

HV OPERATOR TRAINING



ZONE SUBSTATION

ZSS

LOG BOOK



*Enabling the establishment, consistency and portability of agreed industry standards across
the Victorian Electricity Supply Industry*

TRAINEE NAME

Name

Issue date

EMPLOYER**MANAGER APPROVAL**

Name

Signature

Issue date

**EXAMPLE ONLY
NOT TO BE USED**

INTRODUCTION

This Log assists the trainee in documenting evidence of the practical (on-the-job) component of HV Switching to enable them to be assessed for authorisation to perform High Voltage Switching Operations (ZSS) on the Victorian Electricity Supply Industry (VESI) High Voltage Distribution Networks.

All items listed in the Log shall be completed and submitted to the Distribution Network for assessment with all accompanying evidence within 12 months or as stipulated by the Distribution Network.

Accompanying evidence

- A diary recording a brief account of daily activities and any fault switching carried out.
- All Access Authorities, Applications and Switching Instructions associated with the trainee's switching tasks.

PRE-REQUISISTE

Participants shall have completed initial training as stipulated in the VESI Skills and Training guideline for High Voltage Switching – ZSS.

SCOPE

Perform High Voltage Switching, Earthing and issue Electrical Access Authorities on:

- Sub-transmission and distribution apparatus within zone substations.
- Endorsed to perform supervision for the earthing of metal clad switchgear in zone substations.

USE OF LOG BOOK

- The trainee completing this Log shall be under the guidance of a mentor.
- The trainee shall carry the Log Book at all times during the training period and have the mentor print, sign and date when applicable.
- The mentor shall print their name, sign and date specific items when they feel that the trainee has a complete understanding of the task.
- The trainee shall remain under the direct supervision of the mentor whilst they are operating on a network as a ZSS in training.

ROLES AND RESPONSIBILITIES

Employer

- Shall ensure mentoring of trainees is carried out by a person that has current competencies and authorisation to carry out the work.
- Provide suitable tools, equipment and vehicles for the tasks being undertaken.
- Monitor trainee's progress.
- Ensure that the Log Book is completed correctly and signed off prior to assessment by the Distribution Network.

Team Leader/Supervisor/Manager

- Appoint mentor that has current competencies and authorisation to carry out the work.
- Assist with the planning and scheduling of ZSS class operator work.
- Ensure that suitable tools, equipment and vehicles are available for use.
- Ensure that the Log Book is completed correctly and signed off. Submit the Log Book and accompanying evidence to the Distribution Network's responsible person for review and verification **prior** to the assessment.

Mentor

- Work with the trainee at all times, reviewing the work practices and standards of the trainee's tasks/work.
- Maintain direct visual and audible contact with the trainee whilst they are switching on a network.
- Forward planning and scheduling of appropriate 'ZSS' class switching activities.
- Ensure that the Log Book is completed correctly and signed off prior to assessment by the Distribution Network.

Trainee

- Maintain an up-to-date Log Book and provide evidence of activity completion as described in the Log Book.
- Record in a diary a brief account of daily activities and any fault switching carried out.
- Gain the experience and knowledge required.
- Ensure that the Log Book is completed correctly and signed off prior to assessment by the Distribution Network.

1. SAFETY REQUIREMENTS

Correct Personal Protective Equipment (PPE) eg.:

Hard Working Gloves, Hearing Protection, Safety Glasses, Safety Harnesses, Safety Helmets, Safety Boots, Pole Top Rescue Kit and Personal Tool Kit

Correct Operating Equipment:

Insulated Gloves (HV), Insulated Gloves (LV), Insulated Sleeve (HV), Insulated Mat (HV), Operating Sticks, Modiewark, Approved Earth & Short Circuits.....

Conduct risk assessment of the work environment incorporating:

Personal safety (operator safety), work crew safety, Safe Work Method Statements, Site Risk and Environment Analysis and access hazards/public safety.....

2. PROCEDURES

Reference Manuals:

- Knowledge of and understands the use of Operations Manual, Fieldworker Handbook and Green Book.....
- Terminal Station Operating / Ownership Interfaces

Control Centre Familiarisation/Visit (optional as directed by Distribution Network)

Understands Control Centre planned work processes including communicating red marking of instructions to operators

Operating Instructions:

- Understands:
- Control Room Directed (Use of Switching Instruction Pad).....
 - Tick & Cross Check
 - Outcomes / Consequences of Operating Steps
 - Station Log Book Entries (Condition of the Substation)

Communication:

Understands correct protocols used to communicate with the Control Centre, other operating, contracting and emergency personnel, Work Crews and the general public.....

Apparatus Labelling and Numbering:

- Understands use of apparatus and equipment labelling for
- Primary equipment.....
 - Secondary equipment.....
 - Cables.....

Station Access

- Zone Substation Security.....
- Control Room Advice of Entry

Station Layout

Knowledge and understanding of the single line diagrams of Zone Substations and Terminal Stations Subtransmission ...

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2. PROCEDURES continued

Access Authorities

Written, issued and cancelled a minimum of the following Access Authorities and can provide copies:

- Electrical Access Permit (EAP) x 10
- Electrical Access Permit (EAP) on a Capacitor Bank x 1 ...
- Sanction for Test (SFT) x 1
- Vicinity Authority (VA) x 3.....
- Personal Safety & Service Clearance (PSSC) (receipt) x 1.....
- Notification of Work on Apparatus (NWA) X 1

Earthing Procedure

Undertaken:

- Priority Earthing
- Safe to Earth Test
- Discharging
- Application
- Operational Earthing (Point of Access to all sources of Supply).....
- Cone & Socket Portable Earths
- Ball & Clamp Portable Earths
- Mechanical Earth Switch (MES)
- Probe Earths.....
- Earths via Probe Earth Truck
- Earthing Supervision.....

Commissioning New Equipment

Understanding of:

- Labelling
- Nameplates.....
- PSSC – Clearance Procedure
- Pre-commissioning Tests.....
- Voltage Testing
- HV Phase Out.....

Barriers and Signs

Erected the correct barriers and signs for the listed access authorities and understands the reasons for their placement.

- Electrical Access Permit (EAP).....
- Vicinity Authority (VA)
- Caution Barriers & Signs
- Danger Barriers & Signs
- Sanction for Test (SFT).....

Apparatus Inspections

Correctly identified parts of station apparatus that should be routinely inspected

- Conservator oil level gauges
- CB oil and gas gauges
- Temperature indicators
- Cyclometers.....
- Gas Relay (Buchholz)
- General housekeeping

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2. PROCEDURES continued

Tags

Has correctly identified or can demonstrate the correct application and functions of the following tags associated with Access Authorities and Station Apparatus:

- Caution Under Access Authority
- Caution Men Working on Circuit.....
- Caution Re-Operation (CRO)
- In-operable

3. PROTECTION SYSTEMS, FUNCTIONS & FAULT LOCATION

Fault Location and Analysis

- Involvement in fault activity and restoration.....
- Use of diagrams.....
- Directions from the Control Centre
- Station Protection / Alarm Relay Targets / Interrogation...
- Co-ordination and communication with Emergency Services.....

Reclose function

Understands:

- Auto-reclose.....
- Suppression.....
- Live Line Sequence
- Dead Line Blocking.....

Protection Systems

Understands:

Sub-transmission Line Protection

- Distance Protection.....
- Directional Overload
- Differential Protection
- Pilot Wire
- Voltage Leakage / Neutral Displacement.....
- Sensitive Earth Leakage (SEL).....
- Back-up Transfer Tripping.....

High Tension Bus Protection

- Overload
- Bus Differential
- Back-up Transfer Tripping (X & Y).....

Main Transformers

- OLTC Out of Step
- Differential.....
- HT Overcurrent.....
- Restricted Earth Fault.....
- Gas Protection
- OLTC – Manage Stations Volts/Load.....
- Transformer Temperature

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3. PROTECTION SYSTEMS, FUNCTIONS & FAULT LOCATION continued

<p>Low Tension Bus Protection</p> <ul style="list-style-type: none"> • Overcurrent..... <input type="checkbox"/> • Protection..... <input type="checkbox"/> • Distance..... <input type="checkbox"/> • Structure Leakage <input type="checkbox"/> • Overvoltage <input type="checkbox"/> • Undervoltage <input type="checkbox"/> • Differential (High Impedance, Low Impedance)..... <input type="checkbox"/> <p>Distribution Feeder Protection</p> <ul style="list-style-type: none"> • Overload <input type="checkbox"/> • Earth Leakage <input type="checkbox"/> • Master Earth Leakage <input type="checkbox"/> • Back-up Earth Leakage <input type="checkbox"/> • Sensitive Earth Leakage..... <input type="checkbox"/> • Z Connected Overload (if installed) <input type="checkbox"/> <p>Capacitor Bank Protection</p> <ul style="list-style-type: none"> • Voltage Balance..... <input type="checkbox"/> • Current Balance..... <input type="checkbox"/> • Overload <input type="checkbox"/> • Fuses <input type="checkbox"/> • Earth Leakage <input type="checkbox"/> • Overvoltage <input type="checkbox"/> • Undervoltage <input type="checkbox"/> 			
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4. ZSS PRIMARY PLANT

MENTOR'S NAME	SIGN	DATE
<p>Switchgear</p> <p>Understands and has operated:</p> <ul style="list-style-type: none"> • Low Tension Circuit Breakers (Indoor) <input type="checkbox"/> • Low Tension Circuit Breakers (outdoor)..... <input type="checkbox"/> • Isolators <input type="checkbox"/> • Duo Roll Switch <input type="checkbox"/> • Rotary Double Break Switches <input type="checkbox"/> • Module Switches..... <input type="checkbox"/> • Arc Chute Switches (A/C Sw)..... <input type="checkbox"/> • Arc Buster..... <input type="checkbox"/> • Powder Filled Fuses (Fixed Clip & Hinged)..... <input type="checkbox"/> • Gas Switch..... <input type="checkbox"/> • Ground Fault Neutraliser (GFN) <input type="checkbox"/> • Earth Switch..... <input type="checkbox"/> • Transfer Bus Switching <input type="checkbox"/> • Neutral Earth Resistor (NER) <input type="checkbox"/> 		
<p>Transformers</p> <ul style="list-style-type: none"> • Main Transformers..... <input type="checkbox"/> • Station Service Transformers <input type="checkbox"/> • Voltage Transformers..... <input type="checkbox"/> • Current Transformers..... <input type="checkbox"/> • Isolating Transformers <input type="checkbox"/> 		
<p>Capacitor Banks & Harmonic Filters</p> <ul style="list-style-type: none"> • Single Module <input type="checkbox"/> • Multiple Module..... <input type="checkbox"/> 		

5. ZSS SECONDARY PLANT

Understands: <ul style="list-style-type: none"> • Status Indication & Metering <input type="checkbox"/> • Alarm Panels <input type="checkbox"/> • De-ion Switches <input type="checkbox"/> • Batteries & Chargers 240V, 50V & 24V <input type="checkbox"/> • Auxiliary Supplies (DC & AC)..... <input type="checkbox"/> • Control & Protection Supplies..... <input type="checkbox"/> • Indicating Lights..... <input type="checkbox"/> • Emergency Lighting <input type="checkbox"/> • Switchyard / Switchroom Lighting..... <input type="checkbox"/> • Heaters <input type="checkbox"/> • Switches <input type="checkbox"/> • Links <input type="checkbox"/> • Fuses <input type="checkbox"/> • Network Comms (SCADA Modem Reset) <input type="checkbox"/> 			
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6. SUB-TRANSMISSION SECONDARY PLANT

Dead Line Blocking <ul style="list-style-type: none"> • VF Intertrips <input type="checkbox"/> • VF Guard <input type="checkbox"/> • Supervisory Circuits..... <input type="checkbox"/> • Protection Zones..... <input type="checkbox"/> 			
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7. GENERAL SWITCHING / OPERATING

Demonstrated how to identify the correct primary plant switching device to be operated using: <ul style="list-style-type: none"> • Nameplate details <input type="checkbox"/> • Control Panel <input type="checkbox"/> • Mimic Panel <input type="checkbox"/> • HMI <input type="checkbox"/> • Station Single Line Diagram <input type="checkbox"/> 			
Conducted the following checks on switchgear to be operated: <ul style="list-style-type: none"> • Pre-operation / Serviceability <input type="checkbox"/> • Safety of Operation <input type="checkbox"/> • Switchgear Rating..... <input type="checkbox"/> • Post Operation / Serviceability..... <input type="checkbox"/> • Confirmation of action..... <input type="checkbox"/> 			
Demonstrated the correct method for: <ul style="list-style-type: none"> • Operating a switching device..... <input type="checkbox"/> • Locking & Tagging <input type="checkbox"/> 			
HV Customer Networks Has operated or is able to demonstrate an understanding ... <input type="checkbox"/>			

Appendix A

WHAT IS FERRORESONANCE ?

Ferroresonance causes an unstable **VOLTAGE** situation. The voltages that can occur may far exceed the voltage rating of the HV equipment (up to 7 times).

WHEN CAN FERRORESONANCE OCCUR?

Ferroresonance can occur when the capacitance of an **insulated cable** (HV U/G, or HVABC) and the inductance of a **transformer** (anywhere within the switching zone) are energised, or de-energised as a combination, on a **single phase switching device** (HV fuses, or isolators).

WHAT CAUSES FERRORESONANCE ?

Ferroresonance is caused when the capacitance of an **insulated cable** (HV U/G, or HVABC) **and** the inductance of a **transformer** (anywhere within the switching zone) become “tuned” or “matched” to each other and are energised, or de-energised as a combination, on a **single phase switching device** (HV fuses, or isolators). This causes a resonating effect between the inductive and capacitive voltages, which can produce voltages up to 7 times the operating voltage.

EXPERIENCING FERRORESONANCE IN THE FIELD

If ferroresonance occurs in the field, some of the following events may happen:

- The single phase switching device **you** are using may **flash-over**.
- The ACR or CB may operate.
- The LA's or HV equipment may be damaged.

OPERATING AROUND FERRORESONANCE

Once you have identified the **possibility** of ferroresonance, you should use the following steps:

1. Energise or de-energise the switching zone (combination) on a gang operated switch.
2. Contact the Control Room for instructions.

NOTE: A load-buster tool is **ONLY** for breaking current and cannot be used for ferroresonance because it is a voltage situation.

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STATEMENT OF NOMINATION FOR HV OPERATOR AUTHORISATION

I / we recommend that (Name of Trainee)

.....

be assessed for authorisation for High Voltage Operator Level

ZONE SUBSTATION ZSS

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	Name	Signed	Date
Mentor/s			

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Supervisor			
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Manager			
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