
Electric shock	Risks may arise from damaged or incorrectly wired plugs, the fitting in the plug of a fuse with an inappropriate rating for the equipment and flexible cables which have been damaged or allowed to become worn, impairing the insulation.
Injury	Domestic machines are designed so that access to dangerous parts is limited but a small hand could reach the blades of a liquidiser or a long finger could reach the feed screw of a mincer. Any attempt to reach into either accessory while it is on the machine presents a significant risk. Risks are greatest in busy areas with students working close together.
Manual handling	Lifting a heavy machine from a low cupboard or a high shelf presents a risk of injury to the lower back.
Dust	Flour dust has now been given a Workplace Exposure Limit (WEL) which means that the concentration of flour in the air must be kept below 30 mg/m^3 (15 min ref period)[87] and as far below this as reasonably practicable.

Control measures
Frequent visual checks and regular formal inspections reduce the risk of electric shock to a low level. (See the *General Introduction*.) Manufacturers instructions should be followed at all times. Clear instructions for use should be given Users must be trained not to push food down the tube of a mincer with fingers but to use the pushing implement provided and to isolate the machine from the power supply before removing accessories for cleaning. Discipline is essential and overcrowding should be avoided if the risk of injury is to be controlled. Users must be trained to move heavy machines correctly, using two persons if necessary. If any mixer tends to produce a cloud of flour dust, it should either be fitted with a lid or the method of adding flour to the mix should be chosen to minimise the problem.

87 EH 40/2005

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RESTRICTIONS	The use of these machines should be restricted to those who are sufficiently mature and competent to follow instructions carefully.
Storage	The manual-handling problem can be reduced if storage arrangements are such that heavy machines do not have to be lifted or carried. Blades and attachments should be stored appropriately
Cleaning	When cleaning knives and attachments, care must be taken over putting the sharp blades into the washing up bowl and removing them from the water, eg, by doing them last. It is advisable to leave blades and attachments to dry in the air after cleaning.

FURTHER INFORMATION

It is important to ensure that only one student at a time is using the equipment.
Particular care should be taken with mixers that have exposed, rotating whisks not to insert spatulas or other tools into the bowl while the mixer is operating: they can become caught and jam the machine.
When liquidising hot food, it is advisable to hold a cloth over the top of the liquidiser to ensure that no hot liquid is sprayed at the operator. Many lids will prevent this but some do not.

IMMEDIATE REMEDIAL MEASURES

Flour dust is in the eyes	Wash thoroughly for at least ten minutes with water to prevent scratching of the eye. Seek medical attention if irritation persists.
Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, the wound should be washed clean and a small, sterilised dressing applied.
Electric shock	Send for a first aider immediately. Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a trained first aider does not arrive quickly and the casualty has no pulse, consider carrying out cardio-pulmonary resuscitation.

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3.026 COSHH Regs	Microorganisms used in food PRODUCTION	Applicable to: yeasts; yoghurt culture	See also:

Process(es) covered: Using culinary microbes such as yeast in baking, and bacteria in making yoghurt.

Hazards	
Food poisoning (Infection)	Eating, or hand to mouth contact with, food carrying pathogenic microorganisms and/or their toxic products may result in gastro-intestinal infection.

Risk Assessment	
Food poisoning (Infection)	When using culinary microbes, provided that normal practices of hygiene are observed so that all other microorganisms are excluded, there is no significant risk to health. Extensive years of experience indicate that these microorganisms are not hazardous.

Control measures	
	None are needed, other than to ensure that normal hygiene is observed and that the cultures of microorganisms used are from a reputable source and cannot have become contaminated with other microbes.

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Disposal	Any unwanted stocks of yeast or yoghurt culture should be mixed with a lot of water and flushed into the foul-water drain.
Storage	Dried yeasts may be kept for months but 'live' yeasts are best fresh. If they have to be stored, they must be kept cool.

FURTHER INFORMATION

If other activities involving microbes are contemplated, eg, investigating the growth of bacteria from working surfaces or studying the decay of foods by moulds, there *are* significant risks since it is not possible to be sure of the type of microorganisms that may be isolated. A normal food technology room in a secondary school or college is **not** the place in which such work should be carried out unless the facilities provided are such that potential contamination of food preparation areas is impossible. Arrangements might be made for these investigations to be carried out in the science department. Members of the science department could be consulted, as appropriate, for information on how such investigations should be carried out and how the risks involved in such work should be assessed[88].

The bacteria in normal yoghurt cultures (that ferment glucose and lactose to lactic acid) are *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. In the 'bio' yoghurts, *Bifido bacterium bifidum* and *Lactobacillus acidophilus* are used. Yoghurt drinks (eg, Actimel) use *Lactobacillus casei*.[89]

IMMEDIATE REMEDIAL MEASURES

Dried yeast is in the eyes	Wash thoroughly for at least ten minutes with water holding the eyelids open. Seek medical attention if irritation persists.
Poisoning is suspected	If a casualty is suffering from nausea, vomiting or diarrhoea with drowsiness or unconsciousness, do not induce vomiting. Provided the casualty is conscious, wash out mouth with water. Obtain medical attention.

[88] 'Student Safety Sheet 01 microorganisms' contains details of how to risk assess the use of microorganisms in school practicals.

[89] Advice on the type of microorganism, educational suitability and ease of use can be found in CLEAPSS laboratory handbook section 15 mainly Biology.

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3.027 Man Regs	Microwaves	Applicable to: combination ovens; microwave ovens	See also: 3.010 3.021

Process(es) covered: Heating and reheating food with microwaves in a microwave only oven or one with conventional and steam heating elements as well.

Hazards

Microwave burns	If microwaves can escape from the oven, they may be absorbed by human tissue to produce local heating.
Burns and scalds	Although many food containers used in microwaves do not absorb the waves and do not become hot directly, they will be heated by contact with the hot contents or if the contents boil over.
Superheating	A liquid may become heated in a microwave to a temperature above its boiling point without boiling (ie, it becomes superheated). When removed and stirred, it can instantly boil over onto a hand holding the container.
Tripping and falling	The microwave oven is a portable appliance. Trailing leads could cause a tripping accident and the microwave could cause injury if allowed to fall on someone.

Risk Assessment

Microwave burns	Ovens using microwaves are designed to minimise this risk by the use of door seals and interlocks that prevent power being applied until the door is properly closed.
Burns and scalds	There is a real risk of burns or scalds when removing hot food containers from microwave ovens or when lifting lids to stir the contents.
Superheating	The risk of superheating is difficult to estimate. It depends on the distribution of the item(s) being heated and on the design of the oven. If it happens, the sudden boiling can cause severe scalding.
Tripping and falling	Although classed as a portable appliance the microwave should be positioned in a permanent and suitable location.

Control measures

It is essential for microwave ovens to be regularly maintained and checked according to the manufacturer's instructions. Instruction should be given on the correct use of individual models of microwave ovens.

Although oven gloves are often unnecessary, they should always be used when handling hot food containers in microwave cookers.

The risk of superheating may be controlled by putting a small metal spoon in the container used to heat milk or water. The manufacturer's instructions on this should always be followed.

Position microwave ovens where pupils will have ready access without obstructing others. Leads should be kept short.

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RESTRICTIONS

Use only containers made from appropriate materials for heating and cooking in a microwave oven. The following should be **avoided**:

- plastic dairy product containers and other materials made from soft, pliable plastic;
- items made from Melamine (it becomes brittle and scorches);
- any pottery with a metallic (gilded) rim and all metal containers, including aluminium foil - except in small pieces for shielding;
- wooden or wicker containers - except for just warming foods;
- coloured paper products.

FURTHER INFORMATION

Defrosting foods

If a microwave oven is used for defrosting food then it is important to observe the manufacturer's instructions and recommended standing time and check the food regularly. If ice crystals can still be found within the food then thawing should be continued. If the food starts to become warm then it should be allowed to stand for a while to allow the heat to spread or disperse. If the food remains warm then it should be cooked immediately since warm food is the perfect incubator for bacteria. Thawed food must not be refrozen unless cooked thoroughly.

The temperature of food cooked in a microwave oven can be tested by using a 'microwave thermometer probe', if one is available. This must be cleaned after every use; putting a dirty thermometer into food can add bacteria to it and contaminate it.

Use when empty

If a microwave cooker is used when empty then there is nothing to absorb the microwaves safely. This may cause components in the cooker to be heated up and produce permanent damage to the system. It is good practice to keep a jug of water in the microwave cooker when it is not in use.

Foods with high sugar content

Some manufacturers warn against heating foods with a high sugar content with microwaves. Apparently there is a risk that jam or mincemeat may absorb the microwave energy preferentially to produce local heating or even boiling.

Testing microwave cookers for leakage

Although microwave testers are available, there is not a recommendation that they should be used to check that any leakage of microwave radiation is negligible.

IMMEDIATE REMEDIAL MEASURES

Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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3.028 COSHH Regs	Pest Control	Applicable to: birds; insects; rodents	See also: 3.017

Process(es) covered: Pests that may become a problem in food technology rooms and storage areas include rodents: mice and rats; birds: pigeons and sparrows; insects and other arthropods: houseflies, wasps, ants, cockroaches, moths, silverfish, meal and bacon beetles, flour mites and weevils.

Hazards

Food poisoning (Infection)

Pests can spread bacterial infections to food during its storage or preparation and gastrointestinal infection results from eating, or hand-to-mouth contact with, food carrying pathogenic microorganisms and/or their toxic products. Rodents and flies also carry food-poisoning bacteria in their intestines and can contaminate food by their secretions and droppings.

Poisons on food

Pesticides can contaminate food and give rise to poisoning which is not an infection. Persons applying pesticides may inadvertently come into contact with the substance directly.

Risk Assessment

Food poisoning (Infection)

The risk from pests is low in clean, well-organised premises but if conditions are not clean and pest populations are allowed to build up the risk is increased.

Poisons on food

The risk that humans may come into contact with the chemicals used in pesticides is low if they are used properly.

Control measures

A rigorous policy (see the rules to discourage pest populations below) must be adopted to prevent pest populations building up or becoming a problem. If pests are detected, they must be eradicated using the methods below.

In the extermination of pests, positive steps should be taken to avoid exposure. Pesticide formulations available for use in domestic situations are now carefully controlled. They should be obtained only from normal household retail outlets that will only supply approved products carrying a MAFF / HSE number. Unlike other hazardous substances that give only the hazard warning on the label, pesticides give full instructions on the packaging for their safe use. In effect, each pesticide is supplied with its own individual risk assessment which must be strictly followed.

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RESTRICTIONS

Most pesticides are unsuitable for use by young persons.

Disposal

Surplus solid pesticides may be placed, in their original containers, in the dustbin. Liquids may be diluted and applied to unsurfaced paths or level soil avoiding areas near ponds or other watercourses.

Storage

All pesticides must be stored safely and securely away from food.

FURTHER INFORMATION

Discouraging pests

The following rules can be used to discourage pest populations.

- Make food storage and preparation areas as inaccessible as possible to pests.
- Keep these areas scrupulously clean.
- Clear up food spills promptly.
- Cover all food during preparation.
- Eliminate dark corners and crevices, together with all damp areas.
- Ensure all refuse bins are covered.
- Use covered metal bins or other metal containers for food storage.
- Inspect new deliveries of food for pests.
- Watch out for torn bags or holes in cartons.
- Be vigilant for signs of droppings, larvae or pupae and dead animals.

Eradicating pests

If pests become a problem, expert advice can be obtained from the Environmental Health Department of the local authority or from a professional company.

Minor pest infestation may be dealt with by pesticides[90] from supermarkets provided formulations are chosen carefully, using **only** those which are recommended for the intended purpose. It is **essential** to follow the instructions given.

Any pesticide formulation that, by its described method of application, may contaminate food should be avoided. Some types of pesticide release their active ingredient more safely as a vapour, while other 'residual' formulations are long-lasting and are particularly useful in storage cupboards.

Work at home

It is sensible to encourage students to adopt similar procedures for pest control in their own homes, to warn of the dangers of pets carrying pests and bacteria into the kitchen or food storage area and to recommend that all pesticides are kept out of the reach of small children.

IMMEDIATE REMEDIAL MEASURES

Exposure to pesticide — Follow the instructions on the packaging.

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[90] The use of pesticides is strictly regulated by the *Control of Pesticides Regulations* 1986 and subsequent amendments. These impose a duty of care to ensure that any pesticide used does not affect the health of any organism other than the pest to be controlled. Employers must ensure that employees are provided with sufficient instruction and guidance so that they may use a pesticide correctly and safely. Pesticides sold for domestic use will have been specially developed for this purpose; they are much less hazardous and will not require protective clothing to be worn. Such pesticides may be used in schools, if appropriate, but it is essential that the instructions provided with the pesticide are followed exactly. (Note that it is now *illegal* to use in the home or garden any pesticides that have been produced for agricultural or industrial applications.)

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3.029 COSHH & Man Regs	Portable Food Processors, Mixers and Powered Tools	Applicable to: electric tin openers & knives; hand-held mixers; small blenders; small grinders	See also: 3.016 3.024 3.025

Process(es) covered:	The use of hand-held kitchen equipment which comes in several sizes from small battery-powered whisks to machines which really need a stand and table top blenders and smoothie makers
Hazards	
Electric shock	Damage to the casing of the appliance, the plug or to a mains power cord can present an electric shock hazard. Water inside the appliance can lead to insulation breakdown and to external metal becoming live.
Injury	Sharp cutting surfaces may be hazardous if the equipment is misused or if care is not taken during cleaning or storage.
Tripping	Mains leads that trail across the floor present a tripping hazard.
Dust	Flour dust presents both a health and an allergic reaction hazard.
Risk Assessment	
Electric shock	Appliances that are repeatedly moved, plugged in and unplugged are liable to damage which increases this risk. If the power cord is long then it can be damaged by trapping in cupboard doors, by being caught in its own mechanism or by touching hot objects on a hob. Holding the whole machine under a tap to wash cutters or beaters can allow water to enter which may present a serious risk.
Injury	Small grinders, eg, for coffee beans, which often have a top which must be held down to operate the on / off switch, present little risk of injury unless the top is broken and allows a finger to enter. Hand-held mixers have too low a power to cause significant injury with the beaters supplied.
Tripping	If appliances have to be fitted with long leads that trail across the floor, the tripping risk is significant.
Dust	Flour dust has now been given a Workplace Exposure Limit (WEL) which means that the concentration of flour in the air must be kept below 30 mg/m^3 (15 min ref period)[91] and as far below this as reasonably practicable.

Control measures	
	Frequent visual checks and regular formal inspections reduce risks of electric shock resulting from damage to a low level. Users must be taught to remove cutters and beaters (where possible) for cleaning and not to put the whole appliance in the sink or under a tap. The appliance itself and cutters that cannot be removed must be cleaned with a damp cloth or paper while the appliance is unplugged. Users must be trained not to push food down the feed tube of a processor with fingers but to use the pushing implement provided and to isolate the machine from the power supply before removing accessories for cleaning. Clear instructions must be available. If long mains leads cannot be avoided, they must be routed so that there is no risk of anyone tripping over them. If any mixer tends to produce a cloud of flour dust, it should either be fitted with a lid or the method of adding flour to the mix should be chosen to minimise the problem.

[91] EH 40/2005

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RESTRICTIONS	This type of equipment should be operated by one pupil at a time. Although food processors are safe to use, some classes may contain pupils who are too disruptive to be trusted with such equipment.
Disposal	See 3.034. The *Waste Electrical and Electronic Equipment Regulations* 2006 (the *WEEE Regulations*) apply.
Storage	Any tool that has the potential to be misused should be stored in a secure place.

FURTHER INFORMATION

When using electric carving knives, it is important to follow guidance from the manufacturer and only use with foods that are suitable for cutting with this equipment. It is also important to ensure that the knife is not connected to the power when inserting or removing the blades. Remember never to wash the blades in water while still attached to the motor. After removal, the blades should be washed with care. The blades are self-sharpening by friction during use and should not be sharpened manually. As with food mixers etc, only one student at a time should attempt to use the equipment.

IMMEDIATE REMEDIAL MEASURES

Flour dust is in the eyes	Wash thoroughly for at least ten minutes with water to prevent scratching of the eye. Seek medical attention if irritation persists.
Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, the wound should be washed clean and a small, sterilised dressing applied.
Electric shock	Send for a first aider immediately. Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a trained first aider does not arrive quickly and the casualty has no pulse, consider carrying out cardio-pulmonary resuscitation.

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3.030 Pressure Systems Regs	Pressure Cookers	Applicable to: domestic type pressure cookers only	See also:

Process(es) covered: General use of domestic-type pressure cookers.

Hazards

Explosion	Failure of a pressure cooker in use, causing the explosive release of its contents.
Overpressure	The operation of a safety pressure release system can present a hazard from escaping steam and the contents of the cooker.
Burns and Scalds	Hot surfaces and the sudden release of steam producing scalds.

Risk Assessment

Explosion	Pressure cookers have been known to fail (near normal working pressure) at the points where the handles are attached or as a result of fracture of the lid clamps. Both events are rare and the initial cracks probably would not have been discovered by even an expert inspection.
Overpressure	In use, a pressure cooker should release steam gently. If the outlet becomes blocked by food being cooked or by part of a container, the pressure and temperature rises. A safety device, which is usually a fusible plug, should then operate to release the pressure but, in so doing, the contents boil and may emerge as a scalding jet.
Burns and Scalds	Failure of the pressure regulating system or of the rubber sealing ring are possible causes of sudden release of steam but the most likely cause is the premature release of the lid or removal of weights before pressure has fallen. The metal surface of the pressure cooker gets hot in use and could cause burns if touched.

Control measures

Regular inspection under the regulations (see *Further Information* overleaf) will limit the risk of explosion. For full guidance see CLEAPSS Guide G214 (parts a to d), *Examining Autoclaves, Pressure Cookers and Model Steam Engines*.

Instruction should be given in the use of pressure cookers. Manufacturer's instructions should be followed at all times.

When using the cooker, constant attention to the sound of escaping steam and/or inspection of the indicator or gauge is required to ensure that the pressure does not become too high. After operation of the pressure release, protection of the hand and arm may be necessary in order to approach the cooker and turn off the supply of heat.

The risk of scalds will be reduced if the manufacturer's instructions (see *Restrictions* overleaf) are followed carefully when cooling and releasing the lid after use. Oven gloves must be used when handling a hot cooker or the pressure-regulating system. Supervision at this stage is recommended.

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RESTRICTIONS

The cooker must not be opened nor the weights removed when the internal pressure is still high. After cooking is completed, the manufacturer's instructions on cooling must be followed; usually these require the cooker to cool naturally until an indicator shows that the inside has returned to atmospheric pressure.

Use

It is important to ensure that adequate quantities of water have been added, bearing in mind the cooking time. Boiling dry is often the cause of distortion or 'doming' of the base which may require the cooker to be failed when the safety inspection is carried out. Manufacturer's instructions should always be followed.

Storage

After use, it is necessary to wash the pressure cooker thoroughly, particularly cleaning the weight support and gasket if soiled with food. With cookers that have a 'ready-to-serve' indicator in the safety valve, this must be free-moving and not blocked with food debris. The cooker must be stored completely dry; residual moisture may accelerate pitting of the internal surface.

FURTHER INFORMATION

Under the requirements of the *Pressure Systems Safety Regulations* (2000)[92], it is necessary for the owners or users of pressure cookers, in their places of work, to make arrangements for a regular inspection of these items against a suitable written scheme of examination. See the CLEAPSS guide L214 parts a to d *Examining Autoclaves, Pressure Cookers and Model Steam Engines*. An annual safety check will normally be sufficient, unless the items are in very frequent use, eg, every few weeks, in which case it may be appropriate to make a formal examination more often. (Although it is sensible to give pressure cookers *at home* a safety check, there is no legal requirement that this should happen.)

Under the Regulations, the examination of pressure cookers should be conducted by a 'competent' person and it is the *employer's* responsibility to decide who this should be. Staff in a food technology department may find that their employer has chosen to use the services of an insurance company surveyor to carry out the examinations, often along with the school boilers and equipment in the science department, although there is no requirement that an insurance company is used. The costs of this service may, however, be prohibitive. Employers may, therefore, have chosen to appoint a competent individual to carry out the examinations of equipment in all its establishments, or to authorise an appropriate, competent person in an establishment to carry out the safety checks. It should be noted that the 1999 revision of the *Management of Health and Safety at Work Regulations* state that a competent employee is to be preferred.

IMMEDIATE REMEDIAL MEASURES

Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

92 For details of the Regulations and the Approved Code of Practice that gives guidance on their interpretation, see *Safety of Pressure Systems,* L122, HSE Books, ISBN 071761767X.

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3.031 COSHH Regs	Purchase and Selection of Food	Applicable to:	See also: 3.014 3.015 3.016 3.018 3.034

Process(es) covered: Choice of supplier and selection of food items.

Hazards

Food poisoning (Infection)	Gastrointestinal infection results from eating, or hand-to-mouth contact with, food carrying pathogenic microorganisms and/or their toxic products.
Poisons on food	Poisoning which is not an infection results from eating, or hand-to-mouth contact, with food containing natural toxic chemicals or contaminants from the environment.
Out-of-date foods	Few food-packaging methods eliminate all microorganisms or enzymes that can change food; they usually slow down the effects.

Risk Assessment

Food poisoning (Infection)	If care is not taken in purchasing or selecting food items, there is a possibility that the food may have been contaminated or be carrying pathogenic microorganisms and/or their toxins, resulting in infections when the food is consumed.
Poisons on food	The risks of food becoming contaminated by transfer from other foods or from a dirty environment are greater in shops without adequate segregation of different food types. Carelessness or ignorance of the appropriate preparation techniques increases the risk of natural toxins being consumed but items presenting risks are restricted to red kidney beans, green or sprouting parts of potatoes and rhubarb leaves.
Out-of-date foods	Foods that have passed a 'sell-by date' or 'use-by date' are likely to have a greater risk of infection of the consumer than fresh foods. (See *Further Information* overleaf for comments on 'best-before dates'.)

Control measures

Fresh foods, including eggs, should be purchased only from reputable shops with good hygiene standards (see *Further Information* overleaf) and which are popular, so ensuring a rapid turnover of stock.

Traces of pesticides or polluting chemicals may remain on fruit and vegetables, which should be segregated in shops and washed off before consumption. Dry red kidney beans must be well cooked to destroy their toxins. Potatoes must be prepared by having green parts and 'eyes' removed. Only rhubarb stalks should be cooked and eaten.

Packaged foods should always be checked for a future 'sell-by date', particularly if they are not to be consumed on the day of purchase.

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RESTRICTIONS

Food in the following situations should be rejected:

- unwrapped foods from shelves very close to the floor;
- food in damaged, 'blown' or rusty tins or containers and vacuum packs with suspect seams;
- food that has obviously been mishandled, shows even the slightest evidence of unwanted mould or is past its 'sell-by date';
- green potatoes or those in a pack size such that they cannot be consumed fairly swiftly;
- fatty foods such as cheese or pastries that have been wrapped in 'cling film'. (See 3.019 for more information.)

Storage

See 3.017, 3.018, 3.019 & 3.020.
If pupils bring in food for food technology work, there should be proper storage arrangements available, both before and after the time for the lesson. The problems of storage of food prior to a lesson can be reduced if the school or college supplies the materials from a central stock.

FURTHER INFORMATION

Stores with good hygiene standards can be recognised by:

- good organisation, eg, loose fruit and vegetables being displayed well away from flowers, fish, meat, dairy and delicatessen items;
- being obviously clean (no spills evident in food cabinets or on the floor);
- having good lighting;
- having hand-washing facilities;
- having special facilities for handling raw and cooked foods, ie: separate slicers, boards and small utensils for all different types of foods as well as cooked food products;
- proper storage for frozen and chilled foods, ie, with cartons evenly stacked and not above the load line in an open-topped freezer,

and by staff handling food:

- wearing clean overalls;
- having their hair tied back and covered;
- wearing minimum jewellery;
- having short, clean fingernails with no nail varnish;
- being free from coughs, colds and similar infections;
- having cuts covered with a food-standard (blue) waterproof dressing;
- using tongs or gloves and paper or film to ensure that their hands do not come into direct contact with food.

<u>Foods with 'best-before' dates</u>
'Best-before' dates on food indicate how long the food is expected to be at its best, ie, having a good flavour and texture. After this date, the foods are not necessarily 'unsafe' to eat.

IMMEDIATE REMEDIAL MEASURES

Poisoning is suspected

If a casualty is suffering from nausea, vomiting or diarrhoea with drowsiness or unconsciousness, do not induce vomiting. Provided the casualty is conscious, wash out mouth with water. Obtain medical attention.

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3.032 Man Regs	toasting Food	Applicable to: electric and gas sandwich toasters; electric toasters	See also:

Process(es) covered: The use of an electric toaster or a sandwich toaster as a stand-alone, electrically-powered unit.

Hazards

Electric shock	An electric toaster has elements which, while not freely exposed, are accessible with a slim metal object such as a table knife and hence present a shock hazard.
Burns	Flames and elements, together with hot sides and covers, all present a burn hazard.

Risk Assessment

Electric shock	The risk of electric shock is greatest when trying to extract a small piece of toast from an electric toaster. Even when the switch is off, an incorrectly-wired appliance can produce a fatal accident.
Burns	The surfaces of electric sandwich toasters can be very hot. The risk of injury is greatest in busy areas with several students working together around one appliance.
Trips and falling	The leads on portable appliance can cause dangers of tripping and falling. Sandwich toasters can be heavy and, if dropped, could cause damage to the foot.

Control measures

The standard of maintenance on all electrical appliances must be high but this is particularly true of electric toasters and sandwich makers.
(See *Introduction to Part 3*.)
Items should be removed from an electric toaster / sandwich makers using a plastic tool, eg, spatula or tongs, designed for high-temperature use. Oven gloves are also advisable.
Equipment should be positioned near to socket outlets to prevent leads from trailing.
A ‘caution hot sign’ is also advisable.

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RESTRICTIONS	Pupils who are not sufficiently mature should not use electric toasters.
Disposal	For disposal see 3.034.

FURTHER INFORMATION

Sandwich toasters

Cleaning an electric sandwich toaster requires care. The plates should be allowed to cool down, the toaster unplugged and then it should be cleaned only with a damp cloth or paper towel; never by immersing it in water.

IMMEDIATE REMEDIAL MEASURES

Electric shock	Send for a first aider immediately. Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a trained first aider does not arrive quickly and the casualty has no pulse, consider carrying out cardio-pulmonary resuscitation.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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3.033 Man Regs	Tunnel Ovens	Applicable to:	See also: 3.010

Process(es) covered: A tunnel oven cooks food products by passing them through a chamber that is heated. The cooking time is influenced by the speed of the food passing through the oven.

Hazards	
Burns	Hot surfaces may result in a burn or scald to the skin.
Fire	Overheated food, fats or cooking oil may ignite.
Entanglement	Hair, hands and clothing can become entangled in moving parts.
Electric shock	With any electric equipment there is a danger of electric shock.

Risk Assessment	
Burns	Handling oven shelves and hot containers often result in minor burns and scalds. The greatest risk occurs when putting items into, and removing them from the oven.
Fire	Oils and fats present the greatest risk of fire in the kitchen. Build up of debris in oven can cause fires.
Entanglement	As moving parts are partly exposed, entanglement is possible.
Electric shock	If properly installed by a qualified electrician then this risk should be minimal. Tunnel ovens should be correctly installed with an appropriate fused switch-disconnector.

Control measures
All teachers and pupils need adequate training in the use of tunnel ovens prior to use. Adult supervision is needed at all times. The equipment installed should be of a type where the external casing temperature does not cause burns if touched. Suitable protective equipment should be provided, eg: oven gloves. The oven should be kept clean and free from build-up of debris that could cause fires. Long hair and loose clothing should be secured so as not to come into contact with moving parts. Loose or dangling jewellery should be removed.

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FURTHER INFORMATION

Tunnel ovens often require a current supply in excess of 13 amps and will need to be directly connected to a suitable fused switch-disconnector. They should be installed by a qualified electrician and be part of an annual planned maintenance programme as well as regular visual inspections.

IMMEDIATE REMEDIAL MEASURES

Burns or scalds to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Seek further medical assistance. Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.
Fire	Cover item with damp tea towel. If necessary ring fire alarm and use fire extinguisher.
Entanglement	Stop the machine with isolator stop switch. Carefully release item caught. Calm pupil.
Electric shock	Send for a first aider immediately. Taking care for your own safety, break contact by switching off. If necessary move the casualty without switching off the supply, use a broom handle or rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance.

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3.034 Man Regs	Waste Disposal	Applicable to:	See also:

Process(es) covered: The disposal of food waste including cooked and uncooked material. Disposal of unwanted / irreparable equipment.

Hazards

Encouraging pests	Disposing of waste food unhygienically encourages pests that may then contaminate food.
Injury	Irreparable equipment from knives to food mixers may constitute a hazard to persons handling waste.

Risk Assessment

Encouraging pests	Work in food technology inevitably generates quantities of food waste that may pose a hazard if pests such as flies, cockroaches or rodents can gain access. These can transfer bacteria to items of food in storage areas or left uncovered during food preparation, causing food poisoning. Handling a dirty refuse bin and dirty lid can spread bacteria to the hands and so onto food, if good personal hygiene is not observed.
Injury	Any sharp object placed in ordinary refuse can cause injury to cleaners or waste disposal operatives.

Control measures

Separate bins should be used for food waste and other waste materials. These must be easy to clean and always fitted with a lid that should preferably be foot-operated. Each bin should be lined with a plastic bag of suitable size and a new one used every time the bin is emptied. The bin must be kept clean, especially the lid; the bin should be washed and dried thoroughly every time it is emptied. Hands must be washed thoroughly after touching the inside of the bin or its contents.
Sharp, pointed or damaged tools and broken crockery should be placed in a tough container that is sealed before placing it in a dustbin.
Damaged or irreparable electrical items should be disposed of following WEEE guidance (see overleaf).

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RESTRICTIONS

Much of the electrical equipment in food technology rooms and in other departments comes under the *Waste Electrical and Electronic Equipment Regulations* 2006 (the *WEEE Regulations*) for disposal. In practice, in most schools the site staff will arrange for the collection and disposal of such equipment. The CLEAPSS guidance leaflet PS 77, *The WEEE Regulations,* gives further details of what is required.

Disposal

Refuse must not be allowed to accumulate in food rooms and should not be left in the room overnight. As soon as possible, food waste must be moved to the bin used for kitchen waste, which itself should be covered to exclude pests. Increased use of composting is to be encouraged.
Irreparable electrical goods will have to go to a recycling centre - local authorities have recycling schemes.

FURTHER INFORMATION

Waste-disposal units

Some sinks in food technology may have waste-disposal units fitted. These electrical devices are built into the waste pipe and macerate waste so that it can be flushed away down the foul-water drain. Water authorities do not encourage the fitting of these units now but there is no prohibition on their use. They are designed so that fingers cannot reach the cutters but the handles of teaspoons or other narrow implements can pass through the grill into the macerating region.
Clearly, care is needed to avoid damage to either spoons or the unit itself.
See CLEAPSS guidance leaflet PS 31, *Disposal of Waste in Design & Technology* for a summary of the present legal position.

IMMEDIATE REMEDIAL MEASURES

Dust is in the eyes	Wash thoroughly for at least ten minutes with water to prevent scratching of the eye. Seek medical attention if irritation persists.
Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, the wound should be washed clean and a small, sterilised dressing applied.

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Appendix 3 Food poisoning: The major causes of food poisoning

Cause of food poisonin	Source	Incubation period	Symptoms
Bacillus cereus	This bacterium is commonly found in soil. If present in food, it produces a harmful toxin. 'At risk' foods include boiled rice, fried rice, custards, cereal products, puddings and sauces.	6-18 hours	Diarrhoea; abdominal pains.
Campylobacter	A food-borne (typically poultry and raw meat) or water-borne infection. Bacteria present in food do not tend to multiply in it but once swallowed can multiply in the gut causing an infection. The bacteria need a nutritionally-rich medium and a low oxygen atmosphere to grow; they survive well in moist, cool environments.	3-7 days	Abdominal pains; bloody diarrhoea; exhaustion.
Clostridium botulinum ('botulism')	The toxin produced is probably the most poisonous known to humans. The bacterium is commonly found in soil and is spore-forming. Therefore, even when live bacteria are killed, the next generation is still present in a dormant form. 'At risk' foods are those which are badly processed or found in damaged containers of processed products and often include vegetables, fish and meat.	12-18 hours	Nausea; vomiting; progressive paralysis.
Clostridium perfringen	Bacterium present in animal and human intestines, soil and dust; meat dishes and food with a low oxygen content are particularly affected.	8-22 hours	Diarrhoea; abdominal pains.
Escherichia coli	This bacterium is naturally present in the intestines of animals and humans. Contamination is caused by transfer of *E. coli* from faeces to foods. 'At risk' foods include meat which may have been infected with faeces when raw, undercooked beefburgers and chicken, plus cold foods, such as salads and sandwiches. Some strains are more dangerous than others.	12-24 hours; sometimes up to 72 hours	Abdominal pain; fever; diarrhoea; vomiting.
Listeria monocytogenes	Widespread in the environment, including soil, water and manure. Animals that carry *Listeria* are likely to be a source of infection for foods made from their products. 'At risk' foods include milk (and milk products such as soft cheeses), meat and poultry, pate, prepared salads, cook-chill products and chilled, processed foods. Over 5% of normally healthy people carry *Listeria* in their guts without showing any symptoms; they may be a source of infection if hands become contaminated as a result of poor hygiene.	5 days - 5 weeks	'Flu-like but few gut symptoms; miscarriage; still-birth; septicaemia; menin-gitis
Salmonella	Several species of bacteria that can multiply rapidly and cause food-borne gastro-enteritis which is highly infectious. 'At risk' foods include eggs, meat, meat products, poultry, milk and milk products.	12 hours - 2 days	Abdominal pains; diarrhoea; dehydration; exhaustion.
Staphylococcus aureus	Commonly found in the nasal passages of animals and humans, infected wounds or boils. Human skin can carry *S. aureus* if the person is infected, or infected cattle can pass the bacterium into their milk. 'At risk' foods include poultry, fish, meat, milk and milk-related products such as cream, custards and sauces plus any baked food containing cream.	30 minutes - 6 hours	Vomiting, often with appearance of blood.

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Appendix 3 Major causes of food poisoning (continued)

Cause of food	Source	Incubation period	Symptoms
Moulds	Mould fungi cause food spoilage and produce toxic metabolites (mycotoxins including aflotoxin) which are harmful when eaten. Aflotoxin has been associated particularly with mouldy cereals and nuts. The presence of mould, which resembles cotton wool, on food is often an indication that the food may be contaminated with other microorganisms. Moulds can develop on any suitable nutrient base providing sufficient moisture, and can grow over a wide range of temperatures. They spread by forming spores, which are released into the air and if they fall on a favourable environment, such as food, germinate and grow to produce a new colony. 'At risk' foods include poorly stored dried fruit (figs), bread, beans and nuts but any food may become contaminated.	—	—
Parasites in food	The only significant risk is from toxoplasmosis; other parasites, such as tapeworms, should not be a problem if food is obtained from reputable sources. Infection is most hazardous to those in the 'at risk' groups, particularly young children and pregnant women. The parasite can spread to humans in undercooked meat or raw meat and raw vegetables which have been contaminated with infected cat faeces or cat litter. The parasite is found in many animals but can only reproduce successfully in the cat's gut.	—	—
Natural toxins	Some food plants contain harmful chemicals, eg, rhubarb and tomato, but the quantities are very small in the parts of the plant that are normally eaten. The bean *Phaseolus vulgaris*, often called the red kidney bean, haricot bean or french bean among other common names, contains a poison which is, however, broken down by heat. Inadequately cooked beans may still be toxic. Solanine builds up in green or sprouting potatoes; if taken in large amounts it leads to gastro-intestinal pain, diarrhoea and could ultimately be fatal. Great care must be exercised if food from the garden or the wild is chosen; particularly guard against mistaken identity when selecting leaves, roots and berries. Certain types of mushroom are poisonous, so care must be taken to use only species *known* to be safe and accurately identified.	—	—

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Appendix 4 Food Tests: Details of suggested tests

Test	Food detected	Test reagent 1	Test reagent 2	Use	Positive result
Benedict's	Reducing sugars	Add 170 g tri-sodium citrate-2-water and 256 g of hydrated sodium carbonate to 850 ml of pure water in a 1 litre beaker. Stir to dissolve. Add 17.4 g of copper sulfate crystals (harmful solid) and stir. Pour the solution into a 1 litre		Put 5 ml of Benedict's reagent in a test tube and heat by standing it in a bowl of boiling water. Add as much ground-up food as can be put on the tip of a teaspoon and boil again until the colour no longer changes. Repeat this without adding food as a 'control' and compare the colours.	A change of colour from blue to yellow or red indicates the presence of a reducing sugar, ie, glucose, fructose or lactose but not sucrose.
Clinistix strips	Glucose	The reagent and a minute amount of indicator are impregnated into a strip of card. NB The indicator is probably a banned carcinogen; ensure no one		Make a solution of glucose (teaspoon tip in 5 ml of water). Dip the Clinistix strip into it for one second and allow the colour to develop for one minute in the air.	The colour change indicates the presence of glucose.
Iodine	Starch	A solution of 0.01 M iodine (harmful solid) in potassium iodide is required. This is best prepared in the science prep room as a pale sherry coloured		Place a small lump of food to be tested on a watch glass or saucer and add a drop or two of the reagent.	If a deep blue colour develops, starch is present.
Biuret	Protein	Add 2.5 g of copper sulfate crystals (harmful solid) to 70 ml of pure water in a beaker. When it has dissolved, pour it into a measuring cylinder and dilute to 100 ml. Before use, dilute this solution 10 fold to give the required strength of 0.01 M.	A solution of 0.1 M sodium hydroxide is required. This is best prepared in the science prep room. Wearing gloves and goggles or face shield, weigh out 4.0 g of sodium hydroxide (corrosive solid). Add this to 70 ml of water in a beaker and stir. When the solution has cooled, pour it into a measuring cylinder and make up to 100 ml. This 1 M solution (corrosive) should be diluted 10 fold (and labelled irritant) before use.	This test is only suitable for liquid samples, eg, milk, liquid yogurt, egg white frothed up in water or other foods which have been liquidised and strained. To a 5 ml sample of the liquid, add 5 ml of reagent 2 and add reagent 1 drop by drop.	If a pink or violet colour develops before the blue of the copper sulfate becomes domin-ant, protein is present.

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Appendix 4 Details of suggested food tests (continued)

Test	Food detected	Test reagent 1	Test reagent 2	Use	Positive result
Emulsion	Fats	Ethanol (highly flammable): industrial methylated spirit is clear and suitable.		Add a small sample of the food to be tested to 2 ml of ethanol in a test tube. Shake gently. The fat should dissolve in the alcohol. Pour the fat solution into another test tube containing 2 ml of water.	The presence of fat is revealed if it comes out of solution as an emulsion of fine droplets.
DCPIP (PIDCP)	Vitamin C	Dissolve 0.1 g DCPIP in 100 ml of pure water to give a blue solution.		This test is only suitable for almost clear solutions and other substances present may produce other colour changes. Try a solution of 0.1 g of ascorbic acid in 100 ml of pure water first and compare the result with diluted lemon or lime juice.	The presence of vitamin C is shown by the decolorisation of the dye.

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MODEL RISK ASSESSMENTS

IN SECONDARY SCHOOLS AND COLLEGES

Part 4
Model Risk Assessments for Art and Design

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Contents

4.001 CERAMICS: CLAY & DUST
4.002 CERAMICS: GLAZES & COLOURS
4.003 CERAMICS: ELECTRIC KILNS
4.004 CERAMICS: GAS-FIRED KILNS
4.005 CERAMICS: OUTDOOR KILNS
4.006 CERAMICS: MACHINERY
4.007 3-DIMENSIONAL WORK: CARVING, CUTTING & ABRADING
4.008 3-DIMENSIONAL WORK: EMBEDDING
4.009 3-DIMENSIONAL WORK: PLASTER OF PARIS
4.010 3-DIMENSIONAL WORK: WORKING WITH SCRAP MATERIALS
4.011 USING BENCH-MOUNTED CUTTING TOOLS
4.012 PAINTING & DRAWING
4.013 PAPER-MAKING
4.014 PRINT-MAKING: PRINTING
4.015 PRINT-MAKING: CHEMICAL ETCHING
4.016 PRINT-MAKING : ENGRAVING WITH SMALL HAND TOOLS
4.017 PRINT-MAKING: USE OF ULTRA-VIOLET (UV) LIGHT & PHOTO-SENSITIVE RESISTS
4.018 SOLVENTS
4.019 ADHESIVES: GENERAL
4.020 ADHESIVES: SPRAY TYPE
4.021 ADHESIVES: GLUE GUNS & GLUE STICKS
4.022 TEXTILES: DYES, MORDANTS, BLEACHES, ETC
4.023 TEXTILES: BATIK & OTHER WAX PROCESSES
4.024 TEXTILES: USING ELECTRIC HEAT SOURCES
4.025 TEXTILES: SEWING MACHINES
4.026 TEXTILES: SMALL SHARP ITEMS
4.027 ENAMELLING: KILNS
4.028 ENAMELLING: MATERIALS
4.029 WORKING WITH GLASS
4.030 JEWELLERY (LAPIDARY): STONE CUTTING & GRINDING
4.031 JEWELLERY: METAL CASTING
4.032 JEWELLERY: SOLDERING
4.033 PHOTOGRAPHY: CHEMICALS
4.034 PHOTOGRAPHY: DARKROOMS
4.035 USE OF ICT & AUDIOVISUAL EQUIPMENT
4.036 ARTISTS IN RESIDENCE & OTHER VISITORS
4.037 OFF-SITE VISITS
4.038 PROJECTS, TESTING, EXPERIMENTAL & NOVEL ACTIVITIES & MATERIALS

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4.001 COSHH Regs	CERAMICS: CLAY & DUSTS	Applicable to: pottery studios, ceramics studios	See also: 4.002, 4.003, 4.004, 4.005, 4.006

Process(es) covered:

Working with wet clay by hand or on a wheel.
Grinding and crushing raw materials.
Carrying out processes (eg, fettling, towing, sanding) on dry clay before firing.
Cleaning equipment, utensils, work surfaces and floors.

Hazards

Inhalation of dusts

Some dusts, especially fine dusts containing free silica, if inhaled, can damage the respiratory system leading to respiratory diseases. This normally takes a number of years. Some ball clays, red clays and fireclays contain a proportion of silica.

Skin irritation

Repeated handling of wet clay can cause dermatitis.

Risk Assessment

Inhalation of dusts

The Workplace Exposure Limit for inhalable dust in general is 10 mg m^{-3} (8-hour time-weighted average) and for respirable dust is 4 mg m^{-3} (8-hour). However, for amorphous silica the 8-hour limits are 6 mg m^{-3} (inhalable) and 2.4 mg m^{-3} (respirable) and for respirable crystalline silica it is 0.1 mg m^{-3} (8-hour).
Steps must be taken to minimise the air-borne dust levels. Students are unlikely to be exposed to dust for long enough for there to be much risk. However, teachers, technicians, TAs and cleaners will be at greater risk because of longer exposure.

Skin irritation

Students are unlikely to be handling wet clay for long enough for this to be a problem, but teachers, technicians or TAs will be at greater risk.

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Control measures	
	Do not use fine silica such as ground flint for coating kiln furniture. Use a non-toxic bat wash such as aluminium hydrate in slop form. Use wet processes where practicable; dusty processes should be carried out under an efficient extraction hood. If using ground flint, ensure it is dampened. Fettling and shaping are best done when the clay is leather hard. Place clay scraps in covered scrap containers before they dry. If hessian or similar cloths are used to prevent clay slabs sticking to table surfaces, do not shake these out into the air in the studio. Work surfaces should be impervious to water. Do not work clay on wooden surfaces. Clean up spills as soon as they occur, including both dusts and slurries which could become a dust when dry; encourage students to clear up their own workspace, both as incidents occur and when they have finished working. Clean equipment and utensils by wet methods, never by dry brushing. Wipe working areas at the end of the lesson/activity with a damp sponge and dispose of the dust in a bin. Use wet methods to clean floors and work surfaces; do not use a vacuum cleaner (unless an industrial type with a fine-dust (HEPA) filter is available). If dust sometimes becomes airborne while cleaning, wear a disposable dust mask (to BS EN 149 FFP3). Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science Ensure that cleaning staff understand that dry cleaning is not generally appropriate. Do not switch on extraction fans if this could raise dust, but they are advisable at the end of the day during wet sweeping or damp wiping. With dry clay on the hands or overalls, do not generate additional dust by brushing, clapping hands, etc. Thoroughly wash hands when leaving the studio. Protective clothing (eg, a wipeable apron or polyester overalls) needs to be cleaned or washed frequently to minimise dust. Do not allow eating and drinking in the studio. Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap. It is not generally considered necessary to wear protective gloves when handling clays, but teachers need to be vigilant for possible signs of dermatitis amongst staff and children.

Disposal

Surplus clay is low hazard and can be bagged and disposed in the refuse collection. Take care, including when disposing of waste packaging material, to avoid raising dust. Damping may be helpful.

Storage

Store in clearly labelled, sealed containers.

FURTHER INFORMATION

Control of Substances Hazardous to Health in the Production of Pottery, Approved Code of Practice, HSC, 1995, HSE Books; ISBN 0 7176 0849 2.

There are many types of clay. Kiln-fired clay is the most durable. If merely air-dried, it will be brittle. Oven-baked clay is intermediate in durability, but cannot use the same glazes as kiln-dried clay.

Non-hardening clays are soft and do not dry out or harden if left out. Mould-making clay is stiffer.

IMMEDIATE REMEDIAL MEASURES

If clay or dust gets into the eyes	Wash thoroughly for at least ten minutes with water, holding the eyelids apart. Seek medical attention if irritation persists.
If clay or dust gets onto the skin	Wash thoroughly with warm soapy water.

Further information regarding the use of ceramics in school can be found in **GL245 Ceramics in schools** available from the CLEAPSS website.

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4.002 COSHH Regs CLAW Regs	CERAMICS: GLAZES & COLOURS	Applicable to: glazes and colours used in pottery and ceramics	See also: 4.001, 4.003, 4.004, 4.005, 4.006

Process(es) covered: Preparing and applying glazes and colours.

Hazards

Very toxic Some of the materials used in glazes and colours are very toxic by inhalation of the dust, skin contact or ingestion. They may cause cancer by inhalation and serious damage to health by prolonged exposure. They may cause hereditable damage, impair fertility and cause harm to the unborn child. There is a possible risk of irreversible effects. They may be very toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment. Examples which may be encountered include cadmium sulfide and sulfoselenide, and chromates [but note that the green chromium(III) oxide is low hazard].

Toxic Some of the materials used in glazes and colours are toxic by inhalation of the dust, skin contact or ingestion. Examples which may be encountered include chromates, red lead (lead oxide), litharge (yellow lead), lead sulfide (galena) and lead chromate, nickel oxide (R43, R49, R53) and vanadium pentoxide.

Harmful Many of the materials used in glazes and colours are harmful by inhalation of the dust, skin contact or ingestion There may be limited evidence of a carcinogenic effect. Examples which may be encountered include antimony oxides, barium carbonate, cobalt oxide and carbonate, copper oxide and carbonate, fluor(o)spar (calcium fluoride) and manganese dioxide.

Irritant Some of the materials used in glazes and colours are irritating to the eyes, respiratory system and skin, cause burns and may cause sensitisation by inhalation or skin contact. Examples which may be encountered include chromates [but note that the green chromium(III) oxide is low hazard].

Risk Assessment

Very toxic
Toxic
Harmful
Irritant

The Workplace Exposure Limits for materials likely to be encountered are: antimony compounds, 0.5; barium compounds, 0.5; cadmium sulfide and cadmium sulfide pigments, 0.03; chromates, 0.05; cobalt compounds, 0.1; copper dusts, 1.0; lead compounds, 0.15; manganese compounds, 0.5; (insoluble) nickel compounds 0.1; vanadium pentoxide, 0.05 (all mg m^{-3} for an 8-hour reference period).

Teachers, students, technicians, TAs and cleaners could all be at risk of inhaling hazardous materials if glazes and colours are handled carelessly, using dry rather than wet methods or if cleaning is done by dry rather than wet methods.

Teachers, students, technicians, TAs and cleaners could all be at risk of inhaling hazardous materials if kilns used for firing the ceramic materials do not have good ventilation.

Teachers, students, technicians and TAs could all be at risk of making skin contact with hazardous materials if glazes and colours are handled without appropriate protection.

Teachers, students, technicians and TAs could all be at risk of ingesting hazardous materials if eating and drinking are permitted in areas where glazes and colours are handled or hands are not washed on leaving the studio.

Students and the public in general could all be at risk of ingesting hazardous materials if the glaze used for making a food or drink container is soluble in water or subject to acid attack.

Under normal circumstances, the risk of eye contact is considered low.

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Control measures	
	Do not use old materials, for which hazard warnings (or a suppliers' Safety Data Sheet) are not available. Use only proprietary glazes from reputable sources. Do not use raw lead (ie, direct use of lead oxide, etc) or glazes containing more than 5% soluble lead. Where possible, use 'leadless' glazes (less than 1% lead). Failing this, use a low solubility frit, eg, lead bisilicate, as a source of lead oxide. Do not grind a prepared low solubility glaze to a finer particle size, as this will generate dust. Choose glazes on ceramics intended for contact with food or drink carefully to ensure they are not subject to acid attack - use cooking ware quality. Do not use lead or copper in such glazes. Do not blend or mix glazes or stains (unless specifically designed for this purpose), as this may change the susceptibility to acid attack. When preparing glazes, add the dry material to water, not vice-versa, to minimise dust formation. Where possible, buy glazes in liquid or paste form. If spraying glazes, only do so in a spray booth with adequate extraction. Wear protective gloves, eg nitrile, especially if immersing the hands in glaze suspensions. Use appropriate protective clothing (eg, a wipeable apron or polyester overalls); clean or wash frequently. Do not allow eating and drinking in the studio and thoroughly wash hands when leaving. Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap. Clean equipment and utensils by wet methods, never by dry brushing. Use wet methods to clean floors and work surfaces; do not use a vacuum cleaner unless an industrial type with a fine-dust (HEPA) filter is available. Ensure that cleaning staff understand that dry cleaning is not generally appropriate.
Disposal	Take care, eg when disposing of waste packaging material, to avoid raising dust. Unfired glazes and colours may be hazardous and thus subject to the *Hazardous Waste Regulations.* Schools and colleges must check that any waste disposal contractor whom they use has a licence (or is exempt). Science departments will have a list of possibilities on the *CLEAPSS Science Publications CD-ROM* or the (password-protected) part of the CLEAPSS web site - ask for PS5 *Waste Disposal Contractors*. Seal any containers of unknown or unlabelled materials and treat as if hazardous.
Storage	Store in clearly labelled, sealed containers. Do not store unknown or unlabelled materials. Hazardous materials should be under lock and key.

RESTRICTIONS

DES Administrative Memorandum 517/55 *Restrictions on the use of Certain Types of Glazes in the Teaching of Pottery* has been around since 1955 but in fact is purely advisory, rather than statutory.

The Control of Lead at Work Regulations prohibit the use of certain lead glazes.

The Ceramic Articles in Contact with Food Regulations specify the limits of lead and cadmium that might be transferred from ceramics intended to come into contact with food.

FURTHER INFORMATION

Control of Substances Hazardous to Health in the Production of Pottery, Approved Code of Practice, HSC, 1995, HSE Books; ISBN 0 7176 0849 2.

IMMEDIATE REMEDIAL MEASURES

If glazes or colours get into the eyes	Wash thoroughly for at least ten minutes with water, holding the eyelids apart. Seek medical attention if irritation persists.
If glazes or colours get onto the skin	Wash thoroughly with warm soapy water.

Further information regarding the use of ceramics in school can be found in **GL245 Ceramics in schools** available from the CLEAPSS website.

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4.003 Man Regs & COSHH Regs	CERAMICS: ELECTRIC KILNS	Applicable to: Electrically-operated pottery kilns	See also: 4.001, 4.002, 4.004, 4.005, 4.006

Process(es) covered: Firing ceramic materials in electric kilns.

Hazards	
Radiant heat	Infra-red radiation from hot surfaces can damage the eyes.
Burns	Although the temperature of the exterior of a kiln is much lower than the interior, it can reach 160 °C and possibly more.
Fire	Extractor fans, roofs, ceilings and floors above the kiln, or combustible materials carelessly stored near to it, may get sufficiently hot to char or ignite. Many kiln fires start at night.
Electric shock	The high operating temperature may lead to damage of the supply cables.
Inhalation of fumes	Electric kilns produce little by way of fumes, but hazardous fumes may be given off by some glazes, especially if firing is not at the correct temperature.
Inhalation of insulating fibres	Some old kilns used asbestos fibre for insulation. Even low levels are carcinogenic and prolonged exposure may damage health in other ways. More modern kilns contain man-made mineral fibres, for which there is only limited evidence of a possible carcinogenic effect.

Risk Assessment	
Radiant heat	Viewing the inside of the hot kiln directly presents a high risk of eye damage.
Burns	If the kiln is in a separate room, with restricted access, only the teacher or technician would be at risk. However, if it is situated in the classroom there would be a high risk, especially, that children might touch the hot surface.
Fire	The risk will depend on the siting of the kiln, especially the proximity to combustible materials, walls and ceilings.
Electric shock	Opening the kiln door when it is switched on presents a high risk of electric shock, as does use of supply cables with insulation not able to withstand the high temperatures expected.
Inhalation of fumes	Natural ventilation (opening windows, etc) may be sufficient but is susceptible to outdoor conditions. Ventilation of electric kilns is mainly for comfort rather than health & safety. A canopy hood above the kiln will more effectively remove fumes and heat but it may then be necessary to ensure there is sufficient replacement air, eg through grills in the room door.
Inhalation of insulating fibres	There would be minimal risk during routine operation of the kiln, but exposure to the fibres might occur if the kiln were being dismantled or disposed of. The presence of asbestos fibres should already have been identified by the employer's survey and entered on the school's Asbestos Register. Maintenance staff would be at risk if they were unaware of this.

Control measures
Ensure kilns have a protective glass window, wear goggles giving protection from infra-red or use blue or smoked glass. Use a pyrometer to determine the temperature inside the kiln. Where possible, fit a heat lock to the kiln door, so that it cannot be opened until the temperature falls to a safe level. Do not allow students to operate kilns. Ideally site kilns in a separate room, to which access can be restricted. If in teaching rooms, site kilns within a lockable cage, which can be opened from the inside. Provide a warning sign when the kiln is firing, eg, a double bulb bulkhead light above the kiln or kiln room door, fitted with red bulbs and wired into the firing circuit, so that the light is automatically on when the kiln is on. Only allow firing to be undertaken by adequately-trained operators. Ensure at least two people in a school are competent to supervise the firing process.

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	Site kilns with free air movement all around them (including above the kiln) and good access for servicing. Ensure kiln rooms have high ceilings and/or a heat shield and that adjacent floors, walls, ceilings and shelves, etc are made of (or covered with) non-combustible materials. Do not store any items, including paper, so close that they reach much above normal room temperature. Place a carbon dioxide fire extinguisher just outside the kiln room or cage. Ensure the kiln has a convenient means of isolation from the electrical supply and is protected from over-loads and short-circuit. Clearly label the main power switch. Ensure wiring, control panels, etc are protected from mechanical and heat damage. Ensure kiln doors are fitted with a fail-safe inter-locking device which turns off the power if the door is opened. Alert the caretaker if left firing overnight and provide emergency contact details of the operator. Ensure kilns are serviced regularly by a suitably qualified contractor, in accordance with the supplier's instructions. Ensure that the kiln room is adequately ventilated, with opening windows or extractor fans. In most cases, there should be a canopy to duct heat and fumes directly to the outside. Check whether any asbestos is listed in the Asbestos Register and, if so, place a warning notice that protective equipment may be required if dismantling.

FURTHER INFORMATION

Display operating instructions clearly in the kiln room. These should include start-up procedures, operating procedures, shut-down procedures and emergency procedures. If adequate ventilation requires windows to be open, write this in.

Keep a log of all firing processes and retain the log for subsequent inspection.

The kiln must be inspected regularly and kept properly maintained. Records of maintenance must be retained. Kiln operators should visually check the kiln furniture, brick work and framework to ensure they are in good condition. The kiln should be cleaned inside regularly. The grit and dust can be removed by an industrial vacuum cleaner fitted with a filter suitable for trapping silica dust. Do *not* use household vacuum cleaners, the dust filters are totally inadequate for containing silica dust.

See also: *Safe Use of Electric Kilns in Craft and Education*, HSE Information Sheet, Ceramics Information Sheet 3, HSE, 2003; free download from www.hse.gov.uk/pubns/ceis3.pdf.

Disposal	If an old kiln is to be disposed of, the Asbestos Register must be checked for the presence of asbestos and, if found, dealt with in a safe manner.

IMMEDIATE REMEDIAL MEASURES

If burns to the skin occur	Cool the affected area under a running cold tap for ten minutes.
If serious burns to the skin occur	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches which might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.
Electric shock	Send for a first aider immediately. Taking care for your own safety, break contact by switching off (or, if there is one, pulling out the plug). If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a trained first aider does not arrive quickly and the pulse is absent, consider carrying out cardio-pulmonary resuscitation.

Further information regarding the use of ceramics in school can be found in **GL245 Ceramics in schools** available from the CLEAPSS website.

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4.004 Man Regs & COSHH Regs	CERAMICS: GAS-FIRED KILNS	Applicable to: kilns using mains gas and bottled gas	See also: 4.001, 4.002, 4.003, 4.005, 4.006

Process(es) covered: Firing ceramic materials in kilns powered by mains or bottled gas.
Reduction firing ceramic materials in limited air (oxygen) supplies.

Hazards

Radiant heat Infra-red radiation from hot surfaces can damage the eyes.

Burns Although the temperature of the exterior of a kiln is much lower than the interior, it can reach 160 °C and possibly more.

Explosion Mixtures of gas and air can be explosive. Bottled gas (propane), unlike mains gas (methane), is denser than air and will tend to accumulate at ground level.

Fire Extractor fans, roofs, ceilings and floors above the kiln, or combustible materials carelessly stored near to it, may get sufficiently hot to char or ignite. Many kiln fires start at night.

Inhalation of fumes Hazardous fumes may be given off by some glazes, especially if firing is not at the correct temperature.
Gas-fired kilns will produce carbon dioxide, WEL 27 400 mg m^{-3} (15 min ref period), with traces of nitrogen oxides (R26) (WEL too low to quote) and carbon monoxide (R12, 23, 48/23, 61), WEL 232 mg m^{-3} (15 min ref period)[93] present as combustion products. Such fumes are especially likely with reduction firing.

Inhalation of insulating fibres Some old kilns used asbestos fibre for insulation. Even low levels are carcinogenic and prolonged exposure may damage health in other ways. More modern kilns contain man-made mineral fibres, for which there is only limited evidence of a possible carcinogenic effect.

Risk Assessment

Radiant heat Viewing the inside of the hot kiln directly presents a high risk of eye damage.

Burns If the kiln is in a separate room, with restricted access, only the teacher or technician would be at risk. However, if it is situated in the classroom there would be a high risk, especially, that children might touch the hot surface.

Explosion Explosive mixtures might arise if the gas supply were interrupted and the gas was not re-ignited.
There is a risk that bottled gas, if leaking, may accumulate in ducts in the floor, drawers, etc. Storage of bottled gas can present a particular risk, eg, to fire-fighters.

Fire The risk will depend on the siting of the kiln, especially the proximity to combustible materials, walls and ceilings. The risk is greater for gas-fired kilns than electric kilns because very hot exhaust gases have to be ducted away.

Inhalation of fumes The risk of inhalation of fumes by staff or pupils is much greater than with electric kilns because the combustion process produces large volumes of exhaust gases. If the air supply is inadequate toxic gases are formed.
Inhalation of toxic fumes is especially likely with reduction firing.

Inhalation of insulating fibres There would be minimal risk during routine operation of the kiln, but exposure to the fibres might occur if the kiln were being dismantled or disposed of. The presence of asbestos fibres should have been identified on the school's Asbestos Register. Maintenance staff would be at risk if they were unaware of this.

93 EH 40/2005 (as amended).

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Control measures	Ensure kilns have a protective glass window or wear appropriate goggles. Use a pyrometer to determine the temperature inside the kiln. Where possible, fit a heat lock to the kiln door, so that it cannot be opened until the temperature falls to a safe level.
	Do not allow students to operate kilns. Ideally site kilns in a separate room, to which access can be restricted. If in teaching rooms, site kilns within a lockable cage, which can be opened from the inside; there must be no possibility of tampering with the controls. Provide a warning sign when the kiln is firing but make sure pupils are unable to interfere with it. Fit burners with a flame safeguard device to minimise the explosion risk. Clearly label the main gas cut-off. If the kiln uses bottled gas, do not store spare propane cylinders adjacent to the kiln. Only allow firing to be undertaken by adequately-trained operators. Ensure at least two people in a school are competent to supervise the firing process. Alert the caretaker if left firing overnight and provide emergency contact details of the operator. Ensure kilns are serviced regularly by a qualified gas engineer, in accordance with the supplier's instructions. Site kilns with free air movement all around them (including above the kiln) and good access for servicing. Ensure kiln rooms have high ceilings and/or a heat shield and that adjacent floors, walls, ceilings and shelves, etc are made of (or covered with) non-combustible materials. Do not store any items, including paper, so close that they reach much above normal room temperature. Place a carbon dioxide fire extinguisher just outside the kiln room or cage.
	Ensure that the kiln room is adequately ventilated. An extraction system is necessary to duct heat and fumes directly to the outside. This is especially true with reduction firing. Extraction systems must be subject to regular inspection.
	Check whether any asbestos is listed in the Asbestos Register and, if so, place a warning notice that protective equipment may be required if dismantling.
Disposal	If used, empty propane cylinders should be returned to the supplier. If an old kiln is to be disposed of, the Asbestos Register must be checked for the presence of asbestos and, if found, dealt with in a safe manner.
Storage	Spare gas bottles should be stored out of doors in a securely locked, well-ventilated, cool area away from flames, combustible materials and escape routes.
RESTRICTIONS	Generally speaking, gas-fired kilns are best avoided in schools. Some local authorities do not permit them in their schools. If used, staff should have specialist training in firing procedures. They should be aware of lock-out procedures and how to prevent the risk of explosion by blowback during lighting. Display operating instructions clearly in the kiln room. These should include start-up procedures, operating procedures, shut-down procedures and emergency procedures. Keep a log of all firing processes and retain the log for subsequent inspection.

IMMEDIATE REMEDIAL MEASURES

If burns to the skin occur	Cool the affected area under a running cold tap for ten minutes.
If serious burns to the skin occur	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches which might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.
If fumes are inhaled	In the event of dizziness occasioned by fume, remove the affected person to the fresh air until recovered. Seek medical advice if symptoms persist.

Further information regarding the use of ceramics in school can be found in **GL245 Ceramics in schools** available from the CLEAPSS website.

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4.005 Man Regs & COSHH Regs	CERAMICS: OUTDOOR KILNS	Applicable to: raku kilns	See also: 4.001, 4.002, 4.003, 4.004, 4.006

Process(es) covered: Firing ceramic materials in ad hoc outdoor kilns, including raku kilns, portable kilns and brick-built kilns. Kilns may be electric or use solid fuel, oil or gas.

Hazards	
Radiant heat	Infra-red radiation from hot surfaces can damage the eyes.
Burns	The temperature of the exterior of ad hoc outdoor kilns would be difficult to determine but certainly high enough to cause serious burns.
Fire	The covered shelter, stores of fuel and adjacent buildings and trees may be accidentally ignited.
Explosion	Bricks other than firebricks can split explosively when hot enough.
Inhalation of fumes	Hazardous fumes may be given off by some glazes, especially if firing is not at the correct temperature. Smoke and possibly toxic fumes may be given off by sawdust or other materials used in raku kilns.

Risk Assessment	
Radiant heat	Viewing the inside of the hot kiln directly presents a high risk of eye damage.
Burns	There is a high risk that children and others might touch hot surfaces. The ad hoc nature of outdoor kilns makes it harder to establish routine procedures and hence increases the risk of burns to teachers and technicians.
Fire	The risk will depend on the siting of the kiln, especially the proximity to combustible materials in adjacent buildings, trees, the location of the fuel store and the nature of the covered shelter in which the kiln is located.
Explosion	The rate of heating is unlikely to be sufficient to cause bricks to explode.
Inhalation of fumes	The risk will depend on the siting of the kiln and the nature of the shelter in which it is situated but is generally less outdoors than indoors.

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Control measures	
	If relevant, see also the Control Measures for electric kilns or gas-fired kilns.
	Restrict access to the kiln, eg, by barriers marking a no-go area. Depending on the nature of the barriers, continuous supervision may be necessary. Display a warning notice when the kiln is firing, and locate it carefully to minimise the risk of tampering. Do not allow children to operate kilns or handle hot ceramic materials. Only suitably-trained operators, wearing protective clothing and using kiln tongs should open the kiln to place work inside or remove work when hot for reduction.
	Site kilns with free air movement all around. A covered shelter is satisfactory but ensure that combustible materials are not too close. Do not locate kilns so close to fuel stores, trees or buildings that their temperature reaches much above ambient temperatures. Site kilns at a distance from surrounding buildings so that smoke and fumes cannot blow into them.

IMMEDIATE REMEDIAL MEASURES	
If burns to the skin occur	Cool the affected area under a running cold tap for ten minutes.
If serious burns to the skin occur	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches which might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.
If fumes are inhaled	In the event of dizziness occasioned by fume, remove the affected person to the fresh air until recovered. Seek medical advice if symptoms persist.

Further information regarding the use of ceramics in school can be found in **GL245 Ceramics in schools** available from the CLEAPSS website.

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4.006 Man. Regs	CERAMICS: MACHINERY	Applicable to: throwing wheels, mixers (eg, blungers), pug mills, pot mills, jiggers, batting machines, pottery lathes	See also: 4.001, 4.002, 4.003, 4.004, 4.005

Process(es) covered:	Shaping hollow-ware on a throwing wheel. Mixing clay and other materials to form a slip or plastic body. Use of pug mills for extruding plastic clay. Use of pottery lathes for turning unfired hollow-ware.
Hazards	
Trapping & entanglement	Closing movements between moving parts, eg, a belt and pulley or gears, can present a trapping hazard. Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
User injury	Human contact with rotating parts, eg, fan blades, shafts and spindles, can cause cuts or abrasions. Particles thrown off when turning unfired pottery on lathes could enter the eye.
Tripping	Equipment on the floor around machines can present a trip hazard.
Electric shock	Electric shocks are possible since the machines are mains-powered.
Risk Assessment	
Trapping & entanglement	Unguarded moving parts present a considerable risk of entrapment to any user, however experienced. Entanglement is most likely to occur if rotating parts are exposed.
User injury	Unguarded moving parts present a considerable risk of injury to any user. Dust when turning on a lathe or when cleaning a lathe presents a significant risk of eye injury.
Tripping	Users may concentrate on the machine and be unaware of hazards on the floor.
Electric shock	Because of the amount of water used in some processes, electric shocks are a significant risk to any user if equipment is not properly installed.

Control measures	
	Enclose moving parts, eg, belt and pulley drives, with fixed guards to reduce the risk of hand or finger injury by trapping or contact. If guards need to be removable, use a fail-safe interlock to prevent the machine operating unless the guard(s) are in place. If a pug mill has a de-airing chamber, ensure the cover is bolted on or fitted with an inter-lock. Clay-processing pug mills should be fitted with a finger guard. Do not allow children (or untrained staff) to operate pug mills or other clay-processing machines with rotating cutters or worms. Never feed clay into such machines by hand, use a pusher. Ensure adequate stop and start controls are fitted and clearly labelled and that the emergency stop button is easily accessible to the operator. Ensure electric wheels are hard-wired into insulated wall-mounted isolators and never connected via 13 amp plugs. Switch off the power supply during cleaning and maintenance work. Where fitted, remove the mains plug from the socket. Where the equipment is hard-wired, lock the isolating switch in the ‘off’ position.

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	Use a fail-safe key isolator for equipment such as pug mills which is intended for use only by (or under the direct supervision of) trained staff. Tie back long hair; remove or cover jewellery and cover loose clothing with a secure apron or overall to reduce the risk of entanglement. Wear eye protection (to BS EN 166 4 standard) whenever there is a risk to the eyes, especially dust when using or cleaning a pottery lathe. To avoid trips, place slop buckets carefully under electric wheels, away from areas of movement. Ensure electric equipment is adequately earthed, or double insulated, and temporary wiring or trailing leads avoided. Connect equipment permanently through a no-volt starter and isolator. Use RCDs where possible.

RESTRICTIONS

	Whilst children can use throwing wheels, they should not operate pug mills or other clay-processing machines with rotating cutters or worms.
Disposal	Broken and/or surplus electrical goods are subject to the *Waste Electrical and Electronic Equipment Regulations* 2006 (the *WEEE Regulations*). These cannot be put in the ordinary refuse collection. Most schools will have in place arrangements for the disposal of old computers, TV sets, kettles, refrigerators, etc.

FURTHER INFORMATION

Ensure there is sufficient space around machines to avoid contact with moving parts. Although not directly relevant (except for textiles), Chapter 5 of *Building Bulletin 81, Design and Technology Accommodation in Secondary Schools* (DfES, 2004) (download from http://publications.education.gov.uk/default.aspx?PageFunction=productdetails&PageMode=publications&ProductId=0 112711707&) gives detailed drawings of the space needed for safe working around various types of machine and may give guidance on a reasonable standard at which to aim.

These machines should be included in the planned annual maintenance programme.

IMMEDIATE REMEDIAL MEASURES

If dust is in the eye	Irrigate immediately with water for several minutes, telling the casualty to hold eyelids apart.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Severe cuts	Lower the casualty to the floor. Raise the wound as high as possible. If feasible, ask the casualty to apply pressure on or as close to the cut as possible, using fingers, a pad of cloth or, better, a sterile dressing (adding further layers as necessary). If the casualty is unable to do so, apply pressure yourself, protecting your skin and clothes from contamination by blood if possible. Leave any embedded large bodies and press around them. Send for a first aider.
Impact injury	Rest the injured part; apply ice to reduce the bruising and pain; attention from a first aider may be required.

Further information regarding the use of ceramics in school can be found in **GL245 Ceramics in schools** available from the CLEAPSS website.

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4.007 COSHH Regs	3-DIMENSIONAL WORK: carving, cutting & ABRADING	Applicable to: Thermalite, Green Oasis, Glass Reinforced Plastic, Polystyrene, MDF, wood	See also: 4.008, 4.009, 4.010, 4.011

Process(es) covered: Cutting, carving and smoothing aerated concrete (insulation) blocks, GRP (glass reinforced plastic), Green Oasis (florists blocks, an open-celled phenolic foam), plaster of Paris blocks, wood or MDF including mould-making.
Cutting expanded polystyrene with a sharp tool or a hot wire and smoothing it.
Using a chain saw on wood, etc.

Hazards

The bulk materials are generally low hazard. However the dust (if sanding or abrading) or the fumes (if using hot-wire cutters) may present hazards. Sharp tools and flying off-cuts also present a hazard.

Toxic If heated, polyvinyl chloride (PVC) and polyurethane foams can decompose to give toxic products. When it is worked, MDF has been accused of producing hazardous fumes from the bonding agent used but there is no evidence to support this.

Harmful Styrene vapour, formed by heating polystyrene, is harmful by inhalation.

Dust Wood process dust is hazardous by inhalation. MDF produces considerable amounts of fine wood dust, even with hand sanding. Silica dust from concrete blocks can be harmful if inhaled or ingested and may cause irritation to the respiratory and digestive tracts. Glass fibres (in GRP), although not officially classified as irritant, can irritate the skin and respiratory system.

Irritant The fine dust produced by abrading some materials can irritate eyes and skin.

User injury Incorrect use or careless handling of sharp tools can cause cuts and incorrect use or careless handling of a hammer or mallet may cause an impact injury. Power tools, such as a chain saw, could cause life-threatening injury.

Risk Assessment

Toxic Decomposition of PVC powder in air starts at around 150 °C with the release of vinyl chloride monomer (R45) (WEL 7.8 mg m^{-3}, 8h TWA) which must be regarded as a carcinogen. Unless these vapours can be removed, staff and pupils could be at risk. Polyurethane foam may produce hydrogen cyanide (R 26, 50/53) (WEL 11 mg m^{-3}, 15 min ref period) and nitrogen oxides (R26) when heated.

Harmful Cutting expanded polystyrene with a hand-held hot-wire cutter produces small amounts of styrene vapour. Styrene vapour (R10, 20, 36/38) is released during curing of polystyrene resin and when polystyrene is heated. However, measurements show that, in school processes, the concentration is well below the WEL of 430 mg m^{-3} (8 h TWA).

Dust Hand operations (except with MDF) do not usually produce large quantities of dust but might do so if a number of pupils are carrying out similar activities. Machine operations invariably produce much more dust, so staff and pupils could be at risk. Dust rich in glass fibres is produced when GRP mouldings are abraded. This can irritate the skin, nose and throat and may exacerbate existing chest conditions. Consequently, dust levels may need to be controlled.

Irritant There is a risk of skin and eye irritation from a build-up of dust around the studio following abrading operations.

User injury Serious cuts have resulted from the use of chisels, eg, if knocked off the bench, falling onto the foot. Novices are likely to hit fingers with a hammer or mallet, but the injuries are usually trivial. Chain saws present a very high risk of serious injury.

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Control measures	
	Do not use a hot-wire cutter on any plastic except expanded polystyrene, and especially not on polyurethane foam or PVC. Ensure good ventilation if casting with polystyrene resin (even on a small scale). Use hand-held hot-wire cutters near an open window (or forced ventilation) to avoid nuisance fumes. Only use large bench-mounted, hot-wire cutters if local exhaust ventilation is available. Do not abrade insulation or building blocks (unless they are known not to have a high silica content). Use dust extraction if abrading materials, especially GRP or MDF, by machines (or wear dust masks at least to BS EN 149 FFP3 standard). Work outdoors if a number of people are abrading or sawing by hand, especially MDF (or wear dust masks at least to BS EN 149 FFP3 standard). (Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science) Use wet methods to clean floors and work surfaces contaminated with dusts; do not use a vacuum cleaner (unless an industrial type with a fine dust (HEPA) filter is available). Wash hands thoroughly after producing dust. Wear eye protection. Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap. Train users in the correct use of tools. Chain saws should never by used by students, and only by staff who have undergone recognised training. Observers should be at least 3 metres away.

Disposal	Waste and fragments of the bulk materials, ie, insulation blocks, Green Oasis (florists' blocks), plaster of Paris blocks, expanded polystyrene and wood, are low hazard and can be disposed of in the solid refuse collection.
Storage	Store bulk materials and work in progress carefully, avoiding trip and similar hazards.

IMMEDIATE REMEDIAL MEASURES

Dust in the eyes	Wash thoroughly for at least ten minutes with water to prevent scratching of the eye. Seek medical attention if irritation persists.
Severe cuts	Lower the casualty to the floor. Raise the wound as high as possible. If feasible, ask the casualty to apply pressure on or as close to the cut as possible, using fingers, a pad of cloth or, better, a sterile dressing (adding further layers as necessary). If the casualty is unable to do so, apply pressure yourself, protecting your skin and clothes from contamination by blood if possible. Leave any embedded large bodies and press around them. Send for a first aider.
Impact injury	Rest the injured part; apply ice to reduce the bruising and pain; attention from a first aider is required.

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4.008 COSHH Regs	3-DIMENSIONAL WORK: embedding	Applicable to: resin casting, embedding	See also: 4.007

Process(es) covered: Embedding small objects in resin.
Embedding resin comprises polyester dissolved in styrene (phenylethene). The styrene is made to polymerise (harden) by the addition of a catalyst (hardener), commonly MEK (methyl ethyl ketone or butanone) but sometimes benzoyl peroxide (dibenzoyl peroxide). It sets in 10 to 30 minutes. All mixing vessels, etc, are disposable and are not cleaned with solvents.

Hazards

Harmful — Vapours from styrene are harmful by inhalation.

Irritant — Styrene and some of the catalysts used are irritating to eyes, may degrease the skin and vapours may cause drowsiness and dizziness.

(Highly) Flammable — MEK is highly flammable and styrene is flammable.

Explosive — Some peroxide catalysts (hardeners) can be explosive.

RISK ASSESSMENT

Harmful — Styrene vapour (R10, 20, 36/38) is liberated until curing has ceased. For the low-emission resins, where the maximum total quantity of material laid up or curing in a workshop at any time has a surface area of 1 m^2 or 0.25 kg of resin, the WEL for styrene (430 mg m^{-3}, 8 h TWA)[94] will not be approached. A few people are very sensitive to even low levels of fumes and can suffer headaches.

Explosion — While pure benzoyl peroxide (R2, 36, 43) is explosive (WEL 5 mg m^{-3}, 8 h TWA)[1], the formulations used here are most unlikely to explode. The paste catalysts used with embedding kits are even safer.

Irritant — Styrene is irritating to eyes and skin (R36/38).

MEK is irritating to eyes (R36). Repeated exposure may cause skin dryness or cracking (R66) and vapours may cause drowsiness and dizziness (R67). It is absorbed through the skin. The WEL is 899 mg m^{-3} (15 min ref period).

Benzoyl peroxide is irritating to eyes (R36) and may cause sensitisation by skin contact (R43), WEL is 5 mg m^{-3} (8 h TWA). Prolonged contact may cause dermatitis.

All will cause irritation to the eyes for several hours after exposure. However, with the small amounts generally used in embedding, the risk is small as long as there is some ventilation.

Catalysts are usually very irritant to eyes, nose, throat and airways. Irreversible damage to the eyes will result from prolonged contact.

Highly flammable — Catalysts and resins (R10 or R11) could be ignited by a naked flame.

Control measures

Ensure all users wear eye protection and disposable gloves (preferably nitrile).

Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap.

Ensure good ventilation.

If low-emission resins are not used, or more than the above amounts are used and forced ventilation is not available, remove work to an unoccupied room until completely cured.

Do not allow children to dispense the catalyst. Teachers, technicians and TAs should take great care when doing so.

Keep catalysts and resins away from all sources of ignition.

94 EH 40/2005 (as amended)

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RESTRICTIONS

Disposal	Wherever possible, disposal is achieved by mixing the resin and catalyst, allowing them to harden and then placing the hard waste in a sealed plastic bag in the bin.
Storage	Store resin and catalyst as highly flammable liquids in a locked cupboard in suitable unbreakable containers that are clearly labelled. Unused resin and catalyst should be discarded after 1 year.

IMMEDIATE REMEDIAL MEASURES

If swallowed	Give plenty of water. DO NOT INDUCE VOMITING. Obtain medical attention.
If vapour is inhaled	Remove casualty to fresh air to rest. If breathing is even slightly affected, obtain medical attention.
If substances get into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Spilt on the skin or clothes	Remove contaminated clothing. Wash affected area thoroughly with soap and tepid water. If a large area is affected or blistering occurs, obtain medical attention. Scrape resin off clothing, wash in tepid water and rinse repeatedly.
Spilt in the studio	Scrape and wipe up as much as possible, using newspaper, old rags etc. Dispose of in plastic bags.

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4.009 COSHH & Man Regs	3-DIMENSIONAL WORK: PLASTER OF PARIS	Applicable to: ModRoc; ArtRoc; Plaster of Paris bandage; Fine Casting Plaster; Herculite; Crystacast	See also: 4.007

Process(es) covered:

Pressing an object (such as a fossil or a hand) into a slurry of plaster of Paris and water, with a view to making a mould, from which a cast can later be made.
Pouring a slurry of plaster of Paris and water into a mould (eg, a footprint) to make a cast of it.
Making models or sculptures using a stiff slurry of plaster of Paris and water.
Using strips of plaster of Paris-impregnated bandage (eg, ModRoc) soaked in water for modelling, sculpture or making moulds of body parts.

Hazards

Irritant

A few suppliers classify plaster of Paris as irritating to eyes, respiratory system and skin (R36/37/38) but most do not. Even so, prolonged or repeated direct skin contact may cause irritation and attempts at removal may cause abrasion.

Burns

When plaster of Paris is mixed with water, the material slowly becomes hot. The temperature may approach 60 °C after an hour, with the highest temperatures being reached with the largest volumes. Temperatures above 45 °C can cause skin damage, the extent of damage depending on the contact time.

Trapping

When plaster of Paris is mixed with water, the material hardens and expands slightly. This can trap, for example, hands which then suffer burns as the temperature slowly rises. Physical damage may also result from attempts to remove the hardening plaster using chisels, hammers, saws, etc.

User injury

When mixing plaster, using moulds or clearing away plaster of Paris, particles or fragments can injure the eyes.

Risk Assessment

Irritant

Brief contact with the powder or its mixture with water are unlikely to cause any problems.

Burns

As the temperature rises only slowly, burns are unlikely from casual contact with the plaster / water mix or from simply pressing, say, a hand onto the surface of a mix for a short time to form a mould.

Trapping

Trapping is possible only if the hand or other part of the body is surrounded by the plaster/water mix as it starts to harden. This has happened with serious consequences at least twice to children using large amounts of the mix who misunderstood instructions, failed to follow them or suitable supervision arrangements were not in place.

User injury

Plaster of Paris fragments can scratch eyes or even cause loss of sight.

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Control measures	
	If making a mould of a body part using plaster-impregnated bandages, use a barrier cream. Thoroughly wash hands (or other body part) and scrub nails after handling plaster of Paris or making a mould of a body part. If handling large quantities of the dry powder, consider wearing dust masks to prevent prolonged inhalation (to BS EN 149 FFP3, Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science). If mixing plaster of Paris with water by hand consider using a barrier cream. For making moulds of hands, etc consider safer alternatives such as alginate or clay press moulds. Where possible, use plaster-impregnated bandages instead of s slurry of plaster of Paris, but do not allow the thickness to exceed 15 mm. Never attempt to make a mould by enclosing any part of the body with a plaster / water mix (or plaster-impregnated bandages). If large volumes of the plaster / water mix are being made, carefully supervise pupils to ensure that they are not tempted to enclose any part of the body in it. Wear eye protection when mixing, moulding or clearing away plaster of Paris. Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap.
Disposal	Mixtures of plaster of Paris with water which have been allowed to set are low hazard, but **can no longer** be disposed of in the solid waste. Never pour wet plaster down the sink, as it will set and block the sink. Ensure sinks are fitted with a plaster trap. Even plaster rinsed off equipment has particles that will settle, so it is best to use running water. Plaster of Paris can now **only** be disposed of either via a Hazardous Waste contractor or via the special section for Plaster of Paris & Gypsum at the local tip / waste centre.
Storage	Store in a sealed bag in a dry place.

FURTHER INFORMATION

There have been two very serious accidents in recent years in secondary schools in which pupils immersed their hands in a large volume of plaster of Paris and water. The mixture hardened and they were unable to remove their hands whilst the material continued to generate heat. Both suffered serious burns, with some amputation necessary. Some damage may also have been caused by tools used in attempts to remove the hardening plaster.

More detailed information about safe techniques is available in *Using Plaster of Paris* from NSEAD at www.nsead.org/downloads/Plaster.pdf.

IMMEDIATE REMEDIAL MEASURES

If plaster of Paris is swallowed	The swallowing of small splashes is unlikely to cause any adverse effects. Wash out mouth with plenty of water.
If plaster of Paris is splashed into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention if irritation persists.
Effects on the skin	Flush skin with running water before washing with water and soap.
If a body part is trapped in setting plaster of Paris	Act rapidly. Cool the affected skin by immersing the whole limb (and plaster container, if appropriate) in plenty of water, eg, in a sink. This may help soften the plaster. Call the emergency services and warn them what has happened so they may be prepared with suitable cutting equipment. You can try using a pad saw (or key hole saw or similar) to cut away the plaster but take care not to cause further damage to the body part inside. Using a hammer and chisel is almost certain to cause such damage unless it is possible to aim to the side and in any case the plaster may not have set hard enough to shatter.

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4.010 COSHH & Man Regs	3-DIMENSIONAL WORK: WORKING WITH SCRAP MATERIALS	Applicable to: All types of scrap and waste materials	See also: 4.038

Process(es) covered: Creating art using scrap or waste materials of various sorts.
Making mosaics by breaking up ceramic tiles or similar.

Hazards

It is in the nature of scrap materials that there will be no Safety Data Sheet and the origin and nature of the materials may be unknown or not fully known.

Fumes	If scrap materials are heated or treated chemically they may generate hazardous fumes.
Dust	If scrap materials are abraded, especially by machine, they may generate hazardous dusts.
User injury	Scrap materials may have sharp edges which could result in injury to the user.
Infection	Scrap materials may have microbial contamination which could result in ill-health.

Risk Assessment

Fumes	There could be some risk of hazardous fumes if previously painted or similarly treated surfaces are heated, eg, in a kiln or during soldering. Old painted surfaces may have used lead-based paints which are toxic.
Dust	Abrading wood will result in wood dust and possibly paint dust. Some wood dusts are allergenic or carcinogenic or can cause rhinitis, asthma, eczema or dermatitis. Old painted surfaces may have used lead-based paints which are toxic.
User injury	Serious cuts can result from touching unsuspected sharp edges or handling known sharp objects carelessly.
Infection	The risk of infection from handling domestic toilet roll centres or egg boxes, is negligible. However, it might be greater if the origin of the material is unknown.

Control measures

Before heating or surface treating scrap materials, especially previously painted or treated surfaces, test a very small portion to ensure there is no sign of fumes.
So far as reasonably practicable, use local exhaust ventilation to control dust at its source. Alternatively, a dust mask to standard BS EN 149 FFP3 must be worn by all in the vicinity. Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science
Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap.
Check the condition of material carefully on arrival. Reject any that has sharp edges, unless steps can be taken to prevent accidental contact (eg, by taping over the sharp edge or otherwise protecting the user). If handling is unavoidable, wear thick protective gloves (eg, gardening gloves).
Do not accept scrap material that appears to be, or is likely to be, seriously contaminated, eg, by animal excreta.
Wash hands thoroughly after handling scrap material.

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RESTRICTIONS

Disposal	Most scrap materials can be disposed of in the refuse collection, but under the general duty of care, any sharp edges should be protected first. Scrap electrical goods are subject to the *Waste Electrical and Electronic Equipment Regulations* 2006 (the *WEEE Regulations*). These cannot be put in the ordinary refuse collection. Most schools will have in place arrangements for the disposal of old computers, TV sets, kettles, refrigerators, etc.
Storage	Store scrap materials in a tidy and accessible manner. Avoid high-level storage for heavy or fragile materials and, where high-level storage is used, a step ladder or similar should be readily available. Do not allow stored materials to obstruct circulation space or working areas. Protect any sharp edges.

IMMEDIATE REMEDIAL MEASURES

If fumes are inhaled	In the event of dizziness occasioned by fume, remove the affected person to the fresh air until recovered. Seek medical attention if symptoms persist.
If dust gets into the eyes	Holding open the eyelids, wash thoroughly for at least ten minutes with water to prevent scratching of the eye. Seek medical attention if irritation persists.
Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, then the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Severe cuts	Lower the casualty to the floor. Raise the wound as high as possible. If feasible, ask the casualty to apply pressure on or as close to the cut as possible, using fingers, a pad of cloth or, better, a sterile dressing (adding further layers as necessary). If the casualty is unable to do so, apply pressure yourself, protecting your skin and clothes from contamination by blood if possible. Leave any embedded large bodies and press around them. Send for a first aider.

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4.011 Man Regs	# USING BENCH-MOUNTED CUTTING TOOLS	Applicable to: Guillotines; bench shears; notchers and nibblers	See also: 4.007, 4.016

Process(es) covered:

Guillotines for cutting paper and board.

Scissor-action guillotines (shears) for cutting sheet metal.

Notchers or nibblers: this type of guillotine works by removing a slice of material (kerf) allowing the cut to be achieved without distortion. Since the kerf is cropped off at each stroke, the machine can produce notches of rectangular and other shapes in both metals and plastics.

Hazards

Trapping	Movement between cutting or closing surfaces can result in serious injury.
User injury	Contact with the operating handle can cause an impact injury.
Cuts from edges	Sharp edges on the metal workpiece or waste can cause cuts.

Risk Assessment

Trapping	Unguarded guillotines present serious risks to the user.
User injury	The user or an observer could stand in such a position that operation of the handle could hit a head, shoulder or foot.
Cuts from edges	The edges of cut metals are often very sharp and can cause deep cuts to anyone touching them.

Control measures

Ensure guillotines with a worktable have guards that prevent access to the shearing points (front and rear).

Bench shears are difficult to guard. Lock them when not in use.

Provide careful instruction when folding or rolling machines are used.

Ensure adequate space around guillotines, notchers and bench shears, bearing in mind the sizes of sheets to be cut as well as the space to operate the machinery safely.

Allow only one person to operate the guillotine with any assistants positioned at the side. Train users in the hazards and safe ways of operating.

Only use rolling blade trimmers when the safety guard is in place. Do not attempt to trim unsuitable material nor exceed the thickness specified in the manufacturer's instructions.

Use industrial-type gloves to handle sheets of metals with sharp edges.

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FURTHER INFORMATION

If bench shears are used, they must be secured to the bench or stand. Notchers are much safer and it is **strongly recommended** that bench shears are replaced at the earliest opportunity.
Shearing blade-type guillotines are unsuitable for cutting paper and card.

IMMEDIATE REMEDIAL MEASURES

Severe cuts	Lower the casualty to the floor. Raise the wound as high as possible. If feasible, ask the casualty to apply pressure on or as close to the cut as possible, using fingers, a pad of cloth or, better, a sterile dressing (adding further layers as necessary). If the casualty is unable to do so, apply pressure yourself, protecting your skin and clothes from contamination by blood if possible. Leave any embedded large bodies and press around them. Send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.

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4.012 COSHH Regs	painting & drawing	Applicable to: Use of airbrushes and aerosols; oil paints; acrylics; varnishes	See also: 4.013, 4.014, 4.015, 4.016, 4.017, 4.018, 4.019, 4.020, 4.021

Process(es) covered: Painting using brushes, etc, including paints which use solvents other than water.
Spray painting, including the use of paints in aerosol cans.
Finishing with polyurethane varnish, 'transparent' polish, cellulose-based finishes.
Cleaning brushes, etc with solvents and thinners other than water.
Drawing with inks and permanent felt tip markers.

Hazards

Most (but not all) of the pigments used are low hazard but solvents other than water can present significant hazards. Acrylics are amongst the safest paints to use. Polyurethane varnish contains white spirit but cellulose-based finishes contain toluene (methylbenzene) as the main solvent.

Very toxic	A few pigments are very toxic and may cause cancer, eg arsenic compounds, chromates and dichromates [but the green chromium(III) oxide is low hazard].
Toxic	Some solvents are toxic by inhalation, in contact with skin or if swallowed, eg, carbon tetrachloride (tetrachloromethane) and trichloroethylene (trichlorethene) (limited evidence of a carcinogenic effect). The former is banned in all 'diffusive'" applications (ie, uses not in an enclosed system). Some household paints contain fungicides which may be toxic.
Harmful	Some solvents are harmful by inhalation, in contact with skin or if swallowed, eg, turpentine. White spirit (turpentine substitute) and solvent naphtha (R65) may cause lung damage if swallowed. Vapours from toluene (methyl benzene) (R11, 38, 48/20, 63, 65, 67) and xylene (dimethylbenzene) (R10, 20/21, 38) (used in some drawing inks and felt-tip pens) are harmful by inhalation, causing headaches, dizziness and nausea.
Irritant	Some solvents are irritating to the eyes, skin or respiratory system. For example, xylene (R38) is irritating to the skin and acetone (propanone) and methyl ethyl ketone (MEK or butanone) (R36) are irritating to the eyes. Repeated exposure to MEK may cause skin dryness or cracking (R66) and vapours may cause drowsiness and dizziness (R67). It is absorbed through the skin.
Extremely / Highly flammable	Butane (R12), often used as a propellant in aerosols, is extremely flammable. Solvents, such as propanone (acetone) and toluene (methylbenzene) (R11) are highly flammable.
Misuse	Cans of aerosol paints are often subject to misuse.

Risk Assessment

Very toxic Toxic	There would be some risk to teachers, technicians, TAs and pupils of inhaling hazardous pigment dust when using dry pigments or when spray painting using an airbrush or compressor or an aerosol. There would be a risk of ingesting hazardous pigments if users lick or point a paintbrush by mouth. Toxic pigments or fungicides could be absorbed if there is skin contact.
Harmful	The WEL^{95}s for toluene is 384 mg m^{-3} and xylene is 441 mg m^{-3} (15 min ref period). These values can easily be exceeded if more than tiny amounts of toluene or aerosol paints are used, putting teachers and pupils at risk. The WEL for turpentine is 850 mg m^{-3} (15 min ref period). These values would not be exceeded from simple brush cleaning and similar. The WEL for acetone is 3620 mg m^{-3} (15 min ref period). These values are unlikely to be exceeded in typical school use.
Irritant	The WEL for MEK is 899 mg m^{-3} (15 min ref period). Splashes to the eye will cause discomfort and possible damage. Prolonged contact with the skin (more likely for staff than pupils) may have a defatting (drying) effect which may lead to skin irritation and dermatitis.
Extremely / highly flammable	There is a serious risk of fire if any source of ignition (a naked flame, a source of sparks or a very hot surface) is present close to where flammable solvents are being used or handled.
Misuse	There is a significant risk that pupils may steal aerosol cans for making graffiti.

[95] EH04/2005

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Control measures	
	Only carry out spray painting using an airbrush with a compressor or canned propellant or an aerosol can in a well-ventilated area, ideally in a spray booth or out of doors. Do not use toxic or very toxic pigments or household paints containing fungicides. Do not use carbon tetrachloride. Do not allow eating and drinking in the studio. Thoroughly wash hands when leaving the studio.
	Do not use toluene-based paints and finishes unless local exhaust ventilation is available or work can be carried out in the open air.
	Wear eye protection and protective gloves when spray painting. Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap. Remove all naked flames and other sources of ignition before spraying with flammable solvents or aerosols or when pouring flammable thinners or cleaners.
	Closely supervise all use of aerosol cans by pupils. When not in use, keep them under lock and key.

Disposal	Aerosols cans, surplus paints containing solvents other than water, surplus or contaminated solvents other than water and hazardous pigments are subject to the *Hazardous Waste Regulations.* Schools and colleges must check that any waste disposal contractor whom they use has a licence (or is exempt). See PS5 *Waste Disposal Contractors*.
Storage	Store powders securely in tightly closed, labelled containers. Aerosols, paints containing solvents other than water and solvents themselves should be stored in a cool, dry, well-ventilated place, away from sources of ignition. Guidance from the HSE allows up to a maximum of 50 litres of highly flammable liquids to be held in any one workroom in a highly flammable liquids cupboard or bin (see page 6). Although up to half a dozen containers which are 'in use', each less than 500 ml, could be kept on the open shelf outside such a cupboard or bin, this is much less secure and tempts thieves.

FURTHER INFORMATION

If spray booths are in use to control exposure to substances hazardous to health, the ventilation system will need checking at least every 14 months in accordance with the *COSHH Regulations*. See G225 *Local exhaust ventilation in design and technology* for further information.

IMMEDIATE REMEDIAL MEASURES

If hazardous paints or solvents are swallowed	DO NOT INDUCE VOMITING. Keep casualty at rest and obtain medical attention.
If hazardous vapour is inhaled	Remove casualty to fresh air. Keep warm and at rest. If breathing is irregular or has stopped, administer artificial resuscitation. Obtain medical attention.
If paints or solvents are sprayed or splashed into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. If discomfort continues, obtain medical attention.
If paints or solvents get on the skin	Remove contaminated clothing. Wash skin thoroughly with soap and water or use a proprietary skin cleanser. Do not use solvents.
If hazardous paints or solvents are spilt in the studio	Remove sources of ignition. Ventilate area. Contain and collect the spill with non-flammable absorbent material, eg, sand or earth. Store safely pending disposal. Do not allow to enter drains.

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4.013 COSHH & Man Regs	PAPER-MAKING	Applicable to: Re-cycling waste paper Making paper from plant materials	See also: 4.012, 4.014.

Process(es) covered:

Making craft paper by recycling newspaper or other waste paper or cloth.
Making paper pulp using table-top food processors, blenders or liquidisers or hand-held mixers, whisks, etc.
Making paper directly from plant materials such as leaves by boiling with chemicals such as sodium hydroxide (caustic soda), sodium carbonate or sodium phosphate solutions.

Hazards

Electric shock	Damage to the casing of the appliance, the plug or to the power cord can present an electric shock hazard.
Cuts	Some equipment has sharp cutting blades which may produce injuries if the equipment is misused or if care is not taken during cleaning.
Trapping	Hand-held mixers may have unguarded gears which can result in trapping injuries.
Manual handling	Some equipment is so heavy that it presents a manual-handling hazard.
Slips	Paper-making uses large amounts of water and tends to be a messy process leading to wet floors which can present a slip hazard.
Corrosive / Irritant	Sodium hydroxide solution may be corrosive, irritant or low hazard depending on the concentration. Sodium carbonate and sodium phosphate solutions may be irritant or low hazard depending on the concentration.

Risk Assessment

Electric shock	Risks may arise from damaged or incorrectly-wired plugs, the fitting in the plug of a fuse with an inappropriate rating for the equipment and flexible cables which have been damaged or allowed to become worn, impairing the insulation.
Cuts	Domestic machines are designed so that access to dangerous parts is limited but a (small) hand could reach the blades of a liquidiser. Any attempt to reach into either accessory while it is on the machine, eg during cleaning, presents a significant risk.
Trapping	Unguarded moving parts present a significant risk of trapping, especially of small fingers.
Manual handling	Lifting a heavy machine from a low cupboard or a high shelf presents a risk of injury to the lower back.
Slips	Wet floors present a considerable risk of slip injuries to both pupils and staff.
Corrosive/Irritant	If leaves or similar plant materials are being boiled with sodium hydroxide, sodium carbonate or sodium phosphate solutions there is a significant risk of the solution being splashed into eyes or onto skin, eg, if the mixture is being stirred or the solution being poured. The risk of injury would be greater if the solution were hot.

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Control measures	
	Ensure all electrical appliances are inspected regularly according to the employer's policy and that there is a quick visual check each time the appliance is used. Any electrical equipment brought in from home must be properly inspected before use. Train children how to use the appliance safely, including switching off and unplugging the appliance before attempting to clean it. Train users how to move heavy machines correctly, using two persons and trolleys or trucks if necessary. Encourage staff and pupils to clear up water spills at once by ensuring mops, cloths, etc. are readily available. Do not use sodium hydroxide (caustic soda) unless it is very dilute. Sodium carbonate and sodium phosphate solutions are safer. When using sodium carbonate or sodium phosphate solutions wear eye protection. Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap.

RESTRICTIONS .

The use of machines such as food processors, blenders or liquidisers should be restricted to those who are sufficiently mature and competent to follow instructions carefully. These machines must be identified for Art use only, and must not be used in the preparation of food stuffs.

Storage	The manual-handling problem can be reduced/eliminated if storage arrangements are such that heavy machines do not have to be lifted or carried. Blades and attachments should be stored securely.
Cleaning	When cleaning knives and attachments, care must be taken over putting the sharp blades into the washing up bowl and removing them from the water, eg, by doing them last. It is advisable to leave blades and attachments to dry in the air after cleaning. Fingers must be protected when cleaning sharp blades, eg by using thick cloths or sponges to prevent physical contact.

FURTHER INFORMATION

Particular care should be taken with mixers that have exposed, rotating whisks not to insert spatulas or other tools into the bowl while the mixer is operating; they can become caught and jam the machine.

IMMEDIATE REMEDIAL MEASURES

Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Impact injury resulting from trapping or slipping	Rest the injured part; apply ice to reduce the bruising and pain; attention from the first aider may be required.
Electric shock	Send for a first aider immediately. Taking care for your own safety, break contact by switching off (or, if there is one, pulling out the plug). If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial resuscitation. Send for an ambulance. If a trained first aider does not arrive quickly and the pulse is absent, consider carrying out cardio-pulmonary resuscitation.
If solutions get into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. If discomfort continues, obtain medical attention (essential if the contaminant is corrosive). For corrosive solutions, continue irrigation on the way to hospital.
If solutions splash onto the skin	Remove contaminated clothing. Wash skin thoroughly with soap and water or use a proprietary skin cleanser.

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4.014 COSHH Regs & Man Regs	PRINT-MAKING: PRINTING	Applicable to: Screen printing; lithography; intaglio; relief printing; lino printing; Sericol screen printing products	See also:, 4.012 4.015, 4.016, 4.017, 4.018

Process(es) covered:

Placing ink on the printing slab.
Using hand-operated or power-driven machines and presses to make prints.
Cleaning up the printing slab, press bed and plate using various solvents.

Hazards

Trapping

Closing movements between moving parts can present a trapping hazard.

Harmful
Irritant
Toxic
Very toxic
Highly flammable

In so far as the pigments and solvents (vehicles) traditionally used for print-making are the same as those used for painting (see 4.012), there are similar hazards. This particularly applies to oil-based inks and solvents.
Inks for print-making consist of pigments suspended in water or linseed oil (low hazard).
Other solvents may be used for cleaning the press, etc. Sericol screen wash, for example, may contain methyl ethyl ketone (MEK)(R36) which is irritating to the eyes; repeated exposure may cause skin dryness or cracking (R66) and vapours may cause drowsiness and dizziness (R67). It is absorbed through the skin. Universal screen cleaner contains solvent naphtha (R65) (a mixture of mainly saturated hydrocarbons and xylenes).
Modern non-toxic, water-based inks present few hazards. This includes products comprising a mixture of acrylic paint and a screen-printing paste.

Risk Assessment

Trapping

With hand-operated presses the risk would be negligible unless there is misbehaviour. With power-driven machines, unguarded moving parts present a considerable risk of entrapment. Long hair and/or loose clothing increase the risks.

Harmful
Irritant
Toxic
Very toxic
Highly flammable

In so far as the pigments and vehicles (solvents) traditionally used for print-making are the same as those used for painting (see 4.012), there are similar risks to staff and pupils although the risk of inhaling hazardous solvent fumes might be greater because of the larger surface area over which the solvent is spread. The risk continues whilst the solvent evaporates, ie, whilst the prints are drying. It is greatest during clean-up if traditional screen washes are used. There is also a risk of skin absorption during clean-up.
There is a significant risk of rags soaked in linseed oil and some other oil-based solvents igniting by spontaneous combustion, sometimes after an interval of several hours.
Modern toxic-free, water-based inks present few risks both while printing and during clean-up, although splashes to the eye will cause discomfort.

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Control measures	
	All use of presses must be supervised by a trained teacher, technician or TA. Ensure presses have guards in place and check the guards regularly. Lock presses (both hand-operated and power-driven ones) when not in use. Tie back long hair and cover loose clothing with aprons or similar. Use only non-toxic, water-based inks. (If solvent-based inks are unavoidable, ensure good ventilation, wear eye protection and protective gloves, eg nitrile or others offering adequate solvent protection.) Do not allow eating and drinking in the studio and thoroughly wash hands before leaving the studio. Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap. All naked flames and other sources of ignition must be removed before using flammable solvent-based printing inks or screen washes. If linseed oil or other oil-based solvents are used, place oil-soaked rags in a bucket of water or in a container with an air-tight lid.
Disposal	Low-hazard water-based inks and materials contaminated with such inks, can be disposed of in the normal refuse. Surplus paints containing solvents other than water, surplus or contaminated solvents other than water, hazardous pigments and rags contaminated with them are subject to the *Hazardous Waste Regulations.* Schools and colleges must check that any waste disposal contractor whom they use has a licence (or is exempt) (see PS5 (or GL5) *Waste Disposal Contractors*). Rags soaked in linseed oil and other oil-based solvents must be placed in a bucket of water or in a container with an air-tight lid pending ultimate disposal.
Storage	Store pigments and inks securely in tightly-closed, labelled containers. In so far as the pigments and vehicles (solvents) traditionally used for print-making are the same as those used for painting (see 4.012), they should be stored in a similar way.

FURTHER INFORMATION

Ensure there is sufficient space around machines to avoid contact with moving parts (see G79 Auditing Health and Safety in a Secondary School Design and Technology Department).

IMMEDIATE REMEDIAL MEASURES

If hazardous inks or solvents are swallowed	DO NOT INDUCE VOMITING. Keep casualty at rest; obtain medical attention.
If hazardous vapour is inhaled	Remove casualty to fresh air. Keep warm and at rest. If breathing is irregular or has stopped, administer artificial resuscitation. Obtain medical attention.
If inks or solvents are splashed into eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. If discomfort continues, obtain medical attention.
If inks or solvents get onto the skin	Remove contaminated clothing. Wash skin thoroughly with soap and water or use a proprietary skin cleanser. Do not use solvents.
If hazardous inks or solvents are spilt in the studio	Remove sources of ignition. Ventilate area. Contain and collect the spill with non-flammable absorbent material, eg, sand or earth. Store safely pending disposal. Do not allow to enter drains.

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4.015 COSHH Regs	PRINT-MAKING: CHEMICAL etching	Applicable to: Etching plates for intaglio printing or aquatint; preparing lithographic plates	See also: 4.014, 4.016, 4.017, 4.018,

Process(es) covered:	Etching zinc or copper plates for intaglio printing using dilute nitric acid, Dutch mordant (hydrochloric acid + potassium chlorate), ferric chloride (iron(III) chloride) or saline sulfate etch (copper sulfate and table salt). Protecting unetched parts with resists such as varnishes, colophony (rosin) or shellac dissolved in alcohol (ethanol, methylated spirits, industrial denatured alcohol, IDA), grounds containing asphaltum and white spirit (mineral spirits) and rubber cement. Preparing zinc or aluminium plates or stones for lithographic printing using acid solutions (including hydrofluoric), dichromates and various solvents. Removing emulsion with sodium periodate.
Hazards	
Very toxic	Dichromates (R45,46) are very toxic and may cause cancer. Fumes produced when nitric acid is used to etch metals (R26) are very toxic and may provoke an asthma attack.
Toxic	Mixing hydrochloric acid with potassium chlorate will produce chlorine gas (R23,36/36/38) which is toxic by inhalation and irritating to the eyes, skin and respiratory system.
Harmful	Potassium chlorate and copper sulfate are harmful if swallowed (R22) and potassium chlorate also by inhalation (R20). White spirit (mineral spirits) (R65) may cause lung damage if swallowed.
Corrosive	All the undiluted acids [and ammonium hydroxide (ammonia solution) used in aquatint processes] (R34 or R35)are corrosive and cause burns or severe burns. Those caused by hydrofluoric acid are particularly damaging and difficult to heal. Some of the diluted solutions at working strength would be classed as corrosive (eg, nitric acid).
Irritant	Most of these solutions are irritant to the eyes, skin and respiratory system (R36/37/38). Asphaltum is a skin irritant and colophony (rosin) can cause asthma-like symptoms and may cause sensitisation.
Highly flammable	Varnishes etc containing alcohol (ethanol, methylated spirits, industrial denatured alcohol, IDA), are highly flammable (R11). White spirit (mineral spirits) is flammable (R10).
Explosive	Mixtures of nitric acid and ethanol (alcohol) can explode unpredictably.
Oxidising	Potassium chlorate (R9) is explosive when mixed with combustible material; contact between concentrated nitric acid and combustible material may cause fire (R8). Sodium periodate is also oxidising (R8).
Risk Assessment	
Very toxic	At working strength, dichromate solutions are likely to be classed as toxic (see below). When using dilute nitric acid, good ventilation (eg, open windows or fume extraction) will be necessary if more than small amounts of metal are being etched.
Toxic & Harmful	There needs to be good ventilation if chlorine is generated (WEL[96] 1.5 mg m^{-3}, 15-min ref period). Otherwise the solutions used for etching etc present minimal risks to the user.
Corrosive	When staff are diluting the concentrated acids (or ammonium hydroxide [ammonia solution]) to prepare working solutions, there is a risk of injury from splashes or droplets. Hydrofluoric acid, however, presents unacceptable risks in the school context. Even diluted acids (especially nitric acid) may still present a risk of injury from splashes or droplets.
Irritant	Splashes to the eye will cause discomfort and possible damage, as may inhaling vapours from concentrated acids, ammonium hydroxide or colophony dust etc.
Highly flammable	There is a serious risk of fire when handling ethanol (WEL 1920 mg m^{-3}, 8-hour ref period) if there are naked flames.
Explosive	If 'Nital' (nitric acid / ethanol mixture) were stored, it could explode.
Oxidising	Potassium chlorate and sodium periodate require careful storage.

[96] EH04/2005

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Control measures	
	Use the most-dilute solution that is able to give the required result.
	Only allow staff (teacher, technician or TA) to prepare the solutions. When etching with dilute nitric acid, or with Dutch mordant, ensure there is good ventilation (eg, fume extraction). Do not allow eating and drinking in the studio. Thoroughly wash hands before leaving the studio. Do not use hydrofluoric acid.
	When staff are diluting the acids (or ammonium hydroxide [ammonia solution]) they must wear eye protection (goggles, giving chemical splash protection, BS EN 166 3) and **add the acid (or ammonia) slowly to the water**. The sulfuric acid will need cooling between additions, or the acid can be added to ice rather than to water. When staff are preparing, and students are using, the etching and other solutions, they must wear eye protection. Ensure emergency eye-washing facilities are available in the room, eg a short length of clean soft rubber or plastic tubing that fits on the cold tap.
	When using products containing ethanol, do not allow naked flames in the room.
	Use water-based materials where possible. Do not make a solution of more than 2% (v/v) nitric acid in ethanol ('Nital') and in any case do not store the solution. Such solutions are best prepared by a qualified science technician.
Disposal	Small quantities of these solutions can be diluted in a large volume of water and flushed into the foul-water drain (toilet). Large quantities (more than 500 ml) require an authorised waste disposal contractor. Schools and colleges must check that any waste disposal contractor whom they use has a licence (or is exempt) (see PS5 or GL5 *Waste Disposal Contractors*).
Storage	Store concentrated acids, ammonium hydroxide (ammonia solution) and potassium chlorate in a locked cupboard. Ideally, acids and ammonia should be in separate cupboards but if this is not possible, keep them as far apart as practicable. The acid bath should be stored in a ventilated, locked cupboard or, if kept on the bench, have a lid which is locked when not in use. If Nital is used then it should be prepared on each occasion that it is needed and **NOT** stored.
FURTHER INFORMATION	
Copper etching	Dissolve 20 g hydrated iron(III) chloride (ferric chloride) (R22, 38, 41) WEL 2 mg m^{-3}, 15 min ref period, in 80 ml water and add 20 ml concentrated hydrochloric acid (R34, 37) WEL 8 mg m^{-3}, 15 min ref period. Label the solution **IRRITANT**.
IMMEDIATE REMEDIAL MEASURES	
If swallowed	DO NOT INDUCE VOMITING. Keep casualty at rest and obtain medical attention.
If fumes are inhaled	Remove casualty to fresh air. Keep warm and at rest. If breathing is irregular or has stopped, administer artificial resuscitation. Obtain medical attention.
If acid gets into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. If discomfort continues, obtain medical attention.
If solutions are splashed onto the skin	Remove contaminated clothing. Wash skin thoroughly with soap and water or use a proprietary skin cleanser.
If spilt in the studio	Any acid spills must be carefully and quickly dealt with. Neutralise with sodium carbonate powder (soda ash) and then, when fizzing has stopped, wearing protective gloves (preferably nitrile) wipe up with a cloth. Rinse under the tap.

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4.016 Man Regs	PRINT-MAKING : ENGRAVING WITH SMALL HAND TOOLS	Applicable to: Making images for printing such as engraving, drypoint and mezzotint; lino cuts; wood carving	See also: 4.007, 4.011, 4.014, 4.015, 4.017

Process(es) covered: Using sharp tools for cutting, engraving or incising wood and other resistant materials, eg, Perspex, linoleum or hardboard.
The use of scissors for cutting paper and board.
The use of craft knives and scalpels, with and without cutting mats.

Hazards

Cuts to user — Craft knives and other cutting tools, including scissors (whether powered or not), can cut fingers.

Injury when carried — Knives, scissors and other cutting tools can injure the user or others when being carried or as a result of misbehaviour in the studio.

Risk Assessment

Cuts to user — Cuts are received by any user from sharp tools by slicing when cutting along a straight edge or template or when the tool slips out of the material. Cuts also result from changing blades in scalpels and craft knives, particularly the type with snap-off blades.
Tools which are properly sharp present less risk than when bluntness causes the user to exert excessive pressure.

Injury when carried — There is a real risk of injury if scissors or sharp tools are carried with the blade exposed. This risk is increased where desks / tables are close together or where bags on the floor give a risk of tripping.

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Control measures	
	Ensure tools are kept sharp at all times. If tools are shared by a number of teachers, give one person the main duty of maintaining and storing them. Teach children the proper care and use of sharp tools, eg, cutting away from the body and away from the hand holding the material. Teach children safe ways to change blades on knives and scalpels. Use steel 'safety rule(r)s' to reduce the risk of slicing fingers and teach children that the hand holding the material should always be behind the direction of cutting. Use a cutting mat to reduce the risk of the work slipping and of loss of control of the knife when the end of the cut is reached. Clamp or otherwise hold wood (eg, with a bench hook) so that hands cannot be cut when craft knives are used for carving and shaping wood. Use bench hooks, or G-clamps for large blocks, to provide a more-stable working surface when cutting or engraving wood, linoleum or hardboard. Where possible, use types of linoleum which are easy to cut; warming may help. Teach children how to carry scissors safely with the blades enclosed by the fist. Where possible, use craft knives with retractable or rotary blades which are safer to carry than those with open ones. Where this is not possible insert the tip of the blade into a cork. In some cases it may be safer for the teacher to distribute them, carrying them on a tray. Give clear instructions to ensure the circulation space is kept clear of obstructions.

RESTRICTIONS	For younger pupils, blade changing should be carried out by adults. This is especially true of the 'snap-off' type of knife blade. With some classes, it may be necessary to restrict the use of craft knives to an inherently safe type.
Disposal	Used blades must be disposed of responsibly. An old coffee tin or a small 'sharps box' as used in first-aid rooms could be used.
Storage	Scissors and knives must be stored in a secure place to control access. It is important to ensure that scissors and knives are counted out and collected in after use since they could constitute a hazard if removed by children or if left on tables, chairs or on the floor.

FURTHER INFORMATION

Battery-powered scissors (eg, Pifco Speedcut) may be safer than ordinary ones because the opening of the blades is small and the length of exposed blade is short. They may also help children with certain physical disabilities. Ensure there are suitable scissors for use by left-handers.

IMMEDIATE REMEDIAL MEASURES

Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, then the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Severe cuts	Lower the casualty to the floor. Raise the wound as high as possible. If feasible, ask the casualty to apply pressure on or as close to the cut as possible, using fingers, a pad of cloth or, better, a sterile dressing (adding further layers as necessary). If the casualty is unable to do so, apply pressure yourself, protecting your skin and clothes from contamination by blood if possible. Leave any embedded large bodies and press around them. Send for a first aider.

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4.017 COSHH & Man Regs	PRINT-MAKING: USE OF ULTRA-VIOLET (UV) LIGHT & PHOTO-SENSITIVE RESISTS	Applicable to: photosensitive inks and resists	See also: 4.015, 4.033, 4.034

Process(es) covered: Sensitising and curing photosensitive inks and resists.
Exposing treated screens for screen printing.

Hazards

Radiation hazard
The hazards of ultra-violet radiation depend on the wavelength. UVB (280 to 315 nm) is considered carcinogenic and UVA (315 to 400 nm) may contribute. Prolonged exposure to both types may cause eye inflammation.

Very toxic
Ammonium dichromate (R21, 25, 26, 34, 42/43, 45, 46, 48/23, 50/53, 60, 61) may cause cancer; may cause heritable genetic damage; may impair fertility; may cause harm to the unborn child; very toxic by inhalation; toxic if swallowed; toxic, danger of serious damage to health by prolonged exposure through inhalation; harmful in contact with skin; causes burns; may cause sensitisation by inhalation and skin contact; very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. A 3% solution, often used in the past to sensitise photoemulsions, would be classed as toxic.

Explosive
Ammonium dichromate (R2, 8): Risk of explosion by shock, friction, fire or other sources of ignition; contact with combustible material may cause fire.

Irritant
Photosensitive plates, comprising a polymer and other chemicals, may be irritant.

Risk Assessment

Radiation hazard
Staff would be at greater risk of cancer than students, because of exposure over longer periods of time.
Staff and students might expose their eyes to the radiation and not realise until too late that it was having an effect.
There is some risk of exposure as a resulted of reflected radiation from white or shiny surfaces.

Very toxic
There would be particular risks to staff (teachers, technicians, TAs) handling solid ammonium dichromate (the WEL[97] is 0.15 mg m^{-3} (STEL) [as chromium]). Staff and students would be at risk when using the solution. As there are safer alternatives, it would be difficult to justify the use of this substance.

Explosive
Ammonium dichromate could ignite in contact with a naked flame or a hot surface.

Irritant
There would be some risk to users from the chemicals in some photosensitive plates.

[97] EH40/2005

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Control measures	
	Use an arrangement which minimises exposure to all forms of UV radiation, taking care especially to protect the eyes from both direct radiation and that reflected from white or shiny surfaces. Only use UV exposure units which have a safety interlock so that the unit is switched off when the UV source is exposed. Obtain boxes from reputable school suppliers. Do not use ammonium dichromate to sensitise photo emulsions; instead use diazo-types or pre-sensitised films. Wear protective gloves (nitrile) if handling photosensitive plates which are hazardous. Do not allow eating and drinking in the studio. Thoroughly wash hands before leaving the studio.

RESTRICTIONS

Disposal

Broken and/or surplus electrical goods are subject to the *Waste Electrical and Electronic Equipment Regulations* 2006 (the *WEEE Regulations*). These cannot be put in the ordinary refuse collection. Most schools will have in place arrangements for the disposal of old computers, TV sets, kettles, refrigerators, etc.
Fluorescent tubes can usually be disposed of at recycling centres.

FURTHER INFORMATION

Exposure units with low-wattage UV fluorescent tubes are usually sufficient. High-power mercury-vapour lamps are best avoided.

IMMEDIATE REMEDIAL MEASURES

If inflammation of the eye occurs	Seek medical attention.
If inflammation of the skin occurs	Cool the affected area under running water from a cold tap for 10 minutes. Generally, the effects will be equivalent to sun burn. Some peeling of the skin may occur. Seek medical attention if more than a small amount.

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4.018 COSHH Regs	SOLVENTS	Applicable to: solvents other than water (used in paints, aerosols, adhesives or for cleaning)	See also: 4.012, 4.014, 4.015, 4.019, 4.020

For ease of reference, this sheet deliberately duplicates information that appears on other sheets.

Process(es) covered:	Spraying (with aerosols) or using brushes etc to paint or for print-making where a solvent other than water (non-aqueous) is used. Cleaning brushes, etc using solvents such as turpentine, white spirit (turpentine substitute, mineral spirits), acetone (propanone), or cellulose thinners (a mixture of several solvents). Using adhesives based on solvents other than water.
Hazards	
Toxic	Some solvents are toxic by inhalation, in contact with skin or if swallowed, eg, carbon tetrachloride (tetrachloromethane) and trichlorethylene (trichlorethene) for which there is limited evidence of a carcinogenic effect.
Harmful	Some solvents are harmful by inhalation, in contact with skin or if swallowed, eg, turpentine, alcohol (ethanol, methylated spirits, industrial denatured alcohol, IDA). White spirit (turpentine substitute) may cause lung damage if swallowed. The vapours of toluene (methylbenzene) and xylene (dimethylbenzene) (used in some drawing inks and felt-tip pens) are harmful by inhalation, causing headaches, dizziness and nausea. There is limited evidence of a carcinogenic effect for methylene dichloride (dichloromethane).
Irritant	Some solvents are irritating to the eyes, skin or respiratory system. For example, acetone (propanone) is irritating to eyes and repeated exposure may cause skin dryness or cracking ; xylene is irritating to the skin. Methyl ethyl ketone (MEK or butanone) is irritating to the eyes and respiratory system.
Extremely flammable	Butane, commonly used as a propellant in aerosols, is extremely flammable.
Highly flammable	Some solvents, eg, propanone (acetone), alcohol (ethanol, methylated spirits, industrial denatured alcohol, IDA) and toluene (methylbenzene) are highly flammable.
Risk Assessment	
Toxic	For carbon tetrachloride there is risk of serious damage to health by prolonged exposure through inhalation (R23/24/25, 48/23). It is a category 3 carcinogen (R40). Its use is banned in all “diffusive” applications (ie, uses not in an enclosed system). Trichlorethylene (trichlorethene) may cause cancer (R45) and there is a possible risk of irreversible effects (R68). The vapours may cause drowsiness and dizziness (R67). The WEL[98] is 820 mg m^{-3} (15 min ref period).
Harmful	The WELs for toluene (R11, 38, 48/20,63, 65, 67) is 384 mg m^{-3} and xylene (R10, 20/21, 38) is 441 mg m^{-3} (15 min ref period). These values can easily be exceeded if more than tiny amounts of toluene or aerosol paints are used, putting teachers and pupils at risk. The WEL for methylene dichloride (R40) is 1060 mg m^{-3} (15 min ref period). This might be exceeded in some circumstances. The WEL for acetone (R11, 36, 66, 67) is 3620 mg m^{-3} (15 min ref period). This value is unlikely to be exceeded in typical school use. The WEL for turpentine (R10, 20/21/22, 36/36, 43, 65, 51/53) is 850 mg m^{-3} (15 min ref period). The WEL for alcohol (ethanol, methylated spirits, industrial denatured alcohol, IDA) is 1920 mg m^{-3} (8 h TWA). These values would not be exceeded during simple brush cleaning and similar typical uses. No WEL is listed for white spirit (R10, 51/53, 65). All such solvents, if acquired by pupils, may be involved in ‘solvent abuse’.
Irritant	Splashes to the eye will cause discomfort and possible damage. Prolonged contact with the skin may have a defatting (drying) effect which may lead to skin irritation and dermatitis.
Extremely flammable	There is a serious risk of fire if any source of ignition (a naked flame, a source of sparks or a very hot surface) is close to where flammable solvents are being used or handled.
Highly flammable	

[98] EH40/2005

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Solvents (Continued)

Control measures	
	Do not use carbon tetrachloride.
	Avoid the use of methylene dichloride as a solvent (unless spread over areas less than 300 mm x 300 mm) and of toluene-based paints unless local exhaust ventilation is available or work can be carried out in the open air. Carry out spray painting in a well-ventilated area, ideally in a spray booth. Do not use any non-aqueous solvents in confined spaces. Open windows when using non-aqueous solvents in ordinary studios unless quantities are small. Do not allow eating and drinking in the studio. Thoroughly wash hands before leaving the studio. Always wear eye protection when spray painting or when using hazardous solvents. Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap. Wear protective gloves (preferably nitrile) when spray painting. Protective masks (to BS EN 149 category FFP3) may also be necessary, especially for large-scale activities. Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science All naked flames and other sources of ignition must be removed before spraying with flammable solvents or aerosol cans or when pouring flammable thinners or cleaners.
RESTRICTIONS	Solvent abuse. Strict control over the use and storage of solvents should be enforced to ensure that theft and the deliberate inhalation of vapour does not take place.
Disposal	Empty containers may be placed in normal refuse. Waste, surplus or contaminated solvents other than water are subject to the *Hazardous Waste Regulations.* Ensure that no one (neither students nor staff) pour used/waste solvents (other than water) down the drain. They should be collected for proper disposal. Schools and colleges must check that any waste disposal contractor whom they use has a licence (or is exempt) (see PS5 (or GL5) *Waste Disposal Contractors*).
Storage	Aerosols, paints containing solvents other than water and solvents themselves should be stored securely in a cool, dry, well-ventilated place, away from sources of ignition. Guidance from the HSE allows up to a maximum of 50 litres of highly flammable liquids to be held in any one workroom in a highly flammable liquids cupboard or bin. Although up to half a dozen containers which are 'in use', each less than 500 ml, could be kept on the open shelf outside such a cupboard or bin, this is much less secure and tempts thieves.
IMMEDIATE REMEDIAL MEASURES	
In case of fire	Small solvent fires are most easily controlled by covering them with a fire blanket or damp cloth.
If much vapour is inhaled	Remove individual to fresh air and seek medical attention.
If solvents get into the eyes	Irrigate immediately with water for at least 10 minutes, holding the eyelids apart. Obtain medical attention.
If solvents are swallowed	For most solvents, rinse out the mouth and drink plenty of water. DO NOT INDUCE VOMITING. Seek medical attention.
Effects of solvents on skin	Repeated and prolonged contact with the skin may cause removal of natural greases, resulting in dryness, cracking and possible dermatitis. Wash with mild antiseptic and apply moisturising cream.

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4.019 COSHH Regs	Adhesives: GENERAL	Applicable to: Araldite; acrylic cement; Balsa cement; Copydex; Pritt stick; PVA; Rubber cement; Superglue	See also: 4.018, 4.020, 4.021.

Process(es) covered: Joining two surfaces together using a variety of adhesives.

Hazards	
Toxic	Trichlorethylene (trichlorethene, NOT trichlorethane), sometimes used in acrylic cement) may cause cancer and is a mutagen (R45, 68, 67, 36/38, 52/53).
Harmful	Inhalation of vapour from some organic, solvent-based adhesives, eg, rubber or balsa cements containing toluene (R11, 38,48/20, 63, 65, 67), may cause nausea, headaches, dizziness, breathing difficulties and, eventually, unconsciousness. Epoxy or polyester resin adhesives (eg, Araldite) involve a curing reaction in which the resin is mixed with a hardener. The uncured material may be harmful if ingested or absorbed through the skin.
Irritant	Some adhesives in contact with the skin and eyes may cause irritation or allergic reaction in sensitive individuals. Cyanoacrylate vapour is irritating to the skin and nasal passages (R36/37/38).
Skin adhesion	Cyanoacrylate adhesives (eg, Superglue) may bond the skin or eyelids.
Highly flammable	Some adhesive vapours are highly flammable, eg, those using propanone (R11, 36, 66, 67).
Risk Assessment	
Toxic	There are usually safer solvents for acrylics than trichloroethylene, eg methylene dichloride (dichloromethane) (R40), WEL 1060 mg m^{-3}.
Harmful	The amounts of epoxy or polyester resin adhesives used are so small that these hazards do **not** represent a significant risk to health. Similarly, tests indicated that, even if 1 m^2 (about 12 A4 sheets) were being glued at once and the solvent was all propanone (WEL 3620 mg m^{-3} 15 min ref period[99]) the limit would not be approached. Such adhesives, if acquired by pupils, may be used in 'solvent abuse'.
Irritant	The nozzles of tubes of adhesives may become blocked and, when pressure is applied to clear the blockage, spurting can occur. Cyanoacrylates are irritant but the risk is trivial in areas with normal ventilation.
Skin adhesion	Cyanoacrylate adhesives (eg, Superglue) may easily lead to the skin sticking within seconds. Misbehaviour by pupils can be a serious risk.
Highly flammable	There is a serious risk of fire if any source of ignition (a naked flame, a source of sparks or a very hot surface) is close to where adhesives containing flammable solvents are being used or handled.

Control measures
Do not use trichloroethylene as a solvent for acrylics.
Do not use any adhesives based on non-aqueous solvents in confined spaces.
Do not allow eating and drinking in the studio.
Thoroughly wash hands before leaving the studio.
Teach children how to use adhesives safely.
Wear eye protection if there is a risk of spurting from tubes.
Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap.
Avoid prolonged skin contact with organic solvent-based adhesives.
Wear protective gloves (preferably nitrile) when using adhesives based on non-aqueous solvents, unless quantities are small.
Do not allow pupils below year 12 to use cyanoacrylate adhesives.
All naked flames and other sources of ignition must be at least 2 metres away when adhesives based on flammable solvents are in use.

Adhesives: General (Continued)

RESTRICTIONS	Solvent abuse. Strict control over the use and storage of solvent-based adhesives should be enforced to ensure that theft and the deliberate inhalation of vapour does not take place.

[99] EH 40/2005 (as amended)

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	It may be necessary to avoid adhesives in tubes with some classes to control the risk of spurting into eyes.
Disposal	Part-empty and empty containers may be placed in normal refuse.
Storage	Store all adhesives in a dry place in the temperature range 5 to 25 °C. Protect water-based ones from frost. Spare containers should be kept well away from sources of ignition such as sparks, pilot lights and other naked flames, in a highly-flammable liquids cupboard. Although up to half a dozen containers which are 'in use', each less than 500 ml, could be kept on the open shelf outside such a cupboard or bin, this is much less secure and tempts thieves. All storage for 'sniffable' glues must be secure.

FURTHER INFORMATION

Safe adhesives

Most adhesives will be applied only in small amounts and are very safe, though it is always wise to avoid contact with the eyes and hands, particularly for individuals having sensitive skin. Water-based, polyvinyl acetate (PVA) and rubber latex types are all safe to handle; such adhesives include cellulose powders (wallpaper pastes so long as they do not contain fungicides) and 'Copydex' (but beware the possibility of latex allergy)

Although PVA and rubber latex adhesives are among the safest available, they should not be used by those pupils who might put them in their noses or mouths. This action could lead to a dangerous obstruction to breathing if the solidifying products were inhaled; there is similarly a danger that they might be swallowed. This risk is reduced if the adhesive is supplied in a tub rather than in a tube.

Water-based adhesives can usually be washed out of clothing, especially if washed quickly. Other adhesives are more difficult to remove: try placing the garment in a freezer and then cracking the adhesive off when very cold. Or dry-clean.

IMMEDIATE REMEDIAL MEASURES

In case of fire	Small fires of fabrics or solvents are most easily controlled by covering them with a fire blanket or damp cloth.
If adhesives get onto the skin	Wipe off excess with a paper towel and wash skin with soap and water. If 'Superglue' bonds the skin together, **do not panic**. Do **not** attempt to *pull* the skin apart; soak in warm water and ease the skin apart with a gentle peeling action using a blunt edge such as a spoon handle. (If the eyelids are stuck together, wash with warm water for at least 10 minutes and seek medical attention.)
If much vapour is inhaled	Remove individual to fresh air and seek medical attention.
If adhesives get into the eyes	Irrigate immediately with water for at least 10 minutes, holding the eyelids apart. Obtain medical attention.
If adhesives are swallowed	For most adhesives, rinse out the mouth and drink plenty of water. For solvent-based adhesives, DO NOT INDUCE VOMITING. Seek medical attention.
Effects of solvents on skin	Repeated and prolonged contact with the skin may cause removal of natural greases, resulting in dryness, cracking and possible dermatitis. Wash with mild antiseptic and apply moisturising cream.

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4.020 COSHH Regs	Adhesives: SPRAY TYPE	Applicable to: Photomount; Scotch Mount; SprayMount	See also: 4.018, 4.019.

Process(es) covered: Use of solvent-based, repositionable adhesives. The adhesive is sprayed onto one of the surfaces to be bonded; the drying time is long so that repositioning is possible. The adhesive is supplied as a solution in organic solvents and delivered as an aerosol with propane / butane propellant.

Hazards

Harmful A small fraction of the solvent mixture is hexane (R48/20, 65) which is harmful by inhalation or swallowing. This can lead to nausea, headaches, dizziness and, eventually, to unconsciousness.

Irritant Hexane (R38) is irritating to the skin.

Highly flammable Highly flammable, volatile solvents and propellants are used.

Extremely flammable Butane and propane (R12), commonly used as propellants, are extremely flammable.

Risk Assessment

Harmful Hexane has a WEL of 72 mg m^{-3} (8-hour TWA[1]) and butane has a WEL of 1810 mg m^{-3} (15 min ref period)[100]. Propane is asphyxiant at high concentration. There is a risk of solvent abuse.

Irritant Repeated spraying of the adhesive onto the hand is likely to cause irritation.

Extremely flammable

Highly flammable There is a serious risk of fire if any source of ignition (a naked flame, a source of sparks or a very hot surface) is close to where flammable solvents are being used or handled.

Control measures

Ensure good ventilation during application and drying to prevent the inhalation of solvent vapours and propellant gases.
Spray and dry outside if good ventilation is not available in the workplace.
Avoid holding the surface being sprayed with a bare hand. If pins cannot be used, the hand should be protected with a disposable nitrile glove.
Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap.
Do not use in the same room as sources of ignition, although the ventilation required would usually disperse explosive concentrations of solvent vapour.

100 EH 40/2005 (as amended).

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RESTRICTIONS	Solvent abuse. Strict control over the use and storage of solvent-based adhesives should be enforced to ensure that the theft and deliberate inhalation of vapour does not take place. Only staff should use spray type adhesives and then only in well-ventilated areas.
Disposal	Empty containers may be disposed of in ordinary waste. No attempt must be made to incinerate locally.
Storage	Spare containers should be kept at temperatures well below 49 °C in a metal cupboard designated as suitable for the storage of highly flammable liquids. Although up to half a dozen containers which are 'in use', each less than 500 ml, could be kept on open shelf outside such a cupboard or bin this is much less secure and tempts thieves.

IMMEDIATE REMEDIAL MEASURES

If adhesives are swallowed	DO NOT INDUCE VOMITING. Seek medical attention
If adhesive vapour is inhaled	Remove casualty to fresh air and seek medical attention.
If adhesives get into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
If adhesives get onto the skin	Wipe off excess with a paper towel. Wash with soap and water.

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4.021 Man Regs	Adhesives: Glue Guns & GLUE STICKS	Applicable to: Hot-melt glue guns, cool-melt glue guns & relevant glue sticks	See also: 4.019, 4.020.

Process(es) covered:

Adhesives are supplied as sticks of copolymers of ethene and vinyl acetate. Heat is used to melt the adhesive in the 'glue gun' so that drops can be applied to the materials to be joined. Bonding results when the glue solidifies on cooling. Many different types of gun are available with electric or butane cartridge heating and supplying glue at different rates.

Different types of adhesive are available, which melt at lower/higher temperatures. There are two basic classes of molten adhesive:

the original (hot-melt) material, melting at 160 to 190 °C and
the 'low-temperature' (cool-melt) one, melting at 90 to 110 °C.

The guns are designed for one class of glue only (although there are variants within each class). The cool-melt glue sets more quickly and may be difficult to use for complex assemblies.

Hazards

Electricity In the past, some low-cost guns have not been made to satisfactory standards.

Tripping Trailing cables present a tripping hazard.

Fire Cordless types present a fire hazard from the butane cartridge.

Burns Although the handle and trigger of the gun should remain sufficiently cool not to be a hazard, every design will have at least a small component at a temperature high enough to cause skin burns.

Even the 'cool-melt' adhesives are hot enough to cause skin burns.

Irritant If the glues are overheated (by using a soldering iron or flame to melt them), they can release irritant fumes and vapours.

Risk Assessment

Electricity Glue guns purchased from an established educational supplier will meet satisfactory standards. Double-insulated models are most appropriate and present minimal risks.

Tripping Trailing cables can be avoided by working close to a power socket.

Fire Small butane cartridges present a high risk in the hands of students but could be used safely by staff.

Burns The risk of burns from a properly-used glue gun is minimal.

Both classes of glue are capable of blistering the skin when dripped directly onto it but the cool-melt glue is safer.

Irritant If the glues are heated only with the appropriate glue gun, the risk is trivial.

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Control measures	Ensure that the glue gun is subject to a regular inspection of the integrity of the body and mains cables, with a portable appliance test when necessary and at least every 12 months. (Where glue guns are used throughout the year and they are used responsibly, a monthly inspection checking for damage should be sufficient. If they are used intensively for a few weeks, then it might be necessary to check them every time they are removed from the store.) Only work at benches provided with a suitable power socket to avoid the need for trailing cables. Use cable covers if there are not suitably-located power sockets. Do not allow children to use cordless glue guns, ie with butane cartridges. Carefully control access to such guns. Teach the children how to use glue guns safely but, with some classes, it could be advisable to restrict use to the low-temperature types. If cool-melt glue is not adequate for the task, close supervision will have to be exercised or use restricted to staff only.
RESTRICTIONS	Low-melt glue sticks must never be used in a hot-melt glue gun: the slightest pressure will cause the glue to squirt out.
Disposal	Broken and/or surplus electrical goods are subject to the *Waste Electrical and Electronic Equipment Regulations* 2006 (the *WEEE Regulations*). These cannot be put in the ordinary refuse collection. Most schools will have in place arrangements for the disposal of old computers, TV sets, kettles, refrigerators, etc. Empty butane cartridges should be left outside (in a secure location) with the burner valve open to allow the remaining vapour to disperse; then the cartridge can be placed in the solid refuse. Unwanted glue can be disposed of as normal refuse.
Storage	Cartridges can be kept between use with the burner attached or removed, according to the maker's recommendations. The location should be secure, well-ventilated, cool, away from flames, combustible materials and escape routes and, ideally, in a fire-resistant structure. For further details, see CLEAPSS guide L164 (or G164) *Portable Laboratory Gas Burners* on the password-protected part of the CLEAPSS web site, under *Secondary/Science/Guides.* Glue sticks should be stored in a cool, dry place to avoid distortion of the sticks, which might prevent them from moving freely through the glue gun.

IMMEDIATE REMEDIAL MEASURES

If hot adhesive gets onto the skin	As soon as possible, plunge the skin into cold water or hold it under a running cold tap. Keep the burn in cold water for at least 10 minutes. If extensive, seek first-aid treatment as for any other burn. DO NOT APPLY CREAMS OR OINTMENTS OF ANY TYPE.

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4.022 COSHH Regs	TEXTILES: Dyes, Mordants, BLEACHES, ETC	Applicable to: alum, ferrous sulfate & other mordants; bleaches; natural & reactive dyes	See also: 4.023, 4.024.

Process(es) covered:	*Cold-water dyes*: Textiles may be prepared in one of several ways and then left to soak in a room-temperature dye bath. *Hot-water dyes*: Quicker results can be achieved by using a hot dye bath but this is not possible when wax is used to create a pattern. *Dyeing with mordants*: Some fabrics must be pretreated with a mordant to make the coloured dye stick to the fibres, eg, alum, ferrous sulfate, tin(II) chloride, potassium dichromate. *Bleaches:* Bleaches may be used to produce special effects *Devore pastes* and *fibre etch*: Contain sodium hydrogensulfate (bisulfate) used to produce special effects.
Hazards	
Corrosive	Concentrated acetic acid (ethanoic acid) is corrosive (R35), causing severe burns. Sodium hydrogensulfate (bisulfate) (R34, R37) is corrosive, causing burns, and irritating to the respiratory system.
Toxic	Some dyes are suspected as cancer-causing agents. They are now labelled TOXIC. Potassium dichromate(VI) (R8, 21, 25, 26, 34, 42/43, 45, 46, 48/23, 50/53, 60, 61) is carcinogenic by inhalation (of the dust) and toxic if swallowed. Domestic bleaches (sodium hypochlorite) liberate the toxic gas chlorine on contact with acids.
Harmful	Some mordants, eg, iron(II) (ferrous) sulfate (R22) and tin(II) (stannous) chloride (R21/22, 36/37/38) are harmful if swallowed.
Irritant	Some dyes, eg, Disperse Yellow 7, (R36/37/38) and dye fixatives, eg, containing sodium silicate, and mordant solutions containing more than 7% potassium dichromate(VI) are irritant to the skin. Domestic bleaches, containing sodium hypochlorite may be irritant.
Allergic reaction	Certain reactive dyes have been identified as giving rise to allergy and/or sensitisation. Potassium dichromate(VI) solutions (> 0.5%) may cause sensitisation.
Flammable	Concentrated acetic acid (ethanoic acid) is flammable (R10).
Risk Assessment	
Corrosive	Use of concentrated acetic acid is unnecessary. Replace by vinegar. Devore pastes and fibre etch can be used safely if following the supplier's instructions.
Toxic	Warnings on dyes suspected to be carcinogenic have usually arisen from data obtained in studies on laboratory animals given very high doses. If such dyes are used with care, there should be no reason to worry about long-term adverse effects on human health. However, potassium dichromate dust presents a risk that must be controlled, WEL 0.15 mg/m^3 (15 min ref period).
Harmful	Iron(II) (ferrous) sulfate has a WEL of 2 mg m^{-3} (15 min ref period). Tin(II) chloride has a WEL of 4 mg m^{-3} (15 min ref period)[101]. When solutions are being used as mordants, they are unlikely to give rise to spray at these concentrations.
Irritant	Several of these solutions could have an effect on sensitive skin, particularly solutions of tin(II) chloride and potassium dichromate(VI) used as mordants (1%).
Allergic reaction	In some cases, an individual may become sensitised to a dyestuff so that the briefest subsequent exposure will trigger an immune response (sensitisation). Contact can be through inhalation, ingestion or skin absorption. Certain very reactive dyes, eg, Procion Yellow MX-8G, are more likely than others to trigger a response. The hazard is greatest when handling the solid dye; solutions are much safer.

Textiles: Dyes, Mordants, Bleaches, etc (Continued)

Control measures

[101] EH 40/2005 (as amended)

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	Follow the manufacturer's instructions or Safety Data Sheet. Use vinegar rather than diluting concentrated acetic (ethanoic) acid. Always handle solid dyes with care. Wear eye protection and protective gloves (preferably nitrile) when using dyes, fixers, mordants or bleaches that are toxic or irritant. Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap. Open containers of toxic materials and weigh out the solid in a laboratory fume cupboard; once covered with water the risk becomes minimal. Do not allow chlorine-based bleaches (hypochlorites) to come into contact with acids, including vinegar. Do not allow eating and drinking in the studio. Thoroughly wash hands before leaving the studio. Avoid the Procion MX range of dyes; Procion HE dyes are safer. If Procion MX dyes are used, they should be handled in the science department fume cupboard.
RESTRICTIONS	It is best if pupils handle dyes in solution rather than as solids. If powdered dyes must be employed, they **should not be used by pupils under 14**, and then only with **close supervision under 16**. Pupils should **not** be allowed to handle the powder of very reactive dyes, such as Procion Yellow MX-8G.
Disposal	Small quantities (ie, typical of domestic use) of unwanted dyes are best made into solutions and flushed away. Large quantities are best disposed of by an authorised waste contractor.
Storage	All dyes, fixers and mordants should be kept in a secure place. Potassium dichromate(VI) and its solutions are oxidising agents which will assist fire; store them away from flammable and other combustible materials.

FURTHER INFORMATION

Many of the dyes used for work with fabrics have been produced so that they do not pose a significant risk to most users, though they should nevertheless be handled with care. Some mordants, such as alum (aluminium potassium sulfate), are not classified as hazardous.

It is not possible to advise which mordants to use with which natural dyes on which fabrics but this could form an interesting investigation.

IMMEDIATE REMEDIAL MEASURES

If dyes, etc are swallowed	Give plenty of water and seek medical attention. DO NOT INDUCE VOMITING.
If dye, mordant or bleach gets into the eyes	Obtain medical attention. Irrigate immediately with water, holding eyelids apart and continue the irrigation until the patient reaches hospital. This is especially important for alkalis in the eye, eg domestic bleach (sodium hypochlorite).
If dye, mordant or bleach is spilt on the skin or clothes	Remove contaminated clothing. Wash affected area thoroughly with a large amount of water. If a large area of skin is affected, seek medical attention. Soak contaminated clothing and rinse repeatedly.
If there is an allergic reaction to dyes, etc	If the casualty shows anxiety, red, blotchy skin, swelling of the face and neck and puffiness around the eyes, s/he could be suffering from a serious allergic reaction. Call an ambulance and prop the patient in a sitting position in case breathing problems develop.

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4.023 COSHH & Man Regs	TEXTILES: Batik & OTHER WAX PROCESSes	Applicable to: All wax-resist dyeing techniques	See also: 4.022.

Process(es) covered: Melting wax for application to fabrics using self-contained, electrically-heated pots or wax kettles on hotplates or in specially-designed pans suspended over a larger container partially filled with water. The molten wax is applied to cloth which is then dyed. Dye does not soak into the waxed areas.

Hazards	
Burns or scalds	Hot wax can cause scalds and the edges of the pot become sufficiently hot to cause burns. Tipping wax out of the pot can result in a further hazard.
Tripping	The mains cord presents a possible tripping hazard.
Electric shock	The mains cord is subject to wear and may present a shock hazard.
Fumes	Fumes from melted wax can present a fire hazard and may irritate the respiratory system.

Risk Assessment	
Burns or scalds	The sides of self-contained pots are well insulated although some areas could become hot enough to cause a minor burn. However, the casualty is very unlikely to require more than immediate remedial measures. The pots are usually thermostatically controlled but, when melted, wax can stick to the skin and cause scalds. If using a pan suspended over a larger container of water, there is a risk of water splashing into the wax container. Tipping could cause a wax spill that could scald. The risk of injury would be greater if users were sitting down. Splashing hot wax could cause eye injury.
Tripping	The risk of tripping depends much more on the location of the socket outlets relative to the positions of the Batik pots than on anything else. This is a matter that has to be assessed locally.
Electric shock	If the cable is subject to regular checks, the risk would be small.
Fumes	The WEL for paraffin wax is 6 mg m^{-3} (15 min ref period[102]) (other waxes are not listed but should be assumed to be similar). These levels may well be exceeded especially if more than one pot is in use at a time. Fumes from melted wax have been known to cause headaches and can cause lung irritation although it is unlikely that any permanent harm will be caused. Paraffin wax fumes are unlikely to ignite unless heated to a very high temperature.

[102] EH 40/2005 (as amended)

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Control measures	
	Teach children how to carry out the process safely, including how to minimise the risk of tipping a separately-heated wax kettle. Users must stand, not sit, when using hot wax. Wear gloves giving thermal protection when holding the handle of a wax kettle, if it is of a design that becomes hot. Do not move hot wax pots until they are completely cool. If possible, do not use wax pots heated by being suspended over containers of hot water. If unavoidable, take special care to avoid splashing water into the wax. Wear eye protection when using hot wax or working within 2 metres. Only work at benches provided with a suitable power socket to avoid the need for trailing cables. Carry out a visual inspection of Batik pots for wear to the power cord every time they are taken out for use. Depending on use, consider the need for a formal inspection and test more frequently than for some other portable electric items. Use the lowest possible temperature setting to melt the wax, preferably below 60 °C. Heat the wax slowly. The pot should be located near an open window. If the fumes cause distress then only one pot should be in use at a time. Pupils or staff who suffer from asthma or other respiratory problems would be advised not to do the process.

RESTRICTIONS	Batik work should only be carried out by children with close supervision. Dripping wax from lighted candles presents additional hazards (eg, fire) and is not covered by this model risk assessment.
Storage	Batik Pots must be allowed to cool before having the power cord wound around them to be put away. A major cause of damage to the cord is winding it up too tightly.

FURTHER INFORMATION

The safest equipment to use for melting wax in this work is a self-contained electrically-heated, thermostatically-controlled Batik pot with interchangeable wax kettles where necessary.

A ‘HOT’ warning sign, left adjacent to the pot, is also advisable, especially if the pot is left to cool after the end of the lesson.

Waxes which are liquid at room temperatures, and can be applied simply by brushing without the need to heat, are available from some educational suppliers.

IMMEDIATE REMEDIAL MEASURES

Burns and scalds	Cool the affected area under a running cold tap for 10 minutes.
Electric shock	Send for first aider immediately. Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a first aider does not arrive quickly and the pulse is absent, consider carrying out cardio-pulmonary resuscitation.

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4.024 Man Regs	TEXTILES: USING ELECTRIC HEAT SOURCES	Applicable to: fabric irons; hair driers and heat guns	See also: 4.023

Process(es) covered: Manual ironing with steam and dry irons.
Drying textiles with hair driers.
Distressing fabrics or producing special effects, eg with an embossing heat gun or pyrography tool.

Hazards

Burns	The sole plate of an electric iron, the tip of pyrography tools and the output of heat guns can be hot enough to burn flesh.
Scalding	A steam iron could cause scalding from hot water sprays as well as from steam jets. A damp pressing cloth, immediately after use, could be hot enough to scald.
Tripping	The mains cord presents a possible tripping hazard with a further hazard presented by the falling appliance.
Electric shock	The mains cord may be subject to considerable wear and may present a shock hazard.
Trapping	Ironing boards may trap fingers or collapse onto feet if not erected correctly or if folded away inappropriately.
Fumes	If some fabrics are over heated, they can produce irritant or other hazardous fumes.
Fire	Some fabrics will melt or smoulder at high temperatures but many will ignite if the temperature is sufficiently high.

Risk Assessment

Burns	Minor burns are quite likely when students are learning to iron textiles, particularly if pupils are allowed to pass a hot iron from hand to hand. However, the casualty is very unlikely to require more than immediate remedial measures. Heat guns used for embossing do not have a fan and are less powerful than the paint-stripping type but nevertheless present a serious risk of burns. Pyrography tools present only a small risk, as the hot area is limited in size.
Scalding	Since the fabric irons are designed for domestic use, the steam production is slow and the risks are again minor.
Tripping	The risk of tripping depends on the location of the socket outlet relative to the position of the ironing board or other work surface. This is a matter that has to be assessed locally. A falling appliance could cause a foot injury.
Electric shock	The rate of wear and the severity of the harm makes this a significant risk. Appliances designed for the domestic market may not be of a sufficiently safe design for school use.
Trapping	Some designs of ironing board are more prone to collapse or finger trapping than others.
Fumes	It is unlikely that dangerous amounts of fumes would be produced by distressing fabrics in normal school work.
Fire	Fire is very unlikely unless naked flames are used.

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Control measures	
	Give clear instruction to minimise the risks of burns and scalds. Locate ironing boards or other work surfaces close to the socket outlets to minimise the risk from trailing cables. Give electrical appliances a visual inspection for wear to the power cord every time they are taken out for use. They may need a formal inspection and test more frequently than some other portable electric items. Teach pupils how to handle ironing boards to minimise finger trapping and to prevent collapse. Do not attempt to distress large areas of fabric by means of heat. Never attempt to distress fabrics with naked flames.

RESTRICTIONS

Care must be taken at all times when ironing fabrics to ensure that students do not lean against ironing boards and they need to be taught to place hot irons on their ends on a suitable heat-proof surface during use. A 'HOT' warning sign, left adjacent to the iron, is also advisable, especially if it is left to cool after the end of the lesson.

Disposal

Broken and/or surplus electrical goods are subject to the *Waste Electrical and Electronic Equipment Regulations* 2006 (the *WEEE Regulations*). These cannot be put in the ordinary refuse collection. Most schools will have in place arrangements for the disposal of old computers, TV sets, kettles, refrigerators, etc.

Storage

Irons must be allowed to cool before having the power cord wound around them and being put away. A major cause of damage to the cord is winding it up too tightly.

FURTHER INFORMATION

Choice of electrical heat sources and related equipment

The equipment used in a place of work is subject to the *Provision and Use of Work Equipment Regulations* and, as such, must be safe and suitable for the intended purpose.

Hair driers intended for the domestic market may overheat if subjected to continuous operation and may not be sufficiently robust for use in schools, etc.

Ironing boards chosen for use in education must be stable, properly maintained and capable of secure fixing to guard against collapse during use. Consequently, the cheapest designs may not be 'safe and suitable'.

IMMEDIATE REMEDIAL MEASURES

Burns and scalds	Cool the affected area under a running cold tap for 10 minutes.
Electric shock	Send for first aider immediately. Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a first aider does not arrive quickly and the pulse is absent, then consider carrying out cardio-pulmonary resuscitation.

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4.025 Man Regs	TEXTILES: SEWING MACHINES	Applicable to: programmable or computer-controlled (CNC) machines; sewing machines.	See also: 4.026

Process(es) covered: Setting up and using electrically-driven sewing machines including computer-controlled sewing machines.

Hazards	
Manual handling	Carrying and lifting a sewing machine presents a hazard of lower back injury.
Electric shock	Making connections and changing lamps can introduce electric shock hazards.
User injury	The needle can pass through a finger including the nail. If a needle breaks in use, fragments can fly into the face and eyes of the operator.
Tripping	This hazard can arise from trailing mains cords.
Entanglement	Hair, clothing and fingers can become caught up in the machine.

Risk Assessment	
Manual handling	Many machines approach the safe load for anyone to carry and lift, making this a significant risk for children of small build or anyone pregnant. Some machines are so heavy that a special risk assessment is required before moving them. Incorrectly fitted casings can allow the machine to fall during a lift and injure feet.
Electric shock	Mains cords pull out of plugs and connectors and also become damaged by trapping. Live contacts may be exposed when changing a lamp bulb.
User injury	The risk of a needle passing through a finger is low when using a single-needle machine with presser foot attached. The risk is increased when multiple needles are in use or the presser foot is removed for free embroidery work. Broken needles may arise when the machine needle hits a pin or a thick fold in the fabric. This is more likely when a novice user has not mastered the foot pedal and loses control of the fabric movement.
Tripping	The risk of tripping over a mains cord depends on the layout of the work room and the spacing between tables.
Entanglement	Long hair or loose clothing may be caught in the mechanism or sewn into the work. Fingers can be trapped by moving parts but serious injuries are unlikely.

Control measures
Teach children to fit covers and lift machines correctly. Use a suitable trolley whenever machines are transported any distance. Ensure heavier machines are handled by two persons. Visually check sewing machines where cords are at risk before each use and carry out a formal inspection and test regularly. Teach users to unplug the machine from the power before changing lamps. Train users carefully when starting work on machines, especially those with multiple needles or when using one without a presser foot. Allow only one pupil to use a machine at a time to minimise the chance of pushing each other. Ensure good lighting to reduce the risk from flying needle fragments; eye protection would be advisable for novice users. Only work at benches provided with a suitable power socket to avoid the need for trailing cables. Ensure there is adequate space for pupils (as users) and teachers (as supervisors) to move between them. Seating must provide support and encourage good posture. Tie back long hair; remove or cover jewellery and cover loose clothing with a secure apron or overall to reduce the risk of entanglement.

Textiles: Sewing Machines (continued)

RESTRICTIONS	Where a programmable machine is fitted with a guard, that guard must be in place during use.

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Disposal	Broken and/or surplus electrical goods are subject to the *Waste Electrical and Electronic Equipment Regulations* 2006 (the *WEEE Regulations*). These cannot be put in the ordinary refuse collection. Most schools will have in place arrangements for the disposal of old computers, TV sets, kettles, refrigerators, etc.
Storage	If it is necessary to put sewing machines away after use, they should be stored (if possible) at such a height that lifting or lowering them onto a trolley is avoided.

FURTHER INFORMATION

Sewing machines should be regularly serviced by a suitably competent and trained person.

It should be noted that whilst sewing machine needles normally break into two pieces, and one piece remains in the machine and the other remains in the fabric, there have been instances where a sewing machine needle breaks into three or more pieces and one of these enters the eye of the user. Teachers should therefore give particular emphasis to the care needed to avoid breakage of needles.

IMMEDIATE REMEDIAL MEASURES

Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Electric shock	Send for the first aider immediately. Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a first aider does not arrive quickly and the pulse is absent, consider carrying out cardio-pulmonary resuscitation.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Needles in fingers	If the needle is protruding, it may be extracted but, if it is broken, that part in the finger may be difficult to remove and attention from a trained first aider or doctor will be required. Once the needle has been removed, the finger may be squeezed to encourage bleeding, the wound washed and a small, sterilised dressing applied by the casualty.

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4.026 Man Regs	TEXTILES: Small sharp items	Applicable to: hand needles; pins; unpickers	See also: 4.025

Process(es) covered: Hand sewing, pinning for machine sewing and unpicking stitching.

Hazards

User injury

The needles and pins can cause pricking injuries, usually to a finger. Stitching unpickers have a sharp, pointed blade that can produce a more serious injury.
If a needle breaks in use, fragments can fly into the face and eyes of the user.
If pins are left in the fabric as the machine passes over them, they may cause the machine needle to snap.

Risk Assessment

User injury

An ordinary sewing needle presents a low risk because the injury resulting from a needle prick is minor. The risk from an unpicker is greater since stabbing with this small, sharp blade could injure a blood vessel in the wrist.
Hand sewing needles are unlikely to break if an appropriate size is chosen for each task.
If pins are not removed from fabric just before reaching the presser foot of the sewing machine then there is a significant risk of needle breakage.

Control measures

Teach the safe use of the unpicker, pointing it away from the body and not near to another person.
Ensure there is adequate lighting for pupils to carry out fine, close work.
Choose the size and type of needle to match the task, bearing in mind the age and ability of the children.
Use pins with glass heads which are easier to see and remove while machining.

Textiles: Small Sharp Items (Continued)

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RESTRICTIONS	With some classes, it may be necessary to restrict the use of unpickers.
Storage	It is important to ensure that pins, needles, scissors and other small items of equipment are collected in after use since they could constitute a hazard if left on tables, chairs or on the floor.

IMMEDIATE REMEDIAL MEASURES

Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Severe cuts	Lower the casualty to the floor. Raise the wound as high as possible. If feasible, ask the casualty to apply pressure on or as close to the cut as possible, using fingers, a pad of cloth or, better, a sterile dressing (adding further layers as necessary). If the casualty is unable to do so, apply pressure yourself, protecting your skin and clothes from contamination by blood if possible. Leave any embedded large bodies and press around them. Send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.

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4.027 Man Regs	Enamelling: Kilns	Applicable to: jewellery enamels on copper, gilding metal, silver and gold	See also: 4.028, 4.029.

Process(es) covered: Finely-ground borosilicate glass (coloured by trace metallic compounds) which melts at 800 to 820 °C is fused to the surface of certain metals. Kilns may be either electric or gas fired but some work is done with a blowtorch.

Hazards

Toxic Gas-fired kilns will produce carbon dioxide, WEL 27 400 mg m^{-3} (15 min ref period), with traces of nitrogen oxides (R26) (WEL too low to quote) and carbon monoxide (R12, 23, 48/23, 61), WEL 232 mg m^{-3} (15 min ref period)[103] present as combustion products.

Electric shock Electrically-heated kilns sometimes have exposed elements which can be touched when the door is open.

Burns The enamelled product may be extremely hot when removed from the source of heat.
Blowtorches have a naked flame which presents an obvious hazard of burns or fire.

Risk Assessment

Toxic The combustion products from gas-fired kilns and torches present a risk if they are allowed to accumulate.

Electric shock There is a serious risk to users of electrical contact through metal tools if the element is exposed and 'live'.

Burns Handling hot metals (particularly when at 'black heat' which may not appear hot) presents a significant risk of burns.
Inexperienced users, especially pupils, may have inadequate control of the size or direction of a flame.

Control measures

If gas-fired kilns are used, ensure the fumes are extracted through a flue. Small torches, especially the needle-flame type, require no special ventilation.

Ensure electric kilns with exposed elements have an interlock that interrupts the power when the door is opened.
Handle hot materials with tongs or other suitable tools.
Use heat-resistant gloves when removing the cartridge from a blowtorch.
Do not allow younger pupils to place objects in, or remove them from, hot kilns.
Only use blowtorches in areas away from flammable materials.

[103] EH 40/2005 (as amended).

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Disposal	Broken and/or surplus electrical goods are subject to the *Waste Electrical and Electronic Equipment Regulations* 2006 (the *WEEE Regulations*). These cannot be put in the ordinary refuse collection. Most schools will have in place arrangements for the disposal of old computers, TV sets, kettles, refrigerators, etc.

FURTHER INFORMATION

Overheating and bending of enamelled objects should be avoided as the glazed surface may shatter.
Every type of kiln should be included in the planned annual maintenance programme.

IMMEDIATE REMEDIAL MEASURES

Fumes are inhaled	In the event of dizziness occasioned by fume, remove the affected person to the fresh air until recovered. Seek medical advice if symptoms persist.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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4.028 COSHH & Man Regs	Enamelling: materials	Applicable to: jewellery enamels on copper, gilding metal, silver and gold	See also: 4.027; 4.029.

Process(es) covered: Finely-ground borosilicate glass (coloured by trace metallic compounds) which melts at 800 to 820 °C is fused to the surface of certain metals.

Hazards

Toxic	The enamels are hazardous by swallowing.
Dust	Dust from the enamels is hazardous by inhalation.
Irritant	Enamels are irritant to the eyes. Prolonged contact with skin may cause irritation and inflammation.
Flying particles	If an enamelled surface is reheated, the glass may shatter.

Risk Assessment

Toxic	Lead-free enamels are available. However, they will contain small quantities of insoluble compounds of chromium(III), cobalt(II), copper(II), nickel(II), antimony(V), cadmium(II) or manganese(II). These present minimal risk when handled carefully in the small quantities required.
Dust	Although cadmium pigments have a WEL of 0.025 mg m^{-3} (8 h TWA)[104] and certain chromium compounds have a limit of 0.05 mg m^{-3} (8 h TWA), these compounds are present as minor constituents of the enamelling glass and these limits will not be approached in a school. The other trace compounds have higher WEL values and these limits too will not be approached in work on the scale of this activity.
Irritant	Eye protection and hand washing after use will prevent irritation.
Flying particles	Over-heating an enamelled surface is particularly likely to result in the glass shattering.

Control measures

Only use enamels that are lead-free.
Wash hands thoroughly after handling enamels.
Do not eat or drink in areas where the material is being used.
If reheating an enamelled surface, raise the temperature slowly to minimise the risk of the glass shattering.
Wear eye protection that conforms to BS EN166 9 when heating enamelled surfaces by blowtorch.
Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap.

104 EH 40/2005 (as amended).

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Disposal	Do not attempt to discard waste enamel by washing into the drainage system. Dispose of spills or unwanted materials in a sealed plastic bag in the ordinary waste.
Storage	Enamels should be stored in sealed, clearly-marked containers which should be in a dry, ventilated area.

FURTHER INFORMATION

Overheating should be avoided as the glazed surface may shatter.

IMMEDIATE REMEDIAL MEASURES

If enamels are swallowed	Give plenty of water and seek medical advice.
If enamels are spilt in the workshop	Use industrial vacuum equipment where practicable. Moisten prior to sweeping. Do not attempt to sweep a spill in a dry state from a bench.
If enamels are blown into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
If enamels get in contact with the skin	Wash with soap and water.

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4.029 COSHH & Man Regs	WORKING WITH GLASS	Applicable to: all types of glass	See also: 4.027; 4.028

Process(es) covered:

Working with molten glass.
Working with cold glass; cutting, grinding, polishing.
Painting glass or working with stained glass.
Acid etching and polishing glass.

Hazards

Corrosive

Hydrofluoric acid (R35) (used for etching glass) causes severe burns and ammonium bifluoride (ammonium hydrogenfluoride) (R34) causes burns.

Toxic

In batch mixing and loading, toxic and silicaceous dusts are likely to be created. Lead compounds, arsenic and antimony oxides are used as fining agents and copper, cobalt and selenium compounds are used to provide colour. Handling lead can result in particles being trapped under finger nails. Ammonium bifluoride (ammonium hydrogenfluoride) (used for etching glass) is toxic if swallowed (R25). Soldering lead strips to join stained glass can produce toxic fumes of lead solder and/or flux.

Burns

The glass product may be extremely hot when removed from the source of heat.

Radiant heat

Infra-red radiation from hot surfaces can damage the eyes.

Cuts to user

Broken glass and sharp (unpolished) edges can cut fingers. Glass may shatter on cooling if it has not been properly annealed.

Dust

Dust can be generated when grinding glass.

Risk Assessment

Corrosive

Hydrofluoric acid can leak through pin holes in protective gloves and the damage may not become apparent for some hours. The injuries heal only with difficulty.

Toxic

Teachers, students, technicians, TAs and cleaners could all be at risk of inhaling hazardous materials if handled carelessly. There would be a risk of inhaling toxic fumes when soldering stained glass unless efficient fume extraction is used. They could all be at risk of ingesting hazardous materials if eating and drinking are permitted or hands are not washed before leaving the studio.

Burns

Handling hot glass (particularly when at ‘black heat’ which may not appear hot) presents a real risk of burns.

Radiant heat

Observing hot objects, or the furnace itself, could cause damage to the eyes. The risk is minimal if the inside of the hot kiln is inspected only through suitably-coated glass.

Cuts to user

Careless handling or storage of glass can present a significant risk, as can failure to anneal hot glass properly.

Dust

Dust can be suppressed by the use of plenty of water.

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Control measures	
	Do not attempt glass etching with hydrofluoric acid or with ammonium bifluoride (ammonium hydrogen difluoride). Obtain batch materials from a reputable source. Mix batches of glass only in a closed container and check the container regularly to ensure the seals are effective. When soldering stained glass, ensure efficient fume extraction. Do not eat, drink or apply cosmetics in the studio. Wash hands thoroughly and scrub nails after handling lead. Wear appropriate personal protective equipment when working with hot glass. If working with high temperature glass, use safety goggles or face shields with infra-red filters. Directly supervise children directly when selecting broken glass or breaking glass for use as part of a glazing process in a clay form in a ceramics kiln. Use proper scoops for handling glass fragments. Wear eye protection when cutting, shaping or grinding glass. Wear protective gloves when handling broken glass. Ensure hot glass is appropriately annealed to prevent the risk of it shattering when cold. Run grinding wheels at the appropriate settings and speeds. Use enough water to prevent local heating and remove waste.

FURTHER INFORMATION

Further information about working with glass (types of glass, safety, cutting glass tubing, smoothing sharp glass edges, bending glass tubing and other techniques will be found in section 11.5 of the CLEAPSS *Laboratory Handbook* (see *Secondary/Science/LaboratoryHandbook*).

Disposal	Broken or waste glass should be kept in a strong, labelled container, which is then sealed, still clearly labelled, before disposal in the ordinary waste.
Storage	Glass should be stored in a secure place and in a way which would allow it to be picked up easily without injury.

IMMEDIATE REMEDIAL MEASURES

Glass in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Severe cuts	Lower the casualty to the floor. Raise the wound as high as possible. If feasible, ask the casualty to apply pressure on or as close to the cut as possible, using fingers, a pad of cloth or, better, a sterile dressing (adding further layers as necessary). If the casualty is unable to do so, apply pressure yourself, protecting your skin and clothes from contamination by blood if possible. Leave any embedded large bodies and press around them. Send for a first aider.
If burns to the skin occur	Cool the affected area under a running cold tap for ten minutes.
If serious burns to the skin occur	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches which might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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4.030 Man Regs	jewellery (Lapidary): STONE CUTTING & GRINDING	Applicable to: decorative minerals; semi-precious stones	See also: 4.029, 4.031, 4.032.

Process(es) covered: *Stone cutting:* A diamond-impregnated saw blade is used to cut semi-precious stones and minerals.
Stone grinding: The cut stone is ground and polished to a high surface finish.

Hazards

The bulk stones and minerals normally present no significant hazards, however dust from grinding operations may present a hazard. There are also hazards associated with the equipment or any adhesives used.

Flying particles	When cutting crystalline materials, the saw blade can flick particles towards the operator.
Flying workpiece	Pieces of stone can be ejected violently if not held correctly or if the machine starts unexpectedly.
User injury	Human contact with the rotating grinding wheel can cause cuts or abrasions. Fingers can become jammed between the wheel and the rest.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with the rotating parts, dragging the user onto them.
Inhalation of dusts	Some dusts, especially fine dusts containing free silica, if inhaled, can damage the respiratory system leading to pneumoconioses. This normally takes a number of years. The following materials are reported as having high silica: Cornwall stone, quartz, flint, sandstone, granite, soapstone and onyx. The following have variable silica content: anthracite, coal, ash, limestone, diabase, marble, serpentine, dolomite, gemstones and travertine. This list is not exhaustive.

Risk Assessment

Flying particles	Water is usually used to cool the diamond saw blade and this reduces to a low level the risk of particles being ejected.
Flying workpiece	A hand-held workpiece may be released if it becomes too hot to hold or if excessive pressure causes it to be pulled from the user's hand.
User injury	An unguarded wheel presents considerable risks of injury.
Entanglement	Entanglement is most likely to occur if the spindle ends are exposed.
Inhalation of dusts	The Workplace Exposure Limit (WEL[105]) for inhalable dust in general is 10 mg m^{-3} (8-hour time-weighted average) and for respirable dust is 4 mg m^{-3} (8-hour time-weighted average). However, for amorphous silica the limits are 6 mg m^{-3} and 2.4 mg m^{-3} and for respirable crystalline silica it is 0.1 mg m^{-3} (8-hour).

[105] EH40/2005

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Control measures	
Flying particles	Use a cutting oil or water to cool the blade. Wear eye protection (at least to BS EN 166 F) for cutting as well as for grinding. Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap.
Flying workpiece	Use the rest to minimise the risk of losing control of the workpiece. Wear eye protection (at least to BS EN 166 F) in addition to the use of any shields fitted to the machine.
User injury	Ensure that each grinding wheel is surrounded by a guard that is only open at the front in order to allow access for the workpiece. Use a dop stick (see below) to hold the stone for grinding.
Entanglement	Ensure the guard also covers the spindle ends. Tie back long hair; remove or cover jewellery; cover loose clothing with a secure apron or overall.
Inhalation of dusts	Do not use stones containing high or variable amounts of silica. Use local exhaust ventilation because even non-toxic dust can cause respiratory problems. If necessary, borrow facilities from the D&T or science departments.

FURTHER INFORMATION

Small stones must be mounted onto a wooden stick (a 'dop stick') with a suitable adhesive during cutting and polishing operations to prevent injury to fingers.

There should be sufficient space around a grinding machine to ensure that the user is not pushed into the machine by a passer-by and the floor surface should not be slippery to avoid accidental slips while using the machine.

For requirements of controls for electrical machines, see the *Introduction*.

Grinding machines should be included in the planned annual maintenance programme.

Useful guidance is available from HSE Books in HSG 17, *Safety in the Use of Abrasive Wheels* (HSE, 2000, ISBN 9780717617395) but there is a charge for this publication.

IMMEDIATE REMEDIAL MEASURES

If dust gets into the eyes	Irrigate immediately with water for several minutes, telling the casualty to hold eyelids apart.
If a particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.

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4.031 COSHH & Man Regs	jewellery: metal casting	Applicable to: Use of Lee electric melter Lost wax or lost foam process	See also: 4.029, 4.030, 4.032.

Process(es) covered:

The production of a piece of jewellery from molten metal (usually lead-free pewter) poured into the cavity of a mould.
Creating castings using the lost-wax or lost-foam process. If wax is used, the wax is melted and poured out; if polystyrene is used it is vapourised when hot metal is poured in.
In general, metal casting for jewellery making is carried out on a very small scale. Although the hazards are the same, the risks are much reduced as compared with the risks in foundry work, sometimes carried out in D&T workshops (see CLEAPSS *Model Risk Assessments for Design and Technology*).

Hazards

Explosion	Water, on or in the mould material, can boil explosively when heated by the hot metal.
Burns	Contact with a hot crucible or molten metal splashed onto skin can cause severe burns.
Toxic	Lead, at one time used in pewter, is toxic. However, modern pewter is lead-free. If polyurethane were used, wrongly, in the lost-foam process, it would produce toxic fumes.
Harmful	Fumes of styrene vapour are harmful (R10, 20, 36/38).
Electric shock	Electrically-heated crucibles, like any equipment connected to the mains supply, have the possibility of giving an electric shock to the user.

Risk Assessment

Explosion	The risk of explosion is high when moulds are wet, or even slightly damp.
Burns	Molten metal can be splashed around when moving hand-held crucibles and ladles or as a result of an explosion whilst pouring.
Toxic	Lead may cause harm to the unborn child (R61) and there is possible risk of impaired fertility (R62). It is harmful by inhalation and if swallowed (R20/22). There is a danger of cumulative effects (R33). The WEL is 0.45 mg m^{-3} (15 min ref period) as lead. Lead-free pewter presents minimal risks.
Harmful	Styrene vapour (WEL 1080 mg m^{-3}, 15 min ref period) is liberated when polystyrene patterns are used. There would be a significant risk to staff and students if local exhaust ventilation were not used.
Electric shock	Equipment obtained from reputable educational suppliers and used and maintained in accordance with the supplier's instructions, should present minimal risk.

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Control measures	
	Ensure any moulds used are completely dry; take especial care on wet days. Where the pattern is created in wax, heat the mould to melt or burn out the wax before the metal is poured. Use a tilting crucible furnace to melt the metal, to minimise the use of a ladle. Never lift a ladle nor crucibles above waist height. Wear suitable personal protective equipment, ie, eye protection (to BS EN 166 9), heat-resistant gloves. Use only lead-free pewter. Do not use polyurethane in the lost-foam process. Only use polystyrene if efficient fume extraction is available. Obtain equipment only from reputable educational suppliers.

FURTHER INFORMATION

Several serious incidents occurred involving casting during the 1990s, resulting in serious injuries to staff and pupils but these all involved large-scale casting in school foundries. Low-temperature casting using lead-free pewter is much safer, although there have been instances of molten metal exploding from a wooden mould that is damp.

Centrifugal casting is used for making jewellery and it can be practised using lead-free pewter or white metal if silver is too expensive.

CLEAPSS holds a directory of suppliers of equipment for schools.

IMMEDIATE REMEDIAL MEASURES

If fumes are inhaled	In the event of dizziness occasioned by fume, remove the affected person to the fresh air until recovered. Seek medical advice if symptoms persist.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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4.032 COSHH & Man Regs	jewellery: soldering	Applicable to: Ronson blowtorch Taymar blowtorch Use of safety pickle	See also: 4.030, 4.031.

Process(es) covered: Small soldering jobs requiring a flame with a blowtorch attached to a small cartridge or to a gas bottle of butane.
Pickling to remove 'fire stain' after soldering when silversmithing.

Hazards

Explosion	Accumulations of butane (which is heavier than air) can explode. Cartridges, even when apparently empty, can explode if in a fire. Bricks other than firebricks can split explosively when hot enough.
Fire	The naked flame could ignite other flammable material.
Radiant heat	Infra-red radiation from hot surfaces, flames etc, can damage the cornea of the eye.
Burns	Users have been burned by their own blowtorch or by heat from the metal on which they have been working.
Corrosive	Sodium hydrogensulfate (bisulfate) (R34, 37), used in 'safety pickle' is corrosive, causing burns, and is irritating to the respiratory system.
Irritant	The blowtorch may produce nitrogen oxides that might cause irritation of the respiratory tract.

Risk Assessment

Explosion	Cartridges of gas bottles that leak in storage present a significant risk, as does inappropriate disposal of nearly-empty cartridges. The rate of heating is unlikely to be sufficient to cause bricks to explode.
Fire	The risk is small if work is done in a non-flammable environment.
Radiant heat	This is unlikely to be a problem with the temperatures involved in these operations.
Burns	Trainees are likely to have inadequate control of the size or direction of the flame while even experienced users may underestimate heat conduction through the workpiece. The burner will be too hot to separate from the cartridge after only a short period of use.
Corrosive	'Safety pickle' can be used safely if the supplier's instructions are followed closely.
Irritant	Burnt gases from the blowtorch are unlikely to cause any problem in well-ventilated areas.

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Control measures	
	Cartridges must be checked for leakage after use (eg, by painting with soapy water) and stored correctly. Only allow staff to attach the burner to the cartridge or gas bottle. Restrict the use of these portable blowtorches to responsible students of sufficient maturity to follow the instructions safely under adult supervision. Ensure that even small blowtorches are used only in areas free of flammable materials. Wear heat-resistant gloves for handling the work and for dismantling the blowtorch.
	Only allow staff to prepare pickling solutions. When staff are preparing, or students using, pickling baths, eye protection (at least to BS EN 166 3) must be worn. If a hot pickling bath has to be left running over night, ensure that it is in a safe location and has a suitable warning label attached. The caretaker should be informed. Ensure emergency eye-washing facilities are available in the room, eg a short length of soft clean rubber or plastic tubing that fits on the cold tap. Ensure the area is well-ventilated.

Disposal

Empty cartridges should be left outside (in a secure location) with the burner valve open to allow any remaining vapour to disperse; then the cartridge can be placed in the solid refuse. Gas bottles should be returned to the supplier for refilling.

Storage

Cartridges and gas bottles can be kept between use with the burner attached or removed, according to the maker's recommendations. They should not be kept in cupboards used for the storage of flammable substances. The location should be secure, well-ventilated, cool, away from flames, combustible materials and escape routes and, ideally, in a fire-resistant structure. Some employers may require gas bottles to be stored in a well-ventilated outside store room. For further details, see CLEAPSS guide L164 (or G164), *Portable Laboratory Gas Burners*.
Pickling baths should be stored in a ventilated, locked cupboard or, if kept on the bench, have a lid which is locked when not in use.

IMMEDIATE REMEDIAL MEASURES

Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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4.033 COSHH Regs	PHOTOGRAPHY: chemicals	Applicable to: developers, eg Agfa PDEV, Ilford Multigrade, or Microphen, Kodak Dektol; fixers, eg Ilford 2000RT; stop baths, eg, Ilfostop.	See also: 4.016; 4.034.

Process(es) covered:

Developing colour or black and white films or prints.
Fixing colour or black and white films or prints.
Stop baths used between developing and fixing.
Chemicals used for specialist treatments, eg, photoresists.

Hazards

Chemicals for use in photography are usually supplied as concentrates in solution in water, which are then diluted for use in the darkroom. Some may be supplied as powders or crystals. The concentrates and solids are often hazardous but the working solutions are usually so dilute as to be low hazard. This may not be true of more-specialist chemicals.

Toxic/Harmful/ Irritant

Developers are usually complex mixtures containing several components which are individually hazardous (irritant or harmful). At the concentration used in the concentrate the traditional mixture is classed as harmful or irritant mainly because of the presence of hydroquinone (R22, 40, 41, 43, 50, 68). Some developers contain diethanolamine (R22, 38, 41, 48/22), which is harmful or other hazardous products. *p*-phenylenediamine is toxic (R23/24/25, 36, 43). Newer developers may use sodium isoascorbate (low hazard). Other components, eg to adjust the acidity, may also be present; these are often irritant or harmful.

Depending on exactly what is present, developer concentrates may be irritating to eyes and may cause sensitisation by skin contact. They can be harmful in contact with skin or if swallowed. There may be limited evidence of a carcinogenic effect and possible risk of irreversible effects.

Photographic fixers are thiosulfates which are low hazard at all concentrations but some may contain other components to adjust the acidity which may be harmful or irritant in concentrated form.

Corrosive

Stop bath working solution contains acid so dilute as to be low hazard. However, it may be made by diluting concentrated ('glacial') acetic (ethanoic) acid (R10, 35), which is corrosive, or by dissolving citric acid crystals (R36), which are irritant.

Developing photoresists and finally removing them often requires the use of solutions of sodium hydroxide (caustic soda) (R35), which may be corrosive at the concentration used.

Very toxic
Explosive

Ammonium dichromate (bichromate) (R2, 8, 21, 25, 26, 34, 42/43, 45, 46, 48/23,50/53, 60, 61) (sometimes used with gum arabic or in photo-silk screen printing or in cyanotype processes) is very toxic, may cause cancer and is explosive.

Risk Assessment

Toxic
Harmful
Irritant
Corrosive

Handling the developer (or stop bath) concentrate or powder presents a greater risk than handling the working solution. There is some risk of injury from splashes of the concentrate. Particular care needs to be taken to avoid inhaling the dust if using a powder. Staff (ie, teachers, technicians and TAs) are likely to be at greater risk than students, who will usually only handle the diluted solutions.

Skin contact with the solutions would present less risk but should still be avoided.

Very toxic
Explosive

There would be significant risks through inappropriate or untrained handling of ammonium dichromate.

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Control measures	
	Wear eye protection when handling the concentrate or solids; if using corrosives, ensure the eye protection complies with BS EN 166 3. Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap. Where practicable, dilute concentrates or dissolve powders to make working solutions outside the darkroom, but do not carry bottles through crowded corridors. Where possible, use special bottle carriers (which you may be able to borrow from the science department). Use tongs and/or protective gloves (preferably disposable nitrile gloves, as latex allergy is increasingly common) particularly when processing prints in trays. Do not use ammonium dichromate or *p*-phenylenediamine in school artwork.
	Wash hands at once if a photographic chemical is splashed on the skin and always after using such chemicals. Do not allow eating, drinking or the application of cosmetics in darkrooms.

Disposal	
Small volume of used solutions	Spent developer and stop bath are low hazard solutions and can be poured down the drain, but in case they are not fully spent it is best to mix first with ten times the volume of water. Spent fixer will contain significant amounts of silver as a stable thiosulfate complex ion. It can be poured down the drain, mixed with ten times its volume of water (where it will be converted to insoluble silver sulfide at the sewage works). However, if facilities exist it may be worthwhile trying to recover the silver (talk to the Science Department or contact the CLEAPSS Helpline).
Large volume of used solutions	Colleges offering specialist photographic courses and other establishments where significant volumes of photographic waste are produced should consider silver recovery and should enquire of their local water authority whether a Trade Effluent Permit is required or make use of a licensed waste contractor.
Unused concentrates or powders	Unused concentrates or powders, which are surplus to requirements, would need much more dilution so it is best to make use of a licensed waste contractor. This is essential for ammonium dichromate. Science departments will have a list of possible licensed waste contractors on the CLEAPSS Science Publications CD-ROM or on the password-protected part of the CLEAPSS web site, under Secondary / Science / Guidance Leaflets - (or GL5) Waste Disposal Contractors.
Storage	Store concentrates and powders securely in tightly closed, labelled containers.

FURTHER INFORMATION

Photographic developers, even working solutions, are likely to stain clothing.

IMMEDIATE REMEDIAL MEASURES

If photographic chemicals are swallowed	Give plenty of water and seek medical attention. DO NOT INDUCE VOMITING.
If photographic chemicals are splashed into the eyes	Wash thoroughly for at least ten minutes with water, holding the eyelids apart. Seek medical attention if irritation persists.
If photographic chemicals are splashed onto the skin or clothing	Remove contaminated clothing. Wash affected area thoroughly with a large amount of water. Soak clothing and rinse repeatedly.

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4.034 COSHH & Man Regs	PHOTOGRAPHY: DARKROOMS	Applicable to:	See also: 4.017, 4.033

Process(es) covered: Working in a darkened room (often with subdued red light).
Processes include developing and printing or enlarging colour and black and white films and papers.

Hazards

Exposure to fumes	Fumes from the processing chemicals used may be hazardous. Mercury thermometers, if broken, release mercury which produces a toxic vapour and has cumulative effects.
Slipping	Water and solutions spilled on the floor can make it slippery.
Tripping	Trailing cables and other objects on the floor can present a trip hazard.
Electric shock	The proximity of water and electricity can present an electric shock hazard.
False accusation	Especially in a small, darkened room, teachers and other adults may be maliciously or erroneously accused of improper conduct or unprofessional behaviour by pupils.

Risk Assessment

Exposure to fumes	A darkroom often has a small volume hence fumes may build up, especially as, in order to make it light tight, it may also be almost airtight. Thermometers are particularly likely to be broken if used as stirrers or if rolling around on the bench.
Slipping	Because of the low light levels, patches of water etc may not be visible to users.
Tripping	Because of the low light levels, trailing cables and other objects may not be visible to users.
Electric shock	Because of the low light levels, the presence of water and electricity close to each other may not be obvious to users.
False accusation	False accusation is more likely to occur if an adult is alone in the darkroom with a child.

Control measures

Ensure the darkroom has air extraction; 10 air changes per hour are recommended.
Use spirit thermometers, not mercury thermometers, and do not use them as stirring rods. (Note, however, that spirit thermometers require immersion to the specified depth if readings are to be as accurate as possible)
Mop up spills promptly; ensure a supply of paper towels to facilitate this.

Check that the floors are clear before starting work.

Keep water and mains electricity as far apart as possible; organise the room into wet and dry areas.
Use paper towels to keep hands dry; have a plentiful supply easily available.
Use pull-cord switches rather than surface-mounted switches.
Ensure that teachers and other adults are never in a darkroom with less than three pupils.

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FURTHER INFORMATION

All darkrooms need a light-insulated extractor fan.
The entrance to a darkroom will need a light trap of some form. Revolving barrel-type door entrances are suitable, but will need an emergency push-out panel.

RESTRICTIONS

Students will often be working without direct supervision in darkrooms. Even so, a teacher should be within earshot, should know which students are working there and should be satisfied that they have the experience, training and maturity to allow them to work with only limited supervision.

IMMEDIATE REMEDIAL MEASURES

If fumes are inhaled	Remove casualty to fresh air. If discomfort persists, seek medical attention.
Impact injury resulting from a slip or trip	Rest the injured part; apply ice to reduce the bruising and pain; attention from a first-aider is required.
Electric shock	Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check the airways are clear and begin artificial ventilation. Send for an ambulance. If the first-aider does not arrive quickly and the pulse is absent, consider carrying out cardio-pulmonary resuscitation.

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4.035 Man Regs	USE OF ICT & audiovisual equipment	Applicable to: computers; data projectors; overhead projectors; laser pointers; visualisers; interactive whiteboards.	See also:

Process(es) covered: Working at personal computers and laptops.
Video-editing, image manipulation and developing presentations.
Delivering presentations using data projectors, visualisers, overhead projectors, interactive whiteboards, etc.

Hazards

Electric shock	The mains cords may be subject to wear and tear, leading to a shock hazard.
Tripping	Trailing cables can present a trip hazard.
Eye damage	The very bright light of some data projectors could cause eye damage. Laser pointers have sometimes been misused, eg directly shone into people's eyes.
Health problems	Use of computer screens (visual display units, VDUs) for periods of time can lead to upper limb disorders (pains in the neck, arms, hands, etc - repetitive strain injury, RSI), back ache, fatigue, temporary eye strain and headaches.

Risk Assessment

Electric shock	Properly maintained electrical equipment should present minimal risk.
Eye damage	There is no risk in viewing an image on a computer or wall-mounted screen. There could be a very small risk in staring directly into a data projector for a length of time but a casual glance presents no risk, although there may be some projector dazzle. Whilst there may be some initial dazzle, there is no evidence that misuse of laser pointers has caused permanent problems.
Health problems	It is very unlikely in a school context that either teaching staff or pupils would be using VDUs for sufficiently long periods of time (more or less continuously for an hour on most days) for any health problems to develop. Nevertheless, as pupils may go on to further study or employment where this could arise, it is important to develop good habits.

Control measures

Inspect electrical appliances visually for wear to the power cord every time they are taken out for use.
Do not stare directly into the beam of a data projector.
Do not stand facing into the beam of a data projector.
Use a stick or laser pointer to avoid the need for the user to enter the beam.
Supervise pupils when they are asked to point out something on the screen.
Try to ensure that projectors are located out of the sight line from the screen to the audience, eg, by ceiling mounting rather than floor or table mounting.

When working at a VDU, where possible, provide adjustable seating and train users in adopting a suitable posture (see below).
Locate screens so that they are free from glare and ensure screen size and colour is suitable for the task in hand.
Ensure users take a break of 10 minutes every hour; encourage physical exercise during the breaks. Help the eyes relax by gazing outdoors at a distant object from time to time.

Use of ICT & Audio-visual Equipment (Continued)

RESTRICTIONS

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Disposal	Broken and/or surplus electrical goods are subject to the *Waste Electrical and Electronic Equipment Regulations* 2006 (the *WEEE Regulations*). These cannot be put in the ordinary refuse collection. Most schools will have in place arrangements for the disposal of old computers, TV sets, kettles, refrigerators, etc.

FURTHER INFORMATION

The use of VDUs is governed by the *Health and Safety (Display Screen Equipment) Regulations* 1992, as amended. However, most teachers and pupils will not be covered by the Regulations as they do not "habitually use display screen equipment as a significant part of their normal work". Even so, it would be good practice to follow as much of the guidance as possible. See *The law on VDUs. An easy guide.* HSE Books, 2003, ISBN 0 7176 2602 4.

Adjust the seat height to achieve:	**When seated:**
• Elbow level with the top of the keyboard. • Upper arm vertical or slightly forward. • Fingertips just above the home row of the keyboard. • Forearm and hands horizontal. • Elbow with right-angle bends. • Elbows tucked in at the sides.	• Sit back in the chair. • The spine should be curved at the back. • Adjust the backrest height to support the small of the back. • Sit erect, or lean slightly back, letting the backrest support some of the weight. • Sit with thighs horizontal, not letting them support the weight of the body. • The lower legs should be vertical. • The knee joint should have a right-angle bend. • Feet flat on the floor or on a foot-rest.
Adjust the screen and keyboard to achieve:	**Arrange any documents such that:**
• Keyboard and screen directly in front, not to one side. • Top of the screen just below eye level. • Viewing distance between 45 and 75 cm. • Keyboard 10 cm back from front edge of desk and parallel to it.	• Paperwork is in a document holder alongside or below the screen. • Users avoid continually twisting the back or neck to read documents.

IMMEDIATE REMEDIAL MEASURES

Electric shock	Send for a first aider immediately. Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a first aider does not arrive quickly and the pulse is absent then consider carrying out cardio-pulmonary resuscitation.

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4.036 COSHH & Man Regs	# ARTISTS IN RESIDENCE & OTHER VISITORS	Applicable to: Professional artists working in schools on a one-off or temporary basis	See also:

Process(es) covered: Giving studio space to an artist in residence who may work with groups of children. Inviting artists and others into the school to give occasional talks, lectures or demonstrations.

Hazards

Process hazards — Visitors may wish to demonstrate or encourage children to use techniques which are not part of the normal curriculum, thereby introducing hazards with which the school is unfamiliar and has no risk assessments available.

Child abuse — Child abuse is a slight possibility.

False accusation — Visitors, especially those unaccustomed to working with children, may be maliciously or erroneously accused of improper conduct or unprofessional behaviour by pupils.

Risk Assessment

Process hazards — Visitors may overestimate the skills and competence of children or may not realise the lack of facilities in, or other limitations of, the studio in which they are working.

Child abuse — The risk of child abuse can be reduced greatly by adoption of the proper procedures.

False accusation — False accusation is most likely to occur if an adult is alone with a child, especially of the opposite sex. Visitors may not be as vigilant at avoiding this risk as experienced teachers would be.

Control measures

Ensure that the visitor understands that work cannot proceed until there has been a suitable risk assessment.

Check whether guidance on unfamiliar processes is covered elsewhere in this collection of model risk assessments. Consider whether the school can adopt the relevant control measures and whether the risk assessment needs to be modified given the school's inexperience in this process.

Ensure that anyone working with children on a regular basis has had a satisfactory DBS (previously CRB) check. Occasional visitors, eg giving a lecture once a month, do not require a DBS check but should not be left alone with children.

Visiting artists etc should be warned not to allow themselves to be alone with a child.

FURTHER INFORMATION

Government guidance on DBS checks and related matters can be found in *Guidance: Safeguarding children and safer recruitment in education on teachernet at www.teachernet.gov.uk.*

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4.037 Man Regs	OFF-SITE VISITS	Applicable to: Creating art off the school site, visits	See also:

Process(es) covered:	Visits to art galleries, museums, exhibitions, studios of professional artists and similar locations. Visits off the school site in order to create works of art in a different environment, eg sketching or photographing street scenes, buildings, landscapes.
Hazards	
Site-specific hazards	Sites which regularly welcome the public, eg museums and art galleries, will have identified any hazards. This may not be true, or may not have been done as reliably, for the studios of professional artists. Working outdoors, eg on the street or in the countryside, will introduce hazards specific to the location, eg traffic, drowning, falls from a height, slips and trips, animal-borne infections.
Transport hazards	Walking to the site may result in exposure to traffic hazards. Public transport, hired coaches, the school minibus or private cars introduce a variety of different hazards.
Child disappearance and/or abuse	Children in unfamiliar settings may wander off. If children are in contact with members of the public, there is a small possibility of child abuse.
Risk Assessment	
Site-specific hazards	The risks at sites regularly open to the public should be minimal. There may be more significant risks at studios which are not normally open to the public. Risks at street locations will depend on the amount and type of traffic, etc but children may become so engrossed in their work that they are less vigilant than they would normally be in the street. Risks in the countryside will depend on the nature of the terrain and the type of environment. The presence of children with special educational needs may increase the risks.
Transport hazards	Risks can be minimised by following nationally-available guidance and/or the employer's requirements for off-site visits.
Child disappearance and/or abuse	Risks are minimal with adequate supervision and clear procedures.
Control measures	Ensure that there are a sufficient number of adult supervisors to comply with the employer's minimum requirements, bearing in mind any children with special educational needs. For sites regularly open to the public, follow the risk assessments of the site, having first checked their suitability. For all other sites, make a prior visit to identify the hazards, assess the likely risks and select appropriate control measures. Book any coaches from reputable companies. Follow nationally-available guidance and/or the employer's requirements for transport for off-site visits. Take care not to allow children to wander off unsupervised.

FURTHER INFORMATION

Guidance on risk management and related matters when learning outside the classroom is available from Local Authorities and the Government:
(https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/338498/SCE_Outdoor_Ed_Policy_Guidance_Procedures.pdf)

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4.038 COSHH & Man Regs	projects, testing, experimental & novel activities & materials	Applicable to:	See also: 4.009, 4.010

Process(es) covered: Almost unlimited. CLEAPSS has encountered examples including working at a height when making and fixing mobiles, photography using a blueprint process, sketching decaying fruit, dead fish and other animals, unusual reagents to fix dyes in textiles work.

Hazards

It is in the nature of projects, testing, experimental and novel activities that Safety Data Sheets may be unavailable or irrelevant and the hazards of the materials and risks from the activities may be unknown, not fully known or unexpected. Proposals by students to use experimental materials or techniques, where hazards may not be well known, may require teachers to curb such projects.

This sheet does NOT constitute a Model Risk Assessment.
The examples of hazards, risk assessments and control measures are illustrative, not exhaustive.

Toxic, harmful, corrosive, irritant	Using unusual chemicals can introduce unfamiliar hazards.
Falls	Working on murals or fixing sculptures or mobiles at a height could result in falls.
Burns and/or entrapment	Plaster of Paris and some monomers (when they polymerise to form a plastic) become hot and can set hard, adhering to or trapping body parts.
Allergy	Bread, fruit and similar items if allowed to go mouldy will produce spores to which some people are allergic.
Infection	Microbes on dead animals, or parts of animals, used as models or as part of a work of art could result in ill-health.
Fumes	Substances not normally intended for use in art and design work may give off hazardous fumes. Heating unusual materials or in unusual contexts (eg, attempting to melt metals in a pottery kiln, heating MDF with a hot-air gun, testing fire-proofed textiles and other materials for possible use for lampshades) can produce hazardous fumes.

Risk Assessment

Toxic, harmful, corrosive, irritant	There is a significant risk of being exposed inadvertently to unfamiliar chemical hazards.
Falls	Use of step ladders or kick stools is safer than standing on chairs, etc.
Burns and/or entrapment	It would be dangerous to place any body part in a setting material.
Allergy	Inhalation of spores needs to be prevented.
Infection	Unless steps are taken to prevent this (by preserving them) dead animals will rot rapidly, causing unpleasant odours and becoming a serious health risk.
Fumes	The only safe assumption is that fumes from unknown or unusual sources may be hazardous.

Control measures

If in doubt, consult the CLEAPSS Helpline via the website or phone 01895 251496.

- Especially for unusual materials, consult the supplier's Safety Data Sheet.
- Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap.
- Do not stand on chairs, etc. Ensure step ladders are used in accordance with the manufacturer's instructions.
- Warn students about the risks of burns or entrapment from setting materials.
- If bread, fruit, etc shows any signs of going mouldy, enclose it (eg in a sealed plastic bag) to prevent release of spores.
- Avoid art work which involves using dead animals or animal parts unless they are preserved.
- Always carry out a first test on a very small scale, adopting full precautions.

Projects, Testing, Experimental & Novel Activities & Materials (Continued)

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RESTRICTIONS

Disposal	Most waste materials can be disposed of in the refuse collection, but any sharp edges should protected first. Hazardous materials (and anything unknown or unlabelled must be treated as such) are subject to the *Hazardous Waste Regulations.* Schools and colleges must check that any waste disposal contractor whom they use has a licence (or is exempt) (see PS5 (or GL5) *Waste Disposal Contractors*). Scrap electrical goods are subject to the *Waste Electrical and Electronic Equipment Regulations* 2006 (the *WEEE Regulations*). These cannot be put in the ordinary refuse collection. Most schools will have in place arrangements for the disposal of old computers, TV sets, kettles, refrigerators, etc.
Storage	Store materials in a tidy and accessible manner. Avoid high level storage for heavy or fragile materials and where high level storage is used a step ladder or similar should be easily available. Do not allow stored materials to obstruct circulation space or working areas. Protect any sharp edges.

FURTHER INFORMATION

For further help, consult the CLEAPSS Helpline via the website or phone 01895 251496

IMMEDIATE REMEDIAL MEASURES

Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.
Crushing injuries (casualty crushed for more than 15 minutes)	DO NOT RELEASE THE CASUALTY. Send for an ambulance, giving details of the incident. Comfort and reassure the casualty until help arrives.
Crushing injuries (casualty crushed for less than 15 minutes)	Release the casualty as quickly as possible. Control any external bleeding and cover wounds. Send for the first aider who will secure and support any suspected fractures, examine and observe the casualty for signs of shock and treat accordingly.
Impact injury	Rest the injured part; apply ice to reduce the bruising and pain; attention from a trained first aider is required.
Burns to the skin	Cool the affected area under a running cold tap for ten minutes.
Serious burns to the skin	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches that might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.
If fumes are inhaled	In the event of dizziness occasioned by fume, remove the affected person to the fresh air until recovered. Seek medical attention if symptoms persist.
If dust gets in the eyes	Wash thoroughly for at least ten minutes with water to prevent scratching of the eye. Seek medical attention if irritation persists.
Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, then the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Severe cuts	Lower the casualty to the floor. Raise the wound as high as possible. If feasible, ask the casualty to apply pressure on or as close to the cut as possible, using fingers, a pad of cloth or, better, a sterile dressing (adding further layers as necessary). If the casualty is unable to do so, apply pressure yourself, protecting your skin and clothes from contamination by blood if possible. Leave any embedded large bodies and press around them. Send for a first aider.

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MODEL RISK ASSESSMENTS

IN SECONDARY SCHOOLS AND COLLEGES

Part 5
Model Risk Assessments for use in Construction Courses

5.001 ADHESIVES: ACRYLIC CEMENT AND PIPE SEALANTS
5.002 ADHESIVES: REACTIVE RESINS, EPOXY, POLYESTER
5.003 ADHESIVES: REACTIVE RESINS, FORMALDEHYDE
5.004 ADHESIVES: SOLVENT-BASED
5.005 ADHESIVES: WATER-BASED, PVA, RUBBER LATEX, WALLPAPER ADHESIVE
5.006 BUILDING CRAFTS: BRICK AND BLOCK WORK
5.007 BUILDING CRAFTS: USE OF CEMENT AND LIME MORTAR AND CONCRETE
5.008 BUILDING CRAFTS: USING LINTELS
5.009 BUILDING CRAFTS: CONCRETE (CEMENT) MIXERS
5.010 BUILDING CRAFTS: PLASTER AND PLASTERBOARD
5.011 BUILDING CRAFTS: GLAZING
5.012 BUILDING CRAFTS: WALL AND FLOOR TILING
5.013 BUILDING CRAFTS: CUTTING COMPLIANT MATERIALS
5.014 BUILDING CRAFTS: USING HAND TOOLS
5.015 BUILDING CRAFTS: USING LASER SPIRIT LEVELS
5.016 HEAT PROCESSES: BLOWTORCHES (BUTANE &/OR PROPANE)
5.017 HEAT PROCESSES: SOFT SOLDERING, FUMES AND FLUXES
5.018 METAL WORKING: CUTTING AND SHAPING METAL USING HAND TOOLS
5.019 METAL WORKING: USING LEAD
5.020 PAINTING AND DECORATING: PAINTING
5.021 PAINTING AND DECORATING: BRUSH CLEANING
5.022 PAINTING AND DECORATING: SURFACE PREPARATION BY SANDING
5.023 PAINTING AND DECORATING: SURFACE PREPARATION USING CHEMICAL STRIPPERS
5.024 PAINTING AND DECORATING: SURFACE PREPARATION USING HEAT PROCESSES
5.025 PAINTING AND DECORATING: PAPER-HANGING
5.026 PLASTICS: HAZARDS OF MATERIALS
5.027 PLASTICS: ABRADING, TRIMMING, DRILLING & SHAPING EQUIPMENT
5.028 PLASTICS: MACHINE ABRADING - FUMES AND DUST
5.029 PORTABLE POWER TOOLS: ANGLE GRINDERS AND ABRASIVE WHEEL CUTTERS
5.030 PORTABLE POWER TOOLS: BISCUIT CUTTERS
5.031 PORTABLE POWER TOOLS: DRILLS
5.032 PORTABLE POWER TOOLS: PLANING MACHINES
5.033 PORTABLE POWER TOOLS: ROUTERS
5.034 PORTABLE POWER TOOLS: SANDERS
5.035 PORTABLE POWER TOOLS: CIRCULAR SAWS, JIG SAWS
5.036 WOOD WORKING: USING SHARP EDGED HAND TOOLS
5.037 WOOD WORKING: WOOD CUTTING USING HAND SAWS
5.038 WOOD-WORKING: MORTISING MACHINES
5.039 WOOD-WORKING: PLANING AND THICKNESSING MACHINES
5.040 WOOD-WORKING: DISC, BELT AND BOBBIN SANDERS
5.041 WOOD-WORKING: BAND SAWS

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5.042 WOOD-WORKING: CIRCULAR SAWS, VERTICAL PANEL SAWS
5.043 WOOD WORKING: BENCH-MOUNTED JIG SAWS, SCROLL SAWS AND FRET SAWS
5.044 WOOD-WORKING: CROSS CUT, MITRE, RADIAL ARM AND CHOP SAWS
5.045 WOOD-WORKING: WOOD TURNING LATHE
5.046 WORKING PRACTICES: CONTROL OF DUST
5.047 WORKING PRACTICES: MANUAL HANDLING
5.048 WORKING PRACTICES: WORKING AT HEIGHT
5.049 WORKING PRACTICES: ELECTRICAL WORK
5.050 WORKING PRACTICES: MINOR DEMOLITION
5.051 WORKING PRACTICES: WORK EXPERIENCE ON, OR VISITS TO,CONSTRUCTION SITES

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5.001 COSHH Regs	Adhesives: Acrylic cement and PIPE SEALANTS	Applicable to: acrylic cements, eg, Tensol 12 or Tensol 70 and pipe sealants, eg, No Nonsense 'Liquid PTFE'.	See also: 5.002, 5.003, 5.004, 5.005

Process(es) covered:	Spreading cement on joint surfaces; pouring from a large stock container to smaller ones. Sealing metal joints in plumbing. 'Liquid PTFE' does not contain PTFE; it is a flexible setting sealant used in plumbing on metal threads as an alternative to PTFE tape. Formulations vary but some contain methacrylates, acrylic acid and organic peroxides.
Hazards	
Toxic	Hydroxypropylmethacrylate (R23/24/25) used in 'Liquid PTFE' is toxic by inhalation, in contact with skin and if swallowed.
Corrosive	Acrylic acid and organic peroxides used in 'Liquid PTFE' are corrosive (R34).
Harmful	Hazardous by inhalation (may cause drowsiness), through the skin and by swallowing. Both methylene chloride (R40 Sk) and trichloroethylene (R45, 67 Carc Sk) can have irreversible effects.
Irritant	Trichloroethylene (R36/38 Sk), laurylmethacrylate, hydroxyethylmethacrylate (R36/37/38), methyl methacrylate (R37/38) are irritating to the skin, eyes and respiratory tract. The last two are skin sensitisers (R43).
(Highly) flammable	If a highly flammable solvent (R11) is used, flammable or explosive vapour-air mixtures may form. Thermal decomposition will evolve toxic and flammable vapours. Acrylic acid and organic peroxides used in Liquid PTFE are flammable (R10).
Risk Assessment	
Toxic	Hydroxypropylmethacrylate used in Liquid PTFE: WEL: 0.5 ppm (8 h TWA)[106] is unlikely to present a problem if other risks are adequately controlled.
Corrosive	The concentration of acrylic acid and organic peroxides used in Liquid PTFE are usually low and unlikely to present a problem if other risks are adequately controlled.
Harmful	Methylene chloride (dichloromethane): WEL is 100 ppm (8 h TWA)[1] or 300 ppm (15 min ref period), trichloroethylene (trichloroethene): WEL is 100 ppm (8 h TWA) or 150 ppm (15 min ref period). In school activities, the 8 h hazard levels will be reached only in the event of a major spill or use in a small, unventilated room or in a confined space, eg joining pipes under sinks. The 15 minute hazard levels will not normally be exceeded if the total area of exposed adhesive is less than 500 cm^2 but might be exceeded in a confined space, eg joining pipes under sinks.
Irritant	Methyl methacrylate monomer is an irritant liquid which has a WEL of 50 ppm (8 h TWA) or 100 ppm (15 min ref period)[1]. It may act as a sensitiser at much lower concentrations and the level should be kept as low as possible. Splashes on the skin have produced sensitisation. Adhesive splashes must be kept out of eyes and off sensitive skin.
Highly flammable	Vapour from some solvents could be ignited by flames or hot metal surfaces.

106 EH 40/2005.

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Control measures	
	Open and use containers only in well-ventilated areas so that local exhaust ventilation is not normally required. If ventilation is poor, eg in confined spaces, use the Tensol 70 kit to minimise the release of fumes. Provide local exhaust ventilation if the total area of exposed adhesive might exceed 500 cm^2, use by an open window may be required. This would not be necessary for the small amounts of Liquid PTFE normally used. Wear eye protection. Gloves are advisable for sensitive skin.
	The work must be at least 1m from sources of ignition. This includes pilot flames on heat treatment equipment.
Disposal	Small amounts of adhesive that have become solid (or too viscous to be used) may be left in the tin and added to the solid waste. Large tins should be taken to a domestic recycling or disposal site. Cement that is still liquid is subject to the *Hazardous Waste Regulations.* It should be collected for proper disposal. Schools and colleges must check that any waste disposal contractor whom they use has a licence (or is exempt) (see PS5 (or GL5) *Waste Disposal Contractors*).
Storage	Keep containers tightly closed in a cool, dry, well-ventilated place where there should be no smoking.

IMMEDIATE REMEDIAL MEASURES

Adhesive is swallowed	The swallowing of small splashes is unlikely to cause any adverse effects. Large doses may produce internal irritation, nausea, vomiting or diarrhoea and may lead to drowsiness and unconsciousness. DO NOT INDUCE VOMITING. Provided the casualty is conscious, wash out mouth with water. Obtain medical attention.
Fumes are inhaled	Remove from exposure. Keep warm and at rest. Obtain medical attention.
Adhesive is splashed into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
In case of fire	If the cement is ignited, evacuation of the area should take place as thermal decomposition may evolve phosgene. The fire service should be summoned.
Effects on the skin	Repeated and prolonged contact with the skin may cause removal of natural greases, resulting in dryness, cracking and possible dermatitis. Wash with mild antiseptic and apply moisturising cream.
Adhesive is spilt in workshop	Ensure suitable personal protection during removal of the spill. Contain the spill with sand, earth or any suitable absorbent. Transfer to a container for disposal.

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5.002 COSHH Regs	Adhesives: Reactive resins, Epoxy, Polyester	Applicable to: Araldite; Bondaglass; Bostik Epoxy; Permabond; Plastic Padding; UHU Plus; etc	See also: 5.001, 5.003, 5.004, 5.005

Process(es) covered:

This wide range of epoxy adhesives and polyester resins is produced mostly as two-component systems. Curing is effected by the reactions of a resin and a hardener. Epoxy resins are used for the bonding of metals, ceramics, glass, rubber, plastics, wood, etc. Polyester resin has useful applications where glass fibre is involved and for bonding ceramics, some metals and rubbers.
In construction courses, epoxy adhesives are most likely to be used in small scale repair work.

Hazards

Irritant

Sensitisation of the skin and eyes may occur by contact with uncured material (liquid or solid) or exposure to its vapour or dust. May also cause contact dermatitis.
Irritation to the eyes, nose, throat and lungs by dust from the machining or abrading of fully-cured material.

Highly flammable

Certain epoxy materials give off highly flammable vapours

Risk Assessment

Irritant

Because of the limited use and the small quantities involved in school workshop operations, these hazards do not represent a risk to health.

Highly flammable

In school workshops, where the total area of application at one time does not exceed 0.25 m^2, this risk is small.

Control measures

No special measures are required; ordinary ventilation is sufficient

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Disposal	For small quantities, mix the resin and hardener, allow to cure and place in a plastic bag in the waste. Large quantities should be collected for proper disposal. Schools and colleges must check that any waste disposal contractor whom they use has a licence (or is exempt) (see PS5 (or GL5) *Waste Disposal Contractors*).
Storage	In a cool, dry place away from food and food containers.

FURTHER INFORMATION

The catalysts in the hardeners now used in these products are less hazardous than the dibenzoyl peroxide originally used.

IMMEDIATE REMEDIAL MEASURES

Swallowed	Immediately rinse the mouth with water. Drink plenty of water and seek medical attention promptly.
Vapour is inhaled	Take the casualty to fresh air and make her/him rest whilst medical attention is sought.
In the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
On the skin	Immediately remove by wiping with a disposable paper towel. Then cleanse the affected area with resin-removing cream[107], followed by washing with warm, soapy water. Do not use solvents.
Spilt in the workshop	Take up spilt resin with sand, cotton waste, sawdust, paper towel or other absorbent material. This should then be placed in a plastic bag and sealed prior to disposal. The area should then be washed with hot water and detergent. Spills of hardener (catalyst) should **not** be absorbed on sawdust or other flammable material. Mineral-based cat litter is suitable.

[107] Various suppliers of resins can supply barrier cream and cleansing cream.

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5.003 COSHH Regs	Adhesives: Reactive resins, Formaldehyde	Applicable to: Cascamite; Aerodux 185; Aerolite 300/306; Cascophen; RS216M; etc	See also: 5.001, 5.002, 5.004, 5.005

Process(es) covered: These adhesives are essentially a resin bonding agent (liquid or powder) which sets as a result of chemical action with a hardener. A catalyst may be added to accelerate setting at room temperature.
In construction courses, reactive resin formaldehyde adhesives are most likely to be used in woodworking applications where a waterproof adhesive is required.

Hazards	
Toxic	Fumes of methanal (formaldehyde) (R23/24/25) and other organic vapours are toxic.
Dust	Unmixed powder is hazardous by inhalation.
Irritant	All components are potentially irritant to skin and eyes
Highly flammable	Some liquid resin components are highly flammable
Sensitiser	Methanal (formaldehyde) (R43) is a recognized skin sensitiser.
Risk Assessment	
Toxic	Methanal fumes are given off during curing. The WEL is 2 ppm (both 8 h TWA and 15 min ref period)[108]. This will not be reached with the small joints made in school workshops. Some resin components are a complex mixture of hydrocarbons having heavier-than-air vapours that are harmful by inhalation. On the scale of use in school workshops, both fumes and vapours will be adequately removed away by good natural ventilation.
Dust	Urea formaldehyde powder is subject to the general dust limit: a WEL of 10 mg/m^3 (8 h TWA)[1]. However, unless more than a litre of adhesive is prepared at once, this limit will not be reached.
Irritant	Prolonged contact with skin may cause dermatitis so, if these adhesives are used frequently, gloves should be worn.
Highly flammable	For example, Cascophen contains ethanol and methanol but the levels produced in the school workshop will not present a problem.
Sensitiser	There is a small risk of sensitisation.

[108] EH 40/2005.

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Control measures	Manufacturer's advice must be strictly followed. All work areas must have good natural ventilation. Care must be taken to avoid raising dust during mixing, which is best done by teachers or technicians. Gloves should be worn or a barrier cream should be applied. The skin should be thoroughly washed with soap and warm water after using the adhesive and before eating, drinking or using the toilet. All containers should be closed when not in use to minimise evaporation or spilling.

Disposal	Small quantities can be added to solid refuse.
Storage	Store in a cool, dry place with the containers tightly closed and away from sources of ignition. Guidance from the HSE allows up to a maximum of 50 litres of highly flammable liquids to be held in any one workroom in a highly flammable liquids cupboard or bin. Although up to half a dozen containers which are 'in use', each less than 500 ml, could be kept on the open shelf outside such a cupboard or bin, this is much less secure and it is much better to have a small lockable flammables cupboard in each work area where containers in use can be stored.

FURTHER INFORMATION

These adhesives are particularly valuable for bonding wood and produce an exceptionally strong, waterproof joint.

The vapours from some resins may cause nausea, headache and dizziness.

NB Methanal (formaldehyde) is **not** considered to be a human carcinogen, although it is listed as a 'carcinogen category 3', which means there is some evidence that it can cause a cancer in animals when administered at high concentration.

IMMEDIATE REMEDIAL MEASURES

Swallowed	DO NOT INDUCE VOMITING. Seek medical attention.
Vapour is inhaled	The casualty should be taken to fresh air and, if unconscious, turned on face. If breathing is irregular or has stopped, administer artificial resuscitation while medical attention is sought.
In the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
On the skin	Remove excess with hand cleaner, followed by washing with soap and water. Do not use solvents.
Spilt in the workshop	The powder should be collected with an industrial vacuum cleaner to keep the dust to a minimum. Liquid resin should be contained and soaked up by an absorbent, non-flammable material (dry earth or sand). Do not allow to enter drains. Exclude sources of ignition and ventilate the area.

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5.004 COSHH Regs	ADHESIVES: SOLVENT-BASED, CELLULOSICS, POLYMER CEMENTS, RUBBER SOLUTION, solvent-welding adhesives	Applicable to: Bostik No 1; Thixofix; Evostik 528; Britfix PVC; Plastic Weld; Polystyrene & Balsa cements; Floplast solvent cement for pvc	See also: 5.001, 5.002, 5.003, 5.005

Process(es) covered:

The adhesive is applied to both surfaces to be bonded, the solvent allowed to evaporate and the surfaces then joined. The solvents are usually highly flammable (hydrocarbons, esters or ketones) but are sometimes non-flammable chlorinated hydrocarbons.
Cements used with polymers such as ABS and polystyrene are often just mixtures of solvents that are drawn into the joint by capillary action.
Solvent-welding plastic pipes.

Hazards

Harmful

Some are hazardous by inhalation (eg, cyclohexanone, R20) through the skin and by swallowing and may cause drowsiness. Trichloroethylene (R45, 67 Carc Sk) can have irreversible effects. Toluene (R48/20, 63, 65) vapour can lead to nausea, headaches, dizziness and, eventually, to unconsciousness.

Irritant

Some, eg, toluene (R38) are irritant to skin and eyes eg propanone (R36). Methylethylketone is irritating to eyes, repeated exposure may cause skin dryness or Cracking and vapours may cause drowsiness and dizziness (R36, 66, 67). Tetrahydrofuran is irritating to eyes and respiratory system (R36/37).

Highly flammable

Some use highly flammable, volatile solvents (R11) such as toluene, propanone (acetone) and petroleum spirit. Tetrahydrofuran is highly flammable and may form explosive peroxides (R11, 19).

Risk Assessment

Harmful

In use, these adhesives give off a vapour that is heavier than air (eg, toluene, WEL 50 ppm, 8 h TWA[109]; 100 ppm, 15 min ref period). Trichloroethylene has a WEL of 100 ppm, 8 h TWA, 150 ppm, 15 min ref period. In a school workshop, good natural ventilation will be adequate, but these adhesives should not be used in confined spaces. Where total areas greater than 300 mm × 300 mm are being bonded, this work must be done under cover outside or with local exhaust ventilation. When solvent welding plastic pipes, exposed areas are normally much smaller than these figures although the work may be done in confined spaces

Irritant

Avoid prolonged contact. The cements in tubes are quick drying and can block the tube nozzle; when pressure is applied to clear the blockage, spurting can occur.

Highly flammable

There is a considerable risk of ignition during the drying period, particularly with those classified as petroleum mixtures.

109 EH 40/2005.

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Control measures	
	Ensure good ventilation during application and drying to prevent the inhalation of solvent vapours. Replace the top on any adhesive container as soon as possible. Avoid solvent welding of plastic pipes in confined spaces unless the area of exposed solvent is very small. Where avoidance is not possible, use alternative methods such as compression joints. Wear eye protection when using adhesives from tubes or adhesives containing irritants. Ensure good ventilation to disperse potentially explosive concentrations of solvent vapour.

RESTRICTIONS	Solvent abuse. Strict control over the use and storage of solvent-based adhesives should be enforced to ensure that the deliberate inhalation of vapour does not take place.
Disposal	Waste, including emptied containers, must be transported to a domestic recycling or disposal site. Large quantities should be collected for proper disposal. Schools and colleges must check that any waste disposal contractor whom they use has a licence (or is exempt). (see PS5 (or GL5) *Waste Disposal Contractors*).
Storage	In sealed containers in a dry place within the temperature range of 5 to 30 °C and well away from sources of ignition such as sparks, pilot lights and other naked flames, ideally in a highly flammable liquids cupboard. They should not be stored with oxidising agents (eg, the catalysts for hardening resins and sodium persulfate used for etching copper boards) and other highly combustible materials.
FURTHER INFORMATION	
	The adhesives come as a wide range of viscous liquids comprising dissolved resins and rubbers in solvents, whose vapours, if inhaled, can lead to nausea, headaches, dizziness and, eventually, to unconsciousness. Some of the adhesives effectively bond a wide range of materials including wood, rigid PVC, plastic laminates, fabrics etc, whilst others are specifically intended for use with a single material.

IMMEDIATE REMEDIAL MEASURES

Swallowed	DO NOT INDUCE VOMITING. Seek medical attention.
Vapour is inhaled	Remove casualty to fresh air and seek medical attention.
In the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
On the skin	Wipe off excess with a paper towel and clean with resin-removing cream or hand cleanser. Do not use solvent. Finally, wash with soap and water.
Spilt in the workshop	Remove all sources of ignition and ventilate the area thoroughly. Cover the spill with sand or earth, pick up the resultant paste with spark-proof tools and place in a sealable, metal container. Store safely pending disposal.

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5.005 COSHH & Man Regs	Adhesives: Water-based, PVA, Rubber latex, WALLPAPER ADHESIVE	Applicable to: Bostik 8; Britfix PVA; Unibond; Resin W; Copydex; Solvite wallpaper adhesive; Wickes wallcovering adhesive etc	See also: 5.001, 5.002, 5.003, 5.004

Process(es) covered: Most of these adhesives are sold as emulsions and are ready to use. Wallpaper adhesives may be sold ready-mixed or as a powder for mixing with water.

Hazards

Sensitisation — People with a sensitive skin, or who are repeatedly exposed could have an allergic reaction. Latex allergy is especially common. Wallpaper adhesives that contain fungicide have caused dermatitis.

Highly flammable — Vinyl acetate monomer is highly flammable

Risk Assessment

Sensitisation — These adhesives are generally very safe but, although latex allergy has not yet been reported with latex adhesives, contact with skin and eyes should be avoided. Allergy to wallpaper adhesives containing fungicides has occurred amongst professionals.

Highly flammable — As long as there are no nearby naked flames or hot surfaces which could act as sources of ignition there would be no risk.

Control measures

For most of these adhesives, no special measures are required.
Where possible, avoid the use of wallpaper adhesives containing fungicide.
Wear protective gloves (eg, disposable nitrile) when using wallpaper adhesives.
Where possible, avoid flammable adhesives, but if used, ensure that the work is carried out where there are no naked flames or hot surfaces.

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Disposal	Moderate amounts may be placed in normal refuse.
Storage	Store in a dry place in the temperature range 5 to 25 °C. Protect from frost.

FURTHER INFORMATION

Polyvinyl acetate (PVA) bonds wood, paper, fabrics, card and leather. However, it will not stick PVC, rubbers or polythene. PVA adhesives contain different fillers for different applications so a product designed to bond leather is not necessarily ideal for fabrics or paper.
Although these adhesives are among the safest available, they should not be used by those pupils who might put them in their noses or mouths. This action could lead to a dangerous obstruction to breathing if the solidifying products were inhaled; there is similarly a danger that they might be swallowed. This risk is reduced if the adhesive is supplied in a jar rather than in a tube.

IMMEDIATE REMEDIAL MEASURES

Swallowed	Drink plenty of water and seek medical attention.
In the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
On the skin	Wash off with water then with soap and water, before the material dries. If adhesives dry on the skin, wash with a skin cleanser. Do not use solvent for hand cleaning.
Large quantities are spilt	Absorb with earth or sand. Place in a metal or plastic container pending disposal. Do not allow to enter drains.
If there is an allergic reaction	If the casualty shows anxiety, red, blotchy skin, swelling of the face and neck and puffiness around the eyes, s/he could be suffering from a serious allergic reaction. Call an ambulance and prop the patient in a sitting position in case breathing problems develop.

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5.006 Man Regs	BUILDING CRAFTS: brick and block work	Applicable to: Constructing walls using bricks and blocks	See also 5.007; 5.014, 5.043

Process(es) covered: Construction of practice walls using bricks or larger blocks for training purposes.

Hazards

Personal injury	Personal injury can result from bricks or blocks being dropped on the hands or feet, or from trapping the fingers when positioning bricks or blocks. Injury can also result from lifting blocks incorrectly and from the collapse of walls of stacks of loose bricks or blocks.
Irritant	Burns to or sensitisation of the skin and eyes may occur as a result of contact with the mortar used, or with cement dust (see also 5.007).

Risk Assessment

Personal injury	Trapping and crushing as a result of lack of care in handing bricks and blocks is quite likely, especially with inexperienced users. Poor techniques in lifting heavy blocks can cause back strain. Wall collapse is most likely if the wall has no piers, staggers or end returns or if it increases in height too quickly. Collapse of loose stacks or bricks or blocks would be a significant risk if the stack were too high.
Irritant	Irritation of the eyes as a result of contact with cement dust or mixed mortar of different types is common. Prolonged contact of the skin with wet cement may result in burns or dermatitis.

Control measures

Ensure appropriate instruction in manual handling techniques and in the placing of bricks and blocks.
Do not allow younger pupils to work with larger blocks.
The use of gloves when lifting and/or when applying mortar may be appropriate but care should be taken to ensure that gloves are a good fit.
Do not allow brick or blockwork walls to increase in height by more than 1.5 m per day.
Keep stacks of loose bricks and blocks at a low level and check for stability.
Safety footwear should be worn.
Safety helmets (hard hats) may be needed in some circumstances where there is a risk of objects falling onto someone's head.
Use protective gloves or barrier creams and avoid direct contact with mortar.
Consider wearing eye protection when mixing mortar, especially if this is done outside on windy days.

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Restrictions	Younger pupils should not attempt to lift heavy blocks.

FURTHER INFORMATION

The Building Research Establishment publishes a number of *Good Building Guides* and *Good Repair Guides*. Available from the BRE Bookshop http://www.brebookshop.com/.

IMMEDIATE REMEDIAL MEASURES

Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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5.007 COSHH Regs	BUILDING CRAFTS: USE OF CEMENT AND LIME MORTAR and concrete	Applicable to: constructing walls, paths use bricks, blocks and similar, filling cracks etc using Polyfilla, etc.	See also: 5.006, 5.008, 5.009, 5.046, 5.047

Process(es) covered:

Mixing cement, sand and water to produce cement mortar.
Mixing lime putty, sand and water to produce lime mortar.
Using mortar for bricklaying and similar processes.
Mixing cement with aggregate (ballast) to form concrete.
Using concrete to form foundations, footings, etc.
Cleaning concrete from brick walls, etc.
Using plaster-based fillers such as Polyfilla

Hazards

Irritant

(Portland) cement, mortar which contains it and concrete are all strongly alkaline (pH 12 – 13) and irritating to the eyes and respiratory system (R37/38). There is a risk of severe eye damage (R41) and may cause sensitisation by skin contact (R43).
Lime putty and mortar which contains it are strongly alkaline (pH 12 – 13) and irritating to the eyes and skin (R36/38). There is a risk of severe eye damage (R41) and skin contact may cause a mild burning sensation (R43).
Fillers such as Polyfilla contain up to 25% cement and present a risk of eye damage.
Plasticisers added to improve the workability of mortar contain sodium alkyl benzene sulphonate (10 – 30%) which is irritating to the skin (R38) and there is a risk of severe eye damage (R41).
Colorants added to mortar or concrete are generally low hazard iron oxides.

Allergenic

Cement may contain chromium(VI) compounds which may produce an allergic reaction.

Corrosive

Brick and patio cleaners, used to remove concrete spatter from walls, generally contain concentrated hydrochloric acid which causes burns (R34) and is irritating to the re4spiratory system (R37)

Risk Assessment

Irritant

The WEL[110] for Portland cement is 10 mg m^{-3} (8 h TWA) for inhalable dust, 4 mg m^{-3} (8 h TWA) for respirable dust. (Inhalable dust is the fraction that enters the nose and mouth, respirable dust is the fraction that penetrates to the lungs).
Handling cement or mixing it outdoors can easily result in dust in the eye, especially if carried out outdoors on a windy day.
The WEL for calcium hydroxide (in lime putty) is 5 mg m^{-3} (8 h TWA).
Because strong alkaline solutions tend to damage nerve endings before damaging skin, prolonged contact with wet cement, mortar or concrete may result in chemical burns without any pain being felt.
A combination of the wetness, alkalinity and abrasiveness of the sand or aggregate used may cause contact dermatitits.
The presence of plasticisers may exacerbate these effects.

Allergenic

Brief exposure to small amounts of the powder or wet mix should not cause significant effects. However, prolonged contact may cause allergic dermatitis, especially if old samples are used (outside the stated shelf-life) because low hazard chromium(III) compounds may have re-oxidised to hazardous chromium(VI).

Corrosive

Splashing when diluting down the Brick Cleaner concentrate presents a significant risk.

[110] EH40/2005

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Control measures	Avoid raising dust when opening bags, removing cement from the bag, mixing it or cleaning up spills. Take special care on windy days if working outdoors. Wear eye protection, protective gloves (or barrier creams), protective overalls and protective footwear. Do not use samples beyond their stated shelf life.

Disposal	Empty bags can be disposed of via the normal refuse but beware of raising dust from residual amounts of cement in the bag. Cement and concrete which have set are low hazard (but may be heavy) and small amounts could be disposed in the normal refuse but larger amounts should be sent for re-cycling. Waste or surplus dry cement is subject to the *Hazardous Waste Regulations.* It should be collected for proper disposal. Schools and colleges must check that any waste disposal contractor whom they use has a licence (or is exempt) (see PS5 (or GL5) *Waste Disposal Contractors*). Alternatively, surplus cement can be mixed with water, taking all precautions as detailed in the *Control Measures*, allowed to set and then disposed as above.
Storage	Store under dry conditions.

IMMEDIATE REMEDIAL MEASURES

Dust or wet cement or brick cleaner swallowed	Immediately rinse the mouth with water. Do NOT induce vomiting. Drink plenty of water and seek medical attention promptly.
Dust or brick cleaner is inhaled	The casualty should be taken to fresh air. If the nose or airways become inflamed, seek medical attention.
Dust or wet cement or brick cleaner in the eyes	Irrigate immediately with water, holding eyelids apart and continue irrigation until the patient reaches hospital.
Dust or wet cement or brick cleaner on the skin	Immediately remove by wiping with a disposable paper towel. Then wash with warm, soapy water.

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5.008 Man Regs	BUILDING CRAFTS: using lintels	Applicable to: Use of concrete or steel lintels	See also: 5.006, 5.047 5.048

Process(es) covered: The use of concrete or steel lintels to support walls above an opening.
The use of timber beams to provide similar support above an opening.

Hazards

User injury

User injury can result as a result of trying to lift heavy lintels in place.
Injury may result if the lintel is not sufficiently strong to support the loads involved.

Risk Assessment

User injury

User injuries are likely, especially by inexperienced people,
Provided that lintels of an appropriate size are used, the risk of a lintel failing is unlikely.

Control measures

Ensure appropriate instruction in manual handling techniques and lifting procedures.
Ensure good levels of supervision.
Do not allow younger pupils to work with lintels.
Safety footwear should be worn.
Safety helmets (hard hats) may be needed in some circumstances where there is a risk of objects falling onto someone's head.
Ensure lintels are properly supported whilst mortar used to hold them in position sets.
If lintels are used to form openings in existing structures, ensure they are carefully checked by a suitably qualified person so that a lintel of an appropriate size is used.

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RESTRICTIONS	The use of lintels to create new door or window openings in existing structures should be restricted to work in colleges. It is unlikely to be required in work in schools.

IMMEDIATE REMEDIAL MEASURES

Note that back injuries often build up over a period of time and individuals may not realise damage has occurred.

Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.
Crushing injuries (casualty crushed for more than 15 minutes)	DO NOT RELEASE THE CASUALTY. Send for an ambulance, giving details of the incident. Comfort and reassure the casualty until help arrives.
Crushing injuries (casualty crushed for less than 15 minutes)	Release the casualty as quickly as possible. Control any external bleeding and cover wounds. Send for the first aider who will secure and support any suspected fractures, examine and observe the casualty for signs of shock and treat accordingly.
Impact injury	Rest the injured part; apply ice to reduce the bruising and pain; attention from a trained first aider is required.

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5.009 Man Regs	BUILDING CRAFTS: Concrete (cement) Mixers	Applicable to: Electric powered and petrol engine powered mixers for mortar and concrete	See also: 5.007

Process(es) covered: Using a powered mixer to mix mortar or concrete for use

Hazards	
Fumes	Fumes from petrol engines can cause dizziness.
Fire	Fuel for petrol engine mixers is highly flammable
Electric shock	Petrol engines will require a high tension supply for the spark plug. Electrical power leads and equipment will present a shock hazard especially in damp or wet conditions.
User injury	Human contact with rotating parts can cause cuts or abrasions. This applies to the drive mechanism and the rotating barrel.
Tripping	Power leads present a tripping hazard and may be damaged, presenting electrical hazards.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Manual handling	Moving the concrete mixer around the workplace can present a manual-handling hazard.
Dust	Dust will be created when the dry materials are loaded into the barrel.
Burns	The exhaust pipe and other parts of petrol engines will get hot.
Risk Assessment	
Fumes	Exhaust fumes will be a hazard if petrol engine powered mixers are used in confined spaces
Fire	The risk of fire with even small amounts of fuel is high
Electric shock	Spark plugs require many thousands of volts; modern electronic ignition systems deliver this voltage (~ 50 kV) with enough energy to give a severe shock. Electric shock hazard from an electrical supply is a high risk.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts.
Tripping	Trailing leads present a real risk of tripping and damage.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk.
Dust	Inhalation of fine dust or dust in the eye is highly likely.
Burns	Serious burns could result from the hot components.

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Control measures

Do not use petrol engine concrete mixers inside any building.

Remove all possible sources of ignition before handing fuel and when running the engine.
Ensure leads from spark plugs are properly insulated.
Only use 110 volt concrete mixers and power these from a 110 volt supply. This can be provided by a special waterproof transformer. Apart from this, do not use transformers with a 230 volt input supply in damp or wet conditions.
Ensure there are guards around rotating parts.
Do not allow immature pupils to use portable concrete mixers.
Ensure correct training and supervision as it is impracticable to guard all the hazardous areas when using a concrete mixer.
Choose the route of power leads to minimise tripping and damage.

Tie back long hair; remove or cover jewellery and cover loose clothing with a secure apron or overall.
Use two persons to handle heavy items (see also sheet 5.047).

Consider whether a dust mask is required.
Wear eye protection when loading materials into the rotating barrel.
Enclose or cover hot parts to prevent accidental contact.

Restrictions	The use of portable concrete mixers by students aged under 16 years must be under the direct supervision of an adult who has had suitable training. Students over 16 may use concrete mixers but there should still be suitable supervision in the immediate area.

FURTHER INFORMATION

CLEAPSS has further guidance covering general requirements on electrical supplies including a discussion on the use of 110 V.
Portable tools should be examined before use and should have regular formal inspections and tests. The frequency depends on use but half-termly would be typical.

IMMEDIATE REMEDIAL MEASURES

If a particle could be in the eye	Try to prevent the casualty from rubbing the eye. Sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, try to wash it out with clean water. If this is unsuccessful try lifting it out with the corner of a damp tissue. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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5.010 COSHH Regs	BUILDING CRAFTS: PLASTER and Plasterboard	Applicable to: Drywall; gypsum board; gypsum plaster; Thistle plaster.	See also: 5.007, 5.013, 5.046, 5.047

Process(es) covered: Applying plaster board to a wooden frame.
Finishing boarded surfaces using gypsum plaster.
(Some plasters are based on cement rather than gypsum).

Note: Plasterboard contains gypsum (calcium sulfate dihydrate) sandwiched between two layers of paper. However, gypsum plaster is manufactured by strongly heating gypsum which turns it into Plaster of Paris (calcium sulfate hemihydrate).

Hazards

Irritant

Gypsum plasters and plasterboard are not generally classed as hazardous but dust may irritate the respiratory system, skin and eyes.

Burns

When Plaster of Paris is mixed with water, the material slowly becomes hot. The temperature may reach over 45 °C which could cause skin damage, the extent of damage depending on the contact time.

Trapping

When Plaster of Paris is mixed with water, the material hardens and expands slightly. This can trap, for example, hands which then suffer burns as the temperature slowly rises. Physical damage may also result from attempts to remove the hardening plaster using chisels, hammers, saws, etc.

Cuts

Plasterboard is often cut by scoring using a craft knife or Stanley knife and snapping.

Risk Assessment

Irritant

The WEL[111] for gypsum and Plaster of Paris is 10 mg m^{-3} (8 h TWA) for inhalable dust, 4 mg m^{-3} (8 h TWA) for respirable dust. (Inhalable dust is the fraction that enters the nose and mouth, respirable dust is the fraction that penetrates to the lungs).
Brief contact with Plaster of Paris powder or its mixture with water are unlikely to cause any problems but prolonged contact should be avoided.
Inhalation of the dust can cause short term irritation of the respiratory system.
Significant levels of dust might arise if plasterboard were cut or sanded with power tools.

Burns

As the temperature rises only slowly, and plaster must be used quickly after mixing, burns are unlikely from casual contact.

Trapping

Trapping is possible only if the hand or other part of the body is surrounded by the plaster/water mix as it starts to harden. This has happened at least twice in school art classes with serious consequences to children using large amounts of the mix who misunderstood instructions, failed to follow them or suitable supervision arrangements were not in place.

Cuts

There is a significant risk of laceration when using the knife.

[111] EH40/2005

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Control measures	
	Avoid raising dust when opening bags, removing plaster from the bag, mixing it or cleaning up spills. Wear eye protection when mixing plaster and consider wearing dust masks (to BS EN 149 FFP3) to prevent prolonged inhalation if handling large quantities of the dry powder. Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap. If plasterboard is cut or sanded with power tools, do so in a well-ventilated area or wear a dust mask (to BS EN 149 FFP3) Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science Carefully supervise pupils to ensure that they are not tempted to enclose any part of the body in plaster. Train users how to use tools correctly. Train users in carrying tools safely (with edges protected or pointed down) and in placing tools away from the edge of the bench between uses.

Disposal

Empty bags can be disposed of via the normal refuse but beware of raising dust from residual amounts of plaster in the bag.
Small amounts of plaster /water mixes which have been allowed to set are low hazard and can be disposed of in the solid waste but larger amounts should be sent for re-cycling. Off-cuts of plasterboard or bags of unused plaster which is no longer needed could be disposed of in the same way.
Never pour wet plaster down the sink, as it will set and block the sink. Ensure sinks are fitted with a plaster trap. Even plaster rinsed off equipment has particles that will settle, so it is best to use running water.

Storage

Store in a sealed bag in a dry place.

FURTHER INFORMATION

There have been two very serious accidents in recent years in art departments in secondary schools in which pupils immersed their hands in a large volume of Plaster of Paris and water. The mixture hardened and they were unable to remove their hands whilst the material continued to generate heat. Both suffered serious burns, with some amputation necessary. Some damage may also have been caused by tools used in attempts to remove the hardening plaster.

IMMEDIATE REMEDIAL MEASURES

If plaster is swallowed	The swallowing of small splashes is unlikely to cause any adverse effects. Wash out mouth with plenty of water.
If plaster is splashed into the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention if irritation persists.
Effects on the skin	Flush skin with running water before washing with water and soap.
If a body part is trapped in setting plaster	Act rapidly. Cool the affected skin by immersing the whole limb (and plaster container, if appropriate) in plenty of water, eg, in a sink. This may help soften the plaster. Call the emergency services and warn them what has happened so they may be prepared with suitable cutting equipment. You can try using a pad saw (or key hole saw or similar) to cut away the plaster but take care not to cause further damage to the body part inside. Using a hammer and chisel is almost certain to cause such damage unless it is possible to aim to the side and in any case the plaster may not have set hard enough to shatter.

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5.011 Man Regs & COSHH Regs.	BUILDING CRAFTS: Glazing	Applicable to: Fixing glass to window frames using linseed oil putty.	5.012

Process(es) covered: Cutting and fixing of glass to fit a wooden or metal window.
Fixing of glass using putty, with or without wooden beads.

Hazards

Cuts	Cuts can result as a result of contact with the sharp edges of glass
Flying objects	Small pieces of cut glass may fly about the work place when being snapped or trimmed.
Sensitiser	Prolonged skin contact with putty can lead to defatting and possible irritation and dermatitis

Risk Assessment

Cuts	Small cuts are likely, especially by inexperienced users.
Flying objects	The risk of small pieces of cut glass flying about the room is high.
Sensitiser	Linseed oil putty does not contain materials currently classed as hazardous. However, prolonged contact could cause skin problems.

Control measures

Ensure appropriate instruction in the cutting and trimming of glass.
Ensure good levels of supervision.
Ensure gloves giving protection from sharp edges are worn when cutting or moving sheets of glass.
Ensure broken glass and off-cuts are disposed of quickly and safely.
Ensure eye protection is worn by trainees and those supervising them.

Avoid direct contact with the putty as much as possible, by the use of gloves or barrier cream. Wash hands thoroughly with soapy water after working with putty.

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Disposal	Broken glass and off-cuts must be safely stored, in a clearly labelled container, prior to disposal. Disposal must not present any risk to waste handlers. Broken glass should be disposed in a proper sharps container via a specialist collection or in a strong cardboard or other box, sealed and clearly labelled, in the normal school waste collection. As putty is not classed as hazardous, small quantities can be disposed of as part of the normal school waste.
Storage	Sheets of glass must be stored in a safe location, away from areas where people are normally walking, ideally in special racks, nearly vertical. Putty should be stored in the original container, tightly closed, in a dry, cool and well-ventilated place.

IMMEDIATE REMEDIAL MEASURES

Putty on the skin	Wipe off excess with a paper towel and clean with resin-removing cream or hand cleanser. Do not use solvent. Finally, wash with soap and water.
Cuts	If the cuts are minor, ie of a sort which casualties would normally treat themselves, then the wound should be washed clean and a small, sterilized dressing applied by the casualty,
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.

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5.012 Man Regs & COSHH Regs.	BUILDING CRAFTS: wall and floor tiling	Applicable to: Fixing ceramic tiles to walls and floors	See also: 5.005, 5.007, 5.011, 5.014, 5.035

Process(es) covered:

Cutting and fixing of ceramic tiles to walls and floors.
Use of tile cutters and power saws used for cutting thick tiles.
Use of tile adhesives and grouting materials.
Adhesives and grouts may be ready mixed or be in powder form which requires mixing with water.

Hazards

User injury	Cuts can result as a result of contact with the sharp edges of cut tiles. If powered tile cutters are used, contact with the cutting blade will result in cuts or abrasions. Entanglement is possible
Flying objects	Small pieces of cut tiles are likely to fly about the room when being cut or trimmed.
Irritant	Some tile adhesives and grouts are irritant to skin and eyes.
Sensitiser	Some tile adhesives and grouts are sensitisers.
Dust	Some tile adhesives and grouts are supplied as powders and dust may enter the eyes when mixing dry.
Flammable	Some tile adhesives may be flammable.

Risk Assessment

User injury	Small cuts are likely, especially by inexperienced users. Contact with the blade of powered tile cutters is likely by inexperienced users.
Flying objects	The risk of small pieces of tile flying about the room is high
Irritant	There is a risk of irritation of the skin and eyes due, especially with prolonged contact with adhesives or grouts.
Sensitiser	Most tile adhesives and grouts will not contain known sensitisers but if they do repeated contact could result in sensitisation.
Dust	Careful handling can avoid the risk of dust entering the eyes.
Flammable	Tile adhesives may be spread over quite large areas, producing significant amounts of vapour, which, if flammable, could be ignited by flames or hot metal surfaces.

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Control measures	
	Ensure appropriate instruction in the cutting and shaping of tiles. When snapping or trimming tiles teach students to hold the tile at a low level. Do not allow pupils under the age of 16 to use powered tile cutters and always ensure good levels of supervision when using them. Consider the use of eye protection and protective gloves when inexperienced students are cutting tiles. As far as possible, and unless required for specialist purposes, avoid the use of adhesives and grouts which are classed as hazardous. Check labelling and/or safety sheets before purchase. Avoid direct contact with tile adhesives and grout as much as possible, by the use of gloves or barrier cream. Wash hands thoroughly with soapy water after working with putty. Eye protection may be necessary when mixing dry powder grouts. Do not use adhesives that are flammable near to naked flames or hot surfaces.

Disposal	Broken tiles and off-cuts do not normally present a significant risk and small amounts can be disposed in the normal school waste collection. Used containers and hardened tile adhesive and grout do not usually present a significant risk and small amounts can be disposed in the normal school waste collection. Partially used or unused containers of those tile adhesives or grouts not classed as hazardous can be disposed in the same way. Partially used or unused containers of tile adhesive or grout with a hazard warning label need to be collected for proper disposal. Schools and colleges must check that any waste disposal contractor whom they use has a license (or is exempt) (see PS5 (or GL5) *Waste Disposal Contractors*).
Storage	Adhesives and grouts should be stored in the original container, tightly closed, in a dry, cool and well-ventilated place unless instructions on the container or in the data sheet suggest otherwise,

IMMEDIATE REMEDIAL MEASURES

Immediate remedial measures may depend on the particular adhesive or grout being used, but the following will be useful.

Swallowed	DO NOT INDUCE VOMITING. Seek medical attention.
Vapour is inhaled	Remove casualty to fresh air and seek medical attention.
In the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
On the skin	Wipe off excess with a paper towel and clean with resin-removing cream or hand cleanser. Do not use solvent. Finally, wash with soap and water.
Cuts	If the cuts are minor, ie of a sort which casualties would normally treat themselves, then the wound should be washed clean and a small, sterilized dressing applied by the casualty,
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.

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5.013 Man Regs	BUILDING CRAFTS: Cutting Compliant Materials	Applicable to: scissors (hand & powered); craft knives.	See also: 5.010, 5.014, 5.018, 5.036

Process(es) covered:

The use of scissors for cutting wallpaper.
The use of craft knives and scalpels, with and without cutting mats.
The use of heavy duty craft knives to remove insulation from electrical cables.
Scoring and cutting plasterboard.

Hazards

Cuts to user

Craft knives and scissors (whether powered or not) can cut fingers.

Injury when carried

Knives and scissors can injure the user or others when being carried or as a result of misbehaviour in the workplace.

Risk Assessment

Cuts to user

Cuts are received from craft knives by slicing when cutting along a straight edge or template or when the knife slips out of the material. Cuts also result from changing blades in scalpels and craft knives, particularly the type with snap-off blades. Using craft knives to remove insulation from cables presents a high risk.

Injury when carried

There is a real risk of injury if scissors or knives are carried with the blade exposed. This risk is increased where desks/tables are close together or where bags on the floor give a risk of tripping.

Control measures

Use a cutting mat to reduce the risk of the work slipping and of loss of control of the knife when the end of the cut is reached.
Use a steel ‘safety rule’ to reduces the risk of slicing fingers and ensure the hand holding the material is behind the direction of cutting.
Teach the safe ways to change blades on knives and scalpels.
If craft knives are used for removal of insulation, place the cable on a bench or cutting mat. It should not simply be held in the hand.
Teach users how to carry scissors safely with the blades enclosed by the fist.
Where possible, use craft knives with retractable or rotary blades as these are safer to carry than those with open ones.
Give clear instructions to ensure the circulation space is kept clear of obstructions.

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Disposal	Dispose of used blades responsibly. An old tin or a small ‘sharps box’ as used in first-aid rooms could be used.
Storage	Store scissors and knives in a secure place to control access. Ensure that scissors and knives are collected in after use since they could constitute a hazard if removed by children or if left on tables, chairs or on the floor.
Restrictions	For younger pupils, blade changing should be carried out by adults. This is especially true of the ‘snap-off’ type of knife blade. With some classes, it may be necessary to restrict the use of craft knives to an inherently safe type.

Further Information

Battery-powered scissors (eg, Wolf Powered Scissors or Pifco Speedcut) may be safer than ordinary ones because the opening of the blades is small and the length of exposed blade is short. They may also help children with certain physical disabilities.

IMMEDIATE REMEDIAL MEASURES

Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, wash the wound clean and get the casualty to apply a small, sterilised dressing.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.

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5.014 Man Regs	Building crafts: USING HAND TOOLS	Applicable to: pliers, screwdrivers, spanners, wire cutters, wire strippers, masonry bolster chisels	See also:, 5.013, 5.018

Process(es) covered:

The use of pliers to hold metal when bending or heating, or to cut wire.
The use of screwdrivers to tighten and loosen slotted- or cross-head screws.
The use of wire cutters to cut wire.
The use of wire stripper to remove insulation from electrical cables.
Cutting bricks and blockwork with a masonry bolster chisel.
For hand tools for woodworking, see sheets *5.036* and *5.037*.

Hazards

User injury

Screwdrivers, especially flat bladed ones can slip out of the head of the screw and cause severe cuts.
Splinters of metal can be raised from the slots of slotted head screws.
The skin can be trapped between closing parts of pliers, wire cutters and wire strippers.
Spanners can slip off nuts if the nut is tight.

Eye injury

Pieces of brick and blockwork can fly off when being cut with a masonry bolster chisel.
If very small pieces of bare wire are cut, there is a risk of such pieces entering the eye.

Risk Assessment

User injury

There is a high risk of injury to inexperienced users when attempting to start screws into wood and wood based materials.
Splinters will normally only be raised from the slots of wood screws if the screw is over tightened, or excessive force is used.
Whilst the skin can be caught between moving parts of some hand tools, this is relatively uncommon and the risk of harm is minimal.
Spanners and pliers can slip off the component or nut but this is not common in construction situations and the risk of harm is minimal if the correct spanner is used but would be high if an incorrectly-set adjustable spanner were used.

Eye injury

There is a significant risk of eye injury when cutting bricks and blockwork with a bolster chisel.

Eye injury from small pieces of wire is possible but unlikely if soft copper (electrical) wire is being cut. The risk would be greater for steel or hard brass wire.

Control measures

With all of the tools covered by this risk assessment, give inexperienced users appropriate instructions in their use and warn them of hazards.
When inserting wood screws start by drilling a pilot hole in the wood first.
Where possible, use cross-head screws such as Philips or Pozidrive rather than slotted types; even better, use torx-headed screws in conjunction with an electric screw-driver.
Ensure the correct spanner is used. If adjustable spanners are used, ensure they are correctly set.

Wear eye protection when cutting bricks or blockwork with a chisel.
Unless there are unusual circumstances, it is not generally considered necessary to wear eye protection for this type of work.

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Storage	Store hand tools at a height appropriate for safe collection by the students. Ensure the storage system is such that it is easy to check that all tools have been returned. In some situations, it might be considered necessary to lock the cupboard(s) containing hand tools.

IMMEDIATE REMEDIAL MEASURES

Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, wash the wound clean and get the casualty to apply a small, sterilised dressing.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
If a particle could be in the eye	Try to prevent the casualty from rubbing the eye. Sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, try to wash it out with clean water. If this is unsuccessful try lifting it out with the corner of a damp tissue. Otherwise send for a first aider.

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5.015 Man Regs	Building crafts: USING LASER SPIRIT LEVELS	Applicable to	See also:

Process(es) covered: Using laser spirit levels to determine whether walls and other surfaces are truly horizontal or vertical.

Hazards

Eye injury Lasers produce an intense beam of light which when focused by the eye can cause damage to the retina (the light sensitive calls at the back of the eye).

Risk Assessment

Eye injury Damage would be likely if users or others looked directly into the beam or if the beam were unexpectedly powerful

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Control measures

Only use spirit levels which have the CE mark and which are clearly marked as class 1 or class 2 lasers (not class II or class 2M).
Only purchase from reputable sources/manufacturers (eg, Bosch, Stabila, Stanley, DeWalt, Black and Decker) so that the classification can be relied upon to be accurate.
Do not look directly at the light source.
Ensure everybody is kept behind the laser beam.
Do not point the beam at a highly reflective surface.
Do not attempt to dismantle or modify the equipment.
Allow students to use a laser spirit level only under direct supervision.
Rapidly and robustly deal with any misbehaviour
Keep laser spirit levels secure when not in use.

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Storage	Store laser spirit levels securely so as to prevent illicit use.

FURTHER INFORMATION

The classification system changed a few years ago and the classification system used in Europe is not quite the same as that used in the USA.

A class 2 laser is designed to be low power, commonly less than 1 mW although lasers up to 5 mW may be class 2 if the beam has a larger diameter.

Like looking at the sun, the natural aversion response (blinking) will ensure that a casual glance (0.25 seconds) at the beam from a class 2 laser will not cause permanent damage, although there may be temporary effects, in rare cases lasting days or weeks. However, over-riding the blink response by deliberately staring at any very bright light can cause damage and even blindness.

CLEAPSS has tested lasers from a number of sources, including laser pointers/pens and laser spirit levels. Some of the lasers tested were not clearly marked and others, although marked class 2, were more powerful than this and hence unsafe to use. However, laser spirit levels by reputable manufacturers (eg, Bosch, Black and Decker) were correctly classified.

IMMEDIATE REMEDIAL MEASURES

Casual brief glance at a laser beam	Reassure the casualty that this will not cause permanent damage. Medical treatment is unlikely to be necessary.
A longer, deliberate stare at a laser beam	Reassure the casualty that this is unlikely to cause permanent damage although temporary effects may last for hours or even days. Send for an ambulance to take the casualty to hospital.

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5.016 Man Regs	HEAT PROCESSES: Blowtorches (Butane &/OR propane)	Applicable to: Ronson blowtorch Taymar blowtorch	See also: 5.017

Process(es) covered: Soldering of copper pipe fittings with a blowtorch attached to a small cartridge of butane.

Hazards

Explosion Accumulations of butane (or propane) (which are heavier than air) can explode. Cartridges, even when apparently empty, can explode if in a fire. Bricks other than firebricks can split explosively when hot enough.

Fire The naked flame could ignite other flammable material.

Radiant heat Infra-red radiation from hot surfaces, flames etc, can damage the cornea of the eye.

Burns Users have been burned by their own blowtorch or by heat from the metal on which they have been working.

Risk Assessment

Explosion Cartridges which leak in storage present a significant risk as does inappropriate disposal. The rate of heating is unlikely to be sufficient to cause bricks to explode.

Fire The risk of fire is considerable if the work is being done on a site where there is flammable material nearby, or if the flame is left ignited for long periods. Serious fires have been caused by unattended blowtorches.
There is a risk of fire where joint and pipework run through stud partition walls, etc. Wood can smoulder for a considerable time before catching fully alight.

Radiant heat This is unlikely to be a problem with the temperatures and small sizes involved in these operations.

Burns Burns are likely if the blowtorch is left ignited for any longer than necessary.
Burns are also likely for trainees as they may well have inadequate control of the size or direction of the flame. Even experienced users may underestimate heat conduction through the workpiece. The burner will be too hot to separate from the cartridge after only a short period of use.

Control measures

Check cartridges for leakage after use and stored correctly.

Protect the area around the work protected by the use of heat resistant materials. Ignite the blowtorch immediately before soldering (not while setting up the joint) and turn off immediately after soldering. Do not leave on whilst the next soldering job is being set up and never leave it unattended.
Heat-protective goggles are not likely to be necessary.

Heat-resistant gloves should be available for handling the work and for dismantling the blowtorch.

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Disposal	Leave empty cartridges outside (in a secure location) with the burner valve open to allow the last vapour to disperse; then place the cartridge in the solid refuse.
Storage	Cartridges can be stored with the burner attached or removed, according to the maker's recommendations. Do not store them in cupboards used for the storage of other flammable substances. The location should be secure, well-ventilated, cool, away from flames, combustible materials and escape routes and, ideally, in a fire-resistant structure. Some local authorities may require cylinders to be stored in a well ventilated outside store room. For further details, see CLEAPSS publication L164, *Portable Laboratory Gas Burners*.
RESTRICTIONS	The use of these portable blowtorches should be restricted to responsible students of sufficient maturity to follow the instructions safely under adult supervision.

IMMEDIATE REMEDIAL MEASURES

If burns to the skin occur	Cool the affected area under a running cold tap for ten minutes.
If serious burns to the skin occur	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches which might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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5.017 COSHH Regs	Heat PROCESSES: Soft soldering, Fumes and Fluxes	Applicable to: soldering of copper pipes and fittings; soldering of sheet lead.	See also: 5.018, 5.019

Process(es) covered:

The creation of a joint between copper pipe fittings or between sheet lead using molten solder with a flux. Soft solder is an alloy of tin and lead with traces of other metals. The flux may be in cores in the solder or supplied as a liquid or jelly. The most common materials are:

- rosin (also called colophony) - a compound which decomposes at high temperatures;
- halides, eg, ammonium chloride and zinc chloride ('active fluxes').

Newer fluxes (eg, Multicore Ecosol 105 or Omega) are based on organic acids. There is an increasing use of lead free solder and it is likely that solder containing lead will be phased out.

Hazards

Harmful

Lead fumes (especially to the unborn child), ammonium chloride (if swallowed), zinc chloride fumes and the decomposition products of rosin flux are harmful.

Corrosive

Fluxes containing zinc chloride can cause burns.

Eye injury

Flux can spit when heated.
Small lumps of solder can be flicked off the tip of the soldering iron.

Irritant

Flux fumes are irritant to eyes and respiratory system, possibly causing occupational asthma.

Sensitisation

Fumes from rosin fluxes can give rise to sensitisation of the airways.

Risk Assessment

Harmful

Lead vapour is not generated significantly at temperatures below 500 ˚C. Soft solders melt below 300 ˚C so the risk from lead vapour is negligible. Plumbing activities with lead pipes are generally considered minimum risk.
The fumes of ammonium chloride (WEL 20 mg/m^3)[112] and of zinc chloride (WEL 2 mg/m^3) will not reach these 15 min reference values in a school workshop area.

Corrosive

Active fluxes must be kept off the skin and out of eyes.

Eye injury

The likelihood of spitting flux is more likely with inexperienced users.
The risk of small balls of solder being flicked off the tip of the soldering iron when it is replaced in the stand is minimal.

Irritant

Fumes from heating any flux may irritate the eyes and respiratory system at high concentrations. The fumes from decomposition of rosin flux have WEL values of 0.05 mg/m^3 (8 h TWA) and 0.15 mg/m^3 (15 min ref period). The concentration of fumes must therefore be kept as low as reasonably practicable.

Sensitisation

Since sensitisation can occur at very low concentrations, rosin-based fluxes should be avoided altogether.

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112 EH 40/2005

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Control measures	
	Wear eye protection when any soldering is carried out. Due to changes in the environment regulations, CLEAPSS now advises that schools stop using leaded solder and change to non-leaded solder only. Please note this is not due to concerns over any associated health issues, but due to changes in environmental regulations which do not allow Lead to enter the waste system In addition, wear gloves when using active fluxes. Avoid using rosin fluxes. **If work with rosin flux continues, ensure local exhaust ventilation is used.** When using rosin-free (colophony-free) fluxes, ventilation produced by opening windows near the working area will normally be sufficient to control the fumes. The only way of controlling the sensitisation risk is to stop using rosin-based fluxes.
See also the Control Measures for 5.016 *Heat Process: Blowtorches*	

Disposal	Waste or surplus lead is subject to the *Hazardous Waste Regulations.* It should be collected for proper disposal. Schools and colleges must check that any waste disposal contractor whom they use has a licence (or is exempt) (see PS5 (or GL5) *Waste Disposal Contractors*). Alternatively, scrap metal dealers will usually accept lead for re-cycling. Active fluxes can be dissolved in a very large excess of water and poured down the foul-water drain (toilet).
Storage	Store active flux in the container in which it is supplied, tightly-closed, and in a cool, dry, well-ventilated area.

FURTHER INFORMATION

Lead free solder melts at a higher temperature (217 ˚C) than solder containing lead and requires a soldering iron that will reach this temperature.

Sensitisation

Where a person has become sensitive to the fumes from rosin flux, the slightest exposure may give rise to an asthma attack.

IMMEDIATE REMEDIAL MEASURES

If active flux is swallowed	Wash out the casualty's mouth. Do **not** induce vomiting. Sips of water may help cool the throat and help keep the airway open. Seek medical attention.
If fumes are inhaled	Remove from exposure. Keep warm and at rest. Obtain medical attention.
If active flux spilt on the skin	Immediately wash the affected area with plenty of soap and water.
If active flux in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
If active flux is spilt in workshop	Contain the spill with sand, earth or any suitable absorbent. Transfer to a container for disposal.
If burns to the skin occur	Cool the affected area under a running cold tap for ten minutes.
If serious burns to the skin occur	Send for an ambulance. Cool the affected area under a running cold tap for ten minutes. Watch for difficulty in breathing or faintness. Gently remove jewellery or watches which might be difficult to remove later if the limb swells. Apply a dry dressing held in place by a cotton wool pad secured with a bandage or adhesive tape if the ambulance has not yet arrived.

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5.018 Man Regs	Building Crafts: Cutting AND SHAPING METAL USING HAND TOOLS	Applicable to: saws for metal, files, tin snips	See also: 5.013, 5.014

Process(es) covered:

The use of hacksaws to cut metal.
The use of files on metal.
The use of metal snips, often called tin snips to cut sheet lead or other sheet metals

Hazards

Cuts to user

Incorrect or careless use can cause cuts.
Poor work holding can cause saws to slip and cause cuts.
Sharp edges of cut sheets can cause cuts.
Handles of files may work loose from the tang and cause injury.
Wooden file handles may split.

Risk Assessment

Cuts to user

Cuts are likely if the work is not held correctly or if a saw slips from a saw cut. This would be especially likely for inexperienced users.
Cuts are more likely when the work is too large to fit into a suitable vice.
Loose or split handles of files may not be noticed unless they are checked regularly.

Control measures

With all of the tools covered by this risk assessment, give appropriate instructions in their use to inexperienced users.
When using any type of saw, ensure the work being cut is held securely. Inexperienced users may lack the physical strength to hold it securely and some form of clamping will be required. Normally when using a hacksaw a standard metalwork vice or pipe vice should be used. If the work is too large to fit into a suitable vice hold it as securely as possible, perhaps with the aid of G clamps.
Take care to ensure that at no time is the saw cutting towards any part of the body of the operator, or any assistant who may be holding the work.
Warn students about the hazards of sharp edges of sheet materials. Gloves may be appropriate in some cases.
Regularly check wooden file handles for tightness, and for splits, and replace when necessary. Plastic handles are usually more robust and are less likely to work loose. Students should be instructed to seek assistance from a teacher or technician should they find that a file handle is loose.

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Storage	Store hand tools at a height appropriate for safe collection by the students. Ensure the storage system is such that it is easy to check that all tools have been returned. In some situations it might be considered necessary to lock the cupboard(s) containing hand tools.

IMMEDIATE REMEDIAL MEASURES

Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves, wash the wound clean and get the casualty to apply a small, sterilised dressing.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Impact injury	Rest the injured part; apply ice to reduce the bruising and pain; attention from a first aider may be required.
If a particle could be in the eye	Try to prevent the casualty from rubbing the eye. Sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, try to wash it out with clean water. If this is unsuccessful try lifting it out with the corner of a damp tissue. Otherwise send for a first aider.

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5.019 COSHH, CLAW & Man Regs	METAL WORKING: USING LEAD	Applicable to: lead sheet, lead pipes, lead strips, lead-based solders	See also: 5.017, 5.047

Process(es) covered:

The use of lead sheet to form flashings around chimneys, for flat roofs, and drip channels under window sills; using sealant with lead flashing.
The cutting, forming and joining of lead pipe work for water supply pipes and waste water pipes.
Use of lead strips for leaded or decorative window glazing.
Use of lead-based solders to join lead in any form.

Lead flashing is often sold with adhesive already applied but that adhesive is normally low hazard.
Some so-called “lead” flashing is based on aluminium, which is low hazard.

Hazards

Toxic	Lead may cause harm to the unborn child, category 1 teratogen (R61). Possible risk of impaired fertility (R62). Harmful if dust, fumes or vapour are inhaled or if small pieces of lead are ingested as a result of lack of care in washing hands (R20/22). Danger of cumulative effects (R33).
Irritant / Harmful	The polydimethylsiloxanes and alkoxysilane cross-linkers (components in silicone sealants) are irritating to the eyes and skin (R36/38) and/or harmful by inhalation (R20).
Highly flammable/ Flammable	The polydimethylsiloxanes and alkoxysilane cross-linkers components in silicone sealants are flammable (R10) or highly flammable (R11)
Manual handling	Lead is a very dense metal and so even small amounts can be unexpectedly heavy leading to the possibility of lower back injury.

Risk Assessment

Toxic	Lead vapour is not generated significantly at temperatures below 500^0C so the risk from of inhalation during soldering is negligible. Generally the risk of harm is low provided that sensible precautions are taken and good standards of hand washing are observed. Use of lead by students is likely to be low as lead in lead pipework will only be found in old houses, but in any case, plumbing activities with lead are regarded as minimal risk.
Irritant / Harmful	The concentration of irritant/harmful component in the sealant is so low that the product is not classed as hazardous.
Highly flammable/ Flammable	The concentration of irritant/harmful component in the sealant is so low that the product is not classed as hazardous, hence the risk is minimal.
Manual handling	A typical roll of lead flashing of a typical thickness and width would weigh about 15 kg. This would present a significant risk to students if they did not have suitable training.

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Control measures	
	Wear protective gloves when handling lead. Wash hands thoroughly with soapy water after working with lead, including scrubbing the nails. Those who are pregnant or who are breast-feeding or who might be pregnant, should avoid handling lead. Waste or scrap lead should be cleared up at the end of each day; melting lead to re-cycle it should only be done if suitable fume extraction and personal protective equipment is available. Only allow eating and drinking in designated areas that are known to be free from contamination with lead or any other hazardous substances. Ensure adequate ventilation, especially when using sealant or working with lead. Ensure adequate training for those handling heavy loads. Beware of the possibility of young people showing off and attempting to lift unsafe loads, or lifting them in unsafe ways.
Disposal	Waste or surplus lead is subject to the *Hazardous Waste Regulations.* It should be collected for proper disposal. Schools and colleges must check that any waste disposal contractor whom they use has a licence (or is exempt) (see PS5 (or GL5) *Waste Disposal Contractors*). Alternatively, scrap metal dealers will usually accept lead for re-cycling.
Storage	Store lead in a clean dry area, preferably off the floor on a wooden base.

FURTHER INFORMATION

It is against the law for women capable of having children, and for young people under 18, to work in lead smelting and refining and in most jobs in the manufacture of lead-acid batteries.

Further guidance on manual handling and safe techniques can be found in section 3.7 of the *CLEAPSS Laboratory Handbook*, http://www.cleapss.org.uk/attachments/article/0/Sec03.pdf?Secondary/Science/Laboratory Handbook/.

Largely for historical reasons, lead is subject to the *CLAW Regulations* rather than the *COSHH Regulations*. This makes no practical difference so far as schools are concerned.

IMMEDIATE REMEDIAL MEASURES

Swallowed	Immediately rinse the mouth with water. Drink plenty of water and seek medical attention promptly.
Vapour is inhaled	Take the casualty into fresh air and make her/him rest whilst medical attention is sought.
In the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
On the skin	Immediately remove by wiping with a disposable paper towel. Then cleanse the affected area with resin-removing cream[113], followed by washing with warm, soapy water. Do not use solvents.
Spilt in the workshop	Take up spilt resin with sand, cotton waste, sawdust, paper towel or other absorbent material. Then place this in a plastic bag and seal prior to disposal. Wash the area with hot water and detergent. Do **not** absorb spills of hardener (catalyst) on sawdust or other flammable material. Mineral-based cat litter is suitable.

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5.020 Man Regs & COSHH Regs	PAINTING AND DECORATING: painting	Applicable to: Non-drip paints, gloss paints, undercoats, enamel paints, radiator paints	See also: 5.021

Process(es) covered:

Applying emulsion, vinyl emulsion and oil-based paints and varnishes to interior or exterior walls, woodwork and metal surfaces.
Applying wood stains.
Applying primers.
Using thinners.
Most of the pigments used are low hazard but solvents other than water (oil-based paints) can present some hazards as can some of the additives used to improve the properties. However, the proportion of hazardous components is usually so low that the final product is not classed hazardous.
As formulations vary between manufacturers, and can change over time, it is important to check for any hazard warning on the container.
Generally speaking emulsion paints are water-based and present minimal hazards but oil-based paints may present significant hazards, varying according to the solvent used.

Hazards

Harmful	White spirit (turpentine substitute) may cause lung damage if swallowed. Turpentine is harmful by inhalation, in contact with skin or if swallowed.
Irritant	Repeated exposure to some of the solvents used may cause skin dryness or cracking (R66)
Flammable	Some of the solvents used are flammable (R10)
Dangerous for the environment	Some volatile organic compounds (VOCs) may have a detrimental effect on the environment, eg damaging the ozone layer or toxic to various organisms. There may be nuisance odours from VOCs which can cause headaches and nausea.

Risk Assessment

No WEL[114] is listed for white spirit (R10, 51/53, 65) because it is a mixture of varying composition. However, a value can be calculated according to the proportions of hazardous components present. A typical WEL is 550 mg/m^3 (8 h TWA) or about 300 ppm (15 min ref period). In normal school operations, these limits will not be reached.
The WEL for turpentine (R10, 20/21/22, 36/36, 43, 65, 51/53) is 850 mg m^{-3} (15 min ref period).
Splashes to the eye will cause discomfort and possible damage. Prolonged contact with the skin may have a defatting (drying) effect which may lead to skin irritation and dermatitis.
There is some risk of fire if any source of ignition (naked flame, a source of sparks or a very hot surface) is present close to where flammable solvents are being used.
There is a significant risk of rags soaked in some oil-based paints igniting by spontaneous combustion, sometimes after an interval of several hours.
Increasing environmental concerns are leading to reduced use of VOCs in paints and increasingly stringent restrictions on the disposal of surplus paints.

[114] EH40/2005

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Control measures	
	Wherever possible, use emulsion paints (which are water-based). If paints or varnishes containing VOCs must be used then choose those with the lowest VOC and/or low-odour versions. Ensure good ventilation especially for oil-based paints. Wear protective gloves, especially for oil-based paints. Do not allow eating and drinking in the workshop. Thoroughly wash hands before leaving the workshop Wear eye protection, especially for oil-based paints. Remove all naked flames and other sources of ignition if oil-based paints are in use. If oil-based paints are used, place paint-soaked rags in a bucket of water or in a container with an air-tight lid.
Disposal	Empty containers may be placed in normal refuse. Ensure that no one (neither students nor staff) pour surplus or waste paints down the drain. Where possible, surplus paint should be re-cycled. If the can of paint is more than one third full and less than 10 years old, donate it to Community RePaint, http://www.communityrepaint.org.uk/. Often, these operate from Household Waste Re-cycling Centres. If re-cycling is not possible, for emulsion paints, take off the lid and allow the water to evaporate (this may take some time). When it is completely dry, the container may be placed in normal refuse. If re-cycling is not possible, for oil-based paints do NOT take off the lid to allow the solvent to evaporate. The paint may be subject to the *Hazardous Waste Regulations* Check the label on the can for disposal instructions. Some Household Waste Re-cycling Centres may accept them. Otherwise use a licensed waste contractor. Schools and colleges must check that any waste disposal contractor whom they use has a licence (or is exempt) (see PS5 (or GL5) *Waste Disposal Contractors*).
Storage	Keep all paint in a cool, dry location. Avoid storing paint where it would be subject to high temperatures (eg, not adjacent to a boiler) or where it might freeze in cold weather.
IMMEDIATE REMEDIAL MEASURES	
If much vapour is inhaled	Remove individual to fresh air and seek medical attention.
If solvents get into the eyes	Irrigate immediately with water for at least 10 minutes, holding the eyelids apart. Obtain medical attention.
If solvents are swallowed	For most solvents, rinse out the mouth and drink plenty of water. DO NOT INDUCE VOMITING. Seek medical attention.
Effects of solvents on skin	Repeated and prolonged contact with the skin may cause removal of natural greases, resulting in dryness, cracking and possible dermatitis. Wash with mild antiseptic and apply moisturising cream.

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5.021 COSHH Regs & Man Regs	PAINTING AND DECORATING: BRUSH CLEANING	Applicable to: Use of white spirit, cellulose thinners, turpentine	See also: 5.020

Process(es) covered:	Cleaning oil-based paints off brushes and rollers using solvents such as turpentine, white spirit (turpentine substitute, mineral spirits) or cellulose thinners (a mixture of several solvents). Cleaning emulsion and vinyl emulsion paints off brushes and rollers using water.
Hazards	
Harmful	White spirit (turpentine substitute) may cause lung damage if swallowed. Turpentine is harmful by inhalation, in contact with skin or if swallowed. Cellulose thinners have very variable composition which might include iso-butanol, ethyl acetate, n-propyl acetate, toluene, n-butyl acetate, acetone, ethanol, ethyl methyl ketone, methanol. Most thinners are harmful by inhalation and in contact with skin, irritating to eyes and skin and may harm the unborn child. Repeated exposure may cause skin dryness or cracking and vapours may cause drowsiness or dizziness.
(Highly) flammable	Whereas white spirit and turpentine are flammable, cellulose thinners are highly flammable.
Risk Assessment	
Harmful	No WEL[115] is listed for white spirit (R51/53, 65) although some suppliers suggest 600 mg m^{-3} (15 min ref period). The WEL for turpentine (R20/21/22, 36/36, 43, 65, 51/53) is 850 mg m^{-3} (15 min ref period). The WEL for cellulose thinners depends on the exact formulation. Some suppliers quote 416 mg m^{-3} (15 min ref period), (R20, R36/37, R66) but others may be lower (R20/21, R36/38, R63, R67).
Highly flammable	There is some risk of fire if any source of ignition (naked flame, a source of sparks or a very hot surface) is present close to where flammable solvents are being used and especially cellulose thinners.
Control measures	
	Do not use brush-cleaning solvents in confined spaces. Open windows when using brush-cleaning solvents in a workshop unless quantities are small. Avoid the use of cellulose thinners unless required by specialist paints. Wear eye protection. Thoroughly wash hands before leaving the workshop.
	Remove all naked flames and other sources of ignition, especially if using cellulose thinners.

Painting and decorating: brush cleaning (Continued)

[115] EH40/2005

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RESTRICTIONS	Solvent abuse. Strict control over the use and storage of brush-cleaning solvents should be enforced to ensure that theft and the deliberate inhalation of vapour does not take place.
Disposal	Empty containers may be placed in normal refuse. Waste, surplus or contaminated solvents other than water are subject to the *Hazardous Waste Regulations.* Ensure that no one (neither students nor staff) pour used/waste solvents (other than water) down the drain. They should be collected for proper disposal. Schools and colleges must check that any waste disposal contractor whom they use has a licence (or is exempt) (see PS5 (or GL5) *Waste Disposal Contractors*).
Storage	Brush-cleaning solvents should be stored securely in a cool, dry, well-ventilated place, away from sources of ignition. Guidance from the HSE allows up to a maximum of 50 litres of highly flammable liquids to be held in any one workroom in a highly flammable liquids cupboard or bin. Although up to half a dozen containers which are 'in use', each less than 500 ml, could be kept on the open shelf outside such a cupboard or bin, this is much less secure and tempts thieves.

IMMEDIATE REMEDIAL MEASURES

If much vapour is inhaled	Remove individual to fresh air and seek medical attention.
If solvents get into the eyes	Irrigate immediately with water for at least 10 minutes, holding the eyelids apart. Obtain medical attention.
If solvents are swallowed	For most solvents, rinse out the mouth and drink plenty of water. DO NOT INDUCE VOMITING. Seek medical attention.
Effects of solvents on skin	Repeated and prolonged contact with the skin may cause removal of natural greases, resulting in dryness, cracking and possible dermatitis. Wash with mild antiseptic and apply moisturising cream.

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5.022 Man Regs & COSHH Regs	PAINTING AND DECORATING: SURFACE PREPARATION BY SANDING	Applicable to: Use of hand- or machine-sanders	See also: 5.023, 5.024

Process(es) covered: Sanding down surfaces using hand- or machine-sanders.

Hazards

Dust

Wood dust is hazardous by inhalation.
MDF produces considerable amounts of fine wood dust, even with hand sanding.
Dust from gypsum plasters, epoxy fillers and similar may irritate the eyes, skin and respiratory system.

Toxic

Old surfaces may have been painted with lead-based paint. Lead compounds may cause harm to the unborn child (R61); there is a possible risk of impaired fertility (R62); harmful by inhalation and if swallowed (R20/22); very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment (R50/53).

Risk Assessment

Dust

Hard-wood and soft-wood dusts have a WEL of 5 mg/m^3 (8 h TWA) and for gypsum and Plaster of Paris the WEL is 10 mg/m^3 (8 h TWA)[116]. Inhalation of plaster dust can cause short term irritation of the respiratory system. Hand operations prior to painting do not usually produce large quantities of dust but might do so if a number of pupils are carrying out similar activities. Machine operations invariably produce much more dust so staff and pupils could be at risk.

Toxic

WEL (mg m)$^{-3}$: 0.15 (LTEL), 0.45 (STEL) as lead. There is a significant risk of exposure to lead if abrading old painted surfaces. If painted since about 1970, samples are unlikely to contain lead but old samples may have underlying layers of lead-based paint.

Control measures

Use dust extraction if abrading materials, especially MDF, by machines (or wear dust masks at least to BS EN 149 FFP3 standard).
Work outdoors if a number of people are abrading or sawing by hand, especially MDF (or wear dust masks at least to BS EN 149 FFP3 standard).
Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science
Clean floors and other surfaces regularly.
Use wet methods to clean floors and work surfaces contaminated with dusts; do not use a vacuum cleaner (unless an industrial type with a fine dust (HEPA) filter is available).
Wash hands thoroughly after producing dust.
Wear eye protection.
Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap.
Do not abrade lead-based paints. If unsure, test for the presence of lead using a kit from a specialist paint shop. Alternatively, or if lead is known to be present, use a chemical stripping method, which does not produce dust or fumes.

116 EH 40/2005.

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Disposal	If wet cleaning is used, waste materials can be disposed of via the normal refuse collection. If dust is collected via an extraction system, the waste should go into heavy-duty plastic sacks and disposed of via the normal refuse collection.
Storage	Collected dust should not be stored but the sacks should be placed immediately in the refuse bins.

IMMEDIATE REMEDIAL MEASURES

Dust in the eyes	Wash thoroughly for at least ten minutes with water to prevent scratching of the eye. Seek medical attention if irritation persists.

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5.023 COSHH Regs	PAINTING AND DECORATING: SURFACE PREPARATION USING CHEMICAL STRIPPERS	Applicable to: chemical strippers	See also: 5.022, 5.024

Process(es) covered: Removing paint with chemical paint strippers which may be solvent-based, alkaline or eco-friendly. Some preparations may be thixotropic (gel-like).
Stripping wall paper using chemical preparations, which may be applied as a gel or in sheets.

Hazards

Toxic

Old surfaces may have been painted with lead-based paint. Lead compounds may cause harm to the unborn child (R61); there is a possible risk of impaired fertility (R62); harmful by inhalation and if swallowed (R20/22); very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment (R50/53).

Corrosive

Some paint-strippers contain sodium hydroxide (caustic soda). This causes severe burns. Depending on the concentration the paint-stripper may be corrosive or irritant as used.

Irritant

Some paint-strippers contain N-methyl-2-pyrrolidinone usually in an organic solvent. Contact with acids liberates toxic gases (R31). Irritating to the eyes, respiratory system and skin **(R36/37/38).**

Harmful

Solvent-based paint-strippers usually contain dichloromethane (methylene dichloride) and may also contain up to 10% methanol and up to 5% white spirit. The hazards are largely dominated by the dichloromethane for which there is limited evidence of a carcinogenic effect, category 3 carcinogen (R40). There is a possible risk of irreversible effects through inhalation, in contact with skin and if swallowed (R68/20/21/22). It degreases the skin which can lead to secondary inflammation. Repeated exposure may cause liver damage. Will irritate eyes.
A solution of benzyl alcohol in water (less than 30%) is sometimes used in biodegradable environmentally-friendly paint-strippers. It is harmful if swallowed (R22).
Some wallpaper stripping gels contain surfactants and other products which may be irritating to eyes and skin (R36/38), may cause lung damage if swallowed (R65) and repeated exposure may cause skin dryness or cracking (R66). However, the percentage is usually so small that the product is classed as low hazard.

Risk Assessment

Toxic

If painted since about 1970, samples are unlikely to contain lead but old samples may have underlying layers of lead. WEL[117] (mg m^{-3}): 0.15 (LTEL), 0.45 (STEL) as lead. As long as care is taken with handling and disposal, there is unlikely to be a significant risk.

Corrosive

There is a significant risk of paint-strippers containing sodium hydroxide solution being splashed into eyes or onto skin, eg, if the mixture is being stirred or the solution being poured.

Harmful

WEL (mg m^{-3}): 350 (LTEL), 1060 (STEL). It is possible that these limits could be exceeded if large areas of paint (eg, more than 300 mm x 300 mm) were being stripped or the work was carried out in a confined space.
Solvent-based paint-strippers, if acquired by pupils, may be used in ‘solvent abuse’.

[117] EH40/2005

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Control measures	
	Always wear eye protection when using paint-strippers. Ensure emergency eye-washing facilities are available in the room, eg, a short length of soft clean rubber or plastic tubing that fits on the cold tap. Wear protective gloves (preferably nitrile or pvc). Protective masks (to BS EN 149 category FFP3) may also be necessary, especially for large-scale activities. Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science As far as possible, use low-hazard, environmentally-friendly paint-strippers. Avoid the use of methylene dichloride paint-strippers unless spread over areas less than 300 mm x 300 mm or unless local exhaust ventilation is available or work can be carried out in the open air. If small areas of methylene dichloride are used indoors without LEV open windows and do not use in confined spaces. Thoroughly wash hands before leaving the workshop.
RESTRICTIONS	Paint-strippers containing dichloromethane are being phased out under EU legislation. They will be banned from sale (except to licensed professionals) from December 2011 but existing stocks can continue to be used.
Disposal	Empty containers may be placed in normal refuse. Waste, surplus or contaminated paint strippers, if they carry a hazard warning label, are subject to the *Hazardous Waste Regulations.* Ensure that no one (neither students nor staff) pour used or waste stripper down the drain. They should be collected for proper disposal. Scrapings of paint etc should be collected together and the solvent allowed to evaporate in the open air, or in a well-ventilated area. The dried sample may then be placed in the normal refuse unless it contains (or is suspected to contain) a lead-based paint. In that case, it should be placed in a suitable, labelled container (eg, a plastic sack or an empty can) and collected for proper disposal. Schools and colleges must check that any waste disposal contractor whom they use has a licence (or is exempt) (see PS5 (or GL5) *Waste Disposal Contractors*).
Storage	Store containers of paint strippers securely in a cool dry place.

IMMEDIATE REMEDIAL MEASURES

If much vapour is inhaled	Remove individual to fresh air and seek medical attention.
If paint strippers are swallowed	Give plenty of water and seek medical attention. DO NOT INDUCE VOMITING.
If paint strippers are splashed into the eyes	Wash thoroughly for at least ten minutes with water, holding the eyelids apart. Seek medical attention if irritation persists.
If paint strippers are splashed onto the skin or clothing	Remove contaminated clothing. Wash affected area thoroughly with a large amount of water. Soak clothing and rinse repeatedly.

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5.024 Man Regs & COSHH Regs	PAINTING AND DECORATING: SURFACE PREPARATION USING HEAT PROCESSES	Applicable to: stripping paint with blow torches or heat guns,use of steam-strippers for wall paper	See also: 5.022, 5.023

Process(es) covered:

Removing paint with electric heat guns.
Removing paint with blow torches attached to a small cartridge of butane.
Removing wall paper with an electrically-heated steam stripper.

Hazards

Toxic

Old surfaces may have been painted with lead-based paint. Lead compounds may cause harm to the unborn child (R61); there is a possible risk of impaired fertility (R62); harmful by inhalation and if swallowed (R20/22); very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment (R50/53).

Electric shock

The mains cord could be subject to wear and may present a shock hazard.
There could be a hazard if carelessly filling a steam stripper whilst still plugged in or from water dripping onto the mains socket.

Burns and scalds

Users may be burned by their own blowtorch, by hot air from a heat gun, by hot water dripping from the steam plate or by touching the object on which they have been working.
Scalds may also result from contact with steam.

Explosion

Accumulations of butane (which is heavier than air) can explode. Cartridges, even when apparently empty, can explode if in a fire.

Fire

The naked flame could ignite other flammable material.

Risk Assessment

Toxic

WEL[118]: 0.15 (LTEL), 0.45 (STEL) (mg m^{-3} lead). There is a significant risk of exposure to lead if burning off old painted surfaces although modern heat guns will not usually reach a high enough temperature to vapourise the lead. If painted since about 1970, samples are unlikely to contain lead but old samples may have underlying layers of lead-based paint.

Electric shock

It is unlikely that heat guns or steam strippers will be used sufficiently often for wear to be a major problem. The risk of water entering the socket after dripping down from a steam stripper is considered minimal. The risk when refilling the stripper is easily avoided.

Burns and scalds

Trainees are likely to have inadequate control of the size or direction of the flame of a blow torch and the burner will be too hot to separate from the cartridge after only a short period of use. Heat guns are easier to control.
Trainees may find it difficult to control the direction of steam and hot water may drip down the arm if working above chest height.
There is some risk of hot specks of paint flicking into the eye.

Explosion

Cartridges that leak in storage present a significant risk, as does inappropriate disposal.

Fire

There is high risk of scorching woodwork when using a blow torch and a more limited risk with a heat gun. There is also a significant risk of fire if inexperienced users using a blow torch (or even a heat gun) overheat the object being stripped. Charred woodwork, if still hot, can ignite some time later.

[118] EH40/2005

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Control measures	
	Do not burn off lead-based paints. If unsure, test for the presence of lead using a kit from a specialist paint shop. Alternatively, or if lead is known to be present, use a chemical stripping method, which does not produce lead fumes. Visually check the cords of steam-strippers and heat guns before each use and carry out a formal inspection and test regularly. Switch off steam-strippers before re-filling with water. Heat-proof gloves should be worn when using a heat gun or using or dismantling a blowtorch and may be necessary for steam-stripping, especially surfaces at a high level. Wear eye protection when scraping hot paint off surfaces. Cartridges must be checked for leakage after use and stored correctly. Use electric heat guns rather than blow torches for removing paint.
Disposal	Stripped wallpaper may be placed in the normal refuse. Scrapings of paint etc may be placed in the normal refuse unless it contains (or is suspected to contain) a lead-based paint. In that case, it should be placed in a suitable, labelled container (eg, a plastic sack or an empty can) and collected for proper disposal. Schools and colleges must check that any waste disposal contractor whom they use has a licence (or is exempt) (see PS5 (or GL5) *Waste Disposal Contractors*). Broken and/or surplus electrical goods are subject to the *Waste Electrical and Electronic Equipment Regulations* 2006 (the *WEEE Regulations*). These cannot be put in the ordinary refuse collection. Most schools will have in place arrangements for the disposal of old computers, TV sets, kettles, refrigerators, etc. Empty butane cartridges should be left outside (in a secure location) with the burner valve open to allow the remaining vapour to disperse; then the cartridge can be placed in the solid refuse.
Storage	Cartridges for blow torches can be kept between use with the burner attached or removed, according to the maker's recommendations. The location should be secure, well-ventilated, cool, away from flames, combustible materials and escape routes and, ideally, in a fire-resistant structure. For further details, see CLEAPSS guide L164 (or G164) *Portable Laboratory Gas Burners.*
IMMEDIATE REMEDIAL MEASURES	
Burns & scalds	Cool the affected area under a running cold tap for 10 minutes.
Electric shock	Send for first aider immediately. Taking care for your own safety, break contact by switching off or pulling out the plug. If it is necessary to move the casualty without switching off the supply, use a broom handle or wooden window pole or wear rubber gloves. If the casualty is unconscious and not breathing, check that the airways are clear and begin artificial ventilation. Send for an ambulance. If a first aider does not arrive quickly and the pulse is absent, consider carrying out cardio-pulmonary resuscitation.

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5.025 Man Regs & COSHH Regs	PAINTING AND DECORATING: paper-hanging	Applicable to: hanging wallpaper	See also: 5.048

For ease of reference, this sheet deliberately duplicates information that appears on other sheets.

Process(es) covered:	Hanging wallpaper on walls and ceilings. The use of scissors for cutting wallpaper.
Hazards	
Falls	Working on a ladder, platform or scaffolding could result in a fall.
Cuts to users	Scissors (especially large, 25 – 30 cm ones used for cutting wallpaper) can cut fingers.
Injury when carried	Scissors can injure the user or others when being carried or as a result of misbehaviour in the workplace.
Sensitisation	People with a sensitive skin could have an allergic reaction to wallpaper adhesive.
Risk Assessment	
Falls	There is some risk of injury as evidence suggests that most major injuries in schools to staff are caused by low falls, ie from a height of less than 2 m. Where children and young people are concerned, there is an even greater risk because of their lack of experience and likely imprudent behaviour. There is also a risk of injury through inappropriate choice of equipment (eg, climbing on chairs, using ladders which are too short for the job) or through unsafe use of otherwise suitable equipment (eg, leaning to one side of a ladder).
Cuts to users	Careless use of scissors can result in injury although the risk of significant injury is considered low.
Injury when carried	There is some risk of injury if scissors are carried with the blade exposed. This risk is increased where bags or other objects on the floor give a risk of tripping.
Sensitisation	Wallpaper adhesive often contains a fungicide to inhibit mould growth. The concentration is too low for the product to be classed as hazardous but cases of dermatitis have been reported amongst those working professionally.

Control measures
As it is impossible to avoid working at a height when hanging wallpaper, teach students how to choose suitable access methods for different situations and how to use them safely. See the detailed *Control Measures* on *Sheet 5.048, Working practices: working at height.* Teach children how to use scissors and carry them safely with the blades enclosed by the fist. Give clear instructions to ensure the circulation space is kept clear of obstructions. Avoid the use of wallpaper adhesives containing fungicide if students are likely to get the paste in their mouth. Ensure that those with sensitive skin wear protective gloves (eg, disposable nitrile) when using wallpaper adhesives.

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RESTRICTIONS	Although commentaries on the ***Criminal Justice Act 1988*** **(as amended by the *Offensive Weapons Act 1996* and the *Violent Crime Reduction Act 2006*) usually say that the ban on blades is not intended to apply to scissors, nevertheless some retailers do state that** the sale of large scissors is prohibited to persons under the age of 18. Whether prohibited or not, they can be used by younger persons under supervision but there may be a risk of theft.
Disposal	Scissors which are no longer required must be disposed of responsibly. An old tin or a small 'sharps box' as used in first-aid rooms could be used. Surplus wallpaper adhesive is low hazard and can be placed in the refuse.
Storage	Scissors must be stored in a secure place to control access. It is important to ensure that scissors are collected in after use since they could constitute a hazard if removed by children or if left on tables, chairs or on the floor. Store wallpaper adhesive in a cool dry place.

IMMEDIATE REMEDIAL MEASURES

Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.
Crushing injuries (casualty crushed for more than 15 minutes)	DO NOT RELEASE THE CASUALTY. Send for an ambulance, giving details of the incident. Comfort and reassure the casualty until help arrives.
Crushing injuries (casualty crushed for less than 15 minutes)	Release the casualty as quickly as possible. Control any external bleeding and cover wounds. Send for the first aider who will secure and support any suspected fractures, examine and observe the casualty for signs of shock and treat accordingly.
Impact injury	Rest the injured part; apply ice to reduce the bruising and pain; attention from a trained first aider is required.
Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves then the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
If there is an allergic reaction	If the casualty shows anxiety, red, blotchy skin, swelling of the face and neck and puffiness around the eyes, s/he could be suffering from a serious allergic reaction. Call an ambulance and prop the patient in a sitting position in case breathing problems develop.

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5.026 COSHH Regs	Plastics: Hazards of materials	Applicable to: nylon; polyurethanes; PVC; polystyrene; etc	See also: 5.027, 5.028,

Process(es) covered:	All plastics (polymers) degrade at sufficiently high temperatures, producing fumes with various hazards. Those materials presenting hazards at lower temperatures are discussed here. The process itself may also be hazardous, eg drilling or machining, or may produce hazardous by-products, eg, dust.
Hazards	
Toxic	Decomposition of polyvinyl chloride (PVC) (whether plasticised or not) may occur to give vinyl chloride which may cause cancer. Polyurethane foams produce toxic fumes when heated to melting.
Harmful	Styrene vapour is harmful by inhalation.
Dust	PVC and nylon dust are harmful by inhalation.
Irritant	Many powders irritate eyes and skin.
Risk Assessment	
Toxic	Decomposition of PVC powder in air starts at around 150 °C with the release of vinyl chloride monomer (WEL 7.8 ppm, 8 h TWA)[10] which must be regarded as a carcinogen. Polyurethane foam may produce hydrogen cyanide and nitrogen oxides when heated. Both of these would present significant risks, both long-term and short-term.
Harmful	Styrene vapour is released during curing of polystyrene resin and when polystyrene or ABS are heated. However, measurements show that, in school processes, the concentration is well below the WEL of 100 ppm (8 hr TWA)[119] so the risk is small. Cutting expanded polystyrene with a hot wire cutter presents minimal risk.
Dust	PVC - long term exposure to dust may result in a reduction in lung function and the dust has an WEL of 10 mg/m^3 (8 h TWA)[10]. This level will not be reached with occasional use in a school workshop. Nylon dust is subject to a similar WEL which will not be reached with occasional use in a school workshop. Abrading PVC or nylon with hand tools will not cause a significant risk nor does occasional use of powdered pvc or nylon.
Irritant	Some risk of skin and eye irritation from pouring powders.
Control measures	
	If PVC must be used in heat processes, ensure there is local exhaust ventilation, which is tested at least every 14 months. Do not heat polyurethane foam, eg, with a hot wire for cutting. Ensure good ventilation in the workshop if polystyrene resin is used, even on a small scale. Do not heat ABS above its softening point. Handle powdered plastics carefully to avoid the formation of dust clouds. Wash hands thoroughly after handling the powder. Wear eye protection and protective gloves when pouring powder.

[119] EH 40/2005

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Disposal	Small quantities can be disposed via the solid refuse collection, but large quantities must be handled by an authorised contractor. Plastics are often marked with the re-cycling symbol and a code to indicate the type of plastic. For example. code 5 and the caption PP both indicate polypropylene. However most of the plastics used in construction are code 7, miscellaneous. ♣
Storage	Store materials in a clean, dry area at ambient temperature (< 30 °C).

Further information

The following polymer materials present only minimal hazards in normal use:

Systematic name	**Common names**	**Re-cycling code**
Acrylonitrile, butadiene, styrene	ABS mixed polymer	7
Cellulose acetate butyrate	CAB mixed polymer, butyrate sheet	7
Cross-linked polyesters (dicarboxylic acids with diols & triols)	Glyptals, alkyd resins	7
Polyamide	Nylon (various forms)	7
Polycarbonate	PC sheet	7
Polyester and polyester copolymer	Terylene, Crimplene, Dacron, Trevira	7
Polyethers	Epoxy resins	7
Polyethylene	Polythene, Alkathene, HDPE, Plastazote foam, Polymorph	2 (high density polythene, HDPE) 4 (low density polythene, LDPE)
Polyisoprene, polybutadiene, polychloroprene	Rubbers: natural, buna, neoprene	7
Polymethylmethacrylate	Acrylic, Perspex, Lucite, Plexiglass	7
Polymethylpentene	TPX	7
Polypropylene	Corriflute, Correx	5
Polytetrafluoroethene	PTFE, Teflon, Fluon	7
Polyvinyl acetate	PVA	7

IMMEDIATE REMEDIAL MEASURES

If powder is swallowed	Drink plenty of water and seek medical attention.
If vapour is inhaled	Remove casualty to fresh air and seek medical attention.
If dust in the eyes	Wash thoroughly for at least ten minutes with water to prevent scratching of the eye. Seek medical attention if irritation persists.
If spilt in the workshop	If possible, use an industrial vacuum cleaner to get the powder into bags. If sweeping, dampen powder first. Rinse area with soapy water.

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5.027 Man Regs	PLASTICS: Abrading, trimming, drilling & shaping Equipment	Applicable to: acrylics; nylon; polypropylene; polystyrene	See also: 5.026, 5.028

Process(es) covered: Shaping and cutting plastic materials by machine (bandsaw, drilling machine), by portable power tools or by hand

Hazards

Ejection of material	Acrylics can shatter when being machined, with the ejection of fine splinters.
User injury	Human contact with rotating tools can cause cuts or abrasions. Injuries can also arise from loss of control of the workpiece when heat-softened plastics cause tools to jam, putting strains on holding devices and on the material itself.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.

Risk Assessment

Ejection of material	There is some risk of shattering, especially when cutting or drilling acrylic sheet, particularly if it is old stock.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and will forget the particular properties of the material they are using.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.

Control measures

Cover the material with masking tape to prevent sharp fragments from flying.
When drilling, use a slow feed rate so as not to increase the stress in the material unduly.
Clamp the work piece firmly to the table of the drilling machine to reduce the risk of shattering.
Re-grind the drill bit to give a zero rake angle, and change the point angle of the drill to about 130 ° to reduce the risk of shattering.
Use ‘Soluble oil’ as a coolant.
Ensure there are guards around rotating parts.
Ensure users are adequately trained.
When drilling plastics, use a slow speed so as not to increase the temperature of the material unduly.
Tie back long hair; remove or cover jewellery and cover loose clothing by a secure apron or overall.

Storage

All plastics should be kept in cool, dry conditions. Sheet material which may be machined should be kept in the dark to minimise the embrittlement which is caused by UV radiation.

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Restrictions	Persons suffering from asthmatic conditions are particularly prone to health hazards from abrading and should not undertake this process.

FURTHER INFORMATION

When using a moulding trimmer, it is essential to keep the work flat on the machine bed and to ensure that the cutter is set at the correct height for the thickness of material being cut.

IMMEDIATE REMEDIAL MEASURES

Particle in the eye	Try to prevent the casualty from rubbing the eye. Sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, try to wash it out with clean water. If this is unsuccessful try lifting it out with the corner of a damp tissue. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
If coolant is in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.

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5.028 COSHH Regs	Plastics: Machine Abrading - Fumes and Dust	Applicable to: acrylics; nylon; polypropylene; polystyrene	See also: 5.026, 5.027

Process(es) covered: Shaping and cutting plastic materials by hand or machines

Hazards

Dust	Hazardous by inhalation.
Harmful	Rigid polystyrene when heated to the point of decomposition may release styrene fumes.
Shattering	Some plastics can shatter when being machined, with the ejection of fine splinters.

RISK ASSESSMENT

Dust	Many plastics give rise to dust and fine particles when they are machined or abraded. Exposure to high concentrations may cause irritation to nose, throat and eyes. The action level here is the total dust concentration of 10 mg/m^3 (8 hour TWA)[120]. On the scale of school work, this process will not require local exhaust ventilation.
Harmful	Unless care is taken to keep the work cool, machining of rigid polystyrene may release styrene which has a WEL of 100 ppm (8 h TWA) and 250 ppm (15 min ref period). A coolant is therefore required.
Shattering	There is some risk of shattering, especially when cutting or drilling acrylic sheet, particularly if it is old stock.

Control measures

Scrupulously follow any instructions concerning specific hazards associated with particular materials issued by manufacturers.
Use water as a lubricant where possible without introducing electrical hazards, to keep production of dust to a minimum. The wearing of nuisance dust masks is advised when machining.
Wear eye protection.
When using a circular saw or band saw to cut plastic sheet, feed the material slowly and steadily to the blade to minimise heating.
To prevent the cut being re-welded by melted dust, the surface of the sheet can be covered with sticky tape or paper (eg, masking tape).
Work only in a well-ventilated area.
When drilling plastics, use a slow speed so as not to increase the temperature of the material unduly. ‘Soluble oil’ can be used as a coolant.
Clamp down the workpiece to lessen the risk of shattering.

120 EH 40/2005

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Disposal	Small quantities may be added to ordinary dry waste.
Storage	All plastics should be kept in cool, dry conditions. The main store should preferably be outside and built of brick, away from heat sources, open flames and other sources of ignition. Foamed plastics are more flammable and need extra care in storage.
Restrictions	Persons suffering from asthmatic conditions are particularly prone to health hazards from abrading and should not undertake this process.

FURTHER INFORMATION

Machines such as bandsaws, drills, centre lathes and sanders which were designed for use on wood or metal are often used for working plastics. The risk assessments for these applications can be consulted for plastics work too.

It should be noted that there is a risk of explosion from static electricity within local exhaust systems designed to extract wood dust, if the same system is used to extract dust from plastics. Wherever possible separate systems should be used for machines that are only used to machine plastics. Where this is not possible the wood dust should be emptied before the system is used for plastics, and the plastic dust should be removed after use.

IMMEDIATE REMEDIAL MEASURES

Inhalation of fumes	If fumes are inhaled, remove person to fresh air and seek medical advice.
If dust or fumes in the eyes	If eyes water due to fumes or dust, flush with water and remove person to fresh air. If the condition persists, seek medical advice.

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5.029 Man Regs	Portable POWER tools: angle Grinders and abrasive wheel cutters	Applicable to: cutting and shaping metals; cutting and shaping brick and block work, concrete and paving slabs	See also: 5.014, 5.030, 5.031, 5.032, 5.033, 5.034, 5.035

Process(es) covered:

Cutting through brick and blockwork walls to form an opening and other cutting tasks such as cutting walls and concrete to form channels for services and cutting paving slabs and similar to size.
Cutting through metal sections of various sizes and materials.
Most portable power tools are electrically operated but pneumatic tools are used where compressed air is available. The use of tools with integral low-voltage battery packs is increasing. Normally an impregnated cutting or abrasive disc is used, rather than a conventional grinding wheel.

Hazards

Flying material	Off-cuts and broken discs can be ejected violently. Sparks can be ejected when working on steel.
User injury	Human contact with rotating parts and swarf can cause cuts or abrasions. Wrist sprains can result from jammed tools
Tripping	Power leads or compressed air pipes present a tripping hazard.
Eye injury	Particles from the material being cut can enter the eye
Dust	Dust can present an inhalation hazard.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Manual handling	Heavy workpieces and the gyroscopic effect of rotating motors can present a manual-handling hazard.
Hearing injury	Cutting operations with angle grinders produce high levels of noise.
Burns	Workpieces cut with a grinder can become hot.
Fire	Sparks can be emitted which could start a fire.

Risk Assessment

Flying material	Flying off-cuts are unlikely to occur but streams of sparks can cause injury.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts. If a grinding or sanding disc jams, some users may not be able to restrain the tool.
Tripping	Trailing leads or pipes present a real risk of tripping.
Eye injury	There is a very high risk of particles entering the eye whenever these tools are used.
Dust	Some cutting operations, eg cutting bricks or blocks with an abrasive or diamond cutting wheel can produce large quantities of fine dust.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk. Novices may have difficulty controlling the tool.
Hearing injury	The noise is likely to exceed the action level under the *Control of Noise at Work Regulations*.
Burns	Burns from grinding are usually superficial.
Fire	Fire would be most likely if there are combustible materials, such as wood dust or paper, nearby.

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Control measures	It is impracticable to guard all the hazardous areas when using portable power tools. Use the tool so that sparks are not directed towards others in the vicinity. Wear eye protection of the correct impact resistance. Ensure there are guards around rotating parts. Ensure users are adequately trained and supervised. Choose the route followed by power leads and pipes to minimise the tripping hazard. Battery-powered tools avoid this problem. Reduced dust levels by wet cutting, if this facility is available, or wear a dust mask to FFP3 standard (Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science). Alternatively, cut bricks etc using a masonry bolster chisel. Tie back long hair cover or remove; jewellery and cover loose clothing with a secure apron or overall. Ensure two persons handle heavy items. Assess the strength of young persons before using portable tools. Wear suitable hearing defenders. If cutting is regularly done by the same person, exposure to vibration would also need to be assessed and reduced if necessary. Consider the need to wear thermal protection gloves to handle any material which might be hot. Ensure there are no combustible materials, eg wood dust, paper, nearby.
Restrictions	Students may only use portable grinders when they have been assessed and the assessment has shown that they are competent and they are under supervision of specifically trained staff.

FURTHER INFORMATION

All the portable tools covered in this risk assessment should only be used under the supervision of qualified staff. Precautions to be taken with compressed air supplies are listed in the introduction. For general requirements on electrical supplies including a discussion on the use of 110 V, see page 12. Portable tools should be examined before use and should have regular formal inspections and tests. The frequency depends on use but half-termly would be typical. Useful guidance on grinding is available from HSE Books in HSG 17, *Safety in the Use of Abrasive Wheels* but there is a charge for this publication.

IMMEDIATE REMEDIAL MEASURES

If a particle could be in the eye	Try to prevent the casualty from rubbing the eye. Sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, try to wash it out with clean water. If this is unsuccessful try lifting it out with the corner of a damp tissue. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
If coolant is in the eyes	Irrigate immediately with water for at least ten minutes, holding eyelids apart. Obtain medical attention.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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5.030 Man Regs & COSHH Regs	Portable POWER tools: BISCUIT CUTTERS	Applicable to: portable biscuit cutters	See also: 5.029, 5.031, 5.032, 5.033, 5.034, 5.035, 5.046

Process(es) covered:	The construction of biscuit joints, often in manufactured board. A small circular cutter, similar to a small circular saw blade is used to create a curved recess that will accept the "biscuit" that forms the joining piece These tools may be powered by mains electricity, compressed air or low-voltage battery packs.
Hazards	
Flying material	Broken blades can be ejected violently. If machines are used with accessories or adaptors, the accessory can become detached from the machine causing parts to fly off.
User injury	Human contact with rotating parts can cause cuts or abrasions. Wrist sprains can result from a jamming cutter
Tripping	Power leads or air pipes present a tripping hazard and may be damaged, presenting electrical or compressed-air hazards.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Manual handling	Heavy workpieces and the gyroscopic effect of rotating motors can present a manual-handling hazard.
Dust	Considerable dust and fine shavings can be produced, especially when used on manufactured boards.
Risk Assessment	
Flying material	Flying off-cuts are unlikely to occur.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts. When a blade jams, some users may not be able to restrain the tool.
Tripping	Trailing leads or pipes present a real risk of tripping and damage.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk. Novices may have difficulty controlling the tool.
Dust	Considerable dust and fine shavings can be produced, especially when used on manufactured boards.
Control measures	Ensure all guards supplied with the machine are used although it is impracticable to guard all the hazardous areas when using portable biscuit cutters. Wear eye protection. Ensure users are adequately trained and supervised. Do not allow immature pupils to use portable power tools. Choose the route followed by power leads and pipes to minimise tripping and damage. Battery-powered tools avoid this problem. Tie back long hair; remove or cover jewellery and cover loose clothing with a secure apron or overall. Ensure two persons are used to handle heavy items. Use LEV equipment or a suitable face mask (FFP3) to reduce the risks from dusts. Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science

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Restrictions	Students may only use biscuit cutters when they have been assessed and the assessment has shown that they are competent. Students should be given appropriate supervision by specifically trained staff when using a biscuit cutter.

FURTHER INFORMATION

Precautions to be taken with compressed air lines are listed in the *Introduction* to CLEAPSS *Model Risk Assesments for D&T* Part 1.

CLEAPSS provides further information regarding general requirements on electrical supplies including a discussion on the use of 110 V.

Portable tools should be examined before use and should have regular formal inspections and tests. The frequency depends on use but half-termly would be typical.

IMMEDIATE REMEDIAL MEASURES

If a particle could be in the eye	Try to prevent the casualty from rubbing the eye. Sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, try to wash it out with clean water. If this is unsuccessful try lifting it out with the corner of a damp tissue. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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5.031 Man Regs	Portable POWER tools: Drills	Applicable to: mains powered battery drills; Battery powered portable drills	See also: 5.029, 5.030, 5.032, 5.033, 5.034, 5.035

Process(es) covered: The drilling of holes in workpieces too large to bring to fixed machines. Most portable power tools are electrically operated but pneumatic tools are used where compressed air is available. The use of tools with integral low-voltage battery packs is increasing.

Hazards

Flying material Off-cuts, chuck keys or broken bits can be ejected violently. If machines are used with accessories or adaptors, the accessory can become detached from the machine causing parts to fly off. Dust will be produced when drilling into concrete or brick work.

User injury Human contact with rotating parts and swarf can cause cuts or abrasions. Wrist sprains can result from a jamming drill bit.

Tripping Power leads or air pipes present a tripping hazard and may be damaged, presenting electrical or compressed-air hazards.

Entanglement Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.

Manual handling Heavy workpieces and the gyroscopic effect of rotating motors can present a manual-handling hazard.

Burns Drill bits can become hot

Risk Assessment

Flying material Flying off-cuts are unlikely to occur but there is a high risk that inexperienced users will break drills or not assemble multi-function systems correctly. The majority of modern portable drills have keyless chucks which reduces the risk of harm. Dust is a major hazard.

User injury There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts. When a bit jams, some users may not be able to restrain the tool. Higher powered battery powered drills can exert considerable torque.

Tripping Trailing leads or pipes present a real risk of tripping and damage.

Entanglement Entanglement is most likely to occur if rotating parts are exposed.

Manual handling Handling heavy components or awkward manipulation will not occur frequently but will present a real risk. Novices may have difficulty controlling the tool.

Burns Burns from machines and blades are usually superficial.

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Control measures	
	It is impracticable to guard all the hazardous areas when using portable power tools.
	Select the correct bit speed to reduce the risk of drill breakage.
	Wear eye protection when using any portable drill.
	Ensure guards are in place around rotating parts
	Ensure users are adequately trained and supervised.
	Do not allow immature pupils to use portable power tools.
	Choose the route followed by power leads and pipes to minimise tripping and damage. Battery-powered tools avoid this problem.
	Tie back long hair; remove or cover jewellery and cover loose clothing with a secure apron or overall.
	Ensure two persons handle heavy items.
	Consider using gloves or pliers to handle any items which might be hot.

FURTHER INFORMATION

Precautions to be taken with compressed air lines are listed in the *Introduction* to CLEAPSS *Model Risk Assesments for D&T* Part 1.
CLEAPSS provides further advice covering general requirements on electrical supplies including a discussion on the use of 110 V.
Portable tools should be examined before use and should have regular formal inspections and tests. The frequency depends on use but half-termly would be typical.

IMMEDIATE REMEDIAL MEASURES

If a particle could be in the eye	Try to prevent the casualty from rubbing the eye. Sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, try to wash it out with clean water. If this is unsuccessful try lifting it out with the corner of a damp tissue. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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5.032 Man Regs & COSSH Regs	Portable POWER tools: PLANING MACHINES	Applicable to: portable planing machines	See also: 5.029, 5.030, 5.031, 5.033, 5.034, 5.035, 5.046

Process(es) covered: The smoothing of sawn timber, or the machining of planed timber to a required size, especially when the work piece is too large for a fixed machine, or where a fixed machine is not available.

Hazards	
Flying material	It is possible for broken blades to be ejected from the machines.
User injury	Human contact with moving parts can cause cuts or abrasions.
Tripping	Power leads or air pipes present a tripping hazard and may be damaged presenting electrical or compressed-air hazards.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Manual handling	Heavy workpieces and the gyroscopic effect of rotating motors can present a manual-handling hazard. “Kick-back” can occur under some circumstances ie the blades snatch at the workpiece, perhaps because of a knot or twisted grain in the timber.
Dust	See sheet 5.046. Fine dust is caused by these machines especially when cutting manufactured boards.

Risk Assessment	
Flying material	Ejection of broken blades is rare, but is a real risk.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts.
Tripping	Trailing leads or pipes present a real risk of tripping and damage.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk. Novices may have difficulty controlling the tool.
Dust	There would be a significant risk when cutting manufactured board.

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Control measures	It is impracticable to guard all the hazardous areas when using portable power tools. Ensure that only suitably qualified persons fit blades Check the condition of the blades before each use. Wear eye protection. Ensure guards are in place around rotating parts Ensure users are adequately trained and supervised. Do not allow immature pupils to use portable power tools. Choose the route followed by power leads and pipes to minimise tripping and damage. Battery-powered tools avoid this problem. Tie back long hair; remove or cover jewellery and cover loose clothing with a secure apron or overall. Ensure two persons handle heavy items. When planing manufactured board, use local exhaust ventilation if practicable or wear dust masks at least to BS EN 149 FFP3 standard. Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science
Restrictions	Students may only use portable planing machines when they have been assessed and the assessment shows that they are competent. During training, they may use the machines but must be adequately supervised. After training, adequate supervision must still be provided from a competent person. Portable planning machines must not be turned upside down and used as a surface planer.

FURTHER INFORMATION

The blades of portable planing machines should be kept sharp and discarded when blunt. The condition of the blade should be checked before use. The machines should not be used if the operator could be distracted.

Precautions to be taken with compressed air lines are listed in the *Introduction* to CLEAPSS *Model Risk Assesments for D&T* Part 1.

Portable tools should be examined before use and should have regular formal inspections and tests. The frequency depends on use but half-termly would be typical.

IMMEDIATE REMEDIAL MEASURES

If a particle could be in the eye	Try to prevent the casualty from rubbing the eye. Sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, try to wash it out with clean water. If this is unsuccessful try lifting it out with the corner of a damp tissue. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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5.033 Man Regs & COSHH Regs	Portable POWER tools: ROUTERS	Applicable to: Portable hand held routers; hand held routers mounted in a proprietary made router table	See also: 5.029, 5.030, 5.031, 5.032, 5.034, 5.035, 5.046

Process(es) covered: The creation of grooves, rebates and shaped edges of boards using a rotating cutter. Most portable power tools are electrically operated but pneumatic tools are used where compressed air is available. The use of tools with integral low-voltage battery packs is increasing.

Hazards

Flying material Broken cutters can be ejected violently. If machines are used with accessories or adaptors, the accessory can become detached from the machine causing parts to fly off.

User injury Human contact with rotating parts can cause cuts or abrasions. Routers can jam or kick back especially if not controlled correctly at the start and end of a cut.

Tripping Power leads or air pipes present a tripping hazard and may be damaged, presenting electrical or compressed-air hazards.

Entanglement Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.

Manual handling Heavy workpieces and the gyroscopic effect of rotating motors can present a manual-handling hazard.

Dust Cutting of some materials, especially manufactured boards can create fine dust.

Risk Assessment

Flying material Broken cutters are unlikely to occur but there is a high risk that inexperienced users will not fit cutters correctly.

User injury There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts. When a cutter jams or kicks back, some users may not be able to restrain the tool.

Tripping Trailing leads or pipes present a real risk of tripping and damage.

Entanglement Entanglement is most likely to occur if rotating parts are exposed.

Manual handling Handling heavy components or awkward manipulation will not occur frequently but will present a real risk. Novices may have difficulty controlling the tool.

Dust Hazards from fine dust are highly likely, especially when machining MDF.

Control measures

It is impracticable to guard all the hazardous areas when using portable power tools.

Ensure the correct selection and fixing of the cutting tool.

Wear eye protection.

Ensure guards are in place around rotating parts

Ensure users are adequately trained and supervised.

Do not allow immature pupils to use portable power tools.

Choose the route followed by power leads and pipes to minimise tripping and damage. Battery-powered tools avoid this problem.

Tie back long hair; remove or cover jewellery and cover loose clothing with a secure apron or overall.

Ensure two persons handle heavy items.

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	Router tables must always be fitted with LEV equipment. If possible, use a purpose made extraction table as these are designed to collect dust when routing is carried out. Where such devices are not available a dust mask at least to BS EN 149 FFP3 standard should be worn. Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science
Restrictions	Hand held routers may be turned over and mounted in a proper proprietary designed router table. The table must have a guard that covers the cutter and should be fitted with a no-volt and overload push button starter. Dust extraction must be provided. **On no account** should homemade router tables be used. When mounted in a router table the machine is classed as a high risk woodworking machine and should only be used by a member of staff specifically trained in the use of the machine. The cutter guard must always be used. Students under the age of 18 should not use the machine unsupervised **unless** they have the necessary maturity and competence. During training students may use the machine but must be adequately supervised. After training there should still be adequate supervision.

FURTHER INFORMATION

Precautions to be taken with compressed air lines are listed in the *Introduction* to CLEAPSS *Model Risk Assesments for D&T* Part 1.

CLEAPSS provides further advice regarding the general requirements on electrical supplies including a discussion on the use of 110 V.

Portable tools should be examined before use and should have regular formal inspections and tests. The frequency depends on use but half-termly would be typical.

IMMEDIATE REMEDIAL MEASURES

If a particle could be in the eye	Try to prevent the casualty from rubbing the eye. Sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, try to wash it out with clean water. If this is unsuccessful try lifting it out with the corner of a damp tissue. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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5.034 Man Regs & COSHH Regs	Portable POWER tools: Sanders	Applicable to: portable belt, disc and orbital sanders;	See also: 5.029, 5.030, 5.031, 5.032, 5.033, 5.035, 5.046

Process(es) covered: The finishing of large sheets or workpieces too large to bring to fixed machines. Most portable power tools are electrically operated, increasingly with integral low-voltage battery packs but pneumatic tools are used if compressed air is available.

Hazards	
Flying material	It is possible for torn sanding sheets or belts to be ejected from the machines.
User injury	Human contact with moving parts can cause cuts or abrasions.
Tripping	Power leads or air pipes present a tripping hazard and may be damaged presenting electrical or compressed-air hazards.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Manual handling	Heavy workpieces and the gyroscopic effect of rotating motors can present a manual-handling hazard.
Burns	Sanding sheets and belts and sanded surfaces can become hot.
Dust	See sheet 5.046. These tools often have integral dust collection although it is not always adequate for the purpose.

Risk Assessment	
Flying material	Flying pieces of sanding sheets or belts are unlikely to occur but there is a high risk that inexperienced users will not fit sheets or belts correctly.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts.
Tripping	Trailing leads or pipes present a real risk of tripping and damage.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk. Novices may have difficulty controlling the tool. This particularly applies to portable belt sanders
Burns	Burns from sanding sheets and hot surfaces are usually superficial.
Dust	Dust will present a hazard especially when sanding manufactured board.

Control measures

It is impracticable to guard all the hazardous areas when using portable power tools.
Ensure the correct selection and fixing of the tool.
Wear eye protection.

Ensure guards are in place around rotating parts
Ensure users are adequately trained and supervised.
Do not allow immature pupils to use portable power tools.

Choose the route followed by power leads and pipes to minimise tripping and damage. Battery-powered tools avoid this problem.

Tie back long hair; remove or cover jewellery and cover loose clothing with a secure apron or overall.

Ensure two persons handle heavy items.

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	If possible, use down draft or air tables, which extract the dust from work placed on top. When sanding manufactured board, use local exhaust ventilation. If not practicable, eg when emptying dust trays, wear dust masks at least to BS EN 149 FFP3 standard. Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science

Portable Power Tools Sanders (Continued)

Restrictions	Sanders are considered 'high-risk wood-working machines'. This means that 'young persons' (anyone under 18) should not use them unsupervised **unless** they have the necessary maturity and competence. During training, they may use the machines but must be adequately supervised. After training, adequate supervision must still be provided if the young person is not sufficiently mature.

FURTHER INFORMATION

Precautions to be taken with compressed air lines are listed in the *Introduction* to CLEAPSS *Model Risk Assesments for D&T* Part 1.

CLEAPSS provides further advice regarding the general requirements on electrical supplies including a discussion on the use of 110 V.

Portable tools should be examined before use and should have regular formal inspections and tests. The frequency depends on use but half-termly would be typical.

IMMEDIATE REMEDIAL MEASURES

If a particle could be in the eye	Try to prevent the casualty from rubbing the eye. Sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, try to wash it out with clean water. If this is unsuccessful try lifting it out with the corner of a damp tissue. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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5.035 Man Regs and COSHH Regs	Portable POWER tools: Circular saws, jig sawS	Applicable to: portable circular saws; portable jig saws	See also: 5.029, 5.030, 5.031, 5.032, 5.033, 5.034, 5.046

Process(es) covered: *Circular Saws* – the cutting of large sheets of material to size. The forming of rebates or grooves in wood based materials.
Jig saws – the cutting of curved or irregular shapes from wood-based materials.

Hazards	
Flying material	It is possible for broken saw blades or the tips of tungsten tipped blades to be ejected from the machines.
User injury	Human contact with moving parts can cause cuts or abrasions.
Tripping	Power leads or air pipes present a tripping hazard and may be damaged presenting electrical or compressed-air hazards.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Manual handling	Heavy workpieces and the gyroscopic effect of rotating motors can present a manual-handling hazard. 'Kick-back' can occur under some circumstances.
Dust	See sheet 1.071. Dust will present a hazard especially when cutting manufactured board.

Risk Assessment	
Flying material	Ejection of broken blades is rare, but ejection of the tungsten tips is more common.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts.
Tripping	Trailing leads or pipes present a real risk of tripping and damage.
Entanglement	Entanglement is most likely to occur if rotating parts are exposed.
Manual handling	Handling heavy components or awkward manipulation will not occur frequently but will present a real risk. Novices may have difficulty controlling the tool.
Dust	Fine dust is caused by these machines especially when cutting manufactured boards.

Control measures
It is impracticable to guard all the hazardous areas when using portable power saws. Correct selection of the tool will reduce the risks. Eye protection is needed. Guards around rotating parts will reduce the risk of hand or finger injury but training and experience are essential in reducing risks. Immature pupils should not use portable power tools. The route of power leads and pipes should be chosen to minimise tripping and damage. Battery-powered tools avoid this problem. Long hair must be tied back; jewellery should be removed or covered and loose clothing covered by a secure apron or overall. The risk of back injury is reduced if two persons handle heavy items. Local exhaust ventilation should be provided where practicable. If the dust control system is not adequate then an FFP3 dust mask should be worn by the user. Refer to GL310 - A guide to the use of Respiratory Protective Equipment (RPE) in school D&T and science

Portable Power Tools - Saws (Continued)

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RESTRICTIONS	Students may only use portable rotating circular saws and jig saws when they have been assessed and the assessment shows that they are competent. During training, they may use the machines but must be adequately supervised. After training, adequate supervision must still be provided from a competent person.

FURTHER INFORMATION

It should be recognised that large sheets of manufactured board can usually be cut into smaller pieces more safely by the use of a portable hand-held circular saw or jig saw than by trying to manipulate the sheet on a circular saw bench. When sheets are cut in this way, a piece of wood clamped to the sheet can be used as a guide for the saw. Provided that the blade is correctly guarded, and the machine is sufficiently supported, portable circular saws can be used safely to cut grooves and rebates. Lengths of wood clamped on each side of an edge can be used to provide additional support. The blades of jig saws should be kept sharp and discarded when blunt. On both machines the condition of the blade should be checked before use. These machines should not be used if the operator could be distracted.

Precautions to be taken with compressed air lines are listed in the introduction to this part.

Portable tools should be examined before use and should have regular formal inspections and tests. The frequency depends on use but half-termly would be typical.

IMMEDIATE REMEDIAL MEASURES

A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Other injury	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Minor back pain	Help the casualty to lie down, either on the ground or on a firm mattress, and instruct him/her to rest until the pain eases. Obtain medical attention if symptoms persist.
Back injury resulting in loss of control of, or sensation in, limbs	Keep the head, neck and spine aligned while supporting the casualty's head. Send for an ambulance.

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5.036 Man Regs	Wood working: using sharp edged HAND tools	Applicable to: all hand tools with sharp edges	See also: 5.013, 5.018, 5.037

Process(es) covered: Use of hand planes. Use of chisels for hand cutting of woodwork joints, craft knives, etc.

Hazards

Cuts	Incorrect use or careless handling of sharp tools can cause cuts.
Impact injury	The use of a hammer or mallet may give rise to an impact injury if used incorrectly. The work may also fly off the bench if it is not held securely.

Risk Assessment

Cuts	Serious cuts have resulted from the use of chisels and gouges, particularly when they are knocked off the bench and fall onto a foot or when excessive force is used on them. A really sharp tool is less likely to give rise to cuts because less force is needed to use it. Cuts from a plane are rare but can occur if the user attempts to remove shavings from the mouth of the plane.
Impact injury	Novices are quite likely to hit their fingers with a hammer or mallet while attempting to use a chisel or gouge but the resulting injury is usually trivial. Injuries from flying workpieces are also usually trivial.

Control measures

Ensure tools are really sharp.
Train users in carrying tools safely (with edges protected or pointed down) and in placing tools away from the edge of the bench between uses.
Train users how to use tools correctly.
Check chisels with ferrules at the end of the handles to ensure that the ferrule is undamaged.

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Storage	Hand tools should be stored at a height appropriate for safe collection by the students. The storage system should be such that it is easy to check that all tools have been returned. In some situations it might be considered necessary to lock the cupboard(s) containing hand tools. Planes are heavy and should be stored at a low level, preferably no more than 1100 mm above the floor.

IMMEDIATE REMEDIAL MEASURES

Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Impact injury	Rest the injured part; apply ice to reduce the bruising and pain; attention from the trained first aider is required.

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5.037 Man Regs	Wood working: WOOD CUTTING USING HAND SAWS	Applicable to: saws for wood	See also: 5.018, 5.036

Process(es) covered: The use of hand saws, tenon saws, dovetail saws, coping saws and bow saws to cut wood.

Hazards

Cuts to user — Incorrect or careless use can cause cuts.
Poor work holding can cause saws to slip and cause cuts.

Eye injury — Dust may enter the eyes if blown away from the saw cut.

Risk Assessment

Cuts to user — Although most cuts are trivial, serious cuts may occur if the work is not held correctly or if a saw slips from a saw cut.

Eye injury — When dust enters the eye, either if it is blown away from the saw cut or if eyes are rubbed and sawdust is on the fingers, it is usually fine and unlikely to give rise to a permanent injury.

Control measures

With all of the tools covered by this risk assessment, inexperienced users should be given appropriate instructions in their use. When using any type of saw, the work being cut should be held securely. Inexperienced users may lack the physical strength to do this and some form of clamping will be required. When using a large hand saw, the work should be held against a suitable flat surface with a G clamp or bench hold-fast. When using a tenon or dovetail saw, the work should be held on a bench hook (sawing board) or in a wood-working vice. Users who lack the physical strength to hold the wood on a bench hook should use a G clamp to assist in the task.

When sawing, hazards can occur when the work is too large to fit into a suitable vice. In such situations, the work should be held as securely as possible, perhaps with the aid of G clamps. Care should be taken to ensure that at no time is the saw cutting towards any part of the body of the operator, or any assistant who may be holding the work.

Pupils should be warned of the hazards of blowing dust. A portable dust collection system may be helpful for processes producing much dust.

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Storage	Hand tools should be stored at a height appropriate for safe collection by the students. The storage system should be such that it is easy to check that all tools have been returned. In some situations it might be considered necessary to lock the cupboard(s) containing hand tools.

FURTHER INFORMATION

Woodworking hand saws, tenon saws and dovetail saws should be kept sharp since less force is then needed to use the tool. These saws can be sharpened by an experienced teacher or technician but if no one in the establishment possesses the skills to do this then the saws should be sharpened by a suitable contractor.
Coping saw blades are usually set to cut on the return stroke so users should be reminded of this when using them.

IMMEDIATE REMEDIAL MEASURES

Cuts	If cuts are minor, ie, of a sort which casualties would normally treat themselves then the wound should be washed clean and a small, sterilised dressing applied by the casualty.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.
Impact injury	Rest the injured part; apply ice to reduce the bruising and pain; attention from a first aider may be required.
A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.

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5.038 Man Regs & COSHH Regs	WOOD-WORKING: Mortising Machines	Applicable to: mortising machines and attachments	See also: 5.039, 5.040, 5.041, 5.042, 5.043, 5.044, 5.045, 5.046

Process(es) covered: The cutting of a mortise using a hollow chisel-type machine that incorporates a drill bit within the chisel.

Hazards

Flying objects	Workpieces can slip if not clamped securely. Long pieces of timber can slip in the vice if not clamped firmly.
User injury	Human contact with moving parts can cause cuts or abrasions.
Entanglement	Long hair, dangling jewellery or loose clothing can become entangled with rotating parts, dragging the user onto them.
Dust	Dust may be a hazard, depending on the material being cut.

Risk Assessment

Flying objects	Since quite large workpieces can be used, failure to fix them securely can present a significant risk.
User injury	There is a high risk that trainees will put hands or fingers in hazardous places and experienced users may attempt short cuts.
Entanglement	Entanglement is likely if rotating parts are not guarded.
Dust	Little dust is produced when mortising natural wood but man-made boards, particularly MDF, may do so.

Control measures

Additional supports or clamps may be needed to hold large workpieces securely.

Mortising machines normally have a direct drive from the motor to the chuck that holds the auger bit. This reduces the risk of entanglement. However, on many mortising machines the chuck holding the auger bit is exposed or if a cover is fitted, the cover is often fixed with knurled or thumb screws. If not guarded then the chuck should be enclosed by a suitable cover made from sheet metal and fixed in place with machine screws. Knurled or thumb screws should be replaced with bolts or machine screws that require a tool to loosen. It is virtually impossible to guard the bottom part of the auger bit and chisel and students will need to be warned of the hazards of these parts of the machine.

Eye protection must be worn.

LEV should be provided where the risk assessment shows that it is required.

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FURTHER INFORMATION

If the auger bit and chisel of the mortising machine are kept sharp then large chips of wood rather than fine dust should be produced. Dust collection equipment is therefore not normally required but may be needed if fine dust is produced. A risk assessment should be carried out. For details of dust control systems see CLEAPSS guide L225, *Local Exhaust Ventilation in Design and Technology*.

Chain-type mortising machines are inappropriate for use in schools. Any college using one should note that this model assessment has **not** covered the use of such a machine.

IMMEDIATE REMEDIAL MEASURES

Dust is in the eye	Irrigate immediately with water for several minutes, telling the casualty to hold eyelids apart.
A particle could be in the eye	Tell the casualty not to rub the eye, sit him/her down facing the light with the head leaning back. Stand behind the casualty to look for the particle in the eye. If it is over the iris or pupil, DO NOT ATTEMPT TO MOVE IT. Tell the casualty to hold a gauze pad over the eye and close the other one. Send for an ambulance to take the casualty to hospital. If the particle is visible over the white of the eye, the corner of a moistened handkerchief can be used to remove it. Otherwise send for a first aider.
Injury to the eye	If there is any sign of injury to the eye, tell the casualty to hold a gauze pad over the eye and close the other one. Take the casualty to hospital as quickly as possible.
Severe cuts	Apply pressure on or as close to the cut as possible, using fingers or a pad of cloth. Leave any embedded large bodies and press round them. Lower the casualty to the floor and raise the wound as high as possible. Protect yourself from contamination by blood.

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