

**UNIVERSITY OF SUSSEX**  
**Safety Procedure/Guidance number 2 revised 2009**

**CODE OF PRACTICE FOR WORKSHOPS,**  
**WORKSHOP EQUIPMENT AND TOOLS**

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**CODE OF PRACTICE FOR WORKSHOPS,**  
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**INTRODUCTION**

1. University workshops are of three basic types; those dealing with mechanical engineering and woodworking, professional glass workshops, and those dealing with electronics and electrical testing. There are many aspects of safety which are common to all types of workshop and these are dealt with in the main body of the text. Safety problems relating specifically to electronic workshops are considered separately in Section 15. Hazards and risks to health together with the protective measures to be taken in professional glass workshops are described in the University Safety Procedures/Guidance document SPG-4-09.
2. The purpose of this code of practice is to give guidance to all those who have a responsibility for controlling the work undertaken in a workshop and the environmental conditions under which such work is performed, and to all those who may use the tools, plant, equipment and facilities offered by the University's various workshops wherever they may be located.
3. Where a legal reference is given and the words 'shall' or 'must' are used, a legal requirement is involved and the instruction is mandatory. Where the words 'shall' or 'must' are used with no legal reference, a strong recommendation is implied based upon the advice and experience of members of the University Safety Committee or upon the opinion and experience of other recognised authorities.
4. The use of the word 'should' implies a recommendation based upon the judgement of experienced persons and endorsed by the Safety Committee, but it recognises that some discretion is appropriate in the particular circumstances which exist within a University.
5. Skilled technicians have a duty to maintain high standards in safety practice as an example to less experienced workers.
6. Whatever task is being undertaken in the workshop, it is a legal requirement to consider, via a risk assessment, the safety of the equipment used, the method of construction used and the components being made. (Management of Health and Safety at Work Regulations).
7. Workshops must always be regarded as being places of relatively high risk where powerful machinery is readily available which can kill or maim in a split second if not used with the greatest care at all times and with the fullest regard for its potential for causing serious injury.

## **1.**

## **LEGAL REQUIREMENTS**

### **1.1 The Health and Safety at Work Act (HASAWA)**

8. **Section 1** of the Act requires the University to secure the health, safety and welfare of persons at work and to protect any other persons against risks arising from the work activities.

9. **Section 2** is the most important section.

S2(1) the University to ensure the health, safety and welfare at work of all its employees;

S2(2) (a) safe plant and safe systems of work;

(b) safe use, handling, transport and storage of substances and articles;

(c) information on hazards and risks to health; instructions for safe working; the identification of needs for training and, where needs are identified, the provision of training; effective supervision;

(d) safe access and egress to and from the place of work;

(e) the provision of a safe working environment with adequate welfare arrangements;

S2(3) the provision for consultation between management and trades union safety representatives.

NOTE: Most prosecutions brought by the Health and Safety Executive are for breaches of Section 2, particularly for failure to follow safe systems of work (S2(2)(a)) and failure to provide information, instruction, training and supervision (S2(2)(c)).

10. **Section 3** requires the University to protect the health and safety of non employees, e.g. students, visitors and visiting research workers. Many prosecutions are also brought under this section.

11. **Section 4** requires Workshop Supervisors to ensure that others, e.g. contractors, maintenance staff who may be required to work in the workshops, use systems of work which minimise any risks to the health of workshop staff.

12. **Section 5** requires that emissions to the atmosphere from, say, welding or foundry extract systems do not cause pollution of the atmosphere.

13. **Section 6** sets a responsibility both for designers of items being constructed in workshops, and for the Workshop Supervisors concerned with the actual fabrication, to ensure that (a) the items constructed are inherently safe, and that (b) the users of the apparatus or equipment constructed are supplied with sufficient information on risks to health and instructions to enable the apparatus or equipment to be used in a safe manner.

14. **Section 7** sets down the duties of workshop staff who must:

- (a) work safely and take care for the health and safety of themselves and their colleagues, and
- (b) co-operate with their employer (the University/the Workshop Supervisor) to comply with health and safety legislation.

15. **Section 37** is aimed specifically at supervisors and managers, who could be personally liable if they fail to take action when safety regulations are broken where the HSE may prosecute the individual supervisor rather than the University.

## 1.2 **The Management of Health and Safety at Work Regulations MOHASAW**

16. The most fundamental requirement is that all **managers and instigators of work, e.g. research supervisors, members of faculty and technical supervisors, must make a formal hazard and risk assessment for the tasks they wish to be undertaken.** In workshops the assessment may be a two-part process:

- (a) the assessment made by the designer of the item to be constructed - taking into account the possible toxicity of the materials to be used, their strength and their suitability;
- (b) the assessment to be made by the Workshop Supervisor who again needs to consider the strength of the construction as well as the safety of the workshop staff in whatever methods of work are to be undertaken, e.g. the hazards from welding operation, the risks of injury using lathes, drills and other power driven machinery.

17. Each Risk assessment must identify the **hazards** which may arise, e.g. from use of machines, welding equipment, materials, fire, noise, electricity, high pressure, gases, etc.

18. The **risks to health** must then be considered, e.g. being hit by projectiles from machines, being trapped by machines, amputations caused by machines/saws, burns, eye damage from welding, fires, explosions from use of acetylene, risks from inhalation of cadmium fumes, etc.

19. Also to be considered in the risk assessment is the possibility of any breaches of safety legislation, e.g. Electricity at Work Regulations, Control of Substances Hazardous to Health Regulations (COSHH), Manual Handling Operations Regulations, see the relevant University Safety Procedure and Guidance Documents. The next step in making a risk assessment is the establishment of a clearly defined **safe system of work** which not only reduces or eliminates risks to health but also ensures compliance with health and safety legislation. These arrangements for the preventive and protective measures required to eliminate or reduce the risks identified **must** be recorded. When recording safety (hazard and risk assessments) reference in many cases can be made to this Code of Practice which contains many 'generic' (standard) risk assessments as well as to Safety Committee Local Rules documents which also describe generic risk assessments. However, for work activities beyond the scope of the generic assessments in University of Sussex Local Rules, Codes of Practice or Guidance Notes, detailed written safety (hazard and risk) assessments must be undertaken.

20. In the case of workshops, one of the most important of the MOHASAW Regulations is the requirement for designers of apparatus or equipment to co-operate with the Workshop Supervisor to ensure that safety (hazard and risk) assessments are made which cover not only the need to comply with Section 6 of the Health and Safety at Work Act 1974 (HASAWA), but also that due consideration is given to the safety of the item being produced (e.g. strength of materials and quality of workmanship, etc) and due account is taken of the risks to the health of the persons undertaking the construction.

21. A further important requirement of the MOHASAW Regulations is the addition of the following duties of employees to their existing duties under the HASAWA ;

- (a) workshop staff must use equipment or follow work systems in accordance with instructions and training they have been given, and
- (b) every employee **must** inform the Workshop Supervisor or School Safety Adviser/coordinator or the safety Office of:-
  - (i) any work situation which with his/her training he/she would consider a serious and immediate danger to health and safety, and
  - (ii) any shortcomings in the University's health and safety protection arrangements.

### **1.3 The Manual Handling Regulations**

22. Detailed information for compliance with these regulations is given in document SPG-15-09, *Safety Procedure/Guidance for Implementing the Manual Handling Operations Regulations*. The main feature of these Local Rules concerns the need for supervisors to undertake a careful assessment of all proposed movements of loads. A checklist for undertaking assessments is given in document SPG-15-09. The main objective of the regulations is to avoid injuries, especially back injuries caused by lifting loads which are beyond an individual's capability. The best approach is to identify loads which might cause problems and either to automate the process or to provide lifting equipment, e.g. hydraulic lifts or overhead cranes.

### **1.4 The Provision and Use of Work Equipment Regulations**

23. The regulations require that equipment must be suitable for the work it is expected to accomplish. It must be maintained in an efficient state and all dangerous parts must be effectively guarded. Employees and students must:

- take care of their own health and safety and that of others who may be affected by their work;
- co-operate with the Workshop Supervisor to ensure the safety of themselves and other persons;
- not interfere with safety provisions, e.g. must not remove guards for machines, except when authorised by the Workshop Supervisor;
- use work equipment in accordance with their training and instructions;

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- report to the Workshop Supervisor any defects in the equipment and defects in any operational procedures.

### **1.5 Workplace (Health, Safety and Welfare) Regulations**

24. These regulations provide detailed information which covers the workshop environment, the need to maintain the equipment, services and fabric of the building, as well as maintaining the statutory working temperature, ventilation and lighting levels.

### **1.6 The Health and Safety (Personal Protective Equipment) Regulations**

25. Advice to be followed and local rules to achieve compliance are given in document SPG-16-09, entitled *Personal Protective Equipment, Procedures and Guidance*. These Local Rules are particularly relevant for some workshop tasks, especially the machining of materials where metal swarf and wood chips could cause eye injuries, and in welding where ultra violet light may cause the very severe eye pain known as 'arc eye' or the eye may be damaged by splashes of hot metal.

26. The use of PPE must be effectively controlled by Workshop Supervisors who should be aware of their personal vulnerability to prosecution under Section 37 of the HASAWA 1974 if they connive at the failure to wear PPE when it clearly should be worn, e.g. failure to wear eye protection when using an unenclosed lathe or drill.

27. Users of PPE are required by the regulations to use the equipment in accordance with any instructions they have been given concerning its use. Users must report any loss or defects in PPE to the Workshop Supervisor. PPE should not be shared by users.

### **1.7 Electricity at Work Regulations**

28. Local Rules for achieving compliance with these regulations have been produced by the Safety Committee in document SPG-13-09 *Procedures and Guidance for the implementation of the Electricity at Work Regulations*.

### **1.8 Control of Substances Hazardous to Health Regulations**

29. These very important regulations are covered by the University of Sussex Control of Hazardous Substances Policy. The main objective of the COSHH Regulations is to ensure that all persons present in workshops do not suffer any risk to health caused by substances used in the workshop. It is essential therefore that the hazards and risks to health of all substances to be used by workshops are documented in a risk assessment form which is meaningful to workshop staff.

30. Each workshop therefore must have a 'COSHH' file listing the substances used in the workshop, e.g. degreasers, solvents, oils and materials such as hard wood. For each substance the known hazards should be listed, together with the risks to health likely, taking into account the processes to be undertaken in the workshop. **The COSHH/RISK assessment documentation must also describe the preventive or protective measures required to eliminate or minimise the risks to the health of workshop staff.**

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31. Workshop Supervisors should insist that persons who originate work must, where appropriate, provide a detailed Risk assessment for the hazards and risks to health which may be associated with that work or with the materials to be used in its construction.

32. COSHH assessment paperwork and verbal advice are particularly important where equipment which has been contaminated by chemicals or biologically hazardous material is to be dismantled or repaired. See Section 4, paragraph 62.

## 2. CONTROL AND SUPERVISION

### Workshop Supervisor

33. For every workshop there shall always be one particular person who is charged with being **responsible for all aspects of safety** within that workshop or area under his control including, where necessary, the supervision of all individuals and not only their direct reports, using the various machines and equipment. The workshop supervisor carries all additional responsibility of monitoring/checking the work of the persons using the workshop to ensure that safety (hazard and risk assessments) have been undertaken and that safe systems of work are being followed.

34. This person is designated as the Workshop Supervisor and each such Workshop Supervisor shall have a deputy who will fulfil the role of Supervisor when the designated Workshop Supervisor is absent from the University.

### Good Safety Practice

35. All senior staff, not just the Workshop Supervisor, have a duty to ensure that safety procedures are carried out by themselves and by junior staff, even persons of minimum skill have a duty to themselves and to others to work in a safe manner at all times. It is particularly important that members of this latter group should **seek advice** on safe methods of working from the senior workshop staff. Students and junior staff are here to learn and improve their skills by practice and experience, but this must never be gained by exposing the trainee to risk - the trainee must be fully supervised until such time as she/he is judged by the Workshop Supervisor to be competent to work without supervision. (Health and Safety at Work Act 2(2)(c))

### Supervision

36. Despite the guarding of machines to the standard required, there may still remain a residual risk and the Workshop Supervisor must, therefore, ensure that only competent operators (i.e. with sufficient training and experience) are authorised to use machines and equipment unsupervised. (HASAWA 2(2)(c)) Wherever practicable starting fixed machines should be controlled by a key switch. Keys for machines should only be issued by the Workshop Supervisor or his deputy.

37. Whenever a person, who is not yet considered by the Workshop Supervisor to be fully competent, is required (or has need) to use a particular machine, then the Workshop Supervisor shall arrange that the operator is supervised by another fully competent person who must ensure that only safe methods of working are followed.



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38. All students and visiting research workers must obey the instructions given by the Workshop Supervisor and must follow the requirement of the this code.

#### Entry Control

39. Each workshop shall be securely closed when proper supervision is not available and, apart from those regularly employed as operators or supervisors in workshops, permission to use any machine must always be first obtained from the person in charge.

#### Legislation

40. The Workshop Supervisor must ensure that copies of all relevant legislation and regulations are readily available.

#### Codes of Practice and Notes of Guidance

41. Mechanical Engineering Workshop Supervisors must keep a copy of the Health and Safety Executive publication, *Health and Safety in Engineering Workshops*, ISBN 0 717617173. The HSE has made it clear that **if the Guidance in this publication is followed, then the Workshop Supervisor will normally be exercising sufficient managerial control to comply with current health and safety law.**

42. The Workshop Supervisor must also keep copies of relevant **University Local Rules and University Safety Policies** so that they are **readily available to workshop staff.**

#### Safety Bookshelf /Cupboard/Boxfile

43. It is advised that every workshop has a prominently labelled bookshelf, cupboard or box file where safety advice literature and booklets are kept for reference by workshop staff.

#### Safe Work Rules

44. The execution of work by safe methods must always take precedence over deadlines determined by the person commissioning the work. Horseplay must never be allowed in workshops. It can result in serious injuries.

#### Lone Workers

45. Unless at least two persons are present, none of the fixed workshop machines may be used. Some hand held power tools may be used with the specific approval of the Workshop Supervisor. In certain areas lone working may be allowed, if agreed by the risk assessment and the Safety office, if a personal alarm device is provided to summon assistance. Refer to **the University Lone Working Policy**

### **3. LOCATION OF MACHINES**

#### Machine Clearance

46. Machines must always be located within a workshop in such a way as to ensure that there is always adequate room to work without risk of endangering an operator at any other

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machine nearby, or any other persons within the workshop area. The clearance between moving slideways and fixed adjacent objects should not be less than 0.5 m.

#### 4. **HOUSEKEEPING, LIGHTING, VENTILATION AND TEMPERATURE**

47. See SPG-22-09 *Guidance Notes for implementing the Workplace (Health, Safety and Welfare) Regulations and incorporating Procedures for minimising the Risk of Falls on a Level*

48. The Workshop Supervisor must ensure that the working environment is satisfactory, and that any deficiencies are immediately brought to the attention of the School Safety Adviser/coordinator

##### Temperature

49. The workshops should always be above 13 degrees celcius when machines are operated. At low temperatures mistakes and accidents can occur. Excessive heat can also increase the chance of an accident. The workshop supervisor should monitor the temperature and direct work accordingly and report any faults beyond their control to the revelavant unbnit manager to correct.

##### Keeping Waste to a Minimum

50. All swarf and waste material must be regularly cleaned up and placed in approved type bins after a machine has been used, and no rubbish of any kind be allowed to accumulate.

51. Compressed air must not be used for swarf cleaning operations.

##### Oily Rags

52. Oily rags, etc., which can ignite spontaneously, must be placed in metal bins with lids after use, and shall be disposed of daily.

##### Risk of Slips and Falls

53. All oil and other spillages must be **immediately** cleaned up and the floor shall be kept as non-slip as possible. See document SPG-22-09.

##### Clear Gangways

54. All gangways must be kept clear and free from obstructions at all times. (Workplace (Health, Safety and Welfare) Regulations, and Section 2(2)d of the Health and Safety at Work Act)

##### Mineral Oils

55. Mineral oils are known to cause dermatitis and, in some cases, scrotal cancer. Notices should be posted in workshops as may be appropriate, reminding operators of the need for cleanliness and thorough hand washing. The regular and effective cleaning of overalls, and

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any personal clothing which comes into contact with cutting oils, is essential. (COSHH Regulations)

### Lighting

56. The Workshop Supervisor shall ensure that there is always adequate lighting in the area under his control. Because it is known that the removal of one tube from a twin-tube fluorescent fitting may, under certain circumstances, produce a stroboscopic effect in relation to rotating machinery, 24-50 volt local tungsten lighting must be provided at each such machine where this is considered appropriate and fluorescent lighting be regarded only as background lighting. Staff must be warned that the stroboscopic effect can make moving machinery appear stationary. (Workplace (Health, Safety and Welfare ) Regulations)

### Ventilation

57. The Workshop Supervisor must satisfy himself that the ventilation in the area under his control is satisfactory having regard to the nature of the work being undertaken. This is particularly important in areas where welding and/or brazing is being carried out. These areas must be either boothed or screened and equipped with high speed local ventilation in addition to the general workshop ventilation. Staff must be aware that fumes from cadmium containing metals can kill. (Workplace (Health, Safety and Welfare) Regulation)

### Painting

58. Any area in which spray painting is being carried out must be particularly well ventilated and free of all sources which might ignite the spray being used.

### Glass Blowing

59. Particular attention shall be paid to the ventilation of glassblowing workshops where the concentration in air of nitrogen oxides can build up to a level above the occupational exposure limits when oxygen and natural gas flames are used. (COSHH Regulations).

### Hazardous Materials

60. Where adequate local ventilation cannot be provided, the cutting and machining of metals and materials which might be hazardous shall be carried out only in properly designed, totally enclosed machining boxes. This may be necessary, anyway, for certain toxic metals, e.g. U, Ba, Be, etc. Some metals produce flammable swarf and even if machined inside a glove box an argon atmosphere may be necessary. These specialist operations should be undertaken only after detailed consultations with the School appointed safety person or, where appropriate, with the University Safety Officer. These consultations must take place whenever either rare or unusual metals or materials are to be worked. In all cases detailed written COSHH assessments must be provided by the person who originates the work. (COSHH Regulations) Beryllium and asbestos must never be machined in University workshops.

### Oil Mist

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61. The cancer risk from oil mist from cutting oils is very real indeed and local extract must be used wherever necessary to control the airborne concentration of these oils. COSHH Regulations see SPG-23-09

#### Care when Working with Laboratory Components

62. Workshop staff must be aware of contamination risks associated with items sent for machining, e.g. if items have come from a radioactive area they must be accompanied by a certificate indicating that they are free from contamination. Similar contamination with toxic chemicals can occur and this is important, also for glassware sent from laboratories. As a general rule, therefore, all items must be cleaned before being sent to workshops. This requirement is particularly important when items used with volatile toxic chemicals are sent to the glassblower. (COSHH Regulations 1994, see SPG-23-09)

#### Adhesives

63. The use of gloves is advised when using some modern glues, e.g. epoxy resins may cause dermatitis. Cyano-acrylates can stick fingers together.

### **5. MACHINES, POWER TOOLS AND HANDTOOLS**

#### Help must be Near

64. No worker may use a fixed machine **unless another person is present** within the workshop. In certain areas lone working may be allowed, if agreed by the risk assessment and the Safety office, if a personal alarm device is provided to summon assistance.  
(see paragraph 45 above).

#### The Provision and Use of Work Equipment Regulations

65. Safety standards and procedures must be at least as high as those required by the Provision and Use of Work Equipment Regulations (PUWER). Additional guidance concerning safe working procedures should, where appropriate, be obtained from appropriate Health and Safety Executive Guidance documents.

#### Guarding of Machines

66. All machines must be fitted with suitable and appropriate guards as far as is reasonable and practicable and as required by law. There is no exception to this absolute duty for specialist 'tool room' workshops undertaking 'one-off' operations. Regulations also requires the fencing of any part of a stockbar which projects beyond the headstock of a lathe, e.g. with barriers to prevent a person becoming entangled.

67. Compliance to relevant regulations remains of paramount importance since the HSE regularly prosecute when injuries have occurred following a clear breach of this regulation. It is therefore important that all Workshop Supervisors are aware of the exact wording, the full text of which is reproduced as follows:

- (1) Every dangerous part of any machinery (a), other than prime movers and transmission machinery (b), shall be securely fenced (c) unless it is in such a

position or of such construction as to be as safe to every person employed or working on the premises (d) as it would be if securely fenced (e).

(2) In so far as the safety of a dangerous part of any machinery (a) cannot by reason of the nature of the operation be secured by means of a fixed guard, the requirements of sub-section (1) of this section shall be deemed to have been complied with if a device is provided which automatically prevents the operator from coming into contact with that part (f).

(5) Any part of a stock-bar which projects beyond the headstock of a lathe shall be securely fenced (c) unless it is in such a position as to be as safe to every person employed or working on the premises (d) as it would be if securely fenced (e).

68. Further useful information is contained in the HSE publication *Health and Safety in Engineering Workshops*, HS(G)129, ISBN 0-7176-17173.

69. Guards on machines must prevent access to all dangerous parts even from behind the machines. Guards must be robust and securely fitted but not impede the operation of the machine. They should not need to be removed for routine maintenance, e.g. lubrication.

70. Interlocking guards should ensure that access to dangerous parts is prohibited **before** the machine can be operated **and** remain closed until the machine has been stopped.

#### Adjustment of Guards

71. No adjustment of guards, gearing, cutting tools or other parts of, or attachments to a machine shall be made whilst any working parts are in motion, except where such adjustments are caused automatically or remotely by virtue of the normal operation of the machine. Other adjustments shall be undertaken only when all the moving parts are at rest.

#### Stopping Machines

72. Where appropriate, suitable automatic tripping devices and brakes should be fitted to all machines.

#### Safety Stop Buttons

73. At least three clearly labelled safety stop buttons, which break the workshop power circuit, must be installed at easily accessible positions in every workshop.

#### Maintenance

74. Whenever maintenance is taking place on a machine the greatest care must be taken to ensure that the machine is completely isolated electrically against any possibility of inadvertent start-up or electric shock, before any work on the machine is undertaken. The fuses must be removed and a notice attached to the supply. The following wording is suggested: 'Warning – Maintenance in progress, do not switch on'.

75. It is strongly advised that a six-monthly visual safety check be made of fixed machinery which may operate at 415V, paying particular attention to earthing and insulation.

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Safe Restart of Machines

76. Particular attention must be given to the control circuitry associated with all machines to ensure that when the power supply to each machine is interrupted whilst the machine is running, the machine will not automatically restart when the power is restored.

Safeguarding

77. Robots are defined as automatically controlled reprogrammable machines which may be capable of undertaking a wide range of movements, some of which may involve quite rapid movements. Since unguarded moving parts may cause injury, the HSE has issued HS(G)43 *Industrial robot safety*, which gives detailed information on methods for guarding robot systems. This document should be consulted wherever robot systems are to be installed.

Clothing when Using Machines

78. In addition to being responsible for ensuring that only competent operators are permitted to use machines unsupervised, the Workshop Supervisor must also ensure that ALL operators, whether considered to be technically competent or not, are suitably attired.

79. Long hair is notoriously dangerous, and seizure may result in the loss of scalp tissue; operators with hair of such a length that it may be considered to be hazardous must be required to wear a snood or hair-net when using machines. Rings may also cause finger damage if caught by moving machinery or materials.

80. Loose neck-ties and/or other loose clothing, including necklaces, chains, etc., can also present a danger and are prohibited. In particular, supervisors must ensure that rotating stockbars are always securely fenced to prevent entanglement.

Gloves

81. Although the wearing of gloves is sensible in certain operations, e.g. when handling sheet or plate metal at a guillotine or shears, their use must be prohibited when working with any rotating machinery, e.g. drilling machines, milling machines, lathes or wood-working machinery.

Abrasive Wheels

82. Abrasive wheels are to be found in most workshops. If incorrectly maintained, mounted or dressed, these may disintegrate and cause serious injuries.

83. Only Authorised Persons shall be permitted to mount abrasive wheels. Uncertified persons may still change mounted abrasive wheels. Eye protection is required when using abrasive wheels.

84. Special attention must be paid to the care required in monitoring and dressing the wheels and to the maximum permissible speed of abrasive wheels, and these speeds must never be exceeded. **Detailed guidance is given in HSE publication HS(G)17 entitled 'Safety in the Use of Abrasive Wheels'**

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85. Serious accidents can occur with portable grinding tools, which must be treated as abrasive wheels, but which also must be subject to the control and testing required for portable electric power tools.

#### Portable Electric Power Tools

86. Only either properly earthed or certificated double insulated electrical power tools may be used.

87. On arrival from the suppliers, all electrical equipment, including power tools, must be given an initial safety inspection by a competent trained technician or the EFM Portable appliance Testing team. Thereafter, the tool must be inspected at regular intervals, this is undertaken by the EFM Portable appliance Testing team as part of a campus wide program. Workshop Supervisors must make equipment stored in cupboards available to the PAT team. Immediately before each period of use, all power tools, their plugs, leads and any associated equipment must be visually inspected. Pay particular attention to damaged cables and the clamping of the outer cable sheath in the plug.

88. Defective tools must be withdrawn promptly for repair or replacement. Portable power tools must be used only by persons who have been instructed how to use them.

89. Users must be aware of the danger of electrocution, particularly in damp conditions or in metal enclosures. In these cases it is advised that only double insulated tools be used and they are connected via a RCD breaker. Alternatively, use a 110 volt tool powered from a double wound transformer (BS 3526) with secondary centre tap bonded to the system earth. When not in use portable electric power tools must be kept in a dry store.

#### Overloading

90. Even large fixed machines have their limits and neither they nor small electric power tools should be in any way overloaded, or damage may occur which could affect the safety of the machines. Thus machines must be used only within their design capacity and no accessories larger than those recommended by the manufacturer may be used. Unauthorised accessories must not be used.

#### Correct Use of Handtools

91. Only files with handles must be used - files without handles can cause wounds. Tools must be maintained in good condition and used only for their intended purpose, e.g. files must never be hammered. All tools must be regularly examined by a competent person and those found to be defective repaired or replaced. Ring spanners or sockets should be used, where practicable, instead of open-ended spanners.

## **6. PERSONAL PROTECTION**

### The Personal Protective Equipment at Work Regulations

92. Detailed information on these regulations is provided in the Safety Procedures and Guidance Document SPG-09, entitled *Personal Protective Equipment, Procedures and Guidance*.

Protective Clothing

93. Suitable protective clothing must be provided for the use of staff wherever this is considered necessary in the interests of their health and safety, and such protective clothing must be provided without cost to the individual, where required by the regulations. (PPEAWR)

94. Protective clothing shall be inspected/launched/cleaned/changed as often as may be appropriate for the item concerned, and this also shall be without charge to the individual. It is especially important that overalls contaminated with cutting oils be effectively cleaned to minimise the risk of cancer from these oils.

95. Gloves of appropriate design and material are necessary and shall be provided for use when welding/brazing operations are to be carried out, but gloves should NEVER be worn when working with rotating machinery.

96. When handling very low temperature materials the correct insulating gloves must be supplied and used. For work with liquid nitrogen each glove must be loose fitting so that it can easily be shaken off if liquid splashes inside it. Advice on the suitability of gloves can be obtained from the University Safety Office.

97. Where appropriate, workshop staff are advised to wear safety shoes with reinforced toe caps - heavy metal objects, if dropped, can cause serious foot injuries!

Eye Protection

98. It is a legal requirement that an employer must provide appropriate eye protection either by means of personal eye protectors or by means of a fixed shield or shields, wherever the use of such eye protection is called for. (PPEAWR)

99. In the case of personnel who are regularly employed in a process or operation in which the use of eye protectors is required, such eye protectors shall be given into the personal possession of the individual concerned.

100. Where an individual is only occasionally engaged in a process or operation requiring the use of eye protectors, a sufficient number of eye protectors must be provided, maintained and kept readily available for use.

101. In any instance where personal eye protection is required, this must be made available for use by visitors, students and others whether or not they be employees of the University.

102. Where personal eye protection is required, the Workshop Supervisor must ensure that eye protectors or eye shields, as may be appropriate, are used at all times during which the individual is engaged in a process or operation requiring the use of such protection. (PPEAW Regulations)

103. Where, because of a particular process or operation being carried out, eye protection is required to be used by all persons within a workshop area, the Workshop Supervisor must prohibit the entry of any person into the workshop who is not wearing or using the eye protection provided.



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104. Eye protection must always be provided and must be used by the operator whenever abrasive wheels are in use.

105. Eye protection is vital during welding, cutting and similar metal working operations. The eyes must be protected from glare and sparks and, in the case of electric arc welding, intense light may - unless eye protection is worn - cause a painful temporary blindness called 'arc eye'. (PPEAWR )

106. Persons observing welding operations must also be equipped with the correct eye protection. To prevent glare from welding affecting others not in the immediate area, the arc welding bay must (unless an enclosed area) be screened with non-flammable, non-reflecting screens extending to 1.75 m above the floor. The welding bay itself should be painted with non-reflecting paint to absorb glare.

107. A helmet-shaped welding mask is probably best for eye protection as there will be no temptation to lower it from the eyes.

#### Control of Noise at Work Regulations

108. In workshops, as elsewhere, the requirements of the Control of Noise at Work Regulations must be complied with. To achieve compliance, workshop supervisors must ensure that the University Safety Office instructions are followed.

The Control of Noise at Work Regulations 2005 (the Noise Regulations)

109. Any workshop in which noise levels are likely to be hazardous must be clearly labelled 'Use Ear Protection'

110. Where possible, diminution of noise levels is best achieved by reduction of the noise at source, by the use of resilient mountings, damping compounds, the stiffening of panels, balancing of rotating parts, avoidance of loose parts and rattles.

111. If it is not possible to reduce noise to sufficiently safe levels by environmental control, then hearing protectors must be supplied and used.

112. Two forms of hearing protectors are in general use: ear plugs and ear muffs. Cotton wool must **never** be used for ear plugs. It is ineffective.

- **Ear plugs** should be of the disposable type made of glass down or other approved material, e.g. expanding foam. Permanent ear plugs made of rubber or plastics are not regarded as satisfactory.
- **Glass down** is acceptable from 90-105 dBA, as is the expanding foam material called 'EAR'. Ear defenders or equivalent **ear muffs** must be worn above 105 dBA. These may give another 40 dBA protection.

CAUTION: Using glass down and ear muffs does not have a significant additive effect (just 5 dBA), but muffs do leak, and so at high noise levels it is worth wearing both glass down **and** muffs.

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113. Due attention must be given not only to the level of noise but also to its frequency range (Hz) because the protection afforded varies greatly with frequency. In certain circumstances it may be necessary to have a frequency analysis of the noise in order to select the correct protector.

114. **Impact noise** - e.g. sound/pressure rise from 60-120 dBA in 0.5 ms. The ear cannot cope and instantaneous deafness will result. Great care must, therefore, be taken where impact noise occurs to ensure that even the protected ear is never subjected to 140 dBA.

115. **Vibration** - The use of vibrating tools for long periods each day for several years can give rise to 'white finger', an injury involving loss of feeling in the finger, which may go white. After many years the hands may go bluish and suffer blood vessel damage. To avoid this injury (a) always wear gloves to minimise vibration and keep hands warm when using vibrating tools and (b) if long periods of work are to be undertaken, a 10 minute break every hour is advised.

## 7. **RESPIRATORY PROTECTION**

116. In some workshops circumstances may arise in which there is a need for respiratory protection, e.g. where there is a risk of exposure to toxic gases, to fumes or vapours, or to dusts or where oxygen concentrations may be reduced.

117. In each case advice should be obtained from the Safety Office.

118. Respiratory protection must always be regarded as a last resort; the best practice is to contain dusts and vapours at source.

## 8. **GAS CYLINDERS**

### Legal Requirements

119. Pressure safety requirements are set down in the Pressure Systems Safety Regulations 2000.

120. Copies of the BOC publication *Safe Under Pressure*, which gives detailed guidelines for the use of gases in cylinders, must be available to staff in all mechanical workshops.

121. Advice on interpretation of the above Codes of Practice and Guidance may be obtained from the University Safety Office.

122. Comprehensive detailed safety advice is contained in the BOC Gases publication *Safe under pressure*.

The Main Hazards from Gas Cylinders

123. There are three main types of gases:

- |   |   |
|---|---|
| - inert gases<br>e.g. nitrogen,<br>carbon dioxide       | - these are not life supporting. Entry into a confined space where the inert gas has significantly reduced the oxygen concentration can cause rapid loss of consciousness and unless affected persons are rescued death usually occurs.                       |
| - fuel gases<br>e.g. acetylene,<br>hydrogen,<br>propane | - these are highly flammable and explosive, even in low concentrations in air if a source of ignition is present  |
| - oxygen  | - supports combustion. If a cylinder leaks in a confined space or into clothing, a fire could occur of almost violent intensity. Oil or grease or organic material on the cylinder threads will react explosively. Therefore, never use PTFE tape on threads. |

Colour Coding of Cylinders

124. Gas cylinders are painted different colours according to the gas contained. Check the BOC web site for current colour coding or <http://MSDS.chem.ox.ac/cylinders.html> .

NEVER rely on colour coding. Rely only on the cylinder contents label. If no label is present do not accept the cylinder. Cylinders must always be used and stored in an upright position using a cylinder stand clamp or chained support - cylinders must never be left standing without support. Liquefied fuel gas cylinders must also be **secured** in an **upright** position when being transported.

Regulators

125. Cylinders must never be used without the correct pressure reducing regulator. All regulators are designated as to which gas they must be used with. Regulators must **never** be used with a gas for which they are not intended. PTFE tape must **not** be used on any gas connections.

126. Regulators and their associated pressure gauges should never be tampered with or repairs attempted; if they leak or the pressure readings are suspect, a service exchange unit must be obtained from the manufacturer/supplier. Regulators should be replaced after five years of use.

127. In the case of fuel gas supplies, cylinders' manifolds or headers must be fully equipped with pressure regulators and proper **flashback arrestors**. When using oxygen with a fuel

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gas, both cylinders must have flashback arrestors and hose check valves should be fitted next to the torch, where the gases are mixed, prior to combustion.

128. Make sure that the regulator you are going to use can cope with the maximum pressure in the cylinder (this is marked on the cylinder label).

129. When opening the cylinder spindle valve, only open the valve one turn. **Never** remove the valve key, it may be needed to quickly shut off the gas. Before fitting the regulator, wear safety goggles and sniff the cylinder, i.e. use a quick blast of gas to remove any dirt from the cylinder connections. **NEVER** do this with hydrogen - it ignites spontaneously and the flame is invisible!

130. If a cylinder falls over, the valve will only bend. If it did shear off, the cylinder would only spin or move at 6 kph along the floor.

### Hoses

131. Hoses must be of the correct thickness to withstand the required operating pressures. They must also be in good condition, and kept clear of possible damage by cuts, cracks and burns, and contact with oils, solvents, **grease**, etc. Blue hose must be used for oxygen and red for acetylene and other combustible gases. Hoses for arc welding and inert gases should be black. The oxygen and fuel gas hoses must **never** be taped together. All hoses must be secured, e.g. with approved crimped metal clips. Suspected leakages should be tested with a brush and a 1% solution of 'Teepol HB7', NOT with a naked flame. Do not use long hoses. For remote work, take a small, e.g. 'Midipak' or 'Startapak', welding unit to the work location.

### Propane and Butane

132. Propane and butane, like acetylene, have a distinctive smell. A spark, a flame or hot metal may cause all these gases to ignite instantly. Propane or butane cylinders must be stored and used in the **upright** position or liquid gas may flow to the blowpipe or torch. In a fire a propane cylinder stored upright will vent. If stored on its side, liquid propane will be forced out of the safety valve and will ignite to cause a boiling liquid expanding vapour explosion (BLEVE). Propane cylinders on their sides in a fire may burst, again resulting in a BLEVE.

### Oxygen

133. Oxygen is odourless and does not burn, but it accelerates combustion. Therefore, never allow your clothing to get saturated with oxygen! Oil and grease will ignite violently in the presence of oxygen which, if under pressure, can cause an explosion. Oxygen must **NEVER** be used in place of compressed air. No **grease** must ever be allowed to come into contact with oxygen cylinders or connecting fittings. Threads for oxygen fittings must **NEVER** be greased or wrapped with PTFE tape.

### Acetylene

134. Acetylene forms explosive mixtures, if ignited in air, in concentrations of between 2% and 82%. It may explode under excessive pressure in the absence of air. To improve safety and stability, acetylene is supplied in cylinders dissolved in acetone, which is absorbed onto a

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solid packing material. Therefore, it is important that the cylinder is always **stored and used in an upright position**. It is also unsafe to use acetylene at a rate exceeding 20% of the cylinder contents each hour or acetone may boil off, thereby reducing the stability of the cylinder contents. To minimise the risk of flashback to the cylinder ALWAYS ensure an adequate flow of fuel gas is issuing from the blowpipe nozzle before lighting the gas (see paragraph 137).

135. In the case of all combined acetylene and oxygen apparatus, **flashback arrestors** must be fitted to both the oxygen and the acetylene cylinders. In addition, hose check valves should be fitted next to the torch. It is advised that all such oxy-acetylene units are inspected annually, e.g. by an engineer of the British Oxygen Co. Some re-settable FBAs are available - a button pops up. If this happens, switch off the oxygen, then the acetylene.

136 **Lighting-up and shutting down procedures for welding and cutting** - 98% of flashbacks are due to failure to follow the correct torch lighting procedure which is as follows:

- (a) use chart to determine correct pressures to be used for the nozzle size;
- (b) purge 10 seconds with acetylene;
- (c) purge 10 seconds with oxygen;
- (d) light the acetylene - adjust to get a clear flame, then
- (e) open oxygen valve and get a strong blue flame for welding.

For oxy-acetylene cutting, follow the manufacturer's torch lighting procedure. Normally this involves opening the acetylene valve and lighting. Then open the oxygen valve, followed by depressing the oxygen lever. The shut-down procedure is as follows:

- (a) extinguish flame;
- (b) close both cylinder valves;
- (c) vent gases from hose (acetylene first) till gauges read zero; then
- (d) close all valves and wind regulator control fully out.

137. **Dealing with a flashback incident** - Failure to use the correct nozzle size or, more often, failure to set the correct gas pressure can result in a flashback or 'backfire' which, if no flashback arrestor is fitted, could travel into the cylinder where it may cause internal heating or even explosive decomposition of the acetylene! To deal with a flashback:

- (a) close blowpipe/torch valves (oxygen first), then
- (b) close both cylinder valves;
- (c) check surface of acetylene cylinder with bare hand for local heating;
- (d) if heating is detected, treat as though cylinder has been in a fire and evacuate the area - 100 m for staff involved, 300 m for all other persons. Call University Rescue Team to assist you in dealing with the incident.
- (e) if temperature does not rise, unwind pressure adjustment screws on both regulators;
- (f) check nozzle of torch - if hot, plunge it into hot water to cool it;
- (g) check that nozzle is undamaged.
- (h) take flashback arrestors and regulators off and examine them for burns. If necessary replace them;

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- (i) carry out lighting procedure as recommended by supplier. If flashback occurs again, go through above safety procedure and, if necessary, replace torch and nozzle.

**138. Dealing with an overheated acetylene cylinder which has been in a fire  
(NB: Cylinders involved in a fire may explode):**

- Do not approach or attempt to move cylinders.
- Drench the entire surface of all cylinders with water for at least one hour after the fire has been extinguished, from a safe position. Do not use a jet of such strength that it would knock over a free-standing cylinder.
- Check visually from a safe position. If steam is seen to be coming from the surface of the cylinder when water spray is interrupted, continue spraying with water. Then check at half-hour intervals until it is seen that steaming has ceased.
- Once steaming has stopped, observe from a safe distance whether the surface of the cylinder remains wet. If patches dry quickly, continue to cool with water and observe again after half an hour (repeat this operation until all surfaces remain wet after water spray is stopped) paying particular attention to the centre cylinders of manifolded cylinder pallets (MCPs) and any cylinder where some difficulty has been experienced in maintaining a good supply of cooling water.
- Once all cylinder surfaces remain wet after the water spray is discontinued, check (using bare hand) that the cylinder remains cold for 30 minutes. Wait a further 30 minutes and check again. If any part of the cylinder feels warm to the touch, re-apply the cooling water for 30 minutes and repeat procedure until cylinder remains cold for one hour. When you are satisfied that the entire surface has remained cold for one hour, submerge cylinder in water (carefully avoiding shocks and bumps).
- Normally after 12 hours' immersion the cylinder will be blown down and recovered by BOC.
- A fire near acetylene is extremely dangerous. It is treated by the Fire Service as an explosive and an exclusion zone of 200 metres around the scene of the fire is immediately set up.

Health and Safety Executive Requirements for the Storage and Use of Acetylene

139. Wherever possible Acetylene cylinders should not be stored inside building but in secure external compounds or outbuildings. As with other gas cylinders the smallest cylinder size required for the work should be used.

140. Additional guidance in the storage and use of acetylene has been provided in some **Health and Safety Executive notes entitled, *Use of Acetylene***. These notes describe the legal requirements concerning storage conditions and pipework systems permitted for acetylene facilities. They also indicate the very important requirement for an HSE approved type of **flashback arrestor** less than one metre from the reducing valve or less than one metre from a device using acetylene at greater than 9 lb in<sup>-2</sup> (gauge).

141. If in contact with certain metals or alloys, particularly of copper or silver, acetylene can form explosive compounds. Auxiliary equipment made of copper or any alloy of more than 70% copper must never be used.

Handling Gas Cylinders (all gases)

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142. When a cylinder becomes empty, the **cylinder valve MUST BE CLOSED** to prevent entry of moist air which would cause internal corrosion. Each standard cylinder weighs

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approximately 90 kg, so wear safety shoes with steel toe caps! Also wear **clean** gloves - this allows you to "milk churn" cylinders along the floor, keeping them upright at all times. They are best moved on trolleys with the cylinder restrained by chains. Skates should not be used. Never try to catch a falling cylinder! Cylinders must not be transported with regulators attached!

#### Storage of Gas Cylinders (all gases)

143. Cylinders should be stored in a well ventilated area or fireproof room external to the building. There must be a wall or partition giving at least a 3m vapour pathway between stored oxygen and fuel gas cylinders. This segregation applies to empty as well as full cylinders! Containers should be clearly marked if empty or full. (This does not refer to oxygen/acetylene cylinders **in pairs** which are being used or 'in use'.) Toxic and corrosive gases should be stored separately from all other gases.

#### Sources of Heat or Ignition

144. **DO NOT SMOKE, WEAR OILY CLOTHES** near cylinders or allow cylinders to come into contact with any **EXPOSED FLAME, ELECTRICAL APPARATUS OR LIVE WIRES**. Keep well clear of welding or cutting operations.

### **9. WELDING, CUTTING, BRAZING AND ALLIED PROCESSES**

#### Advice and Good Practice

145. For the use of acetylene, see Section 8.

146. Excellent advice and references are provided in BOC Gases publication, *Safe under Pressure*. Additional safety advice is also available in Section 8 of this Code for gas cylinders.

#### Small Tanks or Drums

147. A particular welding or cutting hazard arises when sources of heat are used **on, in or near small tanks or drums** in which flammable liquids may have been present. Only 14 ml of flammable liquid can cause an explosion in a 200 litre drum! The explosion risk is very great indeed with narrow necked tanks or drums.

148. In view of the serious risk to life involved, **it is forbidden to weld** narrow necked tanks or drums which have contained petrol, acetone, ether or other flammable liquid or even oil. In view of the serious risk to life involved, with other than open top tanks, the repair operation must be carefully considered and, wherever practicable, not undertaken at all! A replacement tank or drum should instead be purchased.

#### Toxic Fumes from Brazing



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149. **Ventilation** is particularly important where heat is being applied to toxic metals or metals plated with, for example, cadmium: the fumes from which can kill. **The use of local** exhaust ventilation is the required method for dealing with fumes from welding/brazing type operations (COSHH). Wherever practicable, use cadmium-free alloys. See the Safety Procedures and Guidance SPG-01-09 LEV

### Toxic Fumes from Welding

150. Persons undertaking welding operations must be aware of the hazards from inhalation of toxic fumes. To minimise the risk of inhalation of fumes from welding operations, a local extract ventilation system must be provided in every workshop where welding is being undertaken. (COSHH) The Health and Safety Executive have provided the following guidance in publications:

- EH55 *The Control of Exposure to Fumes from Welding, Brazing and Similar Processes*, and
- EH54 *Assessment of Exposure to Fumes from Welding and Allied Processes*.

See the Safety Procedures and Guidance SPG-01-09 LEV

## **10. USE OF WOODWORKING MACHINERY**

151. Permission must also be obtained from the Workshop Supervisor before using any woodworking machine. Workshop Supervisors must also ensure that all woodworking machinery within their workshop conforms to the requirements of the Provision and Use of Work Equipment Regulations (see Local Rules document SPG18-09).

152. Wood dust can be extremely harmful if inhaled, adequate ventilation must be provided and the use of face masks is recommended.

153. Wood dust is also a fire hazard and suitable arrangements must be made to reduce the buildup of wood dust and shavings.

## **11. FOUNDRY PROCESSES AND MOLTEN METAL HANDLING**

154. Good ventilation to protect workers from dust and fumes is essential. Workers must, where appropriate, use eye or face shields and use heat resistant gloves.

155. Where molten metal is being handled and where molten salts (salt baths) are used, it is vital that steps be taken to ensure the complete absence of moisture or water drops which might cause spattering of the molten material. Heatproof boots, gaiters, apron and face shields must be provided and worn. (PPEAWR)

156. The Control of Lead at Work Regulations require the University to assess the nature and degree of exposure to lead in the workplace and to prevent or adequately control any foreseeable exposure. If significant work with molten lead is to be undertaken Workshop Supervisors should seek advice from the University Safety Office..

## 12. **ELECTRICAL EQUIPMENT**

### Hazards

157. These include:

- Electric shock (few milli amps at more than 40 volts can kill). For resuscitation summon a local first aider and dial 3333 to get a mobile first aider. These are on radio call at all times.
- Fire or explosion - keep solvents from electrics which may spark or overheat.
- Flash burns from electric arc.
- Physical injury may occur if a person receiving a slight shock jumps backwards violently.

### Soldering using Multicore Solder.

**158.** Hazards that might occur:- Burns from soldering iron, splashes of molten solder on skin or in eyes, the inhalation of fumes and the possibility of lead poisoning (absorption through skin or by ingestion). **Asthma can be aggravated by inhalation of fumes.**

Precautions:- Training in the use of soldering equipment. Ensure proper ventilation of fumes by the use of the fume extract fan unit. Awareness of hazards to health (see COSHH data sheet). The use of a fume extractor if prolonged soldering operations are foreseen. Try to avoid contact with solder by the use of a solder reel dispenser. Wash hands after contact with solder and never put solder into your mouth. Consider eye protection if a splash hazard may occur.

### Regulations

159. All work with electrical equipment must conform to the requirements of the Electricity at Work Regulations. Information on these regulations is given in the University *Safety Procedures and Guidance for the implementation of the Electricity at Work Regulations 1989* (document SPG-13-09).

160. **Remember - only competent electricians should install or service electrical equipment.** Before undertaking **any** electrical work approval of the Workshop Supervisor must be obtained.

## 13. **CRANES, SLINGS, HOISTS AND MANUAL HANDLING OF LOADS**

### The Lifting Operations and lifting Equipment Regulations

161. These regulations require certain lifting plant and equipment to be examined and tested at regular specified intervals by a competent person. Although these inspections and tests will be undertaken by the University's Insurance Engineers, it is the responsibility of the Workshop Supervisor to ensure that the relevant equipment is placed on the list for regular inspection/testing and that copies of inspections and tests are retained with the equipment, i.e. within the workshop.

### The Manual Handling Operations Regulations

162. Nationally, more than 20% of accidents involving more than three days absence from work are caused by manual handling operations. Most of these accidents could have been avoided if managers and supervisors had paid more attention to examining the risk of injury and the establishment of safe systems of work. It is therefore essential that Workshop Supervisors comply with the University *Procedures and Guidance for implementing the Manual Handling Operations Regulations 1992* (SPG-15-09) All workshop staff must attend the Manual handling training course put on by the University Safety Office as part of their induction program if new staff or when they transfer into such a post if existing staff.

### Lifting Appliances (Cranes, slings, hoists, etc.)

#### Cranes

163. When using cranes or pulleys in workshops the following rules must be observed:

- Each piece of lifting equipment must be tested before being used for the first time and a certificate of test must be obtained from the manufacturers, or, if the apparatus is 'home made', an initial inspection must be arranged through the Estates Division to whom the certificate must be sent. The Estates Division will arrange subsequent re-testing by the University's Engineering Insurers.
- The crane or pulley, including its lifting, supporting or stabilising cables or chains must be examined twice every 12 months by a competent person (either a qualified engineer or, more appropriately, the University's Engineering Insurers). Records of these examinations must be forwarded to the Estates Maintenance Manager. Copies must be sent to the appropriate School safety coordinator for checking and retention.
- Each piece of lifting equipment must be properly maintained.
- Operators must be fully instructed in the safe use of the machine and only authorised or licensed operators allowed to operate them.
- Persons must not walk under a loaded crane! Operators must not drive a loaded crane **over people**.
- The Safe Working Load must be plainly marked on each crane or pulley and must not be exceeded.

#### Chains and Rope Lifting Tackle

164. The following rules must be observed:

- All lifting tackle, including chains, ropes, shackles and lifting eyes, must be inspected twice every 12 months by the University's Engineering Insurers, having first been tested (and a test certificate obtained) before use. Ropes must be visually inspected before each lifting operation.

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- The Safe Working Load and the identifying number of the pulley must be clearly marked on or adjacent to the equipment (e.g. on the gantry).
- Ropes/slings must be tag marked with the safe working load. Also the correct SWL rope must be used for each pulley block.
- Operators must be fully trained and only persons authorised by the Workshop Supervisor may use chain and rope lifting tackle.

## 14. **PRESSURE VESSELS AND PRESSURE SYSTEMS REGULATIONS**

### Legal Requirement

165. Work with pressure systems is controlled by the Pressure Systems and Transportable Gas Containers Regulations.

166. Gas cylinder regulators, hoses and fittings must be properly monitored and checks made at regular safety inspections on the test date stamped on the regulator.

### Advice

167. Expert advice on gas cylinders and pressure systems may be obtained from the Safety office. See Section 8 for HSE Guidance and Approved Codes of Practice. Further safety advice is contained in a *High Pressure Safety Code*, published by the High Pressure Technology Association (copies available from the University Safety Office).

### Construction of Pressure Vessels/Systems

168. Construction of pressure systems must meet the requirements of the Pressure Vessels and Gas Cylinders Systems Regulations and the supporting approved codes of practice and guidance documents. These publications are listed in Section 8 of this Code of Practice.

169. It is essential that the person requesting the construction of any component of a pressure system provides the Workshop Supervisor with a clear hazard and risk (safety) assessment of the component which is to be constructed/repaired/modified. In many cases the system component may require the approval of the University Engineering Insurers. Where necessary this approval must be received in writing by the Workshop Supervisor before the component is released for use.

170. Whenever a workshop has manufactured a pressure vessel or pressure system, to comply with Section 6 of the Health and Safety at Work Act the Workshop Supervisor must liaise with the designer to ensure that the item being manufactured is intrinsically safe and that the persons to whom it is being supplied receive clear written instructions for the safe use, maintenance and storage of the equipment.

### Compressed Air Systems, including Air Receivers

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171. These must conform to the requirement of the Pressure Systems and Transportable Gas Containers Regulations.

172. Guidance on the safety of these systems is contained in HSE publication HS(G)39 *Compressed Air Safety*. Further advice is available in the High Pressure Safety Code published by the *High Pressure Safety Code* published by the High Pressure Technology Association.

173. Perhaps the most important advice is whenever practicable to keep system volumes to a minimum. In the event of failure of the containment vessel, the larger the volume the greater the system energy and the greater the risk of damage or injuries to persons in the vicinity. Thus it is essential that the **greatest possible care is taken with large vessels**, even when low pressures are involved.

## **15. CONTROL OF RISKS TO HEALTH IN ELECTRONICS AND ELECTRICAL TESTING WORKSHOPS**

### Provision of Equipment and Services, and Safety Information

174. All electronic and electrical testing workshops must be provided with non conducting benches and equipped with RCD protected socket outlets. Local exhaust ventilation, e.g. local fume extraction hoods, must be provided to minimise the risk of asthma due to inhalation of fumes during any prolonged soldering operations. All electronics workshop staff must use a portable RCD protected socket outlets when working away from the workshop if the area is not fitted with RCDs, check first before working on live equipment. At least two emergency stop switches (emergency "power off buttons") should be fitted in each electronics workshop. Each stop button must be capable of instantly switching off all electrical power to machines and workbench socket outlets.

175. Although not specifically a piece of equipment, each workshop must have one or more hazard and risk assessment files which are available to staff at all times. These files must contain the written generic and specific hazard and risk assessment documents to which staff should refer and from which staff may need to take copies to familiarise themselves with the hazards and risks to health as well as the precautions they need to take to ensure that their work is conducted safely and the risks to health are controlled.

176. Reference documents, which should be available to all staff in the workshop, including the Safety Procedures and Guidance for Implementation of Electricity at Work Regulations SPG-13-09

### Workshop Management

177. The electronics or electrical testing Workshop Supervisor is responsible for safety within the electronics or electrical testing workshop in the same way as the Workshop Supervisor is responsible for safety in mechanical or woodworking workshops.

**178.** Most of the safety legislation which applies to mechanical workshops also applies in electronics workshops, and indeed many techniques employed, e.g. use of hand tools, use of drills, etc., are similar in both types of workshop. For this reason, the need for the Workshop Supervisor to control the risks to health is of paramount importance in both workshops, and the need to control access is also important in both types of workshop. **Only trained and**

**competent persons**, whose presence is authorised by the Workshop Supervisor, may carry out electrical work in an electronics and electrical testing workshop.

179. In particular the legal requirements of the Health and Safety at Work Act 1974 and the Management of Health and Safety at Work Regulations 1992 also apply to electrical testing in workshops, as do the other safety legislations outlined in Section 1 of this document.

180. Wherever relevant, parts of the subsequent sections of this document will apply to electronic and electrical testing workshops, e.g. ventilation, housekeeping, lighting, use of machines, power tools, hand tools, hazardous materials, personal protective equipment, welding, brazing and soldering, the manual handling of loads, and especially the safety of electrical equipment.

#### Control of Risks to Health - Hazard and Risk Assessments for Electrical Testing Operations

181. To comply with the requirements of the Management of Health and Safety at Work Regulations, supervisors of electronics and electrical testing workshops must ensure that all work activities have been subjected to a suitable and sufficient **assessment** for the hazards present and the associated risks to health. In electronics workshops the main risks to health include those from electric shock or burns. However, other serious risks to health may be present, including the risk of developing asthma from the inhalation of fumes released when soldering.

182. As part of the assessment, the Workshop Supervisor must be satisfied that the individual who is to undertake the work has sufficient knowledge of the hazards and risks and has received sufficient instruction in how to carry out the work. The Workshop Supervisor must also be satisfied that the person who will do the work is sufficiently trained/experienced to carry out the work safely. The supervisor must also decide on the level of supervision required.

183. Details of the assessments must be communicated to the staff who would be expected to undertake the particular work.

184. The steps to be taken to control the risks to health must be included in the record of the assessment.

#### Hazard and Risk Assessments

185. These may be of two types:

- generic, and
- specific or 'one-off'.

186. Copies of **generic assessments** for the more common workshop tasks should be kept in the workshop in a **risk assessments file**. All assessments, whether prepared by persons requesting work, e.g. faculty, or by workshop staff must, before any work is undertaken, **be seen and approved by the Workshop Supervisor**, who may need to add additional safety information to the assessment document.

187. It is suggested that assessments are recorded in a standard format. Hazard and risk assessments may also be recorded as written statements. Assessments may also be recorded electronically provided they are easily accessible to all members of staff within the workshop.

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188. As well as any verbal communication of risks to health and safe systems of work to staff, Workshop Supervisors should ensure that copies of the hazard and risk assessments are made available to staff. It is particularly important that for one-off operations a copy of the Permit to Work or other assessment document is present at the work location.

189. **Specific risk assessments** will be for a **specific** 'one-off' task or for a unique piece of equipment where the hazards and risks to health may not be covered in sufficient detail by one of the generic risk assessments.

190. In this case either a relevant generic risk assessment document can be extended to cover the special hazards and risks involved, or a completely separate specific hazard and risk assessment document will need to be prepared. In either case the assessment must include a **brief** description to identify the particular equipment.