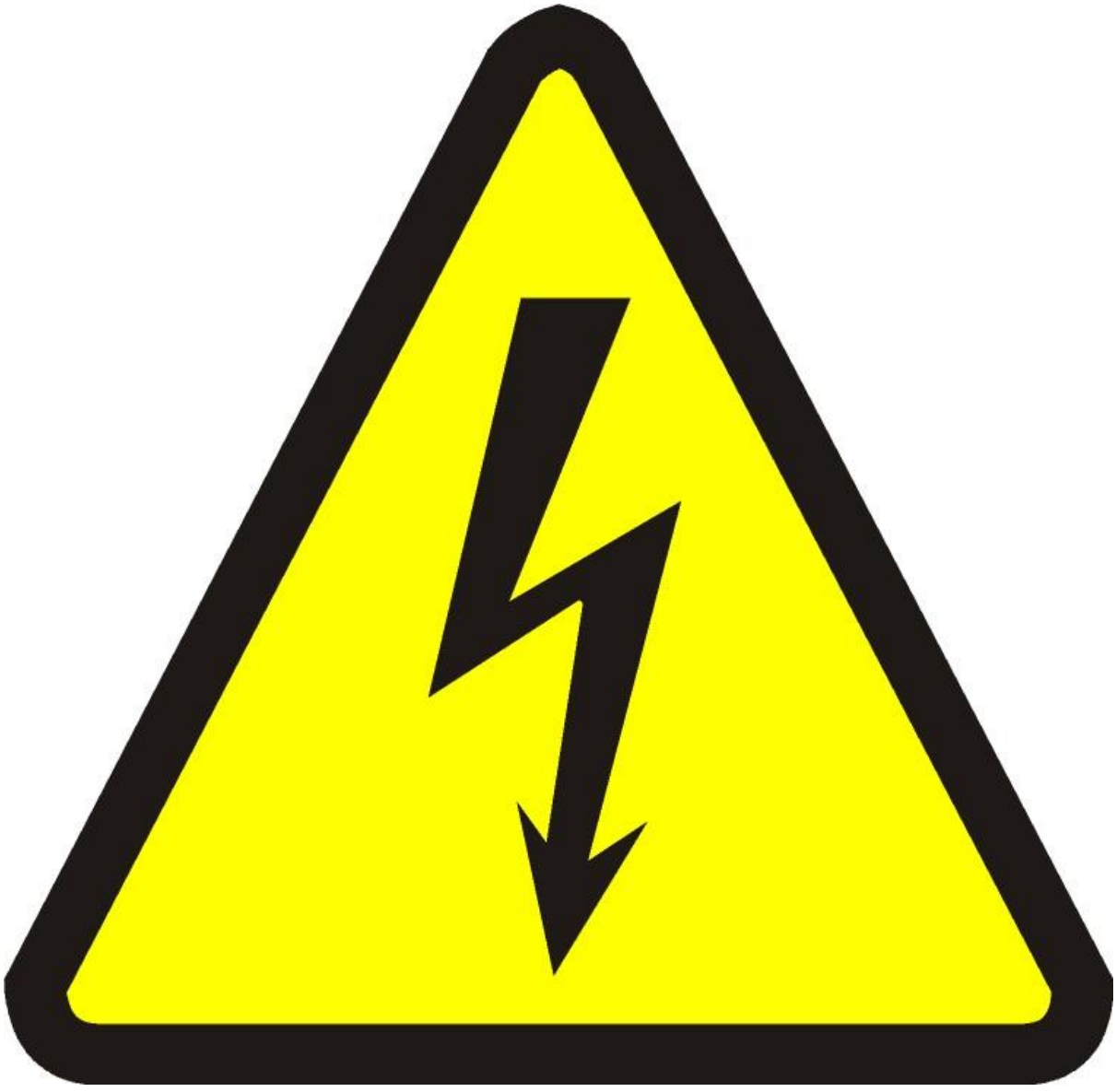
University of Reading

Safety Code of Practice 11

1st Edition, June 2009

SAFE WORKING WITH ELECTRICITY



Contents

1 SUMMARY

This Safety Guide requires Heads of Schools/Directorates/Departments/Units to ensure that electrical systems and equipment for which they are ultimately responsible are designed, operated, maintained, modified and extended in such in a way that avoids danger. The guide is based upon the requirements of the Electricity at Work Regulations 1989 and the supporting Health and Safety Executive (HSE) publication 'Memorandum of Guidance on the Electricity at Work Regulations 1989**'. In addition the British Standard 7671: 2008 "Requirements for Electrical Installations" (the IEE Wiring Regulations 17th Edition) will apply to new electrical work/installations.**

The primary hazard of working with electricity is electric shock. Twenty five volts can be fatal under certain circumstances. In other circumstances people can suffer serious burns. The voltage normally available at socket outlets and lighting points is 230 volts. Voltage on 3-phase equipment such as electric motors etc. is 400 volts. Electrical shock can be caused by bodily contact between two conductors or between a conductor and earth. All precautions must be aimed at reducing the risk of contact with unprotected conductors of electricity at potentially hazardous voltages. In addition a major cause of fire is poor electrical installations and faulty electrical appliances.

The principle is therefore to ensure that electrical equipment and wiring is safe by design, and remains safe throughout its use.

Heads of Schools/Directorates/Departments/Units must ensure that:

- Staff, students and others persons such as contractors engaged by the School/Department/ Directorate follow this guide and any local policy, rules or safe working procedures;
- Persons carrying out the testing and/or repair of electrical equipment, or carrying out experimental work on electrical equipment or its associated connections have appropriate knowledge, training and experience to enable them to work safely;
- Persons without appropriate knowledge, training or experience are adequately supervised by an appropriately qualified person, in order that they may work safely;
- All electrical equipment is safe and suitable for the purpose intended;
- Staff have sufficient knowledge to recognise when portable appliances or any other electrical equipment may be damaged or otherwise present a risk, and to take it out of use.

This guide also sets out the responsibilities for electrical systems and the campus electrical infrastructure. In summary, Facilities Management Directorate (FMD) is responsible for all fixed installations, while Heads of School/Department and other Directorates are responsible for Department-owned or leased equipment and portable appliances. This Safety Guide is supported by FMD policies and procedures for the management of work on low and high voltage electrical systems:

i. FMD Code of Practice for Safe Work on Low Voltage (LV) Systems.
ii. FMD Operational Safety Rules 'HV electrical distribution systems'

No-one may work on the University's LV or HV systems without the prior knowledge and written authority of FMD. Anyone working on LV or HV systems must be familiar with the above document(s) and work in accordance with them.

2 SCOPE

This Safety Guide is intended to provide managers, staff and students with the knowledge to ensure they work safely with electricity and understand their responsibilities. It applies to all places of work, on and off campus, and to all work involving the use of electricity, including low and high voltages, fixed installations and portable equipment. It excludes the specific requirements for the inspection and testing of portable appliances.

Guidance:

The requirements for inspection and testing of portable electrical appliances (PAT Testing) are set out in Safety Guide 12.

Electricity can kill. Each year about 1000 accidents at work involving electric shock or burns are reported to the Health and Safety Executive (HSE). Around 30 of these are fatal.

The main hazards of working with electricity are:

- contact with live parts causing shock and burns (normal mains voltage, 230 volts AC, can kill); This would include contact with over head cables or underground cables.
- contact with live parts which could lead to falls from ladders, platforms and other hazardous locations;
- faults, such as sparks, short circuits and current overloading, which could cause fires;
- fire or explosion where electricity could be the source of ignition in a potentially flammable or explosive atmosphere.

3 LEGAL REQUIREMENTS

The Electricity at Work Regulations 1989 require all electrical systems to be constructed and maintained in good condition so as to prevent danger. Employers must ensure that all live parts of electrical equipment cannot be accessed during normal operation and that adequate measures are in place to protect workers from suffering an electrical shock. Employers must also ensure that all electrical wiring and equipment and everything connected to them is properly installed, maintained and regularly checked by appropriately qualified staff (see Safety Guide 12 Portable Appliance Testing).

The Electricity at Work Regulations are supplemented by the Health and Safety Executive (HSE) publication 'Memorandum of Guidance on the Electricity at Work Regulations 1989'; with which all members of the University must comply. In addition the British Standard 7671: 2008 "Requirements for Electrical Installations" (the IEE Wiring Regulations 17th Edition) will apply to new electrical work/installations.

4 RESPONSIBILITIES

4.1 Heads of Schools/Directorates/Departments/Units

Heads of Schools/Directorates/Departments/Units are responsible for all electrical work, systems and equipment under their control. They must ensure that:

- Electrical systems and equipment are safe;
- Electrical systems and equipment are suitable for the task it is used for;
- Electrical systems are maintained and inspected as necessary;
- Appropriate risk assessments are carried out and recorded where necessary before electrical work is undertaken;
- Project work, in particular the construction of electrical rigs, is suitably risk assessed and safety devices are in place. This would include suitable emergency cut off points which are accessible;
- Electrical equipment is included in activity-based and/or machinery risk assessments, where appropriate;
- Suitable control measures are in place and followed;
- Staff, and students where appropriate, and contractors are provided with a safe working area, and/or are given sufficient information of any known hazards or risks to health and safety to enable them to work safely;
- Staff have sufficient knowledge to recognise when portable appliances or any other electrical equipment may be damaged or otherwise present a risk, and to take it out of use.
- There are competent persons in place to control electrical dangers in their departments/units;
- Any electrical contractors that they engage are suitably experienced and competent. To ensure competence all contractors should be engaged via Procurement's list of contracted suppliers, and they must meet the University's requirements for demonstrating competency.

Within the University Facilities Management Directorate (FMD) is responsible for all fixed electrical installations and infrastructure. Heads of School/Department and other Directorates are responsible for department-owned or leased equipment, including portable appliances, and for any wiring installations and equipment supplied from the fixed installation power socket or isolator.

Under no circumstances must Schools/Directorates (apart from competent persons authorised by FMD) interfere with the fixed electrical systems or give instructions to any contractor concerning any work on the electrical distribution system.

Examples of School / Departmental areas of responsibility are experimental rigs, work activities in electronic and electrical workshops, portable electrical apparatus and equipment fitted to the fixed electrical systems, such as workshop and kitchen machinery. Electrical hazards must be considered in risk assessments and suitable control measures put into place to control the risk.

4.2 Facilities Management Directorate (FMD)

FMD is responsible for power supplies, distribution, and connection of hard-wired installations including machinery and electrical equipment throughout the University (referred to as 'fixed' installations). The fixed installation includes wiring up to and including the socket outlet, or the isolator in the case of more permanently installed pieces of equipment. No one may work on the fixed installation without permission from FMD.

Appendix 1 gives more detail on FMD's role in design and maintenance of the fixed electrical systems. FMD, all contractors engaged by them, and any other person working on the systems are required to work in accordance with the following FMD procedures (copies are available from FMD):

FMD Code of Practice for safe working on low voltage (LV) electrical systems;
FMD Operational Safety rules 'HV electrical distribution systems'.

FMD have appointed a Duty Holder to take overall responsibility for management of the University low and high voltage networks. Responsibilities are set out in Appendix 2.

Only authorised FMD employees / contractors approved by FMD may carry out modifications or extensions of the systems defined as the responsibility of FMD. No-one else may carry out such work unless they have consulted FMD and have the prior written approval of FMD.

4.3 Health and Safety Services

Health and Safety Services will:

- Monitor compliance with legal and University standards via audits;
- Develop University policy, standards and guidance;
- Liaise with the FMD Duty Holder to ensure that FMD management systems, policies and procedures are effective in preventing danger when working with electricity;
- Provide training and refresher training for persons appointed to carry out portable appliance testing (PAT) and minor repairs.

4.4 Staff

4.4.1 Training and competency

Staff, students or contractors working on electrical equipment, machinery or installations must be competent to do so. This includes modifications to, or repair of, electrical equipment. The level of competence required will depend on the work to be done, and should be derived from a risk assessment of the task/activity. Competency may be on the basis of qualifications, experience, training, knowledge and skills. Individuals may need to be regularly re-assessed to ensure that their skills and knowledge remain up-to-date. People who cannot demonstrate competence should not be allowed to work unless they are supervised by someone who is.

Schools/Directorates must ensure that staff have sufficient knowledge to recognise when portable appliances or any other electrical equipment may present a risk, and to take it out of use.

Guidance:

See Safety Guide 12 for details of competency for PAT testing, and FMD Codes of Practice, Refs 1 and 2.

Under no circumstances must Schools/Directorates (apart from competent persons authorised by FMD) interfere with the fixed electrical systems or give instructions to any contractor concerning any work on the electrical distribution system. NB. Certain members of School staff have been trained to carry out minor works out of hours and have been authorised in writing by FMD.

4.5 Students

Students must ensure that all personal electrical equipment that they bring onto campus and into Halls of Residence is in a safe condition. The requirements for equipment used within the University Halls of Residence are set out in Appendix 3. If anyone notices student electrical equipment or practices involving this equipment which appear hazardous, such as poor wiring, exposed mains connections, etc. the danger must be pointed out to the student and the Hall Manager or Unit Head informed. Action must then be taken to make the equipment safe or take it out of use.

4.6 Tenants

4.6.1 Tenants of residential property

Tenants are responsible for the safety of any electrical appliance that is brought into University owned property. Any mains system electrical safety issues must be reported to the University (via the office of the FMD Estates Manager).

4.6.2 Commercial tenants

Depending on the terms of the lease all tenants of University property will be responsible for reporting any mains system electrical safety issues to the University.

The tenant must have in place an effective system to ensure the safety of all electrical equipment and systems for which they are responsible, including the inspection and testing as appropriate of portable appliances.

4.7 Contractors

A contractor is any individual or company not directly employed by the University of Reading through PAYE, who is involved with work on or near to electrical systems that are under the control of the University. Contractors include Preferred Electrical Contractors, Consultants, Designers, Specialist Organisations and Allied Trades.

Electrical contractors must comply with the Electricity at Work Regulations and University Codes of Practice and Guidance. To ensure contractors hold the necessary qualifications, it is a pre-requisite that all contractors working on University electrical systems are members of a professional body such as the 'National Inspection Council for Electrical Installations Contracting' (NICEIC) or the 'Electrical Contractors Association' (ECA) or other approved independent associations. In addition, contractors must meet any additional general health and safety competency requirements set by the University.

A request for a copy of the contractor's staff training records should not be necessary but such requests are at the University of Reading's discretion.

For works carried out in domestic installations that require notification to local Authority Building Control, the contractor shall be a Part P Scheme Member, allowing self-certification.

As deemed appropriate by the Senior Authorising Person or his deputies, contractors possessing the necessary competence shall be designated the appropriate authority level necessary for the task to be undertaken.

5 SAFE DESIGN AND USE OF ELECTRICAL SYSTEMS

Risks can arise if a properly designed and constructed item is used outside the conditions for which it was designed and constructed. Particular examples of high risk conditions are potentially explosive atmospheres, oxygen enriched atmospheres and wet or damp atmospheres. Consideration of conditions of use is part of the risk assessment process and must be undertaken before work begins.

5.1 Safe use of equipment

Users must ensure that electrical equipment that they use is in a safe condition. If there is any doubt it must not be used. The following general precautions must be applied:

- Equipment should be visually checked before it is used. Any item with a plug should be checked for:
  - is the plug cracked/scorched/rattling?
  - is the main cable held by the cable grip (coloured wires should not show)?
  - is the cable worn/split?
  - is the apparatus itself cracked/scorched/rattling?
- Suspect or faulty equipment must be taken out of use, labelled 'DO NOT USE' and kept secure until examined by a competent person;
- Where possible, tools, equipment and power socket-outlets should be switched off before plugging in or unplugging;
- Equipment should be switched off and/or unplugged before cleaning or making adjustments, and when left overnight;
- Where required by risk assessment, 110v equipment and extension cables must be used e.g. in areas where equipment will be exposed to weather, moisture or physical damage (see also Safety Note 52 for guidance on the safe use of extension systems). If the equipment is unavailable as a 110v model, the supply must be controlled by a Residual Current Device (RCD);
- Unless the main switchboard or socket outlet is protected by a RCD, plug-in RCDs should be used for all equipment in high risk areas, or for equipment that is hazardous e.g. lawnmowers, hedge trimmers, portable circular says or any equipment that could cut or damage its own cable;
- When the plug-in type of RCD is used it should be tested each time it is used;
- A means of isolation should be readily accessible when using any electrical equipment, including portable appliances;
- Manufacturers' or suppliers' instructions must be read and understood before an unfamiliar item of equipment is used for the first time;
- Equipment must not be plugged into light bulb sockets, or circuits intended for lighting purposes, or circuits intended for emergency use only. Approved multi-way extension leads may be used but care must be taken not to overload the supply socket. Further guidance is given in Safety Note 52;
- The conditions of use must be safe e.g. some items of equipment may have grills, vents or fans or require a surrounding air space to permit adequate passage of air for cooling purposes. Care must be taken to ensure that air cooling is not obstructed e.g. due to poor positioning of the equipment;
- Mains supply cables must not be positioned in a location where they could be mechanically damaged by furniture, trolleys, people walking on them etc. If positioning in a trafficked area is not avoidable, the cable must be protected with a robust cover and marked to reduce the risk of tripping.

Further guidance for high risk areas is given in Appendix 4.

5.2 Standards for equipment

5.2.1 Supply of equipment

All equipment purchased within the EC will be CE marked. Equipment purchased from outside the EC must always be verified as electrically safe by the importer or supplier and CE marked. Departments themselves may be the importer or supplier and in such a case are responsible for ensuring compliance with the electrical principles in the Electrical Equipment (Safety) Regulations

1994. These Regulations require electrical equipment to be safe and constructed in accordance with good engineering practice. This also applies to second-hand and donated electrical equipment or equipment which is hired in for use.

5.2.2 Electrical standards

Equipment that is installed should be suitable for the task it will perform and the environment within which it will be expected to work. A wide range of electrical equipment and work is covered by recognised standards that offer guidance on good engineering practice. HSE's web site should be consulted for an up-to-date of relevant BS and EN standards and other relevant codes of practice. All new installations and those being upgraded should comply with the relevant standard.

5.3 Live work

There must be no live working for general work with electrical systems or electrical equipment, on or off campus. In certain exceptional cases FMD staff or authorised contractors may undertake live working in accordance with a Permit-to-work system for work on live conductors. Further details are given in the FMD *Code of Practice for Safe Work on Low Voltage Systems for Safe Work on Low Voltage Systems*.

5.4 High voltage work

The rules for working on high voltage systems are set out in FMD's *Operational safety rules high voltage electrical distribution systems*.

5.5 Dangerous substances and explosive atmospheres

Hazardous areas where flammable or explosive atmospheres may exist require specially selected electrical equipment to take account of the particular hazard, e.g. flameproof, explosion proof, etc. Adequate earth protection is essential. Normal electrical apparatus must never be used under such operating conditions.

Any work within these defined areas must take account of the following:

- Safety Guide 24 Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) (Including Flammable Liquids);
- Installations should be designed and constructed in accordance HS(G) 22 Electrical Apparatus for Use in Potentially Explosive Atmospheres;
- Precautions must always be taken to prevent the ignition of flammable atmospheres by the discharge of static electricity;
- Most electrical equipment is unsuitable for use in oxygen enriched atmospheres;
- Selection of equipment for use in these areas must only be carried out by competent personnel.

5.6 Electrical switchgear

All areas where electrical switchgear is installed must be kept clean, tidy and unobstructed. Dedicated switchgear spaces must not be used as storage areas.

Accessible and clearly-defined switches with appropriate signage must be provided near all fixed machines to enable the user to cut off the electrical power in an emergency.

5.7 Teaching and research activities

Risk assessments for research and teaching must take into account electrical hazards where appropriate. Particular attention must be paid to the competent supervision of students and others involved in electrical work, and to the safety of other persons who might be affected by the activities.

No persons may be engaged in any work activity where technical knowledge or experience is necessary to prevent electrical danger or injury unless he/she possesses such knowledge or experience or is under such supervision as may be appropriate having regard to the nature of the work. The supervisors of academic and similar work must be aware of, and adhere to, these requirements.

5.8 Special risks in laboratories, workshops and other hazardous areas

Appendix 4 sets out the specific hazards for higher hazard areas such as laboratories, workshops and greenhouses. Suitable and sufficient risk assessments must be carried out for these areas and adequate precautions put into place.

5.9 Construction sites, building maintenance and work outdoors

Electrical equipment used on construction sites and similar outdoor work places (e.g. University farms) must be compliant with FMD *Site Rules and Guidance* (available on the FMD web site). This may also apply to outdoor events.

Where possible electrical risks should be eliminated by using air, hydraulic or handpowered tools.

5.9.1 Contact with power lines and mains services

Care must be taken to avoid overhead power lines and to identify or detect underground mains services. Any activities that might come into contact with such services on University land must be authorised by FMD via a permit to dig, and supported by appropriate risk assessments and method statements, before work starts. If not on University land, the activity must be risk assessed by a competent person, and if necessary further investigation undertaken to identify the location and status of services.

All University land, and in particular University farm land, must be suitably surveyed and all staff and contractors made aware of the presence of overhead power lines. Suitable and sufficient risk assessments must be completed and adequate control measures put into place where there is a risk of contact with overhead power lines.

5.10 Temporary electrical supplies to events

Social, conference and other events on campus may require the provision of temporary electrical supplies, for lighting, amplifiers and other equipment. The following requirements must be followed:

- The installation must be checked by an FMD competent person prior to the event;
- Any electrical equipment brought onto site must be PAT tested unless proof of PAT testing can be provided.

See also section 4.9 regarding outdoor locations. Further details are given in Safety Guide 33 *Event Management* Section 2.13.

6 EMERGENCY PROCEDURES

6.1 First aid

Where there is a higher than 'normal' likelihood of electric shock (i.e. beyond what might be expected in an office environment or using typical portable appliances) a poster showing the resuscitation procedures to be applied in the event of electric shock must be displayed. Such places include electrical test areas, sub-stations and some laboratories. Adequate first aid provision must be made in accordance with Safety Guide 8 *First Aid* and the FMD *Operational Safety Rules 'HV Electrical Distribution Systems'*.

6.2 Incident reporting

Under the Reporting of Injuries, Diseases, and Dangerous Occurrences Regulations (RIDDOR) the following types of incident are classed as a major injury or dangerous occurrence:

- injury resulting from an electric shock or electrical burn leading to unconsciousness, or requiring resuscitation or admittance to hospital for more than 24 hours;
- plant or equipment coming into contact with overhead power lines;
- electrical short circuit or overload causing fire or explosion.

These events must be reported under RIDDOR. It is therefore essential that School/Directorate staff are aware of this requirement and follow the University procedures for the immediate reporting of such incidents to Health and Safety Services – see Safety Guide 9 *Incident reporting and investigation*.

7 FURTHER ADVICE AND INFORMATION

1. FMD Operational safety rules HV electrical distribution systems
2. FMD Code of practice for safe working on low voltage electrical systems
3. FMD Site Rules and Guidance
4. Safety Guide 8 First Aid
5. Safety Guide 9 Incident reporting and investigation
6. Safety Guide 33 Event management
7. Safety Note 52 The use of electrical extension systems
8. Electrical Safety and You INDG 231 11/05 ISBN 07176 120 74
9. British Standard 7671: 2008 "Requirements for Electrical Installations"
10. Avoiding danger from underground services HSG47 (Second edition) HSE Books 2000 ISBN 0 7176 1774 0
11. Avoidance of danger from overhead electrical lines GS6(rev) HSE Books 1997 ISBN 0 7176 1348 8
12. Electrical safety on construction sites HSG141 HSE Books 1995 ISBN 0 7176 1000 4
13. Electricity at work - safe working practices HSG85 (Second edition) HSE Books 2003 ISBN 0 7176 2164 2
14. Electrical test equipment for use by electricians GS38(rev) HSE Books 1995 ISBN 0 7176 0845 X
15. Electrical safety at places of entertainment GS50 HSE Books 1997 ISBN 0 7176 1387 9
16. Electrical hazards from steam/water pressure cleaners etc PM29(rev) HSE Books 1995 ISBN 0 7176 0813 1
17. Selection and use of electric handlamps PM38 HSE Books 1992 ISBN 0 11 886360 6

18. Memorandum of guidance on the Electricity at Work Regulations 1989 HSR25HSE Books 1989 ISBN 0 7176 1602 9
19. BS 7671: 2001 Requirements for electrical installations. IEE Wiring Regulations 16th edition.
20. Code of practice for in-service inspection and testing of electrical equipment. Institution of Electrical Engineers

Appendix 1: Responsibility for fixed electrical installations

FMD is responsible for the design, construction, operation, repair, maintenance, modification and extension of fixed electrical systems and infrastructure. These include:

i. sub-stations, switchrooms and all electrical services (other than those provided by statutory authorities) including mains supplies, lightning conductors, general and special earthing, lighting of roads, car parks, cycle and pedestrian ways;
ii. the electrical distribution system (in multiphase systems this includes all works up to and including the isolator and in single-phase systems this includes all works up to and including distribution boards), also all subsidiary circuits up to and including socket outlets, fused spurs, ceiling or wall lighting terminations.

The designated FMD Duty Holder must liaise with Schools/Directorate/Departments/Units departments, particularly with respect to timing, access, isolation of supplies and notification of intended works so that departments can prepare or co-operate with FMD in preparing risk assessments.

The FMD Duty Holder responsibilities are set out in Appendix 2.

Appendix 2: FMD Duty Holders' responsibilities

DUTY HOLDERS' RESPONSIBILITIES FOR THE LOW VOLTAGE (LV) ELECTRICAL NETWORK

The duty holder is responsible for ensuring that suitable and sufficient risk assessments are carried out with respect to risk to persons and property for the operation and maintenance of the LV network.

The duty holder is responsible for ensuring that all LV systems are operated and maintained so as to prevent, so far as is reasonably practicable, danger to persons or property.

The duty holder is responsible for ensuring the appointment of a competent person to take managerial responsibility and to provide supervision for the implementation of operation and maintenance policies.

The duty holder is responsible for ensuring that the appointed competent person has the appropriate training, knowledge and experience to prevent danger.

The duty holder is responsible for ensuring that only persons authorised to work on the LV network do so. All such authorised persons (University employees or otherwise) shall have the technical knowledge and experience to prevent injury unless such persons are under such degree of supervision as may be appropriate having regard to the nature of the work.

The duty holder is responsible for ensuring that any consultants appointed to advise on the LV network can demonstrate their competence with respect to knowledge, skills and training and have sufficient resource.

The duty holder is responsible for ensuring that all University employees authorised to work on the LV network have the appropriate initial and refresher training.

The duty holder is responsible for ensuring that the maintenance contract for the inspection and testing of the University's LV installations is carried out in accordance with the maintenance contract.

The duty holder is responsible for ensuring that those who undertake supervision of others, whose technical knowledge or experience is insufficient for them to undertake the work safely, are aware of their responsibilities. The degree of supervision and the manner in which it is exercised is for the duty holder to arrange to ensure that danger or injury is prevented.

The duty holder is responsible for ensuring that the effectiveness of LV maintenance policies is monitored. Without effective monitoring the duty holder cannot be certain that the requirement for maintenance of the LV system has been complied with.

The duty holder is responsible for identifying any new good practice that is relevant and complying with that practice to the extent that it is applicable. Furthermore extra measures that would be effective in further reducing risk should be implemented where reasonably practicable.

The duty holder is responsible for ensuring that all the above duties are discharged subject to sufficient resources being available and responsible for alerting the line management if resources are insufficient to discharge these duties.

Signature of Duty Holder .....

Signature of Head of Small Works .....

November 07

DUTY HOLDERS' RESPONSIBILITIES FOR THE HIGH VOLTAGE (HV) ELECTRICAL NETWORK

The duty holder is responsible for ensuring that suitable and sufficient risk assessments are carried out with respect to risk to persons and property for the operation and maintenance of the HV network.

The duty holder is responsible for ensuring that all HV systems are operated and maintained so as to prevent, so far as is reasonably practicable, danger.

The duty holder is responsible for appointing a competent person to take managerial responsibility and to provide supervision for the implementation of operation and maintenance policies.

The duty holder is responsible for ensuring that the appointed competent person has the appropriate training, knowledge and experience to prevent danger.

The duty holder is responsible for ensuring that only persons authorised to work on the HV network do so; and that all such authorised persons (University employees or otherwise) have the technical knowledge and experience to prevent injury unless such persons are under such degree of supervision as may be appropriate having regard to the nature of the work.

The duty holder is responsible for ensuring that any consultants appointed to advise on the HV network are competent with respect to knowledge, skills and training and have sufficient resource.

The duty holder is responsible for ensuring that all University employees authorised to work on the HV network have the appropriate initial and refresher training.

The duty holder is responsible for ensuring that the maintenance contract for the inspection and testing of the University's HV switchgear is carried out in accordance with the maintenance contract.

The duty holder is responsible for ensuring that those who undertake supervision of others, whose technical knowledge or experience is insufficient for them to undertake the work safely, are aware of their responsibilities. The degree of supervision and the manner in which it is exercised is for the duty holder to arrange to ensure that danger, or as the case may be, injury, is prevented.

The duty holder is responsible for ensuring that the effectiveness of HV maintenance policies is monitored. Without effective monitoring the duty Holder cannot be certain that the requirement for maintenance of the HV system has been complied with.

The duty holder is responsible for identifying new good practice that is relevant and complying with it to the extent that it is applicable. Furthermore extra measures that would be effective in further reducing risk should be implemented where reasonably practicable.

The duty holder is responsible for ensuring that all the above duties are discharged subject to sufficient resources being available and responsible for alerting the line management if resources are insufficient to discharge these duties.

Signature of Duty Holder .....

Signature of Head of Maintenance .....

February 07

Appendix 3: Rules for electrical equipment in Halls of Residence

Mains electricity is dangerous and can kill if misused

- Never overload electrical sockets or use adapters. You must only have one item per socket.
- Only use the University supplied four socket extension leads. The total load on any wall socket must not exceed 13 amps. Do not use block multi-socket adaptors, as they can overheat and cause a fire hazard.
- Ensure the correct rated fuse is used in each appliance.
- Only use CE marked plugs and appliances (this includes rice cookers).
- Electrical items such as irons, kettles, toasters and other kitchen equipment, electric fire heaters, fan heaters, electric blankets, Christmas/fairy lights and plug-in air fresheners etc. must not be brought into the Hall or used in your study bedroom. If found these items will be required to be removed and a fine will be imposed. If you are not sure if an electrical item is permitted please ask at the Group Reception.
- All electrical equipment being brought into the Hall must be safe and if necessary independently inspected (a certificate may be required as proof that the inspections have been carried out within the previous 12 months). Any unsafe items must be removed from the premises immediately.
- Short flexes are safer than long ones. If the protective covering of a flex becomes frayed, split or worn, do not use it, or the appliance, but get the flex replaced. Never staple a flex to the wall or skirting, or run it under carpet or lino, and always use a single continuous length from plug to appliance, without joins. Never let a flex touch hot parts of a fire, toaster, cooker, iron, etc.
- Don't leave computer networking cables or telephone extension cables in the hallways, strung between rooms or on the outside of the buildings. It compromises fire containment if the fire doors cannot shut properly; it also lets thieves know that you've got a PC in your room.
- Never put metal implements (such as a knife) in a toaster if it is still connected to the electricity supply.
- When using the microwave ovens , only use microwave-safe containers. Don't put any metal in the microwave.
- Electricity and water don't mix . Don't handle plugs, switches or any electric appliance with wet hands. Switch off and unplug all appliances before cleaning and make sure they are dry before use. The only items to be used in bathrooms are shavers and then only in the wall socket provided. Never use an extension lead to take electrical equipment into your bathroom.
- If you think any electrical equipment in your residence is faulty, or if it stops working, switch it off straight away and don't attempt to fix it. Tell residence staff immediately if the equipment belongs to the residence, or have the fault repaired by an electrician if it belongs to you. You must remove any dangerous electrical appliances or we may confiscate them.

Appendix 4: Guidance on design of equipment for specific installations

HIGH RISK AREAS AND ACTIVITIES

Some staff and students may be at specific risk of electric shock due to the type of work undertaken. Examples not already covered in the main section of the Safety Guide are:

- staff who construct and maintain electrical/electronic equipment in workshops and laboratories;
- staff and students involved in teaching electrical engineering and electronics;
- staff and students involved in teaching, working and research in dairies or greenhouses where animals, plants etc are maintained and water is used in close proximity to electrical equipment;

The following preventative measures must be taken in these areas. This is addition to the general safety precautions given in section 4.1 of this Guide.

General Points

Where work in workshops or laboratories involves operations on live systems or working with bare conductors, normal safety precautions which prevent danger must be followed whenever practicable. In circumstances where there is no alternative to deviation from standard practice, it is essential that precautions to avoid danger are strictly observed. However, such precautions are not adequate to avoid danger from high voltage (above 650V) systems. At high voltages there is increased risk of death from shock by contact and also the possibility of shock from "spark-over" on close approach to bare conductors.

Planning for electrical systems

Planning for the use of electrical equipments is essential for all but single use/source of supply operations. Where equipment, in particular racks of electrical equipment, is to be used, planning will include:

- Source of supply, where the demand for a test rig or rack is more then a single source (i.e. one outlet point) 240v 30amp demand. Check that the supply points are all on the same phase. Where a test rig or rack is being supplied from more then one phase, there is the risk for the potential difference on current over the test rig or rack to be 400v and not 240v, thereby increasing the hazard;
- Every source of supply in a room or area comes from a distribution point which has a limited capacity. However it is possible for there to be more outlet points than there is capacity on the distribution board. Utilising all outlet points to maximum capacity may cause a system failure;
- Where a large demand is anticipated, you must consult with FMD electrical team who can advise on demand and 'clean' supply issues.

Electrical and/or Electronic Workshops

Workshops used for repairing, modifying, constructing and testing electrical or electronic equipment must have a RCCB fitted to the mains supply (not battery powered and separate "safe" low voltage supplies). The workshop supervisor must check the operation of the RCCB by operating the "TEST" button every working day before work commences.

If "live chassis" work is carried out, an "Earth Free Area" must be provided. Any rubber mats used must be tested annually for adequate insulation and records kept. Testing should be carried out if damage by the impregnation of metal swarf, for example, is noticed. The use of externally earthed

extension cables in the earth free area that are connected to a supply socket outside the area is forbidden.

Electrical Engineering Laboratories

Laboratories used for teaching electrical engineering pose a particularly high risk due to the high voltages used, the need to observe functional parts of devices during operation, and inexperience of the students. A written safe system of work must be established which must include the following provisions and procedures:

Provisions

- All power supplies to apparatus where voltage above 50V AC or 120V DC may be exposed should be provided from a system that is entirely separate from the general services and lighting circuits and should originate from a single circuit breaker so that all supplies - excepting lighting - can be isolated in an emergency;
- Main and sub-circuits should be adequately protected by fusing against over-current;
- A clearly labelled and easily accessible emergency isolation button(s) must be provided to isolate all the apparatus supply circuits - except lighting - in the event of an emergency;
- Outlet points for the connection of research and experimental apparatus and other systems should be arranged so that connections which are electrically safe can only be made without exposure to electrical danger. Acceptable methods include plugs and sockets which are not interchangeable with those used for general service distribution, safe block connections, or switches with the handle interlocked to a cover which protects fixed terminals;
- Bare conductors at less than 650V that need to be observed during use must be covered by transparent covers (e.g. perspex) to prevent anyone falling on them;
- Any apparatus involving the use of bare conductors at greater than 650V must be placed in a segregated enclosure that has an interlocked isolation switch on the door and a portable earthing;
- A rod should be provided within the enclosure which is applied to bare conductors before they are touched after isolation';
- An "AUTHORISED ENTRY ONLY" sign must be displayed on the door(s) to the laboratory;
- All benches should be non-conductive. Areas where live conductors at above 50V AC or 120V DC may be exposed should be surrounded by a clear and unobstructed passageway. A minimum clearance of at least 1 metre is recommended. In the case of adjacent benches and/or areas the separation recommended is 1.5 metres. Small non-conductive barriers should be provided between adjacent bench workstations to prevent inadvertent contact with neighbouring live parts;
- Instructions on the treatment of persons suffering from electric shock must be prominently displayed in all laboratories, where there is exposure to danger at voltages above 50V AC and 120V DC. Those in charge must be able to render artificial resuscitation should it be necessary;
- A telephone must be readily available to summon an ambulance.
- An insulating device to pull someone off a live conductor i.e. an insulated "skipping rope" with long wooden handles must be readily available;
- In general, all experimental and test rigs should be designed to ensure that there is exposure of bare metal live at voltages above 50V AC and 120V DC only where it is necessary to apply test probes, etc for measurement purposes. If any particular experiment involves an abnormally high degree of risk of shock to earth, the supply should be made through a safety isolating transformer with an unearthed secondary or, if for any reason that is technically impracticable, through a high sensitivity RCCB.

- All electrical systems and equipment used for live work in teaching or research must be so constructed that it is clear to all when the system and/or equipment is live. Live conductors should only be accessible by deliberate contact and never accessible by accidental contact.

Procedures

Only persons authorised by the Head of Department may enter and work in the laboratory. Such persons are:

- qualified electrical engineers,
- electrical undergraduate students in their second or subsequent year, provided they are at least 18 years of age and have been properly instructed in the avoidance of the dangers of electricity
- postgraduate students or technical staff working to the directions of the Laboratory Supervisor.

- The laboratory must be kept locked when unattended if there are bare live conductors at dangerous voltages.
- No person except an authorised person should carry out work on experimental apparatus and systems where there are conductors exposed when live at voltages above 50V AC and 120V DC;
- No-one should do such work unaccompanied. Students or technical staff under the age of 18 may be trained to carry out such work provided they are under the close, immediate and continuous supervision of an authorised person;
- No work should be done on any conductors of apparatus or systems operating at or generating voltages above 650V unless the conductors have been made dead and efficiently earthed. This restriction shall not apply to "non-lethal" HV systems (e.g. EHT of TV sets, electrostatic apparatus, pressure test sets, etc) where the current availability is below 5 mA;
- A defect reporting and clearance procedure should be established for all fixed and portable equipment to ensure that maintenance needs are promptly identified and recorded and that defective equipment is not returned to service.

Electrophoresis equipment

The potential for injury from electrophoresis equipment is due to the large quantities of electrical energy involved, and to the supporting medium being commonly immersed in either saline or buffer solution. A safe system of work for electrophoresis requires that:

- power supplies to the tanks are always switched off before the lid of the tank is opened;
- supplementary protection by interlocking the power supply is provided to ensure that anyone who forgets to switch off is not at risk. Effective interlocking can be achieved by arranging for the leads from the power supply to terminate in well shrouded sockets which are separated from the corresponding pins inside the tank by the action of removing the lid. Thus, opening the tank lid automatically removes the power. Leads from the power supply must never terminate in unshrouded pins.
- Alternatively, use a positive mode safety switch on a tank with a hinged lid arranged to break the AC supply to the power pack when the lid is open. Simple control interlocking, by using a safety switch to operate a contactor or relay which breaks the AC supply to the power pack when the lid is opened, is not recommended. The risk with this system is the possibility of a contactor or relay sticking in the closed position.

Power Washed Animal Houses

The supply circuits of animal houses that are power washed (e.g. dairies, must be fitted with Residual Current Circuit Breakers (RCCBs) either on the whole supply or, if this gives rise to nuisance tripping, on each individual outlet including those which supply the power washer. RCD protected 13A plugs must not be fitted to power washers. Water proofed outlets or other equipment may be required in such areas.

Fieldwork and greenhouses

The electrical hazards associated with fieldwork and work in greenhouses are those of damp, wet or corrosive conditions with non-insulated structures and flooring. All equipment in use in such areas must be designed for the purpose:

- It, and any connections, must be waterproof or protected to ensure that they do not get wet;
- Wiring should be mechanically protected, toughened and double insulated;
- There must be a good earth connection.

See Safety Guide 12 for information on testing and inspection.

Cold Rooms

Whilst the atmosphere in a cold room is frequently very dry, condensation can occur on equipment when it is removed from the room. Therefore the following precautions must be adopted:

- Permanent wiring within cold rooms should be waterproof;
- Power sockets in cold rooms should be safeguarded by RCDs;
- If the cold room is used as a laboratory, it is usually not possible to only use waterproof equipment. Therefore any electrical equipment that is removed from the cold room should not be used until it has time to warm up and dry out, which can take several hours.

Appendix 5: Version control

VERSION	KEEPER	REVIEWED	APPROVED BY	APPROVAL DATE
X.X	H&S	Every four years	XXXXX	XX/XX/XX
X.X	H&S	Annually	XXXXX	XX/XX/XX