High Voltage Senior Authorised Persons Refresher Course

Lesson 9 Online

Site Energy Services
Training Solutions & Assessment
Safe Working Process
Safe Working Process

For high voltage installations the acronym D.I.E.D is used to remind us that:

• Dead
• Isolated
• Earthened
• Documented

Must be adhered to, by those authorised to do so.
Typical key safes for Senior Authorised Persons to use, there are other methods employed by companies.
Safety Documents

- Permits to Work
- Sanctions for Test
- Limitation of Access

At the boundary with Distribution Network Operators
- Isolation & Earthing Certificate issued by the DNO Engineer.
Associated Documents

• Switching Schedules
• Switchroom Logs
• Portable earth device register
• Suspension of Operations Handbook
What to wear?

General
Work wear with flame resistant (FR) properties is provided to help minimise injury in the unlikely event of an incident involving fire, flashover or equipment failure.

The requirement for the use of FR work wear will apply to all Company employees.

What do you wear?
What to wear?

Wearing of FR Workwear

- It is important that the garments are worn correctly (i.e. sleeves not pushed up).
- Only Company approved foul weather clothing should be worn over the FR workwear.
- FR material will absorb heat if exposed to a flashover of some sort, a small percentage of that heat will however transfer through the material. It is therefore recommended that only cotton or natural fibre garments are worn beneath FR workwear. Garments that are wholly man-made could melt on to the skin and should not be worn beneath the FR workwear.
- During hot weather, some individuals may want to remove clothing or roll up sleeves etc. However, it is not permitted to remove FR workwear, whilst on duty at work under any circumstances other than those detailed in the exemptions below or to allow for emergency first aid.
- No unauthorised alterations should be made to any Company issued FR garment.
Boundaries & Ownership / Control
When ownership or responsibility changes such as at the origin of the installation from the Distribution Network Operator, to the Commercial Business consuming power.
It is essential to use **Isolation and Earthing Certificates** so that the operation of apparatus and plant for the purpose of controlling points of isolation and application of earthing (circuit main earths) is formally communicated and controlled to the third party.

If two parties rely upon each other, but work individually they must use formal acknowledge and still have control and agreements in place to work at that boundary. They are used because one organisation can only arrange to make their side of the boundary safe formally until the third party require its state to be changed whilst they work on their (other) side of that boundary.
There is also the management of internal voltage boundaries to consider, because those authorised to work on one voltage will require the authorised persons of the adjacent voltage that it is connected between them when they work on the boundary. (Assuming they are not authorised for both systems)
SWITCHING

The following hierarchy must be used to operate Apparatus. The final decision regarding which method of operating rests with the field operative as onsite as they may raise a concern to using lower hierarchy when remote operation is available:

• Tele control.
• Remote operating panels in a separate room to the Apparatus.
• Remote operating panels in the same room as the Apparatus.
• At the immediate location of the Apparatus.
Sequence of typical HV devices

On Position

Selector Mechanism
Position Selected

Earth Off

Earth On (Applied)
There is not many approved means of proving something dead before you touch, you must have the correct unit for the system voltage.

**Proving Device & Proving Unit:**

Test before you touch – It may not be dead, and you soon will be!
When switching
When switching

Fixed Circuit Breaker

Earth Switch
Application of circuit main earth here

Distribution Transformer
Point of work here.

Main LV Circuit breaker

HV Point of Isolation here

LV Point of Isolation here
For Isolations

Remember you have x points of isolation for x sources of energy

- HV Point of isolation here
- LV Point of isolation here

You will need circuit main earths for each source of high voltage energy

You may need to consider additional earths applied to a more local position of the work area

You can issue your safety document when Safety from the system has been achieved and will be maintained

Point of work here.
Sequence of typical LV devices that can be used for isolation
Low Voltage Isolations only
The Electrical Safety Council in the UK recommend for a **low voltage** installation the following isolation process:

Step
1. Check it is acceptable and permission has been granted to isolate and work.
2. Identify the type of supply to the system such as TNCS, TNS or TT
3. Locate and identify the circuit to be isolated
4. Select an approved voltage indicator and verify that it works correctly
5. Verify the circuit / equipment is functional. Use the approved voltage indicator device to verify the circuit / equipment.
6. Identify suitable means of isolation
7. Isolate the circuit / equipment by switching it off, using the functional device and then by an appropriate isolation device.
8. Fit appropriate lock off device with a safety lock. Person carrying out works retains a key to prevent re-energisation by other.
9. Fit warning label for isolation and identified work
10. Verify the circuit / equipment is isolated. Use the approved voltage indicator for the system voltage to verify the circuit is dead. Test between all conductors Line to Line, Line – Neutral, Line – Earth, Neutral – Earth
11. Re-check the approved voltage indicator using the correct proving device to confirm it is still functioning correctly
12. Circuit / Equipment should be safe to carry out the works. Always remain vigilant and re-check with voltage indicator when moving away and returning to the circuit / equipment
Low Voltage circuits when isolated differ from High Voltage circuits.

1. Planning
2. Isolate
3. Lock Out Tag Out (Isolate)
4. Prove Dead
5. Confirm dead
6. Issue Permit
7. Commence Works
   Cancel Permit

High Voltage circuits when isolated differ from Low Voltage circuits.

1. Planning
2. Isolate
3. Lock Out Tag Out (Isolate)
4. Prove Dead
5. Confirm dead
6. Earth the circuit to be worked on
7. Issue Permit
8. Commence Works
   Cancel Permit
A ‘Dry Run’ prior to the works is good practice, with both Authorised persons walking through the procedure to confirm the isolation of all supplies in the correct order (e.g. If the main incoming supply is isolated to soon in the sequence, this could cause an unwanted start of the generator).

Have Ancillary and Auxiliary supplies been accounted for in the switching order? Have remote automatic controls been considered?
PLANNING

• Identify the scope of the works
• Identify the equipment to be isolated
• Consult the end users
• Develop a Safety Program - switching schedule, Isolation & Earthing Diagram
Once the work has been planned and the points of isolation on the equipment have been identified:

- Firstly, shutdown equipment to ensure that equipment is in a safe state.
- Lifts are to be grounded; the plant is not shut down in mid-operation that may cause harm or create a hazard upon re-energising.
- Safety is not compromised - ensure buildings have adequate lighting; building security systems remain operational.
- Stored energy is controlled - batteries disconnected, PV arrays safely isolated to manufacturer's procedures.
- Ensure alternate sources of supply are identified and isolated appropriately.
ISOLATION

Isolations are to be carried out in accordance with the planned Switching Schedule.

The points of isolation and Earthing are to be recorded on a schematic which will be issued to the operative carrying out the work attached to the isolation certificate and permit to work.

You should be careful not to deviate from the planned switching schedule, simply because if the planning stage was correct and the electrical system deviates because of a change. What else is wrong?
Isolation of Equipment

When Main distribution circuits, final circuits or Equipment are NOT being worked on but are required to be isolated, then a ‘Operational’ Lock is to be applied.

Then as the project progresses and Switchgear and equipment gets handed over then Yellow Locks are to be applied by the client team.

This will give a clear indication of who is responsible for the isolation.

These locks are supplied with more than one key. Access to keys must be strictly controlled.

Information tags can be applied to either type lock at this stage.
Isolation of Equipment

‘Operational’ locks are also used to inhibit the operation of switching devices.

For example:
- Locking into place remote open/close switches.
- Remote/Local switches
- Circuit breaker ON/OFF buttons on Automatically controlled systems
- Transformer ‘Off load’ Tap change points
- Switchgear access points

NOTE ‘Operational’ locks are NOT acceptable as part of the Safe LOTO procedure for carrying out works because they are not unique and have more than one key.
Isolation of Equipment - Lock Out

Individual LOTO is for one isolation by an individual on a single source of supply using a ‘Safety Lock.

The Lock will be Tagged
The tag is to have clear information:
- Date Tag applied
- Owner of the Tag

The tag must be attached to the ‘Safety Lock
Isolation of Equipment - Lock Out

Group Lock Outs are used for multiple isolations for several sources of supply and for when several parties are working on the same system or circuit. The equipment ‘Safety Lock Keys are stored within the Group Lockout box. Then the individual operatives apply their own lock to the box. Using this method, only on completion of all works by all operatives, can the equipment safety lock keys be accessible to restore supplies
Barriers

Once the LOTO process is in place, before carrying out works or testing & commissioning activities, the switchgear MUST be cordoned off with barriers of an approved type.

Only authorised persons that are included on work RAMS or responsible for test witness are to enter the barriered area.

When LIVE testing - Signage MUST be posted warning of Test Voltages.
Proving ‘Dead’ - Test Equipment

Proving ‘Dead’ test equipment has to be dependable.
Specific Voltage indicators are the only devices to be used
Volt Sticks are only to be used as additional checking and are not to be relied upon as the only form of testing
Multi function meter are not to be used as it is possible to select the wrong test range and which give false indication
Proving ‘Dead’ - Test Equipment

Test equipment must comply with GS38 and conform to the requirements of BS EN 61010-031 or in the case of a 2-pole voltage detector to BS EN 61243-3
Proving ‘Dead’ Test Equipment - HV/MV

Phasing Out units are not to be used for confirming Live or Dead.
Test Equipment Proving Units

When using Voltage indicators both for HV and LV the indicator they must be checked for correct operation. This is done normally with a ‘proving unit’ or in the case of LV a ‘known’ LIVE source can be used. The test equipment is to be tested both before and after the test.
SAFETY PRECAUTIONS FOR WORK ON OR NEAR HIGH VOLTAGE SYSTEMS

Common Safety Rules

Do not work with anyone who does not implement these safe systems of work.

This is the foundation for safety for you to go home to your family when your shift is over.
General Requirements

• All HV Apparatus and Conductors Shall be treated as Live unless they have been made safe.

• No person Shall undertake any work on or within the safety distance of an exposed conductor or any part of the HV system unless they have been made safe.

• These following procedures must only be executed by competent and authorised staff.
Dangers & Risks of Working on HV Systems

- Switch it Off?
- Ensure it can’t be switched on?
- Position an earth between the work position and HV isolation points?
- Prevent danger from other LIVE apparatus?
- Ensure we are at the right place
- Document and formally communicate your Control measures?
Disconnected from any Live System

At or about Zero Voltage
isolated

-Disconnected from all sources of supply.
  - Isolating device in its Isolating position
  - Adequate physical separation or sufficient gap

-All Practicable steps taken to ensure it can’t be switched on.
  - Safety Locked & Caution Noticed – A must if possible.
  - HV/LV Fuses & links removed/retained & Caution Noticed
  - Sections of jumpers removed/retained
Adequate Isolation

Remember Isolated from **ALL** sources of Supply

- HV AND LV
- VOLTAGE & AUX TX’s
- COMMON NEUTRAL EARTHING
At about Zero Volts
Connected through
Rated Switchgear
Approved leads

A CME is always Connected Between
The Place of work
And Against
all points of HV supply
Rated Switchgear by a suitable
Authorised Switcher
Portable CME applied under the Personal
Supervision of SAP
Earthed

- Prove dead where Reasonably Practicable before the application of an earth:
  - Over Head Lines
  - Busbar/Feeder spouts
  - Associated LV

Where Practicable apply a Safety Lock on and Caution Notice to the switchgear mechanisms that can lock the circuit main earths that are applied in position.

Achieve unique control
To prevent danger from Adjacent Plant & Apparatus.
• Danger notices attached to adjacent LIVE apparatus.

You the SAP SHALL prevent any hazard remaining from causing injury or harm
• Dangers and risks at place of work
• Inadvertent contact with adjacent apparatus containing LIVE equipment.

You the SAP SHALL implement Control Measures using personal supervision of competent persons as a minimum to
• Establish Zone Of Work
• Apply Danger notices to Highlight the risk.
Identified

At the Point of Work By Approved Means

Because there is Now a Risk of being in the wrong place

So you the SAP SHALL:

• Personally obtain Physical Proof that it is dead
• Personally identify the point of work to the safety document recipient using approved means only
• Not issue any safety document or instruct work when no means of identification which is approved is available.
Released

• For work by issue of a Safety Document.
• Recipient to be conversant/understand
  – The Precise parts to work on
  – The extent and nature of the work
  – The safety precautions
    • (Identification of Risk & appropriate Control Measures)
Electrical Risk Assessment

- Lets See before the work starts have we made it:
  - Dead: Appropriate control measures
  - Isolated: Assessed the risks
  - Earthed: Documented the Risk Assessment
  - Screened: PTW etc
  - Identified

- **Confirm understanding of the Recipient**

- Brief the Working Party
As a Senior Authorised Person what does hazard mean?

Hazard or risk?

**Definition of a hazard**
A hazard is something (e.g. an object, a property of a substance, a phenomenon or an activity) that can cause adverse effects.

For example:

Water on a staircase is a hazard, because you could slip on it, fall and hurt yourself.
Loud noise is a hazard because it can cause hearing loss.
Breathing in asbestos dust is a hazard because it can cause cancer.
What does risk mean?

Definition of a risk
A risk is the likelihood that a hazard will actually cause its adverse effects, together with a measure of the effect. It is a two-part concept and you have to have both parts to make sense of it. Likelihoods can be expressed as probabilities (e.g. “one in a thousand”), frequencies (e.g. “1000 cases per year”) or in a qualitative way (e.g. “negligible”, “significant”, etc.). The effect can be described in many different ways.
What does risk mean?

For example:

The annual risk of a worker in Great Britain experiencing a fatal accident [effect] at work [hazard] is less than one in 100,000 [likelihood];
About 1500 workers each year [likelihood] in Great Britain suffer a non-fatal major injury [effect] from contact with moving machinery [hazard]; or
The lifetime risk of an employee developing asthma [effect] from exposure to substance X [hazard] is significant [likelihood].
What are the safety priorities?

Electrical hazards exist in almost every workplace. Common causes of electrocution are:

• making contact with overhead wires
• undertaking maintenance on live equipment
• working with damaged electrical equipment, poorly maintained or inspected
• using equipment detrimented by its environment - i.e. corrosion / dirt
• using electrical appliances, apparatus and plant as climbing aids
• using electrical appliances, apparatus and plant as shelves and convenient storage
• thinking you know more than you do
• not knowing when to stop
Should you be aware of overhead power lines?

• Do you know if there are overhead power lines on your site?
• Do you know where they are located?
• Do you know what the safe work clearance is?
• Strict regulations are laid down to cover any work that may have to be performed close to overhead power lines
Follow guidance for overhead lines.

Look up and Live
Golden Rule One

• If you’re not sure, stop and ask for help.
• Remember Don’t Take Risks!
• Never take risks. Follow Your Company Rules.
• Always wear your PPE

If you have any doubts about what protective equipment you need to wear at a particular site, ask before entering.