

MINIMUM RULES  
FOR CARRYING OUT  
HIGH VOLTAGE  
LIVE LINE WORK  
**IN VICTORIA**

Issue 6, 15 June 2004



OFFICE OF THE CHIEF ELECTRICAL INSPECTOR  
VICTORIA

## STATEMENT FROM THE CEI

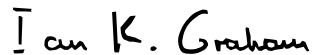
These '*Minimum Rules For Carrying Out High Voltage Live Line Work In Victoria*' have been formulated by the 'Live Line Technical Committee' established under Section 10 of the Electricity Safety Act 1998 and have been circulated throughout the electricity industry.

The committee consisted of a broad range of experienced stakeholders representing the following parties:

- Electricity Supply Companies;
- Contracting Companies;
- Training Providers;
- The Electrical Trade Union; and
- The Office of the Chief Electrical Inspector.

These '*Minimum Rules For Carrying Out High Voltage Live Line Work In Victoria*' aim to provide the Victorian Electricity Supply Industry (VESI) with a further understanding of the principles of the '*Code of Practice on Electrical Safety for the Distribution Businesses in the Victorian Electricity Supply industry (The Green Book 1999)*'.

I endorse these Rules as representing good industry practice.



Ian K Graham  
CHIEF ELECTRICAL INSPECTOR

## PROLOGUE:

This document has been prepared for the guidance of persons and organisation that carry out high voltage live line work in Victoria.

The Live Line Technical Committee Victoria was established under the auspices of the Office of the Chief Electrical Inspector Victoria. Committee members were drawn from a broad range of experienced stakeholders representing all Electricity Supply Companies within the State, Contracting Companies providing live line services, the Office of the Chief Electrical Inspector, Training Providers and the Electrical Trade Union.

The committee's charter is not aimed at specific live line 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 line 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 line work are the minimum standard to be applied when conducting live line work throughout Victoria, and 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.

Live Line work provides many benefits to many stakeholders as the continuing growth in the use of electricity has led to higher community demand for reliability and standards of service without interruption to supply.

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.

Ray Sanders  
COMMITTEE CHAIRMAN  
For and on Behalf of the  
LIVE LINE TECHNICAL COMMITTEE VICTORIA

## AMENDMENTS

Amendments to the previous document (issue 3: 25 February 2002) contained in this document (issue 4: 23 December 2002) are as follows;

- |    |         |  |
|----|---------|--|
| 1/ | Page 4  | This amendments page has been added.   |
| 2/ | Page 4  | Document review date has been added.   |
| 3/ | Page 20 | Using hydraulic tools in direct contact with live HV apparatus   |
| 4/ | Page 23 | An Appendix, (Appendix A), outlining the guidelines for using hydraulic tools in direct contact with live HV apparatus has been added. |

Amendments to the previous document (issue 4: 23 December 2002) contained in this document (issue 5: 8 September 2003) are as follows;

- |    |         |   |
|----|---------|---|
| 1/ | Page 5  | Appendix B: Live line tree cutting and limb removal in and around high voltage conductors has been added to the contents page.  |
| 2/ | Page 13 | NOTE 2: Under Mobile Plant, a section has been added to cover operator requirements when using a Task Truck / Tray Truck Mounted Crane in connection with HV live line work.  |
| 3/ | Page 21 | Single person aloft tasks, paragraph 4, the word trained has been replaced with instructed.   |
| 4/ | Page 24 | Section 4.1, first paragraph, has been changed to "All hydraulic hoses shall be non-electrically conducting and not to exceed 3 metres in length".<br>Section 4.1, second paragraph, has had the words "over 1 metre length" removed. |
| 5/ | Page 27 | An Appendix, (Appendix B), outlining the guidelines for Live line tree cutting and limb removal in and around high voltage conductors has been added.   |

**Amendments to the previous document (issue 5: 8 September 2003) contained in this document (issue 6: 15 June 2004) are as follows;**

- |    |              |  |
|----|--------------|--|
| 1/ | Page 12      | Some additional wording has been added to the section "Clearances" and a reference note added to the section "Safety Observer".                                    |
| 2/ | Page 13 & 14 | Notes have been expanded to define a number of scenarios when working from EWPs.   |
| 3/ | Page 15      | Isolation from structures and other work parties / sites:<br>Paragraph 2 has been updated.   |
| 4/ | Page 18      | Formal Competency Auditing / Annual Re-Assessment:<br>An additional paragraph has been added to cover participants who miss their annual competency re-assessment. |
| 5/ | PAGE 28      | APPENDIX B – LIVE LINE TREE CUTTING<br>The first paragraph has been amended to include training requirements for live line tree cutting.                           |

## DOCUMENT REVIEW DATE

Notwithstanding the fact that specific items and practices related to live line techniques are reviewed on a regular basis, this document is to be reviewed in its entirety on or about 15 June 2005.

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**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 1999), organisational live line manuals and relevant Electricity Supply Association of Australia (ESAA) guidelines for carrying out live line work.

The rules contained in this document shall be considered to be the fundamental rules for live line work in Victoria. ESAA guideline documents pertaining to various types of live line work are supplementary and should be used for guidance as they provide general live line 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 ESAA guideline or rule, the information contained in this document shall prevail for live line work being conducted throughout Victoria. Where specific issues pertaining to relevant live line work are not covered in this document the relevant ESAA guideline may provide guidance.

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

This document does not constitute a live line manual nor does it set down live line 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 live line hot 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 live line sticks.

The concept of live line 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:

- **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 line 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.

- **ELECTRICAL OPERATOR;**

A person tested against an approved training standard who has written authorisation 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 protective gloves.

- **INSULATING PLATFORM;**

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

- **LIVE LINE EQUIPMENT;**

All live line tools, rope, gloves and insulating equipment used for live line work.  
LIVE LINE STICK (also called Hot 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 LINE GLOVE AND BARRIER METHOD;**

A method of performing live line 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 LINE STICK METHOD;**

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

- **LIVE LINE 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.

- **OTHER CABLE SYSTEMS;**

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

- **PROCEDURE;**

A collection of techniques or competencies which together enable the total job outcome to be completed.

- **TESTED;**

Tested in accordance with the relevant standard.

**PLANNING AND CRITERIA FOR DECIDING TO CARRY OUT LIVE LINE 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 Line 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 live line work on these structures can be carried out safely.

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

## Live Line Activity - Hazard / Risk Assessment & Control Measures

**Table 1** below identifies high voltage live line 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</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> </ul>	<ul style="list-style-type: none"> <li>• Site risk assessment procedure</li> <li>• Circuit identification process</li> <li>• Limits of approach procedures and training</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</li> <li>• ESAA Guidelines for live line work</li> <li>• OCEI minimum rules for carrying out live line work in Victoria</li> <li>• System protection devices               <ul style="list-style-type: none"> <li>-Auto Reclose Suppression</li> <li>-Live Line Sequence</li> </ul> </li> </ul>
<p><b>2/ Work on high voltage electrical apparatus (Live Line)</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>• Experience of linesman performing live line work and operation of EWP.</li> <li>• Repetitive tasks</li> <li>• Adverse weather conditions</li> </ul>	<ul style="list-style-type: none"> <li>• Live line training</li> <li>• Live line refresher training</li> <li>• Live line procedures manual</li> <li>• ESAA guidelines for live line work</li> <li>• OCEI minimum rules for carrying out live line work in Victoria</li> <li>• Insulated live line equipment</li> <li>• Insulated plant equipment (EWP)</li> <li>• Limits of approach procedures and Training.</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               <ul style="list-style-type: none"> <li>-Auto Reclose Suppression</li> <li>-Live Line Sequence</li> </ul> </li> <li>• Auditing process</li> <li>• UTT98 National Transmission and Distribution Training Package.</li> <li>• Specific Plant training &amp; Licensing.</li> <li>• Organisational Heat Stress Policy.</li> <li>• Rotation of work roles.</li> </ul>

<p><b>3/ Work in the vicinity of 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>• Low voltage burns</li> <li>• Flashover</li> <li>• Induction</li> <li>• Damage to plant, equipment and assets</li> <li>• System feedback</li> </ul>	<ul style="list-style-type: none"> <li>• Linesman training and qualifications</li> <li>• Refresher training</li> <li>• Procedures manual</li> <li>• Insulated plant equipment (EWP)</li> <li>• Limits of approach procedures and 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</li> <li>• Safety observer posted</li> <li>• Code of practice training</li> <li>• Regular equipment testing</li> <li>• Personal protective clothing</li> <li>• Auditing process</li> </ul>
<p><b>4/ Using EWPs, Mobile Plant and Equipment In the vicinity of powerlines.</b></p>	<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> </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>• Limits of approach procedures and training</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> </ul>

*NOTE: Listed activities 1,2,3 & 4 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.

<p><b>Hazard / Risk Consequences:</b></p>	<p><i>The risk / hazards have been identified as being potentially serious.</i></p>
<p><b>Control Measures:</b></p>	<p><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></p>
<p><b>Residual Hazard / Risk:</b></p>	<p><i>Live line 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></p>
<p><b>Assessed:</b></p>	<p><i>OCEI Live Line Technical Committee Victoria</i></p>

## **RISK ASSESSMENTS:**

Prior to undertaking any live line task a live line 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 live line 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 ESAA 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 Live Line Permit / approval to carry out the work has been gained;
- Auto-reclose suppressed and or Live Line 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; *and*
- 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 LIVE LINE 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 live line sticks instead of the glove and barrier method.
- under outage conditions.

## **SAFETY OBSERVER:**

During all live line 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 certificated to carry out the particular work being observed;
- Be identified on the risk assessment form;
- 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 live line work is in progress; *and*
- 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.

Live Line 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 live line 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.

*(Also refer to NOTE 2 on page 13 and 14)*

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

There is no Live Line 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 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 (hot 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 live line 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>LIVE LINE MINIMUM APPROACH DISTANCE (mm) up to 66kV</b>		
	<b>Hot Stick Techniques</b>	<b>Glove &amp; Barrier Techniques</b>
<b>Live Line Lineworker</b> (The use of covers should be considered when working to 380mm clearances for Hot Stick work up to 22kV)	Up to 22kV-380mm Up to 66kV-680mm	Up to 22kV-Contact wearing gloves & sleeves
<b>Live Line EWP insulated section</b> (see Note 1 below)	Up to 22kV-380mm Up to 66kV-680mm	Up to 22kV-contact with covers
<b>Live Line EWP and Mobile Plant Non-insulated section (to <u>Uncovered</u> conductor)</b>	Up to 22kV-1000mm Up to 66kV-1000mm	Up to 22kV-1000mm
<b>Live Line EWP and Mobile Plant Non-insulated section (to <u>Covered</u> conductor)</b>	Up to 22kV-380mm Up to 66kV-680mm	Up to 22kV-380mm
<b>Mobile Plant Load (ie. Pole)</b> ( <i>Double insulated where the load is covered and the conductors are covered</i> ) (See Note 3 below)	Up to 22kV-380mm Up to 66kV-680mm	Up to 22kV-380mm
<b>Insulated Lifting Equipment (insulated to twice the voltage)</b>	Contact	Contact
<b>Non-Insulated Lifting Equipment (to <u>Covered</u> conductor)</b>	Up to 22kV-380mm Up to 66kV-680mm	Up to 22kV-380mm
<b>Non-Insulated Lifting Equipment (to <u>Un-Covered</u> conductor)</b>	Up to 22kV-1000mm Up to 66kV-1000mm	Up to 22kV-1000mm
<b>Phase to Phase distance</b> (Distance to be maintained between phases when moving conductors)	Up to 22kV-450mm Up to 66kV-900mm	Up to 22kV-450mm
<b>Tool insulation distance</b> (Hand Sticks)	Up to 22kV-450mm Up to 66kV-900mm	Up to 22kV-450mm
<b>EWP Basket Separation</b> (Utilising 1 or 2 live line EWP's working together)	(see note 2 below)	(see note 2 below)

**NOTE: 1/**

When using an insulating EWP or insulating platform between circuits:

- A minimum of 380mm 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 live line 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 working in close proximity. 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.

**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 live line lineworker.

Where a Task Truck / Tray Truck Mounted Crane is being used in connection with HV live line work the operator shall not stand directly on the ground while operating the controls. The operator shall stand on a conductive mat that is electrically bonded to the vehicle OR, the operator shall be positioned on the vehicle, before operating any crane controls.

**INSULATION / COVER-UP POLICY:**

Insulating material is an integral part of any live line 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 live line 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.

Glove & Barrier work shall only be performed on one phase at a time. 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 live line 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.

## **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.

While Live Line work is in progress on a particular structure, no other work shall be performed on that structure or any adjoining structure. No Live High Voltage work can be conducted within an access permit area concurrently with any other line work, unless isolations are established and maintained through normal operating means and or live line techniques between the live structure / circuit and the access permit area.

### **EG.**

Where work is to be undertaken on a double circuit structure such as a 66kV pole with a 22kV subsidiary circuit and the top circuit conductors are under access permit while the subsidiary circuit remains alive, isolations between the two circuits are to be maintained using live line techniques. No other work parties are to be working on the circuit under access permit conductors at the same time unless an isolation is established on that circuit. (eg. Bridges tied back or removed).

### **NOTE 1:**

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

## **COMBINING HOT STICK METHODS WITH GLOVE & BARRIER METHODS:**

As per relevant ESAA guidelines, when live line 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 line stick method into the contact area. Clear transition points and communication shall exist between glove & barrier / Hot Stick techniques.

Lineworkers shall be certificated in the live line method they are using.

All lineworkers carrying out live line 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 live line minimum approach distance appropriate for the live line stick method for the voltage concerned.

The following combinations of live line 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, live line 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 live line training courses. Selected persons should have appropriate attributes such as:

- Current certificate of competency as a lineworker
- Competent in a broad range of line 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

## **SUPERVISION / LEADERSHIP:**

Ongoing safety, competence and adherence to work practices is of the utmost importance. Supervision of live line crews should be an active and regular process able to effectively monitor and inspect live line 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 live line crews should be particularly familiar with live line practices, rules and methodologies.

All live line work crews / work sites should have a designated person in charge of activities.

## **MINIMUM TRAINING STANDARDS / EXPERIENCE:**

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

Training courses shall be from the UTT98 Australian National Transmission and Distribution Training Package 404 (Maintain Energised High Voltage Overhead Electrical Apparatus), underpinned by the relevant ElectroComms and EnergyUtilities Qualifications Standards Body of Australia (EEQSBA) NUE module Descriptors and NTDWP404 On Job Work Performance Module.

Training providers shall be registered training organizations who's scope of registration accredits them to deliver the specific training package 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 live line 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 live line training program (off-job component, under the supervision of an RTO Instructor / Assessor), trainees must complete the on-job workplace module NTDWP 404 under the supervision of a mentor(s).

On completion of the on-job component a final capstone assessment will be conducted by the RTO (at least 70% practical) including analysis of evidence collected in the workplace performance module. The NTDWP404 on-job component is completed over a minimum of 3 months, up to 12 months. The relevant certificate is issued after successful completion of the final judgement / capstone assessment.

Currency of competence for which competence is attributed towards gaining the required qualification is for 12 months only. Where continued currency / qualification 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 live line 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 component conducted by a suitably qualified and registered RTO. This training may take place in the workplace on actual assests 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 the On-Job NTDWP 404 work place performance module component.

**ON-JOB TRAINING**

After formal training has been successfully completed the On-Job component NTDWP 404 Work Performance Module must be completed to meet competency requirements for live line certification / qualification. The NTDWP 404 document is where the trainee works with a mentor(s) to complete and document the representative range of tasks and work functions over a minimum of 3 months, (up to 12 months) to further develop live line skills.

After completion of the on-job 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 live line activities a live line worker may be expected to perform in the field.

The representative range of tasks are outlined in the NTDWP404 work performance module, the instrument for collecting on-job evidence must be in line with the NTDWP404 module and listed tasks signed off by both the mentor(s) and trainee once tasks have been completed.

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 modules, access to network assets in an endeavour to contribute towards providing trainees with the best possible learning and experience outcomes.

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

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

Peru / crane operators regularly used in live line work should have a formal appreciation of the live line concepts used in live line 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 live line team at all times. In line with standard live line 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, live line 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 live line techniques and tasks, work practices, rules, regulation, guidelines, equipment use storage and maintenance, and general site safety in order to provide a holistic review.

Where lineworkers are found to be deficient in some area of live line 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 such as inclement weather, sickness or unavailability of an RTO assessor, 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 live line 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, live line 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 LIVE LINE FIELD;**

Persons who have not practiced live line 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 live line work or not been annually assessed for a period of 5 years and over shall undergo a full live line training course or undergo an RPL (Recognition of Prior Learning Process) by a Registered Training Organisation to become re-qualified to practice live line work and complete the OJT component.

- **INTERSTATE AND OVERSEAS LINEWORKERS;**

Lineworkers from interstate or overseas wanting to carry out live line work in Victoria shall be required to;

- a) Produce a recognised lineworkers certificate in the first instance and undertake OCEI regulatory training requirements as per the Electricity Safety Act 1998 administered by the OCEI so as to be able to operate as a lineworker in Victoria.
- b) Produce a recognised live line certificate and undergo an assessment to demonstrate appropriate theoretical knowledge and practical skills required to practice relevant live line work on energised high voltage conductors / apparatus. The Live Line assessment shall be under the direct and immediate supervision of a trainer certificated in the techniques being assessed, or, an experienced person who is certificated in the techniques being assessed and qualified to perform workplace assessments consistent with live line training requirements / outcomes.
- c) Where an assessment indicates a lack of theoretical knowledge and or practical skills, a recognised HV live line training course must be successfully completed including the OJT component prior to being permitted to perform live line work.

## ELECTRICAL TESTING AND LABELLING:

All live line 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 ESAA guidelines, insulating gloves, sleeves and flexible barriers designed for high voltage live line 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 standards as listed in ESAA guidelines as indicated in the table below.

<b>PERSONAL EQUIPMENT</b>	<b>TEST INTERVALS</b>
Insulating gloves and sleeves	6 months
Insulating blankets	12 months
Insulating line hoses, connectors covers	12 months
Conductor support equipment, insulating platforms & temporary dropout tools	12 months
Insulated jumpers	12 months
<b>PLANT EQUIPMENT</b>	<b>TEST INTERVALS</b>
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 date. Equipment not identified as being in-test shall not be used to carry out live line work.

**NEW EQUIPMENT:**

Appropriate Live Line tools and equipment are essential for safe live line work. Any and all equipment used, created, manufactured for the purpose of live line work shall be designed, tested and approved specifically for live line 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 ESAA guidelines or equivalent. Other rules in regard to live line tools, equipment, care and maintenance shall be as specified in the relevant ESAA guidelines for live line 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 Live Line 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 line work (up to and including 33kV).

### **LIVE LINE 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.

### **LIVE LINE CREW MEMBER REQUIREMENTS:**

The Live Line 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 LIVE LINE TASKS:**

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

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

When undertaking single person aloft tasks, all tasks are to be considered when the live line risk assessment is completed.

All live line 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
- 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

### **LIGHT CONDITIONS:**

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

#### **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 Live Line work.

No exposed personal jewellery shall be worn during Live Line work. Other items such as mobile phones and pagers shall not be carried during live line 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:**

Live line work should not be performed in unsuitable wet, windy and stormy weather conditions. Prior to commencing any Live Line 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 live line 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 Live Line work is in progress and the weather conditions deteriorate to a point where it becomes unsafe to continue, the Live Line 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 ESAA guidelines, auto-reclose equipment controlling a circuit on which live line 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.

Live line rules, practices, procedures, guidelines, insulated gear and equipment are all designed and intended to provide the primary safety protection for live line 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 live line 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 live line equipment which did, or could have the potential to, cause an accident;
- Loss of conductor control.

Any and all live line incidents or potential incidents shall be reported as per OH&S Incident Notification Regulations, current Electricity Safety (Network Assets) Regulations 1999 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 line work (up to and including 33kV).

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

All live line 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
<ul style="list-style-type: none"><li>◆ Make and model</li><li>◆ Registration number</li><li>◆ Reservoir capacity</li><li>◆ Sample date</li><li>◆ Contact person &amp; Telephone number</li><li>◆ Relevant Material Safety Data / reference</li></ul>

### **5.3 Preliminary & Visual Examination**

Hydraulic fluid shall be tested at 6 monthly intervals. All samples of hydraulic fluid (500 ml 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 live line 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**

### **LIVE LINE 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 live line task. Persons engaged in live line 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 live line 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 live line stick
  - c) restrain and move the conductor away using a live line stick
  - d) restrain and control the foliage / limb using an insulated live line control rope anchored at ground level.
  - e) restrain and move the conductor(s) away using an insulated live line 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 live line 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.