

ESR Supporting Procedure 11

LV Systems

SHEQ/HS/TCSESR/SP/011-2.1

Document Authorisation Sheet

Version 2.1
Author David White
Position Senior Asset Manager
Date 29/09/14

Reviewed by:

Name Keith Stonham
Position Technical Consultant to TCS
Date 17/10/14

Authorised by:

Name Mike Lee
Position Head of Asset Management
Date 17/10/14

Version No.	Date	Comment	Author	Reviewed	Authorised
2.1	17/10/14	New Document to replace TCSESR SP11 version 2.0	DW	KS	ML

CONTENTS

1. ADDITIONAL ABBREVIATIONS AND DEFINITIONS	3
2. DANGERS	3
3. PURPOSE AND SCOPE	3
4. GENERAL REQUIREMENTS FOR WORK	4
5. WORK ON OR NEAR DEAD LV EQUIPMENT	4
6. WORK ON OR NEAR LIVE LV EQUIPMENT	6
6.1 Permitted Live LV Work	6
6.2 A Safe System of Work	7
6.3 Battery Terminal Connections and Battery Distribution Boards	8
6.4 Voltages Exceeding 50V AC RMS or 175V DC	8
6.5 Voltages Exceeding 55V DC and Less Than 175V DC	8
6.6 Voltages Not Exceeding 50V AC RMS or 55V DC	8
7. WORK ON CURRENT TRANSFORMER (CT) CIRCUITS	9
7.1 Hazards Associated with CT's	9
7.2 Requirements for CT Secondary Wiring Shorting Connections	9
7.3 Protection CT Circuits	10
7.4 Metering CT Circuits	11
7.5 Working on CT Circuits with No Shorting Links	12
8. WORK ON LV SIDE OF VOLTAGE TRANSFORMERS	12
8.1 Hazards Associated with Voltage Transformers (VT's)	12
8.2 Requirements for Isolating VT Wiring	12
9. NOTES	13
Appendix 1 – Screening / Demarcation of LV Equipment	13
Appendix 2 – Certificate for Live LV Working (CLLVW)	17

1. ADDITIONAL ABBREVIATIONS AND DEFINITIONS

Terms printed in bold type are as defined in the TCS Electrical safety Rules

<i>Conductor</i>	A metallic item that conducts electrical energy
Certificate for Live LV Work (CLLVW)	A Safety Document of a design shown in this Safety Rules Supporting Procedure specifying the LV Equipment , the work which is to be carried out Live and the precautions to be taken to achieve a safe system of work
CT	Current Transformer
<i>Dangerous Energy Level</i>	An energy level contained within batteries that are part of the System or of Low Voltage systems in which currents are not inherently limited.
<i>Dangerous Potential</i>	A potential over 50V AC or 55V DC
IED	Intelligent Electronic Device
MCB	Miniature Circuit Breaker
<i>On or Near</i>	When exposed Live LV Equipment can be touched either directly or indirectly by means of some conducting object
RAMS	Risk Assessments and Method Statements
RCD	Residual Current Device
RTU	Remote Terminal Unit
STCP 19-4	STC Code Procedures – Commissioning and Decommissioning

2. DANGERS

The System Hazard(s) to personnel working *on or near* exposed **Live LV Equipment** are electrocution, burns and effects on eyes arising from:

- a) Personnel mistaking **Equipment** on which it is unsafe to work, for that on which it is safe to work.
- b) **Equipment** being worked on accidentally or inadvertently being made **Live**.
- c) Inadequate precautions being taken under **Live** conditions.
- d) *Dangerous Potential* on open-circuited current transformer secondary windings and associated wiring arising from open circuits or disconnection from earth.
- e) Short Circuit of **Live LV** System.

3. PURPOSE AND SCOPE

This procedure sets down the process to be adopted when applying principles established by the **TCS** Electricity Safety Rules (**TCS** ESRs) and Safety Rules Supporting Procedures (SRSPs) to achieve **Safety from the System** for personnel working *on or near* to **Low Voltage Equipment** which is deemed part of the **System**.

4. GENERAL REQUIREMENTS FOR WORK

- 4.1 The preferred method *shall* be to work *on or near* to **LV Equipment**, which is **Dead**. This procedure does not allow personnel to work **Live** when it is reasonably practicable to work **Dead**.
- Note:** - Conductors are not considered **Live** for inadvertent contact where they are suitably covered with insulating material / shrouding which prevents **Danger**.
- 4.2 A **Senior Authorised Person** *shall* assess the means of achieving **Safety from the System**, taking into account the type of **LV Equipment**, whether work is to take place under **Dead** conditions or can be justified under **Live** conditions, and if a **Safety Document** is to be issued.
- 4.3 A **Senior Authorised Person** *shall* be responsible for the co-ordination, **Switching** and **Safety Documents** with regard to **LV Systems**.
- 4.4 When work on **Live LV Equipment** requires portable instruments to be used for measurements, the instruments and associated tests leads *shall* be fuse protected (or equivalent) and provided with suitably insulated probes and test leads to prevent **Danger**.
- 4.5 When working on **LV Equipment** over a third party control boundary where **Points of Isolation** are required on another User's **System**, the **Senior Authorised Person** *shall* contact the **Control Person** and arrange for a **Record of Inter System Safety Precaution (RISSP)** to be issued in accordance with SRSP 13 – “**RISSP Procedure**”. A **Safety Document** *shall* be issued to a **Competent Person** for work, quoting the safety precautions on the **RISSP-R** document. Examples of cross boundary control may be CT or VT secondary wiring.
- 4.6 Where there is a possibility of the presence of flammable gas, which might be inadvertently ignited by electric sparks, the **Senior Authorised Person** *shall* consider consulting an appropriately qualified specialist, to provide advice to ensure a safe system of work is established.
- 4.7 Guidance on excluding **Danger** from **Charged conductors** is given in ESR supporting procedure 9 (SPSR9) – Cable Systems.
- 4.8 Where necessary or beneficial to the safe system of work, the LV equipment to be worked on shall be demarcated in accordance with the examples in Appendix 2.

5. WORK ON OR NEAR DEAD LV EQUIPMENT

- 5.1 When **Safety from the System** can be achieved by limiting the work or work area, instructions clearly defining the limitations shall be given. When the **Senior Authorised Person** decides it is necessary to confirm these instructions in writing, a **Limitation of Access** *shall* be issued.
- 5.2 When **Safety from the System** cannot be achieved by limiting the work or work area, work on or near to **LV Equipment** shall where *reasonably practicable* be carried out with the **LV Equipment Dead**. The following safety precautions shall be applied:-
- a) The **Senior Authorised Person** *shall* identify the **LV Equipment** and then release it from operational service.

- b) The **Senior Authorised Person** shall ensure **Equipment** to be worked on is **Isolated** and **Point(s) of Isolation** established. Fuses, links and **Safety Key(s)** used to secure the **Point(s) of Isolation** shall be retained in safe custody.
 - c) The **Senior Authorised Person** shall ensure **Danger** has been excluded from **Charged conductors** (refer to guidance in ESR Supporting procedure 9 – Cable Systems).
- 5.3 A **Senior Authorised Person** shall assess the work required *on or near* to the **Dead LV Equipment** and decide whether it will be carried out under:-
- a) A **Permit to Work** (see section 5.5 & 5.7) and/or an **LV Permit to Work** (where **Point(s) of Isolation** only are required),
 - b) **Personal Supervision** of the **Senior Authorised Person**, or
 - c) Oral instructions (where *RAMS* are deemed wholly sufficient to control **Safety from the System**).
- 5.4 When working on **Dead LV Equipment**, it may be necessary to exclude **Danger** from **Live LV Equipment** *on or near* the work area. The **Senior Authorised Person** shall:-
- a) Establish **Point(s) of Isolation** and make the adjacent **LV Equipment Dead**, or
 - b) Apply screening to the **Live LV Equipment** (see Appendix 1) .
- If a) or b) cannot be achieved, then refer to Section 6 – Work *on or near* **Live LV Equipment**.
- Danger Notices** shall be fixed to **Equipment** containing **Live conductors** and at the limits of the zone in which the work will be carried out.
- 5.5 When carrying out work *on or near* **Dead LV Equipment** in conjunction with work on **HV Equipment**, the **LV work** shall be detailed on the **Permit to Work**. If further written instruction is deemed necessary for the **LV works**, a separate **LV Permit to Work** can be issued and shall be referenced in the “Work to be done” section of the **Permit to Work**.
- 5.6 Where work *on or near* **LV Equipment** is near to **HV Equipment** and the means of achieving **Safety from the System** is by limiting the work or work area and the issue of a **Limitation of Access**, the work *on or near* **LV Equipment** may be carried out under the **Limitation of Access**. If further written instruction is deemed necessary, an **LV Permit to Work** can be issued and shall be referenced in the “Work to be done” section of the **Limitation of Access**.
- 5.7 Where **Point(s) of Isolation** are required on the **HV System** to work *on or near* **LV Equipment**, an **LV Permit to Work** shall be issued and the relevant **HV Control Person** informed of the issued **Safety Document**. Where **Earthing** is required on the **HV System**, a **Permit to Work** shall be issued.
- 5.8 The **Senior Authorised Person** shall check that the **LV Equipment** to be worked *on or near* is not **Live**, by means of an **Approved** Voltage testing device. The device shall be tested for correct function immediately prior to and after use.
- 5.9 All work on **Dead LV Equipment** shall be carried out by, or under the **Personal Supervision** of a **Competent Person**.

- 5.10 The **Competent Person**, before commencing work; and as the sequence of work progresses and new wiring is to be worked on should check to confirm the **LV Equipment** is not **Live**, by means of an **Approved** voltage testing device. The device shall be tested for correct function immediately prior to and after use.
- 5.11 During the work, the **Competent Person** *shall* inspect the screening where applied, and ensure its integrity is maintained. Any changes in the condition of the screening e.g. disturbance or condensation forming, must result in the **Working Party** being withdrawn and the **Senior Authorised Person** informed.
- 5.12 Where a **Senior Authorised Person** sets themselves to work on **LV Equipment**, the Risk Assessment process shall be to the same standard of setting a third party to work.

6. WORK ON OR NEAR LIVE LV EQUIPMENT

6.1 Permitted Live LV Work

- 6.1.1 Work shall not be permitted *on or near* any **Live LV conductor** where *Danger* may arise, unless:-
- It is unreasonable in all the circumstances for it to be **Dead**; and
 - It is reasonable in all the circumstances to be at work *on or near* it while it is **Live**; and
 - Suitable precautions (including where necessary the provision of suitable protective equipment) are taken to prevent injury.
- 6.1.2 Work which includes **Live** testing / commissioning is justifiable as there is no other *reasonably practicable* means of undertaking the work. However, it does not follow that there will be justification for repair work to be carried out **Live**.
- 6.1.3 Where **Live** work is to be carried out, the **Competent Person** in charge of the **Working Party** *shall* make an assessment of the site conditions. **Live** work shall only be commenced where the site conditions enable the work to be done safely. If the site conditions become unfavourable, **Live** working shall be suspended. In particular, the following requirements shall be assessed:-
- The **Equipment** to be worked on or near *shall* be visually inspected to confirm a satisfactory condition.
 - There *shall* be adequate working space and safe means of egress.
 - The working space and the **Equipment** to be worked on *shall* be adequately illuminated.
 - All individuals who carry out **Live** work *shall* be **Competent Persons** and *shall* have received appropriate additional training.
 - Only tools and **Equipment** which are designed and suitable for work on, or testing of, **Live LV Equipment** and *conductors shall* be used.

6.2 A Safe System of Work

- 6.2.1 The **Senior Authorised Person** *shall* assess the work required *on or near* to **Live LV Equipment** and ensure a safe system of work is developed. This *shall* include the decision to issue a **Certificate for Live LV Work (CLLVW)** as a control. A **CLLVW** may be issued for any work *on or near* to **Live LV Equipment** if it adds value to the safe system of work; see Appendix 2. The safe system of work *shall* adequately prevent **Danger** from electric shock and inadvertent short-circuiting of *conductors*.
- 6.2.2 Only a **Competent Person** with adequate knowledge, training and experience in **Live LV** working and who has received training under this procedure (SRSP 11) may receive a **CLLVW** or carry out any work *on or near* to **Live LV Equipment**. The knowledge, training and experience *shall* be appropriate for the task in hand.
- 6.2.3 The **Senior Authorised Person** *shall* consider the use of an additional **Competent Person** if; the presence of such a person could contribute significantly to ensuring that injury is prevented or effects mitigated.
- 6.2.4 Any accompanying **Competent Person** *shall* be trained to recognise **Danger** and to render assistance and raise an alarm in the event of an emergency, e.g. has adequate knowledge, training and experience in **Live LV** working, has received training under this procedure and is emergency first aid trained.
- 6.2.5 The responsibilities required of the accompanying **Competent Person** *shall* be clearly communicated to them before work starts, along with all emergency arrangements established.
- 6.2.6 When working on **Live LV Equipment** it may be necessary to exclude **Danger** from adjacent **Live LV Equipment** or any potential difference e.g. between *conductors* or *conductors* and metal work bonded to **Earth** etc. in or near the work area by the following controls as appropriate: -
- Insulated screening
 - Insulated tools
 - Insulated mats
 - Adequate lighting
 - Adequate workspace access
 - Insulated gloves
 - Additional PPE (visor etc)
- The **Senior Authorised Person** *shall* provide the **Competent Person** carrying out the work with adequate information about the **Live conductors** involved, associated electrical system, foreseeable risk and the controls required during the work.
- 6.2.7 The **Competent Person** *shall* remove any metallic objects such as wristwatches, rings, wristlets, cufflinks, pendants, items of clothing with exposed metallic zips, tape metallic zips etc.
- 6.2.8 During the work, the **Competent Person** shall visually inspect the screening where applied and ensure its integrity is maintained.

6.3 Battery Terminal Connections and Battery Distribution Boards

- 6.3.1 Due to dangerous energy levels a **CLLVW** *shall* be issued when working on battery terminals, connections and distribution boards other than routine / testing work. This is due to the **Danger** arising from short circuits via a conducting object, e.g. spanner across the battery terminals etc.

Protection against dangerous energy levels can be afforded by circuits being sub-fused (MCB). The fuse (MCB) is designed to protect the cable from short circuit faults and hence will limit the energy provided by the battery.

Note: - Only a 30 mA RCD will provide protection against the harmful effects of an electric shock.

6.4 Voltages Exceeding 50V AC RMS or 175V DC

- 6.4.1 Working *on or near conductors* subject to these voltages could result in death and will only be carried out after a **Senior Authorised Person** has issued a **CLLVW**.

6.5 Voltages Exceeding 55V DC and Less than 175V DC

Note: Excludes work on battery terminals, connections and distribution boards due to dangerous energy levels.

- 6.5.1 The **Senior Authorised Person** may determine a **CLLVW** for minor work at these voltages is not required, where a safe system of work is achieved wholly within the *RAMS*.

- 6.5.2 Examples of minor works are as follows:-

- Minor repair work during testing and commissioning of a short duration,
- Voltage / Current measurements during commissioning,
- Isolations created to allow major work to proceed e.g. wires isolated in relay panels of other circuits to allow protection installation / modification / decommissioning work to proceed.

- 6.5.3 Shrouding *shall* be applied where **Danger** may arise from source 110V DC systems e.g. J1, J2 next to each other on a terminal block.

- 6.5.4 The **Working Party** *shall* be advised that **Live** voltages at this level may be present and the controls specified in the *RAMS* *shall* be implemented.

- 6.5.5 Where major works are carried out **Live** at these voltage levels a **CLLVW** *shall* be issued by a **Senior Authorised Person**.

6.6 Voltages Not Exceeding 50V AC RMS or 55V DC

Note: Excludes work on battery terminals, connections and distribution boards due to dangerous energy levels.

- 6.6.1 Nominal sub fused (MCB) secondary wiring at these voltage levels do not have sufficient energy levels to cause harm and the issue of a **CLLVW** is not required.

7. WORK ON CURRENT TRANSFORMER (CT) CIRCUITS

Work on Current Transformer (CT) secondary wiring *shall*, where *reasonably practicable* be carried out with the primary circuit **Isolated**.

7.1 Hazards Associated with CT's

- 7.1.1 Special precautions are required when working on CT Circuits. The driving flux of a CT is always present when primary current is flowing and therefore, if the Secondary load is inadvertently disconnected, very high voltages will be developed across the secondary winding with the risk of injury to personnel and damage to equipment.
- 7.1.2 With the primary circuit out of service a hazard may still be present because of the potential for current to flow in the CT in the event of a primary **System** fault or if the primary circuit is **Earthed** for maintenance and circulating current is flowing. **LV** CT secondary wiring disconnections created as **Point(s) of Isolation** *shall* be quoted on the **Safety Document**.

7.2 Requirements for CT Secondary Wiring Shorting Connections

- 7.2.1 In all instances of work on CT secondary wiring, shorting links *shall* be applied between the point of work and the CT windings. Failure to do this may result in open circuiting of CT secondary wiring leading to **Danger** of dangerously high voltages even if the **System** is **Isolated**.
- 7.2.2 Existing, dedicated, bolted CT shorting links, when available, *shall* be the first choice for shorting CT secondary wiring.
- 7.2.3 Where existing, dedicated, bolted CT shorting links are unavailable stud terminals that have sufficient length to accept a ring crimp terminal(s), an anti-rotation washer and a full nut should be used. Shorting connections *shall* be PVC insulated, stranded copper cable, with a minimum cross-sectional area (csa) of 1.5mm² copper or equivalent. Shorting links *shall* be labelled as per Figure 7.2a.

DANGER: TEMPORARY CT SHORTING LINK DO NOT REMOVE		Safety Document No:
Senior Authorised Person Name:		
Competent Person Name:		
Date	Time:	

Figure 7.2a – Temporary CT Shorting Label

- 7.2.4 Another option may be the use of a test plug inserted into a test socket using shorting connections designed by the manufacture for the test plug / socket (see figure 7.2b), e.g. MMLB01, MMLG, 2RMLG (although the use of stud connections, if available, are the preferred option as shorting wires may become accidentally detached).



Figure 7.2b – Alstom MMLB and Siemens (Reyrolle) 2RMLG

- 7.2.5 Other methods may be adopted provided they meet the fundamental principle outlined above.
- 7.2.6 Crocodile clips are not 'mechanically secure' and *shall not* be used. The application of shorts to spring loaded and similar terminal blocks is **not** permitted as it cannot normally be carried out without disturbing the existing CT wiring. However, terminal blocks with facilities for screw-on links may be used provided the correct shorting links are used; see figure 7.2c.

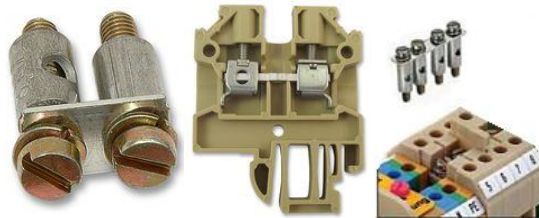


Figure 7.2c – DIN rail terminals with screw-on shorting links

- 7.2.7 Current transformer shorts *shall* be recorded in “Further precautions” section of the relevant **Safety Document** or Section 4 of a **CLLVW**.

7.3 Protection CT Circuits

- 7.3.1 **Live** work on Protection CT secondary wiring requires depletion of system protection. **Live** testing / commissioning of protection CT wiring and function is classed as justifiable. However, it does not follow that there will be justification for repair or modification work to be carried out **Live**.
- 7.3.2 Due to the **Danger** arising from dangerously high voltages associated with open circuiting of CT secondary wiring, and the difficulty in operation with depleted protection, all work on protection CT circuits excluding **Live** testing and commissioning *shall* be undertaken with the primary circuit **Isolated** (refer to Section 5 for **Safety Document** requirements) and temporary CT shorting applied along with warning labels.
- 7.3.3 Where **Live** testing or commissioning is undertaken it *shall* be carried out in accordance with an approved **Method Statement**, utilising fixed test points and suitable instruments and leads. **Live** connections / disconnections for the purposes of **Live** testing / commissioning *shall* not be carried out other than by use of suitable existing test blocks / terminals / positions.

7.4 Metering CT Circuits

- 7.4.1 **Live** testing / commissioning of Metering CT wiring and function is classed as justifiable when in accordance with an **Approved Method Statement**. However, it does not follow that there will be justification for repair or modification work to be carried out **Live**.
- 7.4.2 Work on Metering CT secondary wiring *shall* where *reasonably practicable* be undertaken with the primary circuit **Isolated** due to the **Danger** arising from dangerously high voltages associated with open circuiting of CT secondary wiring.
- 7.4.1 The work shall not be undertaken with the primary circuit **Live** if suitable existing means of shorting the Metering CT secondary wiring between the point of work and the CT windings are not provided. In this instance the **System shall be Isolated** and shorting links applied.
- 7.4.2 It may be justifiable to work on the Metering CT circuit with the primary circuit **Live** provided suitable means of shorting are provided, a disconnection *shall* also be made between the short(s) applied to the CT and the point of work (this will form an **LV Point(s) of Isolation**). In this instance a **CLLVW shall** be issued for the relevant shorting, disconnection and shrouding of the work area. A clip on ammeter shall be used prior to, during, and after shorting connections have been applied, to check and ensure that the major portion of the current flowing in the CT circuitry has transferred to the short(s). Values should be marked on the working sketch. The application of the temporary short(s) shall be earth side first (e.g. A80) using insulated tools.
- 7.4.3 The **Senior Authorised Person shall** ensure all secondary outputs of the CT's (all phases or as appropriate) are shorted and **Danger** is excluded from **Charged CT** secondary wiring by ensuring that the CT wiring being worked on is always **Earthed** at one point, which shall be on the source side of any disconnections made.
- Multiple earth points on a CT's secondary circuit can establish earth loop currents. Any work which involves the disconnection of the CT secondary wiring will be re-commissioned in line with the requirements of the STCP 19-4.
- 7.4.4 Once the shorting, disconnection and shrouding has been completed the **CLLVW** can be cancelled and the work carried out in compliance with Section 5 or 6 of this document.
- 7.4.5 After the work is complete a **CLLVW shall** be issued for the removal of shorting, disconnections and shrouding. A clip on ammeter should be used to establish the current(s) flowing in the existing wiring and the short(s). An insulated tool should be used to carefully remove the first short from the 'live' (e.g. not earthed, A80 etc.) side on the first phase. The connection should be carefully lifted off whilst checking that no significant arcing is present. Use the clip on ammeter to confirm that the current remains constant during and after removal of the short, and the expected current is flowing in the existing wiring downstream of the short. Do this for each shorting link.

7.5 Working on CT Circuits with No Shorting Links

- 7.5.1 When working directly on CT secondary terminals and it is not *practicable* for shorting links to be applied between the point of work and the CT windings, then a **Safety Document** shall be issued. The primary circuit shall be arranged such that no primary current can flow in the CT primary. This shall be achieved by ensuring a physical break is formed by a disconnect, Circuit Breaker or a break in the **HV** conductor on one side of the CT and that a circulating current path is not formed by the application of **Earthing Device(s)**.

8. WORK ON LV SIDE OF VOLTAGE TRANSFORMERS

8.1 Hazards Associated with Voltage Transformers (VT's)

- 8.1.1 Voltage Transformer (VT) Circuits will drive an AC voltage used for protection, control or metering purposes. The secondary voltage is usually 63.5 V AC phase-earth (110 V AC phase-phase) although some other secondary voltages may be used for special purposes.
- 8.1.2 Unlike CT circuits the VT secondary wiring shall not be shorted. If a VT secondary is shorted the resultant current flowing in the secondary circuit wiring will exceed the VT burden rating (VA) and may lead to damage of the VT winding, and a possibility of catastrophic failure of the VT.
- 8.1.3 With the primary circuit out of service a **Danger** may still be present because of induced voltage on the **HV Equipment** or a rise in potential due to a fault on the in-service **HV Equipment** on the local **System**. **LV** VT secondary wiring disconnections created as **Point(s) of Isolation** shall be quoted on the **Safety Document**.

8.2 Requirements for Isolating VT Wiring

- 8.2.1 The VT secondary wiring shall be **Isolated** between the point of work and the VT windings in all instances of work to disconnect, modify or repair VT secondary wiring. Failure to do this may result in short circuiting of VT secondary wiring causing damage to the VT winding or catastrophic failure of the VT unit itself. **Live** testing / commissioning of Protection, Control or Metering VT wiring and function, in accordance with an **Approved Method Statement**, is classed as justifiable.
- 8.2.2 Existing, dedicated, fuses, fuse links, or MCBs (figure 8.2) when available (in most instances found in the VT Marshalling Cubicle/Box) shall be the first choice for isolating VT secondary wiring.



Figure 8.2 – MCB and fuse links

- 8.2.3 Removal of **Live** VT secondary circuit wires from spring loaded and similar terminal blocks is **not** permitted as it risks shorting of the VT.
- 8.2.4 Where existing, dedicated, fuses, fuse-links or MCBs, between the point of work and VT windings are unavailable the work *shall* be undertaken with the **System Dead, Point(s) of Isolation** and **Earthing** applied to the **HV System**, and a **Safety Document** issued. An example of such a requirement is working within the VT Marshalling Box between the MCB/fuse-links and VT winding.

9. NOTES

APPENDIX 1 – Screening / Demarcation of LV Equipment

Screening may be required to avoid **Danger** from **Live LV Equipment** being touched either directly or indirectly.

Screening material *shall* be secured to ensure that it remains an effective barrier for the duration of the work. The edges of the screening *shall* be secured to ensure that no access is allowed to any **Live LV Equipment**.

The **Senior Authorised Person** or **Competent Person** installing the screening *shall* remove any metallic objects such as wristwatch, rings, pendants etc.

If a **Certificate for Live LV Work** is required, this *shall* record controls, such as the use of insulated tools, mats, gloves etc. to avoid **Danger** whilst erecting screening.

Suitable Screening Material



Figure A1-1 – Example of rubber screening material and clips

Screening material *shall* be able to withstand a voltage up to and including 1000 volts and *shall* have sufficient mechanical strength to withstand an accidental blow from a tool without tearing or ceasing to be effective

Example Application of Screening



Figure A1-2 Example of Screening in Relay Panel



Figure A1-3 Example of screening on terminal rails

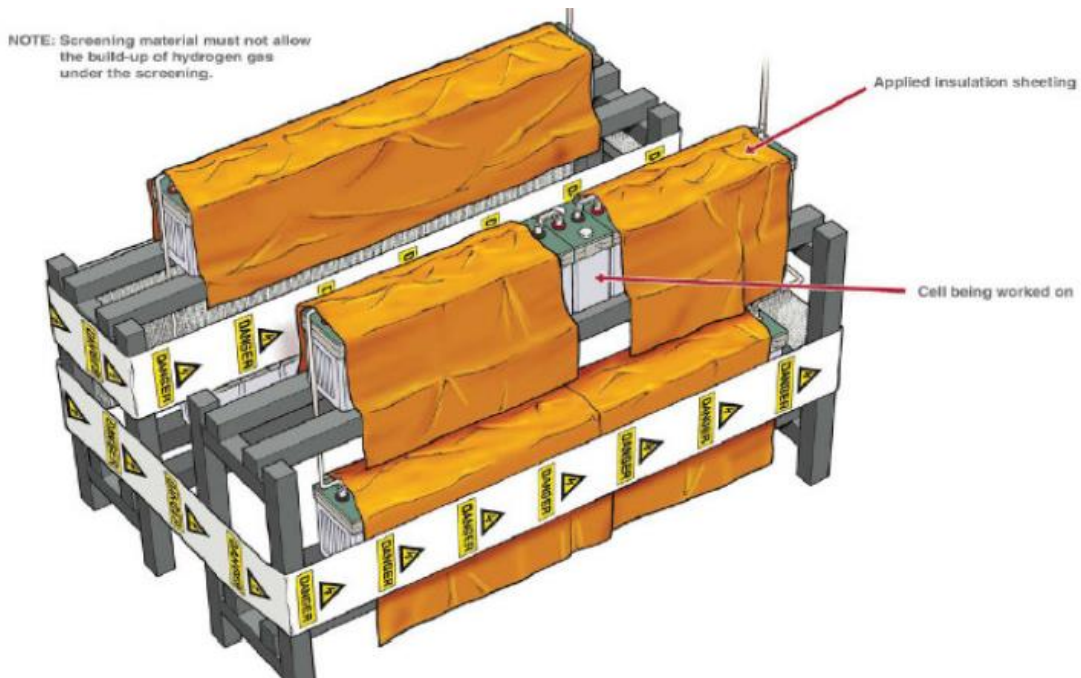


Figure A1-4 – Example of battery cell screening

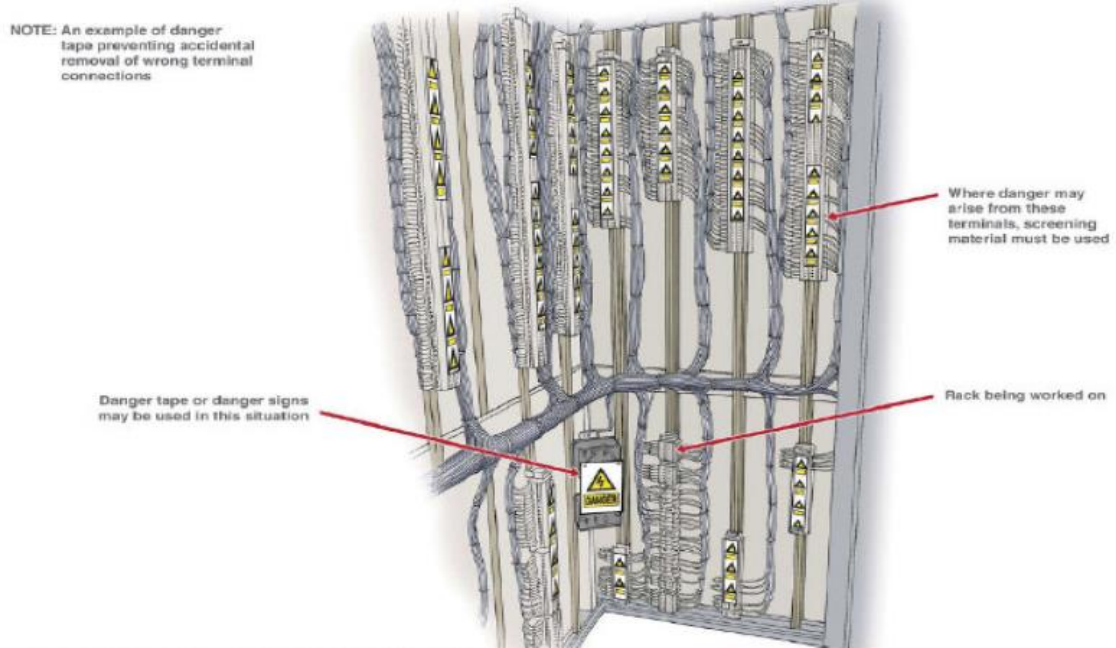


Figure A1-5 – Example of danger tape preventing removal of permanent screening

Example Application of Demarcation for LV Equipment

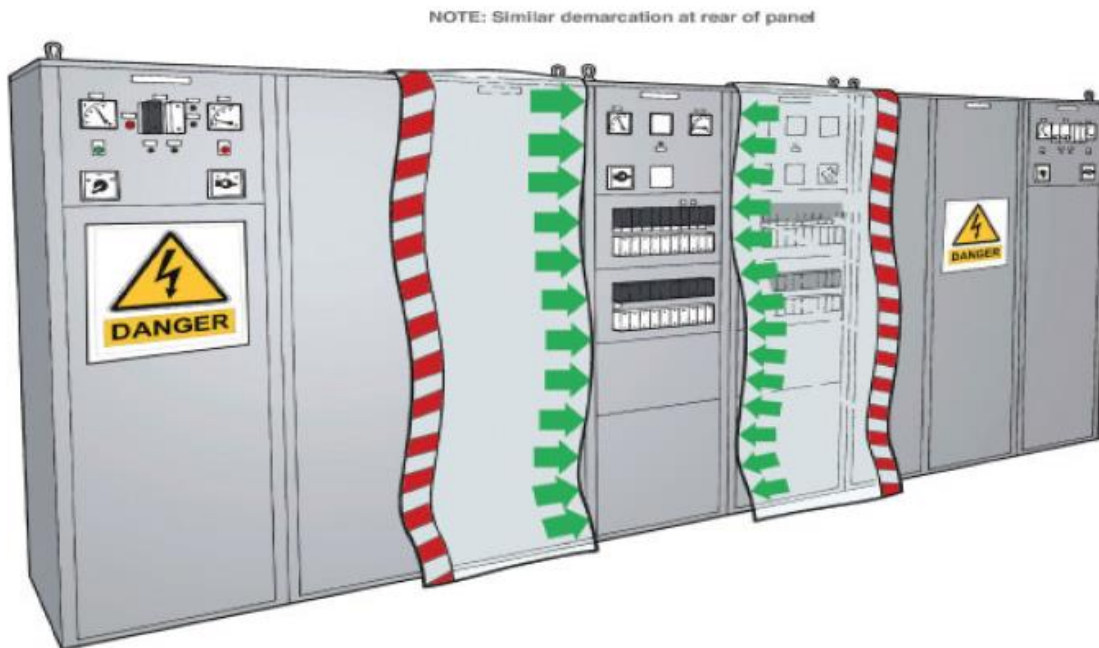


Figure A1-6 – Example of demarcation to identify LV equipment to be worked on

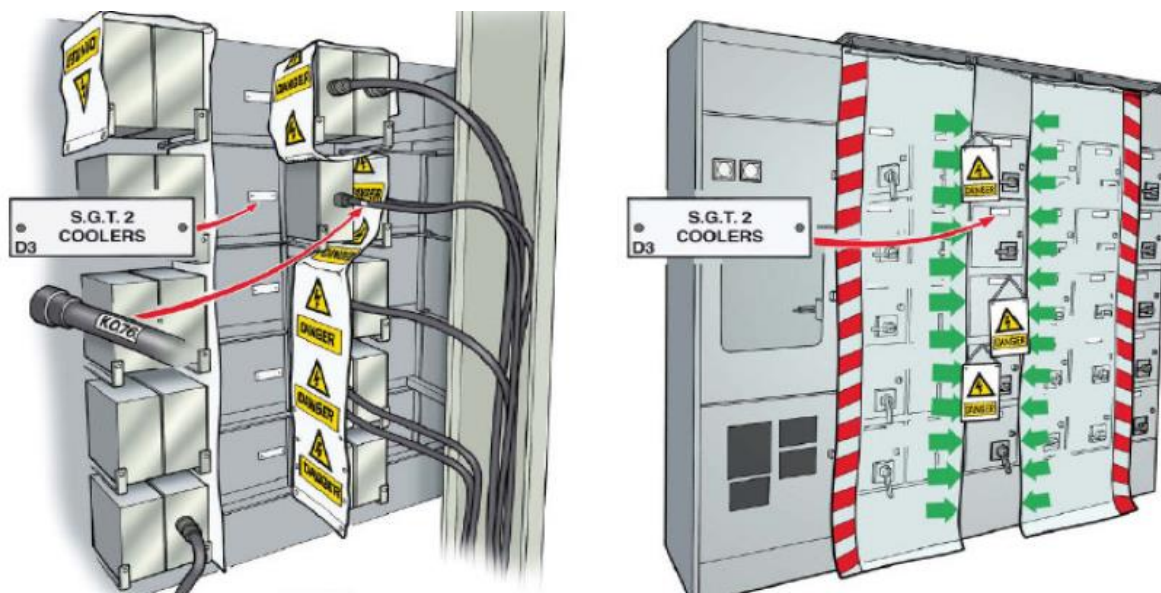


Figure A1-7 – Example of demarcation to identify LV equipment to be worked on

