

Code of practice for

Health and safety in workshops of schools and similar establishments

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- Association of Scientific, Technical and Managerial Staffs
- Association of Teachers in Technical Institutions
- Department of Education and Science
- Educational Institute of Design Craft and Technology
- Electrical Installation Equipment Manufacturers' Association (Beama Ltd.)
- Greater London Council
- Health and Safety Executive
- Inner London Education Authority
- Institution of Production Engineers
- Machine Tool Industry Research Association
- National and Local Government Officers' Association
- Plastics and Rubber Institute
- Royal Society for the Prevention of Accidents

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Foreword

This British Standard code of practice has been prepared under the direction of the Mechanical Engineering Standards Committee and supersedes BS 4163:1975, which is now withdrawn. The Health and Safety at Work etc. Act 1974 brought teachers and technicians employed in education under safety legislation for the first time. Inspectors of the Health and Safety Executive administer the provisions of this Act in educational establishments. They have the right of entry in order to carry out their functions under the Act. In addition, they give technical advice on safety as the need arises.

The Factories Act 1961 and regulations made under that Act apply only to factory premises as defined. They do not apply to school workshops. Their requirements may be used as suitable standards in many cases. Where their use is inappropriate because of differences in working methods, other safety procedures may be necessary. This factor has been taken into account in preparing this standard.

This revised standard has reorganized the material content of the 1975 edition into six sections. Section three, dealing with workshops, equipment and tools, has been considerably extended, there being some repetition to make for easy reference. Additional sections have been included dealing with materials and chemicals, personal protection and safety management. Section two, dealing with planning and services, has been written as a guide to the architect when designing workshops in educational establishments.

This code has been written for those responsible for providing services, equipment and machinery to school workshops and for those employed to work in them. Where similar provision is made in other school departments and in colleges of further education, these recommendations can be applied. They should also be applied where students are undergoing initial teacher training.

Workshop experience provides an opportunity to train children in safe working methods. They should be encouraged to identify potential risks and develop a sense of responsibility for the safety of themselves and others. Teachers should be fully conversant with the potential hazards in the workshop for which they are responsible and should plan, organize and control the work so that as far as possible these are eliminated.

It is hoped that this code of practice will serve as a useful guide to those who teach in school workshops and so contribute to the prevention of workshop accidents and dangerous occurrences. Teachers are recommended to incorporate the advice contained in this document, together with that in the latest Department of Education and Science Safety Series booklets, (see 3.2) in their safety teaching programmes.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations. In particular, attention is drawn to the list of regulations given in clause 3.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 34, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1 Scope

This British Standard code of practice provides guidance both to those responsible for planning services, equipment and machinery and to those persons who may use them in workshops of schools and similar establishments.

Recommendations are made about the supply and safe use of equipment, machine tools, materials and chemicals, the importance of personal protection and safety management with particular reference to the hazards involved.

NOTE The titles of the publications referred to in this standard are listed on page 34 and the inside back cover. Other reference publications are listed in clause 3.

2 Definitions

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

2.1

extra-low voltage

a voltage not exceeding 50 V a.c. or 120 V d.c. between conductors or to earth

2.2

low voltage

a voltage greater than 50 V a.c. or 120 V d.c. but not exceeding 1 000 V a.c. or 1 500 V d.c. between conductors and 600 V a.c. or 900 V d.c. between any conductor and earth

NOTE This includes what is commonly referred to as mains voltage.

2.3

safety extra-low voltage (SELV)

an extra-low voltage supplied from a safety source

NOTE 1 A safety source may be:

- a) a class II safety isolating transformer complying with BS 3535, whose secondary winding is isolated from earth;
- b) a source of current providing a degree of safety equivalent to that of the safety isolating transformer detailed in (a), e.g. a motor generator with windings providing equivalent isolation;
- c) an electrotechnical source, e.g. a battery;
- d) a source independent of a higher voltage circuit, e.g. a diesel-driven generator;
- e) an electronic device that has been designed so that the voltage at the outgoing terminals cannot exceed 50 V a.c. or 120 V d.c. in the event of an internal fault.

NOTE 2 For details of the arrangements of circuits see IEE Wiring Regulations, Chapter 41.

2.4

functional extra-low voltage (FELV)

an extra-low voltage that does not have all the properties of SELV

NOTE For example, if one point of the extra-low voltage is connected to earth or if the circuit contains components (e.g. transformers, relays, remote control switches or contactors) insufficiently insulated with respect to circuits at higher voltages.

2.5

reduced low voltage

a voltage that does not exceed 110 V r.m.s. a.c. between phases (three-phase 65 V to earthed neutral, single-phase 55 V to earthed midpoint)

NOTE 1 Such a voltage may be supplied from one of the following sources:

- a) a double wound isolating transformer complying with BS 3535; or
- b) a motor generator having windings providing isolation equivalent to that provided by the windings of an isolating transformer; or
- c) a source independent of other supplies, e.g. a diesel generator.

NOTE 2 For details of the arrangements of circuits see IEE Wiring Regulations, Chapter 47.

2.6

switch-disconnector

a switch that in the open position provides an isolating distance in accordance with specified requirements, i.e. combines the function of a switch with the requirements of a disconnector (isolator) (See BS 5419)

2.7

equipotential zone

an area (usually a building or part thereof) within which all extraneous conductive parts and exposed conductive parts are connected by means of circuit protective conductors to the main earthing terminal at the entry of electrical supplies to the area

NOTE For details see IEE Wiring Regulations, Chapter 41.

2.8

residual current device

a mechanical switching device or association of devices intended to cause the contacts to open when a fault current attains a particular value (e.g. a residual current circuit breaker complying with BS 4293)

2.9

IP classification

markings used to indicate the degree of ingress protection consisting of the letters IP, followed by two characteristic numerals (see 6.2) one of which may be replaced by the letter X (see note 2).

the first characteristic numeral designates the degree of protection of persons against contact with live or moving parts inside the enclosure and of equipment against ingress of solid foreign bodies

the second characteristic numeral designates the degree of protection against ingress of liquid

NOTE 1 A single characteristic numeral is used to designate the two means of protection mentioned above since it is understood that protection against ingress of solid foreign bodies implies a certain amount of protection of persons against contact with live or moving parts inside the enclosure and vice versa.

NOTE 2 For certain equipment, the letter X replaces one of the characteristic numerals, where no claim is made and thus no test is required, e.g. IPX4 is splashproof only, with no claim being made for its capability to prevent the ingress of solid objects.

2.10

backfire

the return of the flame into the blowpipe of a gas-welding or cutting torch with a screeching sound, the flame being either extinguished or reignited at the nozzle

2.11

flashback

the return of the flame through the blow-pipe of a gas-welding or cutting torch into the hoses and even the regulators; it may also reach the fuel gas cylinder, causing heating and decomposition of the contents

3 References

3.1 General. The references in 3.2 to 3.5 give specific guidance on areas of concern related to this code of practice. The absence of advice for a particular item should not be taken to mean none is available. No guarantee can be given that any publication will be in print at any particular time.

3.2 Department of Education and Science publications. The following publications in the Department of Education and Science Safety Series are obtainable from HMSO, 49 High Holborn, London WC1V 6HB.

- a) Safety in Science Laboratories.
- b) Safety in Practical Studies.
- c) Safety in Further Education.

3.3 Government regulations. The following government regulations are obtainable from HMSO, 49 High Holborn, London WC1V 6HB.

- a) Abrasive Wheels Regulations 1970.

b) Building Standard (Scotland) Regulations 1971.

c) Certificate of Exemption No. 3 to the Foundries (Protective Footwear and Gaiters) Regulations.

d) Electricity (Factories Act) Special Regulations 1908 or 1944.

e) Health and Safety First Aid Regulations 1981.

f) Foundries (Protective Footwear and Gaiters) Regulations 1971.

g) Gas Safety Regulations 1972.

h) Health and Safety at Work etc. Act 1974.

i) Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972.

j) Horizontal Milling Machines Regulations 1928.

k) Petroleum (Consolidation) Act 1928.

l) Petroleum (Mixtures) Order 1929.

m) Petroleum Spirit (Motor Vehicles) Regulations 1929.

n) Protection of Eyes Regulations 1974.

o) Education (School Premises) Regulations 1981. |

p) Woodworking Machines Regulations 1974.

3.4 Other government publications. The following government publications are obtainable from HMSO, 49 High Holborn, London WC1V 6HB.

- a) Health and Safety at Work Booklets (HSW).
 - 1) No. 3 Safety devices for hand and foot operated presses.
 - 2) No. 4 Safety in the use of abrasive wheels.
 - 3) No. 20 Drilling machines: guarding of spindles and attachments.
 - 4) No. 22 Dust explosions in factories.
 - 5) No. 24 Electrical limit switches and their application.
 - 6) No. 32 Repair of drums and small tanks: explosion and fire risk.
 - 7) No. 33 Safety in the use of guillotines and shears.
 - 8) No. 35 Basic rules for safety and health at work.
 - 9) No. 38 Electric arc welding.
 - 10) No. 41 Safety in the use of woodworking machines.
 - 11) No. 42 Guarding of cutters of horizontal milling machines.
 - 12) No. 50 Welding and flame cutting using compressed gases.
- b) Other booklets and leaflets.

- | | |
|--------------------------------|---|
| 1) HSE Guidance Note PM 21 | Woodworking machines — safety hints. |
| 2) HSE Guidance Note EH 40 | Occupational control limits. |
| 3) HSE Guidance Note CS 4 | The keeping of LPG in cylinders and similar containers. |
| 4) HSE Guidance Note CS 5 | The storage of LPG at fixed installations. |
| 5) Booklet No. HS(R) 11 | Guidance on the Health and Safety (First Aid) Regulations 1981. |
| 6) HSE Guidance Note PM 16 | Eyebolts. |
| 7) HSE Guidance Note PM 22 | Training advice on the mounting of abrasive wheels. |
| 8) HSE Guidance Note CS 23 | Electrical safety in schools. |
| 9) Home Office Fire Protection | Guide No. 4. |

3.5 Non-government publications. The following non-government publications are obtainable from the addresses shown.

- a) CIBS Code for Interior Lighting (obtainable from the Chartered Institution of Building Services, Delta House, 222 Balham High Road, London SW12 9BS).
- b) IEE Wiring Regulations for Electrical Installations (obtainable from the Institution of Electrical Engineers, Savoy Place, London WC2).
- c) The following are obtainable from the Association of Advisers in Craft, Design and Technology, London Borough of Hounslow, Civic Centre, Lampton Road, Hounslow TW3 4DN.
 - 1) Safety Training Certificate and Syllabuses for Teachers of Technical Subjects.
 - 2) Safe Conditions Survey and Report Forms.
- d) The following are available from the Machine Tool Trades Association, 62 Bayswater Road, London W2 3PH.

- 1) Safeguarding Sawing and Cutting-off Machines.
- 2) Safeguarding Grinding and Honing Machines.
- 3) Safeguarding Drilling Machines.
- 4) Safeguarding Turning Machines.
- 5) Safeguarding Milling Machines.
- 6) Safeguarding Woodworking Machines.
- e) Liquefied Petroleum Gas Industry Technical Association (UK) (LPGITA) Code of Practice No. 7. Storage of full and empty LPG Cylinders and Cartridges (obtainable from William Culross and Sons Limited, Coupar Angus, Perthshire, Scotland).

Section 2. Planning and services

4 Planning

4.1 General. Safety factors should be incorporated in the design of a school workshop at the planning stage. Expert advice about use of the room should be sought from, for example, a Local Education Authority Inspector/Adviser for Craft, Design and Technology. The brief to the architect should include the maximum number of pupils expected to use the workshop, the facilities to be provided and the equipment and processes involved. The total floor area to be allocated to each workshop should be sufficient to ensure safe working conditions. An area should be designated for the storage of stools and trolleys when not in use. Additional space should be provided for the storage of bulk supplies, chemicals and flammable liquids.

Reference should be made to the Education (School Premises) Regulations 1981 and in Scotland to the Building Standards (Scotland) Regulations 1971 which set out standards of education amenity and health and safety for school premises. These include requirements of site and teaching areas, structural stability, fire precautions, lighting, heating, ventilation, washing and sanitary accommodation and other appropriate matters. Workshops should have a readily accessible secondary means of escape.

4.2 Equipment and furniture. Machinery and furniture should be so arranged as to enable the different processes to be undertaken in definite zones within the workshop area. An adequate free area around each piece of equipment and furniture is required to give the operator safe working space. Reciprocating parts of machinery should not approach within 500 mm of any fixed structure. Recommendations on the safeguarding of machinery are given in BS 5304.

4.3 Storage

4.3.1 General. Storage should be provided for bulk supplies of materials and partly constructed work. Separate, suitable storage areas should be provided for chemicals; flammable liquids; liquefied petroleum gas (LPG); acetylene; oxygen gases. Hazardous substances, whether highly flammable (if liquid or gaseous), highly combustible, e.g. polyurethane foam, toxic or corrosive, should be kept apart from substances of differing hazard. HAZCHEM and other safety notices should be displayed on the outside of the store doors.

The amount of each substance kept on the premises should be as low as possible consistent with purchasing requirements. Inventories should be regularly reviewed and redundant stocks disposed of in a safe manner.

4.3.2 Materials. The storage of bulk materials should be in an area separately designated and supplementary to the teaching area. The store should be adjacent to the workshop with ready access to it and to the outside. Adequate racking for the storage of flat and round metal stock, timber planks, and wood, metal and plastics sheets should be provided. Ends should not protrude from the rack. Retaining bars or chains should be provided when vertical stacking is employed.

Timber and plastics stores should be unheated and well ventilated but metal stores should be warm and dry, to preserve materials in good condition and facilitate the safe handling at all times of the year.

4.3.3 Acids and other corrosive chemicals. Main stocks of acid should be kept in a lockable central store provided with ventilation near ground level. Acids should not be stored with incompatible materials such as hypochlorite.

The store should be lined with acid-resistant material. Only a limited supply of acids and other corrosive chemicals should be kept in the workshop and they should be stored in strong, locked containers where any spillage can be retained. The use of unbreakable containers is recommended. If glass containers are used, they should be carried in a suitable container or plastics bucket. Acid in use should be kept, and used, close to a water supply. The dangers associated with the use of any acid or other chemical should be displayed together with instructions about the correct procedure to be followed in an emergency.

4.3.4 Flammable liquids. The quantities of highly flammable liquids or mixtures held in store should be kept at a minimum and should not exceed 50 L in total.

Cellulose solutions, thinners and many adhesives that are petroleum-based have to be kept in separate containers not exceeding 5 L capacity. Containers should be stored in a special lockable fire-resistant bin or cupboard provided with a sill capable of retaining the contents of the largest container in the event of spillage. The bin should be stored away from other combustible material and sources of ignition.

Not more than 5 L of petroleum spirit should be introduced into workshops or stores.

Only the minimum quantity of highly flammable liquids necessary to complete the task in hand should be introduced into the workshop.

Reference should be made to the Highly Flammable Liquids and Liquefied Petroleum Gas Regulations 1972.

4.3.5 Liquefied petroleum gas (LPG). LPG should preferably be stored in the open air and away from combustible and corrosive materials and oxygen cylinders in accordance with the recognized standard (HSE Guidance Note CS 4).

LPG vapour is heavier than air and consequently cylinders should not be stored below ground level or close to drains, cellars or basements. Wherever cylinders are stored, even in the open air, the area should be well ventilated. Care should be taken to ensure that the valves on empty cylinders are closed, to prevent the ingress of air which may create an explosive mixture.

In fixed installations, the housings should be fire resistant, well ventilated and satisfy the Fire Authority.

Reference should also be made to BS 5482, LPGITA Code of Practice No. 7 and Home Office Fire Preventive Guide No. 4.

4.3.6 Oxygen and acetylene cylinders. Cylinders may be mounted on a trolley and when not in use should be stored in a designated area agreed with the local Fire Authority. The area should be clearly defined and warning notices displayed. Arrangements should be made to enable the equipment to be removed quickly in case of fire.

Cylinders in use may also be housed outside the workshops and gases piped to the welding bench. The store for such cylinders should be fire resistant, well ventilated, clearly marked "Highly Flammable" and not contain any other flammable articles or materials. Where artificial lighting is required, it should be of the flame-proof type. Provision should be made to secure the cylinders in an upright position.

Reference should be made to notes and guidance available from the suppliers.

4.3.7 Plastics. All plastics materials should be stored under cool dry conditions. Catalysts (organic peroxides) and accelerators (cobalt naphthenate) used for glass reinforced plastics (GRP) work should be stored in separate, preferably metal, cupboards where any spillage can be retained within the cupboard. Peroxides should be stored only in vented containers away from any flammable materials and should not be placed in the sun nor near any source of heat.

4.3.8 Heat area. Storage for the forge fuel and moulding sand should be provided.

4.3.9 Equipment. Cupboards should be provided for the storage of hand tools, machine accessories, portable equipment and teaching aids.

4.3.10 Storage of personal clothing. Suitable storage for clothing, school bags and cases should be provided within the workshop or adjacent area.

4.4 Fire. The risk of fire varies with the nature of the work being undertaken. Fire fighting equipment should be approved and inspected periodically by the local Fire Authority.

Well indicated means of escape in case of fire are essential. Employees and pupils should be instructed how to act in an emergency. Escape routes should be kept clear and any doors unlocked when the work area is occupied. Reference should be made to BS 5266 for emergency lighting and to BS 5839 for fire detecting and alarm systems in buildings.

Fire may be started following an explosion caused by the ignition of fine particles of dust when present in sufficient quantities in an enclosed area or container. Dust should not be allowed to accumulate on electrical or other equipment that may be liable to overheat. The abrading of plastics, metals and woods can produce such dusts and although dangerous concentrations are not likely to be present in the open workshop, there is a risk of explosion in the collector of any exhaust system provided to contain such dust. An explosion will occur only if the dust is dispersed in air in dangerous concentrations and a source of ignition is present. It is important to ensure that all collectors are efficiently earthed to remove any static charge. Advice on the precautions which should be taken is given in Health and Safety at Work Booklet No. 22.

5 Environmental factors

5.1 Illumination

5.1.1 General. A good standard of both natural and artificial light is essential. Attention is drawn to the requirements for general lighting and the minimum illumination of working surfaces given in the appropriate School Premises Regulations. The levels of lighting in the Chartered Institute of Building Services code are recommended. The levels of lighting required are at least 300 lx for rough bench and machine work, with due regard to the stroboscopic effect of fluorescent lighting units, and at least 500 lx for medium bench and machine work (ordinary automatic machines, rough grinding, medium buffing, polishing). For fine bench and machine work (engraving, fine automatic machines, medium grinding, fine buffing and polishing) a level of 1 000 lx is recommended. It is important that forge, brazing and welding areas have only subdued lighting to enable the colour changes of heated metals to be more easily observed. Sudden changes in intensity of illumination, either within the workshop or at entrances and exits, are undesirable and should be avoided. If possible, these levels of illumination should be obtained by natural light supplemented by artificial lighting as and when necessary. Mechanical protection should be afforded to lighting units installed in storage areas.

5.1.2 Supplementary lighting. It is sometimes necessary to provide supplementary lighting for machine tools but it should not be regarded as a substitute for a satisfactory standard of general lighting. It should comply with the relevant requirements for such devices specified in BS 2771. The voltage used for the lamp should not exceed extra-low voltage and it is recommended that the voltage should be consistent within an installation. If the switch on the transformer is not easily accessible to the operator, it should be supplemented by one at the light source. The switch and the reflector should not be supported by the lampholder. The lighting fitting should be provided with a deep shade to prevent glare from polished surfaces.

5.2 Heating. Accidents are more likely to occur in underheated workshops. An adequate temperature should be maintained at all times to enable pupils to work in comfort in appropriate protective clothing. The recommended minimum temperature given in the Woodworking Machines Regulations 1974 may be used as a guide. Where fan assisted heating cannot be avoided, it should be carefully positioned so that it does not interfere with any dust or fumes being extracted from the workshop.

5.3 Ventilation. The ventilation system should be capable of removing concentrations of harmful or irritant dust and fumes that might arise from general workshop processes. Local exhaust ventilation may be required to prevent contaminants entering the working environment and processes that should be considered in this category include:

- a) *heat treatment*, involving brazing hearths, crucible and other types of furnaces, forges and welding plant;
- b) *metal and woodworking*, involving sawing machines, sanding machines, planing and thicknessing machines;
- c) *chemical*, involving acid pickling, plastics and paint spraying and engine exhaust emissions.

The intake should be sited at a point as close as possible to the source of the contaminant. When venting to the outside atmosphere, care should be taken not to harm those outside or in another part of the building. When exhaust systems are provided, the ventilation system should be such that compensation can be made for the air exhausted from the room. For information on the full range of airborne contaminants that may give rise to health risks, and on the threshold limit values applied to these in industrial situations, reference may be made to HSE Guidance Note EH 40. (See clause 3.)

5.4 Surfaces

5.4.1 Floors. Workshop floors should be at one level. The floor should be provided with a non-slip surface and this should be maintained in good condition. The floor in the heat treatment area should be of fire-resistant materials. In woodwork shops it should be noted that sawdust may have a burnishing effect on wood floors; CP 209:Part 1 gives useful advice. Spilt oil, water or chemicals should be removed at once. Accumulations of waste materials should be removed daily from the floors. Floors should be kept free of obstacles and tripping hazards. Duckboards should not be used.

5.4.2 Ceilings and walls. A smooth surface that is kept clean and provides a good level of reflected light is required in workshops. Areas used for heat processes should be provided with non-reflective surfaces.

6 Services

6.1 General. Services such as electricity, gas, water or compressed air provided within the workshop by means of pipes and ducts, should be colour coded in accordance with BS 1710. Symbols used on signs within the work area which convey safety information should comply with the Safety Signs Regulations 1980. (See BS 5378-1.)

6.2 Electrical installations

6.2.1 General. All installations and alterations should comply with the IEE Wiring Regulations published by the Institution of Electrical Engineers and any requirements of the local Electricity Board.

An assessment should be made of the frequency and quality of maintenance that the installation can reasonably be expected to receive during its intended life. Wherever practicable, the assessment should be made in consultation with the person or body who would be responsible for the operation and maintenance of the installation. After taking account of the probable frequency and quality of maintenance expected, the requirements of Parts 4 to 8 of the IEE Wiring Regulations should be observed so that:

- a) any periodic inspection, testing, maintenance and repairs likely to be necessary during the intended life can be readily and safely carried out;
- b) the protective measures for safety remain effective during the intended life;
- c) the reliability of equipment is appropriate to the intended life of the installation.

Electrical equipment should be suitable for the environment in which it is used. Where the ingress of water and/or solid objects has to be considered, such equipment may have an IP rating, e.g. IP54, that corresponds to or exceeds the conditions likely to be encountered in service. For details of specifications, and of tests to verify degrees of protection, reference should be made to BS 5420 and BS 5490.

6.2.2 Main workshop switchgear. In each separate workshop or work area it should be possible to isolate all electrical circuits that supply fixed equipment and/or socket-outlets by means of a single switch-disconnector complying with BS 5419. The workshop disconnector should be accessible, easily identified and capable of being locked in the OFF position. The lighting, space heating and “caretakers” socket-outlet circuits should not be controlled by this disconnector.

Workshops without electrically operated fixed equipment and only a 240 V a.c. supply, need not be fitted with a workshop disconnector or an emergency stop system (see 6.2.3), but should preferably have all socket-outlets supplied through a residual current device with a rated residual current of 30 mA or less.

6.2.3 Workshop emergency stop systems. An emergency stop system should be installed in each separate workshop or work area, to switch to OFF in an emergency all the circuits supplied via the workshop disconnect, except those circuits whose operation is specifically to remove a hazard, e.g. fume extractor fans.

The emergency switching device should be a remotely-operated contactor or circuit breaker that opens when the coil is de-energized. The control of the switching device should be by means of a series of push buttons, readily accessible, around the work area at an approximate height of 1.5 m and clear of benches and machines.

In new installations, the push buttons should be the mushroom-headed latching type and coloured red; the surround on the mounting surface should be coloured yellow.

6.2.4 Fixed electrical equipment and its controls. Electrical equipment of machine tools should comply with BS 2771.

Motor starters, switches and controls should comply with BS 4794, BS 4941 and BS 5419, be readily accessible to the operator from the normal operating position and not require the operator to reach over any moving parts of the machine. Where both hands may be used at the same time whilst operating the machine, an additional and suitable stop switch should be provided that can be actuated conveniently by the foot or knee. The colours of indicating lamps and pushbuttons should comply with BS 4099.

All controls and means of isolation not incorporated in the equipment should be sited not more than 2 m from it and in such a position that they can be operated safely while the equipment is in use.

Every electric motor with a rating exceeding 0.37 kW should be provided with control equipment incorporating means of protection against overcurrent in the motor. This recommendation does not apply to a motor incorporated in an item of current-using equipment that is in accordance with the relevant British Standard.

Where unexpected restarting of an electric motor is considered dangerous, means to prevent automatic restarting after a stoppage caused, for example, by a failure of supply or a voltage reduction should be provided. This recommendation does not preclude arrangements for starting a motor at intervals by an automatic control device where other adequate precautions are taken against unexpected restarting.

6.2.5 Electrical supplies for portable equipment.

Where a standard 240 V a.c. supply with a neutral at or near earth potential is used, it is recommended that additional protection against electric shock be provided in the form of a residual current device with a rated residual operating current of 30 mA or less. The residual current device should be accessible and preferably should protect socket-outlets only in the workshop concerned.

If it is intended to supply portable tools outside the equipotential zone, such residual current protection should be provided or alternatively a reduced low voltage supply may be used. Where there is extensive use of reduced low voltage tools, consideration should be given to the provision of a reduced low voltage supply as part of the permanent wiring or alternatively, by means of a portable transformer, from the 240 V a.c. supply.

However, it should be noted that a 240 V a.c. supply fed from 1 : 1 isolating transformer and having a secondary with a centre-tapped earth, is intended for specialist laboratory use and is not suitable for use in workshops.

If personnel are able to touch live parts whilst equipment is energized, e.g. hot wire cutters, it is essential that only safety extra-low voltage be used with a voltage not exceeding 25 V a.c.r.m.s, at 50 Hz or 60 V ripple-free d.c.

6.2.6 Socket-outlets. For the standard nominal 240 V a.c. supply with a neutral at or near earth potential, the preferred socket-outlet system should comply with BS 1363. Where equipment needs to be restricted to a particular location or needs an industrial type plug then socket-outlets should preferably comply with BS 4343 and be colour coded blue.

NOTE The use of socket-outlets complying with BS 548 or BS 198 may be necessary to ensure compatibility with an existing older installation.

For reduced low voltage, the socket-outlets should be colour coded yellow and preferably comply with BS 4343.

Equipment needing an electrical supply of greater than 16 A and/or 250 V should preferably be directly connected to the fixed wiring.

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

Socket-outlets for use exclusively by caretaking staff should preferably be sited adjacent to the workshop door. If they need to be located in the workshop, they should be supplied from an independent circuit and for new installations they should consist of unswitched socket-outlets controlled by an adjacent key switch. They should be labelled "Staff Use Only".