



**Science and
Technology
Facilities Council**

ELECTRICAL SAFETY

STFC SHE Code No 34

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Electrical Safety

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Document Revisions

	Section/Sheet	Comment	Date
1	Initial Launch		December 2014
1.01	B2.4 Working On and Testing LV equipment	NP exemption to work on and test equipment and cables rated above 100A	September 2017
	Table LV1 and B8.2 Safety Programme	Safety programme exemption	
	Appendix C.1 Training requirements	NP Training – courses available	
	Appendix C.1 Training requirements	AP Training – courses available	
	Appendix C.1 Training requirements	Asbestos Awareness training	
	Tables LV1, LV2 and LV3	Equipment with two sources of supply	
	Appendix H Personnel Protective Equipment	Arc flash protective clothing	
	B9.1 Permit To Work, Tables LV1 & 2	Street lighting circuits	
1.1	Appendix H Document Retention Policy	Appendix added	April 2018
	Appendix G Personal Protective Equipment	Insulating Gloves	
1.2	Changes to reflect the launch of SHE Assure		October 2018
1.3	Minor change to title of 4.7		January 2020
1.4	Change names of responsible persons from “(Electrical)” suffix to prefix.		August 2020

Electrical Safety

1. PURPOSE

The nature of STFC operations involves the widespread and pervasive use of electricity from low voltage electrical systems found in offices and workshops through to high voltage distribution systems and high voltage scientific equipment.

Electricity (and stored electrical energy) is taken for granted in almost every aspect of our daily lives, but nevertheless has the potential to cause death through electric shock, serious injury through electrical burns; electrical fires (the most common source of fire in the STFC); and damage to equipment and property resulting in lost time and delays to scientific and technical programmes.

Electrical safety is the subject of extensive and detailed [legislation and guidance](#):

- Electricity at Work Regulations, 1989;
- IET Wiring Regulation, latest edition.
- Electricity Safety, Quality and Continuity Regulations, 2002;
- Provision and User of Work Equipment Regulation (PUWER), 1998;
- Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations, 1996;
- Supply of Machinery (Safety) Regulations, 1992; and
- Electrical Equipment (Safety) Regulations, 1994.

This code outlines STFC policy with respect to the management of electrical safety hazards and the arrangements for complying with the legislation listed above. It sets out the electrical safety rules and procedures throughout STFC. Practical implementation of this code may also result in detailed local rules or procedures.

2. SCOPE

This code applies to all staff, tenants, visitors, facility users and contractors at all STFC sites.

Compliance with this code is mandatory when performing the following functions: specification, design, fabrication, procurement, installation, testing, working on or near, commissioning, operation, modification, maintenance / repair, inspection, and decommissioning of Electrical and Electronic Equipment at all STFC sites.

This code applies where STFC staff undertake electrical work at other sites unless the host site's arrangements provide equivalent or improved electrical safety control.

This Code applies to Electrical and Electronic Equipment that is permanently connected to an electricity distribution system or forms part of an electrical installation. Not electrical equipment connected by a plug / socket.

This code specifically excludes:

- Portable Appliances (see STFC SHE Code 17 Portable Electrical Equipment)
- Electrical installations on STFC sites not under the direct control of the STFC for example incoming substations.

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Due to the pervasive nature of electrical safety hazards there are a large number of related STFC SHE codes and policies, including:

- SHE Code 4 Safety and safe use of work equipment (PUWER);
- SHE Code 6 Risk Management;
- SHE Code 13 Construction, Design and Management;
- SHE Code 15 Management of Contractors;
- SHE Code 17 Portable Electrical Equipment;
- SHE Code 19 Work on buildings, premises, services and infrastructure;
- SHE Code 20 Controlling Explosive and Flammable Gases and Dusts;
- SHE Code 26 Safe use of lifting equipment;
- SHE Code 30 SHE Auditing and Inspection;
- SHE Code 32 Fire and Emergency Management;
- SHE Code 35 Asbestos Management;
- SHE Code 36 Management and Provision of first aid; and
- SHE Code 37 COSHH: safe use of chemicals / hazardous substances.

3. DEFINITIONS

See section 5 for definitions of other items.

- 3.1 **Distribution Electrical Equipment** - the Site Distribution System from point of entry to the Site to the agreed single points of demarcation for experimental electrical equipment. Including all high voltage switchgear, step down transformers, ring main units, conductors and all other related electrical equipment used to receive high voltage electricity and to re-distribute it at lower voltages.
- 3.2 **Experimental Electrical Equipment** - electrical systems directly associated with experimental rigs and facilities requiring additional specialist safety procedures. These systems must have an agreed single point of isolation from the Site Distribution Electrical System.
- 3.3 **Portable Electrical Equipment** - Portable equipment is not part of a permanent (fixed) installation but when used is connected to a fixed installation (or a generator), by means of a flexible cable, plug and socket. It includes equipment that is hand held or hand operated while connected to the supply. It also includes extension leads that supply portable equipment and are not part of the fixed installation. See SHE Code 17 Portable Electrical Equipment.
- 3.4 **Point of Demarcation** – this is normally a switch or circuit breaker on an Electrical Distribution System that has been agreed by the relevant Electrical Authorising Engineers as the point of demarcation between the two areas of responsibility. This would normally be identified on a single line diagram as the single point of demarcation.
- 3.5 **Voltage**
The following ranges of voltage are defined for non-conductive environments:
- High Voltage: A potential normally exceeding Low Voltage;

- Low Voltage: A potential normally exceeding Extra-Low Voltage but not exceeding 1000 volts ac or 1500 volts dc between conductors, or 600 volts ac or 900 volts dc between a conductor and earth; and
- Extra-Low Voltage: A potential normally not exceeding 50 volts ac, or 120 volts dc, between conductors or between conductor and earth.

The RMS ripple on the dc supply is not to exceed 10% of the nominal dc.

High voltage is regarded internationally as being in excess of 1000 volts ac. However in some UK systems the term `high voltage` is used where the voltage exceeds 650 volts.

Voltages in the Extra-Low Voltage range may still present a considerable hazard and when work is carried out on equipment operating in this voltage range a risk assessment should be carried out.

Particular precautions should be employed on equipment, which exceeds **5 Joules of stored energy and is able to exceed 5mA** output current on short circuit.

3.6 **Electrical Live Working**

Work on or near conductors which are accessible and which are live or charged. Working on or near live low voltage equipment or near HV equipment in a HV enclosure is to be avoided whenever possible. Exceptionally, live working is permitted by an Electrical Authorised Person or Nominated Person where a Sanction to Work on or near Live Equipment (see section B11) or Local Rules specific to the equipment to be worked on, have been approved by the Electrical Authorising Engineer. All live work must have a risk assessment and method statement specifically written for the activity.

3.7 **Electrical and Electronic Equipment (*abbr. Equipment*)**

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

3.8 **Electrical system**

All electrical equipment and connected test equipment that is or may readily be connected electrically to a common source of electrical energy. A system encompasses all the constituent parts e.g. conductors, insulation, protective conductors, insulators and electrical equipment in it, and not simply the functional circuit.

Notes:

- Equipment which may readily be made live by a system is considered part of that system. For example, a lighting circuit disconnected from its source of electrical energy by means of removable links or fuses is still part of that system and so is a circuit which has been switched off even though the switch might be a double pole switch.

- A common source of electrical energy includes systems fed by several generators or transformers.
- In the case of transformers where energy is transmitted over galvanic separation between transformer windings, even though they are not connected electrically, the transformer and all its windings are part of the same system.
- Electrical circuits or equipment whose singular source of supply is batteries are not part of the system (such as test equipment, unless it is connected to the system).

3.9 **Electrical Authorising Engineer**

An engineer whose appointment has been approved by the Director to be responsible for implementing and monitoring this SHE Code.

3.10 **Electrical Authorised Person**

A person who has been appointed in writing by the Electrical Authorising Engineer on behalf of the Director to be responsible for the implementation and operation of this SHE Code.

3.11 **Electrical Nominated Person**

A person certified by an Electrical Authorised Person or Electrical Authorising Engineer for defined work and with suitable and sufficient technical knowledge and experience to prevent injury, and who has:

- an adequate knowledge of electricity to undertake the defined work activity;
- an adequate experience of electrical work to undertake the defined work activity;
- an understanding of the system to be worked on and practical experience of that class of system;
- an understanding of the hazards which may arise during the work and the precautions which need to be taken;
- the ability to recognise at all times whether it is safe for work to continue; and
- the ability to recognise their own limitations.

An Electrical Nominated Person can be electrical qualified or non-electrical qualified, the Electrical Authorised Person or Electrical Authorising Engineer shall assess qualifications, competency and experience before issuing a letter of Appointment.

3.12 **Person in Charge**

- An Electrical Nominated Person or Electrical Authorised Person who has accepted a Permit to Work, a Sanction to Test, a Sanction for Work on or near Live Electrical Equipment, a Specific Written Instruction or an Authority for Access, for a particular task from another Electrical Authorised Person, **or**
- An Electrical Nominated Person who has accepted Standing Instruction from an Electrical Authorised Person, **or**
- An Electrical Nominated Person or Electrical Authorised Person who is responsible for working on or testing low voltage equipment in accordance with Table LV3.

3.13 **Accompanying Safety Person**

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A competent person who has received suitable training and has adequate knowledge, experience and the ability to recognise hazards. They are required to keep watch, prevent interruption, summon help and apply first-aid. The person is to have sufficient familiarity with electrical systems being worked on and have received instructions on how to disconnect the equipment from all supplies of electricity, and how to switch off or disconnect any test equipment.

4. RESPONSIBILITIES

4.1 Directors shall:

- 4.1.1 Ensure that the specification, design, fabrication, procurement, installation, testing, commissioning, operation, modification, maintenance / repair, inspection and decommissioning of electrical systems are carried out by a sufficient number of competent people and that sufficient resource and facilities are available to implement the requirements of this code.
- 4.1.2 Appoint in writing sufficient and suitably qualified and/or experienced Electrical Authorising Engineers for their Department who have successfully completed training, and ensure that their appointment and scope of responsibility are recorded in the STFC SHE Directory (See Appendix C for training and experience requirements). Where necessary, collaborate with or share such appointments with other Departments

4.2 Electrical Authorising Engineers shall:

- 4.2.1 Implement, administer, monitor and audit (see Appendix D) the application of this SHE code.
- 4.2.2 Ensure their out of hours contact details are available to those responsible for managing site emergencies.
- 4.2.3 An Electrical Authorising Engineer can undertake the duties of an Electrical Authorised Person within their area of appointment and may undertake duties as an Electrical Authorised Person in an area under the responsibility of another Electrical Authorising Engineer, however their work as an Electrical Authorised Person should be audited by another Electrical Authorising Engineer.

Appointment and management of Electrical Authorised Persons

- 4.2.4 Appoint in writing sufficient Electrical Authorised Persons to ensure cover at all times, for all electrical systems, installations, and equipment for which they are responsible. Record the scope of their responsibilities in the STFC SHE Directory, which will generate appointments in writing. Ensure that Electrical Authorised Persons have at the time of appointment the required training and competence, and maintain their training and competence thereafter (see Appendix C).
- 4.2.5 Ensure absolute clarity of responsibility for Electrical Authorised Persons such that, while there may be more than one Electrical Authorised Person appointed for an electrical system, only one is responsible for any defined work or test on an electrical system at any one time.
- 4.2.6 Defining in writing, using drawings and diagrams as appropriate, the exact extent of the electrical systems and installations for which each Electrical Authorised Person is responsible, keeping appropriate records for each. Clear demarcation must be in place between areas covered by different Electrical Authorised Persons.
- 4.2.7 Report to their appointing Director any deficiency in the number of suitably trained and experienced Electrical Authorised Persons.

- 4.2.8 Review the competence of Electrical Authorised Persons at least every 5 years or more frequently depending on performance and if necessary suspend their appointment and remove their names from the SHE Directory informing the Electrical Authorised Person in writing of the reasons why. The Director is to be advised of such action and the corrective action recommended ensuring the continued safe operation of the electrical systems and installations.
- 4.2.9 Ensure all Electrical Authorised Persons are made aware of any relevant safety information, defect report or operational restriction on the electrical systems or equipment for which they are responsible as soon as is reasonably practicable, providing appropriate advice to prevent injury. (Example NEDeRS – Engineering Directorate)

Management of Electrical Systems

- 4.2.10 Ensure that the electrical systems under their responsibility have accurate documentation, including drawings / schematics available, so that the electrical system can be operated and maintained safely. All changes to the electrical system shall be recorded.
- 4.2.11 Ensure that all electrical incidents, near misses, hazardous conditions, dangerous occurrences or failures of electrical safe systems of work are promptly reported by the relevant Electrical Authorised Persons and others undertaking electrical works, including contractors through Evotix Assure following SHE Code 5 - Incident Reporting and Investigation.
- 4.2.12 Investigate all reported SHE incidents involving electrical systems and installations within their area of appointment. Where learning points can be derived, work with SHE Group to ensure that the learning is cascaded to their Electrical Authorised and Electrical Nominated Persons and to the wider STFC electrical community.
- 4.2.13 Ensure that the correct signage identifying electrical hazards and contact telephone numbers are displayed outside all electrical substations and switch rooms.
- 4.2.14 Ensure that a list of significant hazards is displayed in or near all substation areas, switch rooms, switch cupboards, and adjacent to all distribution switchgear which is not confined to a specific room.
- 4.2.15 As a matter of principle STFC does not permit live working on HV or LV systems, see section B11. However in exceptional circumstances the Electrical Authorising Engineer may authorise such work for example near HV Experimental Equipment or on / near LV systems, and shall ensure the following criteria are met:
- it is unreasonable in all circumstances for the electrical equipment to be dead **and**
 - it is reasonable in all circumstances for any person to be at work on or near conductors whilst they are live **and**
 - suitable precautions (including where necessary the provision of suitable protective equipment) are taken to prevent injury, **and**
 - the authorisation for live working is documented.

Where live working is considered necessary the Electrical Authorising Engineer shall ensure that a documented risk assessment is undertaken before giving written authority for work on or near live electrical equipment. The Electrical Authorising Engineer shall ensure that the people undertaking the work are thoroughly familiar with the risk assessment and that an accompanying safety person is appointed.

- 4.2.16 Ensure that all amendments to this SHE Code are brought to the attention of all staff and others engaged in work on electrical systems at STFC sites for example

Electrical Authorised Persons, Electrical Nominated Persons, electrical contractors etc.

- 4.2.17 Acceptance or otherwise of new works see section B25.
- 4.2.18 Ensure that statutory fixed wiring testing of electrical distribution systems is undertaken 5 yearly by suitably qualified persons supported by annual routine monitoring. Records of tests should be retained.
- 4.2.19 Electrical Authorising Engineers do not have authority to deviate from this Code. Where, exceptionally, they consider that it is appropriate to deviate from the Code temporarily; they must first obtain the agreement of the appropriate Director and SHE Group and record the details and reasons in writing and complete a risk assessment.

4.3 **Electrical Authorised Persons shall:**

- 4.3.1 Be responsible for the practical implementation and operation of this SHE Code for the equipment for which they have been appointed to install, operate, test, work on or maintain etc.
- 4.3.2 Ensure that, where the hazards are significant, a suitable documented risk assessment is undertaken for the work planned, see SHE Code 6, Risk Management.
- 4.3.3 On matters related to this SHE Code the Electrical Authorised Person's instructions are mandatory. In the case of a dispute, the Electrical Authorised Person is to stop the work or test and refer the matter to the Electrical Authorising Engineer for adjudication.
- 4.3.4 Ensure all Electrical Nominated Persons working within their area of responsibility are made aware of this SHE Code.
- 4.3.5 Issue and cancel all documents as described in Appendix A and B relating to the electrical system under their control.
- 4.3.6 Withdraw any documents they have issued or that have been issued by another Electrical Authorised Person and transferred to them, if the Person in Charge fails to follow the Rules and Procedures set out in this SHE Code, or if an unexpected hazard arises.
- 4.3.7 Maintain specialist Personnel Protective Equipment [PPE] (for example face shields, rubber matting, rubber gloves, arc flash protective clothing etc.), Test Equipment and Portable Earthing Equipment for which they are responsible, and ensure the equipment is regularly inspected, calibrated and maintained in good condition, see STFC recommended PPE standards.
- 4.3.8 Before any specialist Personal Protective Equipment is used it is inspected prior to use.
- 4.3.9 Inform the Electrical Authorising Engineer, in writing, of any defects that may compromise safety in an electrical system or equipment.
- 4.3.10 Ensure that all electrical incidents, near misses, hazardous conditions, dangerous occurrences or failures of electrical safe systems of work are reported as soon as is reasonably practicable through Evotix Assure following SHE Code 5 - Incident Reporting and Investigation by those undertaking electrical works, including contractors.
- 4.3.11 Instruct persons required to operate Electrical Equipment under their control in the safe use of that Electrical Equipment and advise on the hazards arising from improper operation.
- 4.3.12 Ensure that cable detection, identification or location work is undertaken prior to excavation or other works on their electrical systems within the geographic area of their responsibility.
- 4.3.13 Where an Electrical Authorised Person is unsure of the meaning of any part of this Code they should refer the matter to their Electrical Authorising Engineer for guidance.

Management of Electrical Nominated Persons and Accompanying Safety Persons

- 4.3.14 Appoint sufficient Electrical Nominated Persons, to undertake electrical work within their area of responsibility for a period not exceeding 5 years, ensuring they are suitably trained and experienced prior to appointment, see Appendix C.
- 4.3.15 Ensure that the record of appointments of Electrical Nominated Persons is recorded in the STFC SHE Directory, which will generate appointments in writing, and maintained.
- 4.3.16 Review the competence of Electrical Nominated Persons at least every 5 years or more frequently depending on performance and if necessary suspend their appointment and remove their names from the SHE Directory, informing the Electrical Authorised Engineer in writing of the reasons why. The Electrical Authorised Engineer is to be advised of the corrective action recommended to ensure the continued safe operation of the electrical systems and installations.
- 4.3.17 As appropriate approve an Electrical Nominated Person (STFC staff, contractors or others) for specific tasks by the issue of a Standing Instruction or Specific Written Instruction (see Appendix C for training requirements).
- 4.3.18 Work with any Electrical Nominated Person carrying out activities on the system or equipment within their area of responsibility to develop a written Method Statement where the Electrical Nominated Person has produced a Risk Assessment for a task which highlights a cause for concern.
- 4.3.19 Stop all electrical works where they consider the activities are not in accordance with this or other SHE Codes.
- 4.3.20 When electrical work is being undertaken that requires the presence of an Accompanying Safety Person, see section 4.6 and B6, prior to work commencing instruct them how to disconnect the equipment being worked on from all supplies of electricity, and how to switch off any test equipment or disconnect it from the supply.

4.4 Electrical Nominated Persons shall:

- 4.4.1 Sign to accept the responsibility to undertake defined electrical work, identified on the letter of appointment, issued by the Electrical Authorised Person for a period not exceeding 5 years.
- 4.4.2 Work in accordance with this SHE Code and take all measures necessary to prevent injury to themselves or others, and to prevent damage to Equipment.
- 4.4.3 Be aware of the extent and limits of the work to be undertaken, their competence, and of any constraints on the sequence or method of working.
- 4.4.4 As appropriate undertake a documented risk assessment of work planned, where the hazards are significant see SHE Code 6, Risk Management, excluding live working - see 4.2.15.
- 4.4.5 Only work on or test equipment which is listed on their letter of appointment unless covered by Standing Instructions or other Specific Written Instructions.

4.5 Persons In Charge shall:

- 4.5.1 Prior to commencing work ensure a suitable risk assessment and method statement is in place for the work planned, and the controls detailed implemented.
- 4.5.2 Be an Electrical Nominated Person, Contractor or Electrical Authorised Person who is working on or testing equipment in accordance with Table LV3 see appendix A and B, or has accepted a Permit to Work, Sanction to Test, Sanction for Work on or near Live Electrical Equipment, a Specific Written Instruction, a Standing Instruction or Authority for Access from the Electrical Authorised Person.

- 4.5.3 Follow the Electrical Authorised Person's instructions and work in accordance with this SHE Code, taking all safety measures necessary to prevent injury to themselves or others and to prevent damage to equipment. Instruct the Accompanying Safety Person, if present, in how to disconnect the Equipment being worked on from all supplies of electricity, and how to switch off any test Equipment or disconnect it from the supply.
- 4.5.4 Having accepted a Permit or Sanction, undertake / supervise only the specified work or test. Upon completion of this work or test, the Person in Charge then signs off the Clearance section of a Permit or Sanction.
- 4.5.5 If the Person in Charge has to temporarily leave the place of work, the work or test is to be suspended, unless local rules apply, and adequate safe systems of work established.
- 4.5.6 Report all electrical safety incidents or near misses to the Electrical Authorised Person or Electrical Authorising Engineer as soon as is practicable, and in Evotix Assure following SHE Code 5 - Incident Reporting and Investigation. Where reasonably practicable following an electrical incident, photographs should be taken before any items are disturbed.

4.6 Accompanying Safety Persons shall:

- 4.6.1 Undertake the following duties (see section B6):
 - Maintain a watching brief for those undertaking electrical work for hazards, distractions and other sources of interruption; and
 - In the event of an incident summon help, make the work area safe as appropriate disconnecting equipment worked on from all supplies of electricity, and switch off any test equipment or disconnect it from the supply, and apply first-aid if it is safe to do so.

4.7 Managers, including Contract Supervising Officers, shall:

- 4.7.1 Prior to allowing electrical work on their equipment ensure that a risk assessment and method statement for the work planned has been established, see STFC SHE Code 6 Risk Management. As appropriate seeking the advice of STFC Electrical Authorising Engineer or Electrical Authorised Person.
- 4.7.2 Where such work is undertaken by STFC electrical staff or contractors working on their behalf, the competence of all individuals working on or near electrical systems must be approved by an Electrical Authorising Engineer or an Electrical Authorised Person before undertaking electrical work or tests.

4.8 Staff, tenants, contractors, facility users or visitors shall:

- 4.8.1 Report all electrical safety incidents or near misses to the Electrical Authorising Engineer or Electrical Authorised Person as soon as is practicable, and in Evotix Assure following SHE Code 5 - Incident Reporting and Investigation.

4.9 SHE Group

- 4.9.1 Ensure STFC subscribes to a suitable industry forum where serious electrical incidents, equipment faults/failures and manufacturers advisory notices are published. Whenever the forum reports on matters that are relevant to STFC, cascade the information in a timely manner.
- 4.9.2 Ensure that electrical SHE incidents are reported to STFC Electrical Authorising Engineers to share learning and experience.

5. TECHNICAL DEFINITIONS

CAT Rating: Overvoltage installation categories have standards from I to IV. The division of a power distribution system into categories is based on the fact that a dangerous high-energy transient such as a lightning strike will be attenuated or dampened as it travels through the impedance of the system. A higher CAT number refers to an electrical environment with higher power available and higher energy transients. Thus, a multimeter designed to a CAT III standard is resistant to much higher energy transients than one designed to CAT II standards. Many test instruments such as oscilloscopes, multimeters, and component testers often have labels near or next to their inputs that indicate CAT rating.

Charged: A piece of Equipment or a conductor that has acquired a voltage charge either because it is live or has been live, or because it has become charged by other means such as 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.

Competent Person: a person judged by an Electrical Authorised Person as competent to receive a Permit or Sanction (usually an Electrical Nominated Person) or an Authority for Access for works in Switch Rooms and Substations for minor electrical work or work that involves other trades. Competent Persons shall have:

- i. an understanding of the work they are to perform;
- ii. an understanding of electricity and its potential to harm;
- iii. an understanding of the electrical hazards which may arise during the work and the precautions which need to be taken;
- iv. the ability to recognise at all times whether it is safe for work to continue;
- v. the ability to recognise their own limitations.

Contractor: any external organisation or other body employed by STFC to carry out specific duties on or within STFC property.

Dead: At or about zero voltage and disconnected from any live or charged system.

Disconnection: The complete isolation, electrically and physically (by the total removal of cables or bus-bars from any live or potentially live apparatus), such that the circuit or system is not reliant on locks or the removal of fuses to prevent it being re-energised, and thus removing all hazards from the circuit, system, or apparatus. Removal of tails from a fuse-way and leaving them taped up in the fuse board would not be deemed a Disconnection.

Earthed: Connected to the general mass of earth in such a manner as to ensure at all times an immediate discharge of electrical energy without risk or, as appropriate, injury.

Electrical Installation (abbr. Installation): An assembly of associated Electrical Equipment to fulfil a specific purpose, which forms part of a system.

Hazardous Area: Any location in which there is a risk to health. The risk may be due to any hazard, such as storage areas, laboratories and facilities containing dangerous substances, explosive atmospheres, poisonous substances, electromagnetic radiation, ionising radiation, or strong magnetic fields. Locations of work should also be considered such as confined space or working at height.

High Voltage Enclosure: A location within which a live High Voltage conductor is or may be exposed without the use of a tool or key.

Interlock: A means to prevent switching operations or access that might cause injury, such as paralleling of supplies, or entering enclosures without the supply being isolated.

International Protection (IP): A specification for degrees of protection provided by enclosures, for example IP2X defines an enclosure providing protection against ingress of foreign objects with a diameter of 12.5 mm, and from a finger being inserted and accessing hazardous parts: the X means there is no protection against ingress of water specified.

Isolate: Disconnect and separate Electrical and Electronic Equipment from the normal source(s) of electrical energy in such a way that the disconnection and separation is secure.

Live: Any apparatus or conductors that are at a voltage by being connected to a source of electricity.

Mimic Diagram: A single line diagram of an electrical distribution system so constructed that the symbol for each item of switchgear may be adjusted to indicate the ON, the OFF, or the EARTHED position. The symbol for each item of Equipment shall use the appropriate colour identification of voltages to BS EN 60617.

Protective Conductor (PE): (BS 7671:2008) A conductor used for some measures of protection against electric shock and intended for connecting together any of the following parts:

- i. exposed-conductive-parts;
- ii. extraneous-conductive –parts;
- iii. the main earthing terminal;
- iv. earth electrode(s);
- v. the earthed point of the source, or an artificial neutral.

Prove Dead: Demonstrate with the use of suitable and sufficient Test Equipment that no electrical potential liable to cause injury is present.

Proving Unit: see Test Supply.

Removable Temporary Earth: This is an earth, which may be removed for the duration of a test. The Electrical Authorised Person lists these on the Sanction to Test, when a Sanction to Test is required.

Substation: Any premises or part of premises in which electrical energy is transformed or converted to or from high voltage, or which contains high voltage switchgear.

Switchboard: High or low voltage switchgear assembled into a single panel or frame.

Switch Cupboard: A room containing distribution boards and other electrical apparatus, but not Distribution Switchgear. An Authority for Access would not normally be required. In exceptional instances where an area classed as a Switch Cupboard may be a shared area, such as those used by cleaners, it may be advantageous to change the reference to show the different level of access control.

Switchgear: An assembly of main and auxiliary electrical equipment for operation, regulation, protection, or other control of an electrical Installation.

Switch Room: A room other than a Substation containing distribution Switchgear. Unless authorised to do so, an Authority for Access would normally be required to enter.

Temporary Earth: A connection to earth made before working on or testing equipment to ensure as far as is practicable that the equipment does not become electrically charged, secured where practicable by a Safety Lock. On completion of a Permit to Work or Sanction to Test these earths are removed by the Electrical Authorised Person.

Test Equipment: Equipment to undertake particular tests that is suitable and sufficient for the use for which it is provided, that is maintained in a condition suitable for that use, and that is properly used (see CAT rating definition).

Test Indicator / Potential Indicator: Test Equipment for proving dead and confirming dead in connection with this SHE Code.

Test Supply (or Proving Unit): Test Equipment for proving the function of a voltage Test Indicator or a Potential Indicator for live voltage and phasing Test Equipment or a current Test Indicator.

6. REFERENCES

- 6.1 Electricity at Work Regulations, 1989.
- 6.2 HSE guidance on Regulations HSR25. Memorandum of guidance on the Electricity at Work Regulations 1989.
- 6.3 Electricity Safety, Quality and Continuity Regulations (ESQCR).
- 6.4 Guidance on the Electricity Safety, Quality and Continuity Regulations (ESQCR), Department of Trade and Industry.
- 6.5 BS 7671, Requirements for Electrical Installations, IET Wiring Regulation, latest edition.
- 6.6 BS EN 61243-3:2010 Voltage indicators, Electrical test equipment for use by electricians, HSE guidance note GS38. (Integral Fuses are prohibited for future purchases of voltage indicators)
- 6.7 Avoiding danger from underground services. HSE guidance note HSG47.
- 6.8 Electricity at Work – Safe Working Practices. HSE guidance Information HSG85.
- 6.9 Keeping electrical switchgear safe, HSG230.
- 6.10 Electrical Switchgear Safety, General information sheet INDG372 (rev1).
- 6.11 Safety in Electrical Testing: Switchgear and control gear, engineering information sheet EIS37.
- 6.12 Safety in Electrical Testing at Work, general Information sheet INDG354.
- 6.13 Guidance on Safe Isolation Procedures for Low Voltage Installations, HSE and Electrical Safety Council best practice guide no. 2.
- 6.14 Specification for degrees of protection provided by enclosures (IP code) IEC 60529, as amended.
- 6.15 Pocket Guide 16, IP codes, NICEIC Pocket Guides.
- 6.16 Safety in Electrical Testing: Service and repair of audio, TV and computer equipment, engineering information sheet EIS36.
- 6.17 Using electric storage batteries safely, general information sheet INDG139 (rev1).
- 6.18 Electrical safety and you, general information sheet INDG231 (rev1).

APPENDIX A - EXPERIMENTAL EQUIPMENT - DESIGN AND OPERATION

A1 INTRODUCTION

A1.1 This appendix is concerned with what constitutes safe practice in the design, construction, and operation of experimental high and low voltage equipment having a steady short circuit current greater than 5mA and a maximum stored energy of greater than 5 Joules.

A1.2 It is essential that the safe operating conditions are established in the design stage. Due to the vast array of high and low voltage equipment only a guide to safe practice in design and operation can be given, based in the main on past experience of similar work. It is advisable in the design stage to consult Electrical Authorising Engineers, Electrical Authorised Persons and SHE Group for consideration of the following precautions:

- Additional Load on the Distribution Network;
- Fire Detection;
- Emergency Exits;
- Emergency Shut-Down Facilities;
- Lighting and Emergency Lighting;
- Audible Alarms;
- Environmental conditions

A1.3 On experimental high or low voltage equipment working on or near live equipment is to be avoided whenever possible. Exceptionally live working is permitted, providing that it is undertaken in accordance with section B11.

A2 ISOLATION AND EARTHING

A2.1 A means of positively isolating low and high voltage equipment shall be provided and shall be clearly marked.

A2.2 Contactors used for operational purposes must not be regarded as points of isolation.

A2.3 Wherever practicable, locate the isolating switches adjacent to the equipment.

A2.4 If the equipment is low voltage and has a single point of isolation, then a suitable risk assessment and / or the procedures set out in Table LV3 shall be followed.

A2.5 Where a Permit to Work or Sanction to Test is required the isolation procedures are set out in Tables EXPHV1, EXPHV2, LV1 and LV2 and shall be followed.

A3 EMERGENCY SHUTDOWN FACILITIES

A3.1 Where there is an increased likelihood that an electrical incident or fire may occur, such as in experimental areas, HV enclosures and laboratories, the inclusion of emergency shutdown buttons or break-glass units to interrupt all electrical supplies should be considered.

A3.2 Emergency shutdown control points shall be situated in prominent positions and shall be clearly labelled to indicate what they control. Circuit reference numbers shall also be included.

A3.3 All personnel working in these areas shall be shown where these control points are located and instructed in their operation.

A3.4 The design and positioning of such control points shall include consideration to avoid accidental tripping of the equipment or system.

A3.5 Consideration should also be given in the design to the way tripped circuits are reset. Whilst for most applications an automatic reset occurs when the button is

released or the glass replaced, other applications may require a more controlled method of reset.

- A3.6 Shutdown circuits shall be fully tested every 5 years, unless an Electrical Authorising Engineer has performed a risk assessment and specified an alternative period. However for main high voltage and low voltage distribution panels, local procedures, agreed with the Electrical Authorising Engineer, may be used to prevent a full trip of the breakers. As reliable operation of a shunt trips is dependent on a functional power supply, monitoring of the supply should be considered.

A4 APPARATUS LEFT WORKING UNATTENDED - Emergency Procedures

- A4.1 If it is necessary for apparatus to be left working unattended, emergency contact details, of those responsible for the equipment in and out of normal working hours, must be recorded on hazard warning posters, located outside the area where the equipment operates.
- A4.2 If there is any doubt about the advisability of leaving apparatus working unattended the Electrical Authorising Engineer or SHE Group should be consulted.
- A4.3 Where emergency instructions for the safe shut down of unattended equipment are necessary these should be located in a prominent position adjacent to equipment left working. Such instructions should be readily operated by personnel unfamiliar with it: a sketch of the layout and position of means of isolation and any specific explosion, toxic, or other hazards which may arise.
- A4.4 Means shall be provided as necessary to prevent injury, or damage to the apparatus (such as manual resets) in the event of an electrical power or other service failure, or upon restarting following restoration of supply.

A5 INTERLOCKS

- A5.1 Safety interlocks shall be fitted to all enclosures to prevent access to any exposed live or charged conductors above ELV. They are required on all panels or doors that can easily be removed without the use of a tool. Mechanical and electro-mechanical interlocks should be used for permanent enclosures.
- A5.2 Permanent interlock systems shall be positively operated, should fail safe, and have their wiring segregated from other wiring (where applicable). Standard micro-switches shall not be used as a sole point of isolation for interlock systems.
- A5.3 For non-permanent experiments simple electrical interlocks may be adequate.
- A5.4 Interlock circuits using positively operated switches are vital for the protection of equipment and personnel against faults and mal operation. It is essential that they are thoroughly tested during commissioning and thereafter are checked periodically throughout the life of the Equipment.
- A5.5 Ensure that all codes for trapped key interlocks employed on STFC sites are unique, for example Castell and Fortress locks, a master list of key interlock codes will be maintained by SHE Group.

A6 ELECTRONIC EQUIPMENT

- A6.1 No clear distinction is drawn between electronic and electrical equipment as far as it concerns safety precautions and safe working.
- A6.2 Consideration must be given to the following recommendations:
- where voltages exceed ELV warning labels must be applied;
 - all designs shall eliminate inadvertent contact with high or low voltage conductors, during servicing or other works, by the inclusion of shrouding or interlocks;

- wherever possible high and low voltage test equipment should be designed so that its maximum steady output current cannot exceed 5mA;
- the fire and/or explosion hazard should be scrutinised, particularly where high currents are involved;
- whenever high power, high frequency equipment is designed or used, the electro-magnetic field and ionising radiation hazards must be considered, see SHE Code 23, Working with time varying electro-magnetic fields and SHE code 28 radioactive open sources.

A7 BATTERIES

- A7.1 Batteries require additional provisions on the grounds that they store energy which is not feasible to make safe by isolation and discharging.
- A7.2 Batteries shall be sub-divided into sections of no more than 120V for charging purposes, with such sections paralleled.
- A7.3 Batteries shall be installed within suitable enclosures to protect against the shorting of terminals, or within designated rooms with restricted access. Suitable and sufficient ventilation shall be provided, especially where Batteries are being charged.
- A7.4 Appendix E contains further recommendations for the safe use, handling, storage, and maintenance of primary and secondary cells, and batteries.

A8 MARKING AND IDENTIFICATION

- A8.1 All switches, control buttons, and indicator lamps must be clearly marked to indicate their function.
- A8.2 Emergency controls and isolators shall be installed in prominent positions and must be marked to identify the equipment they control.
- A8.3 The following information should be displayed near the entrance to all experimental High Voltage Enclosures and low voltage equipment:
- Clear operating instructions; and
 - Clear shut-down instructions; and
 - Location of isolator; and
 - Emergency First Aid instructions; and
 - A hazard warning poster indicating the major hazards; and
 - Contact details for those responsible for the area in and out of normal working hours.

A9 EXPERIMENTAL LOW VOLTAGE EQUIPMENT

A9.1 Enclosures and Barriers

- A9.1.1 All low voltage equipment shall be housed within suitable enclosures to prevent access when the equipment is live or charged. An enclosure shall comprise of a container manufactured from insulated material or earthed metalwork.
- A9.1.2 All covers, fascias, or doors shall only be removable with the use of a tool.
- A9.1.3 Larger enclosures shall be positioned in such a way so as not create additional hazards. Sufficient space and lighting shall be provided around such enclosures to allow work within the enclosure to be carried out safely.
- A9.1.4 All panels and ventilating spaces shall be designed so as to prevent physical contact with live or charged conductors, with a minimum of IP2X rating.
- A9.1.5 Good housekeeping, tidiness, and neatness of layout are important factors in maintaining safety with all types of equipment.

A9.2 Earth Bonding

- A9.2.1 Metal enclosures, cases of all equipment, doors, cable armouring, conduits, and metal trunking shall be suitably bonded and earthed. All bonding and earth connections shall be capable of carrying the maximum possible fault current.
- A9.2.2 Equi-potential bonding will be required where other services (e.g. gas, water, etc.) form part of the experimental Equipment.

A9.3 Temporary Supplies

- A9.3.1 Where experimental low voltage equipment is to be installed for a temporary period, less than one year, the use of Temporary Supplies may be considered. (See section B21)
- A9.3.2 The use of general purpose extension leads shall only be used for very limited periods, less than 3 months. Their lay-out shall be such as to eliminate any trip hazards.
- A9.3.3 "Hard wired temporary supplies" using protected or armoured cable should be considered for most temporary installations. Their installation shall be designed so as to eliminate any trip hazards, and follow manufactures guidelines. Temporary Supplies shall be registered, installed, and subjected to monthly inspection and testing. (see section B21)

A9.4 Voltage Warning Labels

- A9.4.1 Every item of equipment or enclosure where a voltage exceeding ELV exists, and where the presence of such a voltage would not normally be expected, shall be so arranged that before access is gained to live parts, a warning of the maximum voltage present is clearly visible. Specific consideration should be given to instances where multiple phases are present.

A9.5 Earthing of Portable Electronic Test Equipment

- A9.5.1 All class I insulated portable electronic test equipment connected to the main electrical distribution system must be properly earthed. (See SHE Code 17 Portable Electrical Equipment)
- A9.5.2 Before using portable electrical test equipment (such as oscilloscopes and multi-meters) on electrical equipment operating at voltages above ELV, ensure that a risk assessment and method statement for the tests planned has been established; see STFC SHE Code 6 Risk Management. Staff performing tests must be competent and familiar with the equipment to be tested; particular attention shall be given to floating signal references and isolated earths. If equipment under test has been designed with test points then a RA is not required. If Live Working is required then it must conform to section B11.

A10 EXPERIMENTAL HIGH VOLTAGE EQUIPMENT

A10.1 Enclosures and Barriers

- A10.1.1 All high voltage equipment shall be housed within suitable rated IP enclosures and means provided to prevent access when the equipment is live or charged. An enclosure may be a room, a barricaded area, or / and equipment rack.
- A10.1.2 For large equipment where it is possible to enter the enclosure, there should be a safe means of access and a clear and unobstructed passage around the

- equipment. Overhead clearance should be considered, particularly where cranes are installed.
- A10.1.3 On small equipment where entry is not possible, the panels and ventilating spaces shall be designed so as to prevent physical contact with exposed live or charged conductors with a minimum rating of IP2X, taking into consideration HV minimum clearance distances.
- A10.1.4 An enclosure may be:
- Permanent;
 - Temporary (lifetime less than 3 months);
 - Very Short Term (lifetime less than 1 week);
- A10.1.5 Permanent enclosures should be soundly constructed and for large equipment shall be at least 2m high. Use may be made of close mesh perforated metal, and safety glass or plastic for windows. Adequate interlocks and labels must be fitted to doors and on panels which are easily removable, without the use of tools. Removable panels shall be marked with labels stating that live or charged parts will be exposed if those panels are removed.
- A10.1.6 Temporary enclosures shall be designed to suit the scale of the experiment, but should be of a rigid construction and suitably interlocked.
- A10.1.7 Very short term experiments shall be enclosed to bar access. Where reliance is placed on rope or tape barriers and prominent Danger Notices, the equipment should not be unattended when energised.
- A10.1.8 All Low Voltage conductors which may remain live or charged even when the high voltage is de-energised should be completely enclosed and conform to IP2X.
- A10.1.9 Good housekeeping, tidiness, and neatness of layout are important factors in maintaining safety with all types of enclosure.

A10.2 Isolation and Earthing

- A10.2.1 A means of positively isolating and earthing high voltage equipment shall be provided.
- A10.2.2 For large permanent installations it is advisable to mechanically interlock the door of the enclosure with the isolation and earthing switches, thus ensuring the system is earthed before the enclosure door can be opened.
- A10.2.3 Where interlocks are not practicable, the isolator shall be a manually operated switch or fuse-switch located near the door and conspicuously marked. This type of switch must have the facility for safety locks to be fitted.
- A10.2.4 Contactors used for operational purposes must not be regarded as points of isolation.
- A10.2.5 Where the isolator does not interrupt the low voltage circuits, in order to facilitate rescue or firefighting operations, an emergency isolator is to interrupt all supplies and render the enclosure completely dead.
- A10.2.6 Temporary installations may employ an isolator interlocked with the door and with a gravity operated earthing switch.
- A10.2.7 Wherever practicable, locate the isolating and earthing switches so that they are visible from the entrance to the enclosure.
- A10.2.8 The use of approved Earthing Sticks should be considered wherever practicable, but should only be applied after the usual methods of making safe have been performed.
- A10.2.9 The person responsible for the area, in consultation with the Electrical Authorising Engineer or Electrical Authorised Person, must ensure that equipment used within the area is suitably rated (e.g. Earth sticks and test equipment). The user must inspect the equipment before use and ensure that the rating is not exceeded, see A10.8.8 for further details on earth sticks.

A10.3 Earth Bonding

A10.3.1 Each large enclosure shall be provided with a suitable earth point within the enclosure. Metal enclosures, cases of all Equipment, doors, cable armouring, conduits, and metal trunking shall be suitably bonded and earthed. All bonding and earth connections shall be capable of carrying the maximum possible fault current.

A10.4 Interlock Bypass

A10.4.1 Occasionally with high voltage equipment it may be necessary to obtain access to enclosures with the interlocks bypassed. Bypasses provided for this purpose should be carefully assessed with a risk assessment and method statement and approved by an Electrical Authorising Engineer. Refer to table EXPHV3.

A10.4.2 Where, in the judgement of the Electrical Authorising Engineer, or an Electrical Authorised Person approved in the Local Rules, after examining all possible alternatives, it is essential to gain access with conductors live or charged, then the following conditions must also be adhered to:

- There must be adequate working space, adequate means of access and adequate lighting;
- An Electrical Nominated Person or Electrical Authorised Person responsible for the work or acting as an accompanying safety person must have intimate knowledge of the equipment.
- Personnel must not work alone, at least two people must be present and must be in sight of each other.
- Entry must be limited to:
 - Electrical Authorised Person(s) and Electrical Nominated Person(s), with one of them acting as the Accompanying Safety Person; or
 - as detailed in local operating instructions or rules.
- A Sanction for Work on or near Live Electrical Equipment (Section B11) must be issued to the Electrical Authorised Person or an Electrical Nominated Person before access is permitted. This Sanction must specify in detail the limits of the safe area, the conductors which are live or charged, any special precautions taken, and exactly what work is to be done.
- The area within which the work is to be done must be clearly defined by the use of ropes, barriers, or by height, and with notices. These must be arranged to maintain certain minimum clearances.
- As a guide the shortest distances in air between a live or charged conductor and the feet of someone working in the enclosure shall not be less than:

Rated Voltage	Minimum Clearance
1kV to 50kV peak	3m or 10ft
50kV to 150kV peak	4m or 13ft
150kV to 300kV peak	5m or 16ft
300kV to 600kV peak	7m or 23ft
600kV to 900kV peak	11m or 36ft

Where these distances cannot be achieved, or are inadequate to avoid injury, then the Electrical Authorised Person can amend these distances if suitable risk assessments and method statements are followed.

- Where Interlocks are bypassed, the Electrical Authorised Person must ensure that all changes made to the system are formally recorded. Once work or tests are completed they must formally record that the bypassed interlocks have been reinstated and tested.
- When the work involves the use of portable ladders, then it must be supervised and directed by the Electrical Authorised Person. The Electrical Authorised Person must satisfy themselves that the ladders are of a suitable type, are no longer in use than is necessary for the job, and are not erected, moved, or used in a manner inconsistent with other requirements.
- When working or testing in a HV Enclosure ensure that tools, equipment, protective clothing, barriers, and/or screens are safe and fit for purpose.

A10.5 Warning Devices

- A10.5.1 Suitably positioned illuminated lamps shall be used to indicate that high voltage circuits are live or charged, to indicate whether it is safe to enter.
- A10.5.2 Each indicator shall contain two sources of illumination.
- A10.5.3 On large installations lamps should be placed prominently within the high voltage enclosure; the use of an audible evacuation signal are also advisable.
- A10.5.4 Warning notices of a type conforming to the requirements of the Health and Safety (Safety Signs and Signals) Regulations (1996) shall be installed in such a way as to be visible on all approachable sides of the enclosure.

A10.6 Discharging of Capacitor Banks

- A10.6.1 The safety of persons working on capacitor banks must be ensured by discharging, shorting, and earthing the capacitors so that no hazardous voltages remain, or will arise due to dielectric recovery.
- A10.6.2 Two electrically independent systems shall be incorporated for these purposes, without the need to enter the high voltage enclosure. In large installations they will take the form of “Slow Dump” and Shorting Switches, and separate Earthing Switches.

A10.7 Slow Dumping of Capacitor Banks

- A10.7.1 All capacitor banks shall be provided with a means for relatively slow dissipation of their stored energy into a resistive load. The resistance value and rating shall have an adequate margin of safety and be arranged to restrict currents and discharge times to reasonable values.
- A10.7.2 An assessment of the means for slow dissipation of capacitor banks shall be approved by the Electrical Authorising Engineer.
- A10.7.3 For small installations a bleeder chain across the capacitor(s) may be sufficient, on large installations a “slow dump switch” and “dump resistor” must be fitted.
- A10.7.4 The “slow dump switch” circuit shall be an independent means of dissipating the energy stored in capacitors.
- A10.7.5 Any “fast dump or crowbar” circuits provided as a plant protection measure shall be regarded as an additional facility.

A10.8 Shorting Switches for Capacitor Banks and Connections to Earth

- A10.8.1 All capacitor banks shall be provided with sufficient permanently installed shorting switches to remove all hazardous voltages. The connections to the individual capacitors shall be direct, visible, and of robust construction.

- A10.8.2 In cases where capacitor banks are connected in series-parallel, or are subdivided by fuses or protective resistors, each parallel-connected group shall be independently discharged and short-circuited before access to the bank can be considered safe.
- A10.8.3 Facilities for local operation of shorting switches shall be provided.
- A10.8.4 In some cases it may be permissible to combine dumping and earthing in a switch that first connects a resistor in circuit for sufficient time to reduce any capacitor charge to a value at which the application of a short circuit can be shown to be a safe operation.
- A10.8.5 Before short-circuits are applied across capacitors, checks must be made to ensure that there is no hazard to personnel.
- A10.8.6 It is recommended that shorting switches should incorporate a solid connection to the installation earth independent of the load circuit.
- A10.8.7 Except for very simple low energy experiments, Earthing Sticks shall be used only after the standard procedures of making safe as described in Table CAP1.
- A10.8.8 Care shall be taken to ensure Earthing Sticks are:
- suitably rated for the operating voltage of the system; **and**
 - capable of dissipating safely all the stored energy to which they may be subjected;
 - the earth connection is sound and substantial; **and**
 - they have been suitably tested on a 5 yearly basis and records maintained.

A10.9 Capacitor Fault Conditions

- A10.9.1 Fault conditions on capacitor banks require special precautions which may be peculiar to each installation. Consideration should be given to the means of making safe under such conditions. This may include emergency equipment such as voltage indication, and the discharge and earthing of damaged or faulty Capacitor Banks.
- A10.9.2 The design must be such that in the event of a capacitor failure within one bank, the energy flowing into the fault can be absorbed safely.
- A10.9.3 Considerable forces can be generated under fault conditions; the mechanical support systems of conductors must be sized to withstand these forces.

A10.10 Spare Capacitors

- A10.10.1 All spare or disconnected storage capacitors in working areas or storage facilities must be kept short-circuited to prevent the build-up of dangerous voltages through dielectric recovery.
- A10.10.2 Procedures and monitoring must be in place to ensure capacitors are not left open-circuit for longer than the minimum practicable period during the building or modification of Capacitor Banks.

Table EXPHV1 For Working on High Voltage Experimental Equipment in an Enclosure

All High Voltage Equipment in experimental areas having a steady short circuit current greater than 5mA and a maximum stored energy of greater than 5 joules.

The Electrical Authorised Person is responsible for ALL steps except step 6, which is undertaken by the Person in Charge.

Step	Action
1: PREPARATION	COMPLY WITH ANY PARTICULAR SAFETY PROCEDURES APPLICABLE TO THE LOCATION. Risk Assessments must be in place for the work to be carried out before proceeding to Step 2.
2: ISOLATE AND FIX SIGNS	ISOLATE FROM ALL SOURCES OF SUPPLY. Where practicable, prevent unauthorised connection or unauthorised operation by fixing Safety Locks and/or Caution Notices at all the points of isolation. Fix Electrical Equipment Warning Signs on adjacent live Equipment at the places of work.
3: PROVE DEAD AND EARTH	ENSURE THAT THE EQUIPMENT TO BE WORKED ON IS THE EQUIPMENT THAT HAS BEEN ISOLATED. Where fitted, earth Equipment using the earthing switch and fix Safety Locks. Ensure that all Red lights (where fitted) have been extinguished, and replaced by illuminated Green (earthed) lights. Where practicable prove dead, with a High Voltage potential indicator, at all accessible points of isolation and at the places of work. Where possible, earth down exposed electrical conductors using Earthing Sticks.
4: ISSUE PERMIT TO WORK	The prospective Person in Charge is to be aware of the Risk Assessment, Safety Programme, and the safety arrangements at all the points of isolation and at the places of the work. The Person in Charge is to fit their Safety Locks to all points of isolation. The Permit to Work, issued by the Electrical Authorised Person, must be displayed at the point of work.
5: CONFIRM DEAD	Where it is not practicable in Step 3 to prove the Equipment dead until conductors have been made accessible to a High Voltage Test Indicator, the Electrical Authorised Person is to remain with and supervise the prospective Person in Charge to ensure covers or shrouds are removed safely. The Electrical Authorised Person shall then prove dead using an appropriate High Voltage Test Indicator.
6: UNDERTAKE WORK	The Person in Charge undertakes or directly supervises the work and, on completion or when the work is stopped and made safe, checks that all persons under their charge are made aware of the completion/suspension of work, returns the Permit to Work to the Electrical Authorised Person, and completes and signs Part 3.
7: CHECK WORK	If the work has been completed, check that the work is satisfactory, that the Equipment has been restored to working order and that it may be safely energised. If the work was stopped in Step 6, check that the Equipment has been made safe.
8: CANCEL PERMIT TO WORK	Cancel the Permit to Work completing and signing Part 4. The Person in Charge shall remove their Safety Lock applied in Step 4. Where a test is required before the Equipment is energised, Steps 9 and 10 are omitted, and the procedures of Table EXPHV2 are to be followed. Where other Permits relate to the Equipment and have not been cancelled, Steps 9 and 10 are omitted.
9: REMOVE EARTHS	Remove the Safety Locks and Earths applied in Step 3.
10: MAKE EQUIPMENT OPERATIONAL	Remove the Safety Locks and signs fitted in Step 2 and restore the Equipment to an operational state.
11: RECORDS	The completed Permit to Work shall be placed in the operational file and held for 2 years.

Table EXPHV2 For Testing High Voltage Experimental Equipment in an Enclosure

All High Voltage Equipment in experimental areas having a steady short circuit current greater than 5mA and a maximum stored energy of greater than 5 joules.

The Electrical Authorised Person is responsible for ALL steps except step 6 undertaken by the Person in Charge.

Step	Action
1: PREPARATION	COMPLY WITH ANY PARTICULAR SAFETY PROCEDURES APPLICABLE TO THE LOCATION. Risk Assessments must be in place for the test to be carried out before proceeding to Step 2.
2: ISOLATE AND FIX SIGNS	ISOLATE FROM ALL SOURCES OF SUPPLY. Where practicable, prevent unauthorised connection or unauthorised operation by fixing Safety Locks and/or Caution Notices at all the points of isolation. Fix Electrical Equipment Warning Signs on adjacent live Equipment at the places of work.
3: PROVE DEAD AND EARTH	ENSURE THAT THE EQUIPMENT TO BE TESTED IS THE EQUIPMENT THAT HAS BEEN ISOLATED. Where fitted, earth Equipment using the earthing switch and fix Safety Locks. Ensure that all Red lights (where fitted) have been extinguished, and replaced by illuminated Green (earthed) lights. Where practicable prove dead, with a High Voltage potential indicator, at all accessible points of isolation and at the places of test. Where possible, earth down exposed electrical conductors using Earthing Sticks.
4: ISSUE SANCTION TO TEST	The prospective Person in Charge is to be aware of the Risk Assessment, Safety Programme, and the safety arrangements at all the points of isolation and at the places of the test. The Person in Charge is to fit their Safety Locks to all points of isolation. Where the test may extend the boundaries of the HV enclosure, barriers are to be set up at safe distances and High Voltage Enclosure Signs fitted.
5: CONFIRM DEAD	Where it is not practicable in Step 3 to prove the Equipment dead until conductors have been made accessible to a High Voltage Test Indicator, the Electrical Authorised Person is to remain with and supervise the prospective Person in Charge to ensure covers or shrouds are removed safely. The Electrical Authorised Person shall then prove the Equipment dead using an appropriate High Voltage Test Indicator. The Electrical Authorised Person shall then prove the Equipment dead at the places of work before allowing the Person in Charge to assume control of the test.
6: UNDERTAKE WORK	The Person in Charge undertakes or directly supervises the test including the disconnection of any Removable Earths. On completion of the test, or when the test is stopped and made safe, the conductors are to be discharged and any Removable Earths restored. After ensuring that all persons under their charge are made aware of the completion/suspension of work, the Person in Charge returns the Sanction to Test to the Electrical Authorised Person, and completes and signs Part 3.
7: CHECK WORK	If the test has been completed, check that the work is satisfactory, that the Equipment has been restored to working order and that it may be safely energised. If the work was stopped in Step 6, check that the Equipment has been made safe.
8: CANCEL SANCTION TO TEST	Cancel the Sanction to Test completing and signing Part 4. The Person in Charge shall remove their Safety Lock applied in Step 4. Where the test has been stopped in Step 6 and work is required before the Equipment is re-tested, Steps 9 and 10 are omitted, and the procedures of Table EXPHV1 are to be followed.
9: REMOVE EARTHS	Remove the Safety Locks and Earths applied in Step 3.
10: MAKE EQUIPMENT OPERATIONAL	Remove the Safety Locks and signs fitted in Step 2 and restore the Equipment to an operational state.
11: RECORDS	The completed Permit to Work shall be placed in the operational file and held for 2 years.

Table EXPHV3 For Working on or Live Testing of High Voltage Experimental Equipment with Interlock Bypasses Applied

All High Voltage Equipment in experimental areas with Interlock Bypasses, and having a steady short circuit current greater than 5mA and a maximum stored energy of greater than 5 joules.

The Electrical Authorised Person responsible for ALL steps except step 4 undertaken by an Electrical Nominated Person.

Step	Action
1: PREPARATION	<p>COMPLY WITH ANY PARTICULAR SAFETY PROCEDURES APPLICABLE TO THE LOCATION.</p> <p>Standing Instructions and Risk Assessments must be in place for the work or test to be carried out before proceeding to Step 2.</p>
2: ISSUE SANCTION FOR WORK ON OR NEAR LIVE ELECTRICAL EQUIPMENT	<p>ALL PERSONNEL INVOLVED WITH THE WORK OR TEST MUST BE FULLY AWARE OF THE HAZARDS CREATED BY THIS PROCEDURE.</p> <p>The prospective Person in Charge is to be aware of the Risk Assessment, Safety Programme, and the safety arrangements at the places of the work. The Sanction for Work on or near Live Electrical Equipment must be displayed at the point of work.</p>
3: BYPASS	<p>INTERLOCKS SHALL ONLY BE BYPASSED WHERE IT IS NOT PRACTICABLE TO CARRY OUT THE WORK IN OTHER WAYS.</p> <p>Operation of Interlock Bypasses shall only be carried out by the Electrical Authorised Person.</p> <p>Where a switch handle or button must be held in position throughout the work or Test to allow entry, an Accompanying Safety Person must be present at the entrance to the High Voltage enclosure whilst the work is in progress.</p> <p>Where a switch with an audible alarm is fitted to indicate operation of the Interlock Bypass, the Electrical Authorised Person is to act as Accompanying Safety Person.</p> <p>Where changes have been made to the Interlock to achieve bypass, these changes must be recorded.</p>
4: UNDERTAKE WORK OR TEST	<p>Work or testing is to be carried out as timely as possible. Appropriate PPE as defined by the Risk Assessment and/or Standing Instruction must be worn.</p> <p>On completion/suspension of work, the Person in Charge returns the Sanction for Work on or near Live Electrical Equipment to Work to the Electrical Authorised Person, and completes and signs Part 3.</p>
5: CANCEL SANCTION FOR WORK ON OR NEAR LIVE ELECTRICAL EQUIPMENT	<p>Cancel the Sanction for Work on or near Live Electrical Equipment by completing and signing Part 4 and placing the completed Sanction in the "Cancelled SFW File."</p>
6: REMOVE BYPASS	<p>Once work is completed and the door interlock returned to normal, the handle or button of the bypass may be released, or the bypass switch and audible alarm returned to normal.</p> <p>Where changes have been made to the Interlock to achieve bypass, reinstatement of the interlocks must be made and recorded.</p> <p>Where the work is stopped in Step 4 for other work requiring an isolation, procedures of Table EXPHV1 and EXPHV2 as appropriate are to be followed.</p>
7: RECORDS	<p>The completed Sanction for Work on or near Live Electrical Equipment shall be held for 3 years.</p>

Table CAP1 Procedure for working or testing on large high voltage capacitors banks

Capacitor banks having a steady short circuit current greater than 5mA and a maximum stored energy of greater than 5 joules.

The Electrical Authorised Person is responsible for ALL steps except step 8 undertaken by the Person in Charge.

Step	Action
1: PREPARATION	COMPLY WITH ANY PARTICULAR SAFETY PROCEDURES APPLICABLE TO THE LOCATION. Standing Instructions and Risk Assessments must be in place for the work or test to be carried out before proceeding to Step 2.
2: ISOLATE AND FIX SIGNS	ISOLATE FROM ALL SOURCES OF SUPPLY. Where practicable, prevent unauthorised connection or unauthorised operation by fixing Safety Locks and/or Caution Signs at all the points of isolation.
3: DISCHARGE	DISCHARGE ALL CAPACITORS IN A SAFE AND CONTROLLED MANNER. Controlled discharges shall be made using Slow Dump Switches and Dump Resistors to restrict currents.
4: SHORT	ENSURE CAPACITORS ARE DISCHARGED BEFORE SHORTING. Operate Shorting Switches to remove all hazardous voltages. Ensure no hazard to personnel is involved with the operation of Shorting Switches
5: EARTH	Where applicable, operate Earthing Switches.
6: PROVE DEAD	Prove dead using a suitable voltage Test Indicator at all places of work. Additional Earthing Sticks may be used around the places of work.
7: ISSUE PERMIT TO WORK	The prospective Person in Charge is to be aware of the Risk Assessment, Safety Programme, and the safety arrangements at all the points of isolation and at the places of the work. The Person in Charge is to fit their Safety Locks to all shorting points or earthing points. The Permit to Work, issued by the Electrical Authorised Person, must be displayed at the point of work.
8: UNDERTAKE WORK	The Person in Charge undertakes or directly supervises the work and, on completion or when the work is stopped and made safe, checks that all persons under their charge are made aware of the completion/suspension of work, returns the Permit to Work to the Electrical Authorised Person, and completes and signs Part 3.
9: CHECK WORK	If the work has been completed, check that the work is satisfactory, that the Equipment has been restored to working order and that it may be safely energised. If the work was stopped in Step 8, check that the Equipment has been made safe.
10: CANCEL PERMIT TO WORK	Cancel the Permit to Work completing and signing Part 4. The Person in Charge shall remove their Safety Lock(s) applied in Step 4.
11: REMOVE EARTHS	Remove Earths applied in Step 5.
12: REMOVE SHORTS	Remove shorts applied in Step 4. and return Capacitor Bank to an operational state.
13: MAKE EQUIPMENT OPERATIONAL	Remove all Safety Locks applied in Step 2 and return Capacitor Bank to an operational state. The completed Permit to Work shall be placed in the operational file and held for 2 years.

Appendix B ELECTRICAL DISTRIBUTION SYSTEM SAFETY RULES AND PROCEDURES

B1 ALLOCATION OF RESPONSIBILITIES BETWEEN THE STFC AND OTHERS

General

- B1.1 Where there is a division of electrical responsibilities between the STFC and others working on STFC sites, such as contractors or electrical suppliers, the STFC Electrical Authorising Engineer or Electrical Authorised Person shall co-operate and co-ordinate with the other party (or parties) as necessary to prevent injury.
- B1.2 The STFC Electrical Authorised Person shall not exceed their areas of responsibility as defined by their letter of appointment.
- B1.3 In the clauses that follow, each demarcation of responsibility is to be recorded in writing and precisely described by a diagram. The Demarcation Line is to be at a cable termination and should normally be at the outgoing terminals of a switch or circuit breaker, which shall remain under the control of the controlling authority.

Where STFC has Control of the Electrical Hazards

- B1.4 The STFC owns and is responsible for the safe installation, operation and maintenance of all electrical systems on its sites and those working on them. STFC personnel and others are to work in accordance with this SHE Code.

Where STFC does not have Control of the Electrical Hazards

- B1.5 STFC has the general duty of care that is imposed by the Health and Safety at Work etc. Act 1974. The organisation or person having control of the electrical hazard is responsible for ensuring the safety of all persons on site and is required to operate a safe system of work by the Electricity at Work Regulations, 1989. This means, that even where STFC transfers control to another body, such as under a Certificate of Transfer of Control (see section B14), there is still a responsibility upon STFC to ensure work is carried out to a standard, that as a minimum, complies with this SHE Code.

Where STFC Appoints an Electrical Contractor

- B1.6 STFC is to specify in the conditions of contract that the contractor shall comply with this SHE Code.
- B1.7 The STFC Electrical Authorising Engineer may, where appropriate, appoint non-STFC Electrical Authorised Persons to work on STFC electrical systems.
- B1.8 In certain cases, for example under a contract, the contractor may be allowed to adopt their own safe system of work subject to approval by the STFC Electrical Authorising Engineer responsible for the area of work. A copy of such rules shall be sent to the Electrical Authorising Engineer a minimum of 1 month prior to the start of the contract so that any anomalies can be corrected prior to the commencement of work. Any subsequent changes to the Contractors' system of work must be approved by the STFC Electrical Authorising Engineer.
- B1.9 Where the Contractor is to take responsibility for part of a system or installation connected to the STFC system, a Certificate of Transfer of Control shall be issued (see Section B14). The exact extent of the responsibilities of all parties shall be shown on the certificate and on associated drawings, and shall show clearly all Demarcation Lines. This Certificate, including the conditions of issue, must be agreed by the project manager before issuing to the contractor.

B1.10 For acceptance of a new electrical system, see Section B25.

Where STFC Provides a Temporary Electricity Supply to another Consumer or Contractor

- B1.11 The temporary supply is to include a means of isolation under the control of STFC. The supply terminals of the temporary supply are to be the outgoing terminals of a switch dis-connector, circuit breaker, or other clearly identified terminals. (See section B21)
- B1.12 STFC is to be responsible for the control of the system up to and including the supply terminals. The consumer is to be responsible for the connections to the terminals and for the remainder of the downstream system.
- B1.13 Where Temporary Supplies are under the control of contractors it shall be the responsibility of the contractor to provide monthly test certificates to a nominated person at STFC.
- B1.14 Failure to comply with Clause B1.13 may result in a disconnection of supply by STFC.

B2 WORKING ON AND TESTING LOW VOLTAGE EQUIPMENT

General

- B2.1 This SHE Code does not apply where low voltage equipment has been discharged, disconnected, removed from the system or installation and is not energised by other means.
- B2.2 Low voltage equipment that is considered by the Electrical Authorised Person to be in a dangerous condition is to be isolated elsewhere and action taken by the Electrical Authorised Person to prevent it being re-connected to the supply of electricity. The Electrical Authorised Person is to report the matter as soon as reasonably practicable to the Electrical Authorising Engineer.
- B2.3 Unless the provision of Section B11 apply, all working on or testing of low voltage equipment connected to a system is to follow the procedures set out in Tables LV1, LV2 or LV3 of this SHE Code as appropriate. An Electrical Authorised Person or Electrical Nominated Person following the procedures set out in Table LV3 becomes the Person in Charge and is responsible for the Work or Test.
- B2.4 The Electrical Authorising Engineer can issue an exemption to an Electrical Nominated Person to switch, operate and make safe equipment on the load side of a main intake switch rated above 100A provided that a suitable risk assessment has been completed and the specific exemption is detailed on the Electrical Nominated Person's letter of appointment.**
- B2.5 Safety Locks are to be applied wherever practicable at points of isolation to prevent unauthorised operation or re-connection. Voltage Test Indicators are to be tested immediately before and after use against a Test Supply (proving unit).
- B2.6 A low voltage test devices should comply with the recommendations of GS38 – Electrical Test Equipment for use by Electrician, published by the Health and Safety Executive and/or BS EN 61243/IEC 61243 as appropriate. Test Indicators for use in 230/400 volts systems should be suitable and sufficient for use up to 500 volts and should indicate a live supply down to 50 volts. (Voltage indicators with integral fuses are prohibited for future purchases)
- B2.7 Multifunction instruments, single contact neon indicators, or non-contact indicators shall not be used to prove dead at Low Voltage.
- B2.8 A proving unit is the recommended method for verifying the functionality of a Voltage Test Indicator; they must be designed for use with two pole voltage testing devices, examples of compliant units are Martindale PD700, Megger MPU690 and Kewtech

Kewprove3. A known live ac supply can be used for verification in extreme cases, if voltages above ELV are protected to a minimum of IP2X.

- B2.9 Equipment and conductors are to be proved dead prior to the application of any temporary earth and removable temporary earth. Where it is not practicable to prove dead other means are to be used to make an assessment that the Equipment and conductors to which the earth is to be applied are not energised, then any temporary earth and removable temporary earth connections shall be made by means of a switch, or circuit breaker with integral earthing facilities, that form part of the permanently installed equipment. Other forms of temporary earth or removable temporary earth connection shall not be used until the conductor, where the earth is to be applied, has been proved dead.
- B2.10 Where the procedures involve the application of Temporary Earths the unauthorised removal of such earth connections is to be prevented wherever practicable by the application of Safety Locks. These Safety Locks are, where practicable, to be in addition to those required by Clause B2.4.
- B2.11 Where the procedures involve the application of Removable Temporary Earths the unauthorised removal of such earth connections is to be prevented, wherever practicable, by the application of an Earthing Lock. The key of the Earthing Lock is to be issued to the Person in Charge who will retain control of it for the duration of the tests (see Clauses B19.9 to B19.11).
- B2.12 Prior to the issue of a Permit to Work or Sanction to Test, the Electrical Authorised Person is to show the prospective Person in Charge the electrical diagram on the Safety Programme, the safety arrangements at the points of isolation and at the places of work or test and is to ensure that the person understands all the relevant safety procedures and precautions. After accepting the Permit to Work or Sanction to Test the Electrical Authorised or Nominated person becomes the Person in Charge and is responsible for the defined Work or Test until the Permit or Sanction is cancelled.

Where a Permit to Work or Sanction to Test is not required and isolation is achieved by the removal of fuses or links and it is not practicable to apply a Safety Lock, then the fuses or links are to be removed and securely retained in the possession of the Electrical Authorised Person or Nominated Person responsible for the work or test, and a caution notice posted at the point of isolation.

Table LV1 for Working on Low Voltage Equipment

Except where a Risk Assessment indicates that an explosion, electric shock or possibility of short circuit exists, equipment operating at Extra Low Voltage is exempt from these procedures.

Steps in column 1 are to be undertaken in numerical order.

Columns 2, 3 and 4 provide detail for the specified Equipment.

The Electrical Authorised Person is to be in possession of a current Electrical Authorised Person's letter of Appointment appropriate to the equipment being worked on, and is responsible for Steps 1, 2, 3, 4, 5, and 7, 8, 9, 10, 11.

The Person in Charge is to be in possession of a current Electrical Nominated Person's letter of Appointment appropriate to the equipment being worked on, and is responsible for Step 6.

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
EQUIPMENT	Main intake switches, switchboards and Equipment having two or more sources of supply, cables and other Equipment on the supply side of a main intake switch, and all underground cables, street lighting circuits, and supplies rated at 100A or more. (If equipment has two sources of supply and one is for controls / instrumentation only, see Column 2 of Table LV3)	Generating sets started by manual initiation from a remote location, or automatically on receipt of a signal.	Uninterruptible Power Supply Equipment. If a battery system has a maximum series chain/string voltage exceeding 120 volts dc a Sanction to Work should be completed, unless isolators have been provided to allow the string voltage to be reduced to below 120 volts dc.
STEP 1: PREPARE SAFETY PROGRAMME	COMPLY WITH ANY PARTICULAR SAFETY PROCEDURES APPLICABLE TO THE LOCATION. Prepare a Safety Programme and obtain a countersignature before proceeding to step 2, unless B8.2 applies.		
STEP 2: ISOLATE AND FIX SIGNS	ISOLATE FROM ALL SOURCES OF SUPPLY. Prevent unauthorised connection or unauthorised operation by fixing Safety Locks and Caution Notices at all the points of isolation. Fix Caution Notices on motor starting Equipment. Fix Electrical Equipment Warning Signs on adjacent live Equipment at the places of the work.	INHIBIT ENGINE START, ISOLATE GENERATOR. Prevent unauthorised connection, or unauthorised operation or unauthorised starting by fixing Safety Locks. Fix Caution Notices at all the points of isolation and on the engine start panel. Fix Electrical Equipment Warning Signs on adjacent live	ISOLATE FROM ALL SOURCES OF SUPPLY. Isolate mains supply, battery supply, output supply and any standby power supply. On parallel Uninterruptible Power Supply systems and those having an external bypass, ISOLATE the output supply terminal of the

	The need to isolate neutral conductors should be assessed on each job and should be stated on the permit whether or not the neutral link has been broken.	Equipment.	units being worked on from all sources of supply. If a battery installation is to be worked on, follow the rules applicable to Work on or near Live Equipment, disconnect the battery from its charger and disconnect the battery earth. Prevent unauthorised connection or unauthorised operation by fixing Safety Locks and Caution Notices at points of isolation. Fix Electrical Equipment Warning Signs on adjacent live Equipment.
STEP 3: PROVE DEAD AND EARTH	ENSURE THAT THE EQUIPMENT TO BE WORKED ON IS THE EQUIPMENT THAT HAS BEEN ISOLATED.		
	Where practicable prove dead with a voltage Test Indicator at all the points of isolation and at the places of the work. Where practicable earth conductors at points of isolation and fix Safety Locks. Identify cables with certainty at the places of the work.	Where practicable prove dead with a voltage Test Indicator at all the points of isolation and at the places of the work. Earth the line and neutral generators output terminals or conductors and, where practicable, fix Safety Locks.	Except for the battery installation, where practicable, prove dead with a voltage Test Indicator at all the points of isolation and at the places of work. Except for the battery installation, where practicable, earth conductors at points of isolation and fix Safety Locks.
STEP 4: ISSUE PERMIT TO WORK	<p>The prospective Person in Charge is to be shown the electrical diagram on the Safety Programme and the safety arrangements at all the points of isolation and at the places of the work.</p> <p>The Person in Charge is to fit their own safety locks to all points of isolation or is to be issued with a Lock-out Box Key by the Electrical Authorised Person.</p> <p>The Permit to Work must be displayed at the point of work.</p> <p>After issuing the Permit the Electrical Authorised Person shall adjust the Mimic Diagram, if installed, the Electrical Distribution Operating Record is to be completed and the Safety Programme shall be filed in the Electrical Safety Documents Register.</p>		
STEP 5: CONFIRM	Where it is not practicable to prove Equipment dead until conductors have been made accessible to a Voltage Test Indicator, the Electrical Authorised		

DEAD	Person is to remain with and supervise the Person in Charge to ensure covers and shrouds are removed safely. The Electrical Authorised Person shall then prove dead before allowing the Person in Charge to assume control of the work.
STEP 6: UNDERTAKE WORK	The Person in Charge undertakes or directly supervises the work and on completion, or when the work is stopped and made safe, returns the Permit to Work to the Electrical Authorised Person and completes and signs Part 3. The Person in Charge must remove all their Safety Locks.
STEP 7: CHECK WORK	If the work has been completed, check that the work is satisfactory, that the Equipment has been restored to working order and that it may be safely energised. If the work was stopped in Step 6, check that the Equipment has been made safe.
STEP 8: CANCEL PERMIT TO WORK	Cancel the Permit to Work by placing the complete Permit to Work in the "Cancelled PTW File" and completing and signing Part 4. The Person in Charge removes their own Safety Locks or returns their Lock-out Box Key to the Electrical Authorised Person. Where a test is required before the Equipment is energised, Steps 9 and 10 shall be omitted, and the procedures of Table LV2 are to be followed. Where other Permits relate to the Equipment and have not been cancelled, Steps 9 and 10 are omitted.
STEP 9: REMOVE EARTHS	Remove the Safety Locks and earths applied in step 3.
STEP 10: MAKE EQUIPMENT OPERATIONAL	Remove the Safety Locks and Signs fixed in Step 2 and restore the Equipment to an operational state.
STEP 11: COMPLETE RECORDS	Adjust the Mimic Diagram if installed. Complete the Electrical Distribution Operating Record.

Table LV2 for Testing Low Voltage Equipment

Except where a Risk Assessment indicates that an explosion, electric shock or possibility of short circuit exists, Equipment operating at Extra Low Voltage is exempt from these procedures.

Steps in Column 1 are to be undertaken in numerical order.

Columns 2, 3 and 4 provide detail for the specified Equipment.

The Electrical Authorised Person is to be in possession of a current Electrical Authorised Person's letter of Appointment appropriate to the Equipment being tested, and is responsible for Steps 1, 2, 3, 4, 5, and 7, 8, 9, 10, 11.

The Person in Charge is to be in possession of a current Electrical Nominated Person's letter of Appointment appropriate to the Equipment being tested, and is responsible for Step 6.

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
EQUIPMENT	Main intake switches, switchboards and Equipment having two or more sources of supply, cables and other Equipment on the supply side of a main intake switch, and all underground cables, street lighting circuits, and supplies rated at 100A or more. (If equipment has two sources of supply and one is for controls / instrumentation only, see Column 2 of Table LV3)	Generating sets started by manual initiation from a remote location, or automatically on receipt of a signal.	Uninterruptible Power Supply Equipment
STEP 1: PREPARE SAFETY PROGRAMME	COMPLY WITH ANY PARTICULAR SAFETY PROCEDURES APPLICABLE TO THE LOCATION. Prepare a Safety Programme and obtain a countersignature before proceeding to step 2, unless B8.2 applies.		
STEP 2: ISOLATE AND FIX SIGNS	ISOLATE FROM ALL SOURCES OF SUPPLY. Prevent unauthorised connection or unauthorised operation by fixing Safety Locks and Caution Notices at all the points of isolation. Fix Caution Notices on motor starting Equipment. Fix Electrical Equipment Warning	INHIBIT ENGINE START, ISOLATE GENERATOR. Prevent unauthorised connection, or unauthorised operation or unauthorised starting by fixing Safety Locks. Fix Caution Notices at all the points of isolation and on the engine start panel. Fix Electrical Equipment	ISOLATE FROM ALL SOURCES OF SUPPLY. Isolate mains supply, battery supply, output supply and any standby power supply. On parallel Uninterruptible Power Supply systems and those having an external bypass, ISOLATE the

	<p>Signs on adjacent live Equipment at the places of the test.</p> <p>The need to isolate neutral conductors should be assessed on each job and should be stated on the permit whether or not the neutral link has been broken.</p>	<p>Warning Signs on adjacent live Equipment at the places of the test.</p>	<p>output supply terminal of the units being worked on from all sources of supply.</p> <p>If battery installation is to be worked on, follow the rules applicable to Work on or near Live Equipment and disconnect the battery from its charger and disconnect the battery earth. Prevent unauthorised connection or unauthorised operation by fixing Safety Locks and Caution Notices at points of isolation. Fix Electrical Equipment Warning Signs on adjacent live Equipment.</p>
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STEP 3: PROVE DEAD AND EARTH ENSURE THAT THE EQUIPMENT TO BE TESTED IS THE EQUIPMENT THAT HAS BEEN ISOLATED.

	<p>Where practicable prove dead with a voltage Test Indicator at all the points of isolation and at the places of the test. Where practicable earth conductors at points of isolation and fix Safety Locks to Temporary Earths and Earthing Locks to Removable Temporary Earths. Identify cables with certainty at the places of the test.</p>	<p>Where practicable prove dead with a voltage Test Indicator at all the points of isolation and at the places of the test. Earth the line and neutral generators output terminals or conductors and, where practicable, fix Safety Locks to Temporary Earths and Earthing Locks to Removable Temporary Earths.</p>	<p>Except for the battery installation, where practicable, prove dead with a voltage Test Indicator at all the points of isolation and at the places of the test. Except for the battery installation, where practicable, earth conductors at points of isolation and fix Safety Locks to Temporary Earths and Earthing Locks to Removable Temporary Earths.</p>
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STEP 4: ISSUE SANCTION TO TEST

The prospective Person in Charge is to be shown the electrical diagram on the Safety Programme and the safety arrangements at all the points of isolation and at the places of the test.

The Person in Charge is to fit their own Safety Locks to all points of isolation or is to be issued with a Lock-out Box Key by the Electrical Authorised Person.

The Person in Charge is to be issued with a key to the Earthing Lock on the Removable Temporary Earths.

The Sanction to Test is issued to the Person in Charge.

STEP 5: CONFIRM DEAD

Where it is not practicable to prove Equipment dead until conductors have been made accessible to a Voltage Test Indicator, the Electrical Authorised Person is to remain with and supervise the Person in Charge

	to ensure covers and shrouds are removed safely. The Electrical Authorised Person shall then prove dead before allowing the Person in Charge to assume control of the work.
STEP 6: UNDERTAKE TEST	The Person in Charge undertakes or directly supervises the test, including the disconnection of any Removable Temporary Earths. On satisfactory completion of the test or when the test is stopped and made safe, the conductors are to be discharged and any Removable Temporary Earths restored. The Person in Charge is to remove their own Safety Locks or return their Lock-out Box Key to the Electrical Authorised Person. The Person in Charge is to return the key for the Earthing Lock to the Electrical Authorised Person. The Person in Charge then returns the original parts 1 and 2 of the Sanction to Test to the Electrical Authorised Person and completes and signs Part 3.
STEP 7: CHECK TEST	If the test was completed, check that the work is satisfactory, that the Equipment has been restored to working order and that it may be safely energised. If the work was stopped in Step 6, check that the Equipment has been made safe.
STEP 8: CANCEL SANCTION TO TEST	Cancel the Sanction to Test by destroying the original Parts 1 and 2 and completing and signing Part 4. Where the test was stopped in Step 6 and work is required before the Equipment is re-tested, Steps 9 and 10 shall be omitted and the procedures of Table LV1 are to be followed.
STEP 9: REMOVE EARTHS	Remove the Locks and earths applied in Steps 3 and 6.
STEP 10: MAKE EQUIPMENT OPERATIONAL	Remove the Safety Locks, barriers and Signs fixed in Steps 2 and restore the Equipment to an operational state.
STEP 11: COMPLETE RECORDS	Adjust the Mimic Diagram if installed. Complete the Electrical Distribution Operating Record. File the cancelled Sanction in the Electrical Safety Document Register.

Table LV3 For Electrical Nominated Persons Working on or Testing Low Voltage Equipment

Except where a Risk Assessment indicates that an explosion, electric shock or possibility of short circuit exists, Equipment operating at Extra Low Voltage is exempt from these procedures.

Steps in Column 1 are to be undertaken in numerical order.

Columns 2 and 3 provide detail for the specified Equipment.

The Electrical Nominated Person is to be in possession of a current Electrical Nominated Person's letter of Appointment appropriate to the Equipment being worked on or tested, and is responsible for all steps.

COLUMN 1	COLUMN 2	COLUMN 3
EQUIPMENT	Cables and other Equipment on the load side of a main intake switch and sub-distribution boards or equipment, with a single point of isolation rated at less than 100A or two sources of supplies, if one of the supplies is for controls / instrumentation only. (For main intake switches and Equipment having two or more sources of supply, cables and other Equipment on the supply side of a main intake switch and underground cables, see Column 2 of Tables LV1 and LV2 and refer to the Electrical Authorised Person).	Generating sets started by manual initiation. (For generating sets started by manual initiation from a remote location, or automatically on receipt of a signal, see column 3 of Tables LV1 and LV2 and refer to the Electrical Authorised Person).
STEP 1: PREPARATION	COMPLY WITH ANY PARTICULAR SAFETY PROCEDURES APPLICABLE TO THE LOCATION.	
STEP 2: ISOLATE AND FIX SIGNS	ISOLATE FROM ALL SOURCES OF SUPPLY. Make Equipment safe to work on or test. Prevent unauthorised connection or unauthorised operation by fixing Safety Locks and Caution Notices at all the points of isolation. The need to isolate neutral conductors should be assessed on each job. Fix Caution Notices on motor starting Equipment. Fix Electrical Equipment Warning Signs on adjacent live Equipment at the places of the work or test.	INHIBIT ENGINE START, ISOLATE GENERATOR. Make Equipment safe to work on or test. Prevent unauthorised connection, or unauthorised operation or unauthorised starting by fixing Safety Locks. Fix Caution Notices at all the points of isolation and on the engine start panel. Fix Electrical Equipment Warning Signs on adjacent live Equipment.

STEP 3: PROVE DEAD AND EARTH	ENSURE THAT THE EQUIPMENT TO BE WORKED ON OR TESTED IS THE EQUIPMENT THAT HAS BEEN ISOLATED.	
	Where practicable prove dead, with a voltage Test Indicator, at all the points of isolation and at the places of the work or test. Where practicable earth the line and neutral conductors and where practicable fix Safety Locks to Temporary Earths and Earthing Locks to Removable Temporary Earths. Identify cables with certainty at the places of the work or for testing, at the places of test and at the distant end.	Where practicable prove dead with a voltage Test Indicator at all the points of isolation and at the places of the work or test. Earth the line and neutral generator output terminals or conductors and, where practicable, fix Safety Locks to Temporary Earths and Earthing Locks to Removable Temporary Earths.
STEP 4: CONFIRM DEAD	Where it was not practicable in Step 3 to prove the Equipment dead at the places of work or test, the Electrical Nominated Person, using appropriate tools and Protective Equipment where necessary, is to prove it dead at the places of the test, as soon as the conductors have been made accessible to a voltage Test Indicator. Where practicable earth the lines and neutral conductors unless they were earthed in Step 3.	
STEP 5: UNDERTAKE WORK OR TEST	Undertake or directly supervise the work or test.	
STEP 6: CHECK WORK OR TEST	Check that the work or test has been satisfactorily completed, that the Equipment has been restored to working order and that it may be safely energised.	
STEP 7: REMOVE EARTHS	Remove any earths applied in Steps 3 or 4.	
STEP 8: MAKE EQUIPMENT OPERATIONAL	Remove the Safety Locks, and Signs fixed in Steps 2 and restore the Equipment to an operational state. Clear area of work materials, tools and litter.	

B3 WORKING ON AND TESTING HIGH VOLTAGE EQUIPMENT

General

- B3.1 This SHE Code does not apply where high voltage equipment has been discharged, disconnected, removed from the system or installation and is not energised by other means.
- B3.2 High voltage equipment, which is considered by the Electrical Authorised Person to be in a dangerous condition, or is subject to a Health and Safety Warning Notice, that requires it to be immediately switched off, is to be isolated elsewhere and action taken by the Electrical Authorised Person to prevent it being re-connected to the supply of electricity. The Electrical Authorised Person is to report the matter as soon as reasonably practicable to the Electrical Authorising Engineer.
- B3.3 Unless the provisions of Clause B3.19 to B3.22 apply all working on or testing of High Voltage Equipment connected to a system is to follow the procedures set out in tables HV1 or HV2 of this SHE Code as appropriate.
- B3.4 All working on or testing of high voltage equipment connected to a system is to be authorised by a Permit to Work or a Sanction to Test.
- B3.5 Safety Locks are to be applied wherever practicable at points of isolation to prevent unauthorised operation or re-connection.
- B3.6 A High voltage potential indicator is to be tested immediately before and after use against a high voltage test supply. Only the Electrical Authorised Person, or an Electrical Nominated Person acting on the instructions of and personally supervised by the Electrical Authorised Person are to use a high voltage potential indicator to prove dead in accordance with this SHE Code.
- B3.7 Equipment is to be proved dead prior to earthing. Where it is not practicable to prove dead any earth connection shall be made by means of a switch or circuit breaker. Other forms of earth connection shall not be used until the equipment and its conductors have been proved dead.
- B3.8 Where the procedures involve the application of Temporary Earths the unauthorised removal of such earth connections is to be prevented wherever practicable by the application of Safety Locks. These Safety Locks are in-addition to those required by clause B3.5
- B3.9 Where the procedures involve the application of Removable Temporary Earths the unauthorised removal of such earth connections is to be prevented wherever practicable by the application of padlocks. The keys of the padlocks are to be issued to the Person in Charge who is to retain control of them for the duration of the tests.
- B3.10 Prior to the issue of a Permit to Work or Sanction to Test, the Electrical Authorised Person is to show the prospective Person in Charge the electrical diagram on the Safety Programme, the safety arrangements at the points of isolation and at the places of work or test and is to ensure that the person understands all the relevant safety procedures and precautions. After accepting the Permit or Sanction that person becomes the Person in Charge and is responsible for the defined Work or Test until the Permit or Sanction is cancelled.

High Voltage Enclosures

- B3.11 Except in a high voltage enclosure, access to live high voltage conductors is to be possible only by the use of a tool or key.
- B3.12 A high voltage enclosure is to be entered only by:
- the Electrical Authorised Person; or
 - an Electrical Nominated Person acting on the instructions of and personally supervised by the Electrical Authorised Person; or

- the Person in Charge in receipt of a Sanction to Test, when the high voltage enclosure is created as part of the test procedure; or
- an Electrical Nominated Person acting on the instructions of and personally supervised by the Person in Charge in receipt of a Sanction to Test, when the high voltage enclosure is created as part of the test procedure; or
- an Accompanying Safety Person in connection with their safety role;

Operation of High Voltage Switchgear

B3.13 In an emergency high voltage switchgear in service may be switched off or tripped off by any person who should immediately inform the Electrical Authorised Person.

B3.14 In normal circumstances high voltage switchgear is to be operated only by: -

- the Electrical Authorised Person;
- a Person in Charge who has been issued with a Standing Instruction giving authority for the operation;
- a Person in Charge who has been issued with a Specific Written Instruction giving authority for the operation;
- an Electrical Nominated Person acting on the instructions and personally supervised by the Electrical Authorised Person;
- the Person in Charge in receipt of a Sanction to Test, when the operation is part of the test procedure;
- an Electrical Nominated Person acting on the instructions of and personally supervised by the Person in Charge in receipt of a Sanction to Test, when the operation is part of the test procedure.

Testing at High Voltage

B3.15 Where high voltage tests are to be undertaken on high voltage equipment a Sanction to Test is to be issued to an Electrical Authorised Person or Electrical Nominated Person, on acceptance, they become the Person in Charge who is to be present throughout the duration of the tests.

B3.16 Should a testing device introduce high voltages to an area then the area should then be regarded as a high voltage enclosure for the duration of the testing.

B3.17 Unauthorised access to such areas is to be prevented by utilising barriers or tape and signage.

B3.18 High Voltage Potential Indicators and Proving Units should comply with Electricity Association Engineering Recommendation G9/6 – Voltage Testing Devices, or BS EN 61243/IEC 61243 as appropriate. Extension rods, end adapters, and other fittings should be available to suit the equipment on which work is to be undertaken.

Voltage and Phasing Tests

B3.19 Voltage and phasing tests on high voltage equipment may be undertaken provided adequate precautions are taken to prevent accidental contact with, and prevent injury from, live high voltage conductors.

B3.20 Test equipment for live voltage and phasing tests is to be tested immediately before and after use against a test supply.

B3.21 Live voltage and phasing tests on high voltage equipment are to be undertaken only by the Electrical Authorised Person, with assistance, if necessary, from an Electrical Nominated Person acting on verbal instructions from the Electrical Authorised Person, with an Accompanying Safety Person in attendance.

B3.22 Neither a Permit to Work nor a Sanction to Test is appropriate for this activity.

Table HV1 For Working on High Voltage Equipment

Steps in Column 1 are to be undertaken in numerical order.
Columns 2 and 3 provide detail for the specified Equipment.

The Electrical Authorised Person is to be in possession of a current Electrical Authorised Person's letter of Appointment appropriate to the Equipment being worked on, and is responsible for Steps 1, 2, 3, 4, 5, 6 and 8, 9, 10, 11, 12.

The Person in Charge must be in possession of a current Electrical Nominated Person's letter of Appointment appropriate to the Equipment being worked on, and is responsible for Step 7.

COLUMN 1	COLUMN 2	COLUMN 3
EQUIPMENT	Cables	Equipment other than cables
STEP 1: PREPARE SAFETY PROGRAMME	COMPLY WITH ANY PARTICULAR SAFETY PROCEDURES APPLICABLE TO THE LOCATION. Prepare a Safety Programme and obtain a countersignature before proceeding to Step 2.	
STEP 2: ISOLATE AND FIX SIGNS	ISOLATE FROM ALL SOURCES OF SUPPLY. Prevent unauthorised connection or unauthorised operation by fixing Safety Locks and Caution Notices at all points of isolation. Fix Electrical Equipment Warning Signs on adjacent live Equipment and/or cables at the places of the work.	
STEP 3: PROVE DEAD	ENSURE THAT THE EQUIPMENT TO BE WORKED ON IS THE EQUIPMENT THAT HAS BEEN ISOLATED. Prove dead, with a High Voltage potential indicator, at all accessible points of isolation and, except for cables, at the places of the work (and, where appropriate, confirm dead on the low voltage side of the transformer). (Exceptionally, in abnormal cases, it may not be practicable to prove the Equipment dead. In these circumstances the conductors are not to be earthed in Step 4 and are to be proved dead and earthed as described in Step 6).	
STEP 4: EARTH	Earth conductors at all the points of isolation and, where practicable, fix Safety Locks. Identify cables with certainty at the places of the work.	Earth conductors at all the points of isolation and, where practicable, fix Safety Locks. Where practicable, earth conductors at the places of the work.
STEP 5: ISSUE PERMIT TO WORK	The prospective Person in Charge is to be shown the electrical diagram on the Safety Programme and the safety arrangements at all the points of isolation and at the places of the work. The Person in Charge is to fit their own Safety Locks at all points of isolation or is to be issued with a Lock-out Box Key by the Electrical Authorised Person. After issuing the Permit the Mimic Diagram, if installed, must be adjusted to reflect the current status, the Electrical Distribution Operating Record is to be completed and the Safety Programme shall be filed in the Electrical Safety Documents Register.	
STEP 6: CONFIRM DEAD	Where it was not practicable in Step 3 to prove dead the Electrical Authorised Person is to remain with and supervise the Person in	

	<p>Charge until conductors have been made accessible to a High Voltage potential indicator.</p> <p>The Electrical Authorised Person is then to prove the Equipment dead at all accessible points and then earth the conductors at those points and, where practicable, fix Safety Locks.</p> <p>The Electrical Authorised Person is then to prove the Equipment (except cables) dead at the places of the work before allowing the Person in Charge to assume control of the work.</p>
STEP 7: UNDERTAKE WORK	The Person in Charge undertakes or directly supervises the work and, on completion, or when the work is stopped and made safe, returns the Permit to Work to the Electrical Authorised Person and completes and signs Part 3.
STEP 8: CHECK WORK	<p>If the work has been completed, check that the work is satisfactory, that the Equipment has been restored to working order and that it may be safely energised.</p> <p>If the work was stopped in Step 7, check that the Equipment has been made safe.</p>
STEP 9: CANCEL PERMIT TO WORK	<p>Cancel the Permit to Work by placing the complete Permit to Work in the "Cancelled PTW File" and completing and signing Part 4.</p> <p>The Person in Charge removes their own Safety Locks or returns their Lock-out Box Key to the Electrical Authorised Person.</p> <p>Where a test is required before the Equipment is energised, Steps 10 & 11 shall be omitted, and the procedures of Table HV2 are to be followed.</p> <p>Where other Permits relate to the Equipment and have not been cancelled, Steps 10 & 11 shall be omitted.</p>
STEP 10: REMOVE EARTHS	Remove the Safety Locks and Earths applied in Steps 4 & 6.
STEP 11: MAKE EQUIPMENT OPERATIONAL	Remove the Safety Locks and signs fixed in Step 2 and restore the Equipment to an operational state.
STEP 12: COMPLETE RECORDS	<p>Adjust the Mimic Diagram if installed.</p> <p>Complete the Electrical Distribution Operating Record.</p>

Table HV2 for Testing High Voltage Equipment

Steps in Column 1 are to be undertaken in numerical order. Columns 2 and 3 provide detail for the specified Equipment.

The Electrical Authorised Person is to be in possession of a current Electrical Authorised Person's letter of Appointment appropriate to the Equipment being tested, and is responsible for Steps 1,2,3,4,5,6 and 8,9,10,11,12.

The Person in Charge is to be in possession of a current Electrical Nominated Person's letter of Appointment appropriate to the Equipment being tested, and is responsible for Step 7.

COLUMN 1	COLUMN 2	COLUMN 3
EQUIPMENT	Cables.	Equipment other than cables.
STEP 1: PREPARE SAFETY PROGRAMME	COMPLY WITH ANY PARTICULAR SAFETY PROCEDURES APPLICABLE TO THE LOCATION. Prepare a Safety Programme and obtain a countersignature before proceeding to Step 2.	
STEP 2: ISOLATE AND FIX SIGNS	ISOLATE FROM ALL SOURCES OF SUPPLY. Prevent unauthorised connection or unauthorised operation by fixing Safety Locks and Caution Notices at all points of isolation. Fix Electrical Equipment Warning Signs on adjacent live Equipment at the places of the test.	ISOLATE FROM ALL SOURCES OF SUPPLY. Prevent unauthorised connection or unauthorised operation by fixing Safety Locks and Caution Notices at all points of isolation. Fix Caution Notices on motor starting Equipment. Fix Electrical Equipment Warning Signs on adjacent live Equipment at the places of the test.
STEP 3: PROVE DEAD	ENSURE THAT THE EQUIPMENT TO BE TESTED IS THE EQUIPMENT THAT HAS BEEN ISOLATED. Prove dead, with a High Voltage potential indicator, at all accessible points of isolation and at the places of the test (and where appropriate, confirm dead on the low voltage side of the transformer). (Exceptionally, in abnormal cases, it may not be practicable to prove the Equipment dead. In these circumstances the conductors are not to be earthed in Step 4 and are to be proved dead and earthed as described in Step 6).	
STEP 4: EARTH	Earth conductors at all the points of isolation and, where practicable, fix Safety Locks to Temporary Earths and Earthing Locks to Removable Temporary Earths. Identify cables with certainty at the places of the test.	Earth conductors at all the points of isolation and, where practicable, fix Safety Locks to Temporary Earths and Earthing Locks to Removable Temporary Earths. Identify cables with certainty at the places of the test.
STEP 5: ISSUE SANCTION TO TEST	The prospective Person in Charge is to be shown the electrical diagram on the Safety Programme and the safety arrangements at all the points of isolation and at the places of the test. If a High Voltage Enclosure is to be set up, fix High Voltage Enclosure Signs and barriers.	

	<p>The Person in Charge is to fit their own Safety Locks at all points of isolation or is to be issued with a Lock-out Box Key by the Electrical Authorised Person.</p> <p>After issuing the Sanction the Mimic Diagram, if installed, must be adjusted, the Electrical Distribution Operating Record is to be completed and the original of the Safety Programme substituted for the duplicate in the Electrical Safety Documents Register.</p>
STEP 6: CONFIRM DEAD	<p>Where it was not practicable in Step 3 to prove dead the Electrical Authorised Person is to remain with and supervise the Person in Charge until conductors have been made accessible to a High Voltage potential indicator.</p> <p>The Electrical Authorised Person is then to prove the Equipment dead at all accessible points and then earth the conductors at those points and, where practicable, fix Safety Locks and Earthing Locks.</p> <p>The Electrical Authorised Person is then to prove the Equipment (except cables) dead at the places of the test before allowing the Person in Charge to assume control of the test.</p>
STEP 7: UNDERTAKE TEST	<p>The Person in Charge undertakes or directly supervises the test, including the disconnection of any Removable Temporary Earths. On satisfactory completion of the test, or when the test is stopped and made safe, the conductors are to be discharged and any Removable Temporary Earths restored. The Person in Charge then returns the original Parts 1 & 2 of the Sanction to Test to the Electrical Authorised Person and completes and signs part 3.</p>
STEP 8: CHECK TEST	<p>If the test has been completed, check that the work is satisfactory, that the Equipment has been restored to working order and that it may be safely energised.</p> <p>If the test was stopped in Step 7, check that the Equipment has been made safe.</p>
STEP 9: CANCEL SANCTION TO TEST	<p>Cancel the Sanction to Test by destroying the original Parts 1 & 2 and completing and signing Part 4.</p> <p>The Person in Charge removes their own Safety Locks or returns their Lock-out Box Key to the Electrical Authorised Person.</p> <p>Where the test was stopped in Step 7 and work is required before the Equipment is re-tested Steps 10 & 11 shall be omitted, and the procedures of Table HV1 are to be followed.</p>
STEP 10: REMOVE EARTHS	<p>Remove the Safety Locks and Earths applied in Steps 4 & 6</p>
STEP 11: MAKE EQUIPMENT OPERATIONAL	<p>Remove the Safety Locks and signs fixed in Step 2 and restore the Equipment to an operational state.</p>
STEP 12: COMPLETE RECORDS	<p>Adjust the Mimic Diagram if installed.</p> <p>Complete the Electrical Distribution Operating Record.</p>

B4 ENVIRONMENTAL HAZARDS

General

- B4.1 Electrical equipment may be located where additional non-electrical environmental hazards may be present. All electrical equipment must be suitable for operation within the environment in which it is installed and operated. Examples of environmental hazards are dangerous substances (**SF6 – HV dielectric insulator and Asbestos – Arc suppression / electrical insulators**), explosive atmospheres, electromagnetic radiation, ionising radiation, strong magnetic fields, oxygen-depletion, laser light and confined spaces. All environmental hazards should be considered. The list provided is for reference and is not conclusive.
- B4.2 Where environmental hazards are present reference must be made to:
- Relevant Safety Legislation and Regulations;
 - Relevant SHE codes;
 - Local Operating Instructions;
 - Local Rules; and
 - Manufacturer's Instructions.
- B4.3 Advice should be sought from SHE Group, local Health & Safety Officers, experimental facility operations managers, relevant Electrical Authorising Engineers.
- B4.4 When working on or testing high or low voltage electrical equipment located within an area containing non-electrical environmental hazards the Electrical Authorised Person and / or Electrical Nominated Person must comply with the relevant sections of other SHE Codes or Local Rules.

Special precautions for non-electrical environmental hazards

- B4.5 The Electrical Authorised Person or Electrical Nominated Person is to co-ordinate all work on and testing of Electrical Equipment in co-operation with the person responsible for the Hazardous Area.
- B4.6 All persons required to work on or test equipment in a Hazardous Area are to be familiar with, and comply with this and relevant SHE Codes and any instructions issued by the person responsible for the Hazardous Area. If any doubt arises as to the interpretation of such instructions, written clarification from the person responsible for the Hazardous Area is to be obtained before any work or test proceeds.
- B4.7 Wherever reasonably practicable, the working place is to be rendered non-hazardous for the duration of the work or test. However, the provisions of this section apply even if the working place has been rendered non-hazardous for the duration of the work or test.
- B4.8 Any work or test shall cease immediately on request from the person responsible for the Hazardous Area. The Person in Charge is to report such cessation of work or test to the Electrical Authorised Person, who is to take appropriate action.
- B4.9 All tools, test equipment, and materials must be risk assessed to verify their suitability for use in the Hazardous Area and shall comply with any instructions issued by the person responsible for the Hazardous Area.
- B4.10 When using test equipment within a potentially explosive environment additional precautions may be required to prevent currents being generated in other conductors. These currents could spread to other areas and introduce the

possibility of sparking. See SHE Code 20 Controlling explosive and flammable gases and dusts.

- B4.11 Before commencing any testing, in particular high current continuity tests, prospective short circuit current tests, or high voltage tests the environmental hazards for the Area must be considered.
- B4.12 Before a Permit to Work or Sanction to Test is cancelled, the Person in Charge and the Electrical Authorised Person are to be satisfied with the integrity of all equipment that may have been affected by the work or test.
- B4.13 Before equipment in a Hazardous Area is energised or restored to an operational state, the Electrical Authorised Person must obtain permission from the person responsible for the Hazardous Area.

B5 DISPLAY OF SAFETY SIGNS AND POSTERS

General

- B5.1** The design and colours of Warning signs and Caution Notices shall conform to with BS 5499/EN 7010. See examples of Temporary Warning Signs, Caution Notices, Display of Information and Permanent Safety Signs in Appendix F.

Display of Temporary Warning Signs and Caution Notices

- B5.2 Electrical Authorised Persons and Electrical Nominated Persons shall ensure signs and notices are available when required. Caution Notices will bear the Electrical Authorised Persons or Electrical Nominated Persons name and the date of when the Notice was displayed.
- B5.3 Caution Notices are to be fixed at the points of isolation and prominently displayed before the start and for the duration of work or testing, and before the issue and for the duration of any Permit to Work or Sanction to Test.
- B5.4 High Voltage Enclosure Signs are to be prominently displayed so that they are visible from every angle of approach to a High Voltage Enclosure, before the issue and for the duration of a Sanction to Test.
- B5.5 Warning Signs are to be prominently displayed, on any equipment which remains live and is adjacent to the Equipment to be worked on or tested, before the start and for the duration of work or testing and before the issue and for the duration of any Permit to Work or a Sanction to Test.
- B5.6 Where work or testing is to be undertaken on any part of a multi-cubicle switchboard, Warning Signs shall be prominently displayed on the cubicles or compartments adjacent to the part being worked on or tested. If the board has rear access Electrical Equipment Warning Signs shall similarly be displayed at both the front and rear of the board. In identifying parts at the rear of the board, reliance is not to be placed upon the switchboard labelling.
- B5.7 Before a Permit to Work or a Sanction to Test is issued the Electrical Authorised Person is required to have identified the equipment upon which the work or test is to be undertaken. If the work or test involves, or may involve, obtaining access to items of Equipment over which confusion could occur, the Electrical Authorised Person is to identify such items to the prospective Person in Charge and apply temporary marking to them.
- B5.8 Temporary Safety Signs and Notices are to be suspended from non-conducting cords.

Display of Permanent Safety Signs

- B5.9 Signage design should be approved by the Electrical Authorising Engineer.
- B5.10 Permanent Safety Signs are to be securely and permanently fixed.
- B5.11 Signs shall be manufactured from non-metallic weather resistant material.
- B5.12 Non-corrosive materials are to be used when fixing Permanent Safety Signs.
- B5.13 A Danger Sign and a Notice identifying the installation are to be displayed in a prominent position outside every substation. A Notice identifying the installation is to include a contact number in case of emergency or access.
- B5.14 A Main Intake Switch Sign is to be displayed on all Low Voltage main intake switches, except for domestic consumer units.
- B5.15 A Multiple Supplies Sign is to be displayed on all Low Voltage switchboards and Equipment having two or more sources of supply.
- B5.16 A Remotely/ Automatically Controlled Generating Set Sign is to be displayed on or adjacent to all remotely or automatically controlled generating sets.
- B5.17 A Remotely/Automatically Controlled Machine Sign is to be displayed on or adjacent to all remotely or automatically controlled machines, except for small sealed refrigerator motors, in-line circulating pumps and other such domestic items.
- B5.18 A Danger High Voltage/First Aid for Electrical Shock Sign is to be displayed in all High Voltage switch rooms.
- B5.19 A First Aid for Electric Shock Sign is to be displayed in all Low Voltage switch rooms and any other area deemed appropriate by the Electrical Authorising Engineer.
- B5.20 A Danger Live Bus-Bars Sign is to be displayed on switchgear and equipment covers that when removed expose live un-insulated bus-bars.
- B5.21 An Uninterruptible Power Supply (UPS) Danger sign is to be displayed on, or adjacent to all circuits and equipment connected to an uninterruptible power supply system.

Display of Information

- B5.22 The Electrical Authorising Engineer is to carry out an assessment to determine the requirement and location for the display of information in connection with this SHE Code, and Health and Safety matters. Information is to be displayed permanently in a suitable and prominent position. The areas to be considered for the display of information in connection with this SHE Code are to include every intake substation, indoor substation, switch rooms, plant rooms and workshops. A record is to be kept of the assessment for audit and review purposes.
- B5.23 Information and posters to be displayed may include the following:
- 'The Electricity at Work Regulations';
 - 'Emergency First-Aid' (including treatment for electric shock);
 - Any of the Tables from this SHE Code;
 - Hazard Assessments;
 - COSHH Assessments (where required);
 - Drawings;
 - Emergency Action Sign;
 - Other relevant information pertaining to equipment housed in the area (i.e. Emergency Procedures for hand-winding lifts).

B6 ACCOMPANYING SAFETY PERSON

- B6.1 An Accompanying Safety Person shall be in attendance of electrical work where the Electrical Authorised Person considers that it is necessary, and in the following specific circumstances:
- Where working or testing in accordance with Tables LV1, LV2, HV1 or HV2 is to be undertaken, whilst the equipment is being proved dead;
 - Where working or testing in accordance with Tables LV1, LV2, HV1 or HV2 is to be undertaken, whilst the equipment is being earthed, other than by means of a switch or circuit breaker;
 - Where working or testing in accordance with Table LV3 is to be undertaken on equipment for which the means of isolation is not positively identified, an Accompanying Safety Person is to be in attendance until the equipment has been isolated and proved dead;
 - Where working or testing in accordance with Tables LV1, LV2, HV1 or HV2 is being undertaken on Equipment which cannot be proved dead until after the Permit to Work or Sanction to Test has been issued the Accompanying Safety Person is to be in attendance until the Equipment has been proved dead;
 - Whilst work is being undertaken near live high voltage equipment in a high voltage enclosure;
 - Whilst a high voltage potential indicator is in use;
 - Whilst voltage and phasing tests are being undertaken at high voltage;
 - Whilst tests are being undertaken using high voltage test equipment.
 - Whilst inspection, fault finding or testing is being undertaken on live Low Voltage Equipment other than work covered by clause B11.3 to B11.5;
 - Whilst work is being undertaken on live Low Voltage Equipment that does not have a level of protection of IP2X or better;
 - Whilst the Electrical Authorised Person or a nominated Contractor appointed by the Electrical Authorised Person is spiking a cable;

B7 LOCKING OF SWITCHGEAR AND SWITCHROOMS

- B7.1 Where it is necessary to prevent danger or, where appropriate, injury, or prevent unauthorised operation, equipment cubicles and operating mechanisms are to be locked when the Equipment is unattended.
- B7.2 Any entrance to a HV or LV room or enclosure containing a main intake switchboard, central battery system, permanently connected Uninterruptible Power Supply equipment, a generating set or HV equipment is to be closed and securely locked when the equipment is unattended.

B8 SAFETY PROGRAMMES

General

- B8.1 Prior to the issue of any Permit to Work or a Sanction to Test, a Safety Programme detailing the intended sequence of operations to be performed to make the Equipment safe for the execution of the work or test, is to be prepared.
- B8.2 The Electrical Authorising Engineer can approve Safety Programme exemptions for Tables LV1 and LV2, provided that a suitable risk assessment has been completed and the details of the exemptions are included on the Electrical Authorised Person's letter of appointment.

- B8.3 A Safety Programme form shall have an original and a duplicate of each page, and each sheet of a Programme shall bear the same pre-printed serial number. Sets of numbered forms shall be used in sequence.
- B8.4 Computer based software (PCMD) can be used to generate an electrical diagram and sequence of switching operation (Switching Schedule).

Contents of Safety Programmes

- B8.5 The Safety Programme is to be completed in duplicate by the Electrical Authorised Person who is responsible for issuing the Permit to Work or Sanction to Test, and is to indicate:
- The purpose of the proposed work or test;
 - The equipment for which the proposed sequences of operations are intended to make safe to work on or test;
 - The location of the equipment;
 - Details of other safety procedures or documents that relate to the proposed work or test;
 - Details of the work or test to be done;
 - The date on which countersigned programme is required to commence.
 - Special instructions or safety measures to be included on the Permit to Work or Sanction to Test;
 - An electrical diagram of isolating and earthing arrangements; and
 - The sequence of operations to be undertaken prior to issuing the Permit or Sanction including:
 - The location, including any name and identification code, at which each operation is to be performed;
 - The identity of each item of switchgear to be operated, including generic type, manufacturer's name and manufacturer's type or reference;
 - The operation to be performed;
 - The reason for the operation;
 - Any items required (for example keys, locks, Protective Equipment);
 - The requirement for an Accompanying Safety Person for a specific operation;
 - The name of the originating Electrical Authorised Person; and
 - The name of the countersigning Electrical Authorised Person.
- B8.5 Page one of the original completed Safety Programme is to be signed by the Electrical Authorised Person and countersigned by another Electrical Authorised Person or Electrical Authorising Engineer who has knowledge of the system or installation. The countersigning Electrical Authorised Person need not be appointed for the particular equipment, installation or system.
- B8.6 The originals of all subsequent Safety Programme and any additional pages should be initialised by the originating and countersigning Electrical Authorised Persons.

Implementing Safety Programmes

- B8.7 Before commencing the sequence of operations detailed on the Safety Programme, the Electrical Authorised Person is to confirm that the person responsible for the area and / or equipment has given permission for the intended work or test.
- B8.8 Before commencing the sequence of operations the duplicate Safety Programme is to be retained by the Electrical Authorising Engineer.
- B8.9 The Electrical Authorised Person is to note on the original Safety Programme the date and time of each operation.

B8.10 The Electrical Authorised Person is to use the electrical diagram to show the Person in Charge the safety arrangements at the points of isolation and at the places of the work or test.

Completion of Safety Programmes

B8.11 On completion of the Safety Programme, the date and time of each switching operation is to be entered in the Electrical Distribution Operating Record. The original Safety Programme shall be stored in a secure location for three years after the dates on which they were implemented and the duplicate destroyed.

B9 PERMIT TO WORK

General

- B9.1 A Permit to Work must be obtained before any person is allowed to work on:
- bus-bars, switchgear, or isolators located in Low Voltage switch rooms;
 - incoming Low Voltage switch frames and interconnecting cable networks;
 - any other high fault capacity equipment not necessarily part of the distribution network;
 - **street lighting circuits;**
 - where the Electrical Authorised Person or Electrical Nominated Person considers that it is necessary after performing a risk assessment; and
 - all High Voltage equipment.
- B9.2 A Permit to Work is to be issued by the Electrical Authorised Person to the Person in Charge before any work on defined items of Equipment is commenced. The items of Equipment requiring a Permit are defined in Tables LV1 and HV1.
- B9.3 The Permit to Work form shall have an original and duplicate page(s) and bear the same pre-printed serial number and sets of numbered forms organised to be used in sequence.
- B9.4 Unless clause B9.5 applies, a Permit to Work is not to be issued for any item of equipment for which an existing Permit to Work, a Sanction to Test or a Sanction for Work on or near Live Electrical Equipment, remains valid, nor for equipment which is within an area for which an Authority for Access exists unless a Risk Assessment indicates that it is safe to do so.
- B9.5 More than one Permit to Work may be issued for one item of equipment provided that:
- A Risk Assessment indicates that it is safe to do so;
 - One Safety Programme is prepared which applies to all of the permits;
 - All the Permits are prepared before any one is issued;
 - All the permits are issued at or about the same time;
 - All the Persons in Charge are told of the existence of the other Permits, which are to be listed in Part 1 of each Permit; and
 - Multiple locking devices are used, the devices having sufficient capacity to accommodate the Safety Locks required for all the Permits.
- B9.6 Permits to Work are to be offered only to Electrical Authorised Persons or Electrical Nominated Persons who are in possession of a current letter of appointment appropriate to the equipment to be worked on.
- B9.7 On accepting a Permit to Work, the Electrical Authorised or Nominated Person becomes the Person in Charge.

B9.8 Electrical Authorised Persons personally undertaking tasks requiring a Permit to Work must not issue a Permit to themselves. The Electrical Authorising Engineer or another Electrical Authorised Person with adequate knowledge of the system or systems to be worked on must issue the Permit.

Issue and Acceptance of Permits to Work

B9.9 A Permit to Work is, where practicable, to be issued at the place where the work is to be undertaken. The issue and cancellation of every Permit is to be recorded, for example in the Electrical Distribution Operating Record.

B9.10 Before carrying out any isolation the Electrical Authorised Person is to confirm that permission for the intended work has been obtained from the person responsible for the area affected by the intended work.

B9.11 Prior to issuing the Permit to Work the Electrical Authorised Person shall:

- Positively identify to the Person in Charge the equipment upon which the work is to be undertaken;
- Explain in detail to the Person in Charge the exact extent of the work to be undertaken;
- Draw the attention of the Person in Charge to any special instructions, environmental hazards and safety measures noted on the Permit;
- Show the Person in Charge the electrical diagram on the Safety Programme, and the safety arrangements at the points of isolation and the places of work;
- Unless the sub-clauses below apply, demonstrate to the satisfaction of the Person in Charge that the Equipment is dead and safe to work on;
- For Low Voltage Equipment where it is not practicable to prove equipment dead prior to issuing the Permit to Work, one of the following sub-clauses shall apply;
 - the Electrical Authorised Person is to instruct the Person in Charge, using appropriate tools, and Protective Equipment where necessary, to prove the equipment dead as soon as conductors have been made accessible to a suitable voltage test indicator; **or**
 - the Electrical Authorised Person is to remain with and supervise the Person in Charge until conductors have been made accessible to a suitable voltage test indicator. The Equipment is to be proved dead to the satisfaction of the Electrical Authorised Person and the Person in Charge before the work can proceed.
- Where it is not practicable to prove High Voltage equipment dead prior to issuing the Permit, the Electrical Authorised Person having issued the Permit is to remain with and supervise the Person in Charge until the conductor have been made accessible to a High Voltage potential indicator. The Electrical Authorised Person is then to prove the equipment dead before allowing the Person in Charge to undertake the work described on the Permit.

B9.12 Where keys are issued for an area under the control of the Electrical Authorised Person, these keys shall be issued daily to the Person in Charge by the Electrical Authorised Person and must be returned to the Electrical Authorised Person at the end of each working day, or when work is suspended for the day.

Completion of Work and Cancellation of Permit to Work

B9.13 After the work is completed or stopped and all persons, instruments and tools are withdrawn from the place of work, the Person in Charge is to sign off the Clearance section of the Permit to Work and is to return the original to the Electrical Authorised

- Person. When work is stopped the Person in Charge shall also confirm that the equipment has been made safe and write the reasons for stopping the work.
- B9.14 Where keys are issued to the Person in Charge for an area under the control of the Electrical Authorised Person, these keys must be returned to the Electrical Authorised Person on clearance of the Permit to Work.
- B9.15 The Electrical Authorised Person is to check that the work has been satisfactorily completed, and that the equipment is safe. The Electrical Authorised Person is then to cancel the Permit to Work by destroying the originals and signing the Cancellation section of the Permit to Work. Single copies of all the pages of the cancelled Permit are to be retained for three years after their dates of cancellation.
- B9.16 If the Electrical Authorised Person decides, or advised by the person responsible for the Area, that it is necessary to stop the work, the Permit to Work is to be withdrawn and cancelled. The reasons for withdrawal and actions taken are to be noted in the Clearance section of the Permit and in the Electrical Distribution Operating Record.
- B9.17 If the Person in Charge loses any part of the original Permit to Work the loss is to be recorded by the Electrical Authorised Person and countersigned by the Person in charge. The loss is to be reported to the Electrical Authorising Engineer.

B10 SANCTION TO TEST

General

- B10.1 A Sanction to Test is to be issued by the Electrical Authorised Person to a Person in Charge before the commencement of:-
- any testing of Equipment at High Voltage, or
 - any testing on Equipment defined by Tables LV2 or HV2 of this SHE Code.
- B10.2 A Sanction to Test form shall have an original page and a duplicate page. Each page of a Sanction shall bear the same pre-printed serial number and sets of numbered forms shall be used in sequence.
- B10.3 When not in use the Sanction to Test forms are to be kept in a secure location.
- B10.4 A Sanction to Test is not to be issued for any item of Equipment for which an existing Sanction to Test, a Permit to Work, or a Permit for Work on or near Live Electrical Equipment, remains valid, nor for Equipment which is within an area for which an Authority for Access exists.
- B10.5 Sanctions to Test are to be offered only to Electrical Authorised Persons or Electrical Nominated Persons who are in possession of a current letter of Appointment appropriate to the Equipment to be tested.
- B10.6 On accepting a Sanction to Test, the Authorised or Electrical Nominated Person becomes the Person in Charge.
- B10.7 Electrical Authorised Persons personally undertaking tasks requiring a Sanction to Test must not issue a Sanction to themselves. The Electrical Authorising Engineer or another Electrical Authorised Person with adequate knowledge of the system or systems to be tested must issue the Sanction.

Issue and Acceptance of Sanction to Test

- B10.11 A Sanction to Test is, where practicable, to be issued at the place where the testing is to be undertaken. The issue and cancellation of a Sanction is to be recorded in the Electrical Distribution Operating Record.
- B10.12 Before issuing a Sanction to Test, the Electrical Authorised Person is to: -
- Confirm that permission for the intended test has been obtained from the person responsible for the area affected by the intended test, and

- Positively identify to the Person in Charge the Equipment upon which testing is to be undertaken.
- B10.13 Prior to offering a Sanction to Test to the Person in Charge the Electrical Authorised Person is to:
- Explain in detail to the Person in Charge the exact extent of the testing to be undertaken.
 - Draw the attention of the Person in Charge to any special instructions or safety measures.
 - Show the Person in Charge the Equipment on which the tests are to be done.
 - Show the Person in Charge the electrical diagram on the Safety Programme, and the safety arrangements at the points of isolation and the places of test, and at other places affected by the test.
 - Unless sub-clauses B10.13 apply, demonstrate to the satisfaction of the Person in Charge that the Equipment is dead and safe to test.
 - For Low Voltage Equipment where it is not practicable to prove Equipment dead prior to issuing the Permit to Work, one of the following sub-clauses shall apply.
 - the Electrical Authorised Person is to instruct the Person in Charge, using appropriate tools, and Protective Equipment where necessary, to prove the Equipment dead as soon as conductors have been made accessible to a suitable voltage Test Indicator, or
 - the Electrical Authorised Person is to remain with and supervise the Person in Charge until conductors have been made accessible to a suitable voltage Test Indicator. The Equipment is to be proved dead to the satisfaction of the Electrical Authorised Person and the Person in Charge before the tests can proceed.
 - Exceptionally, for High Voltage Equipment, where it is not practicable to prove Equipment dead prior to issuing the Sanction the Electrical Authorised Person having issued the Sanction is to remain with and supervise the Person in Charge until conductors have been made accessible to a High Voltage potential indicator. The Electrical Authorised Person is then to prove the Equipment dead before allowing the Person in Charge to undertake the tests described on the Sanction.
- B10.14 Prior to accepting the Sanction to Test, the Person in Charge, having understood the tests to be carried out, and being prepared to undertake them, is to sign any special instructions or safety measures. The Electrical Authorised Person is to retain the duplicate pages and temporarily keep them with the Electrical Distribution Operating Record.
- B10.15 After signing to accept the Sanction to Test the Electrical Authorised or Nominated Person becomes the Person in Charge and is responsible for personally supervising or undertaking the defined tests. Wherever practicable the Person in Charge is to display the Sanction to Test close to the point of test. The Person in Charge is not to leave the place where the testing is being carried out, or to undertake any other work or tests while the defined tests are in progress. During any temporary absence of the Person in Charge from the place where the testing is being carried out, the tests are to be suspended, and adequate safety precautions taken until testing is resumed on the return of the Person in Charge.
- B10.16 Where keys are issued for an area under the control of the Electrical Authorised Person, these keys shall be issued daily to the Person in Charge by the Electrical Authorised Person and must be returned to the Electrical Authorised Person at the end of each working day, or when work is suspended for the day.

Completion of Tests and Cancellation of Sanction to Test

- B10.17 After the testing is completed or stopped and all persons, instruments and tools are withdrawn from the place where testing was undertaken, the Person in Charge is to complete and sign off the clearance section of the Sanction to Test and return the original to the Electrical Authorised Person.
- B10.18 Where keys are issued to the Person in Charge for an area under the control of the Electrical Authorised Person, these keys must be returned to the Electrical Authorised Person on clearance of the Sanction to Test.
- B10.19 The Electrical Authorised Person is to check that the tests have been satisfactorily completed, and that the equipment is safe. The Electrical Authorised Person is then to cancel the Sanction to Test by destroying the originals and signing off the cancellation section of the Sanction. Hard copies of all the pages of the cancelled Sanction are to be retained for three years after their date of cancellation.
- B10.20 If the Electrical Authorised Person decides, or is advised by the person responsible for the Area, that it is necessary to stop the testing, the Sanction to Test is to be withdrawn and cancelled. The reasons for withdrawal and actions taken are to be noted in the clearance section of the Permit and in the Electrical Distribution Operating Record.
- B10.21 If the Person in Charge has lost the original copy of the Sanction to Test, the loss is to be recorded by the Electrical Authorised Person in the cancellation section, and in the Electrical Distribution Operating Record. The Person in Charge is to countersign the cancellation section to confirm the loss of the original Sanction. The loss is to be reported to the Electrical Authorising Engineer.

B11 WORK ON OR NEAR LIVE ELECTRICAL EQUIPMENT

- B11.1 No person shall be engaged in any low voltage work activity on or near any live conductor, or near live high voltage conductors in a HV enclosure (other than one suitably covered with insulating material so as to prevent danger) that danger may arise unless:
- it is unreasonable in all the circumstances for the conductors to be dead, **and** it is reasonable in all circumstances for the person to be at work on or near the conductor while it is live, **and** suitable precautions (including where necessary the provision of suitable Protective Equipment) are taken to prevent injury; **or**
 - the work is in accordance with clause B11.3 to B11.5.
- B11.2 The Electrical Authorised Engineer is to ensure that the Person in Charge has;
- specified the safety precautions necessary to prevent injury to persons and damage to equipment; **and** monitored their implementation; **and** retained copies of the Sanction (if applicable), method statement and risk assessments.
- B11.3 Local Rules specific to the activity or a Sanction for Work on or near Live Electrical Equipment is not required if equipment is operating at Extra Low Voltage and a Risk Assessment indicates that live working presents no dangers.
- B11.4 Inspection, fault finding and testing of equipment on systems up to 500V ac rms or dc nominal, may be undertaken, without a Sanction for Work on or near live electrical equipment provided that:
- It is unreasonable in all circumstances for the conductors to be dead; **and**
 - it is reasonable in all circumstances for the person to be at work on or near the conductor while it is live; **and**
 - all live parts are adequately protected to prevent direct contact (IP2X); **and**
 - suitable precautions (including where necessary the provision of suitable Protective Equipment and Personal Protective Equipment) are taken to prevent injury, **and**

- test equipment and all tools in use shall be suitable, for the use for which they are provided and, maintained in a condition suitable for that use and, properly used; **and**
 - adequate precautions are taken to prevent damage to equipment and accidental contact with dangerous live conductors.
- B11.5 Inspection, fault finding, testing and topping-up on battery installations, having a terminal voltage not exceeding 500V may be undertaken without a Sanction for Work on or near Live Electrical Equipment. Provided that:
- they are sectionalised in such a way that disconnection and separation is secure; **and**
 - each section of batteries has a terminal voltage not exceeding extra low voltage.

Sanction to Work on or Near Live Electrical Equipment

General

- B11.6 A Sanction for Work on or near Live Electrical Equipment is issued by an Electrical Authorised Person and authorised by an Electrical Authorising Engineer before the commencement of any work on or near live electrical Equipment. Unless such Equipment is operating at Extra Low Voltage and the Hazards have been assessed and appropriate control measures implemented, or the conditions of clauses B11.3 and B11.5 are applicable.
- B11.7 Sanctions for Work on or near Live Electrical Equipment are to be offered only to an Electrical Authorised Person or an Electrical Nominated Person appointed for the system or installation to be worked on.
- B11.8 A Sanction for Work on or near Live Electrical Equipment shall have an original and duplicate page(s) and bear the same pre-printed serial number and sets of numbered forms organised to be used in sequence.
- B11.9 Only one set of Sanction for Work on or near Live Electrical Equipment forms are to be in use at any one time for a given Electrical Authorised Engineer's Area of responsibility.
- B11.10 When not in use Sanction for Work on or near Live Electrical Equipment forms are to be kept by the Electrical Authorising Engineer.
- B11.11 A Sanction for Work on or near Live Electrical Equipment is not to be issued for any item of Equipment for which an existing Sanction for Work on or near Live Electrical Equipment, a Sanction to Test, or a Permit to Work, remains valid, nor for Equipment that is within an area for which an Authority for Access exists.
- B11.12 On accepting a Sanction for Work on or near Live Electrical Equipment, the Electrical Authorised Person or Electrical Nominated Person becomes the Person in Charge.

Issue and Acceptance of Sanction for Work on or near Live Electrical Equipment

- B11.13 A Sanction for Work on or near Live Electrical Equipment shall be signed by the Electrical Authorising Engineer or their nominated representative and states that it is unreasonable for the Equipment to be dead, that it is reasonable for the Person in Charge to Work on or near Live Equipment, that suitable precautions have been specified to prevent injury and gives permission for the specified work to proceed.
- B11.14 A Sanction for Work on or near Live Electrical Equipment is to be issued, where practicable, at the place where the work is to be undertaken. The issue and cancellation of a Sanction for Work on or near Live Electrical Equipment is to be recorded in the Electrical Distribution Operating Record. (if relevant to system being worked on).

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- B11.15 Prior to offering a Sanction for Work on or near Live Electrical Equipment to the Person in Charge, the Electrical Authorised Person is to: -
- Positively and physically identify to the Person in Charge the Equipment on which the work is to be undertaken.
 - Explain to the Person in Charge the safety precautions to be taken.
 - Instruct the Person in Charge to inspect all Protective Equipment before use.
- B11.16 To accept the Sanction for Work on or near Live Electrical Equipment the Person in Charge and Accompanying Safety Person must sign the 'receipt' section of the original and duplicate pages of the Sanction. These signatures render the Sanction valid for the defined work, the Person in Charge shall retain the original pages and the Electrical Authorised Person shall retain the duplicate pages.
- B11.17 After accepting the Sanction for Work on or near Live Electrical Equipment the Person in Charge is responsible for personally undertaking the defined work. The Person in Charge is, therefore, not to leave the place where the work is being carried out, or to undertake any other work or tests while the defined work is in progress. During any temporary absence of the Person in Charge from the place where the work is being carried out, the work is to be suspended and adequate safety precautions taken until work is resumed on the return of the Person in Charge.
- B11.18 The Accompanying Safety Person is not to leave the place where the work is being carried out. During any temporary absence of the Accompanying Safety Person from the place where the work is being carried out, the work is to be suspended and adequate safety precautions taken until work is resumed on the return of the Accompanying Safety Person.

Completion of Work and Cancellation of Sanction for Work on or near Live Electrical Equipment

- B11.19 Having completed the work and having withdrawn all person, instruments and tools from the place of work, the Person in Charge is to sign the Clearance section of the Sanction, which was retained by the Electrical Authorised Person and is to return the original pages to the Electrical Authorised Person.
- B11.20 Where keys are issued to the Person in Charge for an area under the control of the Electrical Authorised Person, these keys must be returned to the Electrical Authorised Person on signing the Clearance section of the Sanction.
- B11.21 The Electrical Authorised Person is to check that the work has been satisfactorily completed and that the Equipment is safe. The Electrical Authorised Person shall then cancel the Sanction by destroying the original pages and signing the Cancellation section of the Sanction. A copy of each page of the cancelled Sanction is to be retained in a secure location for three years after their date of cancellation.
- B11.22 If the Electrical Authorised Person decides that it is necessary to stop the work, the Sanction for Work on or near Live Electrical Equipment is to be withdrawn and cancelled. The reasons for the withdrawal and the action taken are to be noted in the Cancellation section and in the Electrical Distribution Operating Record.
- B11.23 If the Person in Charge has lost the original pages of the Sanction, the loss is to be recorded by the Electrical Authorised Person in the Cancellation section and in the Electrical Distribution Operating Record. The Person in Charge is to countersign the cancellation to confirm the loss of the original Sanction. The loss is to be reported to the Electrical Authorising Engineer.

B12 STANDING INSTRUCTIONS AND SPECIFIC WRITTEN INSTRUCTIONS

Standing Instruction

- B12.1 An Electrical Authorised Person may issue a Standing Instruction for:
- B12.1.1 Defined tasks on a Low Voltage system or installation;
 - B12.1.2 Inspections, fault finding and testing of Equipment on systems up to 500V AC RMS or DC nominal. The issuing of such a Standing Instruction is limited to areas where it has been decided that these activities may be undertaken without Permit to Work on or near Live Electrical Equipment in accordance with Clauses B11.3 to 11.5;
 - B12.1.3 Defined switching operations in respect of specific items of High Voltage Equipment and Low Voltage distribution Equipment.
- B12.2 A Standing Instruction form shall have original and duplicate pages. Each page of a Standing Instruction shall bear the same pre-printed serial number and sets of numbered forms shall be used in sequence.
- B12.3 The original and the duplicate Standing Instruction are to be signed by the Electrical Authorised Person appointed for the system or installation to which the Instruction applies.
- B12.4 A Standing Instruction is to be offered only to an Electrical Nominated Person or an Electrical Authorised Person who has knowledge of the system or installation.
- B12.5 A Standing Instruction for defined tasks as described in Sub-clause B12.1.2 is to include a signed approval from the Electrical Authorising Engineer that states it is unreasonable for the Equipment to be dead, that it is reasonable for the Person in Charge to work on or near live Equipment, that suitable precautions have been specified to prevent injury and gives permission for the specified tasks to proceed.
- B12.6 The Electrical Authorised or Nominated Person is to acknowledge receipt by completing and signing the Standing Instruction; the signature renders the Instruction valid for the defined work and tests. The original of the Instruction is issued to the Electrical Authorised or Nominated Person who thereafter becomes the Person in Charge.
- B12.7 The issue of a Standing Instruction is to be recorded in the Electrical Distribution Operating Record.
- B12.8 The duplicate of the signed Standing Instruction is to be retained from the date of issue until termination.
- B12.9 An Electrical Authorised Person may, at any time, cancel a Standing Instruction by retrieving the original from the Person in Charge and destroying it. The duplicate of the Standing Instruction is to be overwritten with the word, "CANCELLED" or "EXPIRED", as appropriate, followed by the date of termination. The duplicate is to be countersigned by each of the Electrical Authorised Persons and retained for three years after its date of termination. The Electrical Authorising Engineer is to be notified of the cancellation.
- B12.10 The cancellation or expiry of a Standing Instruction is to be noted in the Electrical Distribution Operating Record.
- B12.11 A Standing Instruction is to be renewed at intervals not exceeding one year and whenever a new Electrical Authorised Person is appointed.

Specific Written Instructions

- B12.12 The Electrical Authorised Person may issue a Specific Written Instruction for a defined switching operation or a sequence of operations in respect of items of High and Low Voltage Equipment.
- B12.13 A Specific Written Instruction form shall have the original and duplicate pages. Each page of a Specific Written Instruction shall bear the same pre-printed serial number and sets of numbered forms shall be used in sequence.

- B12.14 A Specific Written Instruction is to be offered only to an Electrical Nominated Person or an Electrical Authorised Person who has knowledge of the system or installation.
- B12.15 The Person in Charge is to accept the Specific Written Instruction by signing the original and duplicate; the signature renders the Instruction valid for the defined operations. The original of the Instruction is issued to the Person in Charge.
- B12.16 The duplicate of the signed Specific Written Instruction is to be retained by the Electrical Authorised Person until the operations are completed and the original returned.
- B12.17 The issue of a Specific Written Instruction is to be recorded in the Electrical Distribution Operating Record.
- B12.18 On completion of the switching operation the Person in Charge is to return the original Instruction to the Electrical Authorised Person without any intentional delay. Details of the switching operations carried out are to be entered in the Electrical Distribution Operating Record. The original is to be retained for three years from the date of issue; the duplicate shall then be destroyed.

B13 AUTHORITY FOR ACCESS

General

- B13.1 The Electrical Authorised Person may issue an Authority for Access to a person of any discipline or specialism. The Authority is issued when any work activities, not requiring a Permit to Work, Sanction to Test, a Sanction for Work on or near Live Electrical Equipment, or not covered by a Standing Instruction or Specific Written Instruction are to be undertaken in an area or location which is normally under the control of the Electrical Authorised Person.
- B13.2 An Authority for Access form shall have an original and duplicate page(s) and bear the same pre-printed serial number and sets of numbered forms organised to be used in sequence.
- B13.3 Provided that a documented Risk Assessment indicates that it is safe, an Authority for Access may be issued for work activities to be undertaken in an area or location containing an item of Equipment for which a Permit to Work remains valid.
- B13.4 An Authority for Access is not to be issued for an area for which a Sanction to Test or a Sanction for Work on or near Live Electrical Equipment remains valid, or where a High Voltage Enclosure has been set up.
- B13.5 Whilst the Authority for Access is in force, the Electrical Authorised Person is to inspect the area at the end of each working period or day to ensure that: -
 - any flammable or hazardous materials introduced into the area during the work activities are removed when the activities cease at the end of each working period or day;
 - access to essential electrical equipment is not obstructed;
 - the area is secure.

Issue and Acceptance of Authority for Access

- B13.6 An Authority for Access is to be offered to a person of any discipline or specialism who is competent to personally execute or supervise the work activities. On accepting the Authority, the person becomes the Person in Charge.
- B13.7 Authorities for Access are to be issued, where practicable, at the place where the work activities are to be undertaken. The issue and cancellation of every Authority is to be recorded in the Electrical Distribution Operating Record.

- B13.8 Prior to offering an Authority for Access to the Person in Charge, the Electrical Authorised Person is to: -
- confirm with the Person in Charge in detail the exact extent of the work activities to be undertaken, including the scope and limits;
 - show the Person in Charge the area in which the work activities are to be done;
 - draw the attention of the Person in Charge to any special instructions and safety measures, and indicate the safety measures applied by the Electrical Authorised Person;
 - Identify to the Person in Charge all items of Electrical Equipment in or adjacent to the work activity area.
- B13.14 To accept the Authority for Access the Person in Charge is to sign the receipt section of the original and duplicate pages of the Authority. The signature renders the Authority valid for the defined work activities, and the original pages of the Authority are issued to the Person in Charge. The Electrical Authorised Person is to retain the duplicate pages in a secure location.
- B13.15 The acceptance of an Authority for Access makes the Person in Charge responsible for personally supervising or undertaking the defined work activities. If the Person in Charge needs to leave the place where the work activities are being carried out, or the work needs to be suspended for a short period of time (not through other works being carried out in the area), the Person in Charge is to ensure the area is left in a safe and tidy condition, and that access to the area is secured.
- B13.16 Keys shall be issued daily to the Person in Charge by the Electrical Authorised Person and must be returned at the end of each working day, or when work is suspended for the day.

Completion of Work and Cancellation of Authority for Access

- B13.17 Having completed the work activities and having withdrawn all persons, surplus materials, instruments and tools from the working place, the Person in Charge is to sign the clearance section of the Authority that was retained by the Electrical Authorised Person, and is to return the original pages to the Electrical Authorised Person.
- B13.18 All keys issued to the Person in Charge for the area under the control of the Electrical Authorised Person must be returned to the Electrical Authorised Person on signing the clearance.
- B13.19 The Electrical Authorised Person is to check that the location has been left in a clean and tidy condition and to secure it against unauthorised access. The Electrical Authorised Person is then to cancel the Authority for Access by destroying the original pages and signing the cancellation section. A copy of each page of the cancelled Authority is to be retained in a secure location for three years after their dates of cancellation.
- B13.20 If the Electrical Authorised Person decides that it is necessary to stop the work activities, the Authority is to be withdrawn and cancelled. The reasons for the withdrawal and the actions taken are to be noted in the cancellation section and in the Electrical Distribution Operating Record.
- B13.21 If the Person in Charge has lost the original pages of the Authority for Access, the loss is to be recorded by the Electrical Authorised Person in the cancellation section, and in the Electrical Distribution Operating Record. The Person in Charge is to countersign the cancellation to confirm the loss of the original Authority. The loss is to be reported to the Electrical Authorising Engineer.

B14 CERTIFICATE OF TRANSFER OF CONTROL

General

- B14.1 Where, under a project or minor works, the responsibility for an area or piece of apparatus is to be transferred to a Contractor, a uniquely numbered Certificate of Transfer of Control shall be issued. The Transfer of Control shall pass responsibilities for safety and for the issuing of required documentation to the Contractor for the specified area or equipment.
- B14.2 Prior to the issue of a Certificate of Transfer of Control the Electrical Authorised Person is to ensure that all persons working on the system under the Certificate can demonstrate their competence on the system to be worked on.
- B14.3 Where switching is required under the Certificate, or the issuing of Permits, Sanctions, Instructions, Authorities, or other Certificates, the Contractor's Electrical Authorised Person must present a copy of their Electrical Authorised Person's Certificate from a validated training institution to the STFC Electrical Authorised Person. This certificate must clearly demonstrate training up to, or exceeding the voltage to be worked on, that has been completed within the last 3 years. The Certificate shall be presented a minimum of 14 days prior to the Transfer of Control.
- B14.4 Where a Certificate of Transfer of Control is in place for more than 30 days, the Electrical Authorised Person who raised the certificate, or their appointed deputy, shall carry out a monthly audit of all documents issued and assess the progression of work and the safety procedures in place.
- B14.5 Where the Electrical Authorised Person finds deficiencies in the working practices of the Contractor, the Electrical Authorised Person shall, depending on the nature or seriousness of non-compliance:
- Request any changes to working practice that the Electrical Authorised Person feels appropriate, **or**
 - Issue a letter of Improvement to the contractor giving the contractor a limited period to meet these requirements, also informing the Project Manager of this action, **or**
 - Issues a letter of Improvement to the contractor for immediate action, also informing the Project Manager and the Electrical Authorising Engineer of this action, **or**
 - Ensures all work on the electrical system giving rise to concern is suspended until the issue is resolved, informing the Project Manager and Authorising Engineer of this action.
- B14.6 The Contractor issued with the Certificate of Transfer of Control must not transfer control and / or responsibility to a sub-contractor without the approval of STFC Electrical Authorised Person.

Implementing a Certificate of Transfer of Control

- B14.7 A Certificate of Transfer of Control is, where practicable, to be issued at the place covered by the Certificate. The issue and cancellation of every Certificate is to be recorded in the Electrical Distribution Operating Record
- B14.8 Before issuing a Certificate of Transfer of Control the Electrical Authorised Person is to: -
- agree with the Project Manager, where applicable, the content of the Certificate, including the Conditions of Issue,
 - confirm that permission for the intended work has been obtained from the person(s) responsible for the day to day operations of any area(s) affected by the intended work;

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- positively identify with the Contractor's representative the area or equipment covered by the certificate, and thereby defining the limits of the certificate;
- ensure no permits, sanctions, instructions, authorities, or other certificates are open for the areas covered by this Certificate.

B14.9 The Electrical Authorised Person shall keep the Duplicate (STFC) copy of the certificate and issue the Original (Contractor's) copy to the Contractor's representative, ensuring that the Contractor's representative is fully aware of their duties. The Original (STFC) copy is to be retained until time of cancellation.

Cancellation of a Certificate of Transfer of Control

B14.10 Having completed the work, control shall be returned to STFC by cancellation of the certificate. Before signing acceptance of the return of control, the STFC Electrical Authorised Person shall:-

- ensure the area or equipment covered by the Certificate has been left in a safe and orderly condition;
- any permits or sanctions raised by the Contractor's representative have been closed;
- all keys issued under the certificate have been returned.

B14.11 Once the Certificate has been cancelled by both parties, the Contractor's representative retains their copy (as proof that he is no longer responsible for the area or Equipment) and the Duplicate (STFC) copy is retained by the STFC Electrical Authorised Person and kept for three years after the date of cancellation.

B14.12 If the Contractor's representative has lost their copy of the Certificate, this loss is to be recorded by the STFC Electrical Authorised Person at the bottom of the Duplicate (STFC) copy and in the Electrical Distribution Operating Record. The Contractor's representative is to countersign the comment on the Duplicate (STFC) copy of the Certificate.

B15 CERTIFICATE OF ISOLATION & EARTHING

General

B15.1 A Certificate of Isolation and Earthing is a formal statement to be completed by an Electrical Authorised Person responsible for one side of a demarcation line on an electrical distribution system. The Certificate is issued to enable work to be undertaken on an electrical system that is controlled by another Electrical Authorised Person or Supply Authority. The Certificate of Isolation and Earthing should normally be issued by the controlling authority, unless otherwise requested.

B15.2 A Certificate of Isolation and Earthing shall be used where:

- the Electrical Authorised Person requires the supply authority to isolate and, where required, earth the supply to a main intake of a substation. The Certificate of Isolation and Earthing is to be issued by the supply authority.
- When requested by the supply authority to isolate and, where required, earth their supply to the main intake of an STFC substation.
- the Electrical Authorised Person is requested to isolate and, where required, earth an electrical supply to another department or consumer.
- the Electrical Authorised Person is requested to isolate and, where required, earth an electrical supply to an area where a Certificate of Transfer of Control has been issued to a Contractor.
- a Risk Assessment deems it necessary to isolate and, where required, earth electrical equipment to facilitate work in the vicinity of electrical services.

B15.3 When a Certificate of Isolation and Earthing is used solely for isolation with no earth's being applied, the section referring to the point at which the equipment is earthed shall be completed with the word 'None.'

Implementation of Certificate of Isolation and Earthing

Where a Safety Programme is to be prepared prior to the issue of the Certificate of Isolation and Earthing the Safety Programme number is to be entered onto the Certificate.

B15.4 A Certificate of Isolation and Earthing is to be issued to the Electrical Authorised Person responsible for undertaking the Work on the other side of a line of demarcation, detailing the isolation and earthing operations undertaken by the issuing Electrical Authorised Person.

B15.5 The recipient of the Certificate of Isolation and Earthing is to acknowledge receipt of the Certificate by signing the original and duplicate copy. The signature renders the Certificate valid for the period of the Work. The original of the Certificate is issued to the receiving Electrical Authorised Person, who thereafter takes responsibility for carrying out the work.

B15.6 The issue or receipt of a Certificate of Isolation and Earthing and details of the Safety Programme associated with the issue of a Certificate of Isolation and Earthing are to be recorded in the Electrical Distribution Operating Record.

B15.7 The duplicate copy of the signed Certificate of Isolation and Earthing is to be retained by the issuing Electrical Authorised Person until the work is completed and the original copy returned.

B15.8 Where testing is required on a supply covered by a Certificate of Isolation and Earthing, on a system which has an Earth applied, the Certificate of Isolation and Earthing shall be cancelled prior to the issuing of a Sanction to Test. A new Certificate of Isolation and Earthing shall be raised, if required, after the cancellation of the Sanction.

Completion of Certificate of Isolation and Earthing

B15.9 On completion of the Work requiring the Certificate of Isolation and Earthing, or to allow a Sanction to Test to be raised, the recipient shall:

- confirm the cancellation of all associated Permits or Sanctions;
- confirm the removal of all persons under the control of the recipient including associated tools and equipment;
- return the original copy of the Certificate to the issuing Electrical Authorised Person and sign the clearance section on the duplicate copy, and the original where required.

B15.10 The Electrical Authorised Person is to sign the cancellation section of the Certificate of Isolation and Earthing (both copies where required) and then restore the network as necessary, or as defined in the Safety Programme.

B15.11 Following cancellation the completed certificate shall be retained for three years after the date of cancellation.

B15.12 If the recipient has lost the original Certificate, the loss is to be recorded by the Electrical Authorised Person in the Electrical Distribution Operating Record. The recipient is to sign the clearance section of the duplicate and the Authorised Person is to sign the cancellation section and write on the Duplicate that the 'Original was lost'. The loss is to be reported to the Electrical Authorising Engineer.

B16 CONNECTION AND DISCONNECTION NOTICES

Connection Notice

- B16.1 Where there is a requirement to ensure all concerned parties are aware that an electrical supply has been energised, a Connection Notice may be issued.
- B16.2 The notice shall state clearly and without ambiguity the supply or supplies that have been energised.
- B16.3 A Connection Notice shall have up to 4 copies: an original copy to be retained by the issuing authority and a duplicate copy retained by the Electrical Contractor, a Principal Contractor (where different) and the STFC Project Manager. Each copy shall bear the same pre-printed serial number. Sets of numbered forms shall be used in sequence.
- B16.4 The issuing of a Connection Notice shall be carried out before the supply has been energised.
- B16.5 The Electrical Authorised Person shall also confirm with the Electrical Authorising Engineer that the new system can be connected to the existing site system.
- B16.6 Implementation of the Connection Notice should be conducted through the following process:
- The Electrical Authorising Engineer or designated Electrical Authorised Person shall sign the declaration section and provide details of the supply or supplies that are to be energised, along with the date and time the operation takes place.
 - The acknowledgement section of the original copy shall be completed by representatives of the Electrical Contractor, the Principal Contractor (where different), and the STFC Project Manager. In so doing the representatives agree to inform all other members of staff, contractors, or sub-contractors under their control who might be affected by the operation(s) detailed in the declaration section.
 - The declaration section of the copies must only be completed by a representative of the Contractor or Group associated with that copy.
 - The issue of a Connection Notice is to be recorded in the Electrical Distribution Operating Record.
- B16.7 Following the issue of a Connection Notice the completed original copy shall be retained in a secure location and kept for three years after the date of issue.

Disconnection Notice

- B16.8 Where there is a requirement for proof of electrical disconnection, a Disconnection Notice may be issued.
- B16.9 The notice shall state clearly and without ambiguity the disconnection(s) carried out.
- B16.10 A Disconnection Notice shall have an Original copy and a duplicate copy and shall bear the same pre-printed serial number on each sheet. Sets of numbered forms shall be used in sequence.
- B16.11 The issuing of a Disconnection Notice shall be implemented through the following process:
- The declaration section shall be completed by an Electrical Authorised Person or an Electrical Nominated Person appointed by the Electrical Authorised Person for the work, and, where necessary, in possession of a Permit to Work. The Electrical Authorised Person or Electrical Nominated Person shall ensure the circuit, system, or apparatus is fully disconnected from all sources of supply;
 - The approval section of the notice shall be completed by an Electrical Authorised Person only when the declaration section has been completed by

an Electrical Nominated Person, and shall confirm that the disconnection has been checked.

B16.12 The duplicate copy of the Disconnection Notice shall either be:

- Issued to the person in charge of the work for which the disconnection is required;
- Posted on the apparatus that has been disconnected.

B16.13 Following the issue of a Disconnection Notice the completed STFC Copy shall be retained in a secure location and kept for three years after the date of issue.

B16.14 If the circuit, system or apparatus being disconnected is to be removed from the electrical distribution network the mimic diagram must be modified to display the current configuration.

B17 OPERATING RECORDS

Electrical Distribution Operating Record

B17.1 A bound book (not loose leaf), entitled “Electrical Distribution Operating Record” shall be clearly and indelibly marked with the name of the location and installation to which the records relate, and shall be kept in locations agreed by the Electrical Authorising Engineer.

B17.2 The pages of the book are to be divided into columns with the following headings: -

No.	DATE	TIME	LOCATION & IDENTITY OF SWITCH	EVENT OR OPERATION & REASON	SIGNATURE

B17.3 Entries are to be made in chronological order and shall record: -

- each individual operation of High Voltage switchgear, unless covered collectively by a single entry of a Switching Programme serial number.
- each operation of Low Voltage distribution switchgear down to and including main intake switches, unless covered collectively by a single entry of a Switching Programme serial number;
- adjustment of the Mimic Panel (if provided) to indicate the present state of the system or installation;
- the relinquishing and acceptance of responsibility between Electrical Authorised Persons;
- the issue and cancellation of a Permit to Work, a Sanction to Test, Sanction for Work on or near Live Electrical Equipment or an Authority for Access;
- the withdrawal of a Permit to Work, a Sanction to Test, Sanction for Work on or near Live Electrical Equipment or an Authority for Access, the reason and the action taken;
- the loss of a Permit, a Sanction, a Standing Instruction, a Specific Written Instruction, Connection / Disconnection Notice, Certificate of Isolation & Earthing, Transfer of Control or an Authority for Access;
- the issuing of a connection notice;
- the receipt and termination of an Operational Restriction;
- any inspection and remedial action associated with an Operational Restriction;
- operation of Tap Changers.

B17.4 Electrical Distribution Operating Record books are to be retained in a secure location for a period of three years after the date of the last entry.

Switchgear Maintenance and Operating Instructions

B17.5 One or more ring binder files entitled “Switchgear Maintenance and Operating Instructions” are to be prepared. The files are to be clearly and indelibly marked with the location and installation to which the records relate, and are to be kept in a location approved by the Electrical Authorising Engineer.

B17.6 The ring binder files are to contain:

- Manufacturers’ maintenance and operating instructions for each type of High and Low Voltage distribution switchgear included in the system or installation with test certificates and records;
- Copies of any Operational Restrictions endorsed with their current status, which are applicable to any Equipment included in the system or installation;
- Information on where maintenance records are to be found.

Electrical Distribution Record of Information

B17.7 A file entitled “Electrical Distribution Record of Information” shall be kept in a location approved by the Electrical Authorising Engineer, which is clearly and indelibly marked with the location and installation to which the records relate.

B17.8 The file is to contain the following information applicable to the site: -

- A site location plan;
- Electrical distribution single line diagram;
- A location plan and layout drawings of the High Voltage Distribution System, of each substation, of Low Voltage distribution Equipment (up to an including main intake switches), and Low Voltage switchboards as appropriate;
- Detail of the Regional Electricity Company supplies;
- Detail of on-site electricity generation;
- A schedule of the High Voltage Switchgear, Distribution Transformers and Low Voltage Switchgear;
- Details, line diagrams and layout drawings of Uninterruptible Power Supply (UPS) Equipment (other than rack mounted UPS’s).
- A cable schedule, including as installed cable route plans and drawings;
- Details of Electrical Protection, including over current protection grading charts and voltage referenced grading charts (as applicable);
- Information on where system and circuit load monitoring records can be found.

B18 SAFETY LOCKS, EQUIPMENT SAFETY LOCKS AND LOCK-OUT BOXES

B18.1 A Safety Lock is a padlock having only one key, which is different from all other keys in use on the electrical distribution system. Safety Locks shall be indelibly coloured in red or marked in red, and each Safety Lock and its key must be clearly identified. Safety Locks are to be used only in accordance with this SHE Code.

B18.2 Two procedures for Safety Lock systems are permissible B18.2.1 System A and B18.2.2 System B on their own, or as a mixed system, provided the locks are clearly identified.

B18.2.1 System A provides all persons with personal locks as follows:

- each Electrical Authorised Person will be issued with 10 Safety Locks, which are keyed alike, and have only one key.
- each Electrical Nominated Person will be issued with 4 Safety Locks, which are keyed alike, and have only one key.

- If deemed necessary the Electrical Authorising Engineer may issue additional locks to an Electrical Authorised or Nominated Person;
- each Electrical Authorised and Nominated Person will also be issued with Safety Signs and Notices for work or testing in accordance with Table LV3 or for defined tasks described on a Standing Instruction. Such Signs and Locks are to be identifiable to the Electrical Authorised or Nominated Person;
- each Electrical Authorised or Nominated Person is to retain control of the Safety Locks and Keys at all times. The Keys to Safety Locks when in use are to be controlled by their assigned Electrical Authorised or Nominated Person and kept in a secure location;
- safety Locks are to be engraved to identify the Electrical Nominated or Authorised Person to whom they have been issued and each safety lock and its key are to be numbered for ease of identification.
- safety locks can be assigned to main LV and HV switch rooms and used by Electrical Authorised Persons in accordance with Tables LV1, LV2, HV1 and HV2. The Caution Notices applied shall identify the Electrical Authorised Person.

B18.2.2 System B provides for a store of locks issued as follows:

- Safety Locks will only be issued if all Risk Assessments and Standing/Specific Written Instructions are in place;
- Safety Locks and keys are to be individually identified. Where applicable, the lock number shall be printed on the Permit or Sanction;
- A safety lock is a lock with only one key, which is different from all other keys;
- Each Electrical Authorised or Nominated Person will collect one or more Safety Locks from the Electrical Authorised Person who is issuing the Electrical Permit to work when carrying out an isolation;
- Each Electrical Authorised or Nominated Person shall also collect the required Safety Signs and Notices for the work or testing in accordance with Table LV1, LV2 & LV3 and these Safety Signs shall contain appropriate contact details;
- The Electrical Authorised Person who is issuing the Electrical Permit to work shall ensure that the isolation has been safely completed and the required Safety Signs and Notices displayed, before the Permit or Sanction is issued;
- Once the isolation is complete and the permit or sanction issued, the key(s) are to be retained in a Safety lockout box until the work or test is completed;
- The safety lockout box shall then be locked with two padlocks. The key for one padlock shall be kept by the Electrical Authorised Person who issued the Electrical Permit to work. The second padlock key shall then be attached to the Permit to Work or Sanction to Test and will be kept by the Electrical Authorised or Nominated Person in charge of the work;
- The Safety lockout box shall only be unlocked and the keys contained within released when the permit or sanction is cancelled.
- An Electrical Authorised Person's Safety Lock key may be available to other Electrical Authorised Persons having an Electrical Authorised Person's letter of Appointment for the specific Equipment. If the isolation is released by another Electrical Authorised Person, the issuing Electrical Authorised Person must be informed as soon as reasonably practicable.

- B18.3 An Equipment Safety Lock is a lock with only one key, which is different from all other keys in use on the electrical distribution system, used for securing the means of isolation of specific equipment. Equipment Safety Locks are to be used only in accordance with this SHE Code.
- B18.4 Equipment Safety Locks are to be identified with specific Equipment or to an area in which they are to be used (such as a specific Substation High Voltage switch room), and shall bear an identification number.
- B18.5 Where appropriate, within an area, a number of Equipment Safety Locks may be kept in the local Operational Key Box, but it may not be necessary to hold locks for each piece of Equipment.
- B18.6 When a Permit to Work or a Sanction to Test is to be issued all points of isolation must be secured in the off position using two locks, one lock being an Electrical Authorised Person's Safety Lock and the other the Person in Charge's Safety Lock. They are to be arranged so that both locks must be released before the system can be made operational. When the Permit is issued the Electrical Authorised Person and Person in Charge must retain their own Safety Lock keys.
- B18.7 On specific equipment an Electrical Authorised Person may decide to use Equipment Safety Locks to secure isolation.
- B18.8 After the Equipment Safety Locks have been applied, and before the Permit to Work or Sanction to Test is issued, the keys to all the Equipment Safety Locks must be secured in an approved Lock-Out Box.
- B18.9 Lock-Out Boxes are to be secured by two Safety Locks, one being the Person in Charge's Safety Lock, and the other the Electrical Authorised Person's Safety Lock. The locks are to be arranged so that both locks must be released before access is gained to the contents of the Lock-Out Box.
- B18.10 When not in use, Equipment Safety Locks and their keys are to be kept in an appropriate key cabinet.
- B18.11 During an Emergency or loss of Safety Lock key the removal of the Safety lock can only be approved by the Authorising Engineer or their nominated representative.

B19 KEYS, KEY CABINETS, MIMIC DIAGRAMS AND PADLOCKS TO SECURE REMOVABLE TEMPORARY EARTHS

Keys for Switchgear and Buildings

- B19.1 The administration and use of suited lock systems in connection with this SHE Code is to be approved by the Electrical Authorising Engineer. The Electrical Authorised Person must retain control of all keys to suited lock systems installed in connection with this SHE Code and the Electrical Authorising Engineer is to audit these control procedures.
- B19.2 Keys issued to an Electrical Authorising Engineer, Electrical Authorised Person, or Electrical Nominated Person on a permanent basis, shall not be loaned or transferred to other persons.
- B19.3 If an Electrical Authorised Person's or Electrical Nominated Person's letter expires and is not renewed, or is withdrawn, the Electrical Authorising Engineer is to ensure that any keys issued to that person are returned.
- B19.4 Where keys to suited locks are issued to persons, other than those covered by Clause B19.2, the specific use and purpose intended for the keys is to be detailed on a Standing Instruction, a Specific Written Instruction, Permit, Sanction, or an Authority for Access issued to that person.
- B19.5 Key plates, may be used, and may bear the identification of the substation, building or item of Equipment to which the keys belong, or the purpose for which each key is intended.

Key Cabinets

- B19.6 Key Cabinets are to be installed in appropriate locations in connection with this SHE Code and clearly marked with a unique identifier.
- B19.7 The Electrical Authorising Engineer shall keep a list of all Key Cabinets installed in connection with this SHE Code. This list shall include the following:-
- Locations of all Key Cabinets and their unique identifiers;
 - The contents of each Key Cabinet;
 - The names of each Electrical Authorised Person who has access.
- B19.8 A copy of this list shall be made available to all Electrical Authorised Persons.

Padlocks to Secure Removable Temporary Earths (Earthing Locks)

- B19.9 Padlocks (Earthing Locks) used to secure Removable Temporary Earths are to have only one key which is different from all other keys used on the electrical distribution system. Earthing Locks shall be indelibly coloured in yellow or marked in yellow, and each Earthing Lock and its key must be clearly identified. Earthing Locks are to be used only in accordance with this SHE Code.
- B19.10 The keys for locks used by the Electrical Authorised Person to secure Removable Temporary Earths are to be issued by the Electrical Authorised Person to the Person in Charge, who is to retain control of them for the duration of the test.
- B19.11 Earthing Locks and their keys may be held in local Operation Key Cabinets within Substations, but are not specific to one piece of Equipment.

Mimic Diagram

- B19.12 A Mimic Diagram is to be provided for all High Voltage distribution systems and Low Voltage distribution systems which include a ring circuit, an automatically started generating set, or a fixed uninterruptible power supply >100kVA.
- B19.13 A Mimic Diagram is to show, as a minimum, the HV electricity distribution system and Equipment that is under the control of the Electrical Authorised Person, from all sources of supply up to and including Low Voltage Interconnectors.
- B19.14 Substations and major Low Voltage intakes are to be appropriately labelled on the Mimic Diagram.
- B19.15 The Mimic Diagram must be permanently displayed and accessible to all Electrical Authorised Persons. The status of the electricity distribution system and Equipment is to be visible at all times, but the Mimic Diagram is to be lockable to prevent unauthorised adjustment.
- B19.16 An electronic Mimic Diagram is acceptable as long as it conforms to clauses B19.12 to B19.14, but consideration should be given to how the diagram might be accessed during a total supply failure. A line diagram of the associated distribution system shall be displayed in all the main LV and HV switch rooms. A hard copy of the Mimic diagram showing the status of the associated distribution system must be clearly displayed when work or test is undertaken.

B20 USE AND PROVISION OF PROTECTIVE, TEST, EARTHING, AND LIFTING EQUIPMENT

Use, Storage, Inspection and Documentation

- B20.1 Protective Equipment, Test Equipment and earthing Equipment is to be maintained and stored in accordance with the manufacturer's or supplier's instructions, and it is to be inspected by the user on each occasion before use, and is to be properly used.

- B20.2 The location of Protective Equipment, Test Equipment and portable earthing Equipment is to be prominently displayed adjacent to the Working Key Cabinet.
- B20.3 Where Protective Equipment, Test Equipment, and portable earthing Equipment is kept on site for use in connection with this SHE Code, details and copies of the equipment specification, operation, maintenance and where appropriate, calibration, are to be kept in a location approved by the Electrical Authorising Engineer.
- B20.4 Unless more frequent intervals are specified by the manufacturer or supplier an Electrical Authorised Person is to inspect each item of Protective Equipment and portable earthing Equipment, kept on the site, at least once a year and in accordance with the manufacturer's or supplier's instructions, to ensure that it is suitable for the use for which it is provided and it is maintained in a condition suitable for that use. Where protective equipment, test equipment and portable earthing equipment is found to be defective or faulty it is to be taken out of use and suitable precautions implemented to prevent further use. The inspecting Electrical Authorised Person is to instigate the appropriate remedial or replacement action where necessary. These inspections are to be recorded in the Electrical Distribution Operating Record, as well as in any other maintenance and inspection record system.
- B20.5 Where practicable, lifting equipment shall be kept with the switchgear for which it is associated.
- B20.6 Reports for each inspection of lifting equipment are to be kept in the Switchgear Maintenance and Operating Instructions ring binder.
- B20.7 The Electrical Authorising Engineer is to review the records every twelve months to determine that the maintenance and inspection is being carried out for protective equipment, lifting equipment, test equipment and portable earthing equipment kept on site.

Protective Equipment

- B20.8 Appropriate protective equipment is to be provided and is to be readily available at all times to those who need it in connection with this SHE Code. Protective equipment is to be used whenever necessary to prevent danger or, where appropriate, injury and as required by this SHE Code.
- B20.9 Protective equipment, in normal circumstance is to be provided by the person responsible for the work activities. Protective equipment provided by the Person in Charge may be used if the Electrical Authorised Person agrees, and such use is to be recorded.
- B20.10 Protective equipment is to be inspected by the Person in Charge for visible defects on each occasion prior to use to ensure that it is suitable for the use for which it is provided, and that it has been maintained in a condition suitable for that use, when properly used. Any suspect item is to be reported to the Electrical Authorised Person who is to consider its withdrawal and replacement.

Test Equipment

- B20.11 The Electrical Authorised Person is to arrange for the necessary test equipment to be available when required in connection with this SHE Code.
- B20.12 Test equipment is to be, where appropriate, calibrated in accordance with the manufacturer or supplier's instructions.
- B20.13 Test equipment is to be inspected by the user for visible defects on each occasion prior to use to ensure that it is suitable for the use for which it is provided, and that it has been maintained in a condition suitable for that use, when properly used. Any suspect item is to be reported to the Electrical Authorised Person who is to consider its withdrawal and replacement.

Earthing Equipment

- B20.14 Before conductors are earthed a check is to be made to confirm that the earthing Equipment to be used is of sufficient strength and current-carrying capability to discharge electrical energy to earth without danger or, where appropriate, risk of injury.
- B20.15 The appropriate manufacturer's or supplier's proprietary earthing Equipment is to be used where it is available; where none is available, purpose made earthing Equipment may be used with the Electrical Authorising Engineer's approval.
- B20.16 Portable earthing Equipment is to be inspected by the user before each use to confirm that it is suitable for use for which it is provided, and that it has been maintained in a condition suitable for that use, when properly used. Any suspect item is to be reported to the Electrical Authorised Person who is to consider its withdrawal and replacement.

Lifting Equipment

- B20.17 Registered and inspected lifting equipment associated with the switchgear shall be used at all times. Where none is available, other means may be used with the Electrical Authorising Engineer's approval, see SHE code 26 Safe use of lifting equipment.

B21 TEMPORARY SUPPLIES, INTERLOCKS, & EMERGENCY SHUTDOWN CONTROLS

Temporary Supplies

- B21.1 An electrical cable that has been installed for a particular purpose and will be removed when no longer required for that purpose.
- B21.2 All Temporary Supplies shall be registered, bearing a registration label at the supply end of the cable and shall be securely fastened to the cable at a point where it can be readily seen.
- B21.3 Before any registered Temporary Supply is put into service a full electrical test as required under a BS7671 installation certificate shall be carried out and the certificate forwarded to the designated Electrical Authorised Person.
- B21.4 All Temporary Supplies shall be inspected every month. This will involve the following work to be carried out:
- A visual inspection of the cable throughout its route, ensuring all labels are in place. Any changes, not previously identified, to the route, fixings, or condition of the cable shall be recorded and a full electrical test and inspection shall be carried out as described in BS7671 for periodic testing;
 - An earth-loop impedance test shall be carried out;
 - Inspection and test results shall be forwarded to the defined Electrical Authorised Person who is to place the documents in the Temporary Supplies Document Folder.
- B21.5 If a Temporary Supply has not been inspected or tested for a period greater than 60 days (due to non-compliance of the user to agree an inspection to be carried out as described in Clause B21.4 or where changes have occurred, the Electrical Authorised Person should isolate the supply and lock it off until a full test has been carried out on the installation.
- B21.6 A Temporary Supply shall have a life span not exceeding 1 year.
- B21.7 Inspection and test results for a temporary supply are to be kept for 3 months following its removal.

Interlocks

- B21.8 A register of Interlock Key-Codes is kept by SHE Group who will authorise the use of such codes, and ensure that no duplicates exist. An electronic list is viewable and editable at <https://staff.stfc.ac.uk/she/Pages/Keys.aspx> if in doubt consult an **Electrical Authorised Person or Electrical Authorising Engineer**.
- B21.9 Where Interlocks are used on Distribution Networks, override Maintenance Keys may be available to change the supply configuration without an interruption of supply. Maintenance Keys shall be:
- kept in a Key Cabinet remote from the Equipment they control;
 - issued only by the Electrical Authorising Engineer as a requirement under a Safety Programme;
 - used only by the Electrical Authorising Engineer or an Electrical Authorised Person; and
 - returned to the Key Cabinet as soon as the work is completed. It is the responsibility of the Electrical Authorising Engineer to ensure the Maintenance Key is returned.
- B21.10 Where Interlocks are used on Experimental Equipment reference shall also be made to appendix A5.

Emergency Shutdown Facilities

- B21.11 Where there is an increased danger that an electrical incident or fire may occur, such as in experimental areas and laboratories, the inclusion of emergency shutdown buttons or break-glass units to interrupt all electrical supplies should be considered.
- B21.12 Emergency shutdown control points shall be situated in prominent positions and shall be clearly labelled to indicate what they control. Circuit reference numbers shall also be included.
- B21.13 All personnel working in these areas shall be shown where these control points are located and instructed in their operation.
- B21.14 The design and positioning of such control points shall include consideration to avoid accidental tripping.
- B21.15 Consideration should also be given in the design to the way tripped circuits are reset. Whilst for most applications an automatic reset occurs when the button is released or the glass replaced, other applications may require a more controlled method of reset.
- B21.16 Shutdown circuits shall be fully tested annually. For main High Voltage and Low Voltage distribution panels only, however, local procedures, agreed with the Electrical Authorising Engineer, may be used to prevent a full trip of the breakers.

B22 IDENTIFICATION OF SERVICES AND SPIKING CABLES

- B22.1 Prior to undertaking electrical work where hidden services may be present, for example gas, electric and water, undertake a site survey, see SHE Code SC19 Work on buildings, services, premises and infrastructure.
- B22.2 Before the conductors of a cable are cut or exposed, the origin, the point of the work and the destination of the cable to be worked on are to be identified with certainty.
- B22.3 The identification may be regarded as clear and certain if the cable is visible throughout its length.

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- B22.4 Identifying a cable by passing an electrical signal along it is not by itself a reliable means of identification, since cables running alongside are inductively coupled and may give a false identification.
- B22.5 Cables without an earth bonded metallic sheath or armouring are not to be spiked.
- B22.6 In the absence of clear and certain identification, the cable is to be spiked at the point of the work and thereafter identified by an appropriate procedure. Before spiking it may be necessary to undertake tests, which are to be repeated after spiking, and the results compared.
- B22.7 Cable spiking equipment is available in two forms of operation; hydraulically or by explosive cartridge. The spiking of cables is to be undertaken only by:
- An STFC Electrical Authorised Person trained in the use of cable spiking equipment;
 - An Electrical Authorised Person employed directly or indirectly by a Contractor, trained in the use of cable spiking equipment, and approved by an STFC Electrical Authorised Person.
 - A contractor trained in the use of cable spiking equipment, who has demonstrated sufficient competency, and who is in possession of Specific Written Instruction issued by an STFC Electrical Authorised Person.
- B22.8 Cable locating devices should, as a minimum, be rugged and weatherproof to NEMA 3S, comply with EMC standards, and be produced by BS EN ISO 90001:2008 accredited manufacturers.

B23 OPERATIONAL RESTRICTIONS

This is a written instruction, issued by the Electrical Authorising Engineer, a supply authority, a manufacturer, or a supplier of Electrical Equipment, modifying or prohibiting the normal operating procedures associated with a particular type of Equipment.

General

- B23.1 Any Electrical Authorising Engineer receiving or discovering an Operational Restriction without any indication of it having been advised through STFC is to forward a copy, as soon as is practicable, to all other Electrical Authorising Engineers within STFC.
- B23.2 Any Electrical Authorised Person receiving or discovering an Operational Restriction is to advise the Electrical Authorising Engineer as soon as is practicable.
- B23.3 On receipt of an Operational Restriction, the Electrical Authorising Engineer shall:-
- Investigate whether or not the Equipment is included in their appointed systems or installations;
 - Retained a copy of Operational Restriction in a secure location;
- B23.4 Where the Operational Restriction relates to equipment that forms part of the appointed systems or installations, the Electrical Authorising Engineer shall ensure:
- An Operational Restriction notice is securely fixed to the Equipment warning of the Restriction and ensure all Electrical Authorised Persons are informed of the Notice;
 - The withdrawal or revision (if applicable) of any Standing Instructions permitting operation of the Equipment, any revisions must incorporating the Operational Restrictions;
 - The Operational Restriction is noted in the Electrical Distribution Operation Record;
 - Arrangement of any necessary inspections and remedial work;

- B23.5 The completion of inspections and remedial work arising from the Operational Restriction is to be noted in the Electrical Distribution Operation Record and reported to the Electrical Authorising Engineer.
- B23.6 The Electrical Authorised Person is to ensure that copies of the inspection reports and details of any remedial work undertaken are:-
- Retained in a location approved by the Electrical Authorising Engineer;
 - Forwarded to the Electrical Authorising Engineer.
- B23.7 The Electrical Authorising Engineer is to notify all Electrical Authorised Persons of the termination of an Operational Restriction. The termination of an Operational Restriction shall also be noted in the Electrical Distribution Operating Record.
- B23.8 On termination:
- The copy of the Operational Restriction held by the Electrical Authorising Engineer is to be overwritten with the word “CANCELLED” followed by the date of the cancellation. It should be retained for a period of three years after the date of cancellation;
 - The copy in the Switchgear Maintenance and Operating Instructions file is to be overwritten with the word “CANCELLED” followed by the date of cancellation, and retained in the file;
 - Any Standing Instructions which incorporate the conditions of the Operational Restriction are to be withdrawn and replaced by new Standing Instructions.

B24 CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS (2007)

- B24.1 For further information regarding the application of CDM to electrical works, see STFC Safety Code SC13 and Safety Code SC19 Work on building, premises, services and infrastructure.

B25 THE ACCEPTANCE OF NEW WORKS

- B25.1 Having visited the site of the new works on main LV or HV Electrical Distribution Systems, the Electrical Authorising Engineer is to be satisfied that:
- there is adequate space and suitable access to enable maintenance and operation to be safely undertaken;
 - the installation is of an acceptable standard;
 - the Equipment is suitable for its intended purpose;
 - compatible design philosophies have been applied to the entire electrical installation for the new works;
 - the new works do not compromise the integrity of the existing electrical installation; and
 - there is a Health and Safety File holding sufficient information to enable operation and maintenance to be undertaken safely.
- B25.2 The Electrical Authorising Engineer may accept an installation that does not satisfy Clause B25.1 subject to the issuing of an Operational Restriction.
- B25.3 The STFC Electrical Authorising Engineer is to nominate Electrical Authorised Person(s) designate for the new systems or installation. The Electrical Authorising Engineer is to ensure appropriate familiarisation and on-site training in accordance with Appendix C is given to the Electrical Authorised Person(s) designate.
- B25.4 Before an installation is connected to the system for the first time:

- STFC is to be satisfied that the installation complies with the Electricity at Work Regulations, the Electricity Safety, Quality and Continuity Regulations, and any other appropriate statutory and mandatory regulations;
- all required design, installation, commissioning, and test certificates shall be handed over to STFC;
- check fuse ratings or protection settings to ensure both discrepancy and protection levels are acceptable;
- all necessary signage and labelling must be fitted;
- all keys associated with the new works shall be handed over to STFC.

B25.5 Before a formal handover is deemed complete, the Contractor shall ensure the area has been left in an acceptable condition with all waste removed and any ground works made good.

APPENDIX C.1 – TRAINING REQUIREMENTS

Role	Initial Training	Refresher	Frequency	Comments
<p>Electrical Authorising Engineers</p>	<p>Electrical Authorising Engineers Courses</p> <p>Courses should address the following topics:</p> <ul style="list-style-type: none"> • Introduction to electrical safe systems of work ; • Structure of roles and responsibilities of persons in these systems; • Practical and procedural aspects of safe working practices; • Nomination, evaluation, appointment and auditing of Electrical Authorised Persons; Candidate interviews; and • Training requirements for new and in post Electrical Authorised Persons; • Termination procedures for Electrical Authorised Persons. <p>And include practical experience applying safe working procedures on a range of typical High Voltage and Low Voltage Equipment arranged to provide simulated circuits.</p> <p>Trainees should be assessed in both written and practical exercises, so that on completion of the course, the training organisation can make an independent assessment of their suitability and technical competence.</p> <p>Asbestos Awareness Training</p> <p>Asbestos was employed routinely during construction of buildings for fire insulation and as thermal insulation in scientific equipment. All Electrical Authorising Engineers must attend a SHE recommended half day tutored course on Asbestos Awareness.</p>		5 years	<p>To be eligible for appointment, a prospective Electrical Authorising Engineer shall:</p> <ul style="list-style-type: none"> • be a Chartered Engineer, in an appropriate electrical engineering discipline or have a sound technical electrical engineering background with a minimum of Engineering Technician Status, plus a minimum of nine years relevant experience in the type of installations and safe systems of work for which they are to become responsible. • have a minimum of five years relevant professional experience including a working knowledge of the Electricity at Work Regulations; • have completed an approved Electrical Authorised Person training course and received a satisfactory marking in the last three years or within six months of a first time appointment; • be familiar with the different types of Equipment, installations and systems in use within the STFC site(s) under their control; • have a basic knowledge of the systems employed on the site(s) for which he or she is to become responsible, and become familiar with the more complex systems; • be able to demonstrate their competence and suitability for the role

				<p>by demonstrating a good understanding of the tasks involved and knowledge of the safe systems of work;</p> <ul style="list-style-type: none"> • be an employee of STFC; and • have an adequate knowledge of and, within the last 3 years, have received electrical First-Aid training.
Courses Available:	AE should, wherever possible attend courses delivered by providers who are familiar with the MoD's Electrical Safety Codes			
Electrical Authorised Persons	<p>Electrical Authorised Persons Courses</p> <p>The type of training will depend upon what equipment the candidate has responsibility for and for what systems appointment is intended. See Appendix C.2.</p> <p>Electrical Authorised Person should be able to demonstrate for the systems, installations and equipment for which they are responsible:</p> <ul style="list-style-type: none"> • a good working knowledge of the operation of this SHE Code, the role and duties of Electrical Authorised Person and any other relevant regulations. • a good working knowledge of the layout of the electrical distribution system. • a good working knowledge of the operation under normal, failure and fault conditions, of all the principal components of the systems and installations for which authorisation is being sought, such as switchgear, distribution Equipment and standby generating sets; • practical experience, under the direct supervision of an experienced Electrical Authorised Person, of the operation of the Electrical Equipment forming part of 		5 years	<p>To be eligible for appointment, a prospective Electrical Authorised Person shall:</p> <ul style="list-style-type: none"> • have five years relevant experience; • have an adequate knowledge of this SHE Code and Electrical Regulations, which are applicable to the systems and installations for which the appointment is sought; • be technically competent and qualified to be able to safely operate, and make safe to work on or test the systems, installations and Equipment for which appointment is sought; • be experienced in the selection and appointment of suitably qualified and experienced Electrical Nominated Persons and Accompanying Safety Persons; • be familiar with the systems, installations and Equipment for which appointment is sought, including where applicable work on or near live low voltage Electrical Equipment;

	<p>the system or installation;</p> <ul style="list-style-type: none"> • knowledge of the location of, how to obtain access to and the use of all the appropriate Protective Equipment, Test Indicators including appropriate Test Supplies (proving units), where applicable High Voltage Potential Indicators including appropriate Test Supplies (proving units), Earthing Equipment and Safety Signs; • a good understanding of all the necessary safety measures to be taken to prevent danger or, where appropriate, injury, and to prevent damage to Equipment; • knowledge of electricity supply authorities and contractors, having operation, repair or maintenance contracts. <p>On-Site Training</p> <p>Consists of putting into practice, under the supervision of an experienced Electrical Authorised Person, the knowledge gained during the familiarisation period and on training courses. During this period the prospective Electrical Authorised Person is to keep a record of each event attended, detailing the actions taken both personally and by the Electrical Authorised Person. This record is to be reviewed with the Electrical Authorising Engineer.</p> <p>Asbestos Awareness Training</p> <p>Asbestos was employed routinely during construction of buildings for fire insulation and as thermal insulation in scientific equipment. All Electrical Authorising Persons must attend a SHE recommended half day tutored course on Asbestos Awareness.</p>			<ul style="list-style-type: none"> • within the last 3 years have successfully completed an appropriate approved training course; • have an adequate knowledge of and, within the last 3 years, have received electrical First-Aid training.
Courses Available:	<p>Electrical Authorised Person should attend:</p> <ul style="list-style-type: none"> • UK Distribution Network Operator or similar, delivering a HV System Operations course based on C&G 6037. 			

<p>Electrical Nominated Persons</p>	<p>Due to the wide scope of potential electrical activity across STFC sites it is not possible to define specific training courses as a pre-requisite for an Electrical Nominated Person.</p> <p>For example:</p> <ul style="list-style-type: none"> • Fire Alarm • Air Conditioning • Access control • Cable jointers • Etc. <p>The type of training will depend upon what equipment the candidate has responsibility for and for what systems the appointment is intended. The training must be STFC approved and be based on this SHE code.</p> <p>On-Site Training</p> <p>Consists of putting into practice, under the supervision of an experienced Electrical Authorised or Nominated Person, the knowledge gained during the familiarisation period and on training courses. During this period the prospective Electrical Nominated Person is to keep a record of each event attended, detailing the actions taken both personally and by the Electrical Authorised or Nominated Person. This record is to be reviewed with the Electrical Authorised Person.</p> <p>Asbestos Awareness Training</p> <p>Asbestos was employed routinely during construction of buildings for fire insulation and as thermal insulation in scientific equipment. All Electrical Nominated Persons must attend a SHE recommended half day tutored course on Asbestos Awareness.</p>		5 years	<p>To be eligible for appointment, a prospective Electrical Nominated Person shall:</p> <ul style="list-style-type: none"> • be able to demonstrate competence to undertake the work activities required; • be familiar with the types of installation and Equipment that they are required to work on or test; • possess the necessary technical knowledge, skill and experience relevant to the nature of the work activities to be undertaken, to prevent danger or, where appropriate, injury; • If electrical qualified have successfully undertaken technical training administered by the Joint Industry Boards, the Electricity Supply Industry training Scheme, or some equivalent form of approved training and have attended an STFC approved training course (based on this STFC SHE Code); • If non-electrical qualified have attended an STFC approved training course (based on this STFC SHE Code). • have demonstrated an adequate knowledge of the relevant parts of this SHE Code, those Associated Regulations and Documents which are applicable to the installations and Equipment on which work or tests are to be undertaken; • have an adequate knowledge of, and within the preceding three years have received training in, Electrical First-Aid.
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	<p>Site based contractors</p> <p>To appoint STFC site based term contractors as a Electrical Nominated Person they must:</p> <ul style="list-style-type: none"> • hold a suitable qualification e.g. Electro-Technical Assessment Specification (EAS) <p>attend a formal briefing* with the appropriate AP to cover the contents of this SHE Code</p> <p>* Formal briefing based on this SHE Code to be developed by AEs to cover all STFC UK sites</p>			
Courses available:	STFC Electrical Nominated Persons course, provided in house – through responsible Electrical Authorising Engineer including bespoke local elements.			
<p>Electrical Authorising Engineer</p> <p>Electrical Authorised Persons</p> <p>Electrical Nominated Persons</p> <p>Accompanying Safety Persons</p>	<p>Electrical First Aid training (1/2 day)</p> <p>Course syllabus:</p> <ul style="list-style-type: none"> • The types of injuries that arise from working with electricity: electrocution/electric shock; arc flash; burns; inhalation etc.; • The effects on the body arising from: <ul style="list-style-type: none"> ○ Electrocution/electric shock; ○ Arc flash; ○ Electric burns; and ○ Secondary injuries arising from the above. • Emergency procedures to be followed in the case of injuries arising from working with electricity: <ul style="list-style-type: none"> ○ Calling for assistance – security and first aiders – site specific procedures; ○ Your personal safety and others attending the incident; and ○ Assessing and managing casualty(s) until first aider and others arrive. • Treatment of injuries arising from working with electricity: 	Ditto	3 years	

	<ul style="list-style-type: none"> ○ Assessing and managing a conscious casualty – electrical burns/bleeding; arc flash; inhalation; and ○ Assessing and managing an unconscious casualty - basic life support (Cardiovascular Pulmonary Resuscitation [CPR]) for a non-breathing casualty. 			
Courses Available:	Delivered by A-Line Associates or similar.			

APPENDIX C.2 - Electrical Authorised Persons TRAINING

HIGH VOLTAGE DISTRIBUTION SYSTEMS

Approved-training courses are to provide the necessary basic training and background information to prepare and enable trainees to safely discharge the duties of Electrical Authorised Persons in respect of the defined distribution systems. The courses are to be appropriate to the High Voltage systems and installations to be worked upon.

The basic training is to provide:

- an adequate knowledge of the rationale and content of this SHE Code;
- a thorough knowledge of, and practical experience in, the duties and responsibilities of an Electrical Authorised Person;
- an introduction to the theory, application, operation and maintenance of the components of typical High Voltage ring and radial and Low Voltage distribution systems.

The background information is to provide an understanding of the principles involved in the design, operation and maintenance of typical High Voltage and Low Voltage distribution systems and their associated protective devices.

The course is to have duration of about five days, and the scope is to include:

- statutory requirements relating to electrical safety;
- this SHE Code;
- Electrical Authorised Person role and duties;
- types and functions of common High Voltage distribution switchgear;
- types and functions of other common High Voltage distribution equipment, including transformers and cables;
- types and functions of Low Voltage distribution switchgear and equipment;
- operation of High Voltage ring and radial distribution systems;
- protective devices, including relays, fuses and interlocks;
- operation and maintenance procedures for High Voltage and Low Voltage distribution equipment;
- operation and maintenance procedures for standby power supplies and equipment;
- practical exercises on switching simulated High Voltage ring and radial distribution systems;
- practical exercises on making High Voltage equipment safe to work on or test, including procedures appertaining to Permits to Work and Sanctions to Test;
- procedures for live working on or near Low Voltage equipment;
- cable detection, location and identification.

LOW VOLTAGE DISTRIBUTION SYSTEMS

Approved-training courses are to provide the necessary basic training and background information to prepare and enable trainees to safely discharge the duties of Electrical Authorised Persons in respect of the defined distribution systems. The courses are to be appropriate to the Low Voltage systems and installations to be worked upon.

The basic training is to provide: -

- an adequate knowledge of the rationale and content of this SHE Code;
- a thorough knowledge of, and practical experience in, the duties and responsibilities of an Electrical Authorised Person;
- an introduction to the theory, application, operation and maintenance of the components of typical Low Voltage distribution systems.
- The background information is to provide an understanding of the principles involved in the design, operation and maintenance of typical Low Voltage distribution systems and their associated protective devices.

The course is to be of the appropriate duration and the scope is to include:

- statutory requirements relating to electrical safety;
- This SHE Code;
- Electrical Authorised Person role and duties;
- types and functions of common Low Voltage distribution switchgear;
- operation and maintenance procedures for Low Voltage distribution equipment;
- practical exercises on switching simulated Low Voltage distribution systems;
- practical exercises on making Low Voltage equipment safe to work on or test, including procedures appertaining to Permits to Work and Sanctions to Test; procedures for live working on or near Low Voltage equipment;
- practical exercises on the isolation of standby, UPS and battery systems including the issue of permits-to-work and letters of authorisation for live working;
- testing of electrical installation to BS 7671
- protective devices, miniature circuit breakers (MCBs), fuses and interlocks;
- monitoring of electrical safety work by staff/contractors;
- cable detection, location and identification.

APPENDIX D - AUDITING

This appendix addresses the audit of electrical safety as defined in this SHE code - Operational Audit of electrical safety undertaken by Authorised Engineers, and the independent Compliance Audit of this SHE code as defined in STFC SHE Code 30: SHE auditing and Inspection.

Operational Audit of Electrical Safety

The Electrical Authorising Engineer shall prepare a programme, undertake and document the findings of an audit programme of electrical safety systems and procedures defined in this SHE Code. The frequency of such audits should not exceed 3 years. Audit findings and recommendations shall be sent to the Electrical Authorising Engineer's appointing Director for consideration.

Listed below are systems and procedures to be included, as a minimum, in this audit programme.

Desk Audit:

- Safety Programmes;
- Permits to Work;
- Sanctions to Test;
- Permits to Work on or near Live Equipment;
- Authorities for Access;
- Electrical Distribution Operating Record;
- Electrical distribution equipment maintenance records;
- Electrical Safety Documents Register;
- Certificates of Transfer of Control;
- Certificates of Operation, Isolation, & Earthing;
- Connection Notices;
- Disconnection Notices;
- Standing Instructions;
- Specific Written Instructions;
- Operating Records;
- Operational Restrictions;
- Electricity Distribution system and installation record drawings;
- Electrical SHE Incidents;
- Emergency First-Aid Training;
- Fire Training and Precautions;
- Risk Management and Risk Assessment;
- Appointment and Training of Electrical Authorised Persons;
- Appointment and Training of Electrical Nominated Persons;
- SHE Group review of Electrical Authorising Engineers; and
- Review of electrical technical reference documentation.

Site Audit:

- Signs and applicable Posters;
- Safety Locks and Lock-out Boxes;
- Use of permits;
- Keys, Key Cabinets, Document Cabinets and Mimic Diagrams;
- Protective Equipment, Test and portable Earthing Equipment; and
- Working on and Testing Low and High Voltage Equipment (including Hazardous Areas).

The programme shall include reviewing the competency of appointed Electrical Authorised Persons and include a formal meeting between the Electrical Authorising Engineer and all appointed Electrical Authorised Persons identifying the need for any training or re-training.

Compliance Audit Checklist

Ref	Item	Rating	Comments
1 (4.1.2)	As appropriate has the Director appointed in writing and recorded in the SHE Directory an Electrical Authorising Engineer (AE)?		
2 (4.2.3)	Does the AE undertake electrical work as an Electrical Authorised Person (AP) and has this work been audited by an independent AE?		
3. (4.2.2)	Are the AE's out of hours contact details listed in site emergency plans?		
4 (4.2.4)	Has the AE appointed APs for the areas they are responsible for in writing and recorded these appointments in the SHE Directory?		
5 (4.2.5/6)	Do APs clearly understand which electrical systems they are responsible for, it is detailed in their letters of appointment?		
6 (4.2.8)	Has AE reviewed the competence of their appointed APs at least 3 yearly?		
7 (4.2.9)	Is there evidence that the AE is communicating to their APs relevant electrical safety information, for example defects, recalls etc.		
8 (4.2.10)	Has AE established accurate documentation for their electrical systems, drawings, schematics etc.?		
9 (4.2.12)	Is there evidence that the AE has investigated electrical incidents within their area of responsibility?		
10 (4.2.13/14)	Are electrical installations suitably supported by hazard warning signs and as appropriate emergency hazard warning posters?		
11 (4.2.15)	Are there any instances of live working or working near live HV conductors? What written supporting documentation is available?		
12 (4.2.18)	Is there evidence of statutory fixed wiring testing of electrical distribution systems?		
13 (4.3.4)	Are all Electrical Nominated Persons (NPs) authorised by the AP aware of SHE Code 34?		
14 (4.3.9)	Are there any examples of instances where APs have informed their AE of electrical defects? Has the AE followed up and investigated these?		
15 (4.3.12)	Is there evidence of cable detection surveys being undertaken prior to works in their areas of responsibility?		
16 (4.3.7)	Is there evidence that electrical PPE including earthing and test equipment has been maintained and as appropriate calibrated and inspected?		

17 (4.3.14)	Have all NP been appointed in writing by the AP, detailing the scope of their appointment, and their appointment recorded in the SHE Directory?		
18 (4.3.16)	Have APs reviewed the competence of NPs at least 3 yearly?		
19 (4.3.17)	Has the AP approved for NPs to undertake specific tasks specific documented standing instruction or written instructions?		
20 (4.4.3)	Has the NP with the support of AP undertaken a documented risk assessment of planned electrical works?		
21 (4.4.4)	Is there evidence that the NP has undertaken work outside the scope of their letter of appointment?		
22 (4.5.1)	Ensure that a suitable risk assessment and method statement are available prior to commencing work?		
23 (4.7.1)	Have contract supervising officers for electrical works ensured that risk assessments and methods statements have been obtained from electrical contractors?		
24 (4.7.3)	Is there evidence that the competence of contract electrical workers has been assessment by an AP or NP prior to work commencing?		
25 (4.9.1)	Are electrical safety incidents reports to AEs by SHE Group?		

APPENDIX E - SAFE USE, HANDLING, STORAGE AND MAINTENANCE OF PRIMARY AND SECONDARY CELLS, AND BATTERIES

1. DEFINITIONS

For the purpose of this Code a primary cell or battery is defined as a voltaic cell which, after discharge, cannot be restored to its original (charged) state.

A secondary cell or battery is defined as a voltaic cell which, after discharge, can be brought back to its original (charged) state by passing a current through it in the reverse direction to that of discharge.

2. GENERAL INFORMATION

Secondary cells have different electro-chemical systems which consist of acidic, alkaline, non-aqueous or solid electrolyte. These electro-chemical systems generate different voltages depending on the type of positive and negative electrodes and the type of electrolyte.

During operation some systems may generate and release gasses, which may be hazardous under certain conditions and require specific protective measures.

3. TRANSPORT AND STORAGE

Packing and transportation of secondary batteries is covered in national and international regulations.

The following international regulations for transport, safe packing and carriage of dangerous goods apply:

- Road: European Agreement for the International Carriage of Dangerous Goods by Road (ADR);
- Rail (international): International Convention concerning the carriage of Goods by Rail (CIM) Annex A: International regulations concerning the carriage of dangerous goods by rail (RID);
- Sea: International Maritime Organisation, Dangerous Goods Code; IMDG Code 8 Class 8 corrosive;
- Air: International Air Transport Association (IATA); Dangerous Goods Regulations (latest edition).

For the transportation of lithium cells or batteries refer also to EN 62281 "Safety of primary and secondary lithium cells and batteries during transport".

For storage of cells or batteries under various climatic conditions, the characteristics regarding charge retention and corrosion effects shall be observed. The manufacturer's recommendations shall be followed.

4. CHARGING FOR SERVICE

For proper charging of secondary batteries, manufacturer's specified charging procedures and charging regimes shall be applied. For achieving long service life of secondary batteries the limit values and operating conditions shall be observed.

Normally the charge current for vented batteries is not limited until the gassing voltage is reached. In case of valve-regulated and gastight sealed batteries the manufacturer's instruction regarding charge current, voltage and temperature shall be observed.

When exceeding the gassing voltage the charge current shall be adjusted according to information from the battery manufacturer or from the relevant safety standards. When applying higher charging voltage, exceeding the gassing voltage, the charging current will increase leading to increased oxygen and hydrogen gas emission, increased water loss, increased temperature and reduced lifetime.

5. INSTALLATION & MAINTENANCE

Care should be taken with all batteries to avoid accidental shorting of their terminals. They should not be subjected to mechanical shock or to extremes of temperature.

In particular 'wet' secondary batteries should be installed upright in a clean, dry, well ventilated place and they should be protected from dust, dirt and accidental shorting of their terminals by metallic objects. If charging facilities are installed as part of the equipment, care should be taken to ensure they are well ventilated to avoid the building up of potentially explosive atmospheres, see STFC SHE Code 20: Controlling explosive and flammable gases and dusts.

Secondary batteries should be kept in a good state of charge in accordance with manufacturers' instructions and given a comprehensive inspection once every six months. They should not be left on charge unsupervised for long periods.

In batteries where the electrolyte is replenishable, the correct level should be maintained; batteries should be topped up with distilled water and care taken to avoid overfilling.

The tops and sides of all batteries should be kept clean and dry and examined for leaks; any vent holes should be kept clear.

When a battery is isolated from its load or any other battery, its bolted connections should be examined for corrosion and tightness. If connections are corroded they should be dismantled, cleaned and greased with petroleum jelly, re-assembled and tightened. Do not use acid neutralising agents and take care when tightening bolted connections to avoid damaging battery terminal pillars.

Remove the vent plug and vent the cell before checking the firmness of the terminal pillars.

Do not attempt to dismantle any battery.

Do not leave exhausted batteries in equipment.

6. SAFETY PRECAUTIONS

Provisions against explosion hazards arising from charging

Gasses can be released during operation (mainly during charging) depending on the type of battery. The gasses can be flammable and can explode at certain gas concentration, temperature and external source of ignition.

Risks can be minimised by adjusted charging procedure, by design, by ventilation of accommodation area and/or prevention of ignition sources. See SHE Code 20 Controlling Explosive and Flammable Gases and Dusts.

The hydrogen concentration should be kept below 1% at all times and the recommended rate of air change is $NI \times 0.042$ cubic metres per hour. (N is the number of cells and I is the gassing current).

Forced ventilation should be provided where natural draught is inadequate. The extract position should be kept as high as possible to ensure thorough scavenging.

In all cases the intake should be at a low level and properly sited to ensure an upward flow round the battery.

All ignition sources should be eliminated as far as is practicable. Smoking and naked flames must be prohibited, static discharges should be avoided and sparks caused by accidental shorting should also be avoided.

Consideration should be given to the provision of electrical equipment which is suitable for flammable gas areas where battery charging is to take place.

Provision against electrolyte hazards

Most of the electrolytes used in batteries are hazardous and can create irritation or burns on eyes and skin. Inhalation and swallowing of electrolyte is dangerous. In case of contact with electrolyte, medical attention is always required.

Properties of electrolyte for topping-up shall comply with IEC 60993 for Ni/Cd. For electrolyte density refer to the manufacturer's specification.

The preparation of electrolyte solutions for batteries on site should be avoided, where it cannot be avoided contact SHE Group.

Spillage and waste disposal

Sulphuric acid spillages should be cleaned up with materials such as soda ash (sodium hydrogen carbonate) or sodium carbonate (washing soda).

Potassium hydroxide spillages should be diluted with copious amounts of water before mopping up.

Surplus electrolyte must be disposed of as hazardous waste, see [site waste disposal contacts](#).

See SHE Code 31 Controlled and hazardous waste disposal and SHE Code 41 Controlling pollution to air, land and water.

Traction batteries

The enclosure of the battery should be kept clean. Charging and maintenance should be carried out in designated areas in accordance with the manufacturer's instructions or recommendations.

Automatic battery chargers

Automatic battery chargers will prevent over-charging and thus excessive gassing and evaporation. Even so, batteries must not be left unattended for too long whilst on charge.

Battery charging installations

All battery charging installations over 15AH (Ampere hours) should be provided with portable type fire extinguishers suitable for use on acid solutions and electrical fires e.g. CO₂. Advise on the number and type of fire extinguishers can be obtained from the site Fire Safety Advisor.

Protective clothing when maintaining batteries

Suggested considerations:

- Protection of eyes and face from splash - acid or alkaline splashes in the eye should be treated by flooding with copious amounts of water. Where mains tap water is not immediately available sterile eye wash bottles and instructions for their use should be placed in each battery room or installation.
- Always obtain medical attention and treatment after first aid;
- Body protection through provision overalls of the boiler suit type or smocks;
- Suitable aprons and gloves of the gauntlet type should be worn. Rubber gloves should be washed after use with soap and water and properly stored; and
- Respirators should be of a type approved by the SHE Group.

7. GENERAL DISPOSAL

Batteries should **never** be disposed in general waste, see site contacts for battery disposal or employ dedicated battery disposal containers.

8. REFERENCES

1. Using Electric Storage Batteries Safely, general information sheet INDG231 (rev1).
2. BS EN 50272-1:2010 Safety requirements for secondary batteries and battery installations.
3. BS EN 60079-17:2007 Explosive Atmospheres Electrical
4. Personal Protective Equipment at Work Regulations 1992, leaflet INDG174.
5. BS EN 374, 420 - Industrial Gloves.

APPENDIX F – EXAMPLES OF TEMPORARY SIGNS, CAUTION NOTICES, DISPLAY OF INFORMATION AND PERMANENT SAFETY SIGNS

 <p>Standard electrical warning sign – for use with – Live Bus-bar, Switchgear, live electrical equipment, warning of death, uninterruptible power supplies, working near live electrical equipment etc.</p>	 <p>Example of electrical warning sign with mandatory instructions for example for use with multiple supplies, remotely/automatically controlled generating sets, main Intake Switch Sign, switch off electrical equipment before working etc.</p>
 <p>Example of an electrical Prohibition Notice, primarily used as a Caution Notice</p>	 <p>Electrical warning sign with mandatory action sign for locking HV enclosures, isolation prior to working for LV and HV equipment (Caution Notice), etc.</p>
 <p>Switch Room 14</p> <p>Danger 400 Volts</p> <p>Authorised personnel only</p> <p>Keep clear</p> <p>Keep locked</p> <p>This area is under the control of Estates Operations</p> <p>In case of emergency or for general access, please contact Estates Help Desk on extension 101, or report to Estates Operations.</p> <p>A Permit to Work may be required.</p> <p><small>Rutherford Appleton Laboratory</small></p>	 <p>First Aid for High Voltage Electrical Shock Sign</p>



CAUTION
Persons
working on
equipment



**DO NOT
TOUCH**

Example of an electrical Prohibition Notice, primarily used as a Caution Notice.



Electrical Warning Sign used on electrical equipment such as switchgear and HV Enclosures.

APPENDIX G – PERSONAL PROTECTIVE EQUIPMENT

1. GENERAL INFORMATION

Personal Protective Clothing (PPE) is defined in this code as 'all equipment (including clothing affording protection against the weather) which is intended to be worn or held by a person at work and which protects them against one or more risks to their health or safety, e.g. safety helmets, gloves, eye protection, high visibility clothing, safety footwear and safety harnesses.

When working on or testing high or low voltage electrical equipment PPE shall be supplied and used wherever there are risks to health and safety that cannot be adequately controlled in other ways. PPE shall be:

- properly assessed before use to ensure it is suitable;
- maintained and stored properly;
- provided with instructions on how to use it safely; and
- used correctly.

2. ARC FLASHING PROTECTION

The Electrical Authorising Engineer shall undertake an arc flash hazard analysis of their appointed area of responsibility and assess whether flame resistant clothing, face shield and gloves are required by Electrical Authorised or Nominated Persons while working on or testing high and low voltage equipment.

An arc flash hazard analysis should determine:

- The maximum duration of a potential arc (dependent on the 3-phase fault detection and clearance time of the system)
- The incident energy level from a potential arc flash (proportional to the prospective short circuit current from the system being worked on or near)
- Whether the work will take place with any enclosure closed or open
- The flash protection boundary within which PPE will be required

The PPE assessment will then use the determined incident energy level which could be received by the person carrying out the specified task and equate this to a level of PPE.

Required level of PPE if incident level:

- $<2 \text{ CAL/ cm}^2$ – recommended cotton overalls (AE to assess risk)
- $>2 \text{ CAL/ cm}^2$ and $<5 \text{ CAL/ cm}^2$ - flame resistant clothing is recommended (AE to assess risk)
- $>5 \text{ CAL/ cm}^2$ - flame resistant clothing must be worn

If the PPE assessment determines that flame resistant clothing is required then it shall have a minimum rating of 10 CAL/cm^2 and shall include arc flash overalls, visor and gloves.

Additional layers of flame resistant clothing can be worn to increase the flame resistant rating above 50 CAL/cm^2 if required.

3. INSULATING GLOVES

If a risk assessment requires the use of insulating gloves during LV electrical work or test they must conform to standard EN 60903:2003. Insulating gloves of classification 00 or 0 are suitable rated for LV electrical work or test and shall be chosen with an appropriate physical size.

Before using insulating gloves of classes 00 and 0 they must be check for air leaks and a visually inspection. During storage keep the gloves away from direct heat or light sources and store in temperatures between 10 and 21°C, humidity 60+/-10%. Do not crush or fold the gloves. Gloves should be kept in their original packaging and stored in a safe location, to prevent damage, when not used.

APPENDIX H - DOCUMENT RETENTION POLICY

Records established	Minimum retention period	Responsible record keeper	location of records	Comments/Justification
Electrical Distribution Operating Record	3 years after last date of entry	Electrical Authorising Engineer	Local records system	
Switchgear Maintenance and Operating Instructions	Duration of life of Equipment	Electrical Authorising Engineer	Local records system	
Electrical Distribution Record of Information	3 years after last date of entry	Electrical Authorising Engineer	Local records system	
Authority to Access (Electrical)	3 years after last date of entry	Electrical Authorising Engineer	Local records system	
Certificate of Isolation & Earthing	3 years after last date of entry	Electrical Authorising Engineer	Local records system	
Connection Notice (Electrical)	3 years after last date of entry	Electrical Authorising Engineer	Local records system	
Certificate of Transfer of Control (Electrical)	3 years after last date of entry	Electrical Authorising Engineer	Local records system	
Disconnection Notice (Electrical)	3 years after last date of entry	Electrical Authorising Engineer	Local records system	
Permit to Work (Electrical)(Short)	3 years after last date of entry	Electrical Authorising Engineer	Local records system	
Safety Programme (Electrical)	3 years after last date of entry	Electrical Authorising Engineer	Local records system	
Sanction to Work on or Near Live Electrical Equipment	3 years after last date of entry	Electrical Authorising Engineer	Local records system	
Standing Instruction for Electrical Equipment	3 years after last	Electrical Authorising	Local records	

	date of entry	Engineer	system	
Sanction to Test (Electrical)	3 years after last date of entry	Electrical Authorising Engineer	Local records system	
Specific Written Instruction	3 years after last date of entry	Electrical Authorising Engineer	Local records system	
Permit to Work (Electrical)(Long)	3 years after last date of entry	Electrical Authorising Engineer	Local records system	
Appointment letters				
Electrical Authorising Engineer	Duration of appointment	Director	SHE Directory	
Electrical Authorised Persons	Duration of appointment	Electrical Authorising Engineer	SHE Directory	
Electrical Nominated Persons	Duration of appointment	Electrical Authorised Person	SHE Directory	