

Health and Safety Department

Electricity at Work Policy and Code of Practice

Document Control

Document Details	
Reference	
Version Number	11
Effective From	July 2019
Approval Date	July 2019
Review Date	July 2022
Author	David Howell

Document Revision History			
Date	Revisions Made	Revisions made by	Approved by
May 2011	SAP and AP's substituted for Duty Holder (DH) and Nominated Deputies (ND) in line with FM's policy titles	David Howell	
May 2011	Control Engineer defined as the sole person making. Switching changes to the system at any one time	David Howell	
May 2011	Reference to "Limitation of Access" document removed – no longer used	David Howell	
May 2011	Expanded the section on CO2 – isolations of the Co2, cswitch or pegs to be recorded on PERMIT	David Howell	
May 2011	Definitions in one section & in alphabetical order	David Howell	
July 2012	Update of definitions, descriptions and 'minor works certificate'	David Howell	
July 2013	Update to reflect DAP reference replacing DH Also to include Extra Low Voltage working	David Howell	
September 2016	General review and update	David Howell	
January 2017	London Campus added	David Howell	
December 2017	General Review	JB	
July 2019	General update and review	David Howell	

Contents

1. Overview
 - 1.1 Purpose
 - 1.2 Scope

2. Key legislative requirements
 - 2.1 The Health and Safety at Work etc Act 1974
 - 2.2 The Management of Health and Safety at Work Regulations 1999
 - 2.3 The Electricity at Work Regulations 1989
 - 2.4 BS 7671:2018 Requirements for electrical installations. IET Wiring Regulations - 18th edition
 - 2.5 The Building Regulations 2000

3. Duty holders
 - 3.1 Heads of Schools / Professional Services
 - 3.2 Operations Managers
 - 3.3 Facilities Services
 - 3.4 University Health & Safety Service
 - 3.5 School / Departmental Safety Officers
 - 3.6 Responsible competent person(s)
 - 3.7 Employees / students
 - 3.8 Contractors / visitors

4. Technical references and further reading

Appendices

- Appendix A - Code of practice – Part One; Electrical safety
- Appendix B - Code of practice – Part Two; Electrical installation & portable (& transportable) equipment test and inspection (including PAT testing)
- Appendix C - Guidance on completing an electrical risk assessment
- Appendix D - High Voltage (HV) Electricity System Safety Rules and Associated Safety Guidance
- Appendix E - Low Voltage (LV) Electricity System Safety Rules and Associated Safety Guidance

1. Overview

1.1 Purpose

Loughborough University recognises its duties under the Health and Safety at Work etc Act 1974 (“the Act”), and the Electricity at Work Regulations 1989, (“the Regulations”) to provide a safe and healthy working environment by ensuring that precautions are taken against the risk of death or personal injury from the use of electricity in work activities.

Furthermore, the University will ensure that electrical systems are constructed and maintained so as to prevent danger, and the use and maintenance of an electrical system, and work near a system, shall not give rise to danger. To this end five guidance documents are included as appendices, incorporating,

Appendix A: Electrical safety

Appendix B: Electrical installation & portable (& transportable) equipment test and inspection (including PAT testing).

Appendix C: Guidance on completing an electrical risk assessment.

Appendix D: High Voltage Safety Rules

Appendix E: Low Voltage Safety Rules

They are intended to assist all duty holders in meeting the requirements of the Regulations.

1.2 Scope

This policy and appendices apply to all electrical systems and equipment including the University High Voltage (HV) distribution ring main (Loughborough campus only) located in both the Loughborough and London Campus. All duties under the Regulations apply to the protection of employees. For the purposes of this policy students shall be afforded the same level of protection under the Regulations as members of staff. The Regulations impose responsibilities on the University, its employees and students, requiring them to conform with this policy and thereby the Regulations, in every respect.

Other individuals e.g. visitors and contractors are also protected by this policy insofar as the Regulations are applicable.

The arrangements necessary to fulfil the requirements of this policy are set out in Section 3 (Duty Holders) of this document and in Appendix C - Guidance on completing an electrical risk assessment.

In addition, Appendix E is produced, ‘Low Voltage Electricity System Safety Rules and Associated Safety Guidance which should be read in conjunction with this policy.

2. Key legislative requirements

2.1 The Health and Safety at Work etc Act 1974

Under the Health and Safety at Work etc Act 1974 (“the Act”), the employer has general duties to ensure the health, safety and welfare of his employees at work. Employers also have duties to persons other than their employees who may be affected by their undertaking. Furthermore, employees have duties to their employer and others whilst at work.

2.2 The Management of Health and Safety at Work Regulations 1999

These regulations require employers to make a suitable and sufficient assessment of the risk to the health and safety both of their employees, and of other persons arising out of or in connection with, the conduct of their undertaking. Guidance on completing an electrical risk assessment can be found in Appendix C. This information should be used as the basis for all electrical risk assessments.

2.3 The Electricity at Work Regulations 1989

These regulations require employers to make a suitable and sufficient assessment of the risk to the health and safety both of their employees, and of other persons arising out of or in connection with, the conduct of their undertaking. Guidance on completing an electrical risk assessment can be found in Appendix C. This information should be used as the basis for all electrical risk assessments.

Regulation	Duty	Comment
3	Persons on whom duties are imposed by the Regulations	Duties fall to employers, the self employed and employees
4	Systems, work activities and protective equipment	Systems shall be constructed and maintained so as to prevent danger. Work on or near a system shall not give rise to danger. Equipment provided for the protection of people at work shall be suitable and properly used.
5	Strength and capability of electrical equipment	The strength and capability of electrical equipment shall not be exceeded whilst in use.
6	Adverse or hazardous environments	Electrical equipment exposed to damage, adverse conditions, effects or substances must be constructed so as to prevent danger.
7	Insulation, protection and placing of conductors	All conductors which give rise to danger shall either be suitably insulated or have precautions taken in respect of them so as to prevent danger.
8	Earthing or other suitable precautions	Precautions shall be taken either by earthing or other means to prevent danger when a conductor becomes charged as a result of a fault or when the system is in use.
9	Integrity of referenced conductors	The object is to prevent referenced circuit conductors from reaching significantly different potentials thereby giving rise to possible danger.
10	Connections	In order to prevent danger, every joint and connection shall be suitable for use.
11	Means for protecting from excess of current	Efficient means suitably located, shall be provided to protect all of the system so as to prevent danger.

12	Means for cutting off the supply and for isolation	In order to prevent danger, suitable means shall be available for cutting and isolating electrical equipment from the electricity supply.
13	Precautions for work on equipment made dead	Precautions shall be taken to ensure equipment is made dead, so work can be done on it, or near it, and it cannot become electrically charged
14	Work on or near live conductors	No person shall be engaged in live work unless (a) it is unreasonable in all the circumstances for it to be dead; and (b) it is reasonable in all the circumstances for him to be at work on or near it while it is live; and (c) suitable precautions (including where necessary the provision of suitable protective equipment) are taken to prevent injury
15	Working space, access and lighting	When working on electrical equipment, adequate space, access and lighting shall be provided
16	Persons to be competent to prevent danger and injury	When carrying out work which requires technical knowledge or experience to prevent danger or injury, that person must possess that knowledge and experience or must be appropriately supervised
29	Defence	It shall be a defence for any person to prove that he took all reasonable steps and exercised all due diligence to avoid the commission of that offence.

2.4 BS 7671:2018 Requirements for Electrical installations. IET Wiring Regulations 18th edition (“the Wiring Regulations”)

The Wiring Regulations are non-statutory regulations and have the status of a British Standard. They relate to the design, selection, erection, inspection and testing of electrical installations, whether permanent or temporary, in or about buildings, including construction sites. Compliance with the Wiring Regulations is likely to achieve compliance with the relevant aspects of the Regulations.

2.5 The Building Regulations 2010

Part P of the Building Regulations 2010, entitled; “Electrical safety”, applies to electrical installations that are intended to operate at low or extra Low Voltage (LV) in buildings or parts of buildings comprising dwelling houses and flats, dwellings and business premises with a shared supply, common areas in blocks of flats, such as corridors and staircases and shared amenities of blocks of flats such as laundries and kitchens. They apply to fixed electrical installations which are not controlled by the Regulations.

3. Duty Holders

3.1 Heads of Schools / Professional Services

Heads of Schools / Professional Services shall:

- a) Ensure that systems better or equal are in place to comply with this policy.
- b) Appoint (in writing) one or more departmental competent persons
- c) Ensure appropriate risk assessments are carried out and recorded where necessary before electrical work is undertaken. In particular, in respect of project work, e.g. the construction of electrical rigs. Electrical equipment must be included in activity-based and/or machinery risk assessments, where appropriate.
- d) Ensure responsible persons identified in this policy know and discharge their duties in accordance with this policy
- e) Whilst Facilities Services (FS) are responsible for all fixed electrical installations and infrastructure. Heads of Schools / Professional Services are responsible for School / Department / Professional Service owned or leased equipment, including portable appliances, and for any wiring installations and equipment supplied from the fixed installation power socket or isolator.
- f) Ensure that under no circumstances, Schools / Departments / Professional Services, interfere with the fixed electrical systems or give instructions to any contractor concerning any work on the electrical distribution system without first seeking FS approval.

3.2 Operations Managers

Operations Managers shall:

- a) Ensure that systems are in place to control the purchasing or introduction into the department of electrical equipment. A register shall be kept within the department for this purpose.
- b) Ensure that adequate resources are made available to implement this policy, in particular, sufficient resources to install and maintain effective control measures in accordance with statutory requirements.
- c) Ensure sufficient information, instruction and training is provided in order to enable staff to comply with this policy.
- d) Seek confirmation from departmental staff that arrangements are still effective. This duty shall be discharged by submitting an annual report to the University's Health, Safety and Environment Committee, (HSEC), when requested to do so by the University Health & Safety Service (H&SS).

3.3 Facilities Services

FS shall:

- a) Identify, tag and compile a register of items of electrical plant and equipment that have been installed following an electrical risk assessment whenever this apparatus forms part of the University FS estate.

- b) Ensure that items on the register are thoroughly inspected and tested at a frequency not less than that stipulated in the attached Code of Practice.
- c) Ensure that where necessary the inspection/testing of fixed wire electrical services will be notified to the relevant SSO / DSO's, and remedial action instigated where required. Reports of results of any tests / inspections will be available upon request.
- d) Support University Schools / Professional Services / Departments by providing upon request technical advice on plant, equipment or engineering controls that is or shall be provided, following an Electricity at work risk assessment.
- e) Keep records of testing for at least 5 years

3.4 University Health & Safety Service

The Health & Safety Service shall:

- a) On request, provide information and guidance to staff on electrical safety.
- b) Support Heads of Schools / Departments / Professional Services in their duty to provide sufficient resources and suitable training to enable staff to comply with this policy.

3.5 School Safety Officers / Departmental Safety Officers

SSO's / DSO's shall:

- a) Monitor the effectiveness of any control measures and make recommendations to the Head of School as necessary. In particular, SSO's / DSO's are expected to:
 - monitor that any electrical equipment introduced into the department is done so in accordance with departmental policies and that the departmental register of portable (& transportable) electrical equipment is maintained
 - periodically inspect risk assessment documentation to verify that suitable and sufficient assessments are in place and that they are reviewed and updated when required.
 - verify that plant, equipment and engineering controls are maintained in accordance with the agreed schedule.
 - liaise with departmental competent person(s) to verify that suitable working practices have been adopted.
- b) Report accidents involving exposure to electricity, to the H&SS.

3.6 Responsible competent person(s)

(NB; These nominations shall be made and approved in writing by the Heads of Schools / Heads of Department / Professional Services to suit the individual needs of their School / Department / Support Service.

The responsible competent person(s) shall:

- a) Coordinate the registration of new and existing electrical items.
- b) Carry out suitable and sufficient assessments of exposure to electrical hazards and record the assessment. Guidance on completing an Electrical Risk assessment can be found in Appendix C.

- c) Identify suitable control measures and monitor and record the ongoing compliance with the control measures.
- d) Ensure the inspection and / or testing of new and existing portable (and transportable) electrical equipment is undertaken, in line with Appendix A, B, the guidance note; “Guidance on the inspection & testing of portable and transportable) electrical appliances” and the results should be recorded a maintenance log,
- e) Record and where practicable, rectify deficiencies or report problems to the SSO / DSO as necessary.
- f) Provide sufficient information, instruction and supervision to employees and students to ensure that they are able to work safely with electricity and electrical equipment.
- g) The Electrical Duty Authorised Person (DAP) shall review and, so often as is necessary, amend the University’s Electricity at Work Policy and CoP. The Electrical DAP shall also monitor compliance with the Electricity at Work Policy and Code of Practice, in conjunction with Departments, Managers and H&SS.

3.7 Employees and students

- a) Attend training as required by the SSO / DSO.
- b) Any portable (& transportable) electrical equipment brought into the School / Department / Professional Service, other than by normal School / Departmental / Professional Service procurement procedures, must be reported to the SSO / DSO / Nominated competent person and tested in accordance with this policy.
- c) Cooperate with the University to implement any control measures identified in the electricity risk assessments.
- d) Report any defects or deficiencies in these measures (e.g. concerns regarding the effectiveness of engineering controls.)
- e) Ensure that all electrical domestic appliance brought onto campus by resident students living in University residential accommodation, conforms to current safety standards, and is maintained in such a condition so as to prevent danger to themselves or others, or damage to University property.
- f) Comply with the guidance note; “Guidance on the inspection & testing of portable and transportable) electrical appliances”.

3.8 Contractors and visitors

- a) Equipment belonging to and used by persons visiting the University, must be in an electrically safe condition. The University reserves the right to prohibit the use of any electrical equipment brought onto the campus by a visitor which does not meet the requirements of this policy and CoP.
- b) Equipment belonging to, and used by, contractors of the University must have a valid test certificate or label attached which is available for inspection upon request by any University employee. If the equipment does not possess the relevant safety documentation it will not be

allowed onto campus.

Any electrically powered tools used by contractors shall be 110 volt supplied by a centre tapped to earth transformer or battery powered. Mains operated 240 volt tools shall not be permitted for use on campus unless approved in writing by an authorised representative from LU.

4. Technical references and further reading

- BS 7671:2018 Requirements for electrical installations. IET Wiring Regulations - 18th edition.
- BS EN 60445:2010 Basic and safety principles for man-machine interface, marking and identification-Identification of equipment terminals, conductor terminations and conductors.
- BS EH 60900:2004 Live working-hand tools for use up to 1000 V ac and 1500 V dc.
- Lighting at work: HSG 38 (2nd edition) HSE Books 1997 ISBN 978 0 7176 1232 1
- Avoiding danger from underground services: HSG 47 (2nd edition) HSE Books 2000 ISBN 978 0 7176 1744 9
- Electricity at work: Safe working practices: HSG 85 (3rd edition) HSE Books 2003 ISBN 978 0 7176 2164 4
- Maintaining portable and transportable electrical equipment: HSG 107 (3rd edition) HSE Books 2004 ISBN 978 0 7176 2805 6
- Electrical safety on construction sites: HSG 141 HSE Books 1995 ISBN 978 0 7176 1000 4
- Keeping electrical switchgear safe: HSG 230 HSE Books 2002 ISBN 978 0 7176 2359 4
- Memorandum of guidance on the Electricity at Work Regulations 1989 – Guidance on Regulations: HSR 25 (3rd edition) HSE Books 2007 ISBN 978 0 7176 6228 9
- Using electrical storage batteries safely: INDG 139L (rev 1) HSE Books ISBN 978 0 7176 6199 2
- Electrical safety and you – a brief guide: INDG 231(rev 1) HSE Books 1996 (single copy free or priced packs of 15) ISBN 978 0 7176 6476 4, Web version; www.hse.gov.uk/pubns/indg231.pdf
- Maintaining portable electric equipment in low risk environments: INDG 236 HSE Books 1996 (single copies free or priced packs of 10) ISBN 978 0 7176 6508 2
- Avoidance of danger from overhead electric power lines: General series Guidance Note GS 6 (3rd edition) HSE Books 1997 ISBN 978 0 7176 1348 9
- Electrical test equipment for use by electricians: General series Guidance Note GS 38 HSE Books 1995 ISBN 978 0 7176 0845 4
- Electrical safety at places of entertainment: General series Guidance Note GS 50 HSE Books 1997 ISBN 978 0 7176 1387 8
- Electrical risks from steam/water pressure cleaners: Plant and machinery Guidance Note PM29 HSE books 1995 ISBN 978 0 7176 0813 3
- Selection and use of electrical hand lamps: Plant and machinery Guidance Note PM 38 HSE Books 1992 Web availability only; www.hse.gov.uk/pubns/guidance/pm38.pdf

- BS 6396:2008 Electrical Systems in office furniture and educational furniture

For general information and links to detailed specific guidance on all aspects of electrical safety, go to the HSE website – www.hse.gov.uk/electricity/index.htm

For a comprehensive list of commonly used electrical British Standards and approved codes of practice, go to www.hse.gov.uk/electricity/standards.htm

Many priced publications can be obtained free of charge from British Standards online and OHSIS databases, University library website (ATHENS password required).

HSE publications are available at www.hsebooks.co.uk and www.hse.gov.uk

Appendix A - Code of Practice – Part One; Electrical safety

1 Introduction

This Code of Practice (CoP) applies to all electrical systems and equipment with the exception of the University High Voltage 11000 volt (HV) distribution system.

The purpose of this CoP is to establish an overall framework to ensure the safe use of electrical equipment and installations within the University. The Code is aimed at providing a flexible framework to help departments comply with the Electricity at Work Regulations 1989, taking into account local conditions and specific risk assessments. Guidance on the Regulations can be found in the Health and Safety Executive's, (HSE), "Memorandum of Guidance on the Electricity at Work Regulations – Guidance on Regulations 1989 (HSR 25). Technical references and standards which provide detailed advice and information of relevance regarding specific electrical applications or installations and risk assessment, are listed in Appendix D

This CoP is approved by the University Council and forms part of the University health and safety policy. The likelihood and consequences of hazards associated with the use of electrical equipment and installations is high. On average electrical accidents are twenty to thirty times more liable to be fatal than other types of accidents at work.

2 Definitions

a) **CHARGED;**

Means that the item has acquired a charge either because it is live or because it has become charged by other means such as by static or induction charging, or has retained or regained a charge due to capacitance effects, even though it may be disconnected from the rest of the system.

b) **CIRCUIT CONDUCTOR;**

Means any conductor in a system which is intended to carry electric current in normal conditions, or to be energised in normal conditions, and includes a combined neutral and earth conductor, but does not include a conductor provided solely to perform a protective function by connection to earth or other reference point.

c) **NOMINATED COMPETENT PERSON**

A person, over the age of 18 years, recognised as having sufficient technical knowledge and/or experience to enable him to avoid DANGER and who has been appointed in writing to carry out specified duties, which may include the authority to issue, receive and cancel specified safety documents, e.g. permits to work.

d) **CONDUCTOR;**

Means a conductor of electrical energy. This means any material which is capable of conducting electricity and therefore includes both metals and all other conducting materials.

e) **DANGER;**

Means risk of injury. Within the context of this CoP, dangerous voltages are those exceeding 50V AC and 120V DC. Also included is the risk of injury from burns, arcing, fire or explosion arising from electrical energy.

f) **ELECTRICAL 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.

g) **INJURY;**

Means death or personal injury from electric shock, electric burn, electrical explosion or arcing, or from fire or explosion initiated by electrical energy, where any such death or injury is associated with the generation, provision, transmission, transformation, rectification, conversion, conduction, distribution, control, storage, measurement or use of electrical energy.

h) **LIVE;**

Means that the item in question is connected to a source of electricity in normal use and is at a voltage.

i) **PORTABLE (& transportable) electrical equipment;**

Portable (& transportable) electrical equipment includes any item of electrical equipment which if required, may be moved from place to place between periods of use, and is connected to a fixed electrical supply via a flexible lead and plug and socket arrangement. This covers a wide range of appliances, from a computer or printer, to sophisticated electronic instrumentation and domestic white goods.

j) **SUPERVISION:**

1) **IMMEDIATE SUPERVISION** - Supervision by a person having adequate technical knowledge or experience who is continuously available at the location where work or testing is in progress.

2) **PERSONAL SUPERVISION** - Supervision by a person having adequate technical knowledge or experience, who is at all times in the presence of the person being supervised

k) **SYSTEM;**

Means an electrical system in which all the electrical equipment is, or may be, electrically connected to a common source of electrical energy, and includes such sources and such equipment

3 Risk assessment, safe systems of work and training

3.1 A risk assessment should be completed prior to working upon electrical apparatus or systems and a safe system of work implemented accordingly. (See Appendix C of this policy and CoP). In particular, in respect of project work, e.g. the construction of electrical rigs. Electrical equipment must be included in activity-based and/or machinery risk assessments, where appropriate.

3.2 No person shall engage in live work unless;

(a) it is unreasonable in all the circumstances for equipment to be dead; and,

(b) it is reasonable in all the circumstances for him to be at work on or near the equipment while it is live; and,

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

- 3.3 Adequate supervisory arrangements should be established where there is a risk of injury with the degree of supervision dependent upon the level of risk, competence, training and experience of those carrying out the work.
- 3.4 If the initial risk assessment is that work upon live equipment is unavoidable, adequate precautions must be established. Such precautions could include working in pairs, the use of screens etc. if this would significantly contribute to reducing danger.
- 3.5 Persons authorised to work upon live electrical equipment, should be fully aware of the resuscitation techniques and emergency actions to be taken in the case of electrical shock. Guidance on first aid at work including basic procedures and training can be found in HSE leaflet “Basic advice on First Aid at work” (INDG 347) and guidance document; “First Aid at Work; The Health and Safety (First Aid) Regulations 1981 (L74). HSE also publish a poster for the workplace entitled “Electric shock – First Aid procedures”. This poster is aimed at employees in a number of industries: electricity supply; generation; transmission and utilisation; electrical testing; electrical applications. It gives basic advice on what to do in an emergency when someone has an electric shock. Further guidance and contact details for HSE Books can be found in Appendix D.
- 3.6 Loughborough University see no occasion where live working can be justified on the building or campus infrastructure. Therefore, this action is forbidden without explicit written instruction from the Duty Authorised Person

4 Installations

- 4.1 Fixed installations in buildings are the responsibility of FM up to the final point of use, i.e. socket outlet or in certain prescribed cases up to the distribution board or other isolation device.
- 4.2 Departments and sections are responsible for installations and equipment from the socket outlet, or in prescribed cases distribution board or isolating device. This includes; electrical equipment, power converters, generators, uninterruptable power supplies units that differ from the standard supply voltage & frequency that forms part of a Departments experiments, research and teaching practices. Any exceptions to this requirement shall be identified and defined in a formal exchange of letters between the Director of Facilities Services and respective Heads of Schools / Departments or Professional Services.
- 4.3 For normal use all conductors on apparatus should be correctly designed and installed to prevent danger.

5 Use of portable (& transportable) electrical equipment

- 5.1 For applications where portability is required, rechargeable equipment should be considered.
- 5.2 Alternatively, 110V supplied by a centre tapped to earth transformer should be utilised.

5.3 In cases whereby a process of selection or replacement, LV equipment is not available, or practicable in a particular set or circumstances, portable (and transportable) electrical tools should either be all insulated or of double insulated construction where practicable. (See Appendix B).

5.4 Where portable (& transportable) equipment with earthed metalwork is used it is required that portable (& transportable) or fixed 30mA residual current protection be provided and used, particularly in harsh environments.

6 Work in Laboratories

(All references in this paragraph also apply to certain specified workshops)

6.1 'Dangerous voltages' in laboratories can usually be defined as over 50V.

6.1.1 Where a source is such that it is impossible for it to supply more than one milliamp continuously it may be regarded as safe whatever the voltage. However, if the supply is exposed in conditions where there are dangers, e.g. rotating machinery, it should not be used.

6.2 Residual current protection

6.2.1 In all new laboratories where electrical or electronic apparatus is used, or when refurbishment occurs, or in existing high risk situations, Residual Current Devices (RCD's), must be installed unless the consequences of a sudden loss of electrical power is likely to be of comparable seriousness to the consequences of electric shock.

6.2.2 Whenever instrument repairs are carried out on site consideration should be given to the use of portable (& transportable) devices.

6.2.3 The sensitivity of RCD's should be set at 30mA. Any departure from this setting should be agreed in writing between Heads of Schools / Departments / Professional Services and the H&SS.

6.2.4 Portable RCD's should be tested by the user before use.

6.2.5 No practice should be allowed where absolute reliance is placed on a Residual Current Device.

6.3 Emergency stop buttons

6.3.1 In all new and refurbished laboratories and similar areas where high risk work is undertaken, isolation emergency buttons must be installed near doors and in convenient places in the laboratory so that all electrical supplies can be cut off in an emergency. These buttons can be made to operate the RCD and can be used for normal switching off at the end of working; in this way, the trip or device is tested regularly. Where danger or damage can arise from unexpected failures in electrical supply, buttons may be provided for emergency use only.

6.4 Second Person

Where a person is working with dangerous voltages, he must be accompanied by a second person, if this presence would significantly contribute to reducing danger. The second person must be capable of rendering the equipment safe and summoning help. Where help is not likely

to be immediately available, the second person must be trained in resuscitation. Live working is not endorsed by FM and only with written approval from the DAP can this be accepted.

6.5 Construction of temporary wiring and experimental rigs

'Rigs' and temporary wiring should be constructed to the relevant standard with exposure to dangerous voltages minimised as low as reasonably practicable, within the context of a risk assessment.

Standard items of equipment, such as mains operated instruments and power supplies, should be constructed, wired and maintained to the standard required for portable (& transportable) electrical equipment in general use.

Large metal structures should be earthed or insulated or dealt with in some other way which will ensure safety, if they come into contact with extraneous voltages.

6.6 Yellow/green earthing

Under no circumstances should the yellow-green colour code be used for anything other than safety earth wire.

Colour coded wires are an aid to following circuits and to help workers to avoid mistakes. Systematic colour coding should follow, so far as reasonably practicable, BS EN 60445:2010 "Basic and safety principles for man-machine interface, marking and identification – Identification of equipment terminals, conductor terminations and conductors". This will enable the colour coding to be understood by workers other than the constructor.

6.7 High current sources (batteries)

High current sources such as secondary batteries present special problems. Wherever possible they should be protected by fuses or circuit breakers as close as possible to the source. Battery terminals should be covered and insulated so that short circuits cannot be caused by dropped metal tools. It is recommended that rings should not be worn when working with unprotected high current sources.

6.8 Batteries

Rechargeable wet batteries must only be used in a well-ventilated area. During recharging an explosive mixture of Hydrogen and Oxygen is produced which can be easily ignited. Notices reading "Battery on charge" and "No Smoking" must be displayed in battery charging areas.

6.9 Test areas

6.9.1 Test areas and laboratories where exposed conductors are present must have access restricted to competent authorised staff only and should meet the requirements of HSE guidance notes GS 38; "Electrical test equipment for use by Electricians", and, HSG 85; "Electricity at Work – Safe working practices".

6.9.2 Test equipment must have insulated fused probes and be constructed to meet BS 7671:2008 Amendment 3 2015. Requirements for electrical installations. IET Wiring Regulations - 18th edition.

6.10 Undergraduate teaching

It is crucial that safety procedures for undergraduates working with electrical apparatus are established and maintained and this CoP endorses the adoption of the guidance produced by the HSE.

Appendix B - Code of practice – Part Two; Electrical installation, portable & transportable equipment test and inspection to include Portable Appliance Testing (PAT)

1 Frequency of inspection and testing

All systems shall be maintained so as to prevent, so far as is reasonably practicable, danger. The method and frequency of formal maintenance and the inspection and testing of such installations shall be determined by the level of risk and nature of installation

1.1 Electrical installations

The minimum frequency of test and inspection of electrical installations will be as shown in **Table 2** unless risk assessment or historical records justify a revised frequent testing regime.

Table 2

Type of Installation	Frequency of Inspection and Test
Services and Installations other than listed below Workshops and industrial installations in laboratories Temporary Experimental rigs and construction sites Roadways and access ways Halls of Residence (not including students personal equipment) Refectories and restaurants Emergency Lighting Fire Alarms	5 years 3 years 3 months 6 years 1 year visual 5 year test 1 year visual 5 year test as BS or Risk assessment as BS or Risk assessment

1.2 Portable and transportable electrical equipment

Schools / Departments / Professional Services are responsible for ensuring that portable and transportable electrical equipment is maintained in a safe condition. Low risk equipment may not require a Portable Appliance Test (PAT) and a visual inspection will suffice. There is considerable evidence to indicate that almost 95% of equipment defects can be detected by visual inspection. Furthermore, the defective components are most likely to be the plug and flexible cable. The types of checks and tests are outlined in **Table 4**.

1.2.1 Regular routine PAT of portable and transportable electrical equipment should be implemented in accordance with this Policy and CoP. The standard interval for testing portable and transportable electrical appliances is 12 months. However, Schools / Departments / Professional Services may decrease or increase this frequency in accordance with their own electrical safety risk assessment, (see Appendix C), and standards recommended by the HSE. Suggested initial intervals for checking portable electrical equipment are given in Table 3 below.

Table 3

Equipment /environment	User checks	Formal visual inspection	Combined inspection and testing
Battery operated (less than 40 volts)	No	No	No
Extra low voltage (less than 50 volts AC): telephone equipment, low voltage desk lights	No	No	No
Desk computers, VDU screens	No	Yes, 2-4 years	No. if double insulated, otherwise up to 5 years
Photocopiers, fax machines; Not handheld, rarely moved	No	Yes, 2-4 years	No if double insulated, otherwise up to 5 years
Double insulated (Class II) equipment: Not handheld. Moved occasionally, e.g. fans, table lamps	No	Yes, 2-4 years	No
Double insulated (Class II) equipment: Hand held, e.g. some floor cleaners, some kitchen equipment	Yes	Yes, 6 months-1 year	No
Earthed equipment (Class I) Electric kettles, some floor cleaners, some kitchen equipment and irons	Yes	Yes, 6 months – 1 year	Yes, 1-2 years
Cables (leads and plugs connected to the above) and mains voltage extension leads and battery charging equipment	Yes	Yes, 6 months - 4 years depending on the type of equipment it is connected to	Yes, 1 - 5 years depending on the type of equipment it is connected to

(Note; Portable Appliance testing can be arranged through Facilities Services, who have a contract with an external provider. Contact the Electrical Service Manager in FS for further details).

1.2.2 Portable (& transportable) electrical equipment brought in by students or staff, is the responsibility of the individual(s) concerned. Certain items of electrical equipment are prohibited in Residential Halls. If found, this equipment can be confiscated by the Hall Manager, members of the Warden team, Campus Services staff or the H&SS. PAT can be carried out on permitted equipment at the request of the student or member of staff. Any equipment found to be causing problems e.g. circuit tripping or damaged, can be tested and if found to be unsafe, removed.

1.2.3 Portable (& transportable) electrical appliances should, apart from specified low risk equipment, be subject to testing utilising a portable appliance tester. The use of a pass/fail tester is normally acceptable as a minimum requirement for checking the validity of the earth and insulation. In cases following repair, or where more sophisticated specific readings are required, the department may use a more comprehensive form of portable appliance tester capable of producing specific readings.

1.2.4 Multi-way plug adaptors, **(see picture below)**



Multi-way plug adaptors must not be used. Over loaded adaptors can cause overheating from excessive current load and the earth pins on the appliances plugged into them are also vulnerable to incomplete contact, which stops earth faults from blowing the circuit as designed. Where there are insufficient sockets: -

- individually fused extension leads are permitted,

Extension leads must not be coupled in series (“daisy chained”). **(See picture below.)** Where additional distribution of electrical power is found necessary, additional socket outlets should be requested through Facilities Services.



- Proprietary purpose designed, and manufactured desks leads can be used to comply with the current BS 6396 (**See picture below**)



1.2.5 Equipment operating at voltages less than 25 volts ac or 60 volts dc, can be excluded from test and inspection procedures, providing that the risk assessment shows there is no risk of injury from electric shock, electric burn, electrical explosion or arcing, or from fire or explosion initiated by electrical energy.

1.2.6 Before equipment is taken into service the competent person appointed to monitor its condition must enter equipment details on the appropriate register and record that a competent person has confirmed that the equipment is :-

- a) suitable for the intended service environment,
- b) free from defects and is correctly fused,
- c) equipped with a serviceable flexible lead, manufactured to the relevant standard.
- d) functioning correctly and has passed the relevant electrical tests.

1.2.7 User checks will be carried out by person(s) using the equipment. Periodic formal visual inspections and combined inspections and tests will be carried out by competent persons properly trained and appointed to do so.

The periodic inspection and testing of portable (& transportable) equipment must be carried out by person(s) competent to do the following:-

- (a) Avoid the dangers presented by the PAT and the equipment under test.
- (b) Securely isolate the equipment under test from the supply system and safeguard other persons who may be affected by the test.

- (c) Visually inspect and electrically test portable (& transportable) equipment and correctly interpret the results of the test and inspection.
- (d) Take the necessary action to withdraw defective equipment from service and initiate repairs or scrap it.
- (e) Record the results of the inspection and test.
- (f) Affix a sticker to the equipment to indicate pass/fail and next date of inspection.

The types of checks and tests, by whom they should be carried out and what they should include, are detailed in **Table 4** below. This is not an exhaustive list; however it represents a guide to what should be included. The results of these checks, inspections and tests should be recorded.

Table 4

Type of testing	Conducted by	To include
User checks	Person using equipment	Damage to cable sheath. Damage to plug. Inadequate joints, including taped joints in the cable. Damage to the external parts of the casing of the equipment. Evidence of overheating
Formal visual inspections	Competent person with School / Department / Support Service	Removing the plug and checking the fuse Checking the cord grip is effective Cable terminations are secure and correct
Combined inspection and test	Competent person with School / Department / Support Service	The correct polarity of supply cables. Correct fusing. Effective termination of cable and cores. That the equipment is suitable for its environment. Any loss of earth or insulation integrity. Earth continuity and insulation resistance

1.2.8 The competent persons appointed to monitor the equipment must instruct users of handheld or frequently moved equipment with flexible leads, to carry out the following pre-use checks on each day of use;

- Socket outlet - is there any sign of surface damage or overheating or missing cover screws?
- Plug – is there any evidence of a cracked case, loose or bent pins, missing cover screws, or cable sheath pulled from cable grip?
- Cable – is there damage to sheath other than light scuffing. There must be no taped joints.
- Equipment – is there damage to the casing or cover screws missing? Is there evidence of misuse, e.g. damage due to water ingress, heat or corrosion.

The departmental competent person responsible for monitoring the condition of the equipment should repeat the pre-use checks weekly for equipment used by students, and quarterly for other equipment. All defects should be reported, and the appropriate action taken.

1.2.9 Visual inspections will be carried out on equipment and associated flexible leads and plugs to confirm that;

- they are free from defects,
- they are fitted with a correctly wired and fused plug,
- cable grommets, where fitted, protect cable insulation and prevent significant movement or rotation of the cable,
- there are no exposed conductors live at voltages exceeding 25 volts ac or 60 volts dc that can deliver 5ma or more,
- where appropriate, it carries the Class II (no earth required) label,
- all control devices function correctly, and the equipment performs satisfactorily.

1.2.10 Electrical tests will be carried out on the following equipment and associated flexible leads and plugs;

- (a) Class I (requiring an earth) equipment.
- (b) Extension leads and extension lead hand lamps,
- (c) Any equipment including Class II identified at registration as likely to be used in a hostile or conductive environment,
- (d) Portable (& transportable) RCD's

1.2.11 Electrical tests will consist of the following;

For (a), (b) and (c) above;

- An earth continuity test. The maximum pass resistance should be 0.1 ohm or 0.5 ohm for equipment protected at 3 amps or less. The value of test current will be determined at registration. For electronic equipment it will be 0.1 Amps. For electrical equipment it will be 1.5 times the protective device rating of the equipment. Where test instruments deliver a 25-amp test current, care must be taken that such current does not damage equipment supply cables.
- An insulation test at twice the operating voltage. The minimum pass resistance should be 1meg ohms.
- Flash tests should not be used as a routine practice. Facilities Management can provide further advice.

For (d) above:

- Portable (& transportable) RCD's should be tested by using the test button provided and checked for tripping times and tripping current accuracy using a RCD test instrument.

1.2.12 Electrical tests may be carried out using portable (& transportable) appliance testers which conform to the current BS EN 61010-2-201, "Safety requirements for electrical equipment for measurement, control and laboratory use. Particular requirements for control equipment". All new equipment should comply with this or an equivalent standard. Equipment predating this standard is not necessarily unsafe. Portable Appliance Testers for departmental use can be of the simple 'pass-fail' type.

FS and some departments possessing the necessary expertise will keep one or more Portable Appliance Testers capable of applying all appliance standard tests including flash tests and giving measured results. Equipment that fails the simple pass-fail test will be subjected to diagnostic testing using such PAT's. Test equipment itself is portable (& transportable) equipment and subject to this CoP. PAT testing equipment should be calibrated in line with control measures identified by the risk assessment.

1.2.13 To prevent damage and / or injury during testing, safe arrangements must be made for the disconnection of equipment such as IT equipment, lasers and optical fibre systems.

1.2.14 Equipment which is rarely moved and is connected by permanent connection or industrial coupler and which has its flexible cable protected against damage due to tension or impact, may be treated as part of the fixed installation and therefore can be excluded from a PAT testing regime.

Equipment operating at voltages less than 25 V AC or 60 V DC can be excluded from test and inspection procedures, providing that the electrical risk assessment shows there is no risk from injury from arc, fire and / or explosion.

1.2.15 Heads of Schools / Departments / Professional Services are responsible for ensuring that inspection and test records are maintained. The results of inspection and test will be recorded in the equipment register, and a label indicating the next due date for inspection and test will be attached to the equipment. Where the equipment's flexible lead is wired into its supply terminals, the label should be affixed to the plug or on the cable adjacent to the plug.

The benefits of keeping records are;

- that it is a useful management tool for monitoring and reviewing the maintenance scheme;
- that it enables managers to demonstrate maintenance does take place, and,
- there is an inventory of portable and transportable electrical equipment which will identify any unauthorised equipment. However, this does not supersede any other existing inventory scheme being operated. Where records are stored on electronic systems it must be possible to extract a paper copy print out for presentation when requested.

Where equipment fails, it should be removed from service, repaired or disposed.

2. Safe systems of work

2.1 Work on University electrical services by Schools/Departments/Professional Services is not permitted. Such work is only to be carried out by, or through FM.

2.2 Work on portable or transportable electrical equipment belonging to Schools/Departments/Professional Services, including experimental rigs, is the responsibility of the relevant School/Department/Support Service.

2.2.1 All work must be done with the system securely isolated from its supply and all conductors discharged to earth potential, except when live diagnostic testing and the use of measuring instruments for carrying out minor adjustments is required.

Secure isolation will be achieved by the most convenient means, such as locking of isolators and labelling (Lock out tag out LOTO), that ensures:-

(a) that the system cannot be re-energised until the persons doing the work and their tools and equipment are withdrawn from the system, and

(b) all persons likely to be affected are informed that the system is to be re-energised.

Where risk assessments have identified other associated hazards, e.g. radiation, chemical, laser etc., precautions shall be taken in accordance with other relevant University Policies, CoP or guidance.

2.2.2 Work on electrical systems will be carried out by persons suitably trained and experienced to avoid injury from electricity.

2.2.3 Where testing, measurement and minor adjustment with the system live cannot be avoided, the following procedure must be observed:-

(a) The work must be done by persons competent to perform the specific task and, who meet the definition of “competent person” given in Section 2 of Appendix A of the policy, (“Definitions”).

(b) Unless live parts are protected to ingress protection standard I.P.2, (maximum access gap 12mm), a second competent person must be present who should be able to contribute to prevention of injury.

(c) Work must be limited to only those parts which need to be live.

(d) The work area must be safeguarded against unauthorised entry by barriers and warning notices.

(e) Proper use must be made of suitable insulating mats, screens, gloves, eye protection and insulated tools.

(f) Only approved test and measuring instruments will be used which are fitted with fused and shrouded leads and conform with the guidance given in the HSE’s Guidance Note; GS 38; – “Electrical test equipment for use by electricians”.

2.3 In addition to the requirements outlined in Appendix A; Code of Practice – Part One; Electrical Safety, the following will apply to work in test and repair workshops.

2.3.1 Test areas must be segregated from repair areas. Repairs and alterations must be done in the allocated repair area with the equipment securely isolated and discharged to earth potential.

2.3.2 Unauthorised persons must be denied access to the workshop unless accompanied by a competent person.

3. Training

3.1 Heads of Schools / Departments / Professional Services and all other persons with responsibilities under this guidance, (except students), must be familiar with their duties under

the Regulations and Section 3 of the University Electricity at Work policy. Familiarity with legal duties can be achieved by reference to the H&SS, it's website, published guidance, and other publications such as the University newsletter; "Health & Safety matters", e-bulletins and attending training courses and seminars, or by personal study. It should be noted that it is a legal requirement that managers and supervisors must be familiar with any risks associated with the use of equipment in their departments or sections.

3.2 Copies of statutory Instruments, codes of practice, guidance notes etc, referred to in this Policy and CoP, must be made available to all University employees having duties in respect of this guidance, should they request them.

3.3 Persons appointed to monitor portable (& transportable) electrical equipment must be competent. Any formal training given should be entered on the person's training and employment records.

3.4 All users of electrical equipment must be instructed in its safe use by a competent person. For equipment with no special risks, reading the manufacturer's instructions for use will be adequate.

3.5 Users of equipment that may contain or produce special risks must be formally trained by a competent person, to avoid danger.

3.6 Where people are at greater risk of electric shock, and therefore may require emergency resuscitation or treatment for electrical burns, the provision of specialised training for first aiders should be provided. The departmental electrical safety risk assessment and/or the first aid risk assessment will inform the decision on the number of first aiders to receive this additional training. (For further information on electrical first aid training courses contact the H&S department on 222181 or email; hse@lboro.ac.uk).

Appendix C - Guidance on completing an electrical risk assessment

The first stage in controlling risks from the use of electricity is to carry out a risk assessment in order to identify what needs to be done. When carrying out a risk assessment;

- Identify the hazards
- Decide who might be harmed and how
- Evaluate the risk arising from the hazards and decide whether existing precautions are adequate or whether more should be taken
- Record any significant findings. (It is recommended that the generic risk assessment form in the University policy guidance can be used to record electrical safety risk assessments).
- Review your assessment from time to time and revise it if necessary

Schools / Departments / Professional Services must conduct a risk assessment of all portable (& transportable) electrical equipment to determine the frequency of user checks, formal visual inspections and combined inspections and tests. Detailed information on the type of equipment to be tested, the type of check, test and /or inspection, and how often the test should be undertaken, is given in Tables 3 and 4 in Appendix B; “Code of Practice – Part two; Electrical installation & portable (& transportable) equipment test and inspection (including PAT testing)”.

The risk of injury from electricity is strongly linked to where and how it is used and so, risk assessments must take account of this. The risks are greatest in harsh conditions, for example;

- in wet surroundings – unsuitable equipment can easily become live and can make its surroundings live
- out of doors – equipment may not only become wet but may be at greater risk of damage.
- in cramped spaces with a lot of earthed metalwork, such as inside a tank or bin - if an electrical fault developed it could be very difficult to avoid a shock.

Some items of equipment can also involve greater risk than others. Extension leads are particularly liable to damage;

- to their plugs and sockets
- to their electrical connections, and,
- to the cable itself.

Other flexible leads, particularly those connected to equipment, which is moved a great deal, can suffer from similar problems.

As well as the nature of the environment and how equipment is used, there are a number of other factors that need to be considered when assessing the risk of injury arising from

working on, near or with electrical equipment. To help identify any precautions you need to take when testing electrical equipment, the following questions should be asked;

- Can the work be done with the equipment dead or energised at a safe voltage or current?
- Is it absolutely necessary for someone to be working on or near to equipment that is live at dangerous voltages or current levels?

- What is the maximum voltage during the work activity?
- Are testers and operatives competent? Are they adequately trained and knowledgeable to do the particular work and, ensure that they others are not put at risk?
- If testers and operatives are not considered fully competent, are they adequately supervised?
- What physical safeguards should be applied to the equipment under test to prevent injury e.g. the use of temporary or permanent screens?
- Is the test instrumentation of safe design? Has it been properly maintained and calibrated?
- Is it necessary to set up a permanent test area separate from the rest of the workplace, where equipment can be taken for testing? Is it necessary to set up a temporary test area around the equipment?
- Are the testers able to supervise the working area sufficiently and at all times to prevent danger to others?
- To what extent should testers be supervised or accompanied?
- If testers design, manufacture or use their own special test equipment, does it meet BS EN 61010-2-201:2013, "Safety requirements for electrical equipment for measurement, control and laboratory use. Particular requirements for control equipment"
- Safety requirements for electrical equipment for measurement, control and laboratory use. Particular requirements for control equipment
- Is there sufficient space around the equipment being tested, in order to do it in a safe manner
- Are others working nearby, competent to avoid danger if they need to approach the equipment? If not, how do you ensure they do not do so?
- Does the workbench or separate area require a warning to show that testing is in progress?
- Is there a need for additional emergency switching devices for use by other employees to reduce the degree of injury to testers? Can RCD's be used to provide supplementary protection?
- Is it possible to reduce the number of paths to earth to reduce the likelihood of shock e.g. insulating mats?
- Is it possible to use unreferenced supplies e.g. isolating transformers/batteries to reduce the likelihood of shock?

Appendix D - High Voltage (HV) Electricity System Safety Rules and Associated Safety Guidance

1. Introduction

- a. These Safety Rules are based on the Electricity Association Model Distribution Safety Rules. This ensures that employees work to recognised industry standards.
- b. The Safety Rules state the basic safety requirements for work on the Loughborough University HV Distribution System but are **NOT designed to cover any Departmental Experimentation or Generation**.
- c. Loughborough University is the “System Owner” and the DUTY AUTHORISED PERSON (DAP) is the “Document Holder”.
- d. These rules are designed to provide: -
 - i. Maximum protection to persons working on SYSTEMS, PLANT or APPARATUS to which they apply.
 - ii. A guide to safe working on or in the vicinity of HIGH VOLTAGE electrical systems.
 - iii. Controls and responsibilities for individuals operating on or working in the vicinity of HIGH VOLTAGE systems, plant and equipment.
- e. It is the responsibility of DAP, Senior Authorised Person and Authorised persons (DAP, SAP, AP) to be conversant with these rules before SWITCHING the distribution system. Note, the DAP may or may not be authorised to switch, depending on currency of approved training.

2. Basic Requirements

No person shall, other than the DAP, SAP or AP:

- a. Enter a substation without a PERMIT-TO-WORK.
- b. Touch insulation covering of a “LIVE” cable.
- c. Interfere with any item of electrical equipment without first having been given instructions in writing to do so by the DAP, SAP or AP.
- d. Disturb a “LIVE” cable.
- e. No person shall commence work until they have undertaken and have approved a Risk Assessment and Method Statement, fully understand their instructions and are conversant with the nature and extent of the work to be carried out. Under no circumstances shall the instructions be exceeded. The Risk Assessment and Method Statement should be submitted by the contractors before the HV PERMIT is issued and work starts. This may take the form of an approved switching schedule.
- f. Should any person consider they are unable to carry out the work safely, the matter must be referred to a higher authority, DAP, SAP or AP for a decision before continuing.

- g. No person shall enter a substation until instructed to do so by the DAP, SAP or AP following a job specific Risk Assessment, after all necessary safety precautions have been taken and a PERMIT-TO-WORK or approved switching schedule has been issued for that work.
- h. Smoking is prohibited in substations and within 3 metres of the building.
- i. The Person-in-Charge of the works will be a COMPETENT PERSON, or a person having a higher level of authority and competence, as defined in these rules.

3. General Provisions

Scope and application of these Safety Rules.

These rules apply to the following electrical systems owned by Loughborough University:

- a. All HV substations, PLANT and APPARATUS
- b. All HV distribution cables

4. Information, Instruction and Training

Arrangements shall be made by the DAP or SAP to ensure that all persons with access to the HV equipment are adequately informed of:

- a. Risks to their health and safety.
- b. Preventive and protective measures to be taken.
- c. Procedure in the event of serious or imminent DANGER. (Stop work, leave the area in a secure state (locked) and inform the DAP, SAP or AP immediately.)
- d. The risks arising from other activities in the workplace.
- e. Those with access to operate equipment are aware of the consequences of operations carried out.
- f. Other people who may be exposed to DANGER by the operations or works receive adequate information and where necessary instruction.
- g. The capabilities of PERSONS are taken into account by the DAP or SAP in allocating tasks.
- h. PERSONS are provided with adequate Health and Safety training and retraining, e.g. HV Safe SWITCHING and refresher courses at periods not exceeding 3 years.

5. Issue of Safety Rules

These rules shall be periodically reviewed by the DAP. The most up to date version will be available in the Duty Holder Electrical file on the FM shared drive. All newly appointed HV AP's

will be issued with a copy and drawings showing the HV Ring, substations and their locations on the Campus and Holywell Park. They will be inducted, and arrangements made to walk them through the substations.

6. Variation of Safety Rules

In exceptional or special circumstances these safety rules may be varied to such an extent as is necessary and APPROVED by the DAP or SAP. Approval must be based on being satisfied that safety requirements are satisfied in another way. These variations must be documented and held as a permanent record.

7. Objections on Safety Grounds

When any person has concerns regarding the operation or work on the system, they shall refer them to the person issuing instructions or to a higher authority, DAP or SAP. The matter shall be investigated and reviewed before proceeding.

8. Treatment for Electric Shock

All persons who may be in charge of or in control of any operation or work on the system shall be trained and conversant with the treatment for electric shock. An Emergency First Aid (HSE) course should be completed every 3 years, emphasising electrical burns & injuries.

9. Definitions

Within these rules, where reference is made to a definition below it will appear in CAPITALS within the text.

- APPARATUS – any equipment or switches on the HV system.
- AUTHORISED PERSON – (AP) – a COMPETENT PERSON
Over the age of 18 years, who has been appointed in writing by the DAP to carry out specified duties, which may include, subject to the permission of the DAP or SAP, the issuing and cancelling of SAFETY DOCUMENTS, PERMITS and LIVE SWITCHING activities.
- CAUTION NOTICE – a notice conveying a warning against interference.
- CIRCUIT MAIN EARTH – means the earthing equipment applied before the issue of, and at a position recorded in, a SAFETY DOCUMENT.
- COMPETENT PERSON – a person over the age of 18 years, who has the relevant technical knowledge and experience to prevent DANGER while carrying out specific duties on or adjacent to the HV system who may be nominated to receive and cancel SAFETY DOCUMENTS, with the permission of the SAP or AP. The Competent person may also be the DAP, SAP or AP.
- CONTROL ENGINEER will be the DAP or SAP or AP who will exercise the function and control SWITCHING of the HV system. The SAP shall have sole authority for any SWITCHING changes on the University HV system at any one time.

- DANGER – a risk to health, bodily injury or equipment.
- DANGER NOTICE – a notice reading “DANGER”, warning of electrical or physical DANGER.
- DEAD – means an electrical potential at or about zero voltage and disconnected from any LIVE SYSTEM.
- DOCUMENT OWNER – The DOCUMENT OWNER is the DAP appointed to be responsible for the application of these safety rules.
- DUTY AUTHORISED PERSON (DAP) – someone who has been appointed in writing by the Director of Facilities Management to carry out specified duties, including the issue and cancellation of SAFETY DOCUMENTS – HV PERMITS.
- EARTH – means the conductive mass of the earth.
- EARTHED – means that the system or APPARATUS being worked upon is connected to EARTH through switchgear or by adequately rated EARTH leads.
- HIGH VOLTAGE (HV) – a voltage exceeding 1000 volts AC or 1500 volts DC.
- IMMEDIATE SUPERVISION – means supervision by a person, having adequate technical knowledge and experience, who is continuously available at the location where work or testing is in progress.
- ISOLATED – means disconnected from associated PLANT, APPARATUS and conductors by a SWITCHING device in the OPEN TO OFF position, or by adequate physical separation, or sufficient gap.
- LOW VOLTAGE (LV) - a voltage NOT exceeding 1000 volts.
- LIVE – means electrically charged.
- OPEN TO OFF – means electrically disconnected from the HV distribution system.
- PERMIT-TO-TEST – specifies the HIGH VOLTAGE APPARATUS which has been made safe for testing to proceed and the conditions under which the testing is to be carried out.
- PERMIT-TO-WORK – specifies the HIGH VOLTAGE APPARATUS which has been made safe to work on, the safety precautions applied to ensure continued safety and the work which is to be carried out.
- PERSONAL SUPERVISION – means supervision by a person having adequate technical knowledge and experience, who is at all times in the presence of the person being supervised.
- PLANT – any equipment or switches connected to the HV system.

- SAFETY DOCUMENT – a HV PERMIT TO WORK SWITCHING SCHEDULE OR SANCTION TO/TEST identifying the person who the PERMIT is issued to and defining the scope and limitations of the work.
- SAFETY LOCK – a lock that has a unique key, being different from all other standard locks used on the system.
- SCREENED – barrier off to prevent contact with LIVE conductors.
- SENIOR AUTHORISED ENGINEER (SAP) – someone who has been appointed in writing by the DUTY AUTHORISED PERSON to carry out specified duties, including the issue and cancellation of SAFETY DOCUMENTS – HV PERMITS.
- SWITCHING – the operation of circuit breakers, isolators, dis-connectors, fuses or other methods of making or breaking an electrical circuit and/or the application and removal of CIRCUIT MAIN EARTHS.
- SWITCHING SCHEDULE – a record of SWITCHING carried out on the HV system. It should record the location, circuit, operation, lock numbers used (if applicable) the time of SWITCHING, who is SWITCHING and the HV PERMIT number it refers to.

10. General Precautions

a. General Safety

- In addition to the requirements specified in these Safety Rules the safety of all persons at work shall be achieved by maintaining General Safety in the vicinity of the workplace.
- The COMPETENT PERSON must ensure that arrangements are maintained to ensure that other work areas are not adversely affected by the activities for which he is responsible.

b. Access to and Work in Substations

- Only COMPETENT PERSONS will be permitted to access substations.
- Persons not classified as COMPETENT PERSONS may gain access or work on the system provided they are under the SUPERVISION of, at minimum, a COMPETENT PERSON and issued with a PERMIT-TO-WORK (access).
- Access doors and gates shall normally be kept locked. Keys are to be issued only by the DAP, SAP or AP.

c. Access to HIGH VOLTAGE APPARATUS and Conductors

- Barriers, doors or gates preventing access to LIVE equipment shall be normally kept locked.
- Keys shall be accessible only by the SAP, AP or DAP.
- Access and Work in Fire Protected Areas – CO2 suppression system. Before access is given to or work is undertaken in any enclosure protected by automatic fire extinguishing equipment:

- The automatic control shall be rendered inoperative and left on “hand control” or by use of the “locking pegs”.
- The precautions taken shall be recorded on any SAFETY DOCUMENT or written instruction issued, including conditions when the automatic control may be temporarily restored.
- The automatic control shall be restored immediately after PERSONS engaged on work activities have been withdrawn from the protected enclosure or at the end of the working day.

11. HIGH VOLTAGE SWITCHING

- a. HIGH VOLTAGE SWITCHING shall only be carried out by the DAP, SAP or AP who will become the Control Engineer.
- b. It is forbidden to undertake SWITCHING operations by signal or prearranged understanding after an agreed time interval.
- c. Any concerns over SWITCHING, or where switchgear shows signs of distress, must be communicated with the CONTROL ENGINEER who will investigate before continuing.

12. Records

- a. Verbal SWITCHING instructions (phone messages) shall be recorded and repeated back to the sender (CONTROL ENGINEER), to ensure that it has been accurately received.
- b. The CONTROL ENGINEER carrying out the SWITCHING on the HV system shall ensure that a record is made of the particulars on the SWITCHING SCHEDULE and the mimic panel is updated.

13. Use of Voltage Testing Devices

Where approved voltage testing devices are used, they shall be tested immediately before and after use, on an approved tester, as a check on functionality and calibrated annually.

14. Safety Precautions For Work On or Near HIGH VOLTAGE Systems

- a. General Requirements:
Safe access to conductors can only be achieved after the following steps have been completed. The section of the system to which access is required must be: -
 - DEAD
 - ISOLATED, and all practical steps should be taken to lock off from all points of supply, including voltage transformers, auxiliary transformers, common neutral earthing equipment and other sources of supply from which the section of the system can be made LIVE.
 - CAUTION NOTICES must be fixed at all points of isolation.
 - EARTHED at all points of disconnection of HIGH VOLTAGE supply.

- SCREENED where necessary to prevent DANGER from other LIVE parts of the system.
 - DANGER NOTICES to be attached to adjacent LIVE equipment.
 - IDENTIFIED at the point of work.
 - RELEASED for work by issue of appropriate SAFETY DOCUMENT, PERMIT-TO-WORK/TEST, which shall not be issued unless the recipient is fully conversant with the part of the system to be worked on and the nature and extent of the work to be done.
 - Where the design of APPARATUS inhibits compliance with the above steps, the work will be carried out under instruction and agreement of the SAP. The instructions shall be documented in writing
- b. Isolation of APPARATUS and Conductors:
- Isolation and re-connection can only be completed with the authority of the CONTROL ENGINEER.
 - Dedicated SAFETY LOCKS shall be used to lock open all switchgear at points of isolation.
 - Keys shall be kept in a key safe or in the possession of the CONTROL ENGINEER.
 - FUSES, LINKS (and carriers) that control circuits to be worked on shall be removed and kept in the custody of the person issuing the SAFETY DOCUMENT, PERMIT-TO-WORK.
 - CAUTION NOTICES shall be fixed at all points of isolation.
- c. Earthing:
- Where practical, earthing shall be provided by use of a circuit breaker or earthing switch.
 - The trip feature shall normally be rendered inoperative before closing. This renders the switch inoperative whilst it remains a CIRCUIT MAIN EARTH.
 - After closing the breaker or switch it shall be locked in the EARTH position.
 - CIRCUIT MAIN EARTHS can only be applied or removed with the authority of the CONTROL ENGINEER, who shall record the time of application and removal.
 - CIRCUIT MAIN EARTHS shall be recorded on the SAFETY DOCUMENT, PERMIT-TO-WORK.
- d. Authority to issue a PERMIT-TO-WORK:
- Before any work can commence on the HIGH VOLTAGE system a PERMIT-TO- WORK must be issued.

- A PERMIT-TO-WORK can only be issued by the DAP, SAP AP., who will then act as the CONTROL ENGINEER.
- Procedure for Issue and Receipt: -
 - A PERMIT-TO-WORK can only be received by a COMPETENT PERSON in charge of the work who shall retain a copy of the PERMIT in their possession.
 - The PERMIT-TO-WORK will be explained by the issuer and the contents read back by the COMPETENT PERSON, who must confirm understanding of the PERMIT, the nature and extent of the work to be done before signing its receipt.
 - Where there is more than one working party, each working party must have a separate PERMIT. The PERMIT-TO-WORK should be cross-referenced.
- Procedure for Clearance and Cancellation: -
 - The recipient shall sign the PERMIT to clear it and hand it to the DAP, SAP or AP, whoever is the CONTROL ENGINEER, indicating that the work is “complete” or “incomplete” and that all gear and tools “have” or “have not” been removed.
 - The CONTROL ENGINEER shall cancel the PERMIT.
 - CIRCUIT MAIN EARTHS shall be removed only when all PERMITS-TO-WORK associated with the EARTHS have been cancelled.
- e. Authority to issue PERMIT-TO-TEST:
 - Before any testing can commence on the HIGH VOLTAGE system, a PERMIT-TO- TEST must be issued.
 - A PERMIT-TO-TEST can only be issued by the DAP or a SAP, being the CONTROL ENGINEER.
 - Procedure for Issue and Receipt: -
 - A PERMIT-TO-TEST can only be received by a COMPETENT PERSON who shall retain a copy of the PERMIT-TO-TEST in their possession at all times during testing.
 - It will be explained to the COMPETENT PERSON receiving the PERMIT-TO-TEST, who after reading the contents back to the issuer, must confirm understanding of the PERMIT-TO-TEST, the nature and extent of the testing to be carried out before signing its receipt.
 - Procedure for Clearance and Cancellation: -
 - The recipient shall sign the document to clear it and hand it to the CONTROL ENGINEER indicating that testing is “complete” or “incomplete”, all equipment “has” or “has not” been removed and the operational state of the APPARATUS.
 - The CONTROL ENGINEER shall cancel it.

15. Procedures for Work on Particular Items of PLANT, APPARATUS and Conductors

a. General Requirements – zone of work:

- When, in order to work on a particular item of PLANT or APPARATUS, a section of the system larger than the “zone of work” is ISOLATED and EARTHED (as in the case of a Ring Main Unit being maintained) the Safety Rule Requirements for PERSONAL SUPERVISION may be waived by the CONTROL ENGINEER, provided that it is for the specified work:-
 - Before the waiver the normal requirements should be applied in full.
 - All HIGH VOLTAGE APPARATUS within the “zone of work” are connected to CIRCUIT MAIN EARTHINGS at the time when the specified APPARATUS is released for work or testing by the issue of a SAFETY DOCUMENT, PERMIT-TO-WORK.
 - The CONTROL ENGINEER, shall at the time of issue of the SAFETY DOCUMENT demonstrate to the recipient that the APPARATUS, CONDUCTOR(S) are DEAD.
 - In these circumstances the COMPETENT PERSON receiving the SAFETY DOCUMENT may, in the course of work or testing, disconnect from the CIRCUIT MAIN EARTHINGS, as required, any APPARATUS within the “zone of work”.
 - The APPARATUS and CONDUCTORS shall be re-connected to the CIRCUIT MAIN EARTHINGS before the SAFETY DOCUMENT is cleared.
 - Precautions shall be taken to prevent DANGER from potential differences arising from remote EARTH points by bonding and earthing at a point as near as possible to the point of work.

b. Work on Ring Main Equipment when an LV system back-feed is available:

- When work is to be carried out on HIGH VOLTAGE contacts or connections of Ring Main Equipment, where there is a known or potential back-feed to the substation, the LOW VOLTAGE switch or links shall be ISOLATED, SCREENED, locked where possible and a CAUTION NOTICE applied.
- Where facilities exist to lock open switches or secure LV control panels a SAFETY LOCK and a CAUTION NOTICE shall be applied.
- The remote ends of all HIGH VOLTAGE in-feeds must be ISOLATED, SAFETY LOCKED, and CAUTION NOTICES applied and EARTHED.
- A PERMIT-TO-WORK must be issued for work on the Ring Main Equipment.

c. Withdrawable APPARATUS:

- All spout shutters not required to be opened for immediate work or operation shall be locked shut, if not otherwise made inaccessible.
- Withdrawn APPARATUS shall be discharged to EARTH but need not remain connected to EARTH.

- Work on withdrawn APPARATUS that remains within the immediate area shall be completed under a PERMIT-TO-WORK.

d. Busbar Spouts, Busbars and Busbar Connections of Multi-panel Switchboards:
ISOLATION - When work is carried out on the above, isolation shall be carried out as follows:

- The section on which work is to be carried out shall be ISOLATED from all points from which it can be made LIVE.
- Isolation arrangements shall be locked, and CAUTION NOTICES applied.
- Where practicable, the shutters of LIVE spouts shall be locked shut.
- CAUTION NOTICES shall be attached, at all points where the Busbar can be made LIVE.
- DANGER NOTICES shall be attached on adjacent LIVE APPARATUS.
- EARTHING – where practicable, the section of busbar will be verified as DEAD by use of a testing device, typically on the panel where the CIRCUIT MAIN EARTH is to be applied.
- The CIRCUIT MAIN EARTH is to be applied at a panel other than that at which work is to take place, on the ISOLATED section of busbars.

WORK:

- The CONTROL ENGINEER, shall satisfy himself that the recipient of the PERMIT-TO-WORK is aware of the location of adjacent LIVE circuits before issuing the PERMIT.
- Work on busbar spouts will be carried out under the PERSONAL SUPERVISION of the CONTROL ENGINEER. This will include: -
 - Identifying spout to be worked on.
 - Provide access by removing shutter locks and
 - Proving spout is NOT LIVE using a voltage testing device.
- Work on busbars or busbar connections shall be completed as follows: -
 - Access shall be identified by the CONTROL ENGINEER.
 - Access shall be made by the removal of appropriate cover plates under the PERSONAL SUPERVISION of the CONTROL ENGINEER, where practicable each busbar or connection shall be proved DEAD by the use of a voltage testing device.
 - The CONTROL ENGINEER, shall remain on site until he is satisfied that no further access is required to complete the work.

e. Feeder Spouts and Connections, Voltage Transformer Spouts and Connections and Single Panel Busbar Spouts and Connections.
ISOLATION - When work is carried out on the above, isolation shall be carried out as follows:

- The spouts or connections on which work is to be carried out shall be ISOLATED from all points from which it can be made LIVE.
- Isolation arrangements shall be locked.
- The shutters of LIVE spouts shall be locked shut.
- CAUTION NOTICES shall be attached, at all points where the circuit can be made LIVE.
- DANGER NOTICES shall be attached where applicable on adjacent LIVE APPARATUS.
- EARTHING – where practicable, the spout contacts or connections shall be verified as DEAD by use of a voltage testing device, typically on the panel where the CIRCUIT MAIN EARTH is to be applied.
- The circuit shall be EARTHED at the point of work and, where reasonably practicable, at all points of isolation.

WORK:

- The CONTROL ENGINEER shall satisfy themselves that the recipient of the PERMIT-TO-WORK is aware of the location of adjacent LIVE circuits before issuing the PERMIT. “DANGER Electric Shock Risk” sign.
- Work on the feeder, voltage transformer or busbar spouts on a single panel unit will be carried out under the PERSONAL SUPERVISION of the CONTROL ENGINEER.
- This will include: -
 - Identifying the spout to be worked on.
 - Provide access by removing shutter locks.
 - Where necessary the CIRCUIT MAIN EARTH may be removed to provide access and
 - Prove each spout is DEAD using a voltage-testing device.
 - No other work shall be carried out on the circuit whilst EARTHS are disconnected.
- Work on feeder or voltage transformer connections and single panel busbar or connections shall be completed as follows: -
 - Access shall be identified by the CONTROL ENGINEER.
 - Access shall be made by the removal of appropriate cover plates under the SUPERVISION of the recipient of the PERMIT-TO-WORK with the permission of the CONTROL ENGINEER.
 - The CONTROL ENGINEER shall remain on site until he is satisfied that no further access is required to complete the work.
 - The CONTROL ENGINEER shall take appropriate action to prove that each connection or busbar in the work area is DEAD by using a voltage testing device.

f. Transformers

ISOLATION

- When work is to be carried out on the connections to, or the windings of, a transformer, the switchgear or fuse gear controlling all windings shall be opened, or the windings or connections shall be ISOLATED by other means from LIVE CONDUCTORS.
- Additionally, to prevent the possibility of the transformer being made LIVE by back-feed, all LOW VOLTAGE fuses or links on associated voltage or auxiliary transformers shall be withdrawn and, where practical, the voltage and auxiliary transformers shall be ISOLATED.
- When work is to be carried out on a HIGH VOLTAGE or LOW VOLTAGE transformer and the LOW VOLTAGE windings of the transformer are controlled by a switch or isolator, the switch or isolator shall be secured open and LOCKED OFF. In other cases, arrangements shall be made to ensure that the LOW VOLTAGE windings are ISOLATED from all sources of LOW VOLTAGE supply.
- The transformer shall be ISOLATED from all common neutral earthing equipment from which it may become LIVE.
- Before any withdrawable voltage transformer is ISOLATED, or reconnected, the associated HIGH VOLTAGE connections shall, where reasonably practical, be made DEAD.
- If it is suspected that the voltage transformer is faulty, the associated busbars or feeder connections shall be made DEAD before it is ISOLATED.
- CAUTION NOTICES shall be attached at all points of isolation, including those of LOW VOLTAGE.

EARTHING

- The transformer shall be EARTHED at all points of isolation from HIGH VOLTAGE supply.

WORK

- The CONTROL ENGINEER shall identify the transformer to be worked on at the point of work before issuing the SAFETY DOCUMENT.

g. HIGH VOLTAGE Cables

- Conductors must be DEAD, ISOLATED and EARTHED before the insulation can be interfered with.
- Where a PERMIT-TO-WORK has been issued to the COMPETENT PERSON the recipient shall spike the cable before starting work.
- Spiking may be omitted when the cable can visually be traced along its entire length from the point of work back to an earthed switch.

- The CONTROL ENGINEER shall identify and spike other cables at LU when applicable.
- The DAP will be informed before and after any cable is spiked.
- Precautions shall be taken to prevent DANGER from induced or sheath voltage.
- It is recommended that cable spiking is included in the work package for the external contract provider. Where this is not possible the LU gun shall be used subject to the following conditions
 - a. The gun is in a safe and usable condition and has been serviced within the last 12 months
 - b. The cartridges are GREEN in strength and within their expiry date
 - c. Post use, the spiking gun should be serviced

16. Safety Precautions for Testing of HIGH VOLTAGE APPARATUS

- a. Testing under a PERMIT-TO-TEST:
 - APPARATUS cannot be connected to the system until it has passed the appropriate test.
 - Connection can only be made with the sanction of the CONTROL ENGINEER.
- b. The recipient of the PERMIT-TO-TEST shall:
 - Be responsible for co-ordinating all testing.
 - Ensure that the APPARATUS, test leads and test equipment are suitably protected to prevent DANGER.
 - Ensure that “DANGER HIGH VOLTAGE Testing” notices are suitably displayed and discharge all cables and capacitors before and after the application of test voltages.
- c. The recipient has the authority to:
 - Remove and replace EARTHS to complete testing without the further reference to the CONTROL ENGINEER.
 - Make LIVE from a testing supply.
 - Where reasonably practicable, CIRCUIT MAIN EARTHS shall be replaced before cancellation of the PERMIT-TO-TEST.

17. Responsibilities of Person

- a. General:
 - All persons concerned with work on or in the vicinity of HV APPARATUS or PLANT to which these safety rules apply have a duty to comply with these HV rules.

- Responsibilities may be tailored to the individual provided they are documented in the individuals' authorisation.
- b. COMPETENT PERSONS may:
- Be nominated to be responsible for a working party.
 - Receive and retain a PERMIT-TO-WORK confirming they are fully conversant with the nature and extent of the work to be carried out.
 - Provide IMMEDIATE or PERSONAL SUPERVISION as required.
 - Implement all necessary measures to establish general safety.
 - Give authority for work under the SAFETY DOCUMENT they hold.
 - Clear SAFETY DOCUMENTS ensuring that all persons are aware that the SAFETY DOCUMENT has been withdrawn and all tools and equipment removed.
- c. The AP may in addition to the responsibilities of a COMPETENT PERSON:
- Be authorised for SWITCHING on the SYSTEM.
 - Be authorised to issue a PERMIT-TO-TEST.
 - Be authorised to issue and cancel a PERMIT-TO-WORK as the CONTROL ENGINEER.
 - Be authorised to identify and spike cables with the permission of the CONTROL ENGINEER.
- d. The SAP may, in addition to the responsibilities of an AP:
- Issue and cancel a PERMIT-TO-WORK or PERMIT-TO-TEST ensuring that the recipient fully understands the nature and extent of the work or testing to be done.
 - Provide IMMEDIATE or PERSONAL SUPERVISION on work specified as requiring a DAP.
 - Take on the responsibilities of a CONTROL ENGINEER for specified sections of a system.
- e. The CONTROL ENGINEER has responsibility for and authority to:
- Release APPARATUS or PLANT from service.
 - Give authority for all HIGH VOLTAGE SWITCHING.
 - Give authority for the issue of and acknowledge cancellation of SAFETY DOCUMENTS.

- Maintain a written record of all operations and the issue and cancellation of SAFETY DOCUMENTS on the system.

18. Access to Substations – General Safety Requirements

Substation Keys are strictly controlled and must be signed for by a competent person

- BEFORE YOU ENTER - Unlock and open substation door.
- STOP
- SMELL for BURNING, GAS, OZONE
- LISTEN for a CRACKLING or HISSING sound (it is normal for transformers to hum or buzz)
- Use your torch
- Check the access, i.e. is there a step down?
- Find the light switch and switch on
- LOOK – Is the access clear and unobstructed? Any open trenches in floor?
- Enter substation
- CHECK – Is there an automatic fire protection system (CO₂) installed. If so, refer to section 10.c.

19. Switchgear Containing SF₆

SF₆ switchgear shall not be used as a point of isolation, or operated live where

- Where no gauge is fitted, and no remote or local alarms or indications are fitted so the gas pressure cannot be confirmed
- it is found that the gas pressure is outside the operating range

Should a gas leak occur, the integrity of the SF₆ to act as an insulant or arc quenching medium is reduced. If the gas pressure falls below the safe operating level the gauge will indicate RED.

- When the pressure drops to below the safe operating pressure (the zone often marked in red) the switchgear must not be operated Live.
- The DAP or SAP must be informed immediately, and they must visit the site to inspect and report on the condition of the switchgear.
- arrange for the apparatus to be isolated and, if appropriate, topped up as soon as is reasonably practicable
- Ventilate the substation including all cable trenches and duct work

20. Access and work in Fire Protected Areas

- a. Request permission and seek approval by a 'limitation of Access' permit to enter the area
- b. Request the Automatic Fire suppression system is isolated and seek written confirmation this has been completed
- c. KEEP CLEAR OF HIGH VOLTAGE SWITCHGEAR, TRANSFORMERS AND LOW VOLTAGE SWITCHGEAR. DO NOT TOUCH ANY EQUIPMENT OTHER THAN YOU HAVE BEEN INSTRUCTED TO DO.
- d. Carry out work
- e. Leave substation, switch off light
- f. LOCK THE DOOR AND CHECK IT IS SECURE. IF YOU NOTICE ANY ABNORMALITIES, REPORT THEM TO THE SAP or AP.
- g. Request the limitation of Access is cancelled and the Fire suppression reactivated

Approved Switching Schedule (Example)



HIGH VOLTAGE SWITCHING SCHEDULE

PROPOSED CHANGE: Isolation of Substation 10 for HV Maintenance
Date: 6th July 2019

Prepared By: Adam Slater

Approved By: David Howell 4th June 2019
Date:

Date	Item No	Location	Circuit/Apparatus	Operation	Time Inst	Time Comp	Lock No	Operator
	1	SS 19	OS 35	NOP Close to ON (Making Ring Parallel)				
	2	SS 10 LV <u>Switchroom</u>	LV Switch	Open to Off/LOCK & POIN				
	3	SS 23	OS 48	Open to Off/LOCK & POIN				
	4	SS 9	OS 18	Open to Off/LOCK & POIN				
	5	SS 9	OS 18	Close to Earth/LOCK & CME Notice				
	6	SS 23	OS 48	Close to Earth/LOCK & CME Notice				
	7	SS 10		ISSUE PERMIT TO WORK				
	8	SS 10		CANCEL PERMIT TO WORK				
	9	SS 23	OS 48	Remove Lock & CME Notice/Open from Earth to OFF				
	10	SS 9	OS 18	Remove Lock & CME Notice/Open from Earth to OFF				
	11	SS 9	OS 18	Remove Lock & POIN/Close to ON				



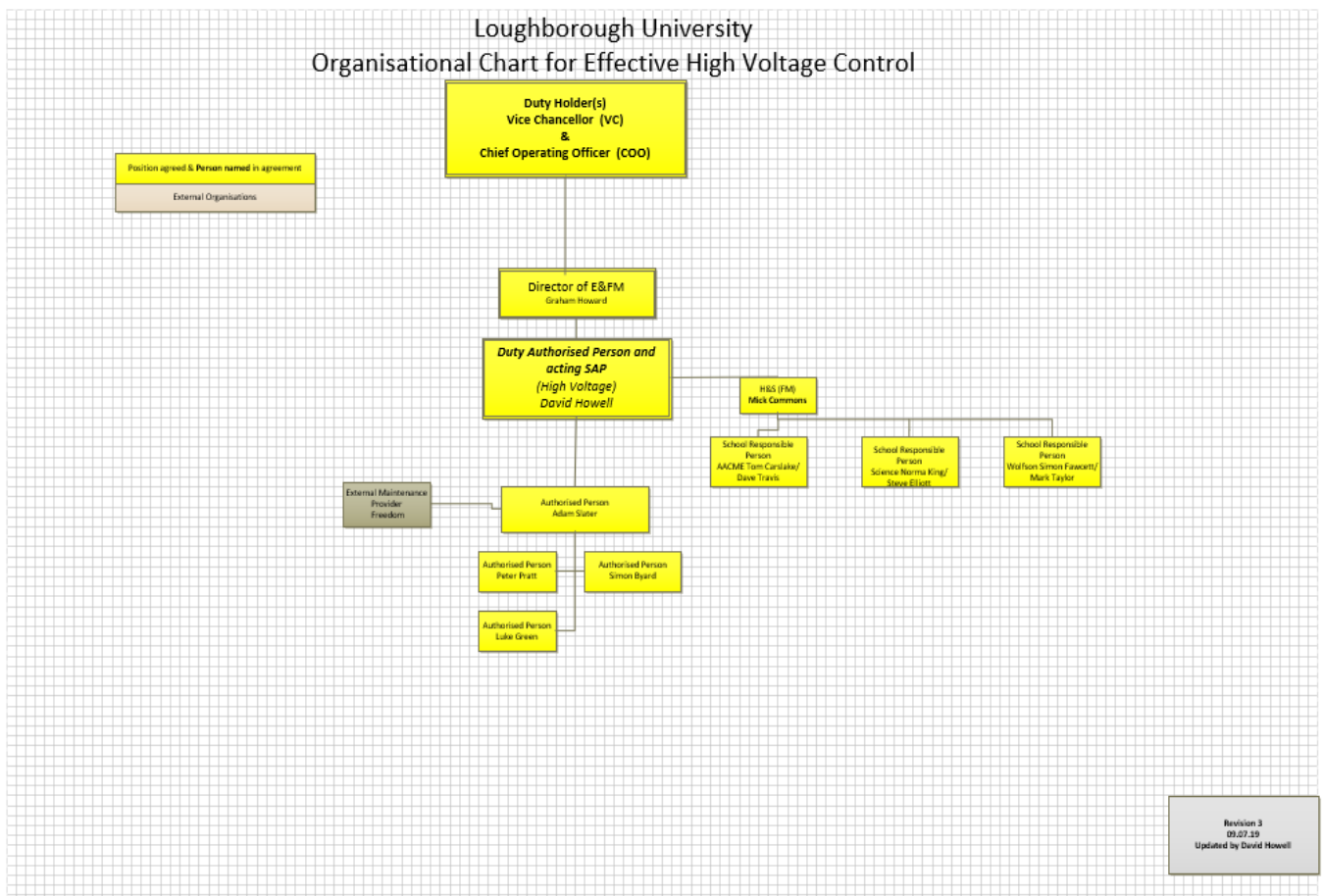
Page 2



Date	Item No	Location	Circuit/Apparatus	Operation	Time Inst	Time Comp	CME No	Operator
	12	SS 23	OS 48	Remove Lock & POIN/Close to ON				
	13	SS 10 LV <u>Switchroom</u>	LV Switch	Close to ON				
	14	SS 19	OS 35	Open to OFF (Breaking Ring Parallel) Restoring NOP				

Approved abbreviations are accepted in complying the switching schedule in accordance with the standard HV training

High Voltage Organisational Chart



Appendix E - Low Voltage (LV) Electricity System Safety Rules and Associated Safety Guidance

1. Introduction

- a. These Safety Rules are based on the Electricity Association Model Distribution Safety Rules and established safety guidelines common to similar institutions. This ensures that employees work to recognised industry standards.
- b. The Safety Rules state the basic safety requirements for work on the Loughborough University LOW VOLTAGE (LV) Distribution System managed by FM, but NOT to any Departmental experimentation or generation. (NB Loughborough University is the “System Owner” and the DUTY AUTHORISED PERSON (DAP) is the “Document Holder”.)
- c. An AUTHORISED PERSON is also referred to as AP.
- d. These rules are designed to provide:
 - Maximum protection to persons working on LOW VOLTAGE equipment, plant and apparatus to which they apply.
 - A guide to safe working on or in the vicinity of LOW VOLTAGE electrical systems.
 - Set out the responsibilities and control systems for individuals operating on or working in the vicinity of LOW VOLTAGE plant and equipment.
- e. It is the responsibility of line managers and supervisors to give details to their staff and individuals, so they are conversant with these rules before operating equipment on the LV distribution system.

2. General

All persons who operate or work on the LOW VOLTAGE electrical equipment and systems of Loughborough University have a duty to:

- a. Comply with all FM Safety Rules, Codes of Practice and Risk Assessment requirements as required by Loughborough University in particular as detailed in the University Health and Safety Policy “Electricity at Work Policy and Code of Practice.
- b. Comply with the legal obligations of statutory regulations governing the work which they carry out, the Health and Safety at Work Act 1974 and regulations pertinent to it, “The Electricity at Work Regulations 1989” and the current IEE Wiring Regulations BS 7671.
- c. Carry out their duties and work so as to prevent harm or INJURY to themselves and DANGER to persons working with them, students, contractors, self-employed persons and the general public.

3. Objections to Working Arrangements and Conditions

When any person has concerns regarding the operation of or work upon the LV system, they shall refer them to the person issuing the instructions, their supervisor, line manager, in the first

instance, or to a higher authority. The matter shall be investigated and reviewed before proceeding.

4. Accidents, Incidents and Near Misses

- a. All employees must report accidents, which cause INJURY, to their supervisor as soon as possible after the accident has occurred. All injuries, which occur at work, must be recorded on the FM (University) Accident Reporting system.
- b. All employees must report “near miss” incidents, where an occurrence may have created a hazard but where the occurrence did not cause INJURY.

5. Treatment for Electric Shock

All persons who may be involved with the operation or work on the LV system shall be conversant with the treatment for electric shock and be suitably trained to administer first aid assistance.

6. Definitions

Within these rules where reference is made to a definition below it will appear in CAPITALS within the text.

- APPROVED – Relates to working practices, tools, instruments, testing equipment (see GS 38), locks, safety notices, temporary screens and barriers which are provided by the employer and are inspected and tested by the user as appropriate.
- CIRCUIT – An assembly of electrical equipment supplied from the same origin and protected against over current by the same protective device.
- CIRCUIT MAIN EARTH – The point at which an electrical CIRCUIT is connected to EARTH to safeguard against it becoming LIVE.
- DOCUMENT OWNER – The DAP appointed is to be responsible for the application of these safety rules.
- DANGER – A risk to health or of bodily INJURY.
- DEAD – At or about zero voltage and disconnected from any LIVE CIRCUIT.
- EARTH – The conductive mass of the earth.
- EARTHED – Connected to EARTH through switchgear or by adequately rated EARTH leads.
- INJURY – Death or personal INJURY from electric shock, burns, explosion or arcing (relevant where a COMPETENT PERSON is working where there is DANGER and INJURY needs to be prevented).

- **ISOLATED** – Disconnected from all associated electrical equipment, plant, apparatus and conductors by an isolating device in the open position, or by adequate physical separation, or sufficient gap.
- **LIVE** – Electrically charged or energised.
- **LIVE PART** – A conductor or conductive part intended to be energised in normal use, including neutrals.
- **CAUTION NOTICE** – A notice conveying a warning or restriction against interference or operation as issued by the FM Department.
- **DANGER NOTICES** – A notice reading ‘DANGER’, warning of electrical or physical DANGER as issued by the FM Department.
- **LOW VOLTAGE (LV)** – A voltage not exceeding AC 1000V or DC 1500V.
- **EXTRA LOW VOLTAGE** – A Voltage not exceeding AC 50V or DC 120V.
- **LOW VOLTAGE APPARATUS** – Electrical equipment or its component parts that are connected to a **LOW VOLTAGE CIRCUIT**.
- **LV PERMIT-TO-WORK** – A document that specifies the **LOW VOLTAGE APPARATUS**, which has been made safe to work on, and the work which is to be carried out. The means of proving **DEAD** should be stated on the **PERMIT**. The procedure for completing an **LV PERMIT-TO- WORK** is documented on the inside cover of all **LV PERMIT-TO-WORK** books.
- **PERSONS** – (i) **COMPETENT PERSON** – A person, over the age of 18 years, recognised as having sufficient technical knowledge and experience to enable him to avoid **DANGER** and who may be nominated to receive and cancel specified **SAFETY DOCUMENTS**. (ii) **AUTHORISED PERSON (AP)** – A **COMPETENT PERSON**, over the age of 18 years, who has been appointed in writing by the **DAP** to carry out specified duties, which may include authority to issue and cancel **SAFETY DOCUMENTS**.
- **SAFETY DOCUMENTS** – A document recording the apparatus to be worked on, the limitations of the work and **SWITCHING** procedures that need to be followed to avoid **DANGER**.
- **SAFETY LOCK** – A lock that has a unique key, being different from all other standard locks used on the **LV** system.
- **SUPERVISION** – (i) **IMMEDIATE SUPERVISION** – **SUPERVISION** by a person (having adequate technical knowledge or experience) who is continuously available at the location where work or testing is in progress. (ii) **PERSONAL SUPERVISION** – **SUPERVISION** by a person (having adequate technical knowledge or experience) who is at all times in the presence of the person being supervised.
- **SWITCHING** – The operation of **CIRCUIT** breakers, isolators, disconnectors, fuses or other methods of making or breaking an electrical **CIRCUIT** and/or the application and removal of **CIRCUIT MAIN EARTHS**.

7. Access to LOW VOLTAGE Switch Rooms

It is a safety requirement of Loughborough University that access to LOW VOLTAGE switch rooms, including HV substations, is restricted to persons deemed COMPETENT to carry out this function. The restriction is as follows:

- a. SAP, DAP and APs (APs).
- b. COMPETENT PERSONS when carrying out their work as instructed by an SAP, DAP or AP and issued with a PERMIT-TO-WORK.
- c. Only SAP, DAP and APs shall give authority for any third-party access to LOW VOLTAGE switch rooms. A PERMIT-TO-WORK may be required.
- d. SAP, DAP and APs may delegate authority in writing to allow selected COMPETENT PERSONS (e.g. FM Projects M&E Engineers) the authority to allow third party COMPETENT PERSONS to access switch rooms.

8. Access and Work in Fire Protected Areas, CO2 Suppression System

Before access to or work in any LV switch room or HV substation, protected by automatic fire extinguishing equipment is affected:

- a. The automatic control shall be rendered inoperative and left 'OFF' in hand control.
- b. A CAUTION NOTICE shall be attached.
- c. The precautions taken shall be recorded on any SAFETY DOCUMENT or written instruction issued, including conditions when the automatic control may be temporarily restored.
- d. The automatic control shall be restored to 'ON' immediately after persons engaged in work activity have left the LV switch room or HV substation for any reason and they shall render it inoperative, 'OFF', when they return.

9. LOW VOLTAGE SWITCHING including Fuse Removal and Isolation

LOW VOLTAGE SWITCHING will only be carried out by persons deemed COMPETENT to carry out this activity. SWITCHING should be carried out in compliance with the following:

- a. Where a risk assessment is in place then the LV SWITCHING should be carried out strictly in compliance with this Safety Policy.
- b. Where no risk assessment is in place the person in charge will carry out a specific risk assessment prior to carrying out the work.
- c. Where no risk assessment exists, and the LV SWITCHING is of a complex nature then the person designated to carry out the work will refer the matter to their supervisor to agree the procedure to be followed.

10. Safety Precautions and Procedures for Work on LOW VOLTAGE Systems

a. General:

- When work or testing is carried out on or near LOW VOLTAGE APPARATUS precautions shall be taken to prevent INJURY from electric shock or burn INJURY, due to electric arc, if the CIRCUIT is exposed.
- If the CIRCUIT is covered with insulation or screening, the adequacy of these materials to prevent INJURY shall be assessed with regard to the nature of the work or testing.
- INJURY may arise in the following circumstances: -
 - A person mistakes a CIRCUIT which has been made DEAD with one which remains LIVE.
 - A DEAD CIRCUIT is accidentally or inadvertently made LIVE.
 - A person accidentally or inadvertently makes contact with an adjacent LIVE CIRCUIT.
 - Inadequate precautions are taken during LIVE working or testing.
- Work or testing of LOW VOLTAGE APPARATUS and CONDUCTORS shall only be carried out by a COMPETENT PERSON.

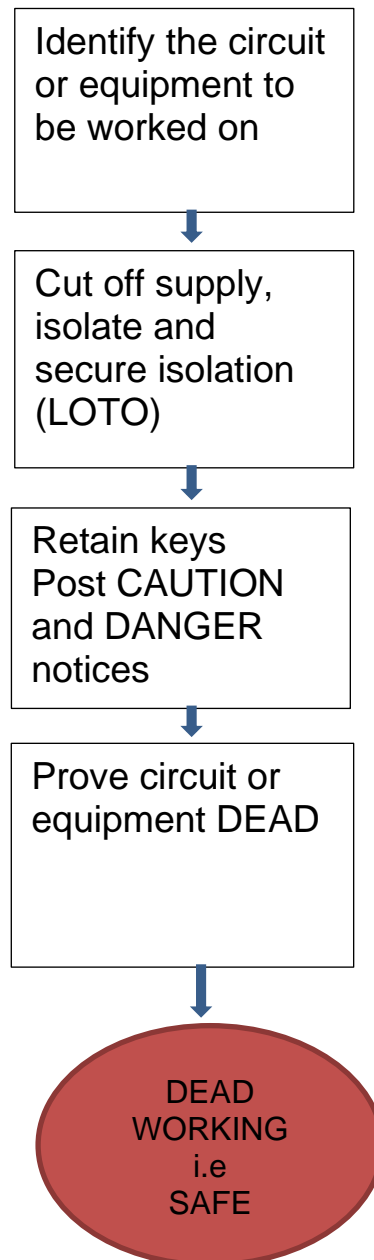
b. Requirements for Work on DEAD, LOW VOLTAGE APPARATUS and Conductors:

- Before any work is carried out on DEAD LOW VOLTAGE equipment, the following must be carried out. It shall be: -
 - Switched off and ISOLATED from all sources of electrical supply.
 - SAFETY LOCKS, if practical and CAUTION NOTICES should be fitted at all points of isolation. If locking facilities are not available isolation must be made secure by other means, e.g. removal of fuses, which should be retained in a secure place by the person in charge.
 - DANGER NOTICES should be fitted at all adjacent LIVE equipment.
 - EARTHED if appropriate.
 - Be proved DEAD at the point of work by means of an “APPROVED testing device” (see GS38). In order to prove its integrity, the voltage testing device shall be tested immediately before and after its use.
 - Where isolation is carried out by a COMPETENT PERSON on behalf of an AUTHORISED PERSON in order that work may be carried out by a third party, the COMPETENT PERSON shall issue a written PERMIT-TO-WORK to the third party.
- If the work requires a point of isolation to be established on the HIGH VOLTAGE SYSTEM, full isolation and earthing shall be carried out and a HV PERMIT-TO-WORK issued (see Appendix D).

Working 'dead'

Identification

Identify the circuit or equipment to be worked on. For most circuits and equipment, correct labelling is important, but never assume the labelling is correct and that work can be started without having first proved that the equipment or circuit is dead.



Secure Isolation

Switches including circuit breakers should be locked off, using a 'safety' lock. All keys should be retained in a safe & secure place.

If a fuse is removed, make sure that it or a similar one cannot be reinserted by taking it away or by locking the box or enclosure until work is completed.

This should follow the LOTO principle

Lockout-tagout (LOTO) is a safety procedure which is used to ensure that potentially dangerous equipment is properly locked off and not able to be re-energised prior to the completion of maintenance or servicing work. It requires that hazardous energy sources be "isolated and rendered inoperative" before work is started on the equipment in question. The isolated power source(s) are then locked, and a tag is placed on the lock identifying the worker who has placed it. The worker then holds the key for the lock ensuring that only he or she can re-energise the equipment.

Multiple locking hasp should be used if more than one individual is working on the same plant or equipment, to ensure inadvertent re-energisation is not possible.

Post notices

A notice or label at the place of disconnection should be used so everyone knows work is being done.

Proving dead

Once the circuit or equipment has been isolated, it must be checked that the circuit is dead before commencing work.

Some luminaires may have more than one source present. Either from a central battery system or dual phases.

Proprietary voltage detectors, test lamps or voltmeters with insulated probes and fused leads shall be used. (see HSE Guidance note GS38). Electrically competent staff shall be supplied with:-

- 1 off LU Approved Proving Unit
- 1 off LU Approved Fluke Tester
- 1 off LU Approved Lock off Kit

The use of multi-meters or non-contact devices such as volt sticks for proving dead on low voltage systems is not permitted.

It is necessary to test the instrument before and after use. This must be done by means of a proving unit with a low power output. If live circuits are used to prove instruments, adequate precautions against electric shock and short circuits should be taken.

All instruments used for checking circuits should be maintained and inspected frequently.

Remove fitting diffuser/cover

When remove the fitting diffuser/cover, assess the condition of the lamps before removing.

- Wear suitable PPE - Gloves

If in doubt, a qualified electrician must be consulted, and a job specific method statement agreed

c. Work on LIVE LOW VOLTAGE APPARATUS and Conductors:

- No LIVE, LOW VOLTAGE work, other than APPROVED testing (see GS38 for test equipment compliance), shall be carried out unless a job specific risk assessment has been undertaken and a written procedure, including an LV PERMIT-TO- WORK being issued and approved by the DAP

This permit is in place to prevent INJURY from electric shock and inadvertent short-circuiting of the CIRCUITS.

- Where LIVE work is to be carried out the following requirements shall be assessed: -
 - The CIRCUIT to be worked on shall be visually inspected to see that it is in a satisfactory condition.
 - There shall be adequate working space and safe means of egress.
 - The working space and the CIRCUIT to be worked on shall be adequately illuminated.
 - If the work is outdoors, the weather conditions shall not be unduly adverse. Suitable temporary cover shall be provided to avoid water ingress into CIRCUITS.
- No person shall carry out work, which involves, or is equivalent to, the manipulation of bare LIVE CONDUCTORS.
- Where work is to be carried out in situations where the LIVE equipment is not housed in a secure location, e.g. switch room, then additional precautions in the form of barriers and DANGER NOTICES must be in place to protect non-FM staff, students and the general public from the DANGER, which exists.
- Only APPROVED tools (see GS 38) and equipment shall be utilised for all LIVE working.
- APPROVED personal protective equipment shall be worn as per the job specific risk assessment.

d. Work on LIVE EXTRA LOW VOLTAGE APPARATUS and Conductors:

- Risks with this type of CIRCUIT are inherently lower. However, risks are present, and care must be taken.
- Potential hazards associated with EXTRA LOW VOLTAGE equipment and CIRCUITS: -
 - Incorrect identification of an EXTRA LOW VOLTAGE CIRCUIT or APPARATUS.
 - Sparking potentially leading to a risk of fire.
 - Minor sensation caused by contact with "LIVE" parts.

- When working on EXTRA LOW VOLTAGE CIRCUITS and APPARATUS the following shall be undertaken: -
 - The CIRCUIT to be worked on will be clearly identified or confirmed as an EXTRA LOW VOLTAGE CIRCUIT by a COMPETENT PERSON.
 - The CIRCUIT to be worked on shall be visually inspected to see that it is in a satisfactory condition.
 - There shall be adequate working space and safe means of egress.
 - The working space and the CIRCUIT to be worked on shall be adequately illuminated.
 -

11. Testing and Inspection or Adjustment of LOW VOLTAGE APPARATUS

- a. Testing or adjustment, including functional testing, may be made on LIVE, LOW VOLTAGE CIRCUITS provided that APPROVED insulated tools and instruments are used (see GS38) and other appropriate APPROVED protection methods taken to prevent INJURY, for example, the use of temporary screens or barriers.
- b. If testing or adjustment requires covers to be removed, so that terminals or connections that are LIVE are exposed, precautions shall be taken to prevent unauthorised access to protect non-FM staff, students and the general public from the DANGER which exists from the APPARATUS. Such precautions shall include the erection of suitable barriers or screening and the display of DANGER NOTICES.
- c. APPROVED LIVE work should not be undertaken alone.
- d. Where an existing CIRCUIT is modified or changed a “Minor Electrical Works Certificate” shall be completed. This work to include the addition or replacement of any sockets, spur units, light fittings or cable repairs on an existing CIRCUIT. This will ensure that the CIRCUIT integrity is not compromised. The Certificate is to be kept by FM and filed on the Facilities Management record system (route or software to be defined by admin dept. /change manager). Any modifications or changes to LOW VOLTAGE control and protection type CIRCUITS will be annotated onto a suitable CIRCUIT diagram.

12. Access to a Switch Room or Substation – General Safety Requirements

- **BEFORE YOU ENTER** – Unlock and open substation door
- **STOP**
- **SMELL** for BURNING, GAS or OZONE
- **LISTEN** for a CRACKLING or HISSING sound (it is normal for transformers to hum or buzz)
 - Use your torch
 - Check the access, i.e. is there a step down?
 - Find the light switch and switch on

- **LOOK** – Is the access clear and unobstructed?
 - Any open trenches in floor?
 - Enter substation

- **CHECK** – Is there an automatic fire protection system installed? If so, refer to Section 8, Access and Work in Fire Protected Areas.

- **KEEP CLEAR OF HIGH VOLTAGE SWITCHGEAR, TRANSFORMERS AND LOW VOLTAGE SWITCHGEAR. DO NOT TOUCH ANY EQUIPMENT OTHER THAN THAT WHICH YOU HAVE BEEN INSTRUCTED TO.**

- Carry out work

- Leave substation or LV switch room and switch off light.

- **LOCK THE DOOR AND CHECK IT IS SECURE. IF YOU NOTICE ANY ABNORMALITIES THESE SHOULD BE REPORTED TO YOUR SUPERVISOR IMMEDIATELY.**