

(VESI) VICTORIAN ELECTRICITY SUPPLY INDUSTRY  
MINIMUM RULES  
FOR CARRYING OUT  
HIGH VOLTAGE LIVE WORK  
IN VICTORIA

Issue 2,  
February 2011

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## PROLOGUE:

These '**VESI Minimum Rules For Carrying Out High Voltage Live Work In Victoria**' have been formulated by the 'VESI Live Work Committee' and have been circulated throughout the electricity supply industry in Victoria for the guidance of persons and organisation that conduct High Voltage live work in Victoria.

Committee members are drawn from a broad range of experienced stakeholders representing Electricity Network Supply Companies within the State, Contracting Companies providing HV live work services and relevant HV Live Work Training Service Providers (RTO's). The Committee's charter is not aimed at specific HV live work practices / task methods, but rather the underpinning safety rules, policies and guidelines to be applied.

The purpose of the committee, and this document, is to promote safety and draw on a broad range of experience to establish, define and document appropriate rules and minimum safety guidelines relevant to conducting High Voltage live work in the Victorian Electricity Supply Industry, and to provide the achievement of consistent state wide industry application.

The rules contained herein pertaining to High Voltage live work are the minimum standard to be applied when conducting HV live work throughout Victoria. Organisations may enhance or supplement rules provided this does not result in reduced safety standards. The underlying aim of this document is to provide a consistent set of rules and guidelines, agreeable to all stakeholders, to be applied without alteration in order to eliminate confusion to lineworkers working across the State.

It is acknowledged throughout the electricity industry that safety is of the utmost importance, in regard to carrying out works, no other consideration is of equal importance.

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**DOCUMENT REVIEW:** This document is reviewed regularly.

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## AMENDMENTS

Amendments to the previous document (issue 1) are contained in this document (issue 2) and are as follows;

Throughout the document references to the Australian Standards AS5804.1, 5804.2, 5804.3

### Amended Sections;

- Document Review – page 2
- Definitions - 7
- Table 1 – page 8
- Safety observer – page 11
- Clearance Approach Distances / Contact Area – page 11
- HV Live Work minimum Approach Distances-Table 2, including Note 1, - page 12
- Working on one phase from 2 EWP's – page 13
- Earthing Requirements Of Plant And Equipment during HV Live Work – page 13
- Insulation / Cover-up policy – page 13
- Personnel Selection – page 16
- Training Standards / Experience – page 17
- Assistants, Persons working in association with HV live Work crews - page 19
- Electrical Testing & Labelling – page 20
- Single Person Aloft HV Live Work Tasks – page 22

### New sections;

- Disclaimer – page 2
- Elevated Conductor Temperature – page 7
- Making and Breaking HV Bridges / Cutting Conductors – page 14
- Work on Dual Circuits – page 15
- Medical Assessment – (as referenced from AS5804.1) – page 16
- HV Live work at night / Light & Other Conditions - page 22
- Appendix "D" Live pole standing training for peru/crane operators - page 34

## SCOPE:

The rules contained in this document are to be read in conjunction with the “Code of Practice on Electrical Safety for the Distribution Businesses in the Victorian Electricity Supply Industry” (The Green Book 2006), organisational live work manuals, relevant Australian Standards AS5804.1, 5804.2, 5804.3 and relevant Energy Networks Association (ENA) guidelines for carrying out HV live work.

The rules contained in this document shall be considered to be the fundamental rules for HV live work in Victoria. Australian Standards AS5804.1, 5804.2, 5804.3 and relevant ENA guideline documents pertaining to various types of HV live work can also be used for guidance as they provide general HV live work information including;

- Scope of methods;
- Applicable concepts;
- General definitions;
- Standards and responsibilities;
- Electric and magnetic fields;
- Approach distances;
- Work techniques and procedures;
- Personnel selection, training and certification;
- Equipment;
- Work considerations;
- Procedures in the event of an accident;
- General work practices; *and*
- List of international standards.

Where rules in this document differ with an existing Australian Standard or ENA guideline or rule, the information contained in this document shall prevail for HV live work being conducted throughout Victoria. Where specific issues pertaining to relevant HV live work are not covered in this document the relevant Australian Standards AS5804.1, 5804.2, 5804.3 or relevant ENA guideline may provide guidance.

These rules cover High Voltage Live Work distribution and sub-transmission work up to and including 66kV. Work defined as electrical operating is not considered HV live work and is not covered by this document.

This document does not constitute a HV live work manual nor does it set down HV live work practices and procedures.

These rules are not designed to substitute or override any presiding legislation, regulation or code of practice,

## CONCEPTS:

The concept of HV live stick techniques is based on the principle that lineworkers always maintain a minimum approach distance from any energised high voltage line or apparatus while performing work, using tools and equipment fitted to insulating sticks.

The concept of HV live glove and barrier techniques is based on the principle that Lineworkers always maintain a minimum of two levels of insulation to prevent phase to earth and/or phase to phase contact.

## DEFINITIONS:

### **NOTE: VOLTAGE REFERENCES;**

Throughout this document, voltage described as up to a specified voltage shall include that specified voltage, eg;

- Voltage up to 22kV shall mean up to and including 22kV
- Voltage up to 33kV shall mean up to and including 33kV
- Voltage up to 66kV shall mean up to and including 66kV.

### • **CONTACT AREA;**

The area within one metre of the nearest energised high voltage line or component whilst carrying out Glove and Barrier work.

### • **DROP ZONE;**

The area below the immediate work position where a conductor or live equipment connected to live apparatus could become uncontrolled (Dropped) during the work process. All sources of potential difference in the drop zone area capable of being reached, or which are, or could be at a different potential to the component being worked on shall be covered with approved insulating barriers.

### • **AUTHORISED ELECTRICAL OPERATOR (ELECTRICAL OPERATOR);**

An approved person who has been assessed as competent against an approved training standard to carry out switching operations on high voltage electrical apparatus.

### • **FORMAL APPRECIATION;**

Means a person has attended a training course conducted by an RTO (Registered Training Organisation) for a relevant period for a relevant tasks to gain a formal appreciation of the relevant subject matter.

### • **INSULATING BARRIER (also called Cover-up equipment)**

A barrier of insulating material specifically designed, approved and tested for use as a line cover, insulator cover, cutout cover, crossarm cover, deadend cover or as a cover for similar equipment. Insulating barriers may be rigid or flexible and are intended to prevent lineworkers from making accidental brush contact with live components or equipment at a different potential.

### • **INSULATING GLOVES AND SLEEVES;**

Insulating gloves and sleeves specifically designed, approved and tested to a rated voltage and worn with approved leather protective gloves.

### • **INSULATING PLATFORM;**

A platform of insulating material specifically designed, approved and tested for use with the live work Glove and Barrier method.

### • **LIVE WORK EQUIPMENT;**

All live work tools, rope, gloves and insulating equipment used for HV live work.

### **HV LIVE WORK STICK**

A solid or filled stick of insulating material specially designed, approved and tested for use in physically bridging the distance between the lineworker and energised components, between the energised components and earth, between adjacent phases, or to enable physical loads to be taken or tools to be applied.

### • **LIVE WORK GLOVE AND BARRIER METHOD;**

A method of performing HV live work where the lineworker is fully insulated from earth and other phases, using approved insulating gloves and sleeves, insulating platform and/or insulated elevating work platform and insulating barriers.

### • **LIVE STICK METHOD;**

A method of performing HV live work using tools and equipment mounted on HV insulated sticks with the lineworker maintaining the minimum approach distance from energised components.

- **HV LIVE WORK;**

All work involving access to high voltage components of electrical apparatus capable of being energised, without implementing the established practice of isolating, proving de-energised, and earthing at the worksite.

- **MENTOR:**

The Mentor is a person appointed in the workplace who is qualified with;

- a current and appropriate HV Live Work certification / qualification or equivalent, AND
- a minimum of two years experience.

The Mentor is not the assessor, but is a person or persons who assists the trainee develop their on-job skills and knowledge.

- **LIMITED HV LIVE WORK;**

Limited aspects of HV live work (stick work up to 22kV) for the purpose of vegetation control (Tree trimming etc).

*(see section on limited live work and training)*

- **OTHER CABLE SYSTEMS;**

Telecommunications cables, Pay TV cable, Control cables, Aerial earthed cables, Electrolysis drainage cables.

- **PROCEDURE;**

The documentation of a systematic series of actions (or activities) directed to achieve a desired result.

- **TESTED;**

Tested in accordance with the relevant standard.

- **MOBILE PLANT;**

Means cranes, elevating work platforms, tip trucks or similar plant, any equipment fitted with a lifting jib or boom and any device capable of raising or lowering a load. Mobile plant can only be considered as a vehicle when in the normal travelling mode and not in the working mode when determining minimum approach distances.

#### **PLANNING AND CRITERIA FOR DECIDING TO CARRY OUT HV LIVE WORK:**

Whenever power line work is being planned, the ability to readily interrupt or alter the network to enable work to be performed under shutdown conditions shall be considered as well as doing the work by Live Work Methods. The specific nature of the assets being worked upon and the proximity of other assets that may impose higher risks shall be considered. Eg. Surge arresters on substation or cable head poles. A risk assessment shall determine if HV live work on these structures can be carried out safely.

HV Live work options shall be rejected on site if the work party believes that the work cannot be completed within appropriate Live Work and Safety guidelines.

#### **ELEVATED CONDUCTOR TEMPERATURE**

Electrical apparatus operating with current will have a temperature above ambient. The temperature will depend on the current, the solar radiation and the prevailing wind.

Elevated conductor temperatures are a risk management issue for the live work process and are of particular significance for glove and barrier work as elevated temperatures may damage insulation integrity.

All HV live workers should be aware of this issue and take appropriate steps to ensure worksite safety.

## HV LIVE WORK ACTIVITY - HAZARD / RISK ASSESSMENT & CONTROL MEASURES

**Table 1** below identifies high voltage live work activities, associated risk factors and industry control measures to be observed to ensure and maintain a work environment safe and free from risk of injury.

TABLE (1):

Task / Activity	Hazards / Consequences	<u>Control Measures</u>
<p><b>1/ Work in the vicinity of live high voltage electrical apparatus, low voltage electrical apparatus, and other cable systems.</b></p>	<ul style="list-style-type: none"> <li>• Death                             <ul style="list-style-type: none"> <li>-Electrocution</li> <li>-Falls</li> <li>-Crushes</li> </ul> </li> <li>• Serious injury</li> <li>• Electric shock</li> <li>• High voltage burns</li> <li>• Low voltage burns</li> <li>• Flashover</li> <li>• Induction</li> <li>• Damage to plant, equipment and assets</li> <li>• Impact from falling objects (struck)</li> <li>• Energization via backfeed</li> <li>• Fire ignition</li> <li>• Inadvertent contact</li> </ul>	<ul style="list-style-type: none"> <li>• Site risk assessment procedure</li> <li>• Circuit identification process</li> <li>• Safe approach distances</li> <li>• Plant clearance requirements</li> <li>• Access procedures</li> <li>• Code of practice training</li> <li>• Auditing process</li> <li>• First aid training</li> <li>• Rescue procedures and training</li> <li>• Safety observer posted</li> <li>• Personal protective clothing &amp; Equip</li> <li>• Australian Standards AS5804.1, 5804.3</li> <li>• VESI minimum rules for HV live work</li> <li>• System protection devices</li> <li>• Asset inspection</li> <li>• Communications process</li> <li>• Worksite security (traffic &amp; pedestrian)</li> <li>• ENA Guidelines</li> <li>• Enterprise rules &amp; guidelines</li> <li>• Linesman training and qualifications</li> <li>• Refresher training</li> <li>• Procedures manual</li> <li>• Insulated plant equipment (EWP)</li> <li>• Regular equipment testing</li> </ul>
<p><b>2/ Work on high voltage electrical apparatus (HV Live Work)</b></p> <p><b>Including single person aloft tasks</b></p>	<ul style="list-style-type: none"> <li>• Death                             <ul style="list-style-type: none"> <li>-Electrocution</li> <li>-Falls</li> <li>-Crushes</li> </ul> </li> <li>• Serious injury</li> <li>• Electric shock</li> <li>• High voltage burns</li> <li>• Flashover</li> <li>• Induction</li> <li>• Damage to plant, equipment and assets</li> <li>• System feedback</li> <li>• Failure of plant, equipment and assets</li> <li>• Level of experience of linesman performing HV live work and operation of EWP.</li> <li>• Repetitive task injury</li> <li>• Adverse weather conditions</li> <li>• Fire ignition</li> </ul>	<ul style="list-style-type: none"> <li>• HV Live Work training</li> <li>• HV Live Work refresher training</li> <li>• HV Live Work procedures manual</li> <li>• Australian Standards AS5804.1, 5804.2, 5804.3</li> <li>• VESI minimum rules for HV live work.</li> <li>• Insulated HV live work equipment</li> <li>• Insulated plant equipment (EWP)</li> <li>• Safe approach distances</li> <li>• HV Live Work minimum approach distances</li> <li>• Manual Handling training.</li> <li>• Plant clearance requirements</li> <li>• Access procedures</li> <li>• Circuit identification process</li> <li>• First aid training</li> <li>• Rescue procedures and training</li> <li>• Site risk assessment procedure (including single person aloft aspects where required)</li> <li>• Safety observer posted</li> <li>• Code of practice training</li> <li>• Regular equipment inspection &amp; testing</li> <li>• Personal protective clothing</li> <li>• System protection devices</li> <li>• Auditing process</li> <li>• National Transmission and Distribution Training Package.</li> </ul>

		<ul style="list-style-type: none"> <li>• Specific Plant training &amp; Licensing.</li> <li>• Organisational Heat Stress Policy.</li> <li>• Rotation of work roles.</li> <li>• Conductor loads and tensions established</li> <li>• Asset inspection</li> <li>• Communications process</li> <li>• Worksite security (traffic &amp; pedestrian)</li> <li>• ENA Guidelines</li> <li>• Enterprise rules &amp; guidelines</li> </ul>
<b>3/ Using EWP's, Mobile Plant and Equipment In the vicinity of powerlines.</b>	<ul style="list-style-type: none"> <li>• Plant rollover</li> <li>• Plant contacting live assets</li> <li>• Traffic hazard in restricted area's</li> <li>• Damage to assets, plant and equipment</li> <li>• High voltage injection into low voltage assets</li> <li>• Flashover between EWP's</li> <li>• Fire ignition</li> </ul>	<ul style="list-style-type: none"> <li>• Plant specific training and licensing</li> <li>• Plant set up requirements and Earthing -separation between plant</li> <li>• Conductor cover-up practices</li> <li>• Traffic management and training</li> <li>• Traffic management equipment</li> <li>• Auditing process</li> <li>• Highly manoeuvrable plant</li> <li>• Site risk assessment</li> <li>• Safe approach distances</li> <li>• Safety observer posted</li> <li>• First aid training</li> <li>• Rescue procedures and training</li> <li>• Regular electrical testing of plant</li> <li>• Code of practice training</li> <li>• Regular equipment inspection and or testing</li> <li>• Personal protective clothing</li> <li>• Australian Standards AS5804.1, 5804.2, 5804.3</li> <li>• Step and Touch potential controls</li> </ul>

*NOTE: Listed activities 1,2 & 3 above must be read in conjunction with each other, not in isolation.*

The risk assessment and control measures table are based on the principals of the Australian Standards AS/NZS 4360 risk management.

<b>Hazard / Risk Consequences:</b>	<i>The risk / hazards have been identified as being potentially serious.</i>
<b>Control Measures:</b>	<i>The control measures listed are mandatory and appropriate combinations shall be strongly implemented and followed so as to maximise the mitigation of the identified risks / hazards.</i>
<b>Residual Hazard / Risk:</b>	<i>HV Live work and associated activities need to be continually monitored and managed as the implementation of the listed control measures render the risk / hazards as still being moderate.</i>
<b>Assessed:</b>	<i>VESI HV Live Work Committee</i>

## **RISK ASSESSMENTS:**

Prior to undertaking any HV live work task a risk assessment shall be conducted. The risk assessments shall be a formalised and documented process. The risk assessment document shall contain a range of prompts to help Lineworkers consider a wide variety of risk factors.

Lineworkers undertaking a HV live work task shall acknowledge having been involved in the formal risk assessment process through either signing or initialling the document before the task is performed. Formal risk assessment documents may use ENA guidelines in regard to the range of variables to be considered including where applicable;

- What is to be accomplished;
- How the work is to be carried out;
- Any other factors that may affect the safety of the crew or general public, including traffic management;
- Who is conducting the task giving due consideration to appropriate authorisation
- Potential second points of contact;
- Who will act as the designated safety observer(s);
- A HV Live Work Permit / approval to carry out the work has been gained;
- Auto-reclose suppressed and or HV Live Work sequence enabled;
- The structure to be worked on is inspected for soundness;
- The structures / conductors on either side of the structure to be worked on are inspected for soundness;
- Estimated conductor weights and loadings and recorded on the risk assessment;
- Weather conditions considered;
- Drop Zone considerations
- Work from multiple EWP's

Network asset owners / managers shall advise service providers / Lineworkers of any known hazards or risks that have the potential to impact on the safe outcome of the work e.g.

- conductor corrosion,
- defective insulator types,
- corroded or defective fittings
- structures in particular environments where hazards may be increased.

## **INSULATOR INTEGRITY PROVISIONS TO CONDUCT HV LIVE WORK:**

All insulators in the immediate work zone should be visually inspected prior to work to ascertain the existence and extent of any damage. This damage should be carefully assessed to ensure that the insulation is safe to approach and work on.

Any insulator or insulator string exhibiting physical damage or signs of electrical stress, such as elevated noise levels or surface discharging, shall be approached with care and appropriate safe working techniques adopted to minimise the risk of flashover and consequent injury to workers.

Where reduced insulating properties are known or suspected, work electrical hazards such as step and touch potentials may exist at the structure. Appropriate safe work practices should be adopted such as:

- performing a safe to approach test before climbing
- undertaking the work from an EWP
- covering the insulation with one or more mats
- undertaking the work at distance using HV live work sticks instead of the glove and barrier method.
- under outage conditions.

## **SAFETY OBSERVER:**

During all HV live work, one member of the work team shall be appointed as the designated Safety Observer. The designated Safety Observer's role is to alert the work team to any potentially unsafe actions or lack of compliance with approved work practices, procedures or documentation.

The designated Safety Observer shall:

- Be an authorised live HV worker; OR, have satisfactorily completed the formal training component of the relevant HV live work training course.
- Be identified on the risk assessment form;
- Be visually identifiable as the safety observer;
- Be positioned at a suitable location to observe the work being performed;
- As per the risk assessment, be in position before work starts;
- Be aware of how the task will progress and any changes made during the task;
- Have the authority to suspend the work at any time;
- Maintain effective and immediate communication with the work team at all times;
- Not perform any other task whilst HV live work is in progress;
- Suspend all work in the event of having to leave the site or significantly change position until he/she has returned/reached new location or has been replaced.

HV Live work is a team effort and as such all team members are safety observers for each other. The designated safety observer is appointed by the team.

The designated Safety Observer's role may be rotated between members of the work team, for example to reduce fatigue. If during a task the designated safety observer's view is impaired by some obstruction he/she must communicate this to the crew aloft carrying out the task and may for short periods transfer the role to a lineworker of the crew working aloft. When this occurs it shall be conscientiously communicated so that all members of the work party are aware at all times who is performing the role of the Safety Observer.

The "Designated Safety Observer" shall observe at all times whilst the HV live work task is in progress. The designated safety observer should be stationed at ground level unless another position provides greater viewing benefit to provide a holistic and broad view of the work.

*(Refer also to NOTE 2- section "Working on separate phases utilising 2 EWP's")*

## **CLEARANCES / APPROACH DISTANCES / CONTACT AREA:**

There is no HV Live Work Minimum Approach Distance that applies to glove and barrier work while wearing gloves and sleeves, carrying out glove & barrier work. Lineworkers shall observe a "Contact Area" which is defined as an approach distance of one metre to the nearest energised high voltage line or component (up to 22kV) whilst carrying out Glove and Barrier work, and shall wear appropriate gloves and sleeves at all times while in this contact area. Lineworkers shall maintain an air gap of 100mm between the uninsulated part of their body and any energised equipment at all times.

The tool insulation distance is the minimum effective length of exposed insulating material (stick), which is subjected to the voltage being contacted. This distance shall be measured between the metal end fitting at the conductor end of the insulating material and the hand mark where the stick is gripped by hand.

### **Working on one phase from an EWP.**

Where HV live work is being performed utilising one EWP, work shall be restricted to one phase at a time.

The minimum approach distance to live distribution and sub-transmission voltages is as per table (2). The distances contained in table 2 shall not be reduced at any time. If it is considered at any time prior to or during a task that the relevant distances cannot be maintained the task shall not be performed.

**TABLE (2)**

<b>HV LIVE WORK MINIMUM APPROACH DISTANCE (MM) UP TO 66kV</b>		
	<b>Stick Techniques</b>	<b>Glove &amp; Barrier Techniques</b>
<b>HV Live Work Lineworker</b> (The use of covers should be considered when working to 400mm clearances for Stick work up to 22kV)	Up to 22kV-400mm 66kV -600mm	Up to 22kV-Contact With gloves/sleeves. 100mm air gap between uninsulated parts of the body & live equipment.
<b>HV Live Work EWP insulated section</b> (see also Note 1 below)	Up to 22kV-250mm 66kV -600mm	Up to 22kV- Contact with Covers
<b>HV Live Work EWP and Mobile Plant Non-insulated section (to <u>Uncovered</u> conductor)</b>	Up to 22kV-700mm 66kV -900mm	Up to 22kV-700mm
<b>HV Live Work EWP and Mobile Plant Non-insulated section (to <u>Covered</u> conductor)</b>	Up to 22kV-400mm 66kV -600mm	Up to 22kV-400mm
<b>Mobile Plant Load (ie. Pole Erection)</b> (Double insulated where the load is covered and the conductors are covered)	Up to 22kV-400mm 66kV -600mm	Up to 22kV-400mm
<b>Insulated Lifting Equipment</b> (insulated to twice the voltage)	Contact	Contact
<b>Non-Insulated Lifting Equipment</b> (to <u>Covered</u> conductor)	Up to 22kV-400mm 66kV -600mm	Up to 22kV-400mm
<b>Non-Insulated Lifting Equipment</b> (to <u>Un-Covered</u> conductor)	Up to 22kV-700mm 66kV -900mm	Up to 22kV-700mm
<b>Conductor Spacing distance</b> (when temporarily relocating conductors the minimum distance to be maintained between the conductors/phases.)	Up to 22kV-450mm 66kV -900mm	Up to 22kV-450mm
<b>Stick insulation distance</b> (Must be calculated - See Note "A" below)	Up to 22kV-400mm 66kV -600mm Plus note "A" below	Up to 22kV-400mm Plus note "A" below
<b>EWP Basket Separation</b> (Utilising 1 or 2 live work EWP's working together)	(see note 2 below)	(see note 2 below)

**NOTE: "A"-** These distances are based on the Standard AS5804.3 and are equivalent to the HV live work lineworker Minimum Approach Distance. This Tool Insulation Distance must be increased where the task requires the hot end of the stick/ tool to go past the live conductor resulting in a reduction of the MAD.

**EG.** Tying in a 22kV conductor the stick end may go 150mm past the conductor position and as such the Tool Insulation Distance would be 400mm + 150mm = 550mm.

**NOTE: 1/**

When using an insulating EWP or insulating platform between circuits:

- A minimum of 250mm clearance shall be maintained between the basket of the EWP and the lower circuit, (could include Aerial earths, catenary cable, Pay TV, any other conductive mediums); or
- Where insulating barriers rated for the higher voltage are fitted to the lower circuit contact can be made with the covers.

**NOTE: 2/**

**Working on separate phases utilising 2 EWP's.**

Where 2 EWP's are utilised for HV live work, two phases may be worked on simultaneously provided that a minimum separation of two (2) metres (i.e. air gap) between the baskets and booms of the EWP's is maintained at all times.

No tools and/or equipment shall be passed between the EWP baskets while physically working on conductors. Care shall be taken to ensure that the work of one person does not compromise the safety of another. (ie. Encroach on the clearance space of another person).

### **Working on one phase from 2 EWP's.**

When work is being performed using 2 EWP's on the same phase, no minimum separation is required between the baskets but care is still required to ensure that the work of one person does not compromise the safety of another.

Where these EWP's are operated with one live worker in each basket, tasks such as; moving or displacing a conductor or installation or removal of a hopper may be undertaken provided they are working as a crew together and in a co-ordinated manner.

### **Safety Observers.**

Where work is being performed utilising 2 EWP's on separate phases simultaneously, two (2) Safety Observers shall be required.

Where work is being performed utilising 2 EWP's on the same phase simultaneously, one Safety Observer may be considered after a documented job safety assessment has been completed.

### **NOTE: 3/**

Mobile Plant being used in accordance with table 2 shall be operated under the direction of a certificated HV live work lineworker.

### **EARTHING REQUIREMENTS OF PLANT AND EQUIPMENT DURING HV LIVE WORK.**

In all cases, mobile plant and equipment such as EWP's, Cranes, Peru's, Task Trucks and any other mobile plant items being used in close proximity to live HV conductors in conjunction with HV live work shall be electrically connected to earth via a conductor from the chassis to a permanent or driven earth.

NOTE: The lowering of an earth chain is not an adequate means of earthing when undertaking HV Live work.

Where possible mobile plant items should be parked at least 2 metres apart or more to reduce potential difference issues and the separate mobile plant items separately earthed.

Where the mobile plant items are parked closer together than 2 metres they shall be bonded together to a common earth system / electrode.

Conductive poles being lifted into live HV conductors shall be bonded to the lifting plant prior to lifting and the mobile plant shall be earthed.

Mobile plant items that have control levers or remote controls that may be operated whilst standing on the ground shall not be used unless the operator is standing on a conductive mat that is electrically bonded to the vehicle OR, the operator shall be positioned on the vehicle, OR 6 metres from the vehicle earth (in the case of remote controls) before operating any crane controls.

**NOTE:** To protect ground staff and the general public, no contact shall be made with earthing (bonding) conductor or EWP(s) or Peru(s) or any other vehicle engaged in HV live work while the aloft work party is inside the contact area or is in any way in contact with live conductors.

### **INSULATION / COVER-UP POLICY:**

Insulating material is an integral part of any HV live work. Lineworkers carrying out glove & barrier work shall wear appropriately rated and tested insulating gloves and sleeves and:

- Always work from an EWP or insulating platform only;
- Ensure the EWP basket is fitted with a 50kV rated liner;
- Cables and HV live work equipment shall always be positively controlled; *and*
- Ensure all sources of potential difference capable of being reached, including within the "Drop Zone" are covered.

Before Glove & Barrier work is performed, gloves and sleeves shall be visually inspected for insulation integrity, and the gloves shall be field air tested. All other equipment shall also be cleaned and inspected prior to use. Insulating gloves and sleeves shall not be worn inside-out, and shall be worn with approved leather protector gloves. All intentional contact should only be made with the area of the gloves protected by the leather outers.

A Glove & Barrier crew shall work on one phase at a time only. Barriers and cover-up equipment is intended and designed only to protect lineworkers from accidental contact with components other than the component being worked on.

When undertaking Glove & Barrier work, gloves and sleeves shall be worn at all times inside the Contact Area and not removed until outside the Contact Area.

Insulating barriers should not be left on energised components overnight or for prolonged periods. Where this has occurred the integrity of the insulation cannot be depended upon, and the barriers shall be visually inspected and cleaned if necessary before re-use. Any doubt as to the integrity of the insulation value will require the barriers to be electrically re-tested.

Contact shall not be made with live components or barriers with any uncovered / unprotected part of the body. Contact may only be made with insulating gloves, sticks and appropriate HV live work tools.

Insulating barriers should be progressively fitted starting with the nearest live apparatus / source of potential difference, and should be removed in the reverse order. Where possible, covers should be fitted from below.

#### **MAKING AND BREAKING HV BRIDGES / CUTTING CONDUCTORS:**

##### **Principal**

Live work methods involve working with energized circuits, generally carrying loads. However, live work methods are generally not designed to switch loads. Current shall not be connected or disconnected unless a suitably rated load connection and disconnection device is used.

Current/load should be assessed or measured, where the load is to be measured a suitable measuring device should be used to measure load prior to making or breaking bridges or similarly prior to cutting conductors in association with fitting Mid Span Isolators (MSI's).

A hierarchy of control based on the complexity of the job and what is deemed as being the most practical alternative to reduce the risk to a point as low as reasonably practicable should be used when making or breaking bridges using HV live work techniques.

The procedures associated with the making and breaking of HV bridges and or cutting of conductors is of critical importance and as such a referral process / procedure should be used which allows the team to stop for a moment prior to the critical step of making or breaking a bridge or cutting a conductor and also allows the safety observer time to identify that everything is in order, as follows...

##### **Procedure**

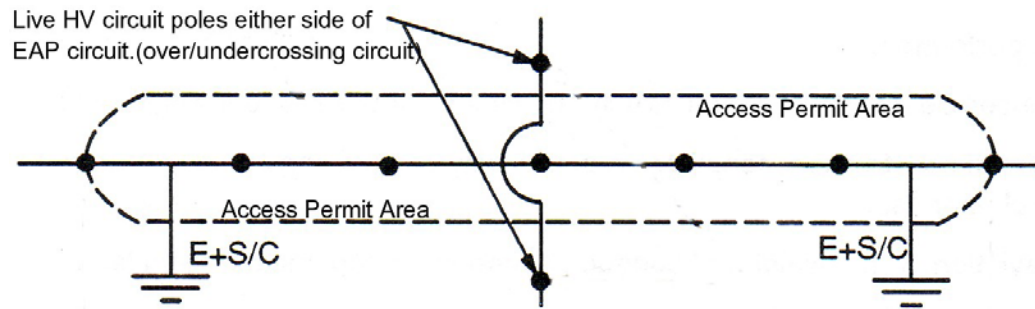
Once the task has been set up, all gear and equipment in place, prior to the actual task of making or breaking a bridge or cutting a conductor, the crew aloft must stop and refer to the safety observer on the ground and confirm that everything is in order to proceed.

#### **ISOLATION FROM STRUCTURES AND OTHER WORK PARTIES / SITES:**

Glove & Barrier work shall never be performed directly from a structure. Glove & Barrier work shall be performed from either an EWP fitted with a 50kV tested basket liner or from an approved insulated platform. The lineworkers belt / harness shall remain at the same potential as the lineworker, and prevented from contacting any component at a different potential to the lineworker. When HV live work is undertaken on a structure no work shall be performed on adjacent structures.

As the gap between an over/ under crossing can be compromised, no HV live work shall be carried out on the first adjacent poles of an over/under crossing where construction / maintenance work is being carried out concurrently.

EG.



## WORK ON DUAL CIRCUIT STRUCTURES

When undertaking work on dual circuit structures, positive steps shall be taken to identify the circuit to be worked on. These steps shall be discussed during the on Site Risk Assessment and can include circuit labels, HV switch No's, feeder diagrams etc.

Where the circuit not being worked on is of a different voltage, eg 66kV when performing 22kV G&B work, this shall be specifically recorded on the Site Risk Assessment and clear and specific instruction given to the safety observer to ensure the maintenance of clearances, that only the correct circuit is worked on and the application of barriers where appropriate.

## COMBINATION HV LIVE WORK AND ACCESS AUTHORITY WORK

### 1. Same Structure

HV Live work and work under an access authority may only be conducted on the same structure providing that:-

- The two work methods are not undertaken simultaneously,
- Clear transition points shall exist between the HV live work and access authority work. This transition process shall be communicated to all of the work party.
- HV Live work personnel who are required to work aloft and have signed on an access authority shall sign off the access authority before ascending to perform HV Live Work. For the access authority to remain current (open), the recipient in charge must remain signed on the permit and must remain on the ground.
- All conductors that have been moved or repositioned are secured using the appropriate techniques and equipment.
- HV Live Work minimum approach distances (table 2) are established and maintained using HV Live Work techniques and or equipment between the live circuit and access authority area.

### 2. Work not on the Same Structure

Where HV Live work is undertaken on a circuit above or below a circuit under access authority an isolation shall be established on that circuit between the work parties performing the access authority work and the HV Live work.

## COMBINING STICK METHODS WITH GLOVE & BARRIER METHODS:

As per relevant ENA guidelines, when HV live work is to be accomplished through a combination of glove and barrier and stick methods the work shall be limited to situations where the safety margins are not decreased by introducing the live stick method into the contact area. Clear transition points and communication shall exist between glove & barrier / Stick techniques.

Lineworkers shall be certificated in the HV Live Work method they are using.  
All lineworkers carrying out HV Live Work glove and barrier method within the contact area shall wear insulating gloves and sleeves and these shall not be removed until they have moved outside the contact area.

Any lineworker changing from glove and barrier method to stick method shall move outside the contact area, remove their insulating gloves and sleeves, and re-enter the work area observing the HV Live Work minimum approach distance appropriate for the method and voltage concerned.

The following combinations of HV live work Glove and Barrier and Stick methods are not permitted:

- One lineworker carrying out stick work and one lineworker carrying out glove and barrier work from the same EWP.
- One lineworker on a pole or structure carrying out Stick work and one lineworker on an Insulating platform carrying out Glove and Barrier work.

Supplementary to the above, given that some tasks naturally require a combination of Stick and Glove & Barrier equipment, HV live work methods to accomplish a task (Stick method or Glove and Barrier method) shall be determined prior to commencement and should not be changed to a different method during the task unless no alternative exists. Tasks should be started and completed using the same methodology.

#### **PERSONNEL SELECTION:**

A formalised selection process should be used to select persons to attend HV Live Work training courses. Selected persons **shall** be authorised Lineworkers and have appropriate attributes such as:

- Competent in a broad range of line work commensurate with the requirements of a Certificate 3 ESI Distribution (Powerline) lineworker and compatible with HV live work.
- Authorised to operate an EWP.
- Proven safety record.
- Able to give and receive clear and precise instructions.
- Demonstrated personal attributes such as responsibility, concentration and the ability to work in a team.
- Medically fit with no disabilities that might have a detrimental impact on the work party, ie (Skeletal problems, Cardiovascular problems, Seizures of any type, hearing or sight impairment, etc.)
- Not under the influence of any substance that may impair judgement

*(Ref - Australian Standard AS5804.1 High Voltage Live Working Part 1: General)*

#### **3.2 MEDICAL ASSESSMENT**

##### **3.2.1 General**

The good health of a live worker is essential to the safe operation of the live work process. The minimum requirements for health should be established as part of the live work process and live workers should meet these requirements both on appointment and while employed as a live worker.

Particular emphasis should be placed on current general physical condition, relative to the work requirements, taking into account normal physical and musculoskeletal functions, cardiovascular and respiratory systems and the functions of the senses necessary to carry out the work.

##### **3.2.2 Initial medical assessment**

Prior to employment or training as a live worker, a medical assessment shall be carried out by a qualified medical practitioner to check that the live worker can physically meet the requirements to carry out the intended work, and has no medical history or medical condition which could affect the safety of the live worker or the work team.

##### **3.2.3 Ongoing regular medical assessment**

Network operators or service providers should arrange routine medical assessments of their staff to ensure their continuing medical capability to perform their role safely.

## **SUPERVISION / LEADERSHIP:**

Ongoing safety, competence and adherence to work practices is of the utmost importance. Supervision of HV live work crews should be an active and regular process able to effectively monitor and inspect HV Live Work field performance.

Competent supervision will allow meaningful task / method discussion to take place, effective communication of requirements and observation of non-conformances. To this end, supervisors / Team Leaders of HV Live Work crews should be particularly familiar with HV Live Work practices, rules and methodologies. All HV live work crews / work sites should have a designated person in charge of activities.

## **TRAINING STANDARDS / EXPERIENCE:**

HV Live Work training courses shall provide trainee's with the theoretical knowledge, practical skills and competencies required to practice relevant HV live work on energised high voltage conductors / apparatus.

The VESI prerequisite for undertaking any stream of HV Live Work training is as follows;

- A current certificate of competency to Certificate 3 in ESI Distribution (Powerline) OR Authorised lineworker.

HV Live Work training courses in either Stick or Glove & Barrier or a combination of both shall be based on the Australian National Transmission and Distribution Training Package. HV Live Work training and assessment guidelines are also referenced in the Australian Standard AS5804.1 "High Voltage Live Working, Part 1: General.

HV Live Work training courses are competency based and supervised learning and assessment time frames may vary due to a range of factors such as competency levels and course participant numbers. The anticipated time frame of the formal training component for a nominal group of 4 trainees is approximately (4 weeks for a Glove & Barrier course to 33kV), (5 weeks for a Stick course to 66kV), (5 weeks for a combination course G&B and Stick to 33kV) and (6 weeks for a combination G&B to 33kV and Stick to 66kV).

Training providers shall be registered training organizations who's scope of registration accredits them to deliver the specific training courses. The integrity of the National Transmission and Distribution sector assessment process is centred on the need for all assessments attributing competence be conducted under the direction of a qualified RTO assessor. Only RTO's are recognised to attribute competence against competency standards.

Successfully carrying out HV live work in every respect is a combination of good basic training that provides the underpinning knowledge, skill and competency, combined with experience across a broad range of situations.

After successful completion of the formal HV Live Work training program (off-job component, under the supervision of an RTO Instructor / Assessor), trainees must complete a work experience component (workbook based) under the supervision of a mentor(s).

On completion of the work experience component a final capstone assessment will be conducted by the RTO (at least 70% practical) including analysis of evidence collected in the workbook. The training course combined with the work experience component including the final capstone assessment will be conducted over a period not exceeding 12 months. The relevant certificate is issued after successful completion of the final judgement / capstone assessment.

Currency of competence is attributed for 12 months only. Where continued currency is required, competency shall be Re-Assessed annually by the appropriate body.

**MENTOR:**

The Mentor is a person appointed in the workplace who is qualified with;

- a current and appropriate HV Live Work certification / qualification or equivalent, AND
- a minimum of two years experience.

The Mentor is not the assessor, but is a person or persons who assists the trainee develop their on-job skills and knowledge.

**RTO;**

Registered Training Organisation. The integrity of the National Transmission and Distribution Sector assessment process is centred on all assessments attributing competence be conducted under the direction of a qualified RTO assessor. Only RTO's are recognised to attribute competence against competency standards.

**OFF-JOB TRAINING**

Off-Job Training is the formal training course conducted by a suitably qualified and registered RTO. This training may take place in the workplace on actual assets or in a simulated environment or a combination of both. On successful completion of the formal training course under the direct and immediate supervision of a suitably qualified RTO assessor / instructor, trainees are issued with a work experience workbook.

**WORK EXPERIENCE**

After formal training has been successfully completed the work experience component (Workbook) must be completed. The workbook document is where the trainee works with a mentor(s) to complete a representative range of tasks and work functions listed in the workbook to further develop their HV Live Work skills.

After completion of the work experience component, analysis of evidence collected and a final judgement / capstone event will be conducted by the RTO to determine final competency, and relevant certification / qualification will then occur.

**REPRESENTATIVE RANGE OF TASKS**

Assessment criteria dictates for the judging of final assessment that a sufficient body of evidence be collected across a range of representative activities and work functions in order that a valid, reliable, fair and timely judgement about an individuals performance for attributing competence can be made.

Representative range of tasks are based on tasks undertaken during formal training and on typical HV Live Work activities a HV Live Work worker may be expected to perform in the field. The representative range of tasks are outlined in the work performance component (workbook), to collect evidence of tasks completed and tasks signed off by both the mentor(s) and the trainee.

In the best interests of the industry, distribution companies who own or manage the power line assets should and are encouraged to provide persons under training or working through work performance workbooks, access to network assets in an endeavour to contribute towards providing trainees with the best possible learning and experience outcomes.

**LIMITED HV LIVE WORK – VEGETATION CONTROL**

The aim of limited HV live work and the relevant limited HV live work training course is to provide the trainee with the theoretical knowledge and practical skills required to perform limited HV live stick tasks up to 22kV for the purpose of vegetation control (Tree trimming etc). The training deemed necessary is attached hereto as Appendix C.

The course involves the limited use of HV live work equipment such as hand sticks, fitting of conductor covers and insulated control ropes to facilitate the moving of HV conductors away from vegetation but does not allow actual work to be performed on conductors or the un-securing of conductors from a structure.

The course is for personnel who are employed or contracted to work on the relevant distribution network and the course participants shall meet the requirements of the personnel selection criteria as detailed in these guidelines. The program is based on limited components of the standard stick HV live work training course.

As no specific national code exists for this limited HV Live Work program, the course is based on relevant components of the national stick course and is recognised in Victoria by the VESI and Energy Safe Victoria (ESV).

After successful completion of the course (formal off-job component), under the supervision of an RTO Instructor / Assessor, trainees may be awarded with a certificate. It is not a requirement for participants to complete a workbook module under the guidance of a mentor as is required with a full HV Live Work course.

#### **ASSISTANTS, PERSONS WORKING IN ASSOCIATION WITH HV LIVE WORK CREWS:**

Persons working with a HV Live Work crew should have an understanding of HV Live Work techniques or at the very least be instructed in the HV live work task at hand prior to the task commencing.

Peru / crane operators regularly used in HV live work shall have a formal appreciation of the HV Live Work concepts used in HV Live Work pole changing techniques. Such operators shall undergo annual assessment or refresher training.

Where Peru / crane operators do not have a formal appreciation, or where hire cranes and operators are employed, prior to the commencement of work, operators shall be instructed on the procedure and safe working distances to be used. These operators shall be under the direct and immediate supervision of a nominated member of the HV Live Work team at all times. In line with standard HV Live Work processes, Operators shall undergo annual assessments and refresher training where required.

#### **FORMAL COMPETENCY AUDITING / ANNUAL RE-ASSESSMENT:**

To ensure ongoing safety, competence and adherence to work practices, HV Live Work lineworkers shall be regularly monitored in the field through formal competency auditing. These audits shall be formally documented, kept on file for analysis purposes and be conducted at least annually.

Audits shall assess demonstrated competencies against documented and approved HV Live Work techniques and tasks, work practices, rules, regulation, guidelines, equipment use storage and maintenance, and general site safety in order to provide a holistic review. Adequate time must be provided to undertake this competency assessment and this would be expected to be approximately 2 days per HV Live Work crew (3 or 4 persons).

Where lineworkers are found to be deficient in some area of work, remedial training specifically tailored towards those deficient area's shall be provided in line with the risks identified.

In regard to currency of qualifications, competency is attributed for 12 months only. Where continued currency / qualification is required, competency shall be Re-Assessed annually. As competency assessment against competency standards can only be attributed by an appropriately qualified RTO, annual Re-Assessment should be conducted by an RTO. Non-RTO,s do not comply with the State and Territory Training Authority Registration requirements as promulgated by Ministers of Vocational Education and Training under the Australian Recognition Framework.

If for some unforeseen circumstance a person is unable to attend the annual competency re-assessment, the re-assessment shall be re-scheduled within 2 months of the persons re-assessment anniversary date and the person may continue to perform HV live work up until their re-scheduled re-assessment provided their knowledge and skills are assessed as satisfactory with regard to their experience level, amount and type of work undertaken in the last 12 months and forthcoming work to be performed.

## MAINTENANCE OF COMPETENCY:

- **CONTINUED COMPETENCY;**

For reasons of personal and team safety, HV Live Work lineworkers shall always be assessed as having the appropriate health requirements that provide the safest possible work environment, not be under the influence of any substance that may impair judgement and must be able to continually display the appropriate attributes in line with initial selection criteria, and must undergo annual competency Re-Assessment.

- **RE-ENTERING THE HV LIVE WORK FIELD;**

Persons who have not practiced HV live work and not attended and successfully completed annual assessments and refresher programs for a period of up to 5 years shall undergo an appropriate refresher training program and assessment under the direct and immediate supervision of a trainer certificated in the techniques being assessed. Persons who have not practiced HV live work or not been annually assessed for a period of 5 years and over shall undergo a full HV Live Work training course or undergo an RPL (Recognition of Prior Learning Process) by a Registered Training Organisation to become re-qualified to practice HV live work and complete the OJT component.

## ELECTRICAL TESTING AND LABELLING:

All HV Live Work insulating equipment shall be electrically tested to prove insulation integrity on a regular basis or where the integrity of such insulation is suspect. In line with Australian Standards AS5804.1, 5804.2, 5804.3 insulating gloves, sleeves and flexible barriers designed for high voltage live work are available in four classes which are listed below.

CLASS	RATED VOLTAGE (AC Proof Test)	MAXIMUM USE VOLTAGE
1	10 kV	7.5 kV
2	20 kV	17 kV
3	30 kV	26.5 kV
4	40 kV	36 kV

The recommended maximum testing intervals are defined in the appropriate Australian Standards AS5804.1, 5804.2, 5804.3 and are indicated in the table below.

PERSONAL EQUIPMENT	TEST INTERVALS
Insulating gloves and sleeves	6 months
Insulating blankets	6 months
Rubber insulating line hoses, connectors and covers	6 months
Rigid line covers/barriers	12 months
Conductor support equipment, insulating platforms, temporary dropout tools, insulating sticks including hand sticks.	12 months
Insulated jumpers	6 months
MOBILE PLANT EQUIPMENT	TEST INTERVALS
Insulated EWPs	6 months
Insulated EWP basket liner	6 months
Insulated hoses	6 months

*High equipment usage may necessitate more frequent testing intervals.*

All insulating equipment shall carry an in-test identification mark (sticker or stamp), or be identified on a current test register that indicates to lineworkers that the equipment has been subject to and passed the appropriate electrical test and or identifies the next test month.

Equipment not identified as being in-test shall not be used to carry out HV live work.

## **NEW EQUIPMENT:**

Appropriate HV Live Work tools and equipment are essential for safe HV live work. Any and all equipment used, created, manufactured for the purpose of HV live work shall be designed, tested and approved specifically for HV live work, capable of being safely used on energised high voltage conductors / apparatus.

All equipment shall be rated and certified for use by the manufacturer and shall meet the relevant standards as listed in the Australian Standards AS5804.1, 5804.2, 5804.3. Other rules in regard to HV Live Work tools, equipment, care and maintenance shall be as specified by other relevant ENA guidelines for HV live work.

## **EWP PROVISIONS AND ASSOCIATED TOOLS:**

When not in use the EWP basket liner shall be covered to keep the inside clean and free from moisture and debris. Before using an EWP for HV Live work the insulated section of the boom shall be inspected, cleaned and dried. Items that might adversely affect the insulation value such as rope, cable, or washing hoses, shall be removed. Hydraulic hoses shall be non-conductive and be inspected and cleaned.

Where power tools are required in close proximity to live components, approved hydraulic tools are recommended. Where hydraulic tools are not available and electric power tools are the only type available, electric power tool leads shall not be brought into close proximity to live conductors. Electric tools and leads shall maintain at least one meter clearance from live components and leads shall be controlled and physically restrained.

### **USING HYDRAULIC TOOLS IN DIRECT CONTACT WITH LIVE HV APPARATUS**

Appendix A attached hereto is the guideline which outlines the minimum requirements for the use of hydraulic tools when they are used in direct contact with live HV apparatus and connected to the hydraulic tool outlets of an Elevating Work Platform (EWP) whilst undertaking high voltage live work (up to and including 33kV).

## **HV LIVE WORK APPROVAL:**

A communication process is required to ensure access to live network assets is approved. This includes;

- Worksite locations and nature of the work are to be advised to Network Control prior to commencing work
- Network Control are to be advised when the work is completed
- Auto-reclose facilities are identified and disabled (see protection systems)

Work crews are responsible for directly communicating the status of their allotted task to Network Control so that where more than one work team is working on the same circuit but at different locations, the procedure shall ensure that all teams are clear of the line before the auto-reclose equipment is returned to normal.

## **HV LIVE WORK CREW MEMBER REQUIREMENTS:**

The HV Live Work crew size shall be sufficient to safely carry out the tasks to be performed. All team members shall be familiar with and able to competently operate EWP controls and shall:

- Have a current first aid certificate
- Be familiar with communication procedures
- Be competent in aerial and pole top rescue procedures

## **SINGLE PERSON ALOFT HV LIVE WORK TASKS:**

Single person aloft tasks are to be read in conjunction with the HV Live Work – hazard / risk assessment and control measures TABLE 1, section 2.

A single person aloft cannot perform any task that involves physically/personally moving or displacing a conductor or installation or removal of a hopper.

All HV Live Work lineworkers undertaking single person aloft tasks shall be suitably instructed and authorised for this type of work.

### ***Allowable tasks by a single person aloft are as follows...***

- Install / fault detection and recording equipment
- Install / Remove insulating barriers / covers
- Install / Remove vibration protection
- Install / Remove bird covers – ( Limited to where working position does not involve working over a conductor, only permitted on intermediate or slight angle poles, NOT permitted on substation or switch or fused structures).
- Install / Remove “D” loops (off load only / no circuit connection)
- Install / Remove spreader ropes
- Replacement of insulator ties (pre-form ties not allowed)
- TVI rectification (limited to lubrication)
- Tighten hardware (crossarms and insulators)
- HV crossarm inspection

## **HV LIVE WORK AT NIGHT / LIGHT & OTHER CONDITIONS:**

Adequate light must be available to perform HV Live Work tasks. This can be achieved by providing sufficient light so as to eliminate distractive shadows from the worksite.

### **Adequate light**

- Workers need to be able to see what they are doing.
- The safety observer needs to be able to see what the workers aloft are doing.
- All other items within the work area that pose a risk need to be visible. Shadows in the work area may hide potential hazards.

Other areas identified as risks for HV live work at night may be considered for management of risk.

### **Moisture.**

- The point at which dew forms “dew point” needs to be considered.
- Weather conditions may not be as predictable due to the lack of day light.

### **Fatigue.**

- HV live work is such that it requires a high level of concentration and all members of the crew need to be alert.

### **Distraction.**

- At night the effect of flashing lights can lead to a more distractive workplace and the flashing may be annoying for the people aloft and at ground level.
- The worksite light should be such that it doesn't blind the workers by the extreme intensity ( Lighting should be passive)

### **Noise.**

- With the lighting equipment there may added noise due to the requirement for generators. This could impair the effectiveness of communication between those aloft and the safety observer or ground staff.

### **Extra equipment in the work area.**

- The extra equipment such as portable lighting towers need to be placed in safe positions.

#### **PROTECTIVE CLOTHING / APPAREL / JEWELLERY:**

Protective clothing (accepted for electricity supply industry work) covering the body from wrist to ankle including approved eye protection, safety hard hat and approved safety footwear shall be worn during HV Live work.

No exposed personal jewellery shall be worn during HV Live work. Other items such as mobile phones and pagers shall not be carried during HV live work as they may cause distractions and reduce concentration. Long hair shall be securely fixed and confined close to the head.

#### **WEATHER / CLIMATE / HEAT STRESS:**

HV Live work should not be performed in unsuitable wet, windy and stormy weather conditions. Prior to commencing any HV Live Work task weather conditions for the day shall be considered. Weather conditions for the day may be unsuitable because of:

- Electrical storm;
- Rain, fog, snow, mist, or sleet;
- Excessive wind velocity;
- Excessive heat;
- Excessive humidity;

Where work is being conducted and heat stress may be a factor, as may be the case with certain types of HV live work such as Glove & Barrier work, particularly on hot weather days, organisations carrying out the work shall have in place an inclement weather policy designed to minimise exposure to heat stress and hot environments as well as providing necessary work-rest cycles and water to minimize heat stress.

If HV Live work is in progress and the weather conditions deteriorate to a point where it becomes unsafe to continue, the HV Live work shall be suspended. Where temperatures rise above a comfortable level the risk of heat stress and fatigue increases and as such Glove & Barrier work should be suspended.

#### **PROTECTION SYSTEMS:**

In line with relevant Australian Standards and or ENA guidelines, auto-reclose equipment controlling a circuit on which HV live work is to be performed shall be suppressed for the duration of the work unless specific and careful engineering and safety analysis indicates otherwise, and additional safeguards are considered to ensure that the work can be performed safely.

HV Live Work rules, practices, procedures, guidelines, insulated gear and equipment are all designed and intended to provide the primary safety protection for HV live work. All persons working on live high voltage lines must be aware of system protection capabilities and not under the false assumption that protection trip devices are failsafe in the event of an incident. System protection devices are used to provide additional safety aspects however, depending on a range of factors, it should not be assumed that system protection devices will always operate to remove hazards, and may not operate in time frames to be of critical benefit.

Some modern feeder protection devices have mechanisms for readily varying their sensitivity, for the purpose of enabling them to detect any earth-fault-current initiated event at the earliest possible time. During any period when HV live work is being performed on a circuit protected by a device that has such a facility, the most sensitive setting shall be selected so as to provide the highest level of protection available.

## **INCIDENT REPORTING:**

Organisations shall have formally documented procedures in place for responding to incidents, that address all relevant considerations including;

- Rescue of injured persons;
- Immediate first aid and medical needs;
- Emergency switching requirements;
- Investigation and reporting requirements;
- Implementation of appropriate remedial measures;
- Communication requirements.

An incident is defined as, but not limited to the following;

- Electric shock or other serious injury;
- Flashover / Arc at, or close to the worksite;
- Complete or partial breakdown of any insulating tool or equipment;
- Electrical or mechanical failure of any HV Live Work equipment which did, or could have the potential to, cause an accident;
- Loss of conductor control.

Any and all HV Live Work incidents or potential incidents shall be reported as per OH&S Incident Notification Regulations, current Electricity Safety (Network Assets) Regulations and the company prescribed reporting processes.

## APPENDIX A

### GUIDELINES FOR USING HYDRAULIC TOOLS IN DIRECT CONTACT WITH LIVE HV APPARATUS

#### 1 Scope

This guideline outlines the minimum requirements for the use of hydraulic tools when they are used in direct contact with live HV apparatus and connected to the hydraulic tool outlets of an Elevating Work Platform (EWP) whilst undertaking high voltage live work (up to and including 33kV).

Only hydraulic tools meeting these requirements may be permitted to make contact with live apparatus.

All HV Live Work persons undertaking tasks where hydraulic equipment is to be used in direct contact with live apparatus shall be instructed in these procedures.

#### 2 Hydraulic Tools

The hydraulic tools approved for use are;

- (l) Low pressure (up to 2000psi [140bar]):
  - . Hydraulic drills, impact wrenches
  - . Conductor crimping equipment
  - . Hydraulic cutters

Individual hydraulic tools shall be selected using a risk assessment process, which includes that tools must automatically release in the event of a malfunction or oil pressure loss.

*Note:*

*High pressure systems using intensifiers and oil pressures at around 10,000PSI are not recommended as a high amount of energy will be released into the surrounding environment in the event of a hose rupture.*

#### 3 System Operating Requirements

The system hydraulic configuration, pressure and hydraulic fluid flow rates from the EWP shall match the system requirements of the hydraulic tools being used (as per manufacturer/s specifications).

The hydraulic fluid reservoir shall be fitted with an approved hydraulic fluid moisture filter (eg. filter type "Velcon" or equivalent) to ensure no moisture is transferred to the hydraulic fluid system. The hydraulic fluid moisture filter should be mounted between the hydraulic pump and main control valve.

The hydraulic hoses connecting the hydraulic tool from the EWP outlet shall be of an approved electrically insulating type and **shall be of a minimum length of 1 metre.**

#### 4 System Electrical Testing Requirements

The electrical testing requirements for use of hydraulic tools from EWP outlets are outlined below;

##### **4.1 Hydraulic Hoses**

All hydraulic hoses shall be non-electrically conducting and not to exceed 3 metres in length.

All hydraulic hoses shall be electrically tested at the same time as the EWP boom is tested (at 6 monthly intervals). **The hoses shall have maximum allowable leakage current of 60 microAmperes at 60 kV.**

All new/replacement hydraulic hoses shall undertake an initial electrical test prior to use in the field. **The hoses shall have a maximum allowable leakage current of 60 microAmperes at 60 kV.**

All new/replacement hydraulic hose assemblies shall undertake an initial pressure test prior to use in the field. The hose shall withstand 125 % of the rated working pressure.

Hydraulic hoses must be inspected prior to use and cleaned with an appropriate solvent as required.

#### **4.2 Hydraulic Hose standards**

All hydraulic hoses shall be selected to meet the anticipated working pressure requirements. Test reports from accredited laboratories should be used to aid verification of hydraulic hose performance.

#### **4.3 Low Pressure Hose**

The current Australian, IEC or SAE standards for hydraulic hoses do not make provision for suitably flexible non-conductive hose at the expected working pressures of 2250 PSI. This pressure requires hoses with a double synthetic braided construction.

Hydraulic hoses shall meet the electrical performance of category *100R6* in Australian standard 3791 (1991) or current equivalent.

Hydraulic hoses shall meet the rupture performance of category *100R7* in Australian standard 3791 (1991) or current equivalent.

Hose that have been identified as meeting these requirements are:

- ◆ Goodyear Saflex
- ◆ Nelphi Rubber Products B098

EWP vehicles must have a verification card or similar to indicate to users that the hydraulic system oil and hoses have undergone and passed the appropriate tests as outlined herein.

It is recommended that hydraulic equipment / tools be assigned to a specific vehicle and not interchanged between vehicles so as to not mix oil types, and reduce the risk of oil contamination.

## **5. Hydraulic Fluid**

### **5.1 Sampling**

Samples of hydraulic fluid taken from the truck shall be taken from the pressure point coupling on the intended *tool* pressure line (installed before the return filter). The truck shall be exercised first for a minimum of 10 minutes to circulate all the oil so that it reaches operating temperature.

Suitable fittings shall be used to safely extract the oil sample. Prior to taking test samples, any fluid in the sample collection fitting should be drained into a separate container and disposed of.

Samples should be obtained directly into a clean, dry and sterile container made from a material that does not interact with, or contaminate the sample. PVC containers are not recommended.

Samples should be promptly sealed to prevent the ingress of atmospheric moisture and not left exposed to sunlight.

The principles of fluid extraction listed Australian Standard 4002.2 (*Extraction of fluid samples from an operating system*) should also be used for further guidance.

## 5.2 Labelling of samples

Sample bottles should be labelled with the following information to aid identification:

Hydraulic Fluid Sample	
◆	Make and model
◆	Registration number
◆	Reservoir capacity
◆	Sample date
◆	Contact person & Telephone number
◆	Relevant Material Safety Data / reference

## 5.3 Preliminary & Visual Examination

Hydraulic fluid shall be tested at 6 monthly intervals. All samples of hydraulic fluid (500 mil each sample) shall be visually examined for presence of free water and sediment such as insoluble sludge, carbon, fibres, dirt or metal particles. Should significant moisture/impurities be detected in the system, the fluid shall be replaced.

## 5.4 Dielectric Strength

While applicable to oils, whose primary function is to provide very high dielectric strength, the following standards provide further guidance on the conduct of oil testing.

- ◆ AS 1767.1. ( Specification for unused mineral insulating oils for transformers and switchgear) and
- ◆ AS 1767.2.1 ( Determination of the breakdown voltage at power frequency)

The dielectric strength of an insulating fluid is the minimum voltage at which electrical flashover occurs between two metallic electrodes. It indicates the ability of a fluid to withstand electrical stress. Low dielectric strength indicates contamination with water, carbon or other foreign matter. High dielectric strength is no indication that a fluid does not contain some contaminants. The contaminants causing low dielectric strength can usually be removed with an approved filter.

Dielectric strength is a 'must' on all fluids, new or used, because if the insulating value is not good, then the fluid is unfit for use, regardless of any other condition. The dielectric strength test does not give an indication as to the deteriorated conditions of a fluid. A fluid that is highly deteriorated will give a high dielectric strength value if dry and free from solid impurities.

## 5.5 Dielectric Strength Results

In evaluating a fluid in terms of dielectric strength test results, it should be remembered that the dielectric strength of a fluid is an index to good maintenance.

**The average breakdown voltage obtained during the 6 tests\* shall be greater than 20kV/cm.**

\*(Australian standard 1767.2.1 requires each fluid sample to undergo 6 individual tests and the results analysed in a specific manner.)

All replacement fluid shall be di-electrically tested as per above prior to use in the field.

Any significant degradation of the hydraulic fluid from previous electrical tests shall determine the need to replace the fluid.

## **6 Cleaning**

Any hydraulic fluid spilled during the use of hydraulic tools shall be cleaned before the tool is to be used again on another job. An oil spill kit should be available.

Hydraulic hoses must be cleaned with an approved HV Live Work cleaner.

## **7 Flame Retardant Hydraulic Fluids**

Flame retardant hydraulic fluids shall not be used, as most are water based.

## **8 Vacuum Exclusion Valves**

Vacuum exclusion valves shall be fitted to the hydraulic circuit of all EWP's with a reach greater than 11 metres.

## **9 Hydraulic Oil Shutdown System**

EWP's shall be fitted with an automatic hydraulic oil shutdown system to the hydraulic tool line to ensure that hydraulic fluid will immediately cease to flow in case of hose rupture etc.

## APPENDIX B

### HV LIVE WORK TREE CUTTING AND LIMB REMOVAL IN AND AROUND HIGH VOLTAGE CONDUCTORS

Where tree limbs and foliage within 300mm of, or anywhere above live high voltage conductor are to be removed, it is considered to be a HV Live Work task. Persons engaged in HV Live Work tree cutting tasks should have attended appropriate training and be assessed as having the appropriate skills and knowledge for the task.

To ensure system security in the event of loss of control of a limb section, foliage / limbs must be cut in small sections of a size so as to not be able to bridge across conductors or between conductors and the supporting structure. Using HV Live Work pruners or approved hydraulic saw, trim foliage / cut limb in short sections (not more than 300mm in length).

Public safety must be carefully considered and managed in terms of both falling debris and possible step and touch potential at the tree base.

- On-site discussion / job planning and risk assessment must indicate that foliage / limbs (while being cut), can be managed and removed in a way so as to not come into direct contact with high voltage conductors.
- Controlled roping techniques of limbs may be required. The integrity / soundness of trees to be worked on and limbs to be removed must be determined.
- Give due consideration to covering low voltage and any other subsidiary circuits in the immediate work area.
- Where foliage / limbs above high voltage conductors are to be trimmed / cut, two persons aloft are required.
- Give due consideration to wind effects on both conductor sway and tree limb movements.
- When aloft, EWP basket must be positioned so as to maintain all appropriate clearances from live components and falling foliage / limbs.
- Where foliage / limbs to be trimmed are making contact or brush contact with a conductor, or could potentially make contact with a conductor during the trimming and removal process, one of or a combination of the following actions should be undertaken prior to trimming;
  - a) fit a cover(s) to the conductor(s)
  - b) restrain and control the foliage / limb with a HV Live Work stick
  - c) restrain and move the conductor away using a HV Live Work stick
  - d) restrain and control the foliage / limb using an insulated HV Live Work control rope anchored at ground level.
  - e) restrain and move the conductor(s) away using an insulated HV Live Work control rope anchored at ground level.
- Ensure a Safety Observer is in position prior to ascending.

#### Single Person Aloft

In the case of single person aloft, only (a), (d) and (e) above are applicable

Where single person aloft techniques are used, the HV Live Work tasks involved are limited to fitting of covers as required and fitting of control ropes if required and the trimming tasks are limited to foliage / limbs below or adjacent to but not above HV conductors.

In the case of single person aloft the EWP basket must be positioned below HV conductors.

## APPENDIX C

### VICTORIAN ELECTRICITY SUPPLY INDUSTRY (VESI) LIMITED HV LIVE WORK TRAINING COURSE, MODULE DESCRIPTOR.

#### 1. MODULE DETAILS

<b>Module name</b>	<b>LIMITED High Voltage Live Work Course.</b> (Vegetation Control)
<b>Nominal duration</b>	2 Days. The anticipated time frame of supervised learning or training deemed necessary to present the material and perform the relevant task within this program adequately is 2 days.

#### 2. MODULE PURPOSE

To provide the trainee with the theoretical knowledge and practical skills required to perform limited stick tasks up to 22kV for the purpose of vegetation control.

The course involves the limited use of HV live work equipment such as hand sticks, fitting of conductor covers and insulated control ropes to facilitate the moving of HV conductors away from vegetation but does not allow actual work to be performed on conductors or the un-securing of conductors from a structure.

#### 3. PREREQUISITES

Selected persons **shall** have a current certificate of competency as a lineworker to Certificate 3 in ESI Distribution (Powerline) or equivalent and should have appropriate attributes such as:

- Competent in a broad range of line work compatible with HV Live work .
- Authorised to operate an EWP.
- Proven safety record.
- Able to give and receive clear and precise instructions.
- Demonstrated personal attributes such as responsibility, concentration and the ability to work in a team.
- Medically fit with no disabilities that might have a detrimental impact on the work party, ie (Skeletal problems, Cardiovascular problems, Seizures of any type, hearing or sight impairment, etc.)
- Not under the influence of any substance that may impair judgement

#### 4. RELATIONSHIP TO NATIONAL MODULES

This program is based on aspects of the HV Live Work stick training course from the Australian National Transmission and Distribution Training Package.

No specific national code exists for this program, the course components are based on the national code and is recognised in Victoria by the VESI and Energy Safe Victoria (ESV).

5.	<b>CONTENT INCLUDES:</b>	<p>1/ Successfully complete a written assessment which demonstrates an understanding of the required skills, knowledge and competencies required for limited stick work up to 22kV for the purpose of vegetation control.</p> <p>2/ Assemble hand sticks, tools and insulated control ropes.</p> <p>3/ Inspect, clean and maintain equipment.</p> <p>4/ Fit HV conductor covers to lines.</p>
6.	<b>ASSESSMENT STRATEGY</b> <b>Assessment method</b>	<p>Check of understanding test paper. Oral questions. Practical Exercise and Observations. Other recognised methods</p>
	<b>Conditions of assessment</b>	<p>Theory session for discussion and written test together with practical field task for observation and assessment.</p>
7.	<b>LEARNING OUTCOME DETAILS</b>  <b>Learning outcome 1</b>  <b>Assessment Criteria</b>	<p><b>Demonstrate an understanding of the relevant VESI HV Live Work policies, safety instructions, VESI rules and general work practices, procedures and techniques for limited HV live work stick method up to 22kV for the purpose of vegetation control.</b></p> <p>1.1 Identify relevant Risk/Hazard assessment.</p> <p>1.2 Identify suitable structures for HV live work.</p> <p>1.3 Identify limits of approach to live components / conductors.</p> <p>1.4 Define the responsibilities of personnel associated with the practice of performing limited HV live work.</p> <p>1.5 Identify items of equipment used to perform limited HV live work.</p> <p>1.6 Demonstrate an understanding of the care and maintenance of insulating HV live work equipment.</p>

- 1.7 Identify the general work practice and Procedure (including mobile plant earthing and bonding) associated with live high voltage work.
- 1.8 Demonstrate an understanding of step and touch potential risks.

## Learning outcome 2

### **Inspect, clean and assemble equipment and perform various limited HV Live Work tasks including;**

- 1/ Fit high voltage covers to conductors
- 2/ Fit insulated control ropes to conductors
- 3/ Cut trees in close proximity or in contact with live HV lines up to 22kV

## Assessment Criteria

- 2.1 Identify the equipment required to perform limited HV live work including the clearing of vegetation in contact with live HV lines.
- 2.2 Identify the methods required to perform the vegetation clearing tasks.
- 2.3 Demonstrate the required skills and knowledge to perform vegetation clearing tasks in a variety of situations in line with the VESI "Minimum Rules for carrying out High Voltage Live Work in Victoria" document.
  - Fit HV covers to conductors where appropriate.
  - Fit insulated control ropes to conductors, move conductors to provide clearance or to vegetation to control limbs where appropriate.
  - Use insulated hand sticks to control conductors or vegetation where appropriate.
- 2.4 Perform and demonstrate competence in vegetation clearing tasks in various situation where the vegetation to be removed is below the conductors, alongside the conductors, and above the conductors.
- 2.5 Demonstrate the required clearances and safety procedures.

**8. DELIVERY OF THE MODULE**

**Delivery strategy**

Delivery strategies must be suitable for both theoretical and/or practical learning and module purpose.

It is recommended that learning and assessment be facilitated in a holistic and learning sequence manner.

After successful completion of the course (formal off-job component), under the supervision of an RTO Instructor / Assessor), trainees may be awarded with a certificate. It is not a requirement for participants to complete a workbook module under the guidance of a mentor as is required with a full HV Live Work course.

**Resource requirements**

Relevant HV Live Work manuals  
Presiding codes of practice  
Organisational policies and procedures  
National Industry guidelines for HV Live work

**Occupational health and safety requirements**

Occupational Health and Safety issues in all situations are to be demonstrated and safe working practices at all times. Electrical safety emphasis is paramount.

**9. PERFORMANCE ISSUES:**

**Team Work**  
**Display good concentration skills**  
**Take part in work site discussions**  
**Display understanding of work**  
**Work safely and to procedures**  
**Display confidence and competence**  
**Maintain appropriate clearances**  
**Observed correct work practices**  
**Use required safety apparel**  
**Always clean relevant equipment**  
**Good house keeping.**

## APPENDIX D

### VICTORIAN ELECTRICITY SUPPLY INDUSTRY (VESI)

#### HV LIVE WORK TRAINING DESCRIPTOR FOR PERU / CRANE OPERATORS TO STAND LIVE HV POLES

#### 1. MODULE DETAILS

**Module name** HV Live Work Pole Replacement for Pole Erector Crane Operators.

**Nominal duration** 6-8 Hours.  
The anticipated time frame of supervised learning or training deemed necessary to present the material and perform the relevant task within this program adequately is 6-8 hours.

#### 2. MODULE PURPOSE

This program covers one HV Live Work procedure only, that of live pole replacement and will provide the trainee with the theoretical knowledge and practical skills required to safely assist a HV Live Work crew in live pole replacement tasks up to 33 kV.

#### 3. PREREQUISITES

Participants must be experienced Pole Erector Crane Operator with the relevant licenses required to operate a Pole Erector Crane.

#### 4. RELATIONSHIP TO NATIONAL MODULES

This program is based on components of the National Transmission and Distribution Training Package (Powerline).

#### 5. CONTENT

1/  
Relevant HV Live Work method, policy, principals and general procedure.

- Risk/Hazard Assessment
- Structures
- Mobile Plant Earthing and Bonding
- General safety work practices
- Setting up the Pole Erector Crane
- Limits of Approach
- Step & Touch Potential
- Jib Positioning & Lifting Operation
- Barriers and Cover up Equipment

2/  
Carry out a pole replacement task under live conditions in conjunction with a HV Live Work crew or under live or simulated live conditions.

#### 6. ASSESSMENT STRATEGY

**Assessment method**

Short answer check of understanding Test  
Oral questions.  
Practical Exercise and Observations.  
Other recognised methods

**Conditions of assessment**

Theory room for discussion and written test together with practical field task for observation.

#### 7. LEARNING OUTCOME DETAILS

**Learning outcome 1**

**Outline the policy, safety instructions and general work practices and procedures for high voltage HV Live Work techniques related to live pole replacement.**

## Assessment Criteria

- Identify relevant Risk/Hazard assessment.
- Identify suitable structures for HV live replacement work.
- Identify plant limits of approach to live components / conductors.
- Define the responsibilities of personnel associated with the practice of HV Live Work pole replacement.
- Identify items of equipment used for HV Live Work pole replacement.
- Identify the general work practice and Procedure (including plant earthing and bonding) associated with live high voltage pole replacement.
- Demonstrate an understanding of step and touch potential risks.

## Learning outcome 2

**Install and/or replace a live high voltage pole in conjunction with a HV Live Work crew or under live or simulated live conditions.**

## Assessment Criteria

- Identify the equipment required to Install and/or replace a live high voltage pole.
- Identify the method required to install and/or replace a live high voltage pole.
- Demonstrate the required set up of the Pole Erector Crane including jib positioning.
- Install and/or replace a live HV pole.

## 8. DELIVERY OF THE MODULE Delivery strategy

Delivery strategies must be suitable for both theoretical and/or practical learning and module purpose.

It is recommended that learning and assessment be facilitated in a holistic and learning sequence manner.

## Resource requirements

Relevant enterprise work instructions  
ESI Guidelines for HV live work  
HV Live Work Manual

## Occupational health and safety requirements

Occupational Health and Safety issues in all situations are to be demonstrated and safe working practices at all times. Electrical safety emphasis is paramount.