

ESTATES OPERATIONS

HEALTH & SAFETY DOCUMENT CODE of PRACTICE

DOCUMENT TITLE

ELECTRICAL LOCK-OUTS

ISSUE DATE & VERSION

MARCH 2018 v1.4

Please Note – the guidance provided in this Code of Practice pertains only to the Estates Operations Group and its activities. For Imperial College’s Health & Safety policies and Codes of Practice go to: <http://www.imperial.ac.uk/safety/>.

INTRODUCTION

This Code of Practice sets down the standards for electrical lock-outs when working on electrical equipment installations within the College.

Over and above the general duty of care owed by the College to its staff, students and others under the Health and Safety at Work etc. Act 1974, all work related to electrical equipment tasks are legislated by The Electricity at Work Regulations 1989. Further information is contained within the BS7671: Wiring Regulations 2008 (17th Edition) document. The requirement to undertake a suitable and sufficient risk assessment of the activities is covered under The Management of Health and Safety at Work Regulations 1999.

This Code of Practice provides the following:

- A definition and the scope of the applicable Regulations
- The duties imposed on the employer / employees / others
- Responsibilities of duty holders and employees
- Procedures

1. Overview and Introduction to Electrical Equipment Safety

The Electricity at Work Regulations 1989 places duties on any person who uses, supervises, manages or has any control of electrical equipment or services. The Electricity at Work Regulations 1989 came into force on 1 April 1990. The purpose of the Regulations is to require precautions to be taken against the risk of death or personal injury from electricity in work activities. The Regulations are made under the Health and Safety at Work etc Act 1974 (HSW Act). The HSW Act imposes duties principally on employers, the self-employed and on employees, including certain classes of trainees. The Regulations impose duties on people) in respect of systems, electrical equipment and conductors, and in respect of work activities on or near electrical equipment.

BS 7671: Wiring Regulations 2008 (17th Edition) is the British Standard for electrical installations in the United Kingdom; it is a non-statutory document. The purpose of the Wiring Regulations is to protect persons, property and livestock from harm which could arise from the use or presence of electricity. BS 7671:2008 should be referred to for all new installations, and any additions and alterations to existing installations; it must be remembered that installations which were installed using earlier editions of BS 7671 will not become noncompliant unless alterations or additions are carried out on them.

The Management of Health and Safety at Work Regulations 1999 require employers to make a suitable and sufficient assessment of the risks to the health and safety of both their

employees, and of others arising out of, or in connection with, the conduct of their undertakings.

2. Duties Imposed on the Employer/Employees/Others

The Electricity at Work Regulations 1989 introduced requirements for the safe provision, maintenance and use of electrical equipment. Regulation 14 of The Electricity at Work Regulations 1989 requires that no person shall be engaged in any work activity on or so near any live conductor that danger may arise unless:

- a) It is reasonable in all circumstances for it to be dead; and
- b) It is reasonable in all circumstances for him/her to be at work on or near it while it is live; and
- c) Suitable precautions (including provision of Personal Protective Equipment (PPE) where required) are taken to prevent injury.

Therefore Estates Operations shall ensure that:

- Live working, which includes not only working on live un-insulated conductors but also working so near live un-insulated conductors that there is a risk of injury, should only be carried out in circumstances where it is unreasonable to work dead.
- Fault finding and testing is undertaken to confirm the live/dead nature of conductors, but only where the risks are acceptable and where suitable precautions have been taken against injury.
- Adequate precautions are taken to ensure that conductors and equipment cannot inadvertently be energised while the work is taking place (isolation).
- All employees are trained and instructed in the implementation of the safe system of work.

3. Responsibilities of Duty Holders and Employees

Estates Operations have a responsibility to ensure that all operations involving electrical equipment and services that could result in injury are assessed and adequately controlled. To this end the Estates Operations should appoint a suitably competent person to carry out the actions below.

- maintaining the electrical equipment and systems so that they are safe to use;
- selecting and instructing the competent person;
- ensuring that the electrical equipment and systems are examined at statutory intervals or in accordance with an examination scheme drawn up by a competent person;
- keeping the competent person informed of any changes in the electrical systems conditions which may affect the risk assessment;
- making relevant documentation available to the competent person, e.g. manufacturer's instructions and maintenance records;
- acting promptly to remedy any defects;
- provide suitable information, instruction and training to employees;
- ensuring that all documentation complies with the Regulations; and
- record keeping.

Employees and students have a responsibility not to undertake any activities in relation to electrical equipment and systems that may cause themselves or others harm and adhere to the information, instruction and training provided. They must immediately bring instances having the potential to cause harm to the attention of their immediate line manager.

4. Safe Isolation Procedures

Identification

For most circuits and equipment correct labelling is important, but it should **never be assumed that labelling is correct** and that work can be started without having first **proved that the equipment or circuit is dead**. In some special cases, e.g. underground cables, cable-locating techniques using specialised instruments may be necessary and it may also be necessary to identify the cable both before and after switching operations and cable spiking.

Disconnection

Disconnect the equipment from every source of electrical energy before working on, or near, any part which has been live or is likely to be live.

Secure isolation

To ensure adequate isolation, the disconnecting device should have an isolating gap sufficient for the voltage levels present or likely to occur. Make sure that any switch disconnecter or other means of disconnection is secure. Switches should preferably be locked in the OFF position using a 'safety' lock, i.e. a lock having a unique key. If a plug has been withdrawn, make sure that it cannot be reconnected to the electrical supply while work is taking place on the circuits or apparatus. 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.

Some manufacturers produce insulating blanks that can be inserted in an empty fuseway and are capable of being locked. This prevents inadvertent insertion of a fuse while the associated circuit is being worked on. If reliance is placed on locking off where a number of people are working, the use of a multiple locking hasp attachment may be appropriate to ensure that all the locks are removed before the equipment can be re-energised.

A list of devices that can be used for isolation is provided in [Appendix 1](#) to the rear of this Code of Practice.

Post notices

Estates Operations should put a notice or label at the place of disconnection so everyone else knows that work is being done. A good system is to use a 'caution' notice to indicate that someone is working on the apparatus and may be injured if it is re-energised. This should be supplemented by 'danger' notices adjacent to the place of work indicating nearby apparatus that is still energised. Notices or labels should be easily understandable to anyone in the area. It is also important to remove labels or notices when they no longer apply so that the system does not fall into disrepute. It is often useful for the 'caution' and 'danger' notices to have a space for the name of the person working or in charge and for the date. All keys should be retained in a secure place.

Proving dead

Having isolated the circuit or equipment, check at the point of work that the parts to be worked on or near really are dead, even if the isolation has been achieved automatically through an interlocking system. If it is a three-phase system or equipment with more than one supply, prove that all supply conductors are dead. The device used for proving dead should itself be proved immediately before and after testing.

Earthing

To ensure that the risk to personnel is minimised, even if the above precautions fail, it is preferable that all the conductors are earthed using properly designed earthing devices or earthing leads, usually applied to all points where the circuit or equipment is isolated from the supply. Additional local earths at the point of work may also be necessary if this is remote from the point of isolation, but these should be applied only after proving dead at the point of work.

The earthing conductors and their connections should be suitable for the energy that may flow in the event of a failure of the above precautions.

Earthing low-voltage equipment is particularly desirable if there is a risk of re-energisation, e.g. from a generator under someone else's control. In other low-voltage equipment, however, it may be physically impractical to apply earths, or the risk of short circuit from introducing an earth near adjacent live parts may outweigh the benefit of earthing the apparatus being worked on.

Adjacent parts

When the circuit or equipment to be worked on has been made dead or where the work is non-electrical, it may still be necessary to protect against inadvertent contact with other live parts nearby. This should preferably be done by erecting physical barriers and/or the use of temporary insulation.

Extra precautions for high-voltage work

The following paragraphs apply particularly to equipment and circuits operating at high voltage. However, there are many installations where the same procedures should be used at lower voltages, for example if the available short-circuit power is such as to give rise to a risk of serious burn injuries. Conversely, there are a few exceptional circumstances where high voltages will not give rise to danger, for example if the maximum possible current is reliably limited to a safe level.

High-voltage equipment should be designed and installed so that it is not necessary to work on exposed live parts. However, allowance has to be made for carrying out potential checks or tests, and also for observation from safe distances such as when phasing out.

Because high voltages can arc across an air gap, it is not necessary to touch live voltage parts to suffer a shock or burns. The isolation should be by means of a device that has a safe isolating gap between live parts and those that have been made dead for work to be carried out (see relevant British Standards contained in [Appendix 1](#)). Earthing of conductors at the point of disconnection of the supply is essential and additional earths may be necessary at the place of work.

The system of locking OFF while work is in progress should use safety locks which have unique keys so that the apparatus cannot be inadvertently re-energised. The keys should be retained in a key safe or other suitable place available only to the person in charge of the activity. The precautions should be backed up with a disciplined documentation system; the permit-to-work is an established system that has proved to work well in practice. Further guidance is given below and in the Estates Operations' [Permits to Work system](#).

There are some situations where additional procedures will be necessary to cover adequately shift changes or work extending over long periods. It may also be necessary to have special rules or procedures for particular items of equipment and for particular working practices such as testing (e.g. it may be necessary to remove earths to facilitate testing under a clearly defined sanction-to-test procedure).

Precautions must be taken to prevent people approaching dangerously close to high-voltage conductors.

A more recent development is live, hands-on working on both electricity transmission and distribution overhead conductors. For this latter work, special vehicles, work equipment, tools, clothing etc, together with exacting working methods, are necessary to ensure safe working. For all the special situations referred to, work procedures need to be specially devised and a very high degree of training and discipline are essential for everyone involved. These special situations are not within the scope of this document.

Similar procedures may also be necessary if high-voltage apparatus is to be tested. In every case, the objective is to prevent anyone coming near to live, high-voltage conductors and the procedure should reflect this.

Permits-to-work

An electrical permit-to-work is primarily a statement that a circuit or item of equipment is safe to work on. A permit should never be issued on equipment that is still live. The information given in the permit should be precise, detailed and accurate. It should state which equipment etc has been made safe, the steps by which this safety has been achieved and exactly what work is to be done. Please refer to the Estates Operations' [permit to work system](#) for details of the system to be used by Estates Operations staff.

Background information on Permits to Work can be found in [Appendix 3](#) to the rear of this Code of Practice.

Appendix 1 – Identification of Devices Suitable for Isolation

The following table is based on the table contained in BS 7671: 2008. Estates Operations will be required to review the applicable British Standard prior to selecting a suitable isolation device.

| Device | Standard | Suitable for Isolation+ |
|-------------------------------------------------------------|-----------------------|-------------------------|
| Switching Device | BS 3676: Part 1: 1989 | Yes*** |
| | BS EN 60669-1 | No |
| | BS EN 60669-2-1 | No |
| | BS EN 60669-2-2 | No |
| | BS EN 60669-2-3 | No |
| | BS EN 60669-2-4 | Yes |
| | BS EN 60947-3 | Yes* |
| | BS EN 60947-5-1 | No |
| Contactor | BS EN 60947-4-1 | Yes* |
| | BS EN 61095 | No |
| Circuit-Breaker | BS 3871 | No |
| | BS EN 60898 | Yes |
| | BS EN 6094-7-2 | Yes* |
| | BS EN 61009-1 | Yes |
| RCD | BS 4293 | No |
| | BS EN 60947-2 | Yes* |
| | BS EN 61008-1 | Yes |
| | BS EN 61009-1 | Yes |
| Isolating Switch | BS EN 60669-2-4 | Yes |
| | BS EN 60947-3 | Yes |
| Plug and Socket <32A | BS EN 60309 | Yes |
| | IEC 60884 | Yes |
| | IEC 60906 | Yes |
| Device for the Connection of Luminaire | BS IEC 61995-1 | Yes** |
| Control and Protective Switching Device for Equipment (CPS) | BS EN 60947-6-1 | Yes |
| | BS EN 60947-6-2 | Yes* |

| | | |
|-----------------------------------|-----------------|-------|
| Fuse | BS 88 | Yes |
| Device with Semi-conductors | BS EN 60669-2-1 | No |
| Luminaire Supporting Coupler | BS 6972 | Yes** |
| Plug and Unswitched Socket-Outlet | BS 1363-1 | Yes** |
| | BS 1363-2 | Yes** |
| Plug and Switched Socket-Outlet | BS 1363-1 | Yes** |
| | BS 1363-2 | Yes** |
| Plug and Socket Outlet | BS 1363-1 | Yes** |
| | BS 1363-2 | Yes** |
| Switched Fuse Connection Unit | BS 1363-4 | Yes** |
| Unswitched Fuse Connection Unit | BS 1363-4 | Yes** |
| Fuse | BS 1362 | Yes |
| Cooker Control Unit Switch | BS 4177 | Yes |

* Isolation provided if the device is suitable and marked with the symbol for isolation

** Device is suitable for on-load isolation that is disconnected whilst carrying load current

*** Isolation provided if the device is suitable and marked with O

Appendix 2 – Further Guidance

Electrical Safety

The following link provides access to free guidance and advice from the HSE website on electrical safety:

<http://www.hse.gov.uk/electricity/index.htm>

Electrical Safety Council

The following link provides access to the Electrical Safety Council website, where a number of free best practice guidance documents can be viewed:

<http://www.esc.org.uk/industry/industry-guidance/best-practice-guides/>

Electricity at Work: Safe Working Practices

The following link provides access to a free HSE publication on Electricity at Work:

<http://www.hse.gov.uk/pubns/priced/hsg85.pdf>

Guide to Isolation Procedure

A pocket guide to the steps to follow when undertaking isolation procedures can be downloaded for free from the NICEIC website. Accessed via the below link:

<http://www.niceic.com>

Appendix 3 – Electrical Permits-to-Work

The following is a guide which details how an electrical permit to work system can operate. Please refer to the [Estates Operations' permit to work system](#) for details of the system which must be used by Estates Operations staff.

In no circumstances should anyone be allowed to work on equipment that is not specified in the permit as having been made safe. This restriction should be understood to apply to everyone in the premises, including directors and senior staff. No one is too important to comply with safety rules and no one should do any work that is not specified in the permit.

If it is found that a programme of work must be changed, no variation of any kind should be introduced until after the existing permit has been cancelled and a new one issued. The only person who has the authority to agree the change in programme and issue the new permit-to-work is either the person who issued the original permit or the person nominated by management to take over the responsibility, e.g. at the end of a shift or during absence on leave.

A permit-to-work should be issued by only a designated competent person who is deemed to be so by means of technical knowledge and/or experience and who is familiar with the system and equipment. The person should be authorised, in writing, by The College to issue permits relating to specified equipment or systems. Before issuing the permit, this person should work out, in detail and in writing, what the various steps are to disconnect, isolate, prove dead, lock OFF and earth the equipment, post warning notices and identify the equipment to be worked on and adjacent equipment which will still be live.

The permit-to-work should state clearly:

- the person the permit is addressed to, i.e. the leader of the group or working party, who will be present throughout the work;
- the exact equipment which has been made dead and its precise location;
- the points of isolation;
- where the conductors are earthed;
- where warning notices are posted and special safety locks fitted;
- the nature of the work to be carried out;
- the presence of any other source of hazard, with cross-reference to other n relevant permits;
- further precautions to be taken during the course of the work.

In most cases it is preferable to include a diagram on, or attached to, the permit confirming the above information and showing the zone for work.

It is strongly recommended that the permit is issued at the place where the work is being done. The designated competent person issuing the permit should explain the work and agree the accuracy and completeness of the details with the person doing the work before they both sign the permit. The person issuing the permit should be sure that all necessary action has been taken to make the equipment safe. As a general rule, a personal inspection should be made but in geographically very large undertakings, such as the electricity supply industry, it may occasionally be necessary to make an exception to this.

In cases where some degree of divided responsibility may arise, the permit-to-work form should be countersigned by a person nominated in the joint ownership schedule and by the duty holder for the premises. Another example is where contractors may need to work on the College's electrical system or equipment. In this case the duty holder at the College needs to take particular care to define responsibilities **in advance of the work being done** and any permit-to-work being issued, to ensure that there is no confusion over divided responsibilities.

The person who accepts the permit (i.e. the person who is in immediate charge of the operation) becomes, from that moment, responsible for ensuring that all the specified safety precautions are adhered to, that only permitted work is done and that this is confined to the

area defined in the permit. If the permit is issued to the leader of a group, the leader accepts responsibility for people in the group.

If the person issuing the permit will also be doing the work, it is strongly recommended that another person should make an independent check of the precautions proposed to be taken. After independent approval the person doing the work should then issue a permit to himself/herself. This routine helps to ensure that the full safety procedure is applied. The self-discipline is vitally important.

The recipient of a permit-to-work should keep it for reference while the work is in progress and to prevent inadvertent cancellation and re-energisation of the equipment.

When the work is complete, whoever the permit clearance was issued to should sign it to declare that any additional earths and tools have been removed and people in the group have been withdrawn and instructed not to approach the equipment again. The person clearing the permit should also indicate whether or not the equipment is fit for service. The permit is then returned, preferably to the designated competent person who originally issued it, for cancellation before the equipment is re-energised.

To reduce the scope for misunderstanding when work is suspended, it is always preferable that the original permit is cancelled and a new one is issued when required. The suspension of permits-to-work is not generally recommended. Where, however, the practice is essential it will be necessary to have a written procedure to ensure that tools and additional local earths are withdrawn and everyone is aware that the permit has been suspended.

Any permit-to-work system should also have an additional procedure for monitoring (audit) to ensure that the safety rules are followed and the documents are completed accurately. The monitoring should preferably be carried out by someone with managerial responsibilities, who is not involved in the day-to-day issuing of permits and should be random and ongoing so that bad habits and inaccuracies can be identified and eliminated quickly.