Electrical Safety Rules

CEOP8030

ESR Short Cuts and Links

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Essential Energy

ESR Short Cuts and Links

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Safety Message from Essential Energy's Chief Executive Officer

Safety is at the core of everything we do at Essential Energy. We all have a responsibility and obligation to identify and control risks, keep ourselves and our colleagues safe and protect the communities in which we operate. Working together in this way, ensuring that everyone understands and applies these Electrical Safety Rules, we can maintain a safe work environment.

The electricity network we own and operate is inherently dangerous. Every day, we perform work that has the potential for life threatening or life altering incidents and injuries. The Electrical Safety Rules have been developed as a uniform approach to ensure that anyone working on or near the electricity network returns safe. These Rules govern the way we work so that we all operate in an environment where we take personal responsibility for being informed, maintaining awareness of the potential hazards and implementing the necessary controls.

It is imperative that everyone – employees, visitors and contractors – comply with Essential Energy's safety policies and procedures. By adopting and applying the Electrical Safety Rules, and ensuring others are aware, we can all help mitigate inherent safety risks by implementing our critical controls.

The Electrical Safety Rules are underpinned by the *Electricity Supply (Safety and Network Management) Regulation 2014* and are founded on three simple steps that we must all follow:

1. Always put safety first
2. Always test
3. Always control your work site.

Making safety your own is a commitment that fosters a culture of accountability and care. Thank you for making safety your own and ensuring that everyone returns home each day to who and what matters most.

John Cleland

Chief Executive Officer

1.0 INTRODUCTION

ESR Short Cuts and Links

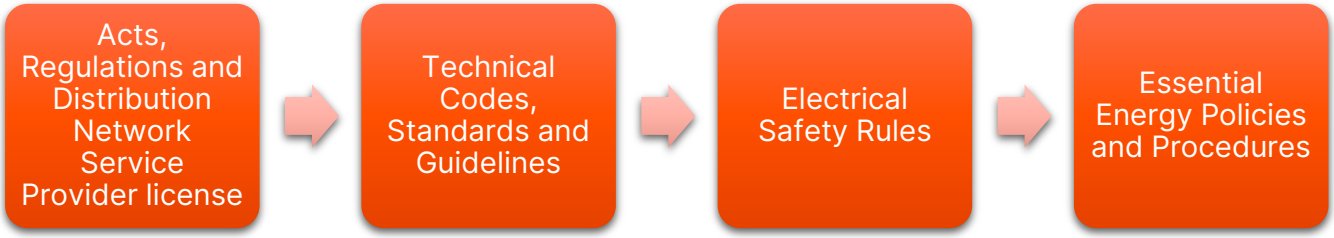
1.1 Application

These rules apply to all persons (Employees, Contractors and Accredited Service Providers) working on or near high voltage and low voltage electrical apparatus associated with Essential Energy's electricity network. These rules apply regardless of whether the electricity network is in a normal, abnormal or emergency state.

In the absence of alternate Electrical Safety Rules, these rules apply to all Essential Energy employees working on other electrical networks and customer electrical assets.

These rules deal only with electrical safety and are **not** the definitive rules for all work associated with the electricity supply industry (ESI) or Work Health and Safety (WHS) obligations.

Always read and apply these rules in conjunction with all other relevant, Regulations, Codes of Practice, Procedures, Guides and Standards, including those applicable within Queensland and the ACT.



ESSENTIAL ENERGY HEIRARCHY OF ELECTRICAL SAFETY

1.2 Exclusions

These rules **do not** apply to:

I Electrical apparatus operating at extra low voltage (see definitions) other than sections 4.4, 4.6, 9.4.1 and 9.9.

II Electrical apparatus that has been disconnected and removed from its normal operating location, for the purpose of dismantling or maintenance except as provided for in section 7.4.

III Direct current traction systems.

IV Testing bays covered by their own documented procedures (e.g. CEOM7006 series).

***NOTE**: that service mains, sealed service equipment, and load control relays, are covered by these Rules.*

In all cases above, low voltage electrical work must be carried out in compliance with *Safe Work Australia Code of Practice – Managing Electrical Risks in the Workplace August 2019.*

1.3 Audience

This procedure is intended for all employees of the Company, including but not limited to executives, managers, staff, contractors, and third-party resources.

2.0 KEY TERMS AND DEFINITIONS

Access Permit: a form of authorisation which allows access to work on or near, or to test electrical apparatus.

Access Permit Earths: approved earthing and short-circuiting equipment applied to conductors, as a requirement for the issue of an Access Permit, to ensure the conductors are earthed.

Accredited Service Provider (ASP): an individual or entity accredited through a ministerially recognised accreditation scheme to undertake contestable work.

Active Observation: to provide dedicated attention to the activity being carried out. This includes the clarification of any intended movement of plant with the safety observer prior to such movement taking place.

Apparatus: see Electrical Apparatus.

Approved: having appropriate organisational endorsement, or in the case of ASP equipment or PPE, meeting an industry standard or guideline for a specific function.

Attended: that a Safety Observer is ready at hand and keeps watch.

Authorised Person: a person with technical knowledge or sufficient experience who has demonstrated competency and has been approved, in writing, by Essential Energy to carry out specific duties associated with the supply or use of electricity.

Broad Supervision: the qualified worker must maintain regular visual and audible contact with the unqualified worker to inspect and assess the tasks and work that is being performed. The intent of the regular contact is to provide the unqualified worker with necessary instructions and directions with appropriate checks being made.

Cable: an insulated conductor, or two or more such conductors laid together with or without fittings, reinforcements or protective coverings. Cable, in these Rules, also means low voltage and high voltage aerial bundled cable (ABC).

Clearance Area: an area in which Access Permits may be issued. The clearance area is defined by the Access Permit earths, or the low voltage isolation points, or a combination of both.

Conductive: a material that will conduct or is capable of conducting sufficient electricity to cause a risk to life in accordance with AS 60479 Part 1 2002.

Conductor: any wire, cable, bar, tube or metal formwork designed for carrying electric current.

Confined Space: an enclosed area that is, or could become, contaminated or deficient of oxygen to the extent that it will not support life in accordance with the *Work Health and Safety Regulation 2017*.

Construction Earths: approved earthing and short-circuiting equipment applied to conductors that are not yet connected or are disconnected from the electricity network, to protect workers from induction, lightning or static build-up. Construction Earths are NOT controlled by the System Controller.

Contract Service Provider (CSP): an individual or entity authorised by Essential Energy to carry out work on the Essential Energy network under a contractual arrangement.

Control Measures: policies, standards, procedures, or actions to eliminate, avoid or minimise risks.

Danger Tag: an approved tag that has the words ‘Danger - Do Not Operate’ clearly printed on it that can be affixed to a device as an instruction against the operation of the device.

De-Energised: not connected to any source of electrical supply but not necessarily isolated.

Defective Apparatus: electrical equipment that is deemed to be unsafe to operate. A ‘Defective Apparatus’ tag must be physically affixed to such equipment, and where applicable an electronic ‘Defective Apparatus’ tag also applied.

Directly Supervised: the qualified person must be in direct visual and audible contact with the unqualified worker while the tasks and work is being performed.

Disconnected: the electrical apparatus cannot be energised by any operating work because of the absence of electrical connections to all sources of electrical supply.

- **Formally Disconnected** – Where conductors or apparatus are disconnected, and the disconnection has been *confirmed and recorded by System Control*.
- **Permanently Disconnected** – Where conductors or apparatus are redundant, disconnected, and *a system alteration notification* has been completed.

Drone: A small, remote controlled flying machine operated by an Authorised Person for the purpose of inspecting and/or capturing images of the electricity network, 3D mapping and conductor stringing.

Earthed: connected to the general mass of earth by a conductor to ensure and maintain the effective dissipation of electrical energy.

Earthed Situation: is a work location where an exposed (bare) earthed conductor or conductive material is within 500 mm of any part of a person's body.

Electrical Apparatus: any electrical equipment (including overhead lines) associated with the supply of electricity at high or low voltage, the conductors of which are live or can be made live.

Electrical Station: any enclosed substation or switching station whether of the indoor, outdoor or underground type including its associated foundation, culvert or basement.

Electrically Qualified: a person who is trained and competent in an electrical trade or profession such as a Power Line Worker, Electrical Fitter or Mechanic, Electrical Engineer or Cable Jointer.

Electricity Network: means transmission and distribution systems consisting of electrical apparatus which are used to convey or control the conveyance of electricity between generators points of connection and customers point of common coupling, and may include service fuses, service neutral link and metering apparatus.

Electrically Traceable: Any locations on the electrical network where the flow of electricity is not interrupted, by open switches, broken bonds, primary to secondary transformer windings etc.

Emergency: An assessed situation that requires immediate attention because of the imminent risk of death or injury to persons or substantial damage to property, network assets, plant or the environment. Loss of supply in itself does not constitute an emergency.

Emergency First Aid: procedures include releasing a person from live conductors, rescuing a person from a pole, structure, electrical panel, pit/pillar or from an EWP and undertaking resuscitation.

Employee: a person employed by Essential Energy (either under an individual contract of employment or apprenticeship or group apprenticeship scheme) to carry out work for Essential Energy.

Enclosed space: an enclosed area that is not intended or designed primarily as a place of work.

Energised: connected to any source of electrical supply.

Essential Aware Tape: temporary plastic tape erected around electrical apparatus to inform the public and emergency services workers that Essential Energy is already aware of that hazard or defect.

EWP: elevated work platform - also known as a MEWP - mobile elevated work platform.

Exposed Conductor: any electrical conductor, approach to which is not protected or guarded by a barrier of rigid material or covered by insulation adequate under a relevant Australian Standard specification for the voltage concerned and which is in sound condition.

Extra Low Voltage: a nominal voltage not exceeding 50 volts alternating current or 120 volts direct current.

Hand Excavation: using shovels, picks, mattock, crow bars, hydro/air vacuum etc to remove soil that must be used very carefully when close to live cables.

High Voltage (HV): a nominal voltage exceeding 1000 volts alternating current or 1500 volts direct current.

Immediately Available: the item is located on the ground at the work site and available without any delay, not on or in a vehicle which could be driven away.

Instructed Person: a person adequately advised or supervised by an authorised person to enable them to avoid the dangers electricity may create. An authorised person whose training has expired is not deemed to be an instructed person.

Insulated Elevated Work Platform: an elevated work platform (EWP) suitable for live work at the voltage concerned and complying with all statutory requirements and AS1418 Part 10.

Insulated: separated from adjacent conducting material by a non-conducting substance or airspace permanently providing resistance to the passage of current or to disruptive discharges through or over the surface of the substance or space to obviate danger of shock or injurious leakage current.

Insulating Barrier: A mat, tube or barrier of insulating material specifically designed, approved and tested for use as a powerline cover, insulator cover, switch cover, cross-arm insulating barrier or as an insulating barrier for similar equipment.

Isolated: separated from all known sources of electricity supply by means which prevent unintentional energisation of the conductors and which is assessed as a suitable step in the process of making safe for access purposes.

Issuer: a person authorised to issue an Access Permit to a recipient.

Known Permanent Earth: an earthing point that is tested periodically to ensure satisfactory resistance to the general mass of earth.

Live: energised or subject to hazardous induced or capacitive voltages.

Live Line Work (HV): work performed on or near components of an overhead line or apparatus energised or capable of being energised to high voltage without implementing the full protective practice of isolating, proving de-energised, earthing and short-circuiting.

Live Work: all work performed on components of low voltage conductors that have not been identified, isolated and proved de-energised.

Low Voltage (LV): a nominal voltage exceeding 50 volts alternating current or 120 volts direct current but not exceeding 1000 volts alternating current or 1500 volts direct current.

Low Voltage Short Circuits: temporary cables applied between all exposed low voltage conductors including the neutral as a control for low voltage de-energised work.

Mobile Plant: cranes, elevating work platforms, tip trucks or similar plant, any equipment fitted with a jib or boom and any device capable of raising or lowering a load.

Near: when there is a reasonable possibility of a person's body or any movable object that the person might be wearing, touching or carrying which is not designed for safe use on live conductors of the same or higher voltage, coming closer to a live exposed conductor than the minimum safe approach distances.

Network: see Electricity Network.

Non-intrusive testing: Testing or inspection of electrical apparatus that does not involve physical interaction and that does not encroach upon the safe approach distances. Examples include: thermography, Transient Earth Voltage (TEV) for partial discharge, Ultrasonic, Maximum Demand Indicator (MDI) reads, Visual Inspection and Capacitive Test points.

Operating Agreement: a written agreement between Essential Energy and another party in which an undertaking is given by a responsible person, that the electrical apparatus specified will remain isolated or disconnected until the written agreement has been cancelled.

Operating Restriction: electrical equipment that is part of the electricity network and is still serviceable but with a restriction on its operation or function.

Operating Work: work involving the operation of switches, the opening or closing of links, fuses, or other connections intended for ready removal or replacement, proving electrical apparatus de-energised for access, access permit earthing or short-circuiting, enabling or disabling protection equipment and voltage regulation equipment, locking and or tagging of electrical apparatus and erection of barriers and or signs, issuing of access permits and operating agreements, high voltage phasing and commissioning electrical assets by switching.

Ordinary Person: a person without sufficient training or experience to enable them to avoid the dangers which electrical apparatus may create

Overhead Line: an aerial conductor or aerial conductors, together with associated supports, insulators, hardware and other fittings used for the supply of electricity. Does NOT include poles, structures, or anything within an enclosed electrical station.

Personal Locator Beacons: self-contained radio transmitters with an encoded GPS location designed for emergency use where there is a threat of grave or imminent danger.

Personal Protective Bond (PPB): A bond to ensure all high voltage electrical apparatus or equipment being worked on is maintained at the same potential (e.g. a connection from the conductor to a point below a worker on a pole).

Personal Protective Equipment: clothing, equipment or substances, which when correctly used, protect parts or all of the body from foreseeable risk of injury or disease at work.

Phasing: a test using approved devices to determine whether energised conductors, may be satisfactorily connected together.

Point of Common Coupling (PCC): The point on a distribution system, electrically nearest to a particular customer or installation, at which other customers or installations are, or could be connected. The electrical assets on the installation side of the Point of Common Coupling are dedicated for the use of that electrical installation. See also Service and Installation Rules of New South Wales.

Qualified: a person who is formally trained and possesses written confirmation of such training and has the competence and skills to complete a given task.

Recipient: a person authorised to receive an Access Permit.

Safe Approach Distance (SAD): the minimum separation in air from an exposed conductor that must be maintained by a person or any object (other than insulated objects designed for contact with live conductors) held by or in contact with that person.

Safety Observer: a person deemed competent to observe the task and specifically assigned the duty of actively observing (see *active observation*) and warning against unsafe approach to live exposed conductors or other unsafe conditions including the need to perform a rescue if required (*refer to* CEOP2354 - Role of a Safety Observer). Historically referred to as a competent assistant.

Stand Alone Power System (SAPS): a generation facility independent of the main grid supplying one or more customers, generally incorporating renewable energy components such as solar or wind, along with a battery and sometimes a back-up generator (petrol or diesel).

Shall or Must: is to be interpreted as ‘mandatory’.

Should: is to be interpreted as ‘advisory or discretionary’.

STATCOM: a **STAT**ic **COM**pensator is an item of electronic equipment designed to provide voltage support and/or inject or absorb reactive power. May be combined with battery storage.

Substation: a switch yard, terminal station or place at which high voltage supply is switched, converted or transformed.

Switch: a device designed and used for the making and breaking of an electric circuit.

System: see Electricity Network.

System Controller: (previously System Operator) is an authorised person responsible for controlling or coordinating the operation across all or a designated part of the electricity network.

Tape Barrier: an approved marker used in conjunction with an Access Permit to delineate between areas, which have live conductors and the electrical apparatus on which it is safe to perform work. This barrier is yellow.

Temporarily Insulated: temporarily covered with insulating material which complies with the procedure CEOM4040a - Tools, Equipment & PPE – Testing & Inspection or industry guideline.

Vegetation Control Personnel: a person approved and authorised to undertake specific vegetation control activities on or near Essential Energy's electricity network.

Vicinity: a situation where there is a reasonable possibility that a person will, either directly or via a conducting medium come within the Safe Approach distance for an ordinary person, but not the safe approach distance for an authorised or instructed person

Work Area: an area within the clearance area where work is being undertaken on the electricity network involving single or multiple work sites that have been made safe for work under the provisions of this operational procedure.

Work Site: a site in the immediate vicinity of work that is being undertaken on the electricity network. The work site has been made safe for work under the provisions of this operational procedure. (Example: A pole, cubicle or pit would be a work site, perhaps one of several within a work area covered by an Access Permit being one of several Access Permits within a Clearance Area).

Worker: an employee of Essential Energy, an employee of a CSP, an employee of an ASP or a sub-contractor working for any of these.

Working Earths: approved earthing and short-circuiting equipment applied to conductors, additional to Access Permit Earths, following the issue of an Access Permit and associated with that access permit only. Working Earths cannot be shared by multiple access permits except by documented agreement between the access permit recipients.

3.0 SAFE APPROACH DISTANCES – PERSONNEL & EQUIPMENT

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In all the following tables the Nominal Operating Voltage is the phase-to-phase voltage. As an example, for a 19.1kV SWER line (which is a phase to earth voltage) the 33kV clearances apply.

3.1 Ordinary Persons Not Working on our Electricity Network

Ordinary persons (to whom these electrical safety rules do not apply) are to refer to the available Codes of Practice for guidance on electrical safe work practices.

- Safe Work Australia – Managing Electrical Risks in the Workplace.
- WorkCover - Work Near Overhead Power Lines.
- WorkCover - Work Near Underground Assets.

The Safe Approach Distances for an Ordinary Person are given in Table A below:

TABLE A: ORDINARY PERSON SAFE APPROACH DISTANCES

NOMINAL OPERATING VOLTAGE	DISTANCE (metres)
Up to and including 132kV	**3**
Above 132kV and up to and including 330kV	**6**
Above 330kV	**8**
Scaffolding work up to and including 33kV	**4**
Scaffolding work above 33kV	**6**

***NOTE**: For assets within the ACT the ACT Utility Networks (Public Safety) Regulation applies.*

3.2 Authorised or Instructed Persons Working on or Near the Electricity Network

Authorised or instructed persons working on or near the electricity network must comply with the following tables except when performing High Voltage Live Line Work.

3.2.1 Safe approach distances to live exposed conductors- Table B.

Except when performing work under the conditions for absolute limit of approach to live exposed conductors (refer next section 3.2.2) no part of a person's body and no material or equipment that the person is controlling, holding, carrying or is supported by, which is not insulated for the voltage concerned, is permitted to come any closer to any live exposed conductor than the safe approach distances shown in Table B.

TABLE B: AUTHORISED AND INSTRUCTED PERSON SAFE APPROACH DISTANCES TO LIVE CONDUTORS (MM)

Nominal Operating Voltage	Authorised Person	Instructed Person	Telecommunications Person & Drones
Up to and including 1000V (insulated conditions)	Contact Allowable	500	500
Up to and including 1000V (uninsulated conditions)	500	500	1,000
High Voltage up to and including 33kV	700	700	1,200
66kV	1,000	1,000	1,400
110kV & 132kV	1,200	1,200	1,800
220kV	1,800	1,800	2,400
330kV	3,000	3,000	3,700
500kV	3,900	3,900	4,600

***NOTE 1**: Covered conductors including Covered Conductor Thick (CCT) are not insulated for the voltage concerned and the safe approach distances of Table B must be observed*

***NOTE 2**: This table also applies to vegetation control by Essential Energy electrically qualified workers.*

***NOTE 3:** The distances for Telecommunications persons are from the SafeWork NSW Code of Practice 'Work Near Overhead Power Lines'.*

***NOTE 4:** High Voltage DC up to +/- 25kV maintain 700mm for Authorised or Instructed persons.*

***NOTE 5:** A drone must not be flown directly below and parallel to overhead conductors because in the event of signal loss, they automatically rise and 'return to base'.*

3.2.2 Absolute limits of approach to live high voltage exposed conductors by an authorised person – Table C

The conditions under which safe approach distances, can be reduced to the absolute limits of approach to live exposed conductors shown in Table C are:

I A written task specific risk analysis must be completed prior to the training and authorisation of the work team, (See CEOF3022 – Job Safety Analysis: Absolute Limits of Approach When Applying Earths); and

II All members of the work team must be qualified and trained in a manner that allows them to safely complete the work; and

III The work to be done must be specific, well defined and involve a limited number of steps; and

IV The absolute limit of approach to be observed must be specified; and

V A safety observer is required to observe the individuals completing the work. The safety observer must actively observe the work to ensure clearances are not compromised and that the work proceeds according to plan.

TABLE C: ABSOLUTE LIMITS OF APPROACH TO LIVE HIGH VOLTAGE EXPOSED CONDUCTORS

NOMINAL OPERATING VOLTAGE	ABSOLUTE LIMIT OF APPROACH (mm)
High voltage up to and including 33kV*	400
Above 33kV and up to and including 66kV	700
Above 66kV and up to and including 132kV	1,200

NOTE: ** When completing operating work the absolute limit of approach can be reduced from 400mm to 300mm for live exposed conductors up to and including 22kV.*

Under no circumstances may anyone come closer to live high voltage exposed conductors than the distances in Table C unless approved live line work techniques are used.

3.2.3 Safe approach distances – mobile plant and loads operated by an authorised or instructed person –Table D

A safety observer must be appointed at any time the crane, plant or load is in motion, in close proximity to live exposed conductors and/or is likely to move to within the distances provided in Table D.

Uninsulated mobile plant operating near overhead energised exposed conductors that has potential to encroach on or within the clearances outlined within Table D of this procedure, must be appropriately earthed, or where not practical, suitably barricaded to prevent step touch potentials between the grounded worker, plant and load.

NOTE: *Additional requirements apply for earthing insulated EWP for HV live work as detailed within CEOM7040 – High Voltage Live Work*

Trailing earth connections must be made to the mobile plant's dedicated earthing point, or where not available, to a suitable bare metallic surface on the chassis. Connections of trailing earths to known permanent earths are preferred, but where not available or practicable, then a driven metal earth stake, firmly anchored into the ground can be used.

Trailing earth leads must be of equivalent size and rating to approved HV portable short-circuit and earthing equipment. Inspections of trailing earth leads must be undertaken in accordance with CEOM4040a Tools, Equipment & PPE – Testing & Inspection, or an equivalent industry standard.

The safe approach distances in Table D do not apply to High Voltage live line work. The relevant safe approach distances for live work are detailed in the CEOM7040 – High Voltage Live Work .

No one shall remain in contact with any part of a crane, load or plant and the ground or other earthed situation while the crane or plant is operated within the safe approach distances listed for ordinary persons in Table A, unless:

I The operator stands on an equipotential conductive mat, which is electrically connected to all metalwork associated with the controls; or
II The crane, load or plant is not being moved; or
III They are handling a non-conductive tail rope.

TABLE D: SAFE APPROACH DISTANCES FOR CRANES, MOBILE PLANT AND LOADS TO LIVE EXPOSED CONDUCTORS

Nominal Operating Voltage	For instructed or authorised persons with a Safety Observer		For instructed or authorised persons without a Safety Observer	
	Uninsulated portions (mm)	Insulated portions (mm)	Uninsulated portions (mm)	Insulated portions (mm)
Up to and including 1,000V	1,000	Contact allowable*	2,000	1,000
Above 1kV and up to and including 11kV	1,200	700	2,400	1,400
22kV	1,200	700	2,400	2,000
33kV	1,200	700	2,400	2,000
66kV	1,400	1,000	2,800	2,000
110kV & 132kV	1,800	1,800	3,000	3,000
220kV	2,400	2,400	4,800	4,800
330kV	3,700	3,700	6,000	6,000
500kV	4,600	4,600	8,000	8,000

** The fibreglass insulation components of EWPs' are not designed for sustained contact and movement against conductors, as these components are easily damaged by the abrasive nature of the conductors.*

3.2.4 Minimum fixed clearances for conductors – e.g. isolation points- Table E

High voltage isolation points must provide the minimum fixed clearances detailed in Table E.

TABLE E: MINIMUM FIXED CLEARANCES

NOMINAL OPERATING VOLTAGE	FIXED CLEARANCE DISTANCES (mm)
Up to and including 11kV	*320
Above 11kV and up to and including 33kV	320
Above 33kV and up to and including 66kV	630
Above 66kV and up to and including 132kV	1,100

** For voltages up to and including 11kV it is permissible to reduce the minimum fixed clearance to 160 mm where there is no risk of the presence of birds, rodents, etc., which may cause a hazard. This table does not apply to commercially manufactured switchgear complying with National or International Standards.*

Legacy constructions often have limited conductor clearance to stays and streetlight brackets. Where stays and streetlight brackets are to be worked on within the clearances of Table E, controls need to be implemented e.g. temporary insulation applied - refer Figure 1.

Where the tension in a stay wire is being altered, the clearances in Table B apply, as it is no longer classified as a fixed clearance.

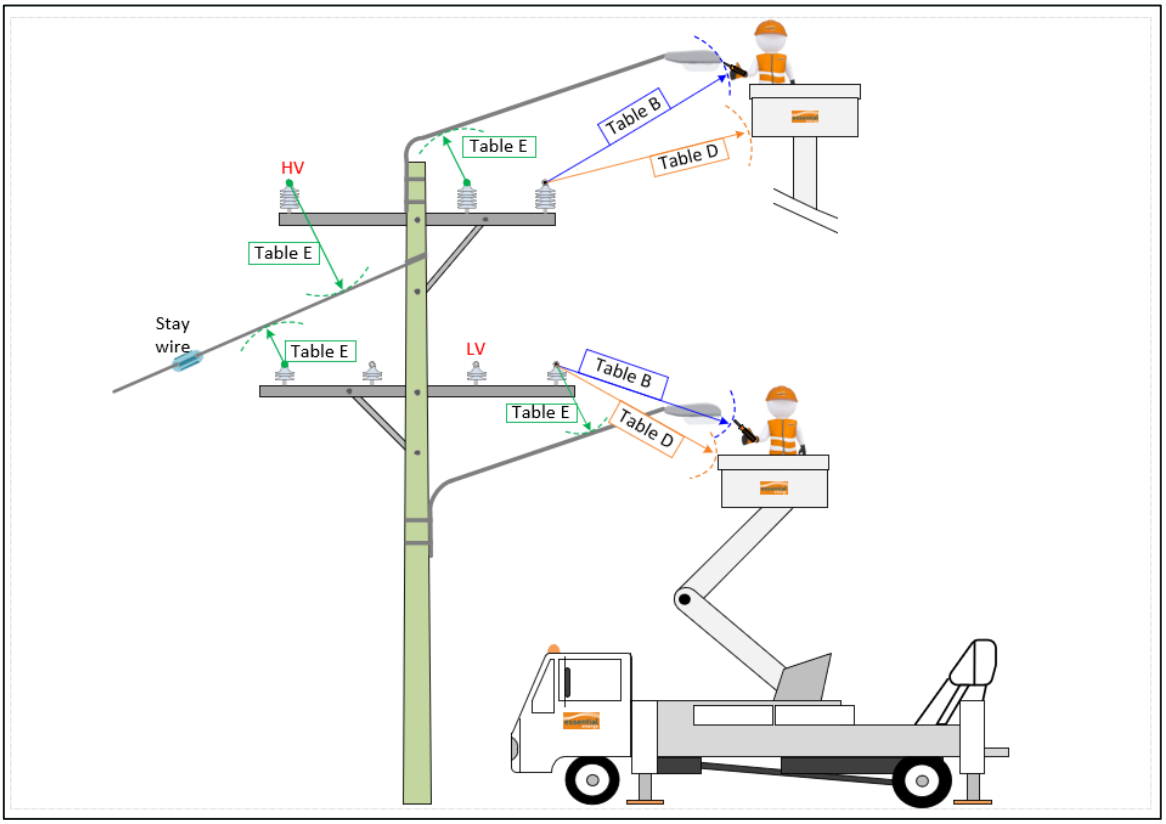

FIGURE 1: FIXED CLEARANCES FOR LEGACY STREETLIGHT BRACKETS AND STAYS

***NOTE**: All new work or augmentation to comply with drawing [CEOM7107.07]*

3.3 Vegetation Management

This section contains the requirements for vegetation management on or near Essential Energy mains and equipment, that is within the minimum safe working distances of an ordinary person (**TABLE A: ORDINARY PERSON SAFE APPROACH DISTANCES**). For voltages up to 132kV this is 3 metres.

The following Vegetation Control methods can only be used:

1. Standard Vegetation Control – Section 3.3.1 Tables F and G
2. Close Approach Vegetation Control (CAVC) – Section 3.3.2 Tables H, I and J
3. HV Live Work – Section 3.3.3
4. Network Outage – Deenergised Network under Access Permit (Section 5)

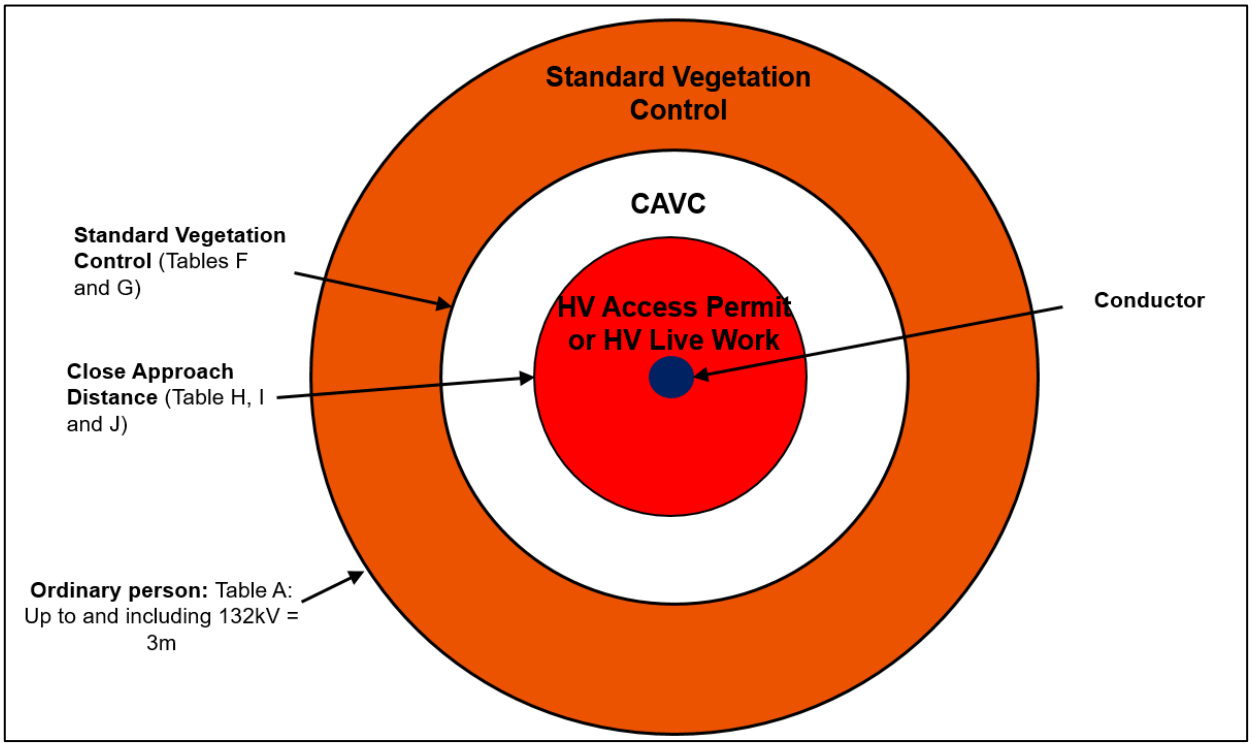

FIGURE 2: VEGETATION MANAGEMENT SAFE APPROACH DISTANCES

3.3.1 *Safe Approach Distances to live conductors for Standard Vegetation Control personnel- Tables F and G*

In all these tables the word 'above' means vegetation overhanging the conductors.

A safety observer is required when vegetation control personnel or any vegetation being trimmed or removed is within, or may come within, the distances specified in the safety observer required column of tables F & G below. The risk assessment may require a safety observer for a distance greater than that shown.

Standard Vegetation Climbers must not climb any vegetation below, beside or above conductors where any part of the vegetation is within or may move within 1200mm of 11kV and 22kV systems, or 1500mm of 33kV and 66kV systems (do not climb zone). These distances are to be taken as a vertical line that extends to the sky.

- Climbers must not position themselves so that they could fall or swing inside these distances.
- Climber must not attach themselves to vegetation that is inside these distances.

NOTE: *This does not prevent the tree from being climbed. Trees may be climbed where the canopy of the tree is within the do not climb zone, however the actual vegetation that is within the do not climb zone must not be climbed. The high point attachment must not be within the do not climb zone.*

TABLE F: STANDARD VEGETATION CONTROL - CLIMBERS AND GROUND PERSONNEL

<table>
<tr><th></th><th></th><th colspan="3">Using Insulating Tools/Equipment</th><th colspan="3">Using Non-Insulating Tools/Equipment</th><th rowspan="2">Safety Observer Required</th></tr>
<tr><th>Nominal Operating Voltage</th><th>Personnel Safe Approach</th><th>Insulated Tool Approach</th><th>Vegetation Clearance Below/Beside</th><th>Vegetation Clearance Above</th><th>Non-Insulated Tool Approach</th><th>Vegetation Clearance Below/ Beside</th><th>Vegetation Clearance Above</th></tr>
<tr><td>LV - Insulated/ Covered</td><td>500mm</td><td>300mm</td><td colspan="2">No clearance required</td><td>500mm</td><td colspan="2">No clearance required</td><td>500mm</td></tr>
<tr><td>LV - Exposed / Bare</td><td>1000mm</td><td>300mm</td><td>No clearance required*
100mm#</td><td rowspan="7">Not permitted</td><td>1000mm</td><td>1000mm</td><td rowspan="7">Not permitted</td><td>2000mm</td></tr>
<tr><td>11kV- 22kV</td><td>1200mm</td><td>700mm</td><td>1200mm#
700mm*</td><td>1200mm</td><td>1200mm</td><td rowspan="2">2000mm</td></tr>
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1000mm*</td><td>1500mm</td><td>1500mm</td></tr>
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<tr><td>220kV</td><td>3000mm</td><td colspan="2">3000mm</td><td colspan="2">3000mm</td><td rowspan="3">6000mm</td></tr>
<tr><td>330kV</td><td>3700mm</td><td colspan="2">3500mm</td><td colspan="2">3700mm</td></tr>
<tr><td>Above 330kV</td><td>4600mm</td><td colspan="2">4500mm</td><td colspan="2">4600mm</td></tr>
</table>

 # Applicable for Climbers

**Applicable for Ground Personnel only*

NOTE*: 12.7kV SWER is treated as 22kV and 19.1kV SWER is treated as 33kV.*

TABLE G: STANDARD VEGETATION CONTROL FROM AN INSULATED EWP

<table>
<tr><th colspan="2"></th><th rowspan="2">Insulated Mobile Plant Safe Approach With a Safety Observer</th><th colspan="3">Using Insulating Tools/Equipment</th><th colspan="3">Using Non-Insulating Tools/Equipment</th><th rowspan="2">Safety Observer Required</th></tr>
<tr><th>Nominal Operating Voltage</th><th>Personnel Safe Approach</th><th>Insulated Tool Approach</th><th>Vegetation Clearance Below/ Beside</th><th>Vegetation Clearance Above</th><th>Non-Insulated Tool Approach</th><th>Vegetation Clearance Below/ Beside</th><th>Vegetation Clearance Above</th></tr>
<tr><td>LV - Insulated/ Covered</td><td>500mm</td><td rowspan="2">Physical clearance (no contact)</td><td>300mm</td><td colspan="2">No clearance required</td><td>500mm</td><td colspan="2">No clearance required</td><td>500mm</td></tr>
<tr><td>LV - Exposed / Bare</td><td>1000mm</td><td>300mm</td><td colspan="2">No clearance required</td><td>1000mm</td><td>1000mm</td><td>1000mm</td><td>2000mm</td></tr>
<tr><td>11kV- 22kV</td><td>1200mm</td><td>700mm</td><td>700mm</td><td>700mm</td><td rowspan="6">Not permitted</td><td>1200mm</td><td>1200mm</td><td rowspan="6">Not permitted</td><td rowspan="2">2000mm</td></tr>
<tr><td>33kV- 66kV</td><td>1500mm</td><td>1000mm</td><td>1000mm</td><td>1000mm</td><td>1500mm</td><td>1500mm</td></tr>
<tr><td>110kV - 132kV</td><td>2000mm</td><td>2000mm</td><td colspan="2">2000mm</td><td colspan="2">2000mm</td><td>3000mm</td></tr>
<tr><td>220kV</td><td>3000mm</td><td>3000mm</td><td colspan="2">3000mm</td><td colspan="2">3000mm</td><td rowspan="3">6000mm</td></tr>
<tr><td>330kV</td><td>3500mm</td><td>3700mm</td><td colspan="2">3500mm</td><td colspan="2">3500mm</td></tr>
<tr><td>Above 330kV</td><td>4500mm</td><td>4600mm</td><td colspan="2">4500mm</td><td colspan="2">4500mm</td></tr>
</table>

***NOTE 1**: Refer to Table D for EWP Safe Approach Distances without a Safety Observer.*

***NOTE 2:** 12.7kV SWER is treated as 22kV and 19.1kV SWER is treated as 33kV.*

3.3.2 Safe Approach Distances to live conductors for Close Approach Vegetation Control –Tables H, I and J

All Close Approach Vegetation Control (CAVC) vegetation control work must be done with a Safety Observer. CAVC techniques are not permitted near energised conductors above 66kV. In all these tables D.A.R. means Disable Auto Reclose. CAVC of vegetation above energised high voltage conductors is only permitted from an insulated EWP. D.A.R. is only required when cutting above and beside with CAVC, it is not a requirement when cutting below the conductors. Any cutting closer than the clearances in these tables must be completed under Access Permit conditions.

CAVC Climbers must not climb any vegetation below, beside or above conductors where any part of the vegetation is within or may move within 700mm of 11kV and 22kV systems, or 1000mm of 33kV and 66kV systems (do not climb zone). These distances are to be taken as a vertical line that extends to the sky.

- Climbers must not position themselves so that they could fall or swing inside these distances.
- Climber must not attach themselves to vegetation that is inside these distances.

***NOTE:** This does not prevent the tree from being climbed. Trees may be climbed where the canopy of the tree is within the do not climb zone, however the actual vegetation that is within the do not climb zone must not be climbed. The high point attachment must not be within the do not climb zone.*

In all these tables the word ‘above’ means vegetation overhanging the conductors.

In all these tables 12.7kV SWER is treated as 22kV and 19.1kV SWER is treated as 33kV.

TABLE H: CLOSE APPROACH VEGETATION CONTROL (CAVC) - EWP

			Using Insulating Tools/Equipment		
Nominal Operating Voltage	Personnel Safe Approach	Insulated Mobile Plant Safe Approach	Insulated Tool Approach	Vegetation Clearance and switching requirements Below / Beside/ Above#	
				Clearance & Outage Requirement	D.A.R required for Vegetation above/beside only
LV - insulated/ covered	500mm	Physical clearance (no contact)	300mm	No clearance required No Outage required unless determined by a risk assessment	D.A.R. Not Applicable
LV - exposed / bare	1000mm				
11kV	1200mm	700mm	300mm	≤100mm^	>100mm and ≤700mm *
22kV	1200mm	700mm	300mm	≤150mm^	>150mm and ≤700mm *
33kV	1500mm	1000mm	300mm	≤200mm^	>200mm and ≤1000mm *
66kV	1500mm	1000mm	300mm	≤400mm^	>400mm and ≤1000mm *

^ These clearances are to be taken as an envelope around the conductor.

** When cutting from an EWP for vegetation over energised high voltage, where an Access Permit is not required then vegetation MUST be cut under D.A.R. conditions. Cut to 200mm maximum permissible lengths on vegetation no thicker in diameter than 50mm limited to working over 1 phase at a time.*

 # Cutting vegetation overhanging energised high voltage mains is only permissible when working from an insulated EWP and is limited to working over 1 phase at a time.

TABLE I: CLOSE APPROACH VEGETATION CONTROL (CAVC) - GROUNDLINE

		Using Insulating Tools/Equipment		
Nominal Operating Voltage	Personnel Safe Approach	Insulated Tool Approach	Vegetation Clearance and switching requirements Below / Beside / Above#	
			Clearance & Outage Requirement	D.A.R required for Vegetation beside only
LV - insulated/ covered	500mm	300mm	No clearance required No Outage required unless determined by a risk assessment	D.A.R. Not Applicable
LV - exposed / bare	1000mm			
11kV	1200mm	300mm	≤100mm ~	>100mm and ≤700mm
22kV	1200mm	300mm	≤150mm ~	>150mm and ≤700mm
33kV	1500mm	300mm	≤200mm ~	>200mm and ≤1000mm
66kV	1500mm	300mm	≤400mm ~	>400mm and ≤1000mm

~These clearances are below, beside and taken as a vertical line that extends to the sky.

 # No cutting of vegetation above (overhang) energised high voltage permitted.

TABLE J: CLOSE APPROACH VEGETATION CONTROL (CAVC) - CLIMBER

		Using Insulating Tools/Equipment		
Nominal Operating Voltage	**Personnel Safe Approach**	**Insulated Tool Approach**	**Vegetation Clearance and Switching requirements Below / Beside / Above#**	
			Clearance & Outage Requirement	**D.A.R required for Vegetation beside only**
LV - insulated/ covered	500mm	300mm	No clearance required	D.A.R. Not Applicable
LV - exposed / bare	1000mm		≤100mm	
11kV	1200mm	300mm	≤700mm ~	>700mm and ≤1200mm ~
22kV	1200mm	300mm	≤700mm ~	>700mm and≤1200mm ~
33kV	1500mm	300mm	≤1000mm ~	>1000mm and ≤1500mm ~
66kV	1500mm	300mm	≤1000mm ~	>1000mm and ≤1500mm ~

~ These clearances are below, beside and taken as a vertical line that extends to the sky.

 # No cutting of vegetation above (overhang) energised high voltage permitted.

3.3.3 Vegetation Management using High Voltage Live Techniques

Vegetation Management may be completed by authorised workers using techniques outlined in CEOM7040 - High Voltage Live Work.

Under no circumstances may anyone come closer to live high voltage exposed conductors than the distances in section 3.3 unless approved live line work techniques are used.

4.0 GENERAL SAFE ELECTRICAL WORK ON OR NEAR CONDUCTORS

ESR Short Cuts and Links

This section must be read in conjunction with:

- Section 6 for low voltage
- Section 7 for high voltage
- Section 8 for underground cables
- Section 9 for electrical stations
- Section 10 for capacitors and similar
- Section 11 for generation

4.1 Work Close to Existing Exposed Conductors

Where electrical apparatus is to be worked on, or erected in the vicinity of, or on the same structures as existing live exposed conductors, precautions must be taken to:

I Prevent the electrical apparatus from becoming energised; and
II Safeguard persons if the electrical apparatus does become energised.
III Satisfactory precautions are provided by preventing the electrical apparatus being worked on from coming within the safe approach distances detailed in Table B from any exposed conductors.
IV If there is a possibility that the required distances cannot be maintained, the existing exposed conductors must either be:
V Temporarily insulated; or
VI Physically restrained; or
VII Isolated, proved de-energised and Access Permit conditions applied.

Additional guidance may be found in procedure CEOP8050 – Working Above, Below or Adjacent to Energised Overhead Exposed Conductors .

4.2 Work Site Hazard Identification, Risk Assessment & Control (HIRAC)

In accordance with CECM1000.02 – HSE Manual: Risk Management , and the *Work Health and Safety Regulation 2017* before commencing any work to which these rules apply, a risk assessment must be conducted:

I The hazards must be identified; and
II The risks must be assessed; and
III Hazards must be eliminated, or control measures determined and implemented; and
IV The effectiveness of the control measures must be monitored and reviewed as the work progresses; and
V A record of this assessment must be made on a SWMS & HIRAC, or similar type form including an electronic form.

Working at height will be carried out in accordance with CECM1000.23 - Working at Heights or other industry approved standard to comply with the WHS Regulation requirements to address the risk of ‘suspension trauma’ and/or inversion of a worker at height in a fall arrest harness.

4.3 Training, Assessment and Authorisation

4.3.1 General

Where there may be an exposure to risk from electrical apparatus a person undertaking work must be appropriately qualified, trained and assessed as competent and authorised to carry out the work.

4.3.2 Qualifications for Work on Electrical Apparatus

A person must not carry out work to which these rules apply, and the person must not be permitted or required to carry out such work, unless:

I The person has received training which is appropriate for the type of work concerned and is assessed as competent; and
II The person is physically fit to safely perform the required work; and
III Persons acting as a Safety Observer must demonstrate every twelve (12) months the capability to rescue and resuscitate a fellow worker appropriate to the type of work being performed; and
IV The person has successfully attained and is current in "ESI Refresher Units of Competency" from the Transmission, Distribution and Rail Training Package as applicable to the work being performed.

NOTE: *Information on the required competency units may be found on the training.gov.au website or in Essential Energy's Training Matrix on the Essential Energy website. The most current ESI unit always applies.*

Persons qualified to work on or near overhead or underground electrical apparatus (other than live high voltage lines) can perform the work provided that they either:

I Possess a relevant qualification (or equivalent) issued by a Registered Training Organisation or recognised issuing body; or
II Are undertaking work for which they have been authorised. For example, Electrical Fitters may do work on an overhead line, which falls within the limits of their competency, or a Cable Jointer may attach fittings or make connection to an overhead line.

Persons are qualified for overhead or underground line work if they either:

I Have successfully completed a nationally recognised Certificate III in ESI Power Systems – Distribution Overhead or Distribution Cable Jointing (or equivalent) delivered by a Registered Training Organisation; or
II Hold previous qualifications or certification for overhead or underground line work, which are recognised by Essential Energy.

Persons who work on live high voltage overhead lines must either:

I Have achieved competence in the applicable nationally recognised Live Line "Units of Competency" from the ESI Training Package (or equivalent) delivered by a Registered Training Organisation; or
II Hold previous or alternative qualifications for live line work recognised by Essential Energy.

In addition, they must undertake additional or refresher training when necessary, in accordance with CEOM7040 – High Voltage Live Work, CEOP2192 - Live Work: Justification, Selection, Training & Appointment *and* CEOP2392 - Verification of Competency HV Live Worker .

NOTE: *In addition to the above qualifications and training, persons must not carry out high voltage live line work unless they hold a current live line authorisation issued by Essential Energy.*

4.3.3 Electrically Unqualified Personnel

An electrically unqualified person must not work on or near, nor be permitted to work on or near conductors associated with the network unless:

The live exposed conductors have been isolated, proved de-energised and Access Permit issued, and in the case of high voltage, earthed and short-circuited; and

I They are directly supervised by qualified personnel; and
II They understand the extent of the safe work area, are made aware of any live conductors adjacent to the safe work area and the appropriate safe approach distance for unqualified personnel that they must maintain; or
III They are an instructed person.

NOTE 1: *An electrically unqualified person may work under broad supervision where the conductors have been disconnected from the system and there are no other live conductors associated with the structure or equipment.'*

NOTE 2: *Trained and Authorised Vegetation workers may approach to the distances as specified in Tables F to J inclusive, and where required work under de-energised Access Permit conditions in accordance with* ***I*** *&* ***II*** *above.*

NOTE 3: *Telecommunications workers may approach to the distance specified in Table B.*

Clause 4.3.3 does not restrict electrically unqualified persons from performing approved earth tests in accordance with an approved procedure and training.

4.3.4 Persons in Training

Persons in training, electrical workers and their supervisors must refer to CEOP2000.57 - Supervision of Persons in Training and Electrical Workers or an industry approved standard, for specific detail about undertaking work to which these rules apply.

Persons in training, and electrical workers must not be placed in a position to perform rescue operations from live electrical apparatus until they are deemed competent to perform the rescue and are familiar with the requirements of these rules and working with live electrical apparatus.

The level of supervision for a person in training or an electrical worker, must be based on the persons level of competency to safely perform the work.

Persons in training or electrical workers must not undertake work to which these rules apply without an appropriate level of supervision.

4.4 Wearing of Clothing and Personal Protective Equipment

4.4.1 Clothing

While working on or near conductors (including operating work), all workers including Safety Observer must wear approved arc rated clothing as per NENS09.

While working on construction sites and wherever mobile plant is in operation, high visibility clothing must be worn in accordance with the HIRAC or employer's procedures.

An instructed person, for example:

I A crane operator in the protected cab of a machine does not require arc rated clothing.
II A welder working near conductors or apparatus may need to temporarily wear arc rated coveralls or similar.

4.4.2 Personal Protective Equipment

While working on or near conductors (including operating work) all workers must wear personal protective equipment, which gives appropriate protection to the eyes, head, body, arms, hands, legs and feet as prescribed by the relevant procedure or an industry approved standard (such as NENS09).

An arc rated face shield (with chin guard) and appropriately rated insulating gloves with leather outers must be worn for the following 'high risk' activities or where required by the work site risk assessment (HIRAC).

I Energised low voltage underground work (e.g. within a pit, pillar or pillar standard)
II Switching and testing on low voltage underground assets
III Switching and testing (other than by remote panel or SCADA) on energised high voltage underground assets
IV Energised low voltage overhead work where an arc may occur (e.g. making or breaking bridges under load, cutting away a live service in an emergency situation) – does not include connecting an overhead service
V Working on meter boxes, panels and switchboards – when energising after a fault. Face shield can only be removed when the authorised person/ operator is clear and meter box has been closed, or five minutes has elapsed since energisation.
VI Testing at 'Quicklag' low voltage circuit breakers.

***NOTE 1**: Item (I) above applies to ASP's who generally do not perform tasks (II) to (VII).*

***NOTE 2**: An arc rated face shield is not mandatory for work on secondary systems or non-intrusive testing within an electrical station unless required by the risk assessment for the task at hand.*

4.4.3 Arc Flash PPE (Cat 4)

An Arc Rated Switching Suit or Coat and Hood/ Face Shield (Cat 4 PPE) is required to be worn as per CEOM1148 - Arc Flash Hazard Risk Mitigation:

I In Zone Substations where an Arc Rated Switching Suit has been provided, it must be worn while undertaking switching operations
II For Underground substation LV switching where required
III For Customer switchboard LV switching where required
IV For Underground substation Live Tasks where required
V Where required by the work site risk assessment (HIRAC)

4.5 Safety, Test Equipment and Other Tools

A periodical inspection of the tools used in work associated with these rules will be undertaken to ensure they are maintained and tested in accordance with CEOM4040a - Tools, Equipment & PPE – Testing & Inspection, or an industry approved standard.

Equipment or tools which are observed to be defective in the course of their use or when periodically inspected or tested must be immediately removed from service and either labelled 'defective equipment - do not use' and stored in a signposted quarantine area or disposed of.

Insulated tools must only be used for the voltage for which they are rated and tested (as required). Operating sticks must be kept clean and dry or in wet conditions, insulating gloves must be worn as per Clause 4.5.1.

4.5.1 Insulating Gloves

Only 1000 volt rated gloves are to be used.

Insulating gloves issued for work on or near live low voltage exposed conductors must not be used on or near live high voltage exposed conductors, but should be worn when handling de-energised conductors while standing on the ground as outlined in CEOP8072 - Handling Conductors on the Ground or where the HIRAC requires them.

Approved protective outer gloves must be worn over the insulating gloves for all live LV techniques. In instances where outer gloves need to be removed for dexterity purposes, the LV must be isolated, and the work conducted in a de-energised state.

Insulating gloves must be worn for all operating work and when applying/removing temporary earths and short circuits, with the exception of switching through control panels, locking and or tagging of electrical apparatus, erection of non-insulating barriers and or signs and overhead field switching while using approved insulated and tested operating sticks, provided the risk assessment has determined the operating stick to be clean and dry.

Other types of gloves for example work gloves must not be used for insulating purposes when working on or near live low voltage exposed conductors.

4.5.2 Insulating Barriers and Ground Mats

When insulating barriers are used to cover live exposed conductors, they must be rated for the applicable voltage and be securely fixed to prevent displacement.

Approved and tested insulating ground mats are to be used where required by the risk assessment.

4.5.3 Non-insulating Barriers

Non-insulating barriers are portable barriers made of a known insulating material and are used as a protection against accidental contact with live exposed conductors when it is necessary for a person to work in close proximity to those live exposed conductors.

When in use, non-insulating barriers must be securely fixed or supported and must not come within the clearances detailed in Table E.

When, during erection, use or removal it is possible for the non-insulating barrier, to accidentally come within the safe approach distance to live exposed conductors only barriers specifically provided for this purpose are to be used.

Non-insulating barriers for use near live exposed conductors must be routinely inspected. They must be clean, dry and in good condition at the time of installation.

4.5.4 Rescue Kits and First Aid Kits

Approved rescue kits appropriate to the work must be checked before use and located so that it is immediately available in the work area (e.g. at the foot of the pole or ladder, or adjacent to live LV panels) as per CEOM7024 - Rescue, Resuscitation and First Aid

Approved first aid kits must be available at each work site.

4.5.5 Electric Shock

For the purposes of this clause, electric shock:

- Is from electrical equipment with a source that has a nominal voltage greater than 50V ac or 120V dc
- Is from electrical equipment from capacitive discharge
- Is not from a defibrillator
- Is not due to static electricity

In the event of an electric shock, the condition of the affected worker must be continuously monitored by an un-affected worker, and the worker is to be conveyed to the nearest medical facility for assessment within two hours. An ambulance must be called if the affected worker is or becomes unconscious.

Where a member of the public receives an electric shock, the above advice is to be provided to the affected person (or a companion) and recorded in TotalSafe (in the case of Essential Energy) or the incident management record system of an Accredited Service Provider or Contract Service Provider.

4.5.6 Portable Arc Flash Barrier

In those electrical stations where a portable arc flash barrier has been provided it must be used while undertaking switching operations.

4.6 Conductive Materials

All materials, including any liquid, gas, wet or damp timber, must be regarded as conductive unless there is a definite knowledge to the contrary. Dry timber may be regarded as insulated for low voltage only (brush contact).

Composite Fibre poles and cross-arms are regarded as insulated.

4.6.1 Metal or Metal-Reinforced Measuring Devices

Metal tapes, metal reinforced linen tapes and metal rules must not be taken near any live exposed conductors or into electrical stations. Short metal rules of less than 500mm in length may be taken into an electrical station.

4.6.2 Portable Metal and Metal Reinforced Ladders

Metal and metal reinforced ladders must not be used for work associated with live conductors. Only approved fibreglass or wood ladders must be used.

4.6.3 Metallic Jewellery and Personal items

Metallic objects such as neck chains, earrings and other body adornments, rings, watches and bracelets must not be worn while carrying out live work on conductors or electrical apparatus. Items that cannot be removed (eg wedding rings) must be fully covered by personal protective equipment.

Metallic items carried in pockets constitute a hazard as they may fall out while working aloft. All metallic items are subject to heat or electrical induction in the event of an arc while working live.

The hazard of carrying or using mobile phones aloft or while carrying out the duties of a Safety Observer must be assessed and controlled.

4.7 Communication

An Authorised Person must formally request permission from the System Controller prior to commencing any of the following:

- Operating work (except as provided in Clause 5.9 Temporary Removal of Access permit Earths) including any steps on a switching instruction e.g. phase rotation and check steps.
- Live Line HV & Live LV work on the network (excluding fitting Aerial Markers from the ground)
- Level 1 work on or near the network that involves the issuing of an Access Permit or Operating Agreement
- Entering or accessing an Electrical Station
- Undertaking close approach vegetation control (CAVC)

All other Level 1 contestable work requiring work on or near the network must be recorded by Customer Contact on 1800 626 544.

Fitting of Aerial Markers from the ground must also be recorded by Customer Contact on 1800 626 544.

Notification is **NOT** required for work on an individual streetlight head, lamp, photoelectric cell or associated connections but **IS** required for work on a circuit controlling multiple streetlights.

Persons communicating with the System Controller must do so in accordance with procedure CEOP2059 – Communication and Control.

4.8 Emergency Communications

In an emergency involving a serious threat to human life or property the **PANPAN, PANPAN, PANPAN** emergency calling sign must be used in accordance with procedure CEOP2060 – Emergency Communication in the case of employees or contractors, or an alternate procedure in the case of other workers. Personal Locator Beacons (PLBs) may be utilised in emergency situations in accordance with CECM1000.21 – Personal Safety or an industry approved standard.

Employees who have been issued with a PLB must have the device available at the work site.

The alert button may also be used in vehicles fitted with In Vehicle Monitoring System (IVMS).

4.9 Electrical Operating Work

Electrical Operating Work must only be carried out by Authorised Persons or Instructed Persons who are under the direct supervision of an Authorised Person for the purpose of training as per CEOP2065 - Authorisation.

Electrical Operating Work on or near exposed conductors must be carried out using approved and tested operating equipment.

A Safety Observer is not required for operating work or testing at ground level - subject to the onsite HIRAC.

4.10 Emergency Response and Operation of Electrical Apparatus

In an emergency, electrical operating work and other actions including access to the network by authorised Essential Energy workers and third parties under direct supervision may be carried out as appropriate, provided the worker undertaking the actions considers it safe to do so. The System Controller must be advised as soon as practicable. Once the emergency has concluded, no further action must be undertaken unless directed by the System Controller, and any further actions must comply with all relevant policies and procedures.

4.11 Preventing Access by Unauthorised Persons

Except when in immediate use, lockable devices that are necessary to prevent unauthorised persons accessing or operating electrical apparatus must be kept locked.

4.12 Labelling of Electrical Apparatus

All operable electrical apparatus, power transformers and voltage regulators must be clearly and permanently labelled with a unique identifier except:

I High voltage dropout fuses protecting a labelled pole mounted transformer substation or a labelled ground mounted transformer substation with the fuse pole immediately adjacent to it; or

II Switchgear associated with labelled recloser, regulator and sectionaliser sites which are mounted on common structures; or

III Low voltage fuses or links associated with and on the same structure as a labelled pole mounted or ground mounted transformer substation where there is only one set of LV fuses or links; or

IV Any other clearly identified operational apparatus, such as low voltage service fuses, temporary mid-span high voltage live line links and live line clamps.

When an alteration occurs to electrical apparatus requiring labelling, the labelling must be immediately altered to reflect the changed arrangement and system diagrams must also be updated concurrently.

All newly installed or altered underground cables must have a cable tag fitted indicating its source/destination.

Refer to procedure CEOP8042 Network Asset Identification & Labels for further detail regarding labelling.

4.13 Danger Tagging

'Danger - do not operate' tags must be attached to the controls of operable electrical apparatus to warn persons against inadvertent or unauthorised operation (that would endanger the safety of persons or the reliability and quality of supply) unless attachment to the controls is impractical. In such instances danger tags must be attached in the next best locations to affect the warning. For the purpose of network commissioning in lieu of a physical isolation, a SCADA site may be used to segregate unproven network in conjunction with a "Do Not Operate" Tag attached to the relevant device in the ADMS.

Danger tags associated with poles must be attached using high visibility yellow PVC tape. Multiple danger tags can be applied with a single tape.

Danger tags are also used to secure a customer's installation in accordance with CEOP2018 – Polarity Identification & Neutral Integrity: Testing. ASP's or CSP's utilising an alternate industry standard may use alternate methods to secure a customer's installation.

'Danger - do not operate' tags must only be installed, altered or removed by authorised persons.

'Danger - do not operate' tags must also be fitted to unserviceable equipment to warn against inadvertent energisation.

Persons must not remove or alter in any way applied danger tags without consulting the System Controller or person who attached the danger tag.

4.14 Phasing

All new electrical apparatus, capable of being paralleled with any other part of the existing electrical network or apparatus, must be phased out before final commissioning. Until phasing is proven a 'Danger - do not operate' tag is to be applied in all appropriate locations to warn against the making of parallels.

All other electrical apparatus, the connections of which have been broken other than by switches provided for the purpose, must be phased out before being returned to service unless there is no possibility of cross phases. Phase rotation must be confirmed where necessary.

4.15 Electrical and Structural Integrity of Poles

A visual assessment must be undertaken upon arrival at the work site for possible risk of electrical leakage and associated step and touch potentials.

An electrical leakage (safe to approach) test in accordance with procedure CEOP2422 - Safe Approach: Assess Overhead Electrical Apparatus or an industry approved standard, must be carried out prior to working on any pole, column or structure, other than poles or structures within an electrical stations earth grid area, or a fibre composite pole without downleads.

Prior to work being undertaken on or near a pole or structure at groundline or at height the worker must be satisfied that the pole or structure is safe to ascend and will remain safe during the carrying out of the intended works. Additional support can be applied to the pole or structure to make it safe to ascend. For more information, refer to procedure CEOP2069 - Pole Assessment or an industry approved standard.

4.16 Confined Spaces

All enclosed and confined spaces associated with the network must be identified and appropriate signage provided. A register of all known sites must be maintained.

Persons required to enter a confined space must be authorised.

The employer must provide, and persons must use procedures and equipment to ensure the safety of persons required to enter and or work in the confined space. In addition, persons who work in confined spaces, or persons in charge of work in confined spaces, must be appropriately trained and assessed as competent. For more information, refer to CECM1000.22 - Safe Entry to Confined Spaces or an industry approved standard.

When working in a confined space all work must be carried out in accordance with the *Work Health and Safety Regulation 2017*.

4.17 System Alterations Notification

Any proposed change to the system (including previously connected and now disconnected conductors/apparatus) must be communicated to System Control in accordance with CEOP2057 – System Alteration Notification and. CEOP2056 – Network Access Request & Planned Outage Notification

4.18 Street Lighting Conductors and Control Circuits

Street lighting conductors and control circuits must be treated as low voltage conductors.

Street lighting conductors and control circuits must be treated as live unless they have been isolated and proven de-energised.

Street lighting conductors, control circuits, luminaires and brackets must be treated as earthed secondary points of contact when working on adjacent apparatus.

An Access Permit is required for work on de-energised and isolated street light circuits, but not on a single streetlight luminaire with a single point of supply to the network (refer earlier Clause 4.7).

4.19 Energising or Re-energising Electrical Apparatus

Before energising electrical apparatus for the first time or before re-energising electrical apparatus, precautions must be taken to ensure that:

I Electrical apparatus is in a state suitable for energisation; and
II All plant, tools and materials are clear of the electrical apparatus; and
III Any earths, short-circuits and equipotential bonds have been removed; and
IV All required testing (e.g. earth resistance, insulation resistance, neutral identification, polarity, phasing and phase rotation) has been satisfactorily completed; and
V All persons are clear and now regard the apparatus as live; and
VI Any Access Permits issued have been cancelled; and
VII All necessary identification of apparatus, warning signs, locks and other security measures are in place; and
VIII It is safe to proceed; and
IX The System Controller's approval has been obtained to energise or re-energise electrical apparatus.

Where practicable, energise or re-energise apparatus from a remote location, particularly when fault finding or after fault repairs.

Wear an arc rated face shield as required by clause 4.4.2 or where the risk assessment (HIRAC) determines an arc face shield is required.

When it is necessary to stand adjacent to a switchboard, panel or pillar to energise or re-energise circuits or apparatus, stand in a position that minimises the risk should an arc flash occur.

After energising or re-energising apparatus, wait five (5) minutes before conducting any final testing or checks.

New overhead conductors may be energised in appropriately insulated rollers provided that:

a. The rollers have a latch or trap to prevent the conductor escaping.
b. Stop structures or slings are installed to prevent conductors 'running thru' rollers at road, river crossings or any other hazardous locations.
c. Conductors should be permanently fixed within three (3) months.

Existing overhead conductors (not new) may only be energised in appropriately insulated rollers following a thorough visual inspection of the line and completion of an onsite risk assessment that considers:

- Size/strength of the conductor
- History of the conductor (previous failures)
- Condition of the line (excessive sleeves, splices, etc.)

4.20 Current Transformer Circuits

The secondary winding of a current transformer must not be opened while the primary winding is live until the secondary has been short-circuited, due to significant voltages that would otherwise occur.

The only exception is when a Protection Withdrawal Instruction (PWI) is in place as part of protection checks within a zone substation.

Rogowski coils are a current measuring device that do not have the same open-circuit characteristics of traditional current transformers. Rogowski coil secondary windings may be opened while the primary winding is live only by staff trained in their use.

4.21 Earthing

Connections between electrical apparatus and the earth system must not be broken while the apparatus is in service unless bonds of at least equivalent current carrying capacity have been connected across the part of the earthing system to be broken or to an alternative known earth.

Where a connection between energised electrical apparatus and the earth system has been damaged or broken, it must not be reconnected while the apparatus is in service, unless the requirements of CEOP2377 Equipotential and Personal Protective Bonding are followed.

If an in-service earth system conductor is broken or disconnected and temporary bonds are applied, and where the earth conductor will not be repaired or replaced immediately, danger tags must be applied adjacent to each temporary bond attachment point. (see Note 1)

Lockable temporary portable earth bonds/bridges are to be used within electrical stations as outlined in Operational Manual CEOM7772.04 Portable Earthing and Bonding Systems in Electrical Stations. This does not apply to portable working earths or access permit earths.

For additional information on earth integrity testing see procedure CEOP2445.1 Distribution Earth Integrity Testing Asset Inspection Staff and CEOP2445.2 Distribution Earth Integrity Testing Electrically Qualified Staff .

NOTE . *A connection may be made to extend the existing in-ground earthing system of an energised transformer on the conventional network (i.e. not HV SWER earths) provided that:*

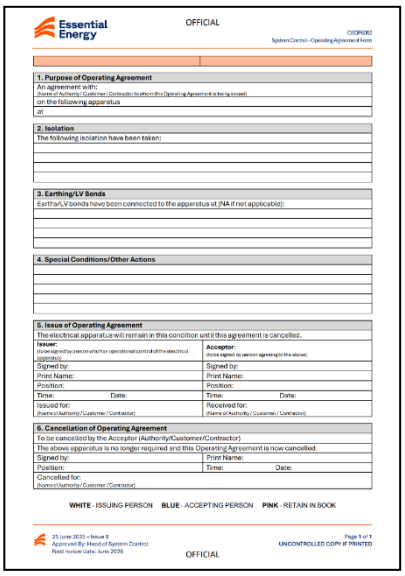
I A HIRAC (e.g. no storms about) and Safe to Approach test has been completed; and
II Testing is carried out between the new and the existing earths to ensure that no hazardous voltages exist; and
III That low voltage insulating gloves (with approved outer gloves) are worn during testing and to make the connection.

4.21.1 Operation of Devices in Service with Damaged or Stolen Earth Systems

Some switchable devices with damaged or stolen earths may be operated subject to the following conditions:

I Gas Switch: Test broken earth lead with a modiewark set to 240V for no voltage. If voltage is not detected, it may be operated with an extendable link stick while remaining clear of any conductive materials on the pole
II Recloser – May be operated via SCADA. Local operation is not permitted until earth is repaired.
III Air Break Switch (ABS) – Operation not permitted until earth is repaired

4.22 Operating Agreements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CEOP8052
System Control - Operating Agreement form

1. Purpose of Operating Agreement
An agreement with:
(Name of Authority / Customer / Contractor to whom this Operating Agreement is being issued)
on the following apparatus
at

2. Isolation
The following isolation have been taken:

3. Earthing/LV Bonds
Earth/LV bonds have been connected to the apparatus at (NA if not applicable):

4. Special Conditions/Other Actions

5. Issue of Operating Agreement
The electrical apparatus will remain in this condition until this agreement is cancelled.

Issuer: (to be signed by person who has operational control of the electrical apparatus)	Acceptor: (to be signed by person agreeing to the above)
Signed by:	Signed by:
Print Name:	Print Name:
Position:	Position:
Time: Date:	Time: Date:
Issued for: (Name of Authority / Customer / Contractor)	Received for: (Name of Authority / Customer / Contractor)

6. Cancellation of Operating Agreement
To be cancelled by the Acceptor (Authority/Customer/Contractor)
The above apparatus is no longer required and this Operating Agreement is now cancelled.

Signed by:	Print Name:
Position:	Time: Date:
Cancelled for: (Name of Authority / Customer / Contractor)	

WHITE - ISSUING PERSON BLUE - ACCEPTING PERSON PINK - RETAIN IN BOOK

25 June 2020 – Issue 9
Approved By: Head of System Control
Next review date: June 2028
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An Operating Agreement is a formal undertaking between Essential Energy and another party. It provides assurance to the **Acceptor** that assets under the control of the **Issuer** will remain in a particular state, until such time as the Operating Agreement is cancelled. Essential Energy can be the Issuer or the Acceptor of an Operating Agreement. Essential Energy staff must prepare the Operating Agreement whether they are the Issuer or the Acceptor. The physical form must be signed and retained by both parties until it is cancelled.

The operating agreement is used in situations where neither Essential Energy nor the other party involved in the isolation has complete operational control over all the isolation points and ensures that the isolation, danger tagging and earthing if required remains secured for the duration of the works, or in circumstances where the other party requires written confirmation of an action by Essential Energy.

Situations when an Operating Agreement can be issued.

1. Where Essential Energy is required to carry out isolation within the Essential Energy network to allow the Other Party to work on the Other Party's electrical apparatus.
2. Where Essential Energy is required to work on Essential Energy's electrical apparatus and requires the Other Party to isolate within the Other Party's network to allow this work to be carried out.
3. Where the Other Party, as part of their planning and risk assessment process, may require Essential Energy to disconnect electrical apparatus within Essential Energy's network to allow for non-electrical construction work to take place. The detailed requirements for this situation including the planning process are referenced in CEOP1116.
4. Situations requiring digital exchange of Operating Agreements, this applies only to Customer/Generator sites with established Operating Protocols with Essential Energy. Digital or electronic exchange of Operating Agreements is restricted for use by System Control.

Further information on Operating Agreements and their use may be found in procedure CEOP2052 - Operating Standards: Operating Agreement

4.23 Defective Apparatus and Operating Restrictions

Defective Apparatus is electrical equipment that is deemed to be unsafe to operate. A 'Defective Apparatus' tag must be physically affixed to such equipment, and where applicable an electronic 'Defective Apparatus' tag also applied. Defective Apparatus cannot be used as an isolation point. An example of Defective Apparatus is:

- A Gas Switch that has lost its gas.

  An Operating Restriction applies on electrical equipment that is part of the electricity network and is still serviceable but with a restriction on its operation or function. Equipment under an Operating Restriction may still be operated and/or used for isolation purposes. An example of an Operating Restriction is:
- Underground switchgear (such as a Hazemeyer Ring Main Unit) deemed not suitable for fault finding but may be used for 'normal' switching operations for isolation purposes.

Operational equipment (e.g. links or a gas switch) on a condemned pole may still be operated subject to a comprehensive risk assessment. Considerations may include operating from an EWP, supporting the pole with a crane and any other measures that minimise mechanical loading on the pole and associated equipment.

4.24 Communication Microcells on Poles

A communications microcell generally consists of a ground mounted transmitter near a pole and an omnidirectional antenna mounted on the pole at least one metre below any electricity conductors. The antennae emit a 'plume' of Radio Frequency (RF) radiation in a localised and well-defined shape.

Essential Energy workers and authorised ASPs are not considered as RF workers and hence the 'exclusion' zone is 3 metres in all directions of the energised RF equipment. Consequently, an isolation switch, and associated signage, is installed on the pole at approximately 3 metres above ground level. This isolation switch includes indication lights showing when the equipment is 'on' or 'off'.

Before operating the isolation switch, and after re-energisation of the microcell, **telephone the Communications Company** on the telephone number shown on the accompanying pole signage.

5.0 ACCESS PERMITS

ESR Short Cuts and Links

The safe work practices and requirements for electrical work under Access Permit conditions do not apply when working live i.e. HV Live Line Work or live LV work.

This section is a summary of the responsibilities of all parties and should be read in conjunction with CEOP2045 - Access Permit .

5.1 Preparation for the Issue of an Access Permit

When an Access Permit is required, a switching instruction that provides a suitable clearance area should be prepared and endorsed by an Authorised Person in accordance with Essential Energy procedure CEOP2056 – Network Access Request & Planned Outage Notification.

Wherever practicable, the Issuer and Recipient of an Access Permit must be different persons.

5.2 Issue of an Access Permit

An Access Permit shall only be issued by an Authorised Person. The person issuing the Access Permit is responsible to:

I Ensure the isolation and Access Permit earthing have been completed, or there has been confirmation that the isolation and Access Permit earthing have been completed; and
II Prove de-energised (or witness an Authorised Person prove de-energised) all circuits under control of the Access Permit at the first worksite and record that location in this section; and
III Ensure barriers and signage required for the purposes of issuing the Access Permit are erected; and
IV Ensure warnings and or instructions, as applicable, are entered on the Access Permit; and
V Ensure that they are satisfied that the Access Permit provides access for the work as requested and is appropriate to the work being undertaken; and
VI Ensure that the authorised recipient demonstrates an understanding of the limits of the Access Permit and their responsibilities as a recipient. The issuer is to ensure the recipient is appropriately authorised to receive the access permit. The issuer may ask to sight a Recipient's current digital authorisation; and
VII Ensure the Access Permit is endorsed as issued.
VIII Provide the Recipient's name and authorisation number to the System Controller who will issue an Access Permit number.

5.3 Receipt of an Access Permit

Only an Authorised Person can receive an Access Permit. A recipient may be asked to produce their current authorisation identification The recipient of an Access Permit shall have the following responsibilities:

I Be satisfied that the Access Permit provides access for the work as requested and is appropriate to the work being undertaken; and
II Understand the limits of the Access Permit, the precautions and control measures that have been taken and any relevant warnings; and
III Ensure control measures, as required, have been applied and are maintained including testing and proving de-energised all circuits at each subsequent worksite that is covered by the Access Permit; and
IV Endorse the Access Permit as having been received; and
V Ensure the limits of the Access Permit, the precautions, control measures and any warnings or instructions, as applicable that are entered on the Access Permit are communicated to, and understood by and are observed by all persons signing on the Access Permit; and

VI Ensure no member of the work party who will be on or near the network commences work until they have signed onto the Access Permit and all members of the work party have signed off prior to cancellation of the Access Permit; and

VII Be present at the work area and maintain Broad Supervision in relation to the Access Permit for the duration of the permit and ensure that the Access Permit is available for the duration of issue; and

VIII Ensure HV working earths, low voltage short-circuits, equipotential bonds and Personal Protective Bonds are recorded on the access permit as applied and removed by the work party where and when required. Working earths are specific to a single Access Permit and cannot be shared except by documented agreement in Section 9 of the Access Permit form between the Access Permit recipients.

5.4 Persons Signing on an Access Permit

The persons signing onto and signing off the Access Permit must:

I Fully understand which electrical apparatus is safe to work or test, on or near and which is still to be regarded as live and the location of isolating points and earths or short circuits and the need for equipotential bonds or Personal Protective Bonds as the work may require; and

II Understand and follow instructions given by the Recipient; and

III Print their name and “sign on” in Section 10 prior to work or test and “sign off” in Section 10 on the same line upon the completion of work or leaving the work area; and

IV Not access the work area after signing off the Access Permit; and

V Not leave the work area without advising the Recipient and seeking approval; and

VI Not sign any other person on or off the Access Permit; and

VII If for any reason a person leaves the work area and signs off the Access Permit and then returns to the work area and requires access to the work area again, the person must inform the Recipient prior to signing back onto the Access Permit. The Recipient must again explain to the person the isolated area, work area and any associated precautions, in particular any changes that have occurred whilst that person was absent.

5.5 Transfer of Responsibility from one Recipient to another Recipient

Where it is necessary to change the authorised recipient of an Access Permit, it must be carried out in accordance with procedure CEOP2045 - Access Permit

5.6 Suspension of an Access Permit

An Access Permit for work may be suspended with the approval of the System Controller where it is deemed necessary, provided all members of the work party sign off the Access Permit and the Access Permit Recipient secures the Access Permit for the period of the suspension.

On return to work after the suspension of the Access Permit, the recipient must advise the System Controller confirming all isolation and earthing is in place as recorded prior to suspension and have all members of the work party sign back on the Access Permit advising them of the conditions of the Access Permit.

Suspension of an Access Permit provides for work on electrical apparatus that continues from day-to-day. ASP’s and CSP’s must co-ordinate through their Essential Energy contact person.

Suspension of an Access Permit may also occur in accordance with CEOP2061 - HV Live Line Work Operational Requirements where HV Live Line work and Access Permit work is occurring on the same structure such that there is a clear transition point between HV Live Line work and work under Access Permit conditions.

5.7 Returning of Electrical Apparatus to Service

Electrical apparatus under Access Permit must not be re-energised until all applicable Access Permits have been cancelled.

After re-energising apparatus, wait five (5) minutes before carrying out any final testing.

5.8 Access Permit for Test

An Access Permit for work and an Access Permit for electrical testing on the same electrical apparatus must not be on issue at the same time. The Access Permit for working must be cancelled before the Access Permit for testing can be issued or vice versa.

An Access Permit for Test must not be suspended.

5.9 Temporary Removal of Access Permit Earths

The circumstances in which the temporary removal of Access Permit Earths may occur are:

I To carry out testing of conductors under an Access Permit for Test; or
II To use polarity identification or phase identification equipment under an Access Permit for Test; or
III To allow for the dismantling or replacement of an item of electrical apparatus

Apply Access Permit Earths, when practical to whatever remains of the isolated item of electrical apparatus (conductor) or progressively to the replacement conductor.

Low Voltage insulating gloves (with approved outer glove) must be worn for the period that the Access Permit earths are in a disassembled or removed state.

ASP's and CSP's must co-ordinate the temporary removal of Access Permit Earths through their Essential Energy Access Permit issuer and be noted on the Access Permit in the special conditions section.

Record Access Permit Earth provisions or changes on the Access Permit form.

6.0 WORK ON OR NEAR LOW VOLTAGE ELECTRICAL APPARATUS

ESR Short Cuts and Links

6.1 Basic Safety Rule

All low voltage exposed conductors must be regarded as live, until isolated and proved de-energised by approved means. Controls must be used for the risk of induced voltages, customer generation, or unknown supplies

Before commencing work on or near isolated low voltage exposed conductors, the following controls must be implemented:

I Identify and isolate the required conductors; and
II Secure points of isolation to prevent unauthorised operation or interference; and
III Fit 'Danger do not Operate' tags to all isolation points; and
IV Clearly identify and establish the clearance area; and
V Prove de-energised at the work site; and
VI Issue Access Permit for work up to the Point of Common Coupling (PCC); and
VII **Control the risks from hazardous induced voltages, customer generation or unknown supplies** using one or more of the three controls (that apply to all work on de-energised low voltage exposed conductors) listed below:

Control 1 [to be used wherever practicable] At least one set of LV Short Circuits with visual sighter aids (eg flags) are placed on the conductors as close as practicable to the work site. The short-circuiting of all low voltage exposed conductors includes the neutral conductor and any streetlight conductor. A fuse must not form part of an earthing and short-circuiting path. Personal Protective Bonds may also be required if working from a conductive structure. When installing or removing low voltage Short Circuits, low voltage insulating gloves (with approved outer gloves) must be worn unless an approved and tested insulating stick is being used. Additional requirements for work on or near isolated Low Voltage exposed conductors are detailed in CEOP2377 - Equipotential and Personal Protective Bonding

LV SHORT CIRCUITS ON BARE LV OH WITH VISUAL SIGHTER AIDS (EG. FLAGS)

LV SHORTS IN UG PILLAR

Control 2 – Isolate the conductors from **all possible** sources of electrical supply.

NOTE: *Possible sources of electrical supply may include sources at customer's installations, such as standby generators, embedded generators, inverter/ UPS systems, multiple control supplies, auxiliary control systems, and transformation up from extra low voltage systems.*

Control 3 - **The wearing of Personal Protective Equipment**, which includes the wearing of a low voltage insulating glove (with approved outer gloves).

NOTE*: The above three controls apply to all work on de-energised low voltage exposed conductors.*

VIII Prevent inadvertent contact with nearby live exposed conductors, conductors at earth potential or objects at different potential (e.g. by affixing insulating barriers).

An Access Permit must be issued before any work commences on or near isolated and proven de-energised low voltage exposed conductors **EXCEPT** for the following circumstances:

a. Work on low voltage at or beyond the Point of Common Coupling (PCC),
b. The installation, removal and/or replacement of low voltage insulated distribution road crossing mains up to and including 50mm^2 that has been disconnected (bridging tails removed from energised conductors).
c. For the purpose of installing HV earthing equipment only utilising a suitably rated and tested insulating operating stick and while wearing a low voltage insulating glove (with approved outer glove).
d. Working on single streetlight luminaire with a single point of supply to the network (see clause 4.18)

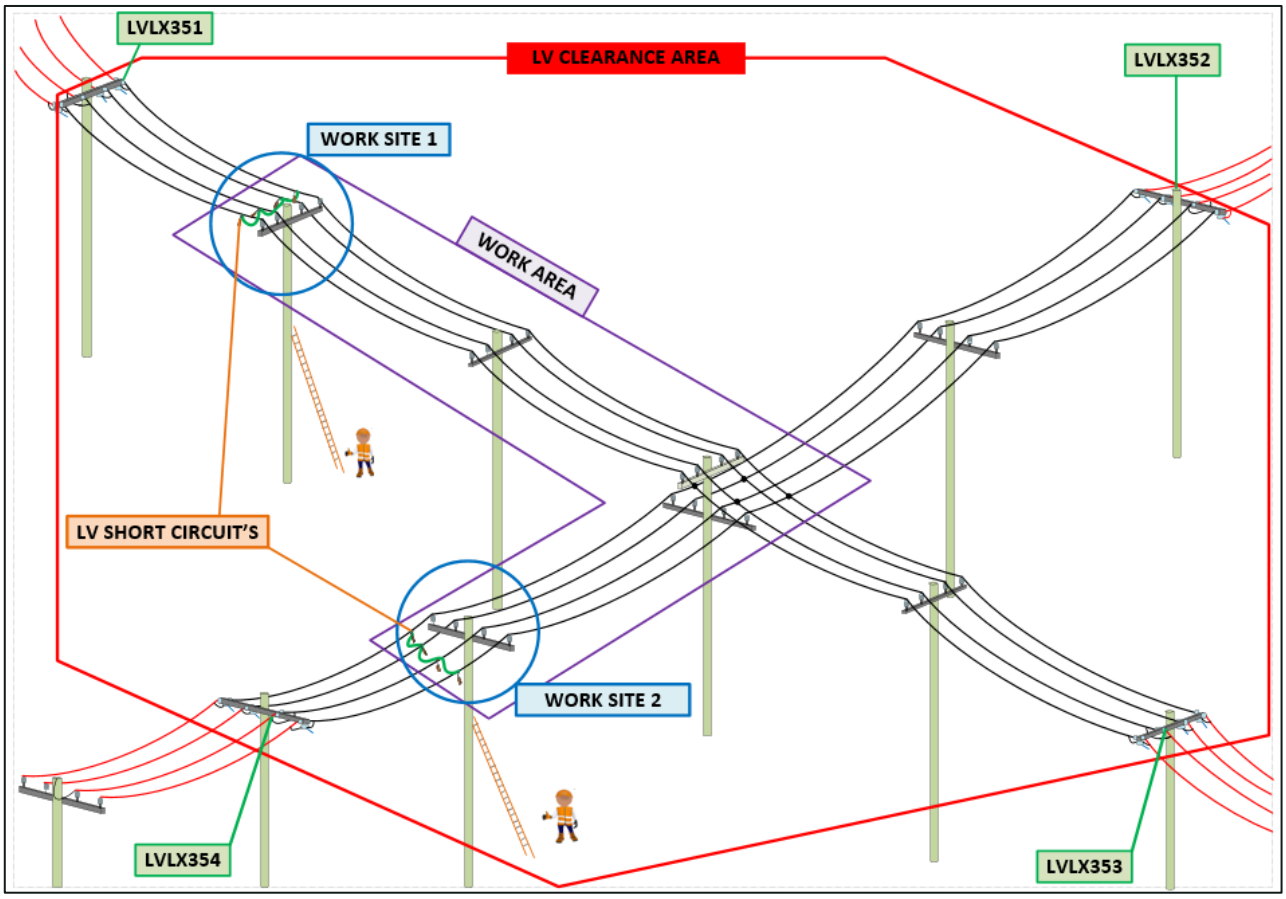


FIGURE 3: LV CLEARANCE AREA SHOWING MULTIPLE LV SHORT CIRCUITS INSTALLED AS CLOSE AS PRACTICAL TO EACH WORK SITE WITHIN A WORK AREA.

6.1.1 Isolating the Identified Electrical Apparatus

Isolation that involves the operation of a switch must only be treated as effective if one of the following conditions is satisfied:

I If the switch is an under-slung low voltage switch or fuse – the carriers or fuse are removed from the assembly, and the carriers are secured with a danger tag to the pole; or

II For a withdrawable switch or fuse – it has been withdrawn from live contacts and a danger tag fitted; or

III For a non-withdrawable switch where the contacts are visible and unauthorised access is prevented – the contacts are seen to be open, and a danger tag is fixed to the structure in an obvious location; or

IV The switch is lockable – the contacts appear to be open as shown by the operating mechanism and the switch has been locked and a danger tag fitted; or

V The switch is not lockable but is in a lockable room or panel – the contacts appear to be open as shown by the operating mechanism, a danger tag is fitted to the switch and the door to the room or panel is locked to prevent unauthorised access.

The yellow indicator on the LV Krone switch **must not** be used for verification of the status of the switch.

If the switch cannot be locked and unauthorised access cannot be prevented by a danger tag, the switch cannot be used as isolation.

Where switches are spring, hydraulically or pneumatically operated, the stored energy must be discharged to prevent inadvertent closing.

Access permit earths must be installed against any HV Isolation points for de-energised LV work.

Isolation by the removal or separation of connections (disconnected) must only be treated as effective if:

I The connection is totally removed; or

II The connecting conductor is securely tied back away from its normal position; or

III When interconnected neutrals need to be broken the isolation must be confirmed by use of a voltmeter and a remote independent earth to ensure that there is less than 10 volts present on either side of the break. If more than 10 volts exist, reconnect the neutral conductors and investigate.

***NOTE**: The preferred method of isolation is to have system neutrals remain connected. When interconnected system neutrals or earths are connected or reconnected, precautions must be taken to prevent contact with exposed conductors across either side of the break.*

6.1.2 Proving Low Voltage Electrical Apparatus De-energised

Low voltage electrical apparatus must be proved de-energised by means of approved test lamps, indicating device or voltmeter or multimeter. A Modiewark is not an approved means for proving de-energised on LV ABC conductors.

The test equipment must be proved to be in good working order immediately before and after use.

Exposed conductors may develop an oxide coating that needs to be removed with a scratch brush in order to give a reliable electrical contact for any test device being used.

Where the test equipment cannot be proved to be in good working order before and after use, two approved test devices must be used independently to prove the low voltage electrical apparatus is de-energised.

6.2 Work On or Near Live Low Voltage Exposed Conductors

All work on or near live low voltage must be carried out to the requirements set out in

CEOP8034 - Low Voltage: Energised Work or any industry approved standard including *ENA Doc044 Guideline for Energised Low Voltage Work*.

Before commencing work on or near live low voltage exposed conductors, they must be identified as the conductors to be worked on or near.

Control measures must be taken to prevent inadvertent contact with other live low voltage exposed conductors and conductors at earth potential. The control measures must include:

I Attendance by a Safety Observer; and
II The wearing of approved arc rated long sleeved shirt and long trousers (see section 4.4.1); and
III The wearing of personal protective equipment, including an insulating glove (with approved outer glove), safety helmet, safety footwear and eye protection (see section 4.4.2); and
IV The use of insulation rated tools, barriers and ground mats as determined by risk assessment.

The control measures above apply when working from all poles including a private pole (not from an EWP) on or near live Essential Energy exposed conductors including service mains. The rescue kit must be located so that it is immediately available at the foot of the pole or ladder.

EWP's used for live low voltage work must be insulated in accordance with AS/NZS1418.10.

Where work will require a person passing between live low voltage conductors, the conductors need to be temporarily insulated unless they are at least 1200mm apart. In this case they must be insulated wherever they are within reach.

Where work requires passing the uninsulated head of portable earthing equipment near exposed live low voltage conductors, temporary insulation must be applied to any exposed conductors within 500mm.

Where cross-arm or pole replacements are required on live low voltage exposed conductor transpositions, the work must be completely de-energised unless the exposed conductor transposition can be removed by means of redesign using Aerial Bundled Conductor or underground cable.

For live low voltage exposed conductor cross-arm or pole replacements where a transposition does not exist, all exposed conductors and apparatus apart from the exposed conductor and apparatus being immediately worked on must be appropriately insulated prior to the commencement of work. These insulating barriers will be individually adjusted and replaced for work on each exposed conductor and apparatus and must not be removed until all work on the exposed conductors and apparatus has been completed.

Essential Energy has determined that its employees will **NOT** work alone aloft in a climbing harness because of the risk of suspension trauma and must be attended. Further details are contained in CECM1000.23 - Working at Heights and CEOP2000.57 Supervision of Persons in Training and Electrical Workers.

The following work may be undertaken by an electrically qualified person without a Safety Observer from ground level or a step/platform ladder:

I Working on an Essential Energy owned switchboard or cubicle or working on Essential Energy assets on a privately owned switchboard or cubicle; and
II Operating Work or testing; and
III The installation and removal of recording and metering equipment; and
IV The installation, removal or replacement of service/meter protection fuse including base.

At all times, in an emergency situation where there is an immediate threat to human life, take appropriate action to make the site safe or perform a rescue if safe to do so after a mental and visual check for any hazards has been completed as outlined in CECM1000.02 – Risk Management or an industry standard.

Nothing in Clause 6.3 prevents the use of a Safety Observer being in attendance when deemed necessary to perform the work safely.

6.2.1 Low Voltage Tasks not permitted to be done energised

The list below (Table K) applies to all Authorised workers including ASP's and CSP's. This list as an extract from Essential Energy procedure CEOP8034 - Low Voltage: Energised Work which may be amended from time-to-time, and Essential Energy workers should regularly check *CEOP8034* for any additions.

TABLE K: LOW VOLTAGE TASKS NOT PERMITTED TO BE DONE ENERGISED

Task Description	ESR's Clause
Multi-circuit LV open wire pole change	N/A
Working on the upper LV circuits of multi circuit, three way or four-way open wire LV, where accessed through or above LV multiphase open wire (other than items 11 & 18 in CEOP8034)	N/A
Erect/replace LV pole or cross-arm with a transposition	6.3
Replace Circuit breaker in the 'unprotected zone of a pole mounted substation (no LV fuses present between TX and circuit breaker)	N/A
Work that disturbs CONSAC cable	8.5.3
Transfer LV UGOH from one pole to another with cable energised	8.8.2
Work on "Fargo" UG connections while energised	N/A
Replace/Repair metallic column (e.g. Potbelly type) or Triangular Concrete column with cables energised	N/A
Make or Break phase connections in the 'unprotected zone' on a padmount (Transformer to LV board/switchgear) or pole mounted substation (source side of LV fuse switch)	N/A
Streetlight luminaire replacement with supply cable remaining energised.	N/A
Work on or near fallen LV energised exposed conductors (excludes testing to prove de-energised)	N/A
Remove/Replace entire LV board or panel	N/A
Replace padmount housing-metallic	N/A
Connect/Disconnect mobile generator to dedicated connections *Energised connections by specific approval from ESO (SA 69-16)	11.3 (iii)
Energised LV cable jointing where feet are below ground level (May be performed with an approved rescue procedure - refer to ESO (SB-659)**	8.5
Remove rear cover of a Tappat Type 8 Pillar	N/A
Live meter or Frequency Injection Relay (FIR) change while maintaining customer supply	N/A
Replace Quicklag circuit breaker with supply cable remaining energised	N/A
Work on LV equipment in a Zone Substation- e.g. lighting and power, air conditioning, tap change motor etc	N/A
Connections to aux supplies, street supplies, switchboards and equipment (*Energised connections with electrically qualified safety observer only made after completion of thorough risk assessment, with specific SWMS and approval from ESO.)**	N/A
Live LV work on 33kV underground substations with 1500kVA transformer	N/A

6.3 Work On or Near Low Voltage Exposed Conductors that are Not Electrically Connected

The requirements of Section 6 of these rules DO NOT apply to conductors that are disconnected.

Section 6 does apply where low voltage conductors are attached to poles or equipment that support other live or de-energised conductors, or personnel may encroach the safe approach distances of other live or de-energised conductors.

6.4 Connecting and Disconnecting the Neutral Conductor

The neutral conductor must be connected before any active conductor is connected.

The neutral conductor must only be disconnected after all active conductors have been disconnected.

Neutral Conductors are ALWAYS connected FIRST and disconnected LAST

6.5 Polarity, Neutral Integrity, and Phase Rotation Testing

Prior to connecting or reconnecting any low voltage mains or service to an installation or group of installations, persons must conduct polarity testing in accordance with procedure CEOP2018 – Polarity Identification & Neutral Integrity: Testing or an industry approved standard, such that:

I The mains neutral is positively identified by electrical test; and
II The service neutral is positively identified by electrical test.

If the correct polarity cannot be positively determined, then the installation must not be connected.

The integrity of the neutral must be proven by the application of procedure CEOP2018 – Polarity Identification & Neutral Integrity: Testing or other approved industry standard aligned to *AS4741 Testing of connections to low voltage networks*.

The polarity and neutral integrity of any new or altered streetlights must be checked.

Where there are multiple phases involved, and the work has the potential to alter the sequence of the phases, the correct phase rotation must be confirmed at the same location before and after the work.

NOTE: *Some phase rotation test devices will give a false indication if only two of three phases are energised. Always check three phases are available.*

6.6 Paralleling of Distribution Substations

Paralleling of distribution substations via the low voltage system must not be undertaken without the prior knowledge and approval of the System Controller.

Where work is likely to have altered the phasing across low voltage paralleling points, the correct phasing must be verified.

7.0 WORK ON OR NEAR HIGH VOLTAGE EXPOSED CONDUCTORS

ESR Short Cuts and Links

7.1 Basic Safety Rule

All high voltage exposed conductors must be regarded as live until isolated, proved de-energised, earthed and short-circuited by approved means in accordance with procedure CEOP2045 - Access Permit.

7.2 General Requirements for Access to High Voltage Exposed Conductors (not applicable to Live Line work)

An authorised person must specify the apparatus to which access is required and submit to the System Controller a switching request in accordance with procedure CEOP2056 –Switching Request & Planned Outage Notification .

Before commencing work on or near isolated high voltage exposed conductors, the following controls must be implemented:

I Identify and isolate the conductors to be worked on; and
II Secure all points of isolation to prevent unauthorised operation or interference; and
III Fit 'Danger do not Operate' tags to all isolation points; and
IV Prove de-energised, earth and short-circuit high voltage conductors: and
V Clearly identify and establish the clearance area; and
VI Issue Access Permit for work or test; and
VII Establish and maintain equipotential conditions within the work site(s).

An Access Permit must be issued before any work commences on or near high voltage exposed conductors except:

I When undertaking live line work in accordance with the Essential Energy manual CEOM7040 - High Voltage Live Work
II When using approved processes for special tasks such as:
- **a** Pruning of trees using insulated pruners and saws;
- **b** Approved tasks using extendable insulating sticks including cutting away of de-energised surge diverters and associated dropper cables using insulated cutters as detailed in procedure CEOP8083 Working with Extendable Insulating Sticks;
- **c** To carry out a tap change on an isolated and proven de-energised padmount or ground sub transformer provided safe approach distances are maintained.
- **d** To carry out work at or beyond the low voltage PCC where isolation has been taken at the overhead HV fuses of a single customer substation for safety reasons, and both HV and LV apparatus has been proved de-energised – HV earthing not required.
- **e** For the purpose of installing Access Permit earths to multiple circuits on the same structure, provided the lower high voltage circuits are isolated, proven de-energised, earthed & short-circuited between all points of high voltage isolation and the work area.

III When carrying out work in compliance with Section 7.4 of this procedure
IV In an emergency in accordance with Section 4.10
V On under-crossings within a clearance area where safe approach distances between the network being worked on and the under-crossing can be maintained.

***NOTE**: If any task requires un-securing or re-tensioning of conductors with an energised HV under-crossing in the adjacent span the under-crossing must have auto reclose disabled. This is for network protection only and must not be relied on for worker safety.*

An Access Permit for work on or near high voltage exposed conductors and an Access Permit for electrical testing on the same conductors must not be on issue at the same time.

7.3 Preparation of Electrical Apparatus for Work on or Near High Voltage Exposed Conductors (not applicable to HV Live Line work)

7.3.1 Isolating the Identified Electrical Apparatus

Isolation that involves the operation of a switch must only be treated as effective if one of the following conditions is satisfied:

I For a withdrawable switch – it has been withdrawn from live contacts, and the shutters are over the live contacts, or access to the shutters has been locked and danger tagged.

II For a non-withdrawable switch where:

- **a** The contacts are visible – the contacts are seen to be open, the operating shaft of the switch has been locked and danger tagged; or
- **b** The contacts are visible and there is no operating shaft – the contacts are seen to be open, and a danger tag fixed to the structure in an obvious location.

III The switch is an expulsion drop out fuse – the fuse carrier is removed from the assembly, and the carriers are secured with a danger tag to the pole.

IV The contacts are not visible, and the operating shaft can be locked – the contacts appear to be open as shown by the indicating lever that is fixed to the moving contacts operating shaft, the operating shaft has been locked and danger tagged, any remote switch controls circuits have been disabled and danger tagged.
Interlocking can also form part of the locking process and must not be forced or overridden. Locking can be effected by the application of a keyed locking device or by a suitable interlock incorporated into the switch operating mechanism.
If the contacts are not visible and the operating shaft cannot be locked the switch cannot be used as isolation.
Where switches are spring, hydraulically or pneumatically operated, the stored energy must be discharged to prevent inadvertent closing.
The points of high voltage isolation must include known low voltage supplies, which have the potential to cause the conductors to become live at high voltage.

V For a pole mounted automated switch that can be operated remotely, either by System Control or locally from the control box, the remote control must be disabled using the mid-pole locking device and a danger tag fixed to the structure in an obvious location.

VI Isolation by the removal or separation of connections must only be treated as effective if:

- **a** The connection is totally removed, or
- **b** The connecting conductor is securely tied back away from its normal position.

VII Temporary mid-span links should be installed as close as practicable to the pole, and a danger tag must be fitted to the adjacent pole. There must be no work performed in the same span as the temporary mid-span links that creates conductor movement or a change in conductor tension.

VIII If the secured isolation (e.g. live line clamps) provides separation from live mains equal to or greater than the required safe approach distance (as per Table B), the de-energised part of the isolation point may be worked on for the purposes of replacement. The isolation must be re-secured as soon as practical to do so. Such work must be noted on all access permits at point of issue. Access Permit earthing affected by such is covered by Clause 5.9.

7.3.2 Proving High Voltage Exposed Conductors De-energised

Where able to do so, high voltage exposed conductors must be proved de-energised by means of approved testing equipment used in conjunction with suitably rated and tested equipment provided for electrical operating work. A Modiewark is not an approved means for proving de-energised on HV ABC conductors.

The test equipment must be proved to be in good working order immediately before and after use.

NOTE: *Where there is the likelihood of a voltage intermix (e.g. fault restoration, staged restoration etc), testing must be carried out at all appropriate voltage settings including the 230V setting on the tester being used.*

Where the test equipment cannot be proved to be in good working order before and after use, two approved test devices must be used independently to prove the high voltage electrical apparatus is de-energised.

If the test equipment has built-in continuous self-testing this must be monitored for the duration of the test and if it operates satisfactorily, no other checking of the high voltage indicating device is necessary.

Where unable to prove high voltage exposed conductors de-energised because of induced or electrostatically coupled voltages, earthing equipment may be applied provided that:

I The conductors are isolated; and
II The conductors are visually traced by two independent persons from each and every isolation point to the point of intended application of the earths.

Where the high voltage conductors are fully enclosed and cannot be accessed to prove them de-energised, the electrical apparatus may be earthed provided that:

III The earthing and short-circuiting equipment is fully rated for the voltage concerned; and
IV The fault making capacity of the earthing switch is equal to or greater than the prospective peak fault current.

The conductors must be proved de-energised, where practicable, at the proposed point of application of earthing and short-circuiting equipment.

7.3.3 Earthing and Short-Circuiting High Voltage Exposed Conductors

Earthing and short-circuiting equipment must be:

I Capable of carrying the prospective peak fault current for a period equal to the back-up protection clearing time; and
II Approved for its intended use; and
III Applied immediately after proving de-energised.

Wherever practical, all high voltage earths and short-circuits must be bonded together and to the structure to provide equipotential conditions.

Persons applying earths must ensure they are not in contact with the conductors of the earthing equipment at the time of application and are wearing appropriate PPE.

An available Known Permanent Earth must be used where practicable. If there is no Known Permanent Earth point available, then a metal earth stake of at least 12mm diameter must be driven into the ground ensuring that it is firmly anchored. The low voltage neutral/earth on a separate earthing system must not be used as part of a high voltage earthing system.

NOTE: *A single or combined earthing system is suitable for use as a Known Permanent Earth*

Access Permit earths must be installed on the high voltage conductors between each point of high voltage isolation and the work area and connected to a Known Permanent Earth where practicable.

Fuses must not form part of any high voltage earthing or short-circuiting path.

A circuit breaker may form part of an electrical path used to earth and short circuit mains and apparatus provided the circuit breaker is closed, made inoperable, locked and danger tagged.

Where a known low voltage supply forms part of the isolation process for high voltage access, additional earths are not required to earth against the low voltage supply where there is an unobstructed view of the Access Permit earths, and these earths are electrically traceable to the transformer which is connected to the low voltage isolation point or points. Working earths may be erected by the Access Permit recipient if required.

For overhead conductors, Access Permit earths must be within unobstructed view and electrically traceable to the work site, otherwise a set of working earths must be installed as close as practicable to the work site under the direction of the Access Permit recipient but only after proving the conductors in the work area are de-energised. For Underground conductors, see section 8.4 Access Permit earths must be applied to the conductors only after proving the conductors de-energised in accordance with an approved procedure.

Where a HV open point is created within a HV clearance area (e.g. to off-load feeders or avoid ferroresonance) additional working earths may be required dependant on work site location.

HV Isolation transformers or step up/down transformers within the HV clearance area may also require additional working earths dependant on the work site location.

If the conductors are being divided, equipotential conditions must be maintained by having one set of earths on each and every side of the break and these earths must be at the work site and bonded together or, alternatively, using equipotential bonds to bridge out the divided mains.

7.3.4 Equipotential Bonding and Personal Protective Bonds

Equipotential bonding is critical when bridging, dividing or open circuiting conductors (or an underground cable) to ensure that the worker is protected from any hazardous voltages when contacting two conductive materials at different potentials.

Where practicable, work on all isolated high voltage apparatus must proceed under equipotential conditions such that:

I The conductors at the work site are kept at earthed potential; and
II All conductive materials within reach at the work site are kept at earthed potential; and
III There is no possibility that persons can form a bridge between two points of different potential; and
IV When applying equipotential bonds to open circuited conductors, low voltage insulating gloves (with approved outer gloves) must be worn

Where it is not practicable to create equipotential bonded working conditions then low voltage insulating gloves (with approved outer gloves) must be worn.

Personal Protective Bonds provide equipotential conditions for persons working on high voltage conductors and between two points of differing potential.

Personal Protective Bonds must be used wherever a worker may be in simultaneous contact with high voltage de-energised conductors and other non-bonded equipment of differing potential.

Personal Protective Bonds must only be applied after conductors are isolated, proven de-energised, earthed and short circuited and an access permit has been issued.

When transformer refurbishment work is to be undertaken and equipotential conditions cannot be maintained, the transformer must be isolated from the low voltage network prior to work commencing.

Personal Protective Bonds are not required when:

- Work is carried out from an insulated EWP such that simultaneous contact with equipment and any conductor is not possible; or
- Live Line working techniques are adopted; or
- When working on a fibre composite pole.

For more information, refer to procedure CEOP2377 - Equipotential and Personal Protective Bonding or an industry approved standard.

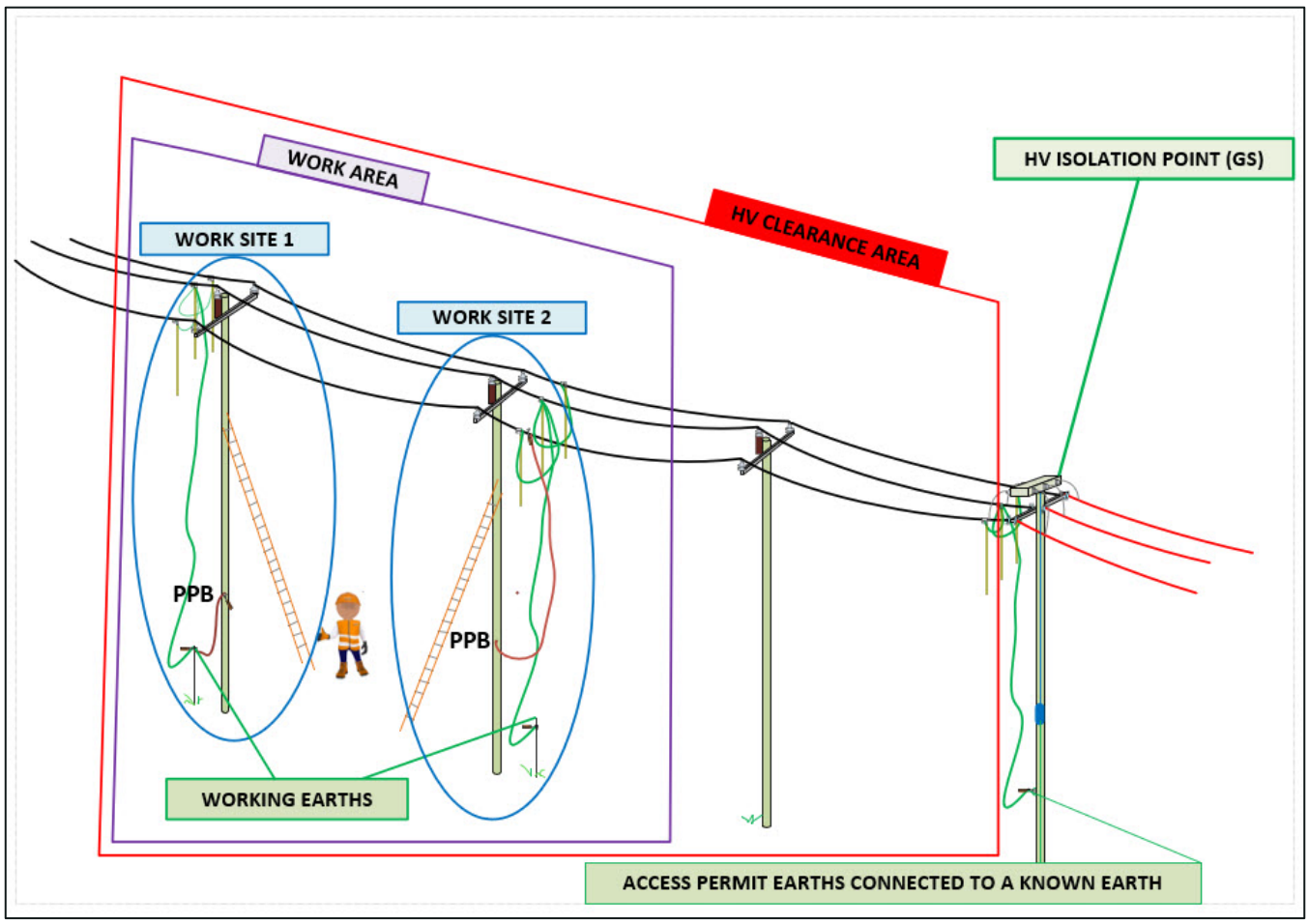


FIGURE 4: EXAMPLE HV CLEARANCE AREA, WORK AREA, WORK SITES AND PPB'S

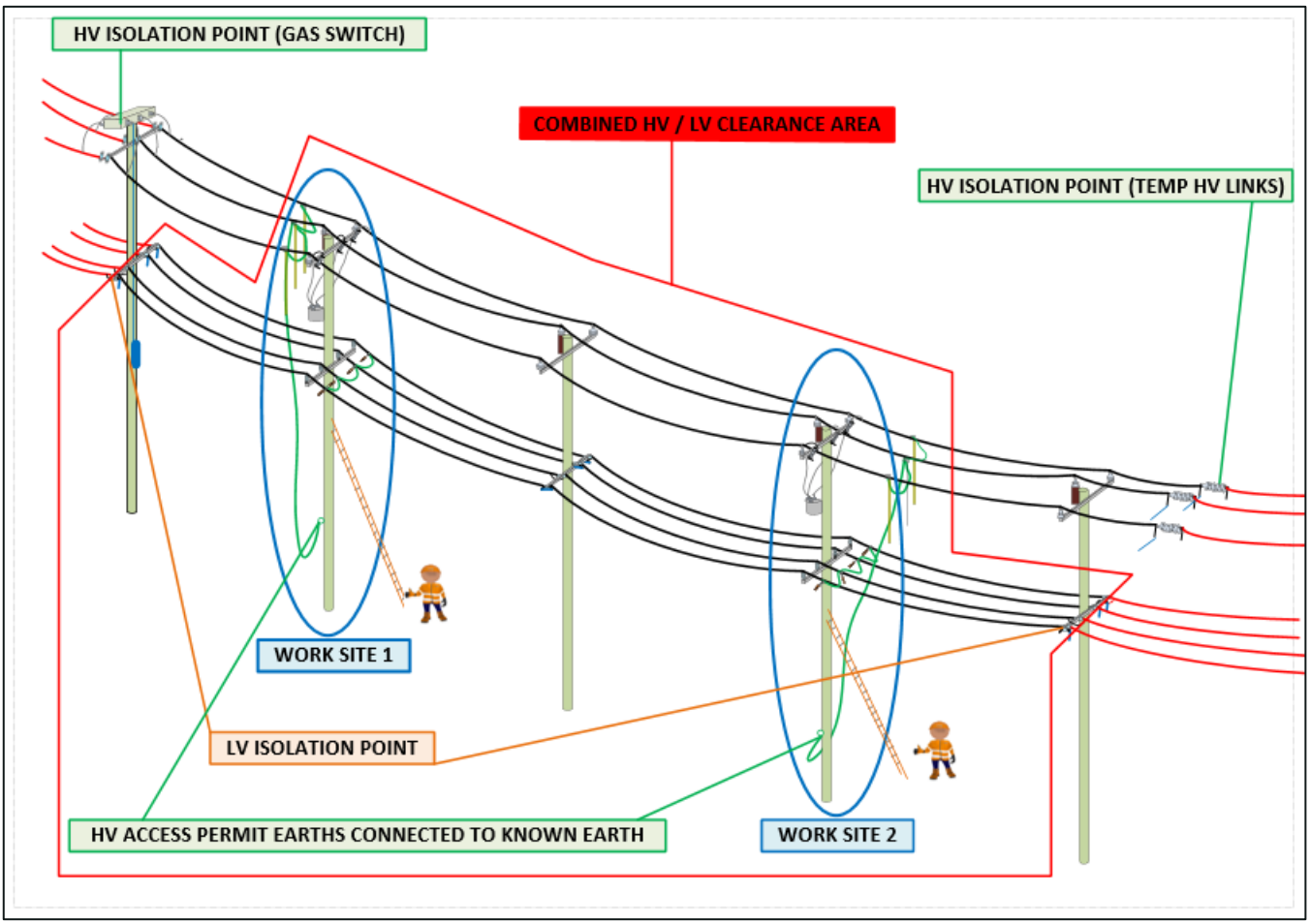


FIGURE 5: EXAMPLE COMBINED HV AND LV CLEARANCE AREA AND AP EARTHING

NOTE: *HV Working Earths and LV Short Circuits not shown - determined and erected under the direction of the AP Recipient by each work crew(s) for each work site.*

7.3.5 Earthing of a SWER Line

When earthing a SWER line, Access Permit Earths must be connected to a known permanent earth.

7.3.6 Earthing of High Voltage Aerial Bundled Cable (HV ABC)

HV ABC consisting of insulated conductors which are continuously screened at earth potential need not be earthed and short-circuited at the work site, provided that the conductors are earthed and short-circuited between all points of isolation and the work area, using permanent earthing facilities.

Earthing and short-circuiting at the points of isolation (Clearance Area) satisfies this requirement.

HV ABC must then be traced visually to the work site, and the visual trace must be independently verified by a second person.

Care must be taken with regard to transferred potentials on the earthed screens.

7.3.7 High voltage insulated unscreened conductors

High voltage insulated unscreened conductors or covered conductors thick (CCT), need not be earthed and short-circuited at the work site, provided that they are earthed and short-circuited between all points of isolation and the work site, using permanent earthing facilities.

As with HV ABC, the line must be traced visually to the work site, with the trace independently verified by a second authorised person.

Alternatively, insulated unscreened conductors may be short-circuited and earthed where required, using earthing tags or connectors specially installed for the purpose.

7.3.8 Defining the safe work site

Barriers and signage may be required to clearly define the work site to indicate the physical boundary between the electrical apparatus that is safe to work on and live electrical apparatus outside the barrier.

Barriers must only be erected by authorised persons and if required must be in place before the issue of an Access Permit.

7.3.9 Temporarily isolated conductors or apparatus during a Declared Incident

During a Declared Major or Crisis Incident (event), sections of feeders and spur lines can be temporarily isolated. Isolated conductors may be left temporarily unearthed, provided that earths are installed:

- when practicable; and
- located as close as practicable to where conductors are low or on the ground.

Note: *Before performing any restoration work, you must contact System Control, prove de-energised, earth and short circuit and issue an Access Permit.*

The location of any temporary earthing must be recorded by the System Controller (nearest pole number) to ensure the earths are removed at some later appropriate time.

7.4 Disconnected apparatus

All disconnected conductors or apparatus being worked on must be short-circuited and earthed to control against induction, static build up, lightning or other electrical hazards.

An Access Permit is required for all work on or near disconnected high voltage conductors with the exception of:

I New conductors or apparatus that have never been connected to the network (see 7.4.1)
II Formally or permanently disconnected conductors or apparatus (see 7.4.2)
III Previously connected but now disconnected conductors or apparatus for third parties under an Operating Agreement (see 7.4.3)

This section does not apply to High Voltage Live work conducted in accordance with CEOM7040 - High Voltage Live Work

Construction earths are not required within a disconnected electrical station where conductors are connected to the earth grid.

7.4.1 New conductors or apparatus that have never been connected to the network

New assets (such as building a substation on an existing high voltage pole or adding a tee-off arm or UGOH) may be built on or attached to an existing pole carrying live conductors provided:

I Safe approach distances are maintained at all times, including safe approach distances for plant where it is in use; and
II No substantive additional lateral loads are being applied to a pole; and
III Once new exposed conductors are attached to a pole carrying energised conductors a set of Construction Earths must be applied as soon as practical to the new assets while they are being worked on and within unobstructed view of the work site.

7.4.2 Previously connected now disconnected conductors or apparatus – being worked on

An Access Permit is not required to work on previously connected and now formally or permanently disconnected conductors or apparatus provided:

I The formally disconnected conductors or apparatus have been approved by System Control, with details including the physical and electrical location as well as the exact nature of the disconnection communicated and recorded in alignment with CEOP2059 – Communication & Control, or

II The permanently disconnected conductors or apparatus are being disconnected (i.e. to allow for removal), a system alteration notification completed in accordance with procedure CEOP2057 System Alteration Notification

AND,

I Safe approach distances are maintained at all times to the adjacent energised network, including safe approach distances for plant where it is in use, and

II The disconnected line or apparatus may not be re-connected by operating work (e.g. bridges have been physically removed), and

III A documented risk assessment has determined the risk of the disconnected high voltage exposed conductor coming near other live high voltage exposed conductors or apparatus is low e.g. any overhead conductors or apparatus being worked on that are attached to a pole or structure that supports other energised conductors (excluding disconnected underground cables) are adequately controlled.

Where the above conditions cannot be met, all high voltage exposed conductors or apparatus being worked on must be isolated, proved de-energised, earthed and short-circuited by approved means and an Access Permit issued. The formally disconnected state must not be used to avoid the requirement to issue an Access Permit where it is reasonably practicable to do so.

Additional guidance may be found in procedure CEOP8050 – Working Above Below or Adjacent to Energised Overhead Conductors including unattached under-crossings and over-crossings.

NOTE: *A formally or permanently disconnected point is not deemed to be an isolation point for the purposes of access and/or earthing*

7.4.3 Previously connected now disconnected conductors or apparatus – being worked near – operating agreement

A section of the electricity network may be disconnected to allow non-electrical construction work near (but not closer than the Instructed Persons Safe Approach Distance of Table B) the Essential Energy network. An Operating Agreement must be issued as per Clause 4.22 and a set of Construction Earths and/or low voltage short circuits applied to any disconnected conductors or apparatus at or near the disconnection point(s).

Where conductors or apparatus that have been connected to the electricity network are being disconnected, the disconnection shall be confirmed and recorded by System Control, including the physical location and exact nature of the disconnection.

7.5 Electrical Testing on High Voltage Exposed Conductors

An Access Permit for electrical testing must be used when the electrical test is likely to produce voltages or currents hazardous to the human body including:

I The application of test voltages which produce high voltage on conductors.
II The use of insulation testing devices at higher than 1000V on conductors.
III The use of electronic insulation testing devices on cables and capacitors at a voltage greater than 1000V unless being used on switchgear to which cables and capacitors are not connected to the system.

An Access Permit for work and an Access Permit for electrical testing on the same electrical apparatus must not be on issue at the same time.

Electrical testing must only be carried out in accordance with approved procedures including but not be limited to:

I The points of isolation provide appropriate separation distances for the test voltages and the insulating medium.
II Control measures are taken to ensure persons are prevented from being on or near the conductors while under test.
III Control measures are taken to ensure adjacent conductors and equipment do not become unintentionally energised during the test.
IV At the conclusion of the test, ensure the conductors that have become electrically charged during test are fully discharged and left in a safe condition – UG cables act like a capacitor in this circumstance – refer to Section 10 for additional guidance on capacitors. All Access Permit earths that were temporarily removed to allow the electrical testing to be carried out should be reapplied immediately.

Where testing requires that one or more Access Permit earths be temporarily removed, the conductors must be regarded as being live, irrespective of whether or not the testing voltages have been applied.

Where testing requires that one or more Access Permit earths be temporarily removed, Low Voltage Insulating Gloves (with approved outer gloves) must be worn until testing is completed and Access Permit Earths are reinstalled. Safe approach distances to Table B must be adhered to when testing voltages are being induced into electrical apparatus.

An Access Permit for electrical testing is not mandatory when testing high voltage conductors that are disconnected, and such testing will be in accordance with approved procedures to ensure the safety of persons and adjacent conductors or equipment.

Major HV connections – such as a new Zone Substation, generation facility (Wind or Solar Farm) or large load customer (mine) require a 'Test Plan' be submitted to the System Controller to co-ordinate sequencing of all testing and commissioning activities.

7.6 Restricted Work Permitted on Access Permit for Test

Construction work cannot be carried out under an Access Permit for test. Maintenance work can be carried out under Access Permit for test when the following conditions are met:

I The maintenance work and testing must be wholly within an electrical station; and
II Both the maintenance work and the testing work must be under the sole direction of the Access Permit for test recipient; and
III The testing work is limited to the application of insulation testing equipment, dielectric dissipation factor (DDF) testing equipment, primary current injection equipment, circuit breaker timing test equipment and primary protection balance checks; and
IV No test voltages exceeding 10,000 volts are applied as part of the testing work.

7.7 Minimising the Risk of Dangerous Ferroresonant Over Voltage

When energising or de-energising the combination of an unloaded or very lightly (3%) loaded transformer and a high voltage cable / overhead line supplying it, the likelihood of ferroresonance must be considered and control measures adopted in accordance with approved procedures to minimise the risk of flashover or insulation damage or breakdown.

Ferroresonance can occur when single phase switching a three-phase network on both underground and overhead systems.

Where concerned that a dangerous ferroresonant situation may occur, advice should be sought from the System Controller.

Additional information on ferroresonance may be found in manual CEOM7092 Distribution Planning Manual and procedure CEOP8044 Ferroresonant Overvoltage Risk Limitation on Distribution Transformers.

8.0 WORK ON UNDERGROUND CABLES

ESR Short Cuts and Links

8.1 Basic Safety Rule

All underground cables and associated electrical apparatus must be regarded as live, until isolated and proved de-energised at the work site and, in the case of high voltage cables, earthed and short-circuited by approved means. CEOP2251 - Positive Identification & Proving De-Energised of Underground Cables or an industry approved standard, shall be the only approved method of identifying and proving underground cables de-energised.

NOTE: *Drums of new cable may have a residual charge from testing in the factory, and drums of cable stored near energised lines or equipment can become charged via induction.*

8.2 Identification

No person may work on any underground cable (including low voltage, pilot or communication cables) unless the appropriate cable has been identified at the work site.

If an electrical method is used to identify a cable, all cables in the immediate vicinity must be exposed and checked.

Low voltage underground cables can be identified from appropriate records and electrical testing methods or by one of the approved techniques where the work site is remote from the exposed terminations and provided no higher voltage cables exists in the general area of where the work is to be carried out.

The cable must be identified either by:

(a) Visual tracing from a point of isolation; or

(b) At least two independent approved methods of identification.

When working on underground pilot cables they must be identified in the same way as low voltage cables.

At all times work must proceed on the cable as if it is live, and all necessary precautions taken until the cable is proved de-energised at the work site.

8.3 Testing to Prove Cables De-energised at the Work Site

Once identified and isolated, underground cables must be proved de-energised by an approved spiking or cutting device wherever possible.

When it is not practical or possible to cut or spike the cable remotely, the cable must be identified by:

(a) Visual tracing from a point of isolation with the trace verified by a second qualified person; or

(b) At least two independent approved methods of identification are used and verified by two qualified people.

For approved methods of identification refer to CEOP2251 – Positive Identification & Spiking Practices

Where spiking or cutting is to be used, then a remotely operated spiker or cutter must be used. Spiking or cutting must only be performed by persons trained in the use of the equipment and in compliance with CEOP2251 – Positive Identification & Spiking Practices or an industry approved standard.

8.4 Earthing and Short-Circuiting High Voltage Underground Cables

Earthing and short-circuiting equipment must:

I Be capable of carrying the prospective peak fault current for a period equal to back-up protection clearing time; and
II Be approved for its intended use; and
III Be applied immediately after proving de-energised; and
IV Be specifically designed for the type of switchgear concerned.

Earthing and short-circuiting must be installed on the high voltage between all points of high voltage isolation and the work area. Where a known low voltage supply forms part of an isolation process for high voltage access, and the access permit earths are traceable to the low voltage supply additional earths are NOT required to protect against low voltage backfeed.

Access Permit earths must be electrically traceable to the work site, otherwise a set of working earths must be installed as close as practical to the work site under the direction of the Access Permit recipient but only after proving the conductors in the work area are de-energised.

Where an underground high voltage cable is to be cut, earthing and short-circuiting must be carried out on each side of any proposed break in the cable.

Earthing and short-circuiting connections must be made to known permanent earthing facilities. These may include a cable sheath connected to a permanent earthing system.

Where the high voltage conductors are fully enclosed and cannot be accessed to prove them de-energised, the electrical apparatus may be earthed provided that:

I The earthing and short-circuiting equipment is rated for the prospective peak fault current.
II The fault making capacity of the earthing switch is equal to or greater than the prospective peak fault current.

8.5 Work On Live Low Voltage Underground Cables

8.5.1 Qualifications and Training

Work on exposed live low voltage underground cables must only be performed by persons specifically trained in the principles and techniques required and who are competent to carry out the work.

8.5.2 Safety Observer Required

A person must not work on exposed live low voltage underground cables or terminations unless attended by a Safety Observer. A safety Observer is not required for operating or testing work. See section 4.9

8.5.3 CONSAC and Paper Insulated Lead Covered (PILC) Cables

Any work that disturbs CONSAC or PILC cable terminations and joints must not be performed while the cables are energised.

Covers and lids of equipment containing energised CONSAC or PILC cables can be removed for operating work, testing, and observation purposes.

Examples of work that disturbs include, but are not limited to:

- Bolting and unbolting lugs and connections on the cable
- Manoeuvring cable cores
- Repairing cable cores
- Repairing/replacing/connecting service tails and flags
- Repairing/replacing service fuse carriers not mounted on a board or frame*
- Replacing pillar bases
- Pole replacements that have CONSAC or PILC cables attached

***NOTE**: Fuse carriers may be replaced if mounted on a board or frame separated from the cores of the cables with service tails.*

8.5.4 General Safe Work Principles

All work on or near live low voltage must be carried out to the requirements set out in

CEOP8034 - Low Voltage Energised Work or any industry approved standard including *ENA Doc 044 Guideline for Energised Low Voltage Work*.

Before commencing work on or near live low voltage underground cables, they must be identified as the conductors to be worked on or near.

Control measures must be taken to prevent inadvertent contact with other live low voltage exposed conductors and conductors at earth potential. The control measures must include:

I Attendance by a Safety Observer; and
II The wearing of approved arc rated long sleeved shirt and long trousers (see section 4.4.1); and
III The wearing of personal protective equipment, including a low voltage insulating glove (with approved outer glove), safety helmet, safety footwear and eye protection (see section 4.4.2); and
IV The use of insulated tools, insulating barriers and insulating ground mats as determined by risk assessment.

Low voltage insulating gloves (with approved outer gloves) must be worn for underground inspection activities when lifting pillar covers or removing pillar standard hatch covers or where required by the work site risk assessment (HIRAC).

8.6 Installed Underground Cables

Information must be attached to each end of disconnected cables, including newly installed, temporarily disconnected or permanently disconnected where the cable ends are at a remote site. The information should include location of the remote end, connected or disconnected status to equipment and any special precautions.

Redundant or permanently disconnected cables must be recorded on appropriate maps or plans and short-circuited and capped in accordance with CEOM7204.16 – Shorting and Capping of UG cables .

Any proposed change to the system (including redundant or disconnected cables) must be communicated to the System Controller in accordance with procedures CEOP2057 System Alteration Notification .

An Access Permit is not required to work on permanently disconnected conductors or apparatus provided a System Alteration Notification has been completed.

Underground cables are to be labelled in accordance with procedure CEOP8042 - Asset Identification and Labels .

Where underground cables are installed in conduit, and that conduit, or an adjacent one needs to be cut into, a vibrating multi tool with approved blades must be used to cut an inspection window. Inspection windows must be no more than 300mm in length.

Reciprocating saws must **not** be used for cutting conduits unless the conduit has been proven empty prior to cutting. When a clearance of 300mm cannot be maintained between the saw and adjacent assets (or the side or bottom of the trench) mechanical protection must be used.

Where other cables or conduits are present within 300mm of the cutting area a vibrating multi tool with approved blades, must be used to prevent cutting into other cables or conduits with cables installed.

8.7 Induced Voltages and Transferred Earth Potentials

In circumstances where the work involves direct contact with the metallic high voltage cable sheath or armouring and is not within the earth grid of a substation, one of the controls in clause 8.7.1 or 8.7.2 must be put in place.

8.7.1 Insulated Working Conditions

All exposed metal parts of cables or pipes or any other parts which may be earthed, and the surfaces of the joint-hole or confined space itself, must be covered with insulating material, suitable for the voltage concerned, while work proceeds on one conductor only with low voltage insulating gloves (with approved outer gloves) worn.

8.7.2 Bonded Earth Mat Conditions

An equipotential area must be created using wire mesh, all bonded together, covering the floor, walls etc. All cable sheaths must be connected to the earth mat so that equipotential conditions are maintained. If not practical, the cable cores and earth screen must be disconnected. When disconnecting or creating an equipotential area, low voltage insulating gloves (with approved outer gloves) must be worn.

8.8 Excavation in the Vicinity of Live Cables

8.8.1 Locating of Services

Persons involved in excavation must identify and locate any underground cables or services of other utilities that may be in the vicinity of the excavation.

Before You Dig Australia (BYDA) is an essential first step for ALL excavation works.

Before You Dig Australia (BYDA) is an essential first step for ALL excavation works.

A copy of the BYDA enquiry must be available on-site, either printed or in electronic format.

Not disturbing or damaging existing underground service utility assets is the responsibility of all persons involved in an excavation. Reticulated natural gas pipework is susceptible to heat from jointing works as well as mechanical damage and leaking gas may accumulate in pits and trenches causing an explosive hazard.

8.8.2 Exposing and Handling of Cables

Cables known to be close to the work site must be exposed by hand or hydro vacuum excavation to verify their location. Before excavating parallel to existing cables, they should be uncovered by hand or hydro vacuum excavation at bends and every 10-15 metres, as well as at joints.

A person must not physically handle/touch an underground cable if it appears defective unless the cable is proved de-energised.

A person must not physically handle/touch a high voltage cable while it is live unless it is a screened cable or is completely surrounded by an earthed sheath, or both. Precautions are also necessary to avoid danger from induced voltages and transferred earth potentials.

Live high voltage underground cables must not be lifted or moved while energised. HV cables must be deenergised, earthed and under access permit prior to moving.

Live low voltage cable UGOH's (Underground to Overhead) must not be erected or removed from poles.

While and after exposing the energised low voltage cable localised and minor movement is permitted (other than a CONSAC or PILC cable) following a thorough risk assessment including attendance by a Safety Observer. Appropriate PPE must be used including the wearing of low voltage insulating gloves (and approved outer gloves).

Where a live underground cable is left uncovered and accessible to the public, it must be mechanically covered and/or securely fenced to prevent unauthorised access. A live underground cable above ground must be mechanically protected from where it leaves the ground to a height greater than 2.4m or enclosed by temporary fencing to prevent unauthorised access.

8.8.3 Mechanical Excavation

Mechanical excavation is permitted down to the top of the cover tiles, slabs or strips; i.e.150mm from a cable, with a safety observer to guide and warn the operator to ensure no cable damage

Pneumatic or other powered excavation, cutting and drilling tools (kanga and jack hammers) must not be used in close proximity to conduits containing live cables. When using powered tools to excavate, cut or drill beside or around direct-laid cables in rock, masonry or hard fill, a steel plate must be placed between the cable and the tool to protect cables.

8.8.4 Hydro/Air Vacuum Excavation

When performing hydro/air vacuum excavation near energised cables, the operator and any assistant must stand on an equipotential conductive mat that is electrically connected to the metalwork associated with the machine controls, the water lance, and the greater mass of earth via a driven earth stake or nearby Known Permanent Earth (KPE). Alternatively create an insulated work site by standing on an insulated ground mat and wear LV insulating gloves (with approved outer glove).

If an energised cable appears damaged, or is suspected to be defective, it must be de-energised before carrying out hydro/air vacuum excavation. An equipotential mat is NOT required where all cables in the vicinity are de-energised.

9.0 WORK IN ELECTRICAL STATIONS

ESR Short Cuts and Links

9.1 Qualifications and Training

A person must not enter an electrical station unless they have contacted the System Controller and are:

I Authorised in accordance with procedure CEOP2065 – Authorisation , or

II Are accompanied by a person who is authorised for supervision for the type of electrical station and have received clear instructions pertaining to the site including the specific sections they can enter existing dangers and the precautions that must be observed.

9.2 General Working Practices

The following work practices must be followed when working in electrical stations:

I Doors, panels or covers enclosing live equipment must be kept closed except when work is being performed inside that enclosure.

II Fixed doors, panels, covers, or shutters to be opened or removed using tools to gain access to the high voltage compartment, must be independently identified for removal by two electrically qualified persons familiar with metal clad apparatus.

III All high voltage electrical components within the high voltage panel must be proved and confirmed de-energised by two electrically qualified persons familiar with metal clad apparatus, one of whom must be the Access Permit recipient.

IV Materials must not block points of egress, doorways, obstruct passageways, hinder normal operations, work, or access to fire extinguishers, deluge showers, first aid kits, telephones, control switches or any operating equipment.

V Long objects such as ladders, conduits, earthing rods, portable earthing devices and the like, must be handled with care in the vicinity of live exposed conductors. Whenever possible, long objects must be carried by two people, holding the objects below shoulder height in a horizontal position and as close as practical to the ends of the object, so as to maintain maximum control.

VI Extreme care must be taken when using portable radio and telephone equipment with protruding aerials in areas containing exposed conductors. At all times, persons must ensure that no parts of this equipment come closer than the safe working distances detailed in Table B. Long protruding aerials are prohibited.

VII When mobile plant is being used within the confines of an electrical station and is likely to come within twice the safe approach distances specified in Table D or when the plant is carrying out excavation work then the mobile plant must be fitted with a trailing earth cable attached to a suitable connection point and connected to the earth grid of the electrical station. The trailing earth cable must be capable of carrying the maximum prospective earth fault current in that electrical station.

VIII Excavation within an electrical station must not be commenced until the location of all underground cables, earthing conductors, ducts and the like in the vicinity of the proposed excavation have been positively identified. Excavation around a foundation or culvert of an energised electrical station is considered as entry.

IX In the event that a circuit breaker is inadvertently tripped, the System Controller must be immediately notified. No attempt should be made to operate the tripped circuit breaker without being authorised to switch and approval from the System Controller.

X Climbing a structure to gain access to equipment, which is under Access Permit conditions, is not permitted. Appropriate ladders, elevated work platforms, scaffolding and work platforms must be used.

XI Where work is to be carried out on or near high voltage electrical station busbars, a minimum, of one set of earthing and short-circuiting equipment must be applied directly to a busbar or bus section of solid construction which are being worked on. When the busbar or bus section is to be divided into sections, each section must be short-circuited and earthed before being divided.

XII The electrical station battery is integral to the safe condition and operation of the substation, so check it is in a satisfactory state before commencing any work.

XIII Lockable temporary portable earth bonds/bridges are to be used within electrical stations as outlined in procedure CEOM7772.04 - Portable Earthing and Bonding in Electrical Stations. This does not apply to portable working earths or access permit earths.

9.3 Requirements for Entering Electrical Stations

Persons entering electrical stations must do so in accordance with approved manual CEOM7074 - Entry into Electrical Stations and in particular the requirements relating to:

I Notifying the System Controller of entry.

II Secure entrances unless in immediate use.

III Checking of other entrances and exits that may be needed in an emergency.

IV Maintaining safe approach distances at all times.

V Wearing appropriate clothing from wrist to ankle to neck and any relevant PPE.

VI Being alert to hazards including the special requirements of indoor, basement and underground stations – see next section 9.4.

VII Duties of persons entering and leaving including notations in the station logbook.

9.4 Hazards within Electrical Stations

Persons entering electrical stations must make themselves aware of any special hazards that exist and place into effect reasonable control measures to manage those hazards.

9.4.1 Exposed Electrical Conductors

Low Voltage

Persons working on or near low voltage panels, instrument transformer secondaries and panel wiring must treat them as live low voltage exposed conductors unless contact is prevented by a barrier of rigid material or they are covered by insulation in sound condition and adequate rating for the voltage concerned, under a relevant Australian standard.

High Voltage

All electrical stations must be designed, constructed and maintained, to ensure that live exposed electrical conductors maintain both statutory and design clearances in accordance with relevant Australian standards.

Extra Low Voltage

When work is carried out in close proximity to extra low voltage, where there is a risk of harmful arcing, electric shock, burns, fire or explosion, appropriate controls must be implemented such as isolation and or the use of an approved face shield and insulating tools or barriers as determined by the risk assessment (HIRAC).

9.4.2 *Electrical Induction*

Suitable precautions must be taken by persons to avoid the dangers of induction when carrying out work on isolated electrical apparatus that is located near live conductors.

Additional working earths short-circuits, and bonds must be applied where necessary to ensure equipotential conditions are maintained.

9.4.3 *Earth Potential Rise*

Equipment that may be subjected to earth potential rise must be insulated, isolated, bonded or other approved measures taken to reduce the risk to a satisfactory level.

9.4.4 *Chemical Hazards*

Where chemical hazards exist, signs (either temporary or permanent) must be erected warning of the dangers present. Instructions for persons responding to the hazards must be prominently displayed.

Extreme care must be exercised to reduce the possibility of injury occurring following the decomposition of products such as polyvinyl chlorides (PVCs) and plastic compounds, polychlorinated biphenyls (PCBs) and sulphur hexafluoride (SF6), which may occur as a result of faults and explosions.

9.4.5 *Confined and Enclosed Spaces*

When an area within an electrical station has been identified as a confined space approved work procedure for working in a confined space must be practiced.

9.4.6 *Arc Flash Hazards*

Electrical Stations present a varying level of arc flash hazard, in-built arc containment and arc flash detection protection schemes. Where an electrical station has been provided with an arc flash switching suit or portable arc flash barrier it must be utilised while carrying out switching operations.

9.5 Emergency Provisions

9.5.1 *First Aid*

An approved first aid kit must be available at all work sites within an electrical station. When working on or near live low voltage electrical apparatus an approved low voltage rescue kit must be immediately available at the work site.

9.5.2 *Emergency Procedures*

Authorised persons entering an electrical station must make themselves aware of any emergency procedures that are relevant to the task being performed.

Signs detailing emergency procedures and other relevant information that are displayed in the electrical station must be followed.

9.6 Operating Work in Electrical Stations

9.6.1 Conditions Necessary for Operating

Prior to carrying out electrical operating work, persons must be satisfied that:

I The correct item of electrical apparatus is located and identified; and
II The equipment is in a serviceable and well-maintained condition; and
III The electrical apparatus to be operated and the operating handle if applicable, has visible connections to the electrical station earth grid or electrodes; and
IV The correct operating equipment applicable to the electrical apparatus being operated is available for use; and
V Where indicators are provided, the levels or pressures of insulating mediums within electrical apparatus are adequate for the service and operating conditions applying; and
VI They are operating equipment under the direction and clearance of the System Controller.

9.6.2 Operating Work

Operating Work within electrical stations must only be carried out by Authorised Persons, using approved equipment rated for the voltages and service conditions applicable within that electrical station.

Protective devices or interlock systems must not be interfered with, bypassed or made inoperative except by an Authorised Person.

Equipment prepared for work, which is capable of storing some form of energy, such as circuit breaker operating mechanisms, must be fully discharged or otherwise disabled in a manner approved prior to work commencing unless otherwise requested by the work party.

When operating disconnectors, air break switches and earth switches a low voltage insulating glove (with approved outer glove) must be worn.

9.6.3 Barriers and Screens

Yellow Tape Barriers

Yellow tape barriers must be erected by an Authorised Person only, in conjunction with the issue of an Access Permit in electrical stations, to indicate as clearly as possible the area in which work is to be performed and to indicate the dividing line between live conductors and the electrical apparatus on which it is safe to perform work.

The tape must be so arranged that the electrical apparatus to be worked on is accessible without interfering with the tape or stepping over or under the tape and to clearly define access for persons to the work site.

No person may pass over or under a yellow tape barrier without approval of the Access Permit recipient.

Only the Access Permit recipient may move or re-arrange the yellow tape barrier, provided that the meaning and intent of the Access Permit is at all times maintained. For further information refer to procedure CEOP2341 - Safe Work Areas.

Insulating Barriers

Approved insulating barriers must be used where it is possible for the barriers to come into contact with live high voltage conductors, or come closer to within the safe working distances as shown in Table B.

Insulating barriers must only be erected by an Authorised Person.

Non-Insulating Barriers

When non-insulating barriers are used near high voltage apparatus, the minimum clearances from live exposed conductors when such barriers are fixed in position must be in accordance with procedure CEOP8032 - Transmission & Zone Substation Design Guidelines or an alternative industry approved standard.

9.7 Pilot, Signalling and Telephone Cables

Persons must make use of the insulation provided by wooden cubicles, insulating barriers or screens, isolating transformers or other isolating devices when working on pilot cables and the like.

Work on protection equipment connected to overhead pilot cables may be carried out with the overhead high voltage mains live provided that the protection equipment is electrically isolated from the overhead pilots by isolating transformers, interposing relays or other suitable devices.

Before jointing work is carried out on either overhead or underground pilot cables, they must first be disconnected from all sources of electrical supply. In all cases work must proceed on pilot cables treating them as live low voltage apparatus.

When work is required to be carried out on pilot cable end terminations (except as specified above), this may be done with other cores of the pilot cable energised at normal operating potential, provided that all precautions are taken as for live low voltage working until the cores or terminals being worked on have been identified and proved de-energised. All cores or terminals that are not to be worked on must be treated as though they are energised.

9.8 Fire Protection Systems

When persons are carrying out work in electrical stations with fixed fire protection systems, suitable control measures must be taken to ensure the safety of personnel and equipment. Precautions may include the isolation, or the making ‘non-auto’ of fire detection and extinguishing systems.

Persons should also check for the existence of remote fire control gas injection systems (such as bulk injection carbon dioxide) to ensure that operation cannot occur during occupancy.

On exiting an electrical station, fire detection and extinguishing systems made ‘non-auto’ prior to work commencing, must be reset for ‘auto’ operation.

9.9 Work on Batteries or in Battery Rooms

Where there are separate battery rooms located within electrical stations, signs must be affixed to all of its entrances to indicate the use of such rooms.

Persons working on batteries or in battery rooms must be trained and competent to do so.

Persons working in battery rooms must ensure that the rooms are adequately ventilated by means of the natural or forced ventilation provided. The use of naked flames and smoking is prohibited in battery rooms.

Precautions must be in place to ensure that arcing caused by making or breaking connections or sparking caused by power tools or conductive materials such as tools and watchbands does not occur. Only insulated tools may be used on batteries. Wear an approved face shield as required by the risk assessment (HIRAC).

9.10 Voltage and Auxiliary Transformers

Before working on voltage transformers, other than draw out type transformers, isolation, earthing and short-circuiting of the high voltage windings and isolation of all secondary windings of the voltage transformers must be carried out.

If the high voltage conductors to which the voltage and auxiliary transformers are connected is isolated, earthed and short-circuited, the voltage transformer may remain connected to the high voltage conductors provided that the low voltage windings are isolated and danger tagged.

For capacitive voltage transformers or similar equipment, do not apply earths immediately after isolation. Allow a minimum period of fifteen (15) minutes for the capacitors to discharge before applying any earths, unless a shorter period is clearly labelled on the equipment – see section 10 for additional guidance.

9.11 Capacitor Bank and Capacitors in Signal Injection Cells

See section 10.

10.0 CAPACITORS, STATCOMS AND SIMILAR

ESR Short Cuts and Links

10.1 Qualifications and Training

A person must not enter an enclosure or cage containing capacitors, Statcoms, DVars or similar electrical apparatus unless authorised to do so in accordance with procedure CEOP2065 – Authorisation. In many situations, entry to such a cage or enclosure, or work on this equipment, will require an Access Permit.

A person must not work on capacitors, Statcoms, DVars, switched reactors, or similar apparatus unless specifically trained or instructed in such apparatus.

10.2 General Working Practices

These types of equipment may be found:

I In electrical stations (refer section 9)
II In the overhead network (refer sections 6 & 7)
III In the underground network (refer section 8)

This section must therefore be read in conjunction with the appropriate earlier sections.

A characteristic of these types of equipment is their ability to store electrical energy. Statcoms in particular may be combined with battery storage.

Any of this equipment may incorporate remote control capability and hence will have an auxiliary supply from either the network or a battery supply that may need to be isolated. There may also be a need to disable the remote-control capability while any work is undertaken.

10.3 Isolation and Earthing

Do not apply earths immediately after isolation. Allow a period of fifteen (15) minutes for capacitors, Statcoms and similar equipment to discharge before applying any earths unless a shorter waiting period is clearly labelled on the equipment. When applying earths there may be a 'residual' charge (particularly on equipment without discharge resistors) so expect a 'splash' or small discharge when earthing.

Before working on individual capacitors of a bank of capacitors that have been isolated, earthed and short-circuited, each individual capacitor must be regarded as live until each of them has been allowed to discharge and has been individually earthed and short-circuited.

FIGURE 6: WAIT 15 MINS TO DISCHARGE BEFORE APPLYING EARTHS

11.0 GENERATION, STORAGE AND OTHER TECHNOLOGIES

ESR Short Cuts and Links

11.1 Qualifications and Training

A person must not enter a generation facility unless they are:

I Authorised in accordance with procedure CEOM7074 Entry into Electrical Stations , or

II Are accompanied by a person who is authorised for supervision for the type of electrical station and have received clear instructions pertaining to the site including the specific sections they can enter existing dangers and the precautions that must be observed.

11.2 General Working Practices

These Electrical Safety Rules shall apply to all generation facilities owned or operated by Essential Energy, both permanent and temporary.

Where generation facilities are owned and operated by a customer (e.g. a High Voltage Customer), and the customer does not have any alternate rules then Essential Energy's Electrical Safety Rules apply.

11.3 Network Batteries

Network Batteries for the purposes of this section provide a level of grid support. This does not include secondary system batteries.

With consideration of AS4777.2 Grid Connection of Energy Systems, Essential Energy has adopted requirements for establishing a clearance area on the network dependent on the rated discharge capacity of any Network Batteries which are present:

For a clearance area incorporating Network Batteries less than 200kVA at any one site:

- Carry out switching to isolate the network as normal
- Anti-islanding protection will operate on any Network Batteries
- No additional isolation is required

For a clearance area incorporating Network Batteries greater than 200kVA at any one site:

- LV isolation must be secured at each Network Battery site greater than 200kVA

11.4 Stand-Alone Power Systems (SAPS)

Stand Alone Power Systems (SAPS) – Essential Energy own, lease or have agreements in place for 'fringe of grid' customers or post natural disaster situations.

11.4.1 Access Permit Requirements

SAPS supplying multiple customers via shared low voltage reticulation require an Access Permit for any work on the shared network. In this case the shared low voltage network is after the main switch on the SAPS, and before the customers Point of Common Coupling (PCC).

Where a SAPS supplies a single customer, the PCC must be deemed to be the main switch at the generator, and an Access Permit is not required for work beyond that point.

An Access Permit is not required for work on the SAPS.

Only trained and authorised workers can work on SAPS.

11.5 Electric Vehicle Chargers

Electric Vehicle Chargers can be attached to Essential Energy Assets, eg LV poles and Streetlight poles. They can also be found in Essential Energy Depots and other buildings. They may be owned by Essential Energy or other companies. Precautions must be taken when working or inspecting around these assets.

The chargers are part of an electrical installation and do not require an Access Permit to work on. Workers must be trained and authorised on Electric Vehicle Chargers before they can work on them.

11.6 Other Types of Generation and Some Precautions

I Permanent generation facilities that operate in the National Electricity Market such as large-scale wind farms and solar farms including permanent generation facilities owned and operated by Essential Energy. Hazards associated with all the above may include communications facilities, 'run-back' schemes and confined spaces.

II Semi-permanent generation used by Essential Energy for network support – such as hired or owned generators injecting into the low voltage or high voltage network via a 'step-up' transformer. Such facilities may be in place from a period of a few days to many months. Precautions for such facilities include temporary fencing and its safe earthing and fuel storage and supply. Temporary high voltage generation cannot be synchronised or run in parallel with the high voltage network and must comply with the requirements of manual CEOM7211.01 - Mobile Site Generation .

III Temporary generation used by Essential Energy for an individual customer or group of customers on a limited low voltage network, generally for one day or less. Such generators may be owned or hired and may be truck, trailer or skid mounted. Precautions for their use include synchronisation issues and reactive power capability, particularly if a large number of solar PV systems re-connect. Solar PV systems may need to be individually isolated to prevent their automatic re-connection.

IV Permanent embedded generation owned and operated by customers, connected at either high voltage or low voltage and operated in parallel with the network with approval. Examples include landfill gas, biogas, natural gas, small scale hydro, wind and solar PV. These systems are always designed to 'separate' from the grid in the event of a grid outage (planned or un-planned). Such generation does not usually operate in an 'island' mode. Refer to V below.

V Stand-by generation for emergency supply (islanded operation) owned and operated by customers. Typical examples are hospitals, piggeries, chicken sheds etc that rely on electricity at all times. Standby generation has in the past been primarily diesel generation, however advances in battery storage now allows larger UPS style applications, including combinations with solar PV known as hybrid systems for domestic applications. Hence, increasingly when the Essential Energy network is

isolated for planned or emergency work, not all customers will lose supply (i.e. their lights may stay on). Some older legacy sites have customer owned equipment on Essential Energy Assets (eg switchboard or sub mains on EE poles). Caution needs to be taken in these instances as standby generation may backfeed onto Essential Energy Poles.

FIGURE 7: LEGACY SITE WITH CUSTOMER ASSETS ATTACHED TO ESSENTIAL ENERGY ASSETS

NOTE: *There is the possibility that standby generation may NOT island and will back-energise the Essential Energy network (i.e. where the load is within the capabilities of the generator). The 'prove de-energise' step before earthing or short circuiting is therefore particularly important where standby generators exist.*

12.0 AUTHORITIES AND RESPONSIBILITIES

POSITION / TITLE	RESPONSIBILITY
Manager Electrical Safety	Approving this manual including any variations
Principal Engineer Electrical Safety	▸ Reviewing the document and making recommendations to the Manager Electrical Safety Clarifying technical aspects of this document

13.0 REFERENCES

INTERNAL
Company Procedure - Polarity and Neutral Identification: Testing - CEOP2018
Company Procedure - Equipotential and personal Protective Bonding - CEOP2377
Company Procedure - Verification of Competency HV Live Worker - CEOP2392
Company Procedure - Safe Approach: Access Overhead Electrical Apparatus - CEOP2422
Company Procedure – Distribution Earth Integrity Testing Asset Inspection Staff - CEOP2445.1
Company Procedure – Distribution Earth Integrity Testing Electrically Qualified Staff - CEOP2445.2
Company Procedure – Networks: Asset Identification and Labels – CEOP8042
Company Procedure – Working Above Below, Adjacent to Energised Overhead Exposed Conductors - CEOP8050
Division Procedure - Supervision of Persons in Training and Electrical Workers - CEOP2000.57
Division Procedure - Access Permit – CEOP2045
Division Procedure - System Control: Network Access Request & Planned Outage Notification – CEOP2056
Division Procedure - System Alteration Notification - CEOP2057
Division Procedure - Communication and Control – CEOP2059
Division Procedure - Emergency Communication – CEOP2060
Division Procedure – Substations: Safe Work Areas – CEOP2341
Company Procedure - Role of a Safety Observer – CEOP2354
Division Procedure - Low Voltage: Energised Work – CEOP8034
Company Procedure – Ferroresonant Overvoltage Risk Limitation on Distribution - CEOP8044
Branch Procedure – Operating Standards: Operating Agreement – CEOP2052
Branch Procedure - System Control: Authorisation – CEOP2065
Company Procedure - Pole Assessment - CEOP2069
Division Procedure - Live Work: Justification, Selection, Training & Appointment - CEOP2192

INTERNAL
Company Procedure: Underground Cables: Positive Identification & Proving De-Energised of Underground Cables - CEOP2251
Branch Procedure - Transmission & Zone Substation Design Guidelines - CEOP8032
Company Manual: Tools, Equipment & PPE - Testing & Inspection - CEOM4040a
Company Manual – HSE Manual: Risk Management - CECM1000.02
Company Manual - Personal Safety – CECM1000.21
Company Manual - Entry into Electrical Stations - CEOM7074
Company Manual - Arc Flash Hazard Risk Management - CEOM1148
Division Manual - Safe Entry to Enclosed and Confined Space - CECM1000.22
Division Manual - Working at Heights - CECM1000.23
Branch Manual - High Voltage Live Work – CEOM7040
Operational Manual - Distribution Planning – CEOM7092
Job Safety Analysis: Absolute Limits of Approach when Applying Earths
Operational Manual – Zone Substations: Portable Earthing and Bonding in Electrical Stations – CEOM7772.04
Company Manual: Plant & Equipment Operations: Mobile Site Generation - CEOM7211.01
Division Procedure Working with Extendable Insulating Sticks - CEOP8083

EXTERNAL
Electricity Supply (Safety and Network Management) Regulation 2014
Work Health and Safety Regulation 2017
ACT Utility Networks (Public Safety) Regulation
Electricity Supply Industry – Distribution National Training Package Refresher Units of Competency
Safe Work Australia Code of Practice: Managing Electrical Risks in The Workplace August 2019
WorkCover Code of Practice: Work Near Overhead Power Lines
WorkCover Guide: Work Near Underground Assets
AS1418 Part 10 Elevated Work Platforms
AS4741 Testing of connections to low voltage networks
AS/NZS60479 Part 1 Effects of Electric Shock on Humans and Animals
ENA NENS 04-2006 National Guidelines for Safe Approach Distances to Electrical and Mechanical Apparatus

EXTERNAL
ENA NENS 03-2006 National Guidelines for Safe Access to Electrical and Mechanical Apparatus
ENA NENS-09 -2014 National Guidelines for the Selection, Use and Maintenance of Personal Protective Equipment for Electrical Arc Hazards.
ENA NENS-23-2009 ENA Guidelines for Safe Vegetation Management Near Live Overhead Lines.
ENA Doc 044 – Guideline for Energised Low Voltage Work

14.0 RECORDKEEPING

The table below identifies the types of records relating to the process, their storage location and retention period.

Type of Record	Storage Location	Retention Period
Nil entry		

* The following retention periods are subject to change eg if the records are required for legal matters or legislative changes. Before disposal, retention periods should be checked and authorised by the 'Records Management Team'.

15.0 REVISIONS

ISSUE NO.	SECTION	DETAILS OF CHANGES IN THIS REVISION	CHANGE RISK IMPACT
20	All	Update Policy Template	
	Various	Minor wording changes, additions and corrections to cross-references. Addition of photos	
	1.1	Addition of hierarchy of electrical safety	
	2	Additional and update various definitions, including non-intrusive testing, formally and permanently disconnected	
	3.3	Separate section for Vegetation Management	
	3.3.2	Addition of CAVC as separate section	
	3.3.3	Vegetation Management using High Voltage Live Line techniques	
	4.4.1	Clothing update	
	4.4.2	Removed point V - Energised high voltage live line work – making or breaking bridges where other controls are not used.	
	4.4.3	Cat 4 PPE update	
	4.5.4	Add detail at foot of pole or ladder	
	4.5.5	Electric shock updated to follow industry	
	4.10	Update of wording	
	4.20	Update to section to include Rogowski coils	
	4.21.1	Additional section on damaged or stolen in service earths	
	4.22	Updated operating agreement section	
	5	Access permit wording changes to align to CEOP2045	
	6.2	Update controls from induced voltages, customer generation or unknown supplies.	

		Add visual sighter aids e.g. flags required on low voltage short circuits.	
	6.2.2	A Modiewark is not an approved means for proving de-energised on LV ABC conductors.	
	6.3.1	Updated to reflect CEOP8034	
	7.3.1	Update clause for automated switches	
	7.3.2	A Modiewark is not an approved means for proving de-energised on HV ABC conductors.	
	7.3.3	Section updated	
	7.3.9	Addition of clause for Temporarily isolated conductors or apparatus during a Declared Incident	
	7.4.4	Clause reworded and moved 7.3.9	
	8.4	Removed “unobstructed view”	
	8.5.3	Clarify requirements for CONSAC and PILC cables	
	8.8.3	Mechanical excavation is permitted down to the top of the cover tiles, slabs or strips; i.e.150mm from a cable, with a safety observer to guide and warn the operator to ensure no cable damage	
	11	Addition of separate sections for SAPS and Batteries, Electric Vehicle Chargers	
	11.6	Removal of reference to Broken Hill Gas Turbines	
	12	Update responsibilities	
	13	Update reference document sections	
	Appendix	Addition of Quick links for use on field devices	
	Various	Remove references to “competent assistant”	
	Various	Implementation of “Formally Disconnected” wording.	

Appendix

ESR Short Cuts and Links

2. Key Terms and Definitions

3. Safe Approach Distances - Personnel and Equipment

4. General Safe Electrical Work on or Near Conductors

5. Access Permits

6. Work on or near Low Voltage Electrical Apparatus

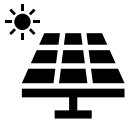
7. Work on or near HV exposed conductors

8. Work on Underground Cables

9. Work in Electrical Stations

10. Capacitors, Statcoms and Similar

11. Generation, Storage and Other Technologies



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