



**UNIVERSITY OF
BIRMINGHAM**

Health and Safety Policy

Electrical Safety

UHSP/18/ES/02

This document sets out in more detail the arrangements for compliance with University Health and Safety Policy at Budget Centre level and it gives guidance on how these requirements may be met. This document forms a part of the University Health and Safety Policy. It has been approved by the Safety Executive Committee, in consultation with the Joint Safety Advisory Committee, and it will be subject to review.

This new Policy covers all use of electricity for which the University is responsible whether on or off campus. It applies to all equipment and installations whether new, second hand, borrowed, leased or donated. Two earlier policies, UHSP/5/CITEE/95 and UHSP/12/ITEE/97, are superseded by this Policy.

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References, page 12 – April 2014

Guidance on Extension leads and Protection, August 2006

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INTRODUCTION

The *Electricity at Work Regulations 1989* require precautions to be taken to prevent the risk of death or personal injury from electricity arising from work activities. These activities include the construction and manufacture, installation, use, maintenance and repair of electrical installations, systems and equipment.

This Policy is based on guidance issued by the Health and Safety Executive and the Institution of Electrical Engineers.

The responsibility for implementing this Policy rests with Heads of Budget Centres.

Scope of this document

This document sets out the University Policy for Electrical Safety. It also contains Guidance to assist in the implementation of that policy. It covers all use of electricity for which the University is responsible whether on or off campus. It applies to all equipment and installations whether new, second hand, borrowed, leased or donated.

The aim of the policy is to prevent electric shock or fire occurring due to a malfunction of the equipment or installation. It also briefly covers the risks that can arise when electricity is used with or near substances, such as ignition or explosion. In these instances more information can be found in the University's Hazardous Substances Policy.

Responsibility for specific parts of an installation

The University's electrical infrastructure

The Director of Estate Management is responsible for the University's electrical infrastructure; i.e. the electrical installation from the incoming supply up to and including the wired sockets or switch fuses.

For equipment, which plugs into the mains supply

Heads of Budget Centres are responsible for equipment and/or installations and wiring up to and including the plugs.

For equipment that is wired in to the mains supply

Heads of Budget Centres are responsible for the equipment and/or installation and wiring up to the switch/fuse.

Definition of 'Competent' as it applies to the Policy

Levels of competency required will vary depending on the work and hence the risks involved. To be classed as competent a person needs sufficient technical knowledge and practical experience to carry out the work safely, i.e.:

- An adequate knowledge and experience of working with electricity.
- An adequate understanding of the system/equipment to be worked on and practical experience on that type of equipment.
- An understanding of the hazards that may arise during the work and the precautions needed to be taken to deal with them.
- A knowledge of the current electrical standards which apply to the work being undertaken.
- A knowledge of University, Budget Centre and Estate Management policies and procedures which apply to the work being undertaken.
- The ability to recognise at all times whether it is safe for work to continue.

POLICY

The Director of Estate Management is responsible for making arrangements to ensure that:

- The University's electrical infrastructure is installed, maintained and operated in a safe condition to the current approved standard.

Heads of Budget Centres are responsible for making arrangements to ensure that, within their area of responsibility:

- All new and refurbished electrical equipment is to current approved British Standards. This includes equipment made in house. Standards of electrical safety must not be relaxed because something is considered 'temporary or experimental'.
- All electrical equipment that is in use is maintained in a safe condition. This will include checking, inspecting and testing as appropriate in accordance with Schedule 1.
- All work involving electricity is organised and managed to eliminate or reduce to a minimum the risk to those carrying it out and others that may be put at risk.
- Work on live equipment or near any live conductor (other than those suitably insulated) is prohibited except when the criteria in Schedule 2 apply.
- Those designing, installing, maintaining, repairing, inspecting or testing electrical equipment are competent (as defined in the Introduction) and are authorised by their Budget Centre.
- Records of inspections, testing and maintenance are kept.
- Equipment wired into the mains supply is only connected or disconnected by Estate Management or their authorised contractors.
- Arrangements are made to prevent unsafe equipment being used.
- Personal electrical equipment, if allowed, is treated as if it were University equipment. This does not apply to personal equipment belonging to residential staff and students in a hall of residence, which is being used for private use in their own rooms.
- Residential staff and students are given guidance about the safe use of electrical equipment and checks are made to ensure this guidance is followed. (See page 9).

Individuals must:

- Ensure, to the best of their ability, that any electrical equipment they use is undamaged and safe.
- Use electrical equipment correctly and not overload the power supply.
- Notify their manager or supervisor if they bring into service any electrical equipment, including personal equipment. (Note this does not apply to personal equipment belonging to students in a hall of residence, which is being used for private use in their own rooms. (See page 9).
- Report any defective electrical equipment to their manager or supervisor.
- Not attempt to repair, dismantle or otherwise interfere with electrical equipment unless competent (as defined in the Introduction) and authorised.

SCHEDULE 1

Checking, Inspecting and Testing of Electrical Equipment

All electrical equipment that is **in use** must be maintained in a safe condition to prevent danger. (The main dangers are electric shock and fire.)

In use means equipment that is currently being used or is capable of being used.

The table identifies three (maintenance) levels of checks, inspection and testing for equipment in use (See page 5 for details.):

- Appropriate User Checks.
- Formal Inspections.
- Testing.

Additionally all electrical equipment should undergo a formal visual inspection before being put into use at the University for the first time. This includes new, second hand, borrowed, leased, donated or repaired equipment.

Type of equipment	Examples	Requirement
<p>Fixed equipment</p> <p>Equipment that forms part of a system and is fixed in position.</p>	<p>Air-conditioning units Fume cupboards Safety cabinets Heaters (fixed, non portable) Radiators Pumps Walk in freezers</p>	<p>Formal inspection and test in accordance with the recommendations laid down by the supplier.</p>
<p>Installed equipment</p> <p>'Industrial' equipment. May be fixed in position. May be built in. May be 240 volts or 415volts. May be hard wired or be plugged into the mains supply.</p>	<p>'Industrial' washing machines 'Industrial' dryers 'Industrial' cookers 'Industrial' dish washers Large workshop machines Large photocopiers Large autoclaves Large centrifuges Large furnaces Ventilated cupboards Large microscopes</p>	<p>Appropriate User Checks. Formal visual inspection every 2 years. Test in accordance with the recommendations laid down by the supplier. If no recommendation test every 4 years if used in wet or adverse conditions.</p>
<p>Stationary equipment</p> <p>Equipment not designed to be moved from place to place. Usually 240 volts. May be hard wired or be plugged into the mains supply.</p>	<p>'Domestic' washing machines 'Domestic' tumble dryers 'Domestic' dish washers 'Domestic' cookers Refrigerators Freezers Microwave ovens Bench top workshop machines Safety cabinets Drying cabinets Bench top furnaces Bench top ovens Incubators High capacity pumps Treadmills, rowing machines, etc.</p>	<p>Appropriate User Checks. Formal visual inspection every 2 years Test every 4 years if used in wet or adverse conditions.</p>

<p>Movable equipment (1)</p> <p>Equipment that is easily moved and:</p> <ul style="list-style-type: none"> • Draws a high current; or • Is used in wet or adverse conditions; or • Is used in an adverse way; or • Is hand held. <p>Usually 240 volts plugged into the main supply but may be a lower voltage e.g.110 volts.</p>	<p>Kettles and coffee makers Toasters Portable heaters Portable humidifiers Floor cleaners Bench top autoclaves Bench top centrifuges Bench top heaters Mixers Hot plates Hand held dryers Photometers Low capacity pumps Shakers Stirrers Water baths Engravers Inspection lamps Welding sets Soldering irons Hand held angle grinders Hand held drills Hand held sanders/planers Hand held saws Portable blowers Pressure washers Lawn mowers Extension leads and power cords used with the above</p>	<p>Appropriate User Checks. Formal visual inspection every 6 months. Test every year.</p>
<p>Movable equipment (2)</p> <p>Equipment moved frequently and: Draws a low current; and</p> <ul style="list-style-type: none"> • Is not used in wet or adverse conditions; and • Is not used in an adverse way; and • Is not hand held. <p>Usually 240 volts plugged into the main supply but may be a lower voltage e.g.110 volts.</p>	<p>Balances Measuring devices/meters Small Microscopes Desk/bench top lamps Fans Portable televisions/video &DVD players Portable projectors Portable sound systems Extension leads and power cords used with the above</p>	<p>Appropriate User Checks. Formal visual inspection every year. Test every 2 years.</p>
<p>Movable equipment (3)</p> <p>Equipment moved infrequently and: Draws a low current; and</p> <ul style="list-style-type: none"> • Is not used in wet or adverse conditions; and • Is not used in an adverse way; and • Is not hand held. <p>Usually 240 volts plugged into the main supply but may be a lower voltage e.g.110 volts.</p>	<p>Most AV equipment Shredders Projectors Televisions/video & DVD players Hi-Fi equipment Computers and peripherals Servers Telephonic equipment Fax machines Photocopiers Microscopes Spectrophotometers Extension leads and power cords used with the above</p>	<p>Appropriate User Checks.</p>

Lap top computer mains adapters		Appropriate User Checks.
Equipment less than 50 volts	Telephonic equipment	None
Battery operated less than 20 volts		None

Notes:

- 1 The requirements for the examples given are not definitive. A more rigorous regime may be required or a less rigorous one may be allowed based on a risk assessment.
- 2 It may be necessary to increase the frequency of inspections and testing if circumstances dictate, (e.g. particularly adverse conditions, adverse use, experience or recurring defects).

Examples of Adverse Conditions Wet, damp, condensation, near sources of heat, where cables can be run over etc.

Examples of Adverse Use Cables being dragged, towed twisted etc, equipment being roughly used etc.

Appropriate User Checks

A visual inspection is very important. It encourages the person using the equipment to look critically at the equipment they are using. No formal record of these checks is required to be kept.

Not all equipment will need the same checks; the risk of damage that equipment and cables could be subjected to should be assessed.

For Example:

Equipment which is moved regularly:

- Each time before use check appliance and cable and plug (especially if cables are dragged about).

Equipment that is moved infrequently but is regularly unplugged:

- Each time before plugging in check plug and the part of the cable leading into the plug.
- Occasionally check appliance and visible length of cable.

Equipment that is moved infrequently and is not regularly unplugged:

- Occasionally check appliance and visible length of cable.
- When unplugged check the plug and the part of the cable leading into the plug.

Equipment that is hard-wired into the mains supply:

- Occasionally check appliance and visible length of cable.

Points to look for:

- The condition of the equipment, signs of damage, misuse and obvious defects.
- Signs of overheating.
- Loose wires.

- The condition of the cable and armouring. Particular attention should be paid to any cuts, scuffing, crushing, signs of overheating, burns, chemical contamination, fraying, any visible inner wiring, signs of abrasion and stretching.
- The condition of plugs and sockets including damage, looseness and contamination.
- The effectiveness of the strain relief for the cable, (usually fitted on equipment rated at 415 volts).

Formal Visual Inspections

This is an important component of a maintenance system since these inspections will enable most potential faults to be discovered. These inspections are more formal than user checks and are carried out at prescribed intervals.

The formal inspection should be carried out in a systematic way, preferably following a check list.

The *User Check* should be carried out first. Additionally the following should be checked:

- The whole length of the lead that it is free from defect.
- That the correct fuse is fitted.
- That the cord grip is effective.

And if the plug top can be removed:

- That the cable terminations are correct and secured.
- That there is no sign of internal damage, overheating or ingress of liquid or foreign matter.

The results of the formal inspection must be recorded.

Testing

Testing should reveal faults that cannot be detected by user checks and inspections.

The essential tests are:

- earth bond (class 1 equipment only);
- insulation resistance.

The results of testing must be recorded.

For equipment rated up to 240 volts and plugged into the mains supply a portable appliance tester (PAT) is needed to carry out these tests.

For equipment hard-wired into the mains supply and/or rated above 240 volts more specialised equipment is required.

SCHEDULE 2

WORK ON OR NEAR LIVE EQUIPMENT

Unless there is no risk, work on live equipment or near any live conductor (other than those suitably insulated) is **prohibited** unless **all** the following criteria are met:

- 1 It is unreasonable in all circumstances for the equipment or conductor to be dead.

AND

- 2 It is reasonable in all circumstances for the person to be at work on or near the equipment or conductor while it is live.

AND

- 3 Suitable precautions (including where necessary the provision of suitable protective equipment) are taken to prevent injury.

Notes

Circumstances where it may be necessary to work on live equipment or near live conductors include:

- Commissioning or adjusting equipment.
- Fault finding.

This may include large high voltage fixed items of the infrastructure or plant or small low voltage equipment such as television sets.

If live working is carried out a **safe system of work** is required based on a risk assessment. This should include:

- Only allowing the minimum number of people to work on the equipment.
- Having the equipment live for the minimum length of time.
- Using the correct tools.
- Ensuring that those working are competent.
- Preventing others not involved from getting near the live conductors.
- Indicating the live areas.
- Using earth free areas.
- Using residual current devices (RCDs).
- Ensuring adequate space around the live areas.
- Ensuring that the floors are not slippery and that there is adequate lighting.
- Having arrangements in place in case someone does come in contact with a live conductor and sustains an electric shock.
- Having permit to work procedures.

Further guidance can be obtained from the Health and Safety Executive's publication *Electricity at Work-Safe Working Practices*, HSG 85.

GUIDANCE

Design of equipment

In general the University guidance *Guidance on Equipment Provided for Use at Work: GUIDANCE/1/EPUW/99* should be followed. Specifically for electrical equipment the following precautions should be taken, depending on the equipment involved:

- All cables, plugs, sockets and connectors should be of a good quality and standard.
- Flexible cables should also be adequately sized and protected with proper connections and colour codes.
- Mains input switches should be suitably placed and 'ON' and 'OFF' positions clearly indicated.
- All phases should be disconnected by the operation of the mains switch.
- An effective over current protection device, (e.g. a fuse) should be provided in each phase of the circuit and be arranged to disconnect the electricity supply in the event of overload or short circuit.
- If the supply is through an isolator, provision should be made for securing the isolator switch against inadvertent or unauthorised operation, (e.g. padlock).
- All live terminals should be screened. If it is necessary for an operator to have access to particular parts of the interior of a machine, this should not allow access to live electrical parts at the same time, (e.g. by the use of interlocks, guards etc).
- If heating elements are used they should be placed or installed so as to cause no deterioration of electrical equipment that would put persons at risk.
- If fluids, except transformer oils and the like, are used in equipment, they shall be used and housed so that they do not come into contact with electrical conductors and components. Where the incorporation of conducting or other fluids into equipment is necessary, the design should, as far as possible, place the fluids at the lowest level possible. If flammable fluids are used special attention should be given to prevent sparking and the build up of flammable gases in the equipment enclosure. If this is not possible, flameproof or intrinsically safe components should be used.

Electrical equipment supplied for use outside the University

If the equipment is supplied by the University for use by another organisation or individual outside the University then where necessary it has to comply with the relevant EC product directive standards and be 'CE' marked. This is a complicated issue and advice should be sought from the Health and Safety Unit. (Note: 'Supply' includes sold, donated, lent, leased and hired.)

Use of electrical equipment out of doors, in laboratories, workshops, craft areas etc.

There are special risks associated with the use of electrical equipment in these areas where conditions may not be ideal. Residual Current Detectors (RCDs) should be used to minimise the risk of electric shock. Risk assessments of the hazards involved should be made. Hazards include:

Using electrical equipment out of doors

- The equipment should be designed to be used out of doors.

Using electrical equipment in the vicinity of water or other conducting fluids

- Segregate and protect electric equipment from these fluids. Ideally the distance from a water tap to a source of electricity or any electrical equipment should be greater than 2.5 metres, (to prevent a person touching the tap and electrical equipment at the same time.)

Using electricity for heating or near heat sources

- High temperature insulated cables or thermal shielding should be used to prevent deterioration of the supply cables.

Using electrical equipment where flammable vapours may be present

Refer to the University's Hazardous Substances Policy UHSP/15/HS/00.

- Care should be taken to prevent electrical sparking that could lead to ignition.
- It may be necessary to use flameproof or intrinsically safe equipment.

Wear and tear on equipment and cables

- Equipment should be treated with care.
- Cables should be protected from cuts and abrasion.
- Equipment should be plugged directly into its own socket with as short a cable as practicable.

Hand held lamps or lamps used with machinery

- These are particularly vulnerable to damage and rapid wear.
- They should be adequately protected.
- They should be fed from a low voltage supply, (i.e. 110 volts maximum).

Batteries

Batteries may present special risks including:

- Difficulty in controlling the electrical output from the battery.
- The potential for a short circuit across exposed terminals.

Precautions should include:

- The fitting of protection devices as near to the battery as possible, (e.g. fuses, current limiting resistors, circuit breakers etc.)
- Covering terminals so a that short circuit will not occur if objects fall across the terminals.
- Not wearing watches or jewellery when working on or near batteries in case they come in contact with exposed terminals.
- Wearing suitable personal protective equipment in case of acid spill.

Additional precautions for using rechargeable wet batteries should be taken due to the potentially explosive levels of hydrogen produced during charging:

- The area should be well ventilated.
- Electrical fittings in the vicinity should be intrinsically safe.
- Before connecting or disconnecting the batteries the circuit should be broken away from the immediate vicinity.

Repairs

When carrying out repairs to electrical equipment there are risks:

- To persons carrying out the work.
- To persons in the vicinity.
- Of the repairs not been completed correctly leading to the possibility of electric shock, overheating or fire.

Precautions should include:

- Repairs only being carried out by competent persons.
- Repairs being carried out as far a possible in dedicated repair areas.
- Refer to Schedule 2 of the Policy re live working.

Unattended Apparatus and Equipment

Refer to the University's Supervision and Unattended Equipment Policy UHSP/8/SSOHA/96.

Where ever possible electrical equipment should be switched off and if possible isolated from the supply when left unattended for any period of time. However, sometimes equipment has to be left running when unattended. In these situations the following precautions should be taken:

- The equipment or apparatus should be designed to run safely unattended, to "fail-to-safety" and be readily shut down. 'Fail-to-safety' means that if the equipment or apparatus breaks down or fails in some way it does so to a safe condition.
- Any unattended running should be authorised by persons nominated by the Head of Budget Centre.
- Security, emergency and maintenance staff should have enough information on which to take appropriate action in an emergency. Such information should be displayed prominently on or near to the equipment.

Private Equipment in Halls of Residence

Portable electrical equipment in halls of residence belonging to residential staff or students does not need to be inspected and tested if it is used in their own rooms. However there is a duty on the owners to ensure that it is in a safe condition. Hall Managers should make arrangements to inform residential staff and students about the safe use of electrical equipment in halls. Points to include are:

- No overloading of sockets.
- Safe use of extension leads and plug boards.
- Not using damaged equipment.
- Using proprietary equipment only.
- Using proprietary 3 pin plugs only and not having exposed live wires, taped joints etc.

Arrangements should be made by Hall Managers to regularly check that the guidance is being followed.

Extension Leads and Socket Adaptors

Extension leads

An extension lead is a board of one or more sockets that is plugged into a single mains socket via a lead and normally a 13 amp plug (in some cases the lead is on a cable reel and the sockets are fitted into the side of the reel). The use of these extension leads other than for temporary use has always been discouraged. When new or refurbished offices, laboratories, workshops etc. are planned the number of electrical items and their position should be considered and a sufficient number of wall sockets provided.

However, it is recognised that there has been a large increase in the number of electrical items, especially information technology equipment, and that it is not always practicable to avoid the use of extension leads.

In order to ensure the safe use of extension leads the following precautions should be taken:

- Wherever possible, the extension socket(s) and their leads should be permanently secured on walls or other fixed equipment.
- Where permanent fixing is not possible the extension sockets and lead should be positioned, preferably off the floor, so that they cannot be damaged (by people, equipment, machinery, furniture spillages of liquid etc.) and cannot cause a hazard (tripping etc.).
- Extension leads should always be 3-core, (i.e. have an earth conductor,) even if used with Class II (non earthed) equipment.
- Extension leads should be kept as short as possible.
- Long extension leads, i.e.:
 - 1.25mm² core cable: longer than 12 metres
 - 1.5mm² core cable: longer than 15 metres
 - 2.5mm² core cable: longer than 25 metresshould be protected by a 30mA residual current device (RCD)

- Cable reel extension leads should be fully unwound in use (to avoid coils overheating).
- Extension lead should not normally be plugged one into another.
- The rating of fuse in the plug of an extension lead must be limited to the current rating of the cable used for the lead.
- The current used by equipment plugged into the extension lead should not exceed the rating of the mains socket outlet (usually 13 amps).

Socket Adaptors

A socket adaptor contains two to four sockets and is plugged directly into a mains socket.

Socket adaptors should not be used because:

- They are not normally fused and if two or more of an adaptor's sockets are used it is possible to draw a total current in excess of the rating of the mains current. This could lead to damage to the wiring of the building and a risk of fire.
- They protrude from wall sockets and can be easily knocked and can be damaged.

Protection

If a fault occurs in electrical equipment the main protection is provided by the fuse in the plug and/or the equipment. A residual current device (RCD) will also provide protection if one is fitted.

If a fuse blows or an RCD trips do not put higher rated fuses in or defeat the trip. Switch off, isolate the equipment and do not use it until the fault is rectified.

Fuses

The correctly rated fuse must be fitted. The greater the current used the higher the fuse rating required.

A fuse is designed to fail if a fault occurs and too high a current is drawn. The wire in the fuse will heat up and eventually melt thus breaking the electrical circuit. The primary purpose of the fuse is to prevent the wiring circuit overheating and causing a fire.

As a general rule 230v equipment rated up to 700 watts should be fitted with a 3 amp fuse. Higher rated equipment should have a 13 amp fuse.

Note: A fuse will not prevent electric shock.

Residual Current Device

An RCD will restrict the effect of an electric shock that a person may receive if a fault occurs on a piece of equipment. The RCD will detect the fault very quickly and will reduce the magnitude of the current that the person is exposed to. Typically RCDs limit the current to between 10-50mA and will trip out in 30ms. This is normally sufficient to prevent a fatal outcome from an electric shock.

Situations where an RCD should be used include all uses of equipment out of doors and indoors in wet or damp conditions, e.g. laboratories, kitchens, workshops etc. Long extension leads should also be protected by RCDs; (see Extension Leads and Socket Adaptors above.)

An RCD may be used with an individual appliance, plugging into the mains supply between the supply and the equipment or may be part of the infrastructure.

RCDs should be tested regularly for correct operation in accordance with the manufacturers' recommendations; (generally via an inbuilt test button).

It should be noted that an RCD only protects against faults to earth. Protection is not given for faults between live and neutral conductors.

PUBLISHED GUIDANCE AND STANDARDS THAT FORM THE BASIS FOR THIS POLICY AND GUIDANCE

Memorandum of Guidance on the Electricity of Work Regulations 1989. Health and Safety Executive HSR 25. <http://books.hse.gov.uk/hse/public/saleproduct.jsf?catalogueCode=9780717662289>

Electricity at Work-Safe Working Practices, Health and Safety Executive HSG85.
<http://www.hse.gov.uk/pubns/priced/hsg85.pdf>

Maintaining Portable Electrical Equipment Health and Safety Executive HSG107.
<http://www.hse.gov.uk/pubns/priced/hsg107.pdf>

Code of Practice for In-Service Inspection and Testing of Electrical Equipment Institution of Electrical Engineers WR233. <http://electrical.theiet.org/books/inspection-test/in-service-inspection-4th-ed.cfm>

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Guidance and Standards references updated April 2014