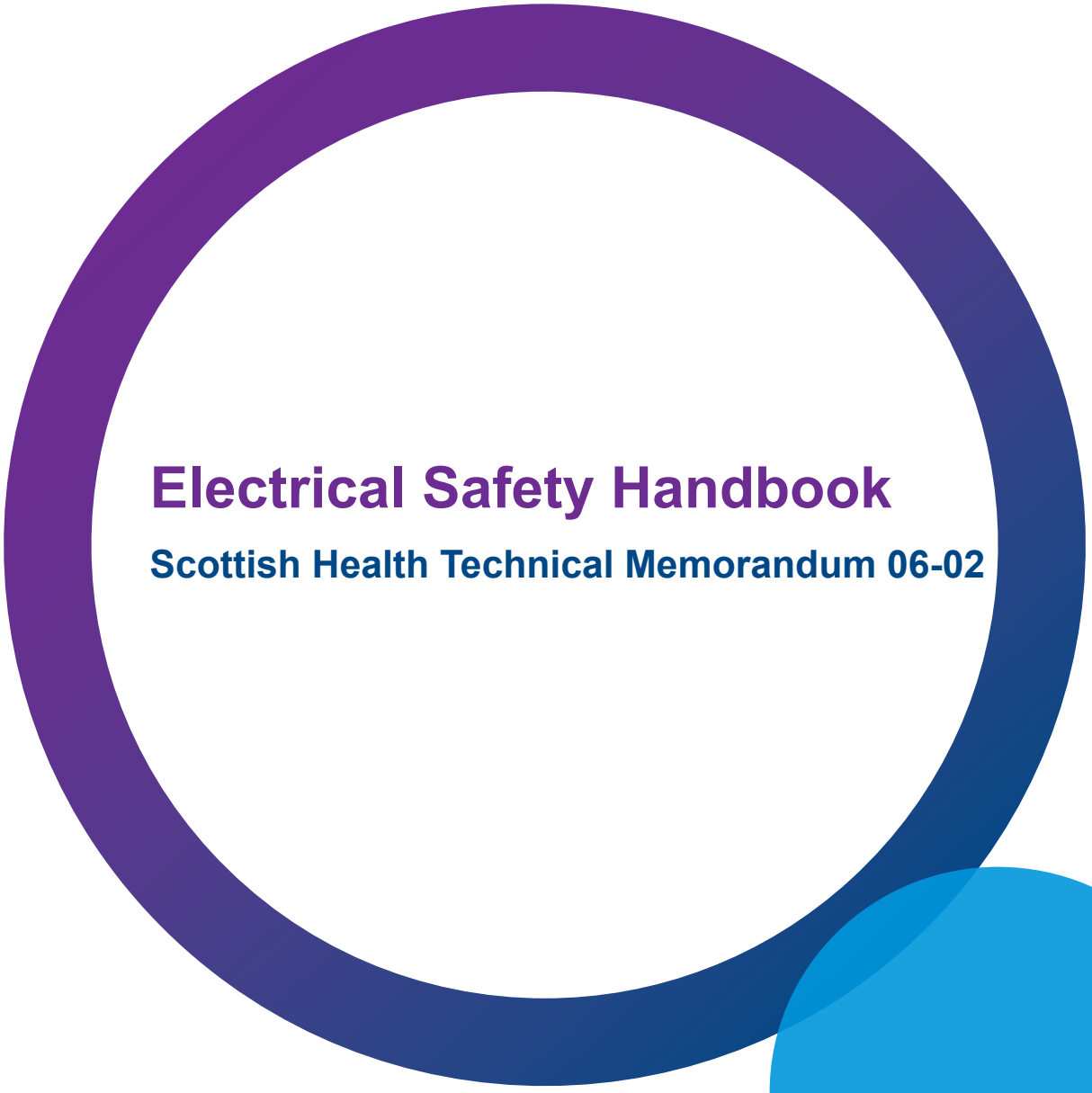
NHS National Services Scotland

Electrical Safety Handbook

Scottish Health Technical Memorandum 06-02



SHTM 06-02 Safety Handbook

Version 4 - February 2026.

Contents

Preface i
Executive summary iv
Acknowledgements v
1. Definitions 1
2. General precautions 10
3. Safety precautions and procedures for work on LV systems made dead 19
4. Safety precautions and procedures for live working and testing LV equipment 33
5. Display of posters and safety signs 42
6. BS 7671 inspection and testing 46
7. First-aid 47
Appendix A Safety forms 48
Abbreviations 66
References 68

Preface

About Scottish Health Technical Memorandum

Scottish Health Technical Memorandums (SHTMs) give comprehensive advice and guidance on the design, installation and operation of specialised building and engineering technology used in the delivery of healthcare.

The focus of SHTM guidance remains on healthcare-specific elements of standards, policies and up-to-date established best practice. They are applicable to new and existing sites and are for use at various stages during the whole building lifecycle.

Language usage in technical guidance

In SHTMs and Health Building Notes (HBNs), modal verbs such as “must”, “should” and “may” are used to convey notions of obligation, recommendation or permission. The choice of modal verb will reflect the level of obligation needed to be compliant.

The following describes the implications and use of these modal verbs in SHTMs/ HBNs (readers should note that these meanings may differ from those of industry standards and legal documents):

A. “Must” is used when indicating compliance with the law

B. “Should” is used to indicate a recommendation (not mandatory/ obligatory), for example among several possibilities or methods, one is recommended as being particularly suitable - without excluding other possibilities or methods

C. “May” is used for permission, for example to indicate a course of action permissible within the limits of the HBN or SHTM

Typical usage examples

A. “The point of demarcation must be at a cable termination and should be at the outgoing terminals of a switch or circuit breaker.” [obligation]

B. “This document makes recommendations for the allocation of duties to personnel and the manner in which these duties should be performed.” [recommendation]

C. “Further advice on the application of this guidance may be obtained from the Authorising Engineer (HV)” [permission]

D. “Shall”, in the obligatory sense of the word, is never used in current SHTMs.

Project derogations from the Technical Guidance

Healthcare facilities built for the NHS are expected to support the provision of high-quality healthcare and ensure the NHS Constitution right to a clean, safe and secure environment. It is therefore critical that they are designed and constructed in accordance with appropriate technical standards and guidance. This applies to all new and refurbishment projects, regardless of procurement model.

Note 1: The healthcare organisation, and their project teams, should ensure that they have a fully documented list of technical standards and guidance that are applicable to the specific project.

It is recommended that the starting point for all projects should be one of full adherence to the SHTM guidance. While it is recognised that derogations may be required in some cases, these must all be risk-assessed and documented in order that they may be considered within a structured derogation review and approval process. In all instances derogations must not compromise the health and safety or operational resilience of the healthcare facility. Healthcare organisations and those proposing any derogation, should ensure that any derogations do not impact on their legal or statutory obligations. Further guidance can be found in Scottish Health Technical Note (SHTN) 00-06 Derogation identification and management guidance.

Derogations must be properly authorised by the project's senior responsible officer and informed and supported by appropriate technical advice including that of the Electrical Safety Group (ESG), irrespective of a project's internal or external approval processes.

A schedule of derogations should be created for any project, including details of consultations, approvals, risk assessment and identified mitigations.

Note 2: This guidance does not alter the healthcare organisations legal or statutory obligations.

NHSScotland Sustainable Development Policy Drivers

Responding to the global climate emergency is one of the Scottish Government's highest priorities. Sustainable development, the concept that the needs of the present must be met "without compromising the ability of future generations to meet their own needs" is integral to the Scottish Government's overall purpose. The Scottish Government's National Performance Framework (NPF) shares the same aims as the United Nations' Sustainable Development Goals. It highlights the need for a 'whole system approach' to successfully

deliver the NPF's national outcomes for Health and recognises the important role that NHSScotland has in helping to achieve this.

Over recent years the current and future impact of climate change has been well documented, with risks to human health and to health and social care delivery highlighted within Scotland's summary report of the UK Climate Risk Independent Assessment .* NHSScotland is committed to the delivery of a high quality, environmentally and socially sustainable health service that is resilient to the locked-in impacts of climate change. Director Letter (DL) (2021) 38 'A Policy for NHSScotland on the Climate Emergency and Sustainable Development' provides the framework for this aim to become a reality, and to maximise NHSScotland's contribution to mitigating and limiting the effect of the global climate emergency.

* NHSScotland Climate Change Risk Assessments (CCRAs) and Adaptation Plans: A Summary Report on the National Services Scotland (NSS) website.

Executive summary

Status

This 2026 version of Scottish Health Technical Memorandum (SHTM) 06-02 Safety Handbook supersedes all previous versions of 'Electrical safety Handbook, SHTM 06-02'.

General

Guidance in this safety handbook applies to all healthcare facilities containing a low voltage (LV) electrical system.

Aim of this guidance

Guidance is intended to assist duty holders in meeting the requirements of the Electricity at Work Regulations, which detail the precautions to be taken against risk of death or personal injury from electricity in work activities.

Who should read this guidance?

This document will be of interest and practical help to those involved in the operation and maintenance of electrical systems and equipment.

Main changes since the 2015 edition

The 2026 edition is derived from Health Technical Memorandum (HTM) 06-02 Electrical safety handbook as published by NHS England. Key differences in the SHTM include:

A. all references to Premises Assurance Model (PAM) removed from the SHTM document
B. the Acknowledgements section of the document has been updated
C. guidance references have been updated to reflect applicable SHTM documentation
D. references to the role of the Duty Authorised Person (AP) have now been included
E. Preface and Executive Summary sections added
F. all references have been updated
G. reference to specific Scottish Government policy and legislation have been made

Acknowledgements

This safety handbook is based upon Health Technical Memorandum (HTM) 06-02: Electrical safety handbook, with minor updates to reflect changes in terminology and processes relevant to NHSScotland. NHSScotland Assure thank all those involved in the production of HTM 06-02 Electrical safety handbook 2023, including colleagues from NHS England, NHS Wales and Department of Health NI, Health Estates.

NHSScotland Assure also thank healthcare colleagues within the Scottish Engineering and Technology Advisory Group (SETAG) and the National Electrical Advisory Group (NEAG) in their support in updating this document for use in Scotland, including the respective Chairs of these groups Alan Wilson (SETAG) and Kenny Andress (NEAG).

Key NHSScotland Assure personnel involved in the production of this updated document:

Mario Capaldi, Senior Engineer, NHSScotland Assure

William Marr, Senior Engineer, NHSScotland Assure

Stuart Russell, Senior Engineer, NHSScotland Assure

Neil Robson, Principal Engineering Manager, NHSScotland Assure

Thomas Rodger, Head of Engineering, NHSScotland Assure

Ian Storrar, Assistant Director Engineering and Assurance, NHSScotland Assure

1. Definitions

1.1. With regard to this Low Voltage (LV) safety handbook, the following definitions apply.

Personnel

Designated Person (DP) - the Designated Person is an individual appointed by a healthcare organisation (a board member or a person with responsibilities to the NHS board) who has overall authority and responsibility for the LV electrical systems within the premises and who has a duty under the Health and Safety at Work etc. Act to prepare and issue a general policy statement on health and safety at work, including the organisation and arrangements for carrying out that policy. This person should not be the Authorising Engineer (LV). See also in Scottish Health Technical Memorandum (SHTM) 00.

Duty Holder (DH) - the Duty Holder is a person on whom the Electricity at Work Regulations impose a duty in connection with electrical safety.

Management - the Management is defined as the owner, occupier, employer, general manager, chief executive or other person in a healthcare organisation, or their appointed responsible contractor, who is accountable for the premises and who is responsible for issuing and implementing the Management Policy (see SHTM 06-02).

Senior Operational Manager (SOM) - the SOM should have operational and professional responsibility for the electrical services. It is important that the SOM has access to robust, service-specific independent professional support which can promote and maintain the role of the “informed client” within the healthcare organisation. This will embrace both the maintenance and development of service-specific improvements, support the provision of the intelligent customer role and give assurance of service quality.

Authorising Engineer (LV) - an Authorising Engineer (LV) is a suitably qualified engineer who has been appointed in writing by the DP to take responsibility for the effective compliance auditing of this SHTM and to provide technical advice. The person appointed should be independent of the healthcare organisation.

Authorised Person (LV) - an Authorised Person (LV) is appointed in writing by the DP on recommendation by the Authorising Engineer (LV) and is responsible for the practical implementation and operation with regard to work on, or the testing of, defined electrical equipment, in accordance with SHTM 06-02. See SHTM 00 for a recommended management structure.

Duty Authorised Person (LV) - the Authorised Person (LV) on site with current responsibility for the system or installation who has accepted the Authorised Person duties

and recorded the acceptance of this in the LV site logbook (see paragraph 4.16 in SHTM 06-02).

Competent Person (LV) - a person who possesses, as appropriate to the nature of the work to be undertaken, adequate education, training and practical skills, and who is able to prevent danger or, where appropriate, injury, and has been formally appointed in writing by an Authorised Person (LV), and who accepts a safety document for defined work.

Note 3: The “defined work” may be work on the electrical system under control of the Authorised Person (LV) but may also be non-electrical tasks that are to be carried out within areas under control of Authorised Persons (LV). Any restrictions on a Competent Person’s (LV) appointment should be clearly recorded on the Certificate of Appointment (see SHTM 06-02).

Skilled Person (LV) - a person who possesses, as appropriate to the electrical work to be undertaken, adequate education, training and practical skills, and who is able to prevent danger, or where appropriate, injury, and has been assessed to be competent by the Authorised Person (LV) for a specific electrical task and is aware of specific requirements from this guidance with regard to the task but has not been formally appointed in writing as a Competent Person (LV).

Note 4: A Skilled Person (LV) may be issued with a safety document at the discretion of the Duty Authorised Person (LV) in instances where it is deemed inappropriate to appoint the person as a Competent Person (LV), as may be the case for a one-off piece of work. When a Skilled Person is likely to carry out work on site on a regular basis that would result in the issue of multiple safety documents, that person should be appointed as a Competent Person (LV) in line with this guidance.

Accompanying Safety Person (LV) - an Accompanying Safety Person is a person not directly involved in the work or test who has received training in emergency first-aid for electric shock and who has adequate knowledge, experience and the ability to avoid danger, keep watch, prevent interruption, apply first-aid and summon help. The person should be familiar with the system or installation being worked on or tested and should have been instructed on the action to be taken to safely rescue a person in the event of an accident.

Safety documents

1.2. Examples of safety documents are given in Appendix A.

Document Centre - the location of the secure storage of the Operational procedures manual (OPM) and safety documentation.

Permit-to-work (LV) - a written authority signed and issued by the Duty Authorised Person (LV) to allow work to be undertaken on electrical equipment. It defines the scope of the work to be undertaken and makes known exactly what equipment is dead, isolated from all live circuit conductors and safe to work on.

Limitation-of-access - a written authority issued by the Duty Authorised Person (LV) for specified tasks to be undertaken in an area or location which is under the control of the Authorised Person(s) (LV) for electrical safety reasons, and for which a permit to work, LW1 Self Check Safety Precautions (LW1), LW2 Authorisation for inspection, testing and work on or adjacent to live electrical equipment at low voltage (LW2) or certificate of authorisation for live working are not appropriate.

LW1: Self-check safety precautions - a self-check form to be completed by a Competent Person (LV) prior to carrying out work, inspection or testing on (or near) live equipment (see paragraph 4.2 on live working procedures) or by an Authorised Person (LV) when issuing a certificate of authorisation for live working.

LW2: Authorisation for inspection, testing and work on or adjacent to live electrical equipment at low voltage - a form to be issued by a Duty Authorised Person (LV) to a Skilled Person (LV) to be able to carry out work, inspection or testing on (or near) live equipment as per the examples in paragraph 4.2.

Certificate of authorisation for live working - this is a safety document, which is a form of declaration, signed and issued by a Duty Authorised Person (LV) with a review and a counter signature being undertaken by the Authorising Engineer (LV) or a suitably qualified electrical subject matter expert to the Competent Person (LV) or Skilled Person (LV) in charge of the work to be carried out live. It makes known to that person exactly what equipment should be worked on, with details of the work to be undertaken live, what safety equipment is to be used, and the safety precautions to be taken.

Permission for disconnection - a form to be completed prior to work on electrical equipment under the control of end-users or designated staff.

Safety signs

Caution sign - this is a temporary, non-metallic sign bearing the words “caution - persons working on equipment” and “do not switch on” which should be used at a point-of-isolation.

Danger sign - this sign is a temporary, non-metallic sign bearing the words “danger live equipment” and “do not touch” which should be placed where there is live equipment adjacent to a point of work.

Switchroom sign - this is a permanent sign bearing the words “electrical switchroom” and “no unauthorised access”.

Voltage range

1.3. The following ranges of voltage (root mean square (rms) values for alternating current (AC)) are defined as follows:

A. **extra-low voltage**: not exceeding 50 Volt (V) AC or 120 V ripple-free direct current (DC) whether between conductors or to Earth

B. **low voltage (LV)**: exceeding extra-low voltage, but not exceeding 1000 V AC or 1500 V DC between conductors, or 600 V AC or 900 V DC between a conductor and Earth

C. **high voltage (HV)**: a potential exceeding low voltage

General definitions

Additional earth - earthing equipment of an approved type applied after the issue of a safety document (for example an Earth applied at a point-of-work).

Audit - the structured process of collecting independent information on the efficiency, effectiveness and reliability of the safe system of work, and drawing up plans for corrective action (see Appendix D in SHTM 06-02). (“Independent” does not necessarily mean external to the organisation)

Authorised Person’s (LV) key - a key that controls access to the key cabinet.

Authorised Person’s (LV) key box - a single locked box that is used for the control of the Authorised Person’s (LV) key.

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

Circuit breaker - a device capable of making, carrying and breaking normal load currents and also making and automatically breaking, under pre-determined conditions, abnormal currents such as short-circuit currents. It is usually required to operate infrequently although some types are suitable for frequent operation.

Competent/ Competence - application of skill, knowledge, experience and behaviour consistently to achieve a specific outcome.

Complex circuit - a circuit which is normally operated at LV, and which requires more than one point-of-isolation from known voltage sources to ensure safety at the point-of-work.

Conductor - a conductor of electrical energy.

Confirm dead - demonstrate dead with the use of suitable test equipment designed for the purpose that no electrical potential liable to cause danger or injury is present once conductors are made accessible, after the issue of safety documentation.

Note 5: the test equipment should be checked for correct operation before and after use.

Danger - risk of injury or death.

Dangerous condition - a condition that is likely to lead to a dangerous occurrence.

Dangerous occurrence - an incident involving a discharge of electrical energy by overload or short circuit, or accidental damage to electrical plant which may cause significant risk of death to any person, or results in stoppage of electrical plant for a period longer than 24 hours.

Dead - a conductor that is neither “live” nor “charged” at a potential equal to or not significantly different from that of Earth at the worksite.

Defect notification - a written safety instruction, in the form of Dangerous Incident (DIN), Suspension of Operational Practice (SOP), National Equipment Defect Reporting Scheme (NEDeRS) or Defect issued via the Energy Networks Association (ENA), or similar official instruction issued by the Authorising Engineer (LV), notifying of a dangerous occurrence with the potential to alter the normal operating procedures associated with a particular type of equipment.

Distribution network operator (DNO) (also known as distribution system operator (DSO)) - organisation that owns and operates the electric power distribution system (power lines and infrastructure) which delivers electricity to end-users.

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 danger or harm.

Note 6: this term is not to be used in the context of a functional Earth.

Electrical danger - refers to the potential risks associated with electrical systems, which can include fires, burns, electrocutions, and arc flash.

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

Electrical Safety Group (ESG) - a multi-disciplinary group responsible for ensuring that all electrical safety issues are monitored, recorded and acted on, in line with the relevant legislation and guidance. (See SHTM 06-01 for a more comprehensive description.)

Energised - implies connection to a source of electricity at a potential significantly different from that of earth at the worksite and which presents an electrical hazard.

Functional Earth - the earthing of a point or points in a system or an installation, or in equipment for purposes other than safety, such as to allow the correct functioning of electrical equipment.

Healthcare organisation - organisation that provides or intends to provide healthcare services.

Informed client - an informed client recognises and adopts best practice in policies and procedures to ensure electrical safety is maintained. A client is "informed" when:

A. it understands its capability and capacity and also where it is lacking in relation to discharging their duties
B. it is effective in gaining and using knowledge to make informed decisions
C. it is efficient at organising itself for the task
D. it designs and retains a sufficient degree of flexibility to be able to adapt to the demands of the operational estate

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

Isolate - disconnect and separate electrical equipment from every source of electrical energy in such a way that the disconnection and separation is secure.

Isolation and earthing diagram - a diagram attached to a permit-to-work illustrating the safety measures taken.

Key cabinet - a cabinet for the sole purpose of retaining all keys relative to the site's LV system(s) to which the Authorised Person (LV) has control.

Key register - a record of keys held in the OPM issued by the Authorised Person (LV) to persons authorised to access LV switchrooms.

Live - implies connection to a source of electrical energy.

Live functional testing - the testing of electrical equipment/ system while live which does not involve live working.

Live working - the connection/ disconnection of electrical equipment or components while live and/ or working near to exposed electrical connections or conductors.

Lockable document cabinet - a lockable cabinet suitable for storing the electrical safety documents, temporary safety signs, distribution system records, and so on used in the application of this SHTM. This cabinet should not be used to store anything not associated with this SHTM.

LV site logbook - a book in which all matters relating to the electrical system should be recorded.

Method statement - a written instruction describing in a logical sequence how a task will be carried out in a way that secures health and safety and includes all the control measures.

Operational procedures manual (OPM) - a hard-copy folder and/ or electronic filing system containing information relating to the control and operation of the LV system in accordance with this SHTM.

Personal supervision - supervision given by a person having adequate technical knowledge and experience, who is present at all times.

Practice improvement notice - a notice issued by the Authorising Engineer requiring improvements to be made in the observed working practices. The notice will relate to specific task(s) and will give a target date and/ or time by which the improvements must be in place before similar task(s) can continue to be carried out.

Protective equipment - equipment used to protect persons from danger in the working environment. Protective equipment includes items such as special tools, protective clothing, insulating screens, safety harnesses, protective visors, electrically insulated gloves or gauntlets, arc flash safety clothing and so on.

Prove dead - demonstrate dead with the use of approved test equipment designed for the purpose that no electrical potential liable to cause danger is present (before safety documentation is issued).

Note 7: the test equipment should be checked for correct operation before and after use.

Reasonably practicable - where a statement is qualified by the words “reasonably practicable”, it means the following as defined in ‘Health and Safety Regulation (HSR)25: Memorandum of guidance on the Electricity at Work Regulations 1989’:

“Generally, you should do everything ‘reasonably practicable’ to protect people from harm. This means balancing the level of risk against the measures needed to control the real risk in terms of money, time or trouble. However, you do not need to take action if it would be grossly disproportionate to the level of risk. In the context of the Regulations, where the risk is very often that of death, e.g. from electrocution, and where the nature of the precautions which can be taken are so often very simple and cheap, e.g. insulation, the level of duty to prevent that danger approaches that of an absolute duty.”

Risk assessment - the analysis of the risks to health and safety inherent in a system and their significance in a particular context.

Safety key-box - a box having two locks, each of which should have only one key. It should be arranged that both locks must be released before access can be gained to the contents of the box.

Safety lock - a padlock indelibly coloured red, with a metal hasp, having a single key that differs from all other keys provided for the system or installation, used for securing the means of isolation and prevent the removal of temporary Earths where fitted.

Safety programme - a written programme prepared by an Authorised Person (LV) setting out the sequence of operations to be followed before safety documents are issued and the operations to be followed to restore supplies. It should include the purpose of the proposed work or test, the sequence of safety operations to be performed and details of the safety documents issued including the reinstatement process for the electrical system on completion of the work and/ or test.

Single line drawing - a single line drawing of the whole site system showing all major LV equipment in its normal operational state.

Spiking gun - an item of safety equipment used to demonstrate that a cable is dead.

Standard operating procedures - local written procedures for electrical equipment. Written authority, applicable for up to three years and reviewed annually, issued by an Authorised Person to undertake regular defined tasks.

Substation - any premises, or part thereof, which contain equipment for either transforming or converting energy to or from high voltage (HV) (other than transforming or converting solely for the operation of switching devices or instruments), or for switching, controlling or regulating energy at HV.

Suspension notice - a notice issued by the Authorising Engineer or regulatory body requiring specified works in progress to be suspended immediately pending action to ensure that compliance with the existing safe system of work can be achieved or a modified system introduced. This may follow an Authorising Engineer's or regulatory body's system improvement notice being issued.

Switchgear - an assembly of main and auxiliary switching equipment for operation, regulation, protection or other control of an electrical installation.

Switchroom - a room or enclosure which contains LV distribution switchgear.

System (electrical system) - includes all parts of a system (for example, conductors and electrical equipment connected to a single source or multiple sources of electrical energy).

Working lock - A padlock that is not a safety lock, which is used to secure equipment that is either in the “off” or “on” position, to prevent unauthorised operation whilst in an operational state. A warning sign must be fitted when this lock is used.

2. General precautions

Security and admittance to switchrooms

2.1. Every site should have a written key procedure and key register as part of the Operational procedures manual (OPM). This should include details on the types of keys in use (master key, switchroom/ substation specific keys, and so on) and levels of access permissions including procedure for issuing, returning or cancelling keys (for example, electronic access devices).

2.2. All access doors to each substation, switchroom and enclosure containing low voltage (LV) electrical equipment should be kept securely locked when unattended.

2.3. Each switchroom should have dedicated key-suiting to ensure that, where keys are issued to a person(s), access be limited only to the area(s) covered under a safety document (for example, permit to work or limitation of access) issued by an Authorised Person (LV). The key-suiting may incorporate a master key that would grant access to all areas. The use of the master key should be limited to Authorised Person(s) (LV) only. The master key should be kept in the Authorised Person's (LV) key cabinet and there should be some form of access control to allow the Duty Authorised Person (LV) to gain access to the master key in the key cabinet.

Note 8: A combination key box may be used in situations where the Authorised Person (LV) considers its use beneficial in managing the system.

Note 9: The combination should be changed regularly, at a frequency to be agreed with the Management, and whenever it is suspected that the key system has been compromised.

2.4. Where considered appropriate under the safe systems of work, a Competent Person (LV) or Skilled Person (LV) may also be issued with a key to a switchroom to carry out work. The issue and return of the key should be recorded by the Authorised Person (LV) in the key register and LV site logbook.

2.5. Unless in receipt of a safety document, no person other than an Authorised Person (LV) or Competent Person (LV) may enter a switchroom unless they are accompanied by an Authorised Person (LV) or a Competent Person (LV).

2.6. Where the switchroom is provided with an automatically controlled fire protection system, persons entering must be trained for entry into such rooms.

Authorised Persons' office

2.7. The Management should designate a location suitable for Authorised Persons to undertake their duties as specified in Scottish Health Technical Memorandum (SHTM) 06-02.

Security of electrical equipment

2.8. All electrical equipment should be secured against unauthorised access and operation. If electrical equipment is not located within a switchroom or other enclosure, access and operation of such equipment should only be by the use of a tool or key.

Availability of electrical supplies

2.9. If the supplies of electricity are to be made unavailable or are to be put at risk via working on stand-by generators or uninterruptible power supplies, the Authorised Person (LV) or Competent Person (LV) responsible for the work should contact the person in charge of the area(s), and a signed "permission for disconnection" form should be obtained before the equipment is isolated.

Operational keys

2.10. The following will apply:

A. only Duty Authorised Persons (LV) should have access to the master key to the key cabinet

B. all other keys to operational locks and padlocks associated with the LV equipment should be kept in the key cabinet when not in use

C. the key cabinet should be kept locked except when the keys are being removed from, or returned to, it. It is important that the key cabinet is kept locked to prevent unauthorised removal of keys

Lockable document cabinet

2.11. All documents specified in this safety handbook should be kept in a lockable document cabinet situated in the Authorised Person's (LV) office. The lockable document cabinet should be kept locked when not in use, and the key kept in the working key cabinet.

Safety locks

2.12. Before a permit-to-work is issued, and before a Competent Person (LV) commences work, safety locks must be applied at all points-of-isolation and where temporary Earths are applied.

Safety key-boxes

2.13. A safety key-box as a minimum should have two locks, each of which should have only one key: one key should be issued to the Competent Person (LV) receiving the safety document and the other key should be retained by the Duty Authorised Person (LV). It should be so arranged that all locks must be released before access can be gained to the contents of the box.

2.14. The number or type of safety key-boxes should be discussed and agreed with the Authorising Engineer (LV):

A. when in use, each safety key-box should contain the keys to safety locks associated with only one permit-to-work

B. after the safety locks have been applied, and before a permit-to-work is issued, the keys to all the safety locks should be placed in a safety key-box, and both locks of the box should be secured. When the permit is issued, the Authorised Person (LV) should retain the Duty Authorised Person's (LV) key and give the Competent Person's (LV) key to the Competent Person (LV)

C. the Competent Person (LV) should retain the Competent Person's (LV) key until the permit-to-work is cancelled or the work suspended

Dangerous occurrences

2.15. A dangerous occurrence should be reported to the Duty Authorised Person (LV) as soon as reasonably practicable.

2.16. The Authorised Person (LV) should as soon as practicable send a preliminary report of the dangerous occurrence to the Authorising Engineer (LV)and the healthcare organisation's Electrical Safety Group (ESG). The AP (LV) may also be required under local policy requirements or procedures to notify other safety groups/ personnel within the healthcare organisation.

2.17. Any notifications and reports required to satisfy statutory or other management requirements should be issued.

2.18. Where required, dangerous occurrences must be reported to the Health and Safety Executive (HSE) in line with the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR).

> Note 10: The healthcare organisation should also notify the Scottish Engineering & Technology Advisory Group (SETAG) and the National Electrical Advisory Group (NEAG) of the dangerous occurrence or equipment failure. It may also be necessary to notify the National Equipment Defect Reporting Scheme (NEDeRS) and the national Incident Reporting and Investigation Centre (IRIC) and this should be discussed and agreed with the Authorising Engineer (LV) and the ESG.

2.19. Upon instruction from the Management, the Authorising Engineer (LV) should investigate or assist with investigations into each dangerous occurrence and issue a report to the Designated Person (DP). The report should be sufficiently detailed to enable the sequence of events leading to the occurrence to be determined. Where reasonably practicable, the report should include photographs taken before any items of equipment involved in the dangerous occurrence are disturbed. In certain instances, the Management may instruct an independent investigation.

2.20. To alleviate potential problems or criticism which may arise at any enquiry into a dangerous occurrence or incident, the Management should consider:

A. the questionable conflict of interests and impartiality of any investigation or subsequent report where it is carried out by those directly involved

B. the reliability of evidence involving self-judgement

Defect notifications

2.21. A defect notification is a written safety instruction in the form of Dangerous Incident Notification (DIN), Suspension of Operating Practice (SOP) or NEDeRS issued via the Energy Networks Association (ENA), notifying of a dangerous occurrence with the potential to alter the normal operating procedures associated with a particular type of equipment.

2.22. NHSScotland Assure manage communication of ENA notifications on behalf of NHSScotland. Healthcare organisations in Scotland should ensure their contacts for the ENA notifications remain up to date.

2.23. Any identified defect that may result in the issue of a DIN, NEDeRS or SOP advised by the ENA must be notified without delay to the Authorising Engineer (LV) as soon as the Authorised Person (LV) on site is made aware.

2.24. On receipt of a defect notification that applies to equipment on site, the Authorised Person (LV) should:

A. inform the Authorising Engineer (LV) and the ESG and in conjunction with the Authorising Engineer notify the respective healthcare organisation of the notification, indicating whether the equipment is included in the local system(s) or installations

B. record the receipt in the LV site logbook and the action taken

C. store a version of the notification signed by all site Authorised Persons (LV) in the OPM

D. arrange for any inspection and remedial work required

E. where considered necessary, fix a defect notification on each item of equipment involved and report the satisfactory completion of any remedial works to the Authorising Engineer (LV)

Temporary earthing equipment

2.25. Proprietary earthing equipment should be used.

2.26. Proprietary earthing equipment should be inspected by the user before and after use.

2.27. A Duty Authorised Person (LV) should inspect proprietary earthing equipment provided by the Management every 12 months, and the inspection recorded in the LV site logbook.

Location of underground cables

2.28. Where it is proposed to carry out excavation work on sites for which Authorised Persons (LV) have been appointed, it is the responsibility of the Duty Authorised Person (LV) to ensure that all underground power cables within the proposed areas of excavation are located and their positions marked before the ground is disturbed. No excavations should take place prior to the Duty Authorised Person being consulted.

Note 11: Hand digging should be utilised when excavating in the proximity of buried LV cables or other buried services. Any party undertaking such work should provide site-specific risk assessments and method statements indicating the safety measures to be implemented.

Note 12: The HSE's 'Health Safety Guidance (HSG)47: Avoiding danger from underground services' outlines the potential dangers of working near underground services and gives advice on how to reduce risks. It explains the three basic elements of a safe system of work during excavation:

- planning the work
- locating and identifying buried services
- safe excavation

2.29. No person should use cable location and tracing devices unless they are competent to do so and have been specifically trained in their use. A certificate should be issued by the instructor on successful completion of the training. A copy of this should be attached to the Competent Person (LV)'s certification placed in the OPM.

2.30. Training in the use of cable location and tracing devices should normally be given by the manufacturers of the equipment, but alternatively it may be given by another training provider, certified and approved as being capable and competent to deliver the training.

Switching methods

Safety switching

2.31. Planned switching on any complex circuit or switching in preparation for the issue of a permit-to-work should be in accordance with the following sequence of events:

A. write a safety programme (which details all switching and requires notification to users of any disconnections), an isolation and earthing diagram and arrange for another Authorised Person (LV) to check and countersign the safety documents if reasonably practical

B. write the programme a reasonable period in advance of the proposed start of the work

C. complete the necessary switching and issue of safety documents as detailed in the safety programme. Record times of each switching action/ document issue

D. enter summary details of the switching undertaken and safety documents issued in the logbook. Reference serial numbers of the safety programme, isolation and earthing diagram and permit(s)

E. on completion of work, cancel the permit-to-work and complete switching to restore supplies to normal as detailed in the safety programme. Record times of each action

F. file the completed safety programme, isolation and earthing diagram and cancelled safety documents in the OPM, in chronological order

G. return the permit-to-work book to the lockable document cabinet located within the Authorised Persons' office

Fault-switching

2.32. Fault-switching is the switching of the LV network to disconnect a faulty part of the network and restore supply to the remaining healthy part of the system that was affected by the fault. Fault-switching is not emergency switching.

Note 13: Healthcare premises can be complex and certain facilities may represent a risk to life/ safety of patients if the supply is lost. In such instances there may be additional electrical infrastructure installed to support the resilience of the facility including generators, automatic transfer switches and uninterruptible power systems (UPS). There also may be electrical systems such as Medical IT systems which are not intended to disconnect on first fault. The Authorised Person should carefully consider the impact on other elements of the electrical system as a result of any switching undertaken during fault conditions. This will also include consideration of any earthing systems and system neutrals.

2.33. If more than one person is switching, one Authorised Person (LV) should be in overall control of the fault-switching and should maintain an accurate record of the operational state of the network. The Duty Authorised Person will direct and sanction all fault-switching.

2.34. The essential steps in fault-switching are:

A. remain calm and assess the situation as it develops

B. record in writing what protection operated as the result of the initial fault

C. inspect all switchgear for signs of distress before operating it

D. plan fault-restoration switching a few steps at a time and write down planned switching before carrying it out. Record all switching activities and times

E. reset lifts, pumps, and so on as required

F. consideration of any consequential impacts on other areas of the electrical system and ensure that clinical/ operational staff are notified of any disruption to electrical supplies as a result of fault switching

Emergency switching

2.35. Emergency switching is switching that is required to remove an immediate threat to life (for example, opening an incoming switch to disconnect supplies to an LV board in which an electrician has accidentally made contact with live busbars).

2.36. Emergency switching, when required, may be undertaken without the need to complete any of the sequence steps detailed for planned or fault-switching.

2.37. Persons who undertake emergency switching should do so in a manner that does not put themselves or others at risk of injury.

Fire protection equipment

Automatic control

2.38. Before work or inspections are carried out in any enclosures protected by automatic fire-extinguishing equipment:

A. the automatic control must be rendered inoperative by the Authorised Person (LV) and the equipment left on hand-control. A caution sign should be attached and displayed whenever the automatic fire-extinguishing system is inoperative

B. precautions taken to render the automatic control inoperative must be noted on any safety document issued for work in the protected enclosure

C. the automatic control will be restored by the Authorised Person (LV) immediately after the persons engaged on the work or inspections have withdrawn from the protected enclosure

2.39. After any activation of automatic extinguishing systems the space should be thoroughly ventilated before entry of personnel, unless suitable breathing apparatus and Personal Protective Equipment (PPE) is worn by appropriately trained personnel.

Portable extinguishers

2.40. Only portable fire extinguishers rated for the electrical voltage to be encountered may be used near live electrical equipment, and a safety clearance of at least 1000 mm should be maintained.

2.41. After any explosion or fire, the space should be thoroughly ventilated before entry of personnel, unless suitable breathing apparatus and PPE is worn by appropriately trained persons.

2.42. Portable firefighting equipment should only be used by staff who are trained and confident in its use and without putting themselves at risk (see also NHS Scotland Firecode: Fire Safety In Healthcare Premises – General Fire Precautions SHTM 83).

Access to, and work in, underground chambers, vessels and confined spaces

2.43. The following points apply:

A. arrangements for access and work, and the precautions to be taken, should be in accordance with the Confined Spaces Regulations, the HSE's 'Safe work in confined spaces: Confined Spaces Regulations 1997. Approved Code of Practice and guidance L101', local procedures and confined spaces permits

B. no person at work should enter a confined space to carry out work for any purpose unless it is not reasonably practicable to achieve that purpose without such entry

C. no safety document should be issued to any Competent Person (LV) for works in a confined space unless the individual(s) are trained, competent and certified to work in confined spaces

D. the person who manages confined spaces for the healthcare organisation should be consulted when issuing safety documents for work in confined spaces

E. barriers, doors or gates restricting access to underground chambers or similar confined spaces, in which dangerous fumes or other hazards are present or likely to be present, should be kept locked and the control of keys be maintained in accordance with an approved procedure

F. for any electrical work within a confined space, safety documentation associated with SHTM 06-02 should be issued in addition to any safety documents for access to confined spaces

Cable identification

2.44. Phase conductors in a new installation or an alteration/ addition to an existing installation should be identified as required by British Standard (BS) 7671.

3. Safety precautions and procedures for work on LV systems made dead

General

3.1. All work or testing on electrical equipment and conductors made dead should be carried out following the procedures within this chapter and Table 3.1 - Table 3.4.

3.2. Work on low voltage (LV) electrical equipment including conductors should be carried out while such electrical equipment and conductors are dead and isolated from all sources of supply and after being proved or confirmed dead at the point-of-work by means of an approved voltage testing device, which should be checked for correct operation before and after use. Exceptions to this rule are for the circumstances described in Chapter 4.

3.3. When work is to be carried out on LV equipment made dead, all reasonably practicable steps must be taken to prevent the electrical equipment and/ or conductors being made live inadvertently during the work, including locking-off any switchgear, removal of any fuses, links or similar approved methods.

3.4. Making electrical equipment and/ or circuit conductors dead or live by means of a signal or prearranged understanding after an agreed interval of time is not an acceptable practice.

Isolation

3.5. In achieving isolation, the following steps should be carried out where reasonably practicable:

A. the application of a safety system to prevent the circuit breaker or switch being closed or fuse replaced whenever the equipment allows its use. Use of special locking devices to allow the use of safety locks is required

B. a visible break in air should be obtained whenever possible

C. a caution sign should be fixed.

Note 14: In exceptional circumstances, if isolation of the neutral conductor is required, this should be risk-assessed and advice from the Authorising Engineer (LV) should be sought.

3.6. Circuits to be worked on must be isolated from all known voltage sources including alternative energy sources (wind generators, photovoltaic (PV) cells, and so on) and generators or battery systems.

Note 15: Where a circuit that is to be worked on contains equipment that has the potential to retain a charge following isolation, any such charge should be safely discharged prior to any works commencing.

3.7. Competent Persons (LV) may carry out isolations on the load side of a final circuit for work or testing that is to be conducted by the Competent Person (LV). A permit-to-work may not be required. A caution sign and safety lock should be applied at the point-of-isolation. It is recommended that an individual's name is added to the caution sign to aid location of the person in charge of the work.

3.8. The Competent Person (LV) responsible for the work or test should retain any keys to safety locks applied as part of the isolation.

3.9. Where a permit-to-work is not required and isolation is achieved by the removal of fuses or links, and it is not practicable to apply a safety lock, the Competent Person (LV) responsible for the work or test must securely retain the removed fuses or links. A caution sign should be displayed.

3.10. When a permit-to-work is required, the Duty Authorised Person (LV) should isolate any circuits and equipment. All keys to safety locks applied by the Duty Authorised Person (LV) should be held in such a way that the safety locks cannot be removed without the permit-to-work being cancelled and until any safety lock/ safety key-box keys held by the Competent Person (LV) have been returned to the Duty Authorised Person (LV):

Example -

A. safety key-box with two keys: one for the Duty Authorised Person (LV) and one for the Competent Person (LV)

B. a multi-lock hasp applied with two safety locks: one key to be held by the Duty Authorised Person (LV) and the other by the Competent Person (LV).

3.11. Caution signs should be securely fixed at all points-of-isolation for the electrical equipment and conductors that have been made isolated and dead, and on which work is to be carried out. Danger signs must be attached where reasonably practicable for any adjacent live circuit conductors (or electrical equipment containing live circuit conductors) that are adjacent to the point-of-work.

3.12. In cases where the work is concerned only with the external earthed metal parts of electrical equipment and no contact can be made with live conductors, or where the connected electrical equipment is physically removed from its normal location, the Authorised Person (LV) may allow some of the measures under paragraphs 3.3 and 3.11 to be omitted providing they are satisfied that the measures taken are still adequate to prevent danger.

Note 16: Work on a final circuit can be safely carried out with isolation of all known live conductors at the controlling distribution board fuse-way only, that is, isolation from the known voltage source only. In such instances appropriate due diligence should be exercised to ensure that this is the only possible source of electrical supply.

Work on the busbars of a sub-main switchboard would require isolation of all circuits connected to the board (not just the incomer or known voltage supply), since it is feasible for a generator to be connected to one of the many circuits normally supplied from the sub-main board.

Permit-to-work

3.13. A permit-to-work should be issued on equipment that has been switched off, isolated and made dead, for work:

- **A.** on a complex circuit
- **B.** on any circuit that serves a Group 2 Medical Location
- **C.** on a main or sub-main LV switchboard or distribution board
- **D.** on cables
- **E.** on stand-by power supplies such as (but not limited to) generators, battery storage systems, UPS and solar PV installations
- **F.** whenever the Authorised Person (LV) deems it necessary to ensure a safe system of work

3.14. A permit-to-work should be issued by an Authorised Person (LV) to a Competent Person (LV) or Skilled Person (LV). The permit holder (recipient) should supervise all members of the working party so as to ensure that only work as detailed on the permit is undertaken and that this is done in a safe manner.

3.15. The Duty Authorised Person (LV) should ensure that the recipient who is to receive the permit fully understands all details and safety precautions required to undertake the work safely as detailed on the permit. The Authorised Person (LV) should confirm the recipient's understanding of permit requirements by:

- **A.** fully explaining at the point-of-work where the circuit has been proved dead and all safety precautions that are to be taken
- **B.** listening to the recipient read the permit aloud (permits should be completed in capitals, that is, printed to aid clarity) and confirming accuracy
- **C.** questioning the recipient by asking relevant open questions (those which require more than a simple "yes" or "no" reply)

3.16. A permit-to-work should only be issued after:

A. the electrical equipment/ conductors to be worked on have been isolated from all voltage sources and wherever possible the means of isolation secured by locking

B. the equipment/ conductors have been proved or confirmed dead at the point-of-work by the Authorised Person (LV) who is to issue the permit in the presence of the recipient who is to receive it

C. the Authorised Person (LV) is satisfied that the potential recipient fully understands all the necessary safety precautions to complete the task as detailed on the permit

Issue of a permit to work to a contractor

3.17. A contractor's employee may be issued with a permit-to-work, providing the Authorised Person (LV) completes the actions required by this SHTM and is satisfied of the capability and competence of the individual. Contractors who are to receive a permit to work should be appointed as Competent Persons (LV) but this may be impractical in all instances. In such cases a permit-to work-may be issued to Skilled Persons (LV) at the discretion of the Authorised Person (LV).

3.18. The Management or any third party who have procured and approved the issue of a contract to a contracting company clearly also has a duty to ensure the capability and competence of the company and its employees.

3.19. The Authorised Person (LV) should have confirmation that checks have been made to determine the satisfactory technical and safety competence of the company and employees by taking into account the requirements of Chapter 4 and Appendix F in SHTM 06-02.

Safety programmes and isolation and earthing diagrams

3.20. A safety programme together with an isolation and earthing diagram are required for all planned work and/ or tests which require the issue of a permit-to-work.

3.21. The safety programme and isolation and earthing diagram should be written by the Authorised Person (LV) who is responsible for the issue of the permit-to-work.

3.22. If the equipment to be worked on is a complex circuit or is a circuit that serves a Group 2 Medical Location, the safety programme and isolation and earthing diagram should be countersigned by another Authorised Person (LV) with knowledge of the site and system.

Working on cables

Identification and spiking of LV cables

3.23. Before the conductors of a cable are cut or exposed, a point-of-isolation for the cable and the point-of-work on the cable should be identified with certainty.

3.24. Identification of a mains voltage or street-lighting cable other than at a labelled termination point may be regarded as clear and certain if the cable can be seen throughout its length, or if it can be clearly seen between the point-of-isolation and the point-of-work.

3.25. In the absence of clear and certain identification of a cable, it should be spiked at the point-of-work. Before spiking, it may be necessary to carry out signal injection using the cable cores. Further tests can be repeated after spiking and the results compared. Where only one cable exists in a given location and accurate records indicate that only one cable is present, signal injection may be dispensed with if the Duty Authorised Person (LV) agrees.

3.26. The spiking of cables should only be carried out under the direct supervision of a Duty Authorised Person (LV) and by a person who has been specifically trained in the operation of the equipment to be used.

3.27. Where more than one cable exists on a single route, the Authorised Person (LV) should identify and label the cable to be worked on. All other cables should be regarded as live, and danger signs attached.

3.28. Approved live-working methods may be used as an alternative to spiking. Such work is usually only undertaken by specialist contractors (for example, electricity supply companies). If these methods are used, a certificate of authorisation for live working should be issued in accordance with Chapter 4.

Additional precautions for dead work or testing on generating plant

3.29. When dead work or testing should be carried out on generating plant, paragraphs 3.1 - 3.12 apply.

3.30. Where possible, any work or test undertaken on generating plant should be carried out with the equipment completely isolated from all sources of supply in accordance with Table 3.3.

3.31. Where it is not possible for the work or testing to be undertaken dead or it is not possible to completely isolate generating plant from all sources of supply, the guidance in Chapter 4 should be followed.

3.32. When dead work or testing is carried out on generating plant (including combined heat and power plant) and directly connected equipment, the following additional precautions should be taken by personnel competent to carry out the task:

A. the generator should be at rest and isolated from all sources of supply

B. the field circuit must be isolated and locked off where it is energised from a separate supply

C. where motor-driven exciters are provided, the switch controlling the motor should be isolated and locked off

D. the prime mover providing the motive power to the generator, and any associated valves controlling the flow of fuel or steam, should be isolated and locked off

E. in the case of an internal combustion engine prime mover, the starting equipment should also be made inoperative

F. caution signs should be prominently displayed at all points-of-isolation

G. to ensure a safe system of work, the permit-to-work procedures identified in paragraphs 3.13 - 3.16 should be operated

3.33. When manual barring gear is to be used on generating plant, a permit-to-work should be issued.

3.34. Generating plant should not be allowed to operate with any part of its protective enclosures (mechanical or electrical) removed - unless for special test purposes when it should be the subject of a risk assessment by an Authorised Person (LV). The risk assessment should establish whether any additional precautions or procedures to those already being implemented are considered necessary to ensure a safe system of work, and these should be confirmed in writing.

Uninterruptible power systems

3.35. The Authorised Person (LV) in conjunction with the Authorising Engineer (LV), and where considered necessary the manufacturers of the equipment, should survey each fixed UPS and carry out a risk assessment to document the risks involved and to develop operating procedures to be applied before routine maintenance, minor repairs or major repairs can be carried out. In some instances, this may involve live working or, in the longer term, modification to the equipment.

3.36. Where possible, any work or test undertaken on a UPS should be carried out with the equipment completely isolated from all sources of supply in accordance with Table 3.4.

3.37. Equipment of this type may be supplied with an internal/ external bypass designed to allow automatic changeover to the mains supply in the event of a UPS failure. In some instances,

this bypass is arranged to provide a no-break changeover to the mains supply for maintenance, which will not allow the complete isolation of the UPS.

3.38. Where it is not possible for the work or testing to be undertaken dead or it is not possible to completely isolate a UPS from all sources of supply, the guidance in Chapter 4 should be followed.

Summary

3.39. Table 3.1 to Table 3.4 summarise the procedures to be carried out for work/ tests undertaken on low voltage equipment.

Figure 3.1 - Dead working procedures flowchart

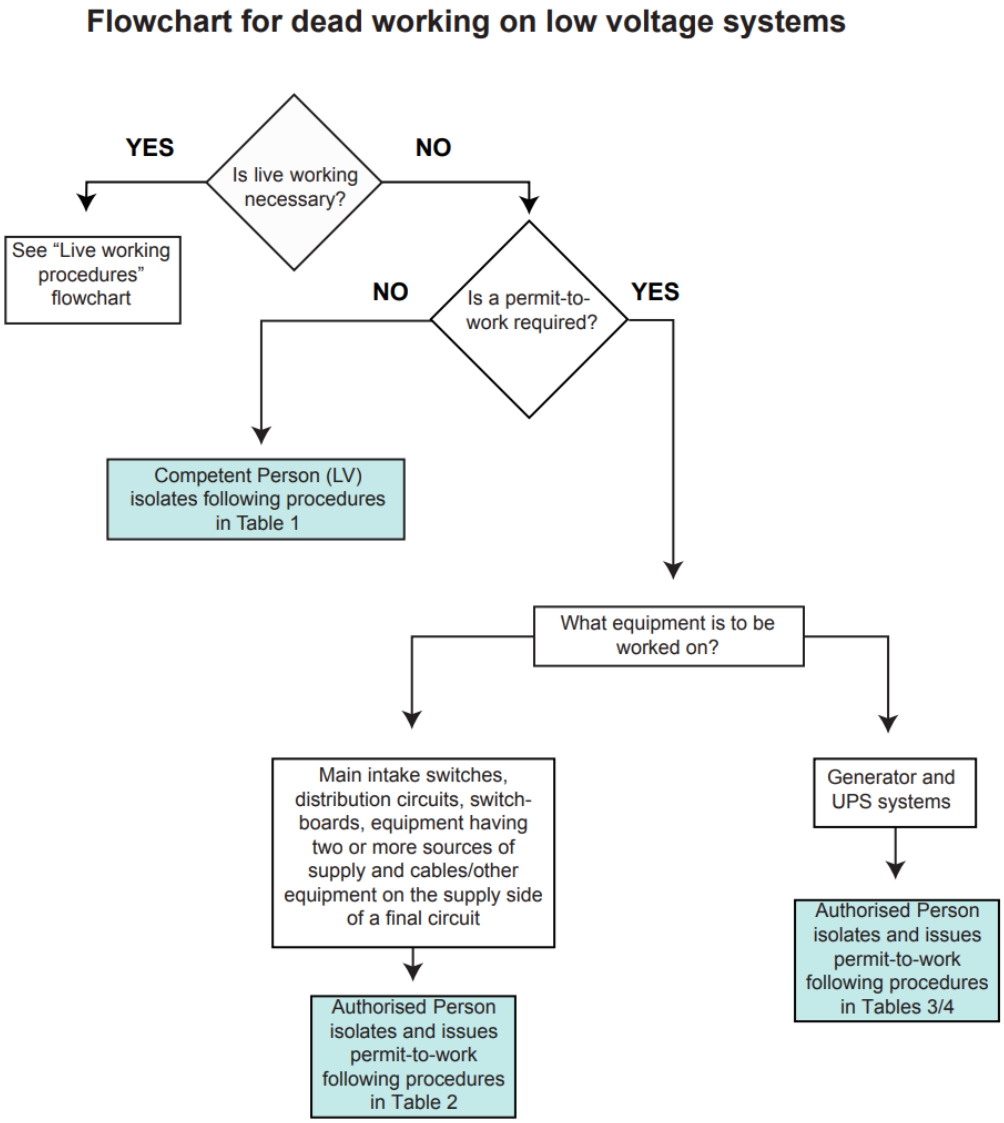


Table 3.1 - Procedures for Competent Persons (LV) working on, or testing, cables and other equipment on the load side of a final circuit

Steps	Procedure
1. Identify and inform	Identify circuit to be worked on. Before any work or testing can begin, permission should be obtained from the person in charge of the area to be affected by the work or testing. See note 18.
	Note 17: the competent person (LV) is responsible for all tasks. Note 18: permission for disconnection to be obtained/ confirmed and recorded prior to the commencement of the work.
2. Isolate and fix signs	**a.** isolate from all sources of supply **b.** make equipment safe to work on or test **c.** fix caution signs at points-of-isolation and where practicable prevent unauthorised connection or operation by fixing safety locks
	Note 19: for main intake switches, switchboards, equipment having two or more sources of supply, cables and other equipment on the supply side of a main intake switch, refer to the Authorised Person (LV) (see Table 3.2).
3. Prove dead	**a.** ensure that the equipment to be worked on or tested is the equipment that has been isolated **b.** prove dead with a voltage test indicator at the places where the work or test is to be carried out
4. Confirm dead	**a.** where it was not practicable in Step 3 to prove the equipment dead, the Competent Person (LV), using appropriate tools and protective equipment where necessary, should confirm it dead at the point-of-work or test as soon as conductors have been made accessible to a voltage test indicator
5. Undertake the work or test	**a.** undertake or directly supervise the work or test

Note 20: except where a risk assessment indicates otherwise, equipment operating at extra LV is exempt from these procedures.

Table 3.2 - Procedures to be carried out by an Authorised Person (LV) to enable planned work on main intake switches, distribution circuits, switchboards, equipment having two or more sources of supply, and cables and other equipment on the supply side of a final

Steps	Procedure
1. Plan work and prepare safety documentation	**a.** determine the scope of works, prepare and review required risk assessments and any potential control measures and access arrangements that are required as part of the works, and agree potential dates and times with appropriate personnel **b.** prepare a safety programme and an isolation and earthing diagram in duplicate and obtain countersignatures from another Authorised Person (LV) if required **c.** before any work can begin, permission should be obtained from the person in charge of the area to be affected by the work or test
2. Isolate and fix signs	**a.** Duty Authorised Person to confirm with the appropriate person(s) in the affected area that the work is authorised to take place **b.** isolate from all sources of supply **c.** fix caution signs at all the points-of-isolation and where practicable prevent unauthorised connection or operation by fixing safety locks **d.** fix danger signs on live equipment adjacent to the point of work or test
3. Prove dead and Earth	**a.** prove dead with an approved voltage test indicator at all points of isolation and the point-of-work or test **b.** if the manufacturer's earthing equipment is available, Earth conductors at points-of-isolation and fix safety locks **c.** identify cables with certainty or spike underground cables at the point-of-work if the conductors are to be cut or exposed

Steps	Procedure
4. Issue the permit-to-work	**a.** the Duty Authorised Person to clearly identify and/ or mark the point-of-work/ equipment to be worked on **b.** the Competent Person (LV)/ Skilled Person (LV) should be shown the isolation and earthing diagram and the safety arrangements at all the points-of-isolation and at the point-of-work or test **c.** issue the permit-to-work, isolation and earthing diagram and the Competent Person's (LV) key to the safety key-box to the Competent Person (LV) **d.** complete the LV site logbook as soon as practicable
5. Confirm dead	**a.** where it was not practicable in Step 3 to prove the equipment dead, the Authorised Person (LV), using appropriate tools and protective equipment where necessary, is to confirm dead at the point-of-work as soon as conductors have been made accessible to an approved voltage test indicator
6. Undertake the work	**a.** the Competent Person (LV)/ Skilled Person (LV) is to undertake or directly supervise the work and on completion, or when the work is stopped and made safe, is to return the original of the permit-to-work, the isolation and earthing diagram and the Competent Person's (LV) key to the safety key-box to the Duty Authorised Person (LV), and complete part 3 of the permit retained in the pad
7. Restore to operational state	**a.** carry out steps required for restoration of supplies **b.** confirm with person in charge of the area that power is restored back to normal **c.** complete site logbook and return keys, sign off as Duty Authorised Person **d.** retain all documents prepared in the Operational Procedures Manual (OPM)

Note 21: The Authorised Person (LV) is responsible for all tasks.

Table 3.3 - Procedures to be carried out by an Authorised Person (LV) to enable planned work on (LV) generators

Steps	Procedure
1. Plan work and prepare safety documentation	**a.** determine the scope of works, prepare and review required risk assessments and any potential control measures and access arrangements that are required as part of the works, and agree potential dates and times with appropriate personnel **b.** prepare a safety programme and isolation and earthing diagram in duplicate and obtain countersignatures from another Authorised Person (LV) **c.** before any work can begin, permission should be obtained from the person in charge of the area to be affected by the work
	Note 22: A separate safety programme and isolation and earthing diagram should be produced for issue of a permit to work and/ or sanction for test. Restoration of the supplies and system should also be recorded on the safety programme; these can be part of the original safety programme or a new safety programme. These can either be on a single safety programme or separate documents. Note 23: This procedure applies to both stand-by generating sets started by manual initiation or automatically on receipt of a signal.
2. Isolate and fix signs	**a.** Duty Authorised Person to confirm with the appropriate person(s) in the affected area that the work is authorised to take place **b.** inhibit engine start and isolate generator. Where practicable, prevent unauthorised connection, operation or starting by fixing safety locks **c.** fix caution signs at all the points-of-isolation and, clearly visible, on the engine start panel **d.** where practicable isolate the generator neutral earthing resistor and fix caution sign and safety lock **e.** fix danger signs on live equipment adjacent to the point of work

Steps	Procedure
3. Prove dead and Earth	**a.** where practicable, prove dead with an approved voltage test indicator at all points of isolation and the point-of-work **b.** if the manufacturer's earthing equipment is available, Earth conductors at points-of-isolation, and fix safety locks
4. Issue the permit-to-work	**a.** the Duty Authorised Person to clearly identify and/ or mark the point of work/equipment to be worked on **b.** the Competent Person (LV)/ Skilled Person (LV) should be shown the isolation and earthing diagram and the safety arrangements at all the points-of-isolation and at the point-of-work **c.** issue the permit-to-work, isolation and earthing diagram and the Competent Person's (LV) key to the safety key-box to the Competent Person (LV) **d.** complete the LV site logbook as soon as practicable
5. Confirm dead	**a.** where it was not practicable in Step 3 to prove the equipment dead, the Competent Person/ Skilled Person (LV), using appropriate tools and protective equipment where necessary, is to confirm dead at the point-of-work as soon as conductors have been made accessible to an approved voltage test indicator. Where practicable, Earth the conductors after they have been confirmed dead.
6. Undertake the work	**a.** the Competent Person (LV)/ Skilled Person (LV) is to undertake or directly supervise the work and on completion, or when the work is stopped and made safe, is to return the original of the permit-to-work, the isolation and earthing diagram and the Competent Person's (LV) key to the safety key-box to the Duty Authorised Person (LV), and complete part 3 of the permit retained in the pad
7. Restore to operational state	**a.** carry out steps required for restoration of supplies **b.** confirm with person in charge of the area that power is restored back to normal **c.** complete site logbook and return keys, sign off as Duty Authorised Person **d.** retain all documents prepared in the OPM

Note 24: The Authorised Person (LV) is responsible for all tasks.

Table 3.4 - Procedures to be carried out by an Authorised Person (LV) to enable planned work on UPS installations which can be totally isolated from all sources of supply (including batteries)

Steps	Procedure
1. Plan work and prepare safety documentation	**a.** determine the scope of works, prepare and review required risk assessments and any potential control measures and access arrangements that are required as part of the works, and agree potential dates and times with appropriate personnel. This may require the preparation of a task-specific planning document, which may require approval by the Electrical Safety Group (ESG) **b.** prepare a safety programme and an isolation and earthing diagram in duplicate and obtain countersignatures from another Authorised Person (LV) **c.** before any work can begin, permission should be obtained from the person in charge of the area to be affected by the work Note 25: These procedures apply to fixed UPS equipment (excluding portable self-contained “plug-in” units).
2. Isolate and fix signs	**a.** Duty Authorised Person to confirm with the appropriate person(s) in the affected area that the work is authorised to take place **b.** isolate from all sources of supply **c.** isolate mains supply, battery supply, output supply and any standby generator supply **d.** on parallel UPS installations and those having an external bypass, isolate the output supply terminals of the unit(s) to be worked on from all sources of supply **e.** if the battery installation is to be worked on, follow the rules applicable to work on live equipment, disconnect the battery from its charger and disconnect the battery Earth **f.** prevent unauthorised connection or unauthorised operation by fixing safety locks and caution signs at points-of-isolation **g.** fix danger signs on adjacent live equipment to the point-of-work

Steps	Procedure
3. Prove dead and Earth	**a.** where practicable, prove dead with an approved voltage test indicator at all points of isolation and at the point-of-work **b.** if the manufacturer's earthing equipment is available, Earth conductors at points-of-isolation and fix safety locks
4. Issue the permit-to-work	**a.** the Duty Authorised Person (LV) to clearly identify and/ or mark the point of work/ equipment to be worked on **b.** the Competent Person (LV)/ Skilled Person (LV) should be shown the isolation and earthing diagram and the safety arrangements at all the points-of-isolation and at the point-of-work **c.** issue the permit-to-work, isolation and earthing diagram and the Competent Person's (LV) key to the safety key-box to the Competent Person (LV) **d.** complete the LV site logbook as soon as practicable
5. Confirm dead	**a.** where it was not practicable in Step 3 to prove the equipment dead, the Competent Person/ Skilled Person (LV), using appropriate tools and protective equipment where necessary, is to confirm dead at the point-of-work as soon as conductors have been made accessible to an approved voltage test indicator. Where practicable, Earth the conductors after they have been confirmed dead
6. Undertake the work	**a.** the Competent Person (LV)/ Skilled Person (LV) is to undertake or directly supervise the work and on completion, or when the work is stopped and made safe, is to return the original of the permit-to-work, the isolation and earthing diagram and the Competent Person's (LV) key to the safety key-box to the Duty Authorised Person (LV), and complete part 3 of the permit retained in the pad
7. Restore to operational state	**a.** carry out steps required for restoration of supplies **b.** confirm with person in charge of the area that power is restored back to normal **c.** complete site logbook and return keys, sign off as Duty Authorised Person **d.** retain all documents prepared in the OPM

Note 26: The Authorised Person (LV) is responsible for all tasks.

4. Safety precautions and procedures for live working and testing LV equipment

Work on or near live equipment

4.1. Live working other than that specified in paragraph 4.2 should not normally be considered. The Electricity at Work Regulations make it illegal to work on or near live equipment, without first complying with Regulation 14:

"Regulation 14 - No person shall be engaged in any work activity on or so near any live conductor (other than one suitably covered with insulating material so as to prevent danger) that danger may arise unless:

a) it is unreasonable in all the circumstances for the conductors to be dead and
b) it is reasonable in all the circumstances for the person to be at work on or near the conductor while it is live and
c) suitable precautions (including where necessary the provision of suitable protective equipment) are taken to prevent injury."

The above represents a very severe legal test on the need to work live. Dead working should always be the first choice and live working only the very last method chosen when all other possibilities of providing alternative supplies or arranging out-of-hours shut-downs of supply have been carefully evaluated.

4.2. Work or testing on (or near) live equipment which may not require the issue of a certificate of authorisation for live working includes:

A. forms of testing, fault-finding, maintenance or adjustment where no components are removed or replaced and where practicalities dictate live working is essential

B. the removal and replacement of fuse carriers in final circuits

C. the removal and replacement of plug-in components

D. servicing of electrical equipment which may include (but not be limited to) Uninterruptible Power Systems (UPS's), generators, Medical IT systems where practicalities dictate live working is essential

E. basic battery maintenance (cleaning/ topping up only)

F. work on battery systems if less than 25 Volt (V) and 10 Ah (ampère-hours) (see paragraph 4.14).

Note 27: The need for a certificate of authorisation should be considered by the authorised person (LV) prior to tasks being undertaken. The AP should consider factors including but not limited to:

a. the complexity and nature of the task

b. whether all steps as far as reasonably practicable have been taken to undertake the work “dead”

c. whether the works are covered under a safety document such as permit to work, and so on

d. local policy/ procedural requirements

e. manufacturers instruction for safe operating of equipment.

4.3. When work of the type referred to in paragraph 4.2 is carried out:

A. the extent of the work should be kept to a minimum

B. if the equipment is not to IP2X or IPXXB standard, or this cannot be confirmed prior to the work or test being carried out an LW1 should be completed by the Competent Person (LV) carrying out the work or an LW2 issued by a Duty Authorised Person (LV) if the work is being carried out by a Skilled Person (LV)

C. approved test equipment to the standard recommended in the Health and Safety Executive (HSE’s) Guidance Note ‘GS38: Electrical test equipment for use on low voltage electrical systems’ should be used, together with any additional approved safety equipment which significantly reduces the risk of injury

4.4. If disconnection of terminals or connectors is required, the work should be carried out dead in accordance with Chapter 3.

Note 28: It is unlikely that situations will occur in healthcare premises which necessitate live working under the terms of a certificate of authorisation for live working (that is, removal and/ or replacement of components with the circuit energised). Live testing, fault-finding or making adjustments are all forms of live working (which can only be undertaken by suitably authorised Competent Persons (LV) and/ or Skilled Persons (LV) using appropriate safe methods) but they do not require the issue of a certificate of authorisation for live working, since components are not removed or replaced.

Work on the essential board or final circuits in a critical care area is often offered as an example of a situation which requires live working because of the need to maintain the electrical supply to critically ill patients. However, if careful planning is applied to finding a way of doing the job dead, a solution can often be found. The ESG may be a useful platform to discuss and agree local protocols in advance of any planned activities.

Safety precautions and procedures for work on live low voltage electrical equipment and conductors

4.5. Other modes of live working other than those specified in paragraph 4.2 should not normally be considered except where all possible alternatives have been considered and eliminated.

4.6. Authorised Persons (LV) should consult their ESG and Authorising Engineers (LV) before undertaking any work (except for work on a battery) which will require them to issue a certificate of authorisation for live working.

Note 29: Permission should be obtained from a person within the healthcare organisation, who has appropriate authorisation, if it is intended to proceed with live working. The relevant person(s) with such authority should be designated within the healthcare organisations Electrical Safety Policy.

4.7. When this condition applies and live working is deemed essential, it will require specific written authorisation in the form of an LW2 - Authorisation for inspection, testing and working on, or adjacent to, live electrical equipment at low voltage, form issued by the Duty Authorised Person (LV) to a Competent Person (LV) or Skilled Person (LV) in accordance with the procedures detailed.

4.8. In all circumstances when work is to be carried out on live LV electrical equipment and conductors:

A. suitable precautions may be taken by the use of screening, insulated tools and other appropriate means to avoid danger from inadvertent contact with live circuit conductors or earthed metalwork

B. the persons carrying out the work should satisfy themselves by examination that the precautions taken are adequate and, before use, that the equipment to be used is suitable for the task

C. only approved instruments should be used for electrical, phase rotation or similar measurements

D. adequate means should be provided to prevent unauthorised access to the zone of work, particularly if working on distribution boards in corridors

E. an Accompanying Safety Person should be present who should have adequate knowledge and experience, be trained to recognise and avoid danger and, if necessary, render assistance in the event of an emergency

4.9. Only a Competent Person (LV) or a Skilled Person (LV) who is competent to carry out the work or task should be authorised for live working.

4.10. Form LW1 should be completed before any live work or testing takes place where a certificate of authorisation for live working is to be issued. A copy of the LW1 form should be attached to the certificate of authorisation for live working.

Precautions for working on battery installations

4.11. The output from the battery should be isolated when working on the equipment it supplies unless for safety reasons the battery output needs to be instantly and permanently available. The battery charger should be isolated.

4.12. Where it is necessary to use tools for working on a battery, they should be of an approved insulated type.

4.13. The requirements to implement any or all of the precautions for work on live equipment as detailed in paragraphs 4.1 - 4.2 to control maintenance work on battery installations should be determined by an Authorised Person (LV).

4.14. All work and testing on batteries other than simple maintenance (for example, topping up electrolyte levels) should be carried out in full accordance with the precautions detailed in this document and Scottish Health Technical Memorandum (SHTM) 06-02.

4.15. For work on batteries less than 25 Volt (V) and 10 Ah, Authorised Persons (LV) should undertake a risk assessment of individual installations and issue local instructions if considered appropriate. When working on any battery system, care should be taken to prevent short-circuiting terminals.

4.16. For work on batteries/ battery strings above 25 V and/ or 10 Ah, the work should be completed under a certificate of authorisation for live working. Authorisation from the Authorising Engineer for the work to proceed is not required.

4.17. Work which may involve a source of ignition must never be undertaken near an enclosed cell or battery unless adequate precautions have been taken to eliminate any risk of danger or injury.

4.18. Where any work is to be carried out near, or directly over, a battery installation, specific precautions should be taken to prevent the potential risk of danger or injury which could result from any accidental short-circuiting of the battery terminals.

4.19. A supply of sterile water to allow flushing of the eyes should be available during the course of the work.

4.20. Personal protective equipment (PPE) identified as being required on the risk assessment (for example, this may include face visor, acid-resistant gloves and apron) should be worn during the work.

4.21. In all cases of burns, medical attention should be obtained.

Live working safety documents

LW1 - Self-check safety precautions

4.22. An LW1 should be completed by a site-appointed Competent Person (LV) prior to carrying out any live work, testing or inspection on or near live equipment as described in paragraph 4.2. If a Skilled Person (LV) is to undertake the work or test, then an LW2 should be issued to the Skilled Person (LV) by a Duty Authorised Person (LV).

4.23. An LW1 should be completed by the Duty Authorised Person (LV) when a certificate of authorisation for live working is issued.

4.24. The LW1 should be attached to the certificate of authorisation for live working and retained in the Operational Procedures Manual (OPM) while the work is being carried out.

LW2 - Authorisation for inspection, testing and work on or adjacent to live electrical equipment at low voltage

4.25. The LW2 should be issued by the Duty Authorised Person (LV) to a Skilled Person (LV), competent to carry out the work or task. The recipient should immediately supervise all members of the working party so as to ensure that only work as detailed on the LW2 is undertaken and that this is done in a safe manner. An Accompanying Safety Person should be present while work is undertaken under an LW2.

4.26. The Duty Authorised Person (LV) should ensure that the person who is to receive the LW2 fully understands all details and safety precautions required to undertake the work/ testing safely as detailed on the LW2.

Certificate of authorisation for live working

4.27. A certificate of authorisation for live working should be issued for live work on or near live electrical equipment not included within paragraph 4.2 and where the requirements of Regulation 14 of the Electricity at Work Regulations are met, with authorisation from the Authorising Engineer (LV).

4.28. A certificate of authorisation for live working should be issued by a Duty Authorised Person (LV) to a named Authorised Person (LV) or a Competent Person (LV) or Skilled Person

(LV). The recipient should only carry out work as detailed on the certificate of authorisation for live working.

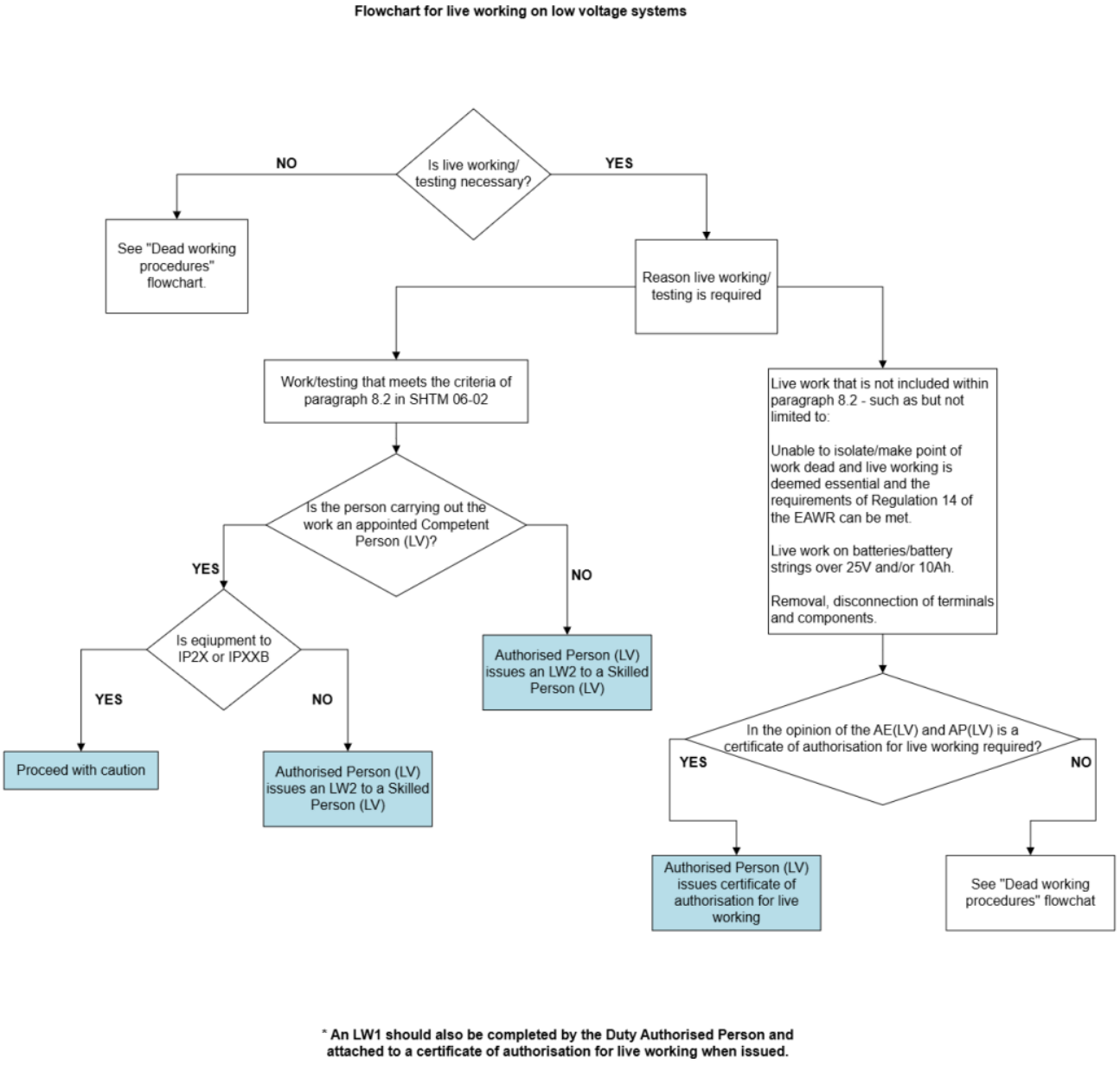
4.29. A certificate of authorisation for live working should only be issued after:

- **A.** authorisation in writing from the Designated Person, or the relevant person within the healthcare organisation, has been given for the work
- **B.** an LW1 has been completed by the Duty Authorised Person (LV)
- **C.** the Duty Authorised Person (LV) is satisfied that the potential recipient fully understands all the necessary safety precautions to complete the task as detailed on the certificate
- **D.** the Management have approved the issue of the contract to the contracting company and has ensured the capability and competence of the company and its employees
- **E.** the Duty Authorised Person (LV) has been given confirmation that checks have been made to determine the satisfactory technical and safety competence of the company by taking into account the requirements of SHTM 06-02

4.30. The Duty Authorised Person (LV) should ensure that the person who is to receive the certificate of authorisation for live working understands all details and safety precautions required to undertake the work safely. The Duty Authorised Person (LV) should confirm the recipient's understanding of the requirements by:

- **A.** listening to the recipient read the certificate aloud (safety documents should be completed in capitals, that is, printed to aid clarity) and confirming accuracy
- **B.** questioning the recipient by asking relevant questions (those which require more than a simple "yes" or "no" reply)

Figure 4.1 - Live working procedures flowchart



Live work/ testing: scenarios when live/ testing documents should be used

Note 30: Regulation 4(2) of the Electricity at Work Regulations says:

“As may be necessary to prevent danger, all systems shall be maintained so as to prevent, so far as is reasonably practicable, such danger.”

Inspection and, where necessary, testing of equipment is an essential part of any preventive maintenance programme. Practical experience of use may indicate an adjustment to the frequency at which preventive maintenance needs to be carried out. Ultimately under the Regulations it is the Duty Holder who is responsible for safety of the electrical installation at work.

This Duty Holder may be identified with specific responsibility within the organisation such as the Designated Person, SOM or Authorised Person (LV).

4.31. Live work/ live testing may be required as part of maintenance and/ or testing. Table 4.1 shows typical examples of these tasks and the documents that should be used in each case. It does not cover every eventuality that may be encountered, and where there is any doubt, the Authorised Person (LV) should consult with the Authorising Engineer (LV) to determine the appropriate action.

4.32. Live work or testing must only be carried out when the requirements of Regulation 14 of the Electricity at Work Regulations are met.

Table 4.1 - Example scenarios of when to use LW1 and LW2

Live work/ testing safety document	Examples of when document would be used
LW1: Completed by a Competent Person (LV)	**a.** live testing of final circuits (for example Earth fault loop impedance, residual current device (RCD)/ residual current circuit breaker with overcurrent protection (RCBO) testing, fault-finding) when being carried out by a Competent Person (LV) and where live conductors are exposed and equipment is not to IP2X **b.** live testing or inspection inside a final distribution board which requires the removal of covers when being carried out by a Competent Person (LV) **c.** thermal imaging survey (no contact with live parts by test equipment) when carried out by a Competent Person (LV)
LW1: Completed by an Authorised Person (LV)	**a.** when an Authorised Person (LV) is carrying out the duties of a Competent Person (LV) **b.** an LW1 should be completed by the Duty Authorised Person (LV) when a certificate of authorisation for live working is to be issued

Live work/ testing safety document	Examples of when document would be used
LW2: Issued by a Duty Authorised Person (LV)	**a.** live testing of final circuits (for example Earth fault loop impedance, RCD/ RCBO testing) when being carried out by a Skilled Person (LV) and where live conductors are exposed and equipment is not to IP2X **b.** live testing or inspection inside a final distribution board which requires the removal of covers when being carried out by a Skilled Person (LV) **c.** thermal image survey (no contact with live parts by test equipment) when carried out by a Skilled Person (LV) **d.** when a Skilled Person (LV) is to carry out service inspections, fault-finding or call-outs to equipment where it is not possible to isolate the supplies such as on UPS installations, generators or Medical IT systems
Certificate of authorisation for live working: Issued by a Duty Authorised Person (LV) with written consent from their Authorising Engineer (LV)	**a.** should only be issued by a Duty Authorised Person (LV) for specified live work that is not included within paragraph 4.2, with written permission from the Authorising Engineer (LV) **b.** work on batteries/ battery strings above 25 V and/ or 10 Ah being carried out by a Competent Person (LV), Skilled Person (LV) or named Authorised Person (LV) **c.** in circumstances where an Authorised Person (LV) with agreement from the DP agrees that a specific task does not fall within the list of live work or tests within paragraph 4.2 but the work needs to be carried out live and the requirements of Regulation 14 of the Electricity At Work Regulations can be met

5. Display of posters and safety signs

Display of posters

5.1. In each switchroom, the following information should be prominently displayed:

A. a poster showing an approved method of treatment for electric shock

B. a schematic: a single line drawing of the low voltage (LV) system up to and including final circuit distribution boards under the control of the Authorised Person (LV) indicating major LV equipment in its normal functional state of operation (that is, switched on-off)

C. the Electricity at Work Regulations

5.2. Where the Management has the responsibility for the danger, the Authorised Person (LV) should carry out an assessment to determine the requirement and location for the display of information in accordance with Scottish Health Technical Memorandum (SHTM) 06-02. Information should be displayed permanently in suitable and prominent positions. The areas to be considered for the display of information in connection with SHTM 06-02 should include every workshop and each Authorised Person (LV)'s office.

5.3. Other information and posters to be displayed may include relevant health and safety information.

Signage - design specification

5.4. The design and colours of the signs should be to British Standards (BS) EN ISO 7010. Colours should be to BS 5252 as follows:

A. yellow 08E51

B. blue 18E53

C. red 04E53

5.5. Signs should be manufactured from laminated plastic or other similar non-metallic weather-resistant material (thickness appropriate to the intended location and application).

5.6. Non-corrosive materials should be used when fixing permanent safety signs. Permanent signs should not be fixed with adhesives.

5.7. Permanent safety signs should be securely and permanently fixed in accordance with the paragraphs in this section.

Display of permanent safety signs

5.8. In all LV switchrooms accommodating LV switchgear or distribution equipment, a safety sign should be fixed (see Figure 5.1 for a typical example, which can be adapted for local conditions).

Figure 5.1 - Electrical switchroom safety sign (actual size: 200 x 100 x 1.5 mm white plastic)

5.9. Appropriate signs should be fixed where there are dangers and risks associated with auxiliary equipment such as (but not limited to) generators and photovoltaic (PV) installations.

5.10. Where a fire suppression system is installed in a switchroom or accommodation where LV is present, a safety sign with appropriate text should be installed in a prominent position.

Display of temporary safety signs

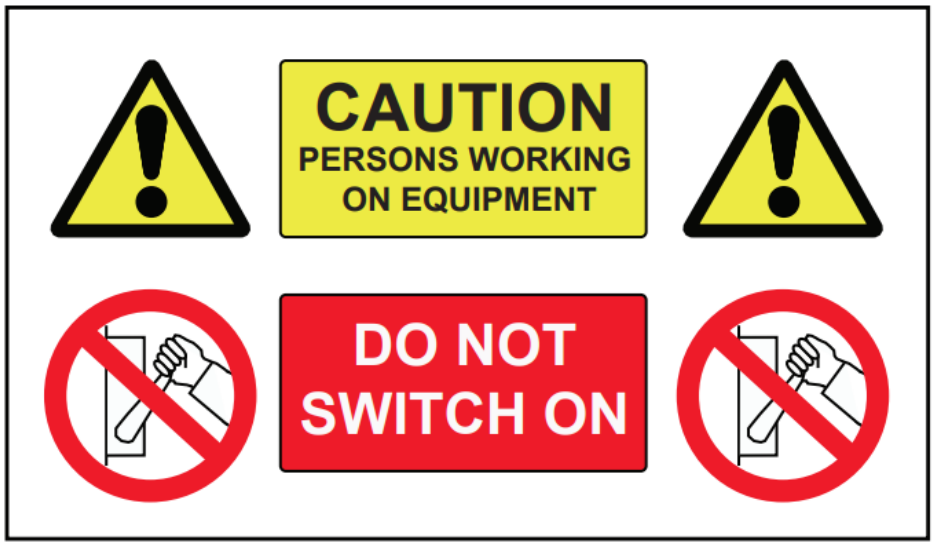
5.11. All temporary signs should be provided with two 5 mm diameter holes for a suspension cord. The holes should be 10 mm from the top edge and 30 mm from each end for 150 mm wide signs, and 50 mm from each end for 200 mm wide signs.

Note 31: Temporary signage can be sized to the installation with agreement of the Authorising Engineer (LV). The position, quantity and physical dimensions of the sign should be selected with regard to the circumstances in which it is used.

5.12. Temporary safety signs should be suspended from non-conducting cords and fixed and removed only by an Authorised Person (LV).

5.13. Caution signs (see Figure 5.2) should be prominently displayed and securely fixed at all points-of-isolation before the start of, and for the duration of, any work or testing, and before the issue of any permit-to-work.

Figure 5.2 - Caution sign (actual size: 200 x 100 x 1.5 mm white plastic)



5.14. Danger signs (see Figure 5.3) should be prominently displayed so that they are visible from every angle of approach to a LV enclosure before any testing at LV is carried out and before the issue of, and for the duration of, any work or testing, and before the issue of any permit-to-work.

Figure 5.3 - Danger sign (actual size: 200 x 100 x 1.5 mm white plastic)

5.15. Danger signs should be prominently displayed on any equipment which remains live and is adjacent to equipment to be worked on or tested before the start of, and for the duration of, the work or testing, and before the issue of any permit-to-work.

5.16. Where work or testing is to be undertaken on any part of a multi-cubicle switchboard, danger signs should be prominently displayed on the cubicles or compartments adjacent to the part being worked on or tested. If the board has rear access, danger signs should be similarly displayed at both the front and rear of the board. Reliance should not be placed on the switchboard labelling when identifying parts at the rear of the board. Any discrepancies found should be reported to the Designated Person (DP) and Electrical Safety Group (ESG).

5.17. Danger signs should be prominently displayed on any equipment which is accessible, both in or adjacent to the area which is the subject of the limitation-of-access, before the issue of and for the duration of any limitation-of-access.

6. BS 7671 inspection and testing

6.1. The person carrying out the inspection and testing of any electrical installation must have, as appropriate to their function the required qualifications, knowledge and experience relevant to the nature of the installation being inspected and tested. The person should be fully versed in the inspection and testing procedures and employ suitable testing equipment during the inspection and testing process as required under British Standard (BS) 7671.

6.2. Where testing of portable appliances is concerned, the person carrying out the inspection and testing must be competent to undertake the inspection and where appropriate testing of electrical equipment and appliances, having due regard to their own safety and that of others.

6.3. Inspection and testing must be carried out by a Skilled Person (LV) or Competent Person (LV) who is qualified to carry out inspection and testing to the current version of BS 7671.

6.4. Where inspection and testing is carried out by a site-appointed Competent Person (LV), they should complete an LW1 self-check live-working form.

6.5. An LW2 form should be issued to a Skilled Person (LV) who has been assessed as competent to carry out the work by an Authorised Person (LV).

7. First-aid

Emergency first-aid training and equipment

7.1. All Competent Persons and Accompanying Safety Persons should successfully complete emergency first-aid training course at intervals not exceeding three years.

7.2. Training in emergency first-aid should be provided by organisations whose training and qualifications for first-aiders are approved by the Health and Safety Executive (HSE) for the purposes of the Health and Safety (First Aid) Regulations.

7.3. Training courses should be of at least six hours' contact time, and should include the following subjects:

A. resuscitation (as appropriate for the treatment of electric shock)

B. treatment of burns

C. control of bleeding

D. treatment of the unconscious casualty

E. contents of first-aid box

F. communication

7.4. This training should be repeated, as a minimum, every three years.

7.5. Copies of the certificates issued by first-aid trainers for Competent Persons and Accompanying Safety Persons should be held in the Operational Procedures Manual (OPM).

7.6. A current list of first aiders for the appropriate locations, including, where appropriate, their telephone numbers, should be held in the OPM.

Contractors' staff

7.7. All contractors' staff working on or testing electrical installations, systems and equipment for which the Management has control of the electrical danger should receive, as a minimum, the emergency first-aid training indicated above.

7.8. Copies of the certificates issued by first-aid trainers for contractors' Competent Persons and Accompanying Safety Persons should be held in the OPM.

Appendix A Safety forms

Model form numbers

A.1 Isolation and earthing diagram

A.2 Safety programme

A.3 Permit-to-work

A.4 Limitation-of-access

A.5 Certificate of authorisation for live working

A.6 Permission for disconnection/ interruption of electrical services

A.7 Logbook

A.8 Self-check safety precautions

A.9 LW2 Authorisation for inspection, testing and work on or adjacent to live electrical equipment at low voltage

A.10 Certificate of boundary demarcation

A.11 Transfer of control certificate

Figure A.1 - Isolation and earthing diagram

Serial No 06/

Isolation and earthing diagram
(Complete precisely and legibly in BLOCK CAPITALS)

Safety programme no ..... Date .....

Permit-to-work/Sanction-for-test no ..... Date .....

Purpose of proposed work/test

Equipment which the proposed sequence of operations will make safe to work on/test

Sketch of isolation and earthing arrangements

Competent Person's initials

Authorised Person

Signed ..... Name ..... Date .....

Countersigning Authorised Person

Signed ..... Name ..... Date .....

Original (green) copy to
White copy to

HTM 06-02/03 IE1 Ver 1.0

Figure A.2 - Safety programme

Sheet of Serial No

Safety programme

Purpose of proposed work/test* (*Delete as appropriate)	Equipment which the proposed sequence of operations will make safe to work on or test

ITEM No	LOCATION	EQUIPMENT	OPERATION AND REASON	ITEMS REQUIRED	TIME & DATE

Date countersigned programme is required to commence .....

Authorised Person

Signed ..... Date .....

Countersigning Authorised Person

I hereby declare that I have checked the above Safety Programme, and I am satisfied that, to the best of my knowledge, it will enable the proposed work or test to be carried out safely and in accordance with the HTM guidance. I have knowledge of, and have access to the current diagram of, the system and equipment concerned.

Signed ..... Date .....

Original (green) copy to
White copy to

HTM 06-02/03 SP1 Ver 1.0

Figure A.3 - Permit to Work Form

Serial No 06/ **Location**

Front – original

Permit-to-work
(Complete precisely and legibly in BLOCK CAPITALS)

Part 1: Issue

Issued to .....
I hereby declare that it is safe to work on the following electrical equipment which has been made **dead**, **isolated** from all **live** conductors and, in the case of high voltage equipment, is connected to **earth**:

All other electrical equipment is dangerous to work on

The system is **isolated** and safety locks and **caution** signs fitted at	
The equipment is **earthed** and safety locks fitted at	
Danger signs are posted	
Other precautions taken are	
The following work shall be carried out	

Authorised Person	**Received by**
Signed..... Date.....	Signed.....

Original (blue) copy to
White copy to

HTM 06-02/03 PW1 Ver 1.0

Back – copy

Part 2: Receipt

I hereby declare that I accept responsibility for carrying out work on the electrical equipment as detailed on this permit-to-work and that no attempt will be made by me or by persons under my control to work on any other electrical equipment I have been shown and have initialled arrangements on the isolation and earthing diagram.

Signed ..... Print name .....

Time ..... Date .....

Part 3: Clearance

I hereby declare that the work for which this permit-to-work was issued is now suspended/completed* and that all persons under my charge have been withdrawn and warned that it is no longer safe to work on the electrical equipment specified on this permit-to-work and that all gear, tools etc have been removed.

Signed ..... Print name .....

Time ..... Date .....

* *Delete as appropriate*

Part 4: Cancellation

This permit-to-work is hereby cancelled. The original has been returned to me and cancelled in the presence of the signatory to Part 3.

Signed ..... Print name .....

Time ..... Date .....

Figure A.4 - Limitation-of-access

Serial No 06/ Location

Front – original

Limitation-of-access
(Complete precisely and legibly in BLOCK CAPITALS)

1. **This form must not be used for work on electrical equipment for which an electrical permit-to-work or sanction-for-test is required.**
2. **On completion of the work, the holder must surrender this limitation-of-access as directed for cancellation, after which no work shall be done.**

Part 1: Issue

Issued to .....

in the employ of ..... being competent to carry out the specified tasks, is hereby given permission to carry out the work described below:

Location

Work

No other work shall be carried out

Remarks

Authorised Person	**Received by**
Signed..... Date.....	**Signed**.....

Original (buff) copy to
White copy to

HTM 06-02/03 LOA1 Ver 1.0

Back – copy

Part 2: Receipt

I hereby declare that I accept responsibility for carrying out work in accordance with this limitation-of-access and no other work will be done by me or the persons under my charge at the location referred to in Part 1 of this document.

Signed ..... Print name .....
(being the person to whom this form is issued)

Time ..... Date .....

Part 3: Clearance

I hereby declare that the work for which this limitation-of-access was issued is now suspended/ completed* and that all persons under my charge have been withdrawn.

Signed ..... Print name .....

Time ..... Date .....
* *Delete as appropriate*

Part 4: Cancellation

This limitation-of-access is hereby cancelled. The original has been returned to me and cancelled in the presence of the signatory to Part 3.

Signed ..... Print name .....

Time ..... Date .....

Figure A.5 - Certificate of authorisation for live working

Serial No 06/

Location

Front – original

Certificate of authorisation for live working
(Complete precisely and legibly in BLOCK CAPITALS)

Part 1: Issue

Issued to .....

I hereby authorise the above named Competent Person or Skilled Person to work on the low voltage electrical equipment specified below whilst it is **live**, but only if accompanied by one or more members of the working party while the work is in progress. Form LW1 has been completed and is attached:

Working party members	
Location of equipment	
Details of equipment to be worked on	
Precautions to be taken, for example rubber gloves, mats, **insulated** tools, screening etc	
Details of work to be undertaken **live**	

No other work shall be carried out

Authorised Person	**Received by**
Signed..... Date.....	Signed.....

HTM 06-02/03 CALW1 Ver 1.0

Back – copy

Part 2: Receipt

I hereby declare that I accept responsibility for carrying out the defined work on the electrical equipment as detailed on this certificate of authorisation for live working, and fully understand the precautions to be taken.
On completion of the work, I will surrender this certificate of authorisation for live working as directed for cancellation, after which no work shall be done.

Signed ..... Print name .....
(being the person to whom this form is issued)

Time ..... Date .....

Part 3: Clearance

I hereby declare that the work for which this certificate of authorisation for live working was issued is now suspended/completed* and that all persons under my charge have been withdrawn, all gear, tools etc have been removed and the electricasl equipment has beeen left in a safe condition.

Signed ..... Print name .....

Time ..... Date .....
* *Delete as appropriate*

Reason for suspending work and action taken (if applicable)

Part 4: Cancellation

This certificate of authorisation for live working is hereby cancelled. The original has been returned to me and cancelled in the presence of the signatory to Part 3.

Signed ..... Print name .....

Time ..... Date .....

Figure A.6 - Permission for disconnection/ interruption of electrical services

Serial No 06/

Permission for disconnection
(Complete precisely and legibly in BLOCK CAPITALS)

Description of work

Authorised/Competent Person requesting disconnection

Position/Title ..... Name .....

Signed ..... Date .....

Circuit to be disconnected

Area service or equipment affected by disconnection

Point of disconnection positively identified Yes ☐ No ☐

Duration of disconnection

from ___:___ hrs on the ___/___/___ to ___:___ hrs on the ___/___/___

Special instructions or safety measures (to be completed by person affected by work)

I confirm that permission for the intended work activity has been given. I have explained to the Authorised/Competent Person any special instructions or safety measures indicated above and understand that isolation of the system is now required and will ensure that all areas, services or equipment likely to be affected by the isolation have alternative provision/will not be put at risk.*

Position/Title ..... Name .....

Signed ..... Date .....

** Delete as applicable*

HTM 06-02/03 PD1 Ver 1.0

Figure A.7 - Logbook

Logbook

Date	Time	Location	Circuit or switch concerned	Event or operation and reason	Safety programme and isolation and earthing diagram numbers	Safety document type and serial no	To whom issued	Signature of Authorised Person

Figure A.8 - LW1 - Self-check safety precautions

LW1 – Self-check safety precautions

This LW1 should be completed by a site-appointed Competent Person (LV) prior to carrying out any live work, testing or inspection on or near live equipment as described in paragraph 8.1 of Health Technical Memorandum 06-02, or by the Duty Authorised Person (LV) when a certificate of authorisation for live working is issued.

Department:	**Location**:
Equipment to be worked on:	Work to be carried out:

Task		Delete as appropriate	If Answer *No*
1	Are you an appointed Competent Person (LV)?	Yes/No	Do not proceed. Consult Duty Authorised Person
2	Is live working necessary?	Yes/No	Follow dead working procedures
3	Is the reason (please tick): Testing/fault-finding not practical dead ☐ Removal and replacement of fuse carriers in final circuits ☐ Removal and replacement of plug-in components ☐ Basic battery maintenance (cleaning/topping up only) ☐ Work on battery systems less than 25 V and 10 Ah ☐ Other (please state) ☐		
4	Has a risk assessment method statement (RAMS) been completed for this task, which is agreed as suitable for the work/test?	Yes/No	Do not proceed
5	What equipment is required to undertake the work safely? (please tick): Insulated gloves (1 kV) ☐ Face/eye protection ☐ Arc-flash/flameproof clothing ☐ Insulated tools ☐ Rubber mats ☐ Test gear/probes (fused) ☐ Screens/barriers ☐ Suitable clothing to wrist ☐ Safety shoes ☐ Head protection ☐ Other (please state) ☐		
6	Do you have all the equipment required?	Yes/No	Do not proceed
7	Has the equipment been checked before use and/or is legal/dated/certified/calibrated?	Yes/No	Do not proceed
8	Do you have the information required to do the work/test safely?	Yes/No	Do not proceed
Note: If you have answered No to any of the above questions **LIVE WORK/TESTING CANNOT TAKE PLACE**			
9	Is an Accompanying Safety Person required for the work or test?	Yes/No	Proceed with work or test
Name of Accompanying Safety Person:			

I confirm that I have read Chapter 8 of Health Technical Memorandum 06-02 and I have carried out the above checks and I am satisfied it is safe to proceed

Signed: Print:

Date: Time:

(Authorised Person (LV)/Competent Person (LV))

Note:

1. If your tests indicate that removal of components from connections or terminals is required, this may only be done live following the issue of a certificate of authorisation for live working by an Authorised Person. The Management policy's is that such work will normally be done with equipment dead and isolated.
2. If completed by a Competent Person, this document should be returned to the supervisor/Authorised Person.
3. If completed by an Authorised Person, a copy of this document should be attached to the certificate of authorisation for live working.

Figure A.9 - LW2 Authorisation for inspection, testing and work on or adjacent to live electrical equipment at low voltage

LW2 – Authorisation for inspection, testing and work on or adjacent to live electrical equipment at low voltage

This LW2 form should be issued by a Duty Authorised Person (LV) to a Skilled Person (LV) where work or testing on or near live equipment is essential but no components are to be removed or replaced. This includes but is not limited to work on battery systems les than 25 V and 10 Ah, UPS systems, generators, Medical IT systems or secondary or tertiary electrical systems.

Department:		Location:	
Equipment to be worked on:		Work to be carried out:	
Partially Isolated or disconnected at:		Adjacent exposed live equipment/parts:	

Task		Delete as appropriate	If Answer *No*
1	Is the person carrying out the work/test competent for live LV work/testing?	Yes/No	Do not proceed
2	Is live working necessary?	Yes /No	Follow dead working Procedures
3	Is the reason (please tick): Testing/fault-finding not practical dead ☐ Removal and replacement of fuse carriers in final circuits ☐ Removal and replacement of plug-in components ☐ Basic battery maintenance (cleaning/topping up only) ☐ Work on battery systems less than 25 V and 10 Ah ☐ Equipment cannot be isolated (please state) ☐ Periodic inspection and testing ☐ Other (please state) ☐		
4	Has a risk assessment method statement (RAMS) been completed for this task, which is agreed as suitable for the work/test?	Yes/No	Do not proceed
5	What equipment is required to undertake the work safely? (please tick) Insulated gloves (1 kV) ☐ Face/eye protection ☐ Arc-flash/flameproof clothing ☐ Insulated tools ☐ Rubber mats ☐ Test gear/probes (fused) ☐ Screens/barriers ☐ Suitable clothing to wrist ☐ Safety shoes ☐ Head protection ☐ Other (please state) ☐		
6	Does the Skilled Person (LV) carrying out the work/test have all the equipment required?	Yes/No	Do not proceed
7	Has the equipment been checked before use and/or is legal/dated/certified/calibrated?	Yes/No	Do not proceed
8	Do you have the information required to do the work safely?	Yes/No	Do not proceed
Name of Accompanying Safety Person:			
Note: If you have answered No to any of the above questions **LIVE WORK/TESTING CANNOT TAKE PLACE**			

Issue:
I have carried out the above checks and I am satisfied it is safe to proceed following the RAMS for the task:

Signed: Print:

Date: Time:

(Duty Authorised Person (LV))

Receipt:
I confirm that I have read Chapter 8 of Health Technical Memorandum 06-02 and I hereby declare that I accept responsibility for carrying out the defined work on the electrical equipment as detailed on this LW2 and fully understand the precautions to be taken. On completion of the work, I will surrender this LW2, as directed for cancellation, after which no further work will be carried out.

Signed: Print:

Date: Time:

(*Skilled Person (LV)*

Clearance:
I hereby declare that the work/test for which this LW2 was issued is now suspended/completed* and that all persons under my charge have been withdrawn, all equipment, tools, etc. have been removed and the electrical equipment has been left in a safe condition.

*Delete as appropriate

Signed: Print:

Date: Time:

(*Skilled Person (LV)*

Reason for suspending work and action taken (if applicable):

Cancellation:

This LW2 is hereby cancelled in the presence of the person responsible for the work/test.

Signed: Print:

Date: Time:

(Duty Authorised Person (LV))

If your tests indicate that removal of components from connections or terminals is required, this may only be done live following the issue of a certificate of authorisation for live working by an Authorised Person. The Management policy's is that such work will normally be done with equipment dead and isolated.

Figure A.10 - Certificate of boundary demarcation

Certificate of boundary demarcation

NHS Foundation Trust	HV /LV Certificate of boundary demarcation No.

Project No.		Site name	

1 Confirmation of demarcation and authorisation

This certificate of boundary demarcation (HV/LV) should only be used to provide formal documentary evidence of demarcation across boundaries, where the operational responsibility of the system/equipment detailed below is passed to a second party (different company) who will be responsible for the control of electrical danger under an electrical safe system of work. This certificate must not be issued instead of a permit to work or any other safety document by either party. The point of demarcation should be as formally agreed between the Trust's Duty Authorised Persons and the Authorised Person of the contracting company and be detailed on the relevant jointly agreed demarcation diagram. Danger signs should be affixed to adjacent live equipment/enclosures not included in the demarcation but forming part of the equipment/system being handed over.

System or equipment to be handed over to the contracting company

.....
.....
.....
.....

Specific points of demarcation secured with demarcation caution signs at the following points

.....
.....
.....
.....
.....

Danger signs posted at

.....
.....
.....
.....

As the Duty Authorised Person HV/LV responsible for the operation of the equipment described in Part 1 above, I confirm that the work being undertaken satisfies the need for this boundary of demarcation to be issued.

Name of Authorised Person (HV/LV) sanctioning this certificate	Signature	Time & date	Department	Contact tel. no.

2 Issue

As the Duty Authorised Person HV/LV responsible for the operation of the equipment descried in Part 1 above, I confirm that operational responsibility is passed to the contacting company and that the boundary of demarcation has been demonstrated to the Authorised Person HV/LV of the contracting company. I undertake to ensure that no alterations are made to the above arrangements until this certificate of boundary demarcation (HV/LV) is cancelled.

3 RECEIPT AND DECLARATION

As the contracting Duty Authorised Person HV/LV responsible for the safe systems of work, I accept this certificate of boundary of demarcation (HV/LV) on the understanding that all work under my control will be carried out under an electrical safe system of work and that no work should be carried out beyond the boundary of demarcation on equipment/system not under my operational responsibility. I also fully understand and have signed the demarcation diagram.

Name of AuthorisedPerson (HV/LV) receiving this certificate	Signature	Time & date	Department	Contact tel. no.

4 Clearance

As the contracting Duty Authorised Person HV/LV responsible for the electrical safe system of work, I declare that all safety documentation related to this certificate of boundary demarcation (HV/LV) has been cancelled, it is safe for this boundary demarcation (HV/LV) to be cancelled and that all persons under my charge have been withdrawn and warned that is it no longer safe to work on the system/equipment specified above.

Nameof AuthorisedPerson (HV/LV)clearing this certificat	Signatur	Time & date	Departmen	Contact tel. No

5 Cancellation

As the Duty Authorised Person (HV/LV) responsible for the operation of the equipment described in Part 1 above, I acknowledge that the above boundary of demarcation is no longer required and that any work on the above equipment/system is now covered by the Trust's electrical HV/LV policy and electrical safe system of work.

Nameof AuthorisedPerson (HV/LV) cancelling this certificate	Signature	Time & date	Department	Contact tel. No.

Figure A.11 - Transfer of control certificate

High voltage/Low voltage* electrical network
Transfer of control certificate

*Delete as appropriate

Part (a)_____ Authorised Person's details

Name: ……

Authorisation:…HV/LV*……

Site address:

……

……

……

Part (b) Transfer of HV/LV system control from _____ to an appointed contractor

I being the above named _____ Authorised Person HV/LV* hereby declare that the control of part/all* of the HV/LV* system at the above-specified location and defined on the attached signed and dated HV/LV* system diagram (control boundary points specified in Part (c) of this transfer of control certificate) is now transferred to:

Print name ……being the contractor's control person employed by:

Company name……

I also declare that there are no safety documents in issue on the transferred system and that I have informed all relevant employees of ……. and other contractors of this control transfer.

No access to switching operation or work should take place on the transferred HV/LV system without the consent of the above-named contractor's control person. At all stages, the above-named contractor's competent person will liaise with the Trust's Authorised Person if other electrical systems will be affected.

Signed ……Trust's Authorised Person.

Time …… Date……

Receipt

I hereby declare that I accept responsibility for the control of the transferred HV/LV* system as the contractor's control person.

Signed …… Contractor's competent person

Time …… Date……

Part (c) Limits of control transfer substation/switchroom/equipment	Circuit	Item

Part (d) Transfer of control from the contractor to the trust

I hereby declare that I relinquish control of the transferred HV/LV* system. All persons employed by the contractor have been informed and all issued safety documents have been cancelled.

Signed …… Contractor's control person

TimeDate……

*Attach any modified system diagram (duly signed and dated) if there are any system alterations.

I hereby declare that I have resumed control of the above system and this transfer of control certificate is cancelled (and have noted and understood any relevant alterations to the modified system diagram provided above).

Signed …… Trust's Authorised Person HV/LV*

Time …… Date……

* Delete as necessary

Abbreviations

AC: Alternating Current

AP: Authorised Person

BS: British Standard

CCRA: Climate Change Risk Assessments

DC: Direct Current

DH: Duty Holder

DIN: Dangerous Incident Notification

DNO: Distribution Network Operator

DP: Designated Person

DSO: Distribution System Operator

ENA: Energy Networks Association

ESG: Electrical Safety Group

HBN: Health Building Note

HSE: Health and Safety Executive

HSG: Health and Safety Guidance

HSR: Health and Safety Regulation

HTM: Health Technical Memorandum

HV: High Voltage

IRIC: Incident Reporting and Investigation Centre

LV: Low Voltage

NEAG: National Electrical Advisory Group

NEDeRS: National Equipment Defect Report Scheme

NPF: National Performance Framework

NSS: National Services Scotland

OPM: Operational Procedures Manual

PAM: Premises Assurance Model

PPE: Personal Protective Equipment

PV: Photovoltaic

RCBO: Residual Current Circuit Breaker with Overcurrent Protection

RCD: Residual Current Device

RIDDOR: Reporting of Injuries, Diseases and Dangerous Occurrences Regulations

rms: root mean square

SHTM: Scottish Health Technical Memorandum

SHTN: Scottish Health Technical Note

SOM: Senior Operational Manager

SOP: Suspension of Operating Practice

SETAG: Scottish Engineering and Technology Advisory Group

UPS: Uninterruptible Power System

References

Note 32: Standards and other specification documents are continually being updated. Readers should ensure that they consult the latest editions of such documents, including any amendments issued after publication, to keep abreast of changing requirements. The following list is indicative and is not an exhaustive list.

Acts and regulations

1. Confined Spaces Regulations. Statutory Instruments (SI) 1997 No 1713
2. Electricity at Work Regulations. SI 1989 No 635
3. Electromagnetic Compatibility Regulations. SI 2016 No 1091
4. Health and Safety (First-Aid) Regulations. SI 1981 No 917
5. Health and Safety at Work etc. Act 1974 (HSW Act 1974)
6. Personal Protective Equipment at Work Regulations. SI 1992 No 2966
7. Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR). SI 2013 No 1471

Scottish Health Technical Memorandum (SHTM) and related guidance

8. SHTM 00 - Healthcare Engineering - Policies and principles of best practice guidance
9. SHTM 81 - Part 1 - Fire safety in the design of healthcare premises
10. SHTM 81 - Part 2 - Guidance on the fire engineering of healthcare premises
11. SHTM 06-01 - Electrical services supply and distribution

Health and Safety Executive guidance

12. GS38: Electrical test equipment for use on low voltage electrical systems
13. Health and Safety Guidance (HSG)47: Avoiding danger from underground services

14. HSG 85: Electricity at work, Safe working practices

15. Health and Safety Regulation (HSR)25: Memorandum of guidance on the Electricity at Work Regulations 1989

16. Health and Safety Executive (HSE) Engineering Information Sheet No 37. Safety in electrical testing - switchgear and control gear

17. HSG 253 “The safe isolation of plant and equipment”

18. Safe work in confined spaces: Confined Spaces Regulations 1997. Approved Code of Practice and guidance L101

British, European and International Standards

19. British Standard (BS) 2559-3. Specification for screwdrivers. Insulated screwdrivers. British Standards Institution (BSI)

20. BS 3087-1. Pliers and nippers. General introduction. BSI

21. BS 5252. Framework for colour co-ordination for building purposes. BSI

22. BS 5306. Fire extinguishing installations and equipment on premises. BSI

23. BS 7671:2018+A3:2024. Requirements for electrical installations. IET Wiring Regulations. Institution of Engineering and Technology/ BSI

24. BS EN 168. Personal eye-protection. Non-optical test methods. BSI

25. BS EN 354. Personal fall protection equipment. Lanyards. BSI

26. BS EN 355. Personal protective equipment against falls from a height. Energy absorbers. BSI

27. BS EN 361. Personal protective equipment against falls from a height. Full body harnesses. BSI

28. BS EN 362. Personal protective equipment against falls from a height. Connectors. BSI

29. BS EN 363. Personal fall protection equipment. Personal fall protection systems. BSI

30. BS EN 364. Personal protective equipment against falls from a height. Test methods. BSI

31. BS EN 365. Personal protective equipment against falls from a height. General requirements for instructions for use, maintenance, periodic examination, repair, marking and packaging. BSI

32. BS EN 60903. Live working. Gloves of insulating material. BSI

33. BS EN 61111. Live working. Electrical insulating matting. BSI

34. BS EN 61243-3. Live working. Voltage detectors. Two-pole low-voltage type. BSI

35. BS EN ISO 7010:2020+A6. Graphical symbols. Safety colours and safety signs. Registered safety signs. BSI

36. BS EN ISO 16321-1. Eye and face protection for occupational use. General requirements. BSI

37. BS EN ISO 18526-1. Eye and face protection. Test methods. Geometrical optical properties. BSI

38. BS EN ISO 9001. Quality management systems. Requirements. BSI

39. Energy Networks Association (2012). Engineering Recommendation G9: Voltage testing devices