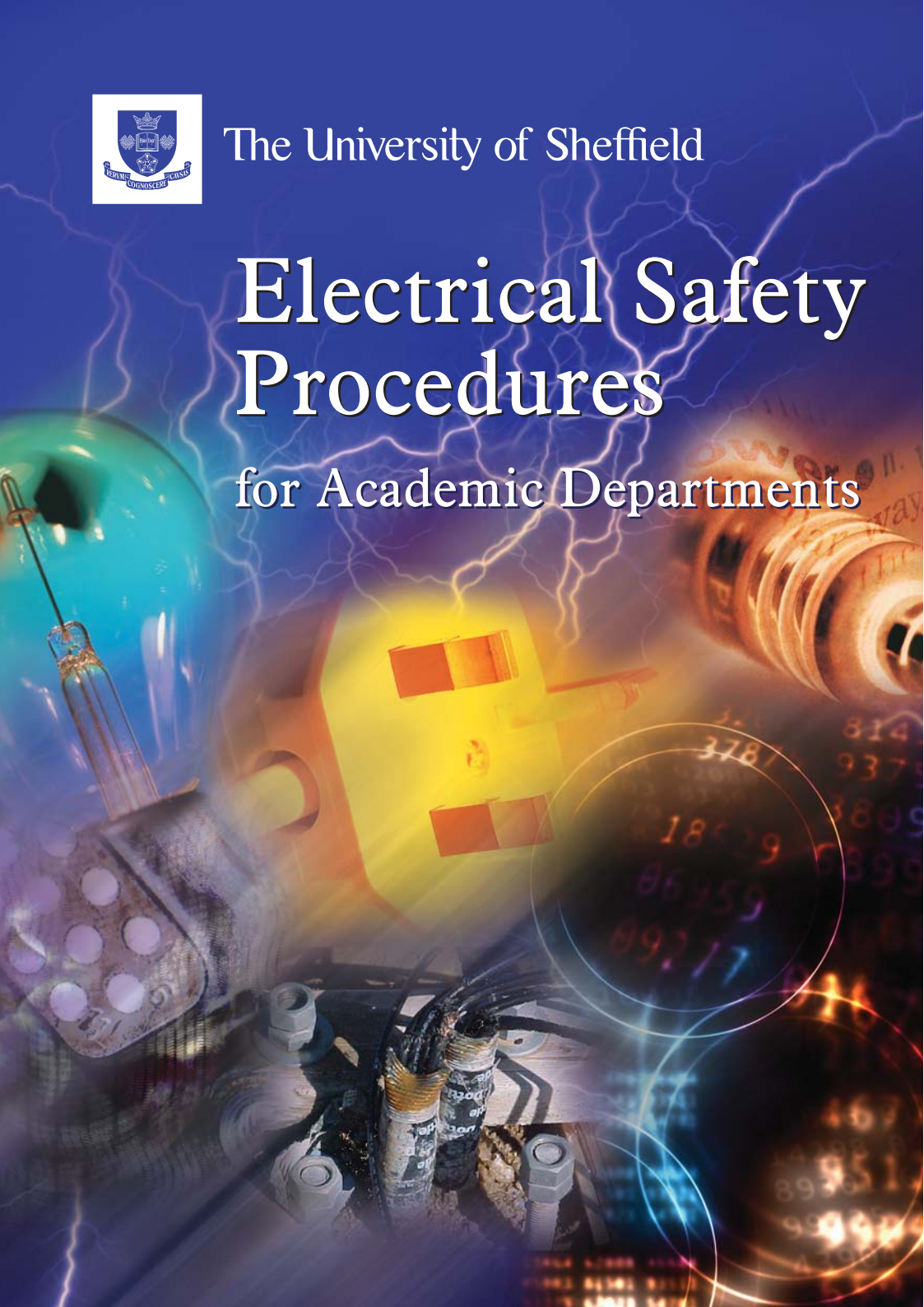




The University of Sheffield

Electrical Safety Procedures

for Academic Departments



ELECTRICAL PROCEDURES

For Academic Departments

This document does not confer the right for staff (employees) to undertake any electrical work described by this document that could: -

- a) Impact upon the capacity of the electrical distribution system within the building,
 - b) Impact upon the fabric of the building,
 - c) Require an increase in the number of suitable and sufficient electrical sockets,
- : - without first contacting Property Services to discuss specific requirements, for example:
- i) Suitability of existing distribution system - via Help Desk
 - ii) Requests for additional supplies - via ES1 Forms

(SAFETY PROCEDURES FOR WORK (E.G. REPAIR, MODIFY, CONSTRUCT) ON/NEAR TO ELECTRICAL SYSTEMS, EQUIPMENT, CIRCUITS AND CONDUCTORS)

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Section A – Application and requirements

Never work on (e.g. wire-up, repair, modify, construct) any electrically powered equipment, system, circuit or conductor unless you have received the necessary training, have the appropriate experience and have been authorised to undertake that work.

1. Scope

- 1.1. These Safety Procedures apply to all work on or with electrically powered equipment, electrical systems, circuits and conductors under the ownership or control of the University, under whose authority they have been issued. These procedures are to be utilised in support of the requirement for task specific risk assessments. All engineering work must adhere to the relevant Codes of Practice and British Standards and in particular the Electricity at Work Act 1989.

2. Other safety procedures and related documents

- 2.1. In addition to the application of these Safety Procedures and related documents, other procedures, rules and documents issued by the University should always be complied with where relevant, in particular the latest edition of the University Health and Safety Code of Practice.
- 2.2. Whereas the Appendices to these Safety Procedures are not in themselves, individual "Safety Procedures", they should be read in conjunction with the procedural parts to which they relate.
- 2.3. Where University employees are required to work on or near to electrical systems, or distribution equipment not owned or controlled by the University, formal arrangements for health and safety must be made between the University and the owner or controller of the system/equipment on which procedures, documents and rules should be applied. Such arrangements should incorporate risk assessment and provision of detailed method statements, taking into account any additional training/authorisation required.

3. Information, instruction and training

- 3.1. The University has a responsibility to ensure:
 - 3.1.1 That all employees are qualified to the appropriate level of competence with regard to the level of work that they are asked to undertake. That they are adequately trained, informed and instructed as to the system, equipment, circuits and conductors which are affected by a particular operation or work and which legal requirements, safety procedures and related documents should apply.
 - 3.1.2 Those other persons who are not employees, but who may be affected by the operations or work, also receive adequate information, instruction and training where appropriate.

4. Application of safety procedures

- 4.1. These Safety Procedures and, as appropriate, related documents, apply to all employees of the University who have cause to control work on/with, or to work on/with, electrical equipment, systems, circuits and conductors.

- 4.2. Persons who have cause in the normal course of their duties, to be involved with only specific sections of these procedures, should still be provided with all sections. Specific levels of work must be limited to those designated in the persons ESTA Certificate of Competence (see relevant section).
- 4.3. Contractors or any other persons working on University property, who have cause to be involved in similar work to that described above, must do so only through Property Services and be supplied by them with The University of Sheffield Electrical Safety Procedures. This will enable them to develop their own safe systems of work based upon their own risk assessment undertaking.
- 4.4. Departments should keep a record of all employees and other persons issued with these Safety Procedures. They should be reminded that they are required to keep them in good condition, up-to-date and have them available for reference as necessary.
- 4.5. **Never work on (e.g. wire-up, repair, modify, construct) any electrically powered equipment, system, circuit or conductor unless you have received the necessary training, have the appropriate experience and have been authorised to undertake that work. (Section 16 outlines competence levels)**
- 4.6. All persons who are likely to work on or accompany persons who work on electrically powered equipment, systems, circuits or conductors to which these electrical procedures relate are strongly advised to receive basic instruction/training in emergency first aid procedures.

5. Review of safety procedures

- 5.1. Due to the nature of electricity at work these procedures will be under constant review, updated and amended accordingly.
- 5.2. New versions and periodic up-dates will be published via the WWW on the Safety Services web pages.

Section B – Demarcation of responsibilities

The responsibilities for the installation, maintenance, inspection and testing of electrical wiring of plant or equipment is as follows:-

6. Permanently wired plant or equipment

Property Services is responsible for:-

- 6.1. All fixed wiring up to and including each socket outlet, lighting point, isolator or fused connection unit.
- 6.2. All electrically powered equipment usually connected by a fused connection unit or isolator, which is installed as part of the building's requirements.
- 6.3. Supervising the final connection of any client department's item of electrically powered equipment including any plug and socket connections other than equipment connected to a 13A socket.
- 6.4. Confirming that the safety and infrastructure load implications are fully satisfied.

Each University department is responsible for: -

- 6.5. Inspecting, testing and maintaining in a safe manner by a qualified and Competent Person (section E15) in accordance with all relevant legislation and regulations, all electrically powered equipment including those connected by a fused connection unit or isolator that is installed as part of the department's requirements.
- 6.6. Ensuring that where possible Property Services is informed **prior** to purchase and planned connection of such electrically powered equipment so that the supply system ratings and services availability can be confirmed.
- 6.7. Consulting with Property Services with regard to installation, maintenance, inspection and testing to ensure that this is carried out in line with all relevant legislation and regulations.
- 6.8. Arranging with Property Services for the final connection of this type of electrically powered equipment.

7. Plant or equipment connected via plug and socket

Property Services is responsible for: -

- 7.1. Supervising (in consultation with the department) the final connection of **all** 3 phase systems and single-phase systems greater than 13A.

Each University department is responsible for: -

- 7.2. All electrically powered equipment connected to a 13A socket.
- 7.3. Ensuring that regular inspection, testing and maintenance of **all** electrical items (including stationary, movable, portable or hand held equipment) is carried out in a safe manner by qualified and competent persons in accordance with all relevant legislation and regulations.

8. 240V Office and general laboratory equipment

- 8.1. **All** office and general laboratory equipment (including such as PC's, printers, faxes, desk lamps, radios, TV's, DVD's, ohp's, slide projectors, approved office heaters, kettles, toasters, microwave ovens, etc) should be subject to approval and test **prior** to being placed into service. This includes all newly purchased, existing and equipment brought into the University irrespective of origin and ownership. Each department is responsible for putting in place a suitable test and approval system. (See also P.A.T. section in the University H&S Code of Practice)

9. Other areas

- 9.1. All electrical work carried out by contractors and equipment installers/engineers must be approved in advance by Property Services. No contractor should be engaged to carry out electrical work or to make electrical connections without prior Property Services approval.
- 9.2. Details of the procedures applied to contractors can be found under section C in the University of Sheffield Electrical Safety Procedures manual.

- 9.3. The following sections describe the areas that fall under the **exclusive responsibility of Property Services staff**. Under no circumstances should other staff attempt to work on any of these systems without the explicit authorisation of Property Services.
 - 9.3.1. Emergency Lighting Systems
 - 9.3.2. Fire Alarm Systems
 - 9.3.3. Building Management Systems (BMS)
 - 9.3.4. Electrical supply equipment and system maintenance/testing
 - 9.3.5. Work on or near High Voltage electrical supply
 - 9.3.6. Working on or near Electrical Plant and Systems
 - 9.3.7. Working on or near Mechanical Plant
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Section C – Personal responsibilities

10. Obstruction of electrical supply equipment

- 10.1. Electrical supply equipment should be free from obstruction in order to be accessible for maintenance and operation.

11. Duties

- 11.1. The Health and Safety at Work etc Act 1974 requires that every employee while at work take reasonable care for the health and safety of himself and others. It should also be his duty to co-operate with his employer and to conform to the requirements of the Act.
- 11.2. All employees of the University whose duties may include the working on, operation of, or working near electrical systems, equipment, circuits and conductors, have a duty to comply with "The Electricity at Work Regulations 1989". All staff in academic departments are required to follow the relevant procedures detailed in this document ie the University of Sheffield – Electrical Safety Procedures for Academic Departments.
- 11.3. There can be dangers present when working on, or near, electrical systems and equipment, irrespective of voltage or current level. It is therefore essential that all relevant personnel are competent ie properly trained, qualified and experienced with the particular electrical system or equipment involved, and familiar with all the relevant regulations and Codes of Practice, etc. This includes familiarity with resuscitation procedures and dealing with fires of an electrical origin. It is important to comply with this requirement in order to minimise the risk i.e. death or personal injury from electric shock, electric burn, electrical explosion or arcing, or from fire or explosion initiated by electrical energy.
- 11.4. The department (HoD) must make it clear to all persons who may in the course of their duties have cause to work on (e.g. repair, modify, construct), operate, or be near to electrical systems, equipment, circuit or conductors their specified duties for which they are competent (section E15). Preferably in writing if appropriate.

12. Objections

- 12.1. When any person receives instructions regarding carrying out work on (e.g. repair, modify, construct) or near electrical systems, equipment, circuits or conductors, any objections should be reported first by them to the person issuing those instructions. They will arrange to have the matter investigated by the Departmental Manager and if necessary referred to the Head of Department. It is important to remember that individuals have a clear responsibility for their own safety and that of their colleagues, and should only undertake work up to a level for which they are qualified and have been trained and authorised.

Section D – Work carried out by contractors

13. Work carried out by contractors

- 13.1. **All** electrical work carried out by contractors and equipment installers/engineers must be approved in advance by Property Services. No contractor should be engaged to carry out electrical work or to make electrical connections without prior Property Services approval.
- 13.2. Details of the procedures applied to contractors can be found under section C in the University of Sheffield Electrical Safety Procedures manual.
- 13.3. New electrical installations should not be used until Property Services have informed the department that it is safe to use and that it has the appropriate test certification.

Section E – Working on electrically powered equipment

14. Working on electrically powered equipment or circuits

- 14.1. Only approved, authorised, competent, trained personnel are allowed to work on (e.g. repair, modify, construct) electrically powered equipment. When instructing their staff to work on or with electrically powered equipment departments must ensure that the relevant individuals are fully trained and competent to carry out the work at the required level. Training should be updated at regular intervals and include a written assessment of clearly defined competence levels (section E16).
- 14.2. Departments should consult with SDU (Staff Development Unit) with regard to tailoring training to the needs of the individual and the work they may be asked to do. Without exception training must be completed to a satisfactory and approved standard prior to starting any electrical work.
- 14.3. Electrical competence and training standards for technical staff in academic departments is set by the University's Electrical Safety Training Assessment panel (UoS ESTA), which is a joint body of qualified people from Safety Services, Property Services and academic departments.
- 14.4. Academic supervisors are responsible as the line manager for those research workers under their control and are therefore responsible for ensuring that they are competent with regard to the level of electrical work required.

- 14.5. Refer to the University Health and Safety Code of Practice for guidance on the supervision of graduate students.

15. Competence levels

15.1. Competent Person (Electrical)

Defined as a person with the necessary understanding and the appropriate technical knowledge, and/or experience of the particular electrical system and equipment to be worked upon or operated. Thus enabling that person to take the necessary precautions to avoid danger to themselves, other people and property etc. Further measures of competence will include: familiarity with resuscitation procedures, dealing with fires and other emergencies, the working environment etc.

16. Training and formal assessment of competence is suggested to be at the following levels:

16.1. ESTA level one –

- 16.1.1. Basic understanding of principles of electricity and knowledge of these Electrical Safety Procedures for Academic Departments.
- 16.1.2. Allowing activities such as replacing 13A plugs and correct fuse rating, basic PAT checks (visual, new equipment, simple test etc.), correct use of extension plug boards.
- 16.1.3. Approved qualifications and experience or successful completion of the one-day SDU training course, which includes continual assessment, exercises and short written test.

16.2. ESTA level 2 –

- 16.2.1. Understanding of electrical principles and detailed knowledge of how and when to apply the Electrical Safety Procedures for Academic Departments, risk assessments etc.
- 16.2.2. Activities such as initial checks and simple repairs (fuses and leads etc.) to electrical/electronic instruments and equipment, very simple instrumentation/equipment construction and wiring (extension leads, inter-connecting instruments/equipment, etc.), advising others on electrical safety and assisting in risk assessment, PAT assessment.
- 16.2.3. Approved qualifications and experience and/or successful completion of one-week SDU training course, which includes continual assessment, exercises, one-day work placement and written test.

16.3. ESTA level 3 –

- 16.3.1. Detailed understanding of electrical/electronic principles and detailed knowledge of how and when to apply the Electrical Safety Procedures for Academic Departments, risk assessments etc.
- 16.3.2. Activities such as checks and straight forward repairs to faulty electrical/electronic instruments and equipment (replacing standard manufacturer supplied parts etc.), straight forward instrumentation/equipment construction and wiring (up to 240 V), advising and training others on electrical safety and carrying out risk assessment.

- 16.3.3. Approved qualifications and experience and/or approved qualification and successful completion of one-month SDU training course, which includes continual assessment, exercises, work placement and written test.

16.4. ESTA level 4 –

- 16.4.1. In-depth understanding of electrical/electronic principles and detailed knowledge of how and when to apply the Electrical Safety Procedures for Academic Departments, risk assessments etc.
- 16.4.2. Activities such as checks and repairs and modifications to electrical/electronic instruments and equipment (fitting equivalent parts, modifying equipment designs and operation etc.), instrumentation/equipment design construction and wiring, advising and training others, carrying out risk assessment.
- 16.4.3. Approved advanced qualification and approved length of relevant practical experience and/or approved advanced qualification plus successful completion of three-month SDU training course, which includes continual assessment, exercises, work placement and written tests.

16.5. ESTA level 5 –

- 16.5.1. Professional standing (electrical or electronic) - advanced qualifications plus relevant extensive experience and a member of a recognised professional institute where appropriate.

17. Precautions to be taken before working on electrically powered equipment and circuits

- 17.1. Before any work is carried out an Authorised Person (Electrical) should be placed in charge of the activity and they should ensure that there is sufficient information available.
- 17.2. Only safety/test equipment of an approved type should be used and there must be an available means of effectively isolating the equipment/system to be worked on from all sources of electrical supply.
- 17.3. The points of isolation should be clearly identified and consideration must be given to the erection of barriers to restrict access to live equipment.
- 17.4. Property Services must be consulted before attempting to carry out isolation procedures of a complex nature, particularly for non-University employees.

18. Procedures for working on dead electrically powered equipment – fixed supply

- 18.1. When work other than normal operation is to be carried out on electrically powered equipment, it must be isolated from all points of supply.
- 18.2. Where the means of isolation incorporates a locking off facility this must be used, attaching a personal safety padlock. General purpose University approved Caution Notices should be securely fixed to all points of isolation. Emergency stop operation is not acceptable as a means of isolation.

- 18.3. In circumstances where the means of isolation described above cannot be achieved Property Services should be contacted to arrange for the removal of fuse/links. Property Services staff must supervise this form of isolation.
- 18.4. The circuit should then be proved dead by means of an approved indicator, the indicator itself being tested immediately before and after verification.
- 18.5. The presence of electromagnetic induction, mutual capacitance or stored electrical energy may have to be guarded against (for example, long cable runs) where identified by risk assessment of the activity.

19. Working on live electrically powered equipment and circuits

- 19.1. See section E18. It is prohibited to carry out any work on/to exposed live electrically powered equipment or circuits. Live diagnostic testing is only permitted when no alternative testing method is available and should only be carried out by a competent person (See section E15 and E16).

19.2. Exemptions

It is recognised that in exceptional circumstances some specialist/research equipment may require adjustments/calibration etc to be made whilst it is working and that this will need to be done in some cases with enclosure panels removed. Under these conditions a specific risk assessment should be carried out with particular attention being paid to the competence of the person required to carrying out the work.

Compliance is not obligatory for work on extra low voltage electrically powered equipment, but if the equipment can be made dead, then this must be the practice.

**THIS EXEMPTION DOES NOT APPLY TO ELECTRICALLY POWERED EQUIPMENT IN POTENTIALLY EXPLOSIVE ATMOSPHERES.
(SEE SECTION J).**

20. Testing on live electrically powered equipment

- 20.1. When no alternative method is available, testing on electrically powered equipment may be carried out by a competent (fully trained) and authorised person with the equipment live, using approved testing apparatus, provided appropriate and adequate precautions have been taken by screening/ segregation or other means to prevent injury from inadvertent contact with live equipment.
- 20.2. If a second Competent Person could assist in the prevention of injury, or could substantially contribute towards the implementation of safe working practice, then a second Competent Person should be present.
- 20.3. Before work begins on any live equipment/plant the Competent Person (electrical) must carry out a formal risk assessment of the activity. This could be of a generic nature, for example in areas such as electrical/electronic workshops.
- 20.4. Where appropriate rubber mats, rubber gloves, eye protection, perspex screens, flame retardant clothing etc must be used.

See Section J for procedures to be adopted in potentially explosive atmospheres.

Section F – Portable and hand held electrically powered equipment

21. Working with electrically powered equipment (fitted with plug connector)

Work safely

Check that:-

- The equipment has a current valid electrical test label.
- Suspect or faulty equipment is taken out of use, labelled "DO NOT USE" and kept secure until examined by a Competent Person.
- Where possible power sockets are switched off before plugging and unplugging.
- Equipment is switched off and unplugged before cleaning or making adjustments.
- Equipment is turned off and unplugged when not in use.

21.1. Extension leads

All extension leads greater than 3 meters in length should be:

- Neatly wound on a drum suitable for its purpose (fully unwound when in use)
- Protected with a 30mA RCD
- Stored in a dry place away from abrasive or sharp surfaces
- Inspected regularly (at least annually)

21.2. RCD

21.2.1. An RCD (Residual Current Device) can provide additional safety and should be used wherever possible. RCD's to protect persons must be of an approved type conforming to the tripping times as specified in BS 7671, and have a tripping current sensitivity of not more than 30 milli Amps (30 mA).

21.2.2. An RCD is valuable safety device never bypass it.

21.2.3. If an RCD trips, it is a sign there is a fault. Check the system before using it again and report any fault to Property Services Help Desk.

21.2.4. The RCD has a test button to check its mechanism is free and functioning. Test the RCD operation regularly.

22. Portable and hand held electrically powered equipment

22.1. This covers all portable electrically powered equipment and includes items such as portable tools, transformers, soldering irons, hand lamps, cables, and small generators. To some degree it may, depending on the circumstances (for example the environment in which they are used and in the way they are used), also include what is normally classed as domestic equipment such as kettles, heaters etc.

22.2. Any person using portable equipment must be competent in their use. Each person must be suitably and appropriately trained in the proper use of the

specific piece of equipment. In the case of portable electrically powered tools for example it is recommended they possess a minimum of ESTA competence level one.

- 22.3. Each Competent Person has a duty to also ensure that all persons under their control are aware of these safety procedures and that they are implemented accordingly.

(See Section 8 for 240V Office/Lab Equipment)

23. Hand-held portable tools

- 23.1. Battery operated equipment; including cordless drills should be used where practicable.
- 23.2. All hand-held portable tools must operate at a voltage not exceeding 110 volts AC and the source of voltage must be centre tapped to earth. Use of hand-held portable equipment operating at a higher voltage is prohibited, unless HoD, DSO or Departmental Manager has given authority and the appropriate written risk assessment carried out. This does not apply to domestic cleaners etc and class 2 domestic appliances and approved test equipment.
- 23.3. The use of 240V soldering irons is discouraged and it is strongly recommended that only approved low voltage soldering irons (supplied via a transformer) are used.
- 23.4. Hand-lamps - Battery powered torches should be used where practicable. All hand-lamps must operate at a voltage not exceeding 50 volts AC between conductors and be fed from a circuit that is isolated from the supply mains and from earth by means such as an isolating transformer. Where the environmental conditions are confined and conducting, such as inside tunnels and other cramped locations where persons are likely to come into good electrical contact with earthed surroundings, then the lamps should be supplied at a voltage not exceeding 25 volts AC. Refer to Health and Safety Executive Guidance Note PM38 for hand-lamps, where use is in potentially explosive atmospheres.

24. Safety Precautions - Portable power equipment/tools

- 24.1. Generally all units regardless of rating must be fed from an industrial BS 4343 socket, protected by a residual current device (RCD 30 mA trip) if 240V.

Before use check:

- The expiry date shown on the safety test label affixed to the equipment (section B8).
- The supply cable has no outward signs of damage.
- The BS 4343 plug is intact.
- The residual current device (RCD 30 mA trip) protecting the socket, operates from its test button.
- If any of the above checks are negative, do not attempt to use it. Any defect or suspected defect in the equipment must be reported immediately. Defective equipment must be withdrawn from service and a "Faulty Equipment – Do Not Use" label attached and the unit kept secure until examined by a Competent Person.

During use:

- Avoid damage to supply cables and ensure that trailing cables are not in a position where they can cause a hazard.
- Ensure that armoured cable is fitted where the cable is at risk of mechanical damage when in use.
- If using an extension lead do not operate with the extension cable coiled.
- Unless the unit is designed to be hand held do not attempt to move the unit whilst plugged in and avoid pulling on the supply cable. Use tools only for their designed purpose.
- Never work with portable electrical tools in the rain or near water (eg. water sprinklers) or place extension connectors etc. on wet surfaces such as damp grass.

After use:

- Disconnect tools when not in use.
- Carefully coil up the cable and attached it to the unit.
- Store unit in a clean dry environment, preferably indoors.

25. Purchase and use of portable electrically powered equipment

- 25.1. All new non-battery portable power equipment/tools should, wherever possible, be purchased with a rating of 110 volts AC and be powered from an 110v isolating transformer. Where practicable further protection can be gained by incorporating a 30mA RCD. Guidance is available from Property Services.
- 25.2. All portable electrically powered equipment purchased for use within the University must be only of an approved type and be tested prior to being put into service.
- 25.3. Each department must make arrangements for this test and approval system. Guidance is available from Safety Services.

NOTE: Remember that under the Health and Safety at Work Act, you have a responsibility for the safety of yourselves and your colleagues. A University procedure for the inspection and testing of portable electrically powered equipment (PAT) is established – ensure that you comply with it.

Section G – Electricity generators

26. Small portable generators

- 26.1. Property Services should always be consulted before embarking on the purchase of electricity generators irrespective of capacity.
- 26.2. The following procedures apply to generators of output powers up to 5 kW rating, generally single-phase machines driven by internal combustion engines.
- 26.3. Typically such machines would be used for supplying 110-volt hand tools, emergency lighting sets etc.
- 26.4. As portable tools require a 110-volt source that provides a maximum voltage to earth under fault conditions of 55 volts, such generators should be checked to see if this is so.

- 26.5. Sets, which have a 110-volt reference to frame, should be modified.
- 26.6. Small generators purchased for supplying portable equipment should only have 110-volt outlets and be checked by electrical personnel before going into service, in order to ensure that the above requirements are satisfied.
- 26.7. Always read and understand the manual before operating.
- 26.8. Operate generators in well-ventilated areas.
- 26.9. Stop the generator in order to refuel. Full risk assessments should be carried out to identify all hazards associated with the generator operation including refuelling, fuel storage etc.

Generators with 240 V outputs are only to be used in exceptional circumstances and must be of a type approved by the University.

(NB: All 240V outputs should be protected with an appropriate RCD with 30-mA trip facility).

27. Static generators

- 27.1. Static generators, including back-up and emergency supply generators, fall under the responsibility of Property Services staff. Under no circumstances should other staff attempt to work on (e.g. repair, modify, construct) any of these systems without the explicit authorisation of Property Services.
- 27.2. All electrical work carried out by contractors and equipment installers/engineers must be approved in advance by Property Services. No contractor should be engaged to carry out electrical work or to make electrical connections without prior Property Services approval.
- 27.3. Details of the procedures applied to contractors can be found in the University of Sheffield Electrical Safety Procedures manual under section C.

Section H – Avoiding danger from metallic pipe-work, buried electricity cables and overhead lines

28. Metallic pipe-work

- 28.1. Where mains water pipes are replaced with plastic alternatives the electrical earth integrity for the building must be checked. Gas and water services must not be used as protective electrical earth electrodes complying with Section 547 of BS 7671 Wiring Regulations.
- 28.2. In circumstances where metallic pipe-work is disconnected or cut, danger may arise due to the interruption of electrical service earth fault currents. To minimise this risk, an approved temporary connector must be attached and a satisfactory contact established before the pipe is disconnected or cut.

ALL SUCH WORK MUST BE APPROVED AND/OR CARRIED OUT BY PROPERTY SERVICES.

- 28.3. It should also be appreciated that a sound temporary connector is not only protecting those working on the particular section of pipe-work, but would also be safeguarding personnel at any installation where the integrity of the electrical service earth was inferior.

29. Buried Electricity cables

- 29.1. Many serious accidents still happen through buried electricity (live) cables being damaged during excavation work. Employers, employees, cable owners and those concerned with planning, organising and supervising excavation, have a duty to follow a safe system of work. Site surveys should first be carried out using cable location equipment and land owners/REB consulted appropriately. Any site service drawings should be examined and the location of all the services that can be identified marked onto appropriate drawings.

ALL SUCH WORK MUST BE APPROVED AND/OR CARRIED OUT BY PROPERTY SERVICES.

NB: All work to be done in compliance with HSG47 – Avoiding Danger from Underground Services.

30. Overhead lines

- 30.1. All work near to overhead electric lines must be carried out in compliance with Health and Safety Executive Guidance note GS6 "Avoidance of Danger from Overhead Electric Lines".

ALL SUCH WORK MUST BE APPROVED AND/OR CARRIED OUT BY PROPERTY SERVICES.

- 30.2. Isolation of the electricity supply remains the preferred option.

NOTE: The risk assessment process will allow identification and elimination/reduction of risks associated with all the above activities and not covered by generic process. Consult Safety Services for guidance.

Section I – Battery systems

[Refer to HSE guidance Note (appendix 3)]

31. Working with batteries

- 31.1. Before working with large capacity batteries always ensure that a competent person carries out a full risk assessment.
- 31.2. When handling batteries wear protective clothing, protect eyes and exposed skin.
- 31.3. If batteries become damaged, split or leak immediate action should be taken. See COSHH assessment.
- 31.4. Under certain recharging conditions batteries give off both toxic and highly flammable gas, care must be taken to prevent any naked flames etc from igniting it. **Smoking must be banned in the immediate area** and adequate ventilation maintained at all times.
- 31.5. Some equipment may carry dangerous voltages and high levels of stored electrical energy. Before any work commences, carry out the following:
- 31.6. Isolate the AC mains supply external to the equipment.

31.7. Isolate the battery and external load to the equipment.

31.8. Discharge all electrolyte filter capacitors.

32. Uninterruptible power supplies (UPS)

32.1. UPS should be covered by individual isolation procedures, relating to the specific installed system. Generally, both mains and battery supplies must be isolated before work can commence.

NB: Care should be taken as generator supplies may also be involved – consult with Property Services if you are unsure.

Section J – Work on electrical equipment in potentially explosive atmospheres

ALL SUCH WORK MUST BE APPROVED AND/OR CARRIED OUT BY PROPERTY SERVICES.

33. Work in potentially explosive atmospheres

33.1. If electrically powered equipment is used where a flammable or explosive atmosphere is likely to occur, the equipment should be so constructed that it is not liable to ignite that atmosphere.

33.2. All equipment should be as recommended in the Health & Safety Executive and British Standards.

33.3. Uncertified electrically powered equipment should not be used.

33.4. The maintenance and repair of explosion protected equipment is a specialised field of work and should be undertaken only by those who have the necessary training and experience.

NB: The Dangerous Substances and Explosives Atmospheres Regulations 2002 establish minimum standards for protecting the health and safety of workers at risk from explosive atmosphere, and identifies a hierarchy of preventative and protective measures.

Section K – Disposal of electrical equipment

34. Disposal of electrical equipment

34.1. For guidelines on the safe disposal of redundant electrical equipment and associated materials (such as batteries) consult Safety Services and/or see the University Waste Management Procedures at:

http://www.shef.ac.uk/estates/energy/waste_procedures.htm

Appendix 1

Definitions

Risk Assessment

This is the process of analysing the level of risk, considering those in danger and evaluating whether hazards are adequately controlled, taking into account any measures already in place.

Extra Low Voltage

Normally not exceeding 50 Volts AC or 120 Volts DC whether between circuit conductors or to earth.

Low Voltage

Normally exceeding extra low voltage but not exceeding 1,000 Volts AC or 1,500 Volts DC between circuit conductors or 600 Volts AC and 900 Volts DC between circuit conductors and earth.

High Voltage

Normally exceeding low voltage.

Mains Voltage

Normally 240v, 50 Hz AC

Equipment

Includes anything used, intended to be used or installed for use, to generate, provide, transmit, transform, rectify, convert, conduct, distribute, control, store, measure or use electrical energy.

Conductors

Any material that is capable of conducting electricity. This is not limited to conductors intended to carry current.

Circuit Conductors

Any conductor in a system that is intended to carry electric current under normal conditions.

Conductors in a System

Any conductor electrically connected to a common source of electrical energy.

System

An electrical system in which all the equipment is, or may be, electrically connected to a common source of electrical energy, including the source.

Injury

Death or injury from electric shock, electric burn, fires of electrical origin, electrical arcing or explosion initiated by electricity.

Note: There are no voltage or current limits, the criteria being whether danger as defined arises.

Isolation

The disconnection and physical separation of electrical equipment from every source of electrical energy in such a way that the disconnection and separation is secure.

Live

Electrically charged.

Dead

At, or about, zero voltage and isolated from any live system.

Approved (including equipment)

Of a type sanctioned for use by the University meeting all relevant safety standards. All products shall comply with all relevant British Standards and current EEC Legislation.

Caution Notice

A notice in approved form securely attached to equipment or its controlling device(s) conveying a warning not to interfere.

Danger Notice

A notice in approved form attached to equipment or sections when live, calling attention to the danger of approach to, or interference with, such equipment or sections.

Competent Person (Electrical)

A person who has a sufficient understanding and the appropriate technical knowledge, and/or experience of the particular electrical system and equipment to be worked upon or operated. Thus enabling that person to take the necessary precautions to avoid danger to themselves, other people and property etc. Further measures of competency will include: familiarity with resuscitation procedures, dealing with fires etc.

Authorised Person (Electrical)

A Competent Person adequately trained and appointed in writing to carry out specific categories of duties on electrical systems and equipment.

Earthed

Connected to the general mass of earth by approved earthing leads in such a manner as will ensure at all times an immediate discharge of electrical energy without danger.

Circuit Main Earth

An earthing arrangement applied by an Authorised (Electrical – section 14) or Senior Authorised (Property Department) Person that effectively connects all circuit conductors to earth.

Potentially Explosive Atmosphere

A potentially explosive atmosphere is an area where the presence or possible presence of a dust or flammable gas/air mixture requires that special precautions be taken to avoid the possibility that any electrical equipment placed within the potentially explosive atmosphere becomes a source of ignition for the hazard.

Intrinsic Safety

A protection technique based upon the restriction of electrical energy within apparatus and of interconnecting wiring, exposed to a potentially explosive atmosphere, to a level below that which can cause ignition by either sparking or heating effects. Because of the method by which intrinsic safety is achieved, it is necessary to ensure that the electrical apparatus exposed to the potentially explosive atmosphere, and also other electrical apparatus with which it is interconnected, is suitably constructed.

Intrinsically Safe Circuit

A circuit in which no spark or any thermal effect produced under test conditions (which include normal operation and specified fault conditions) is capable of causing ignition of a given explosive atmosphere.

Appendix 2

Common causes of electrical hazards

1. The use of double (or triple) plug adaptors in one socket - the adaptors become heavy in use and invariably work loose from the socket increasing the risk of touching live pins and the possibility of poor connection creating sparking, heat and eventually fire. The University outlaws the use of these adaptors.
2. Extension cables not uncoiled when in use. This is a very common hazard and regularly causes fires. Heat will rapidly build in the cable through the effect of electrical induction and lack of circulating air if it is used for any length of time in its coiled state. For this reason NEVER connect an electrical heater to a coiled extension lead.
3. The appliance/equipment is fitted with the wrong fuse rating. Too low and it may blow during normal operation, too high and it reduces protection against shock or fire.
4. Cable rating too low for appliance.
5. Extension plug boards are connected in series (one plugged into another).
6. Electrical cables are trailed across walkways.
7. Damaged or perished insulation is not replaced on supply cables.
8. Electrical cables draped over sources of heat.
9. Equipment left on when not in use.
10. Replacing light bulb with one of too high a rating for the fitting.
11. Supply cable rating does not match the equipment rating and/or extension lead, increasing the risk of fire.
12. Cables temporarily extended by makeshift connections.
13. Poorly wired plugs (exposing inner insulation for example)
14. Use of equipment in inappropriate environments and conditions
e.g. wet conditions
15. Contamination of equipment by heavy dust, oil, or chemicals etc.
16. Equipment is left in use with cracked plug casings or bent pins etc.
17. Blocked cooling holes/grills and loose objects (metallic) falling into case.
18. Drinks and other liquids spilled onto equipment.
19. Obsolete equipment to be permanently taken out of service should have the power plug removed and the cable cut close to the case to prevent re-connection. Never leave a length of open-ended cable connected to a power plug.
20. Capacitors can retain their charge for several days and produce a dangerous release of energy.

Appendix 3

Health and Safety Executive Guidance Note IND(G)139L

ELECTRIC STORAGE BATTERIES

Safe charging and use

Every year a number of people are injured when batteries they handle (mostly vehicle batteries) explode, resulting in acid burns to face, eyes and hands, and other injuries. This leaflet offers simple advice and guidance on the safe charging and use of batteries in motor vehicle repair and maintenance, which if followed will reduce the risk of battery explosions. The advice given may also be more generally applicable. Charging of batteries, even those which are described as maintenance free, gives off flammable hydrogen gas. If this is allowed to collect and a source of ignition (naked flame or spark) is present then the gas and battery will explode. Sparking most often occurs when battery leads are being connected and disconnected. It is important to follow the procedures set out below to prevent such sparking.

General precautions

- Always wear goggles or a visor when working on batteries.
 - Wherever possible, always use a properly designated, well ventilated area for charging.
 - Remove any metallic items from hands, wrists and neck (rings, chains etc) before working on a battery.
-

Disconnecting and reconnecting batteries

- Turn off the ignition switch and all other switches or otherwise isolate the battery from the circuit.
 - Always disconnect the earthed terminal first (often the negative terminal, but not always...CHECK..) and reconnect it last using insulated tools.
 - Don't rest tools or metallic objects on top of the battery.
-

Battery charging

- Always observe the manufacturer's instructions for charging batteries.
- Charging should take place in a well ventilated area. Do not smoke or bring naked flames into the charging area.
- Make sure the battery is topped up to the correct level.
- Make sure that the charger is switched off or disconnected from its power supply before connecting the charging leads which should be connected positive to positive, negative to negative.
- Make sure that the charging leads are firmly and securely clamped in position before switching on the charger. Do not move the clamps while the charger is switched on; always switch off first if adjustment to the clamps is necessary.
- Vent plugs may need to be adjusted before charging. Carefully follow the manufacturer's instructions.

- Do not exceed the recommended rate of charging.
 - When charging is complete, switch off the charger before disconnecting the charging leads.
-

Jump starting

Preparation

- Always ensure that both batteries have the same voltage rating.
- If starting, using a battery on another vehicle, check the earth polarity on both vehicles.
- Ensure that the vehicles are not touching.
- Turn off the ignition of both vehicles.
- Always use purpose made, colour coded jump leads **with insulated handles**, RED for the positive cable, BLACK for the negative cable.

*Connection (for vehicles with **same** earth polarity)*

- First connect the non-earthed terminal of the good battery to the non-earthed terminal of the flat battery.
- Connect one end of the second lead to the earthed terminal of the good battery.
- Connect the other end of the second lead to a suitable, substantial, unpainted point on the chassis or engine of the other vehicle, away from the battery, carburettor, fuel lines or brake pipes.

*Connection (for vehicles with **different** earth polarity)*

In view of the potential for confusion this should only be attempted by skilled and experienced personnel.

- First connect the earthed terminal of the good battery to the non-earthed terminal of the flat battery.
- Connect one end of the second lead to the non-earthed terminal of the good battery.
- Connect the other end of the second lead to a suitable, substantial, unpainted point on the chassis or engine of the other vehicle, away from the battery, carburettor, fuel lines or brake pipes.

Starting

- Ensure that the leads are well clear of moving parts.
- Start the engine of the 'good' vehicle and allow to run for about a minute.
- Start the engine of the 'dead' vehicle and allow to run for about a minute.

Disconnection

- Stop the engine of the good vehicle.
- Disconnect the leads in the reverse order to which they were connected.
- Take great care in handling jump leads; do not allow the exposed metal parts to touch each other or the vehicle body.

Electrically powered vehicles

Electrically powered vehicles use large and heavy battery units, which are designed for the particular vehicle. They will normally have purpose designed connectors for coupling between battery, charger and vehicle, which ensure correct connection. The same principles of safe operation apply to the charging of these batteries as apply to the smaller starter batteries.

- Always use the correct charging unit as specified by the manufacturer for the vehicle/battery.
- Ensure all electrical circuits are switched off before connecting/disconnecting batteries.
- Raise the battery cover to aid ventilation during charging.

Battery Disposal– see section K.

Appendix 4

Frequently asked questions

Q. What about existing staff – how do we assess competency?

- A. These guidelines are intended to help departments in assessing whom can/should be carrying out specific types of electrical work. Initially, it may be appropriate to determine if they fit into one of the categories outlined for ESTA 1 to 5. It is also intended that training will be made available for technical managers on how to assess for electrical competency and the necessary support available via SDU, Safety Services and Property Services.

Q. What is meant by supervising the final connection above 13A, does this include wiring plugs to go into a socket (fixed or otherwise)?

- A. Supervision broadly means through communication with Property Services who will advise you on the appropriate procedure to follow. For example they may consider it necessary to make the connections themselves or, if they are confident that a specific and known competent person is carrying out the work they may feel it appropriate for connections to be made by the department.

Q. Does this mean we cannot use new electrical equipment until has been PAT tested by Central Workshop?

- A. You should not use any electrical equipment unless it has been PAT tested, and this includes new equipment etc. Departments are required to put in place their own arrangements to carry out these tests, which are separate and in addition to the annual tests. The people carrying out PAT must be appropriately trained, see section E.

Q. When will the competence and training courses outlined be available and how long is the training?

- A. The courses will be organised through the University Staff Development Unit and be run on a regular basis. The level 1 training will be available at very frequent intervals. Duration of the course varies according to the skill level and ranges from one day to 3 months.

Q. Do we need to change all our extension leads that don't conform?

- A. Yes. If you have a large number that need bringing up to standard then it may be necessary to implement a planned replacement schedule over an appropriate period of time.

Q. Is it practicable to test RCDs regularly?

- A. Safety devices, particularly those readily accessible for example on 13A sockets and at the end of benches etc should always be tested regularly and it can be in your own interest to show in some way that this has been done.

Q. Do we need to purchase RCDs for all portable power equipment and tools?

- A. It is recommended for new purchases and may be appropriate to be done via a programme of replacement for existing equipment.

Q. Does this mean we can't use 240V hand lamps?

- A. There would need to be a very strong reason why only a 240V hand lamp can be used and this would need to be detailed along with the necessary safety precautions in the relevant risk assessment associated with their use.

Q. Do we have to replace 240V generators not approved by the University?

- A. The simple answer is yes, but first talk to Property Services who will be able to offer advice and assistance with regard to your existing generating equipment.



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